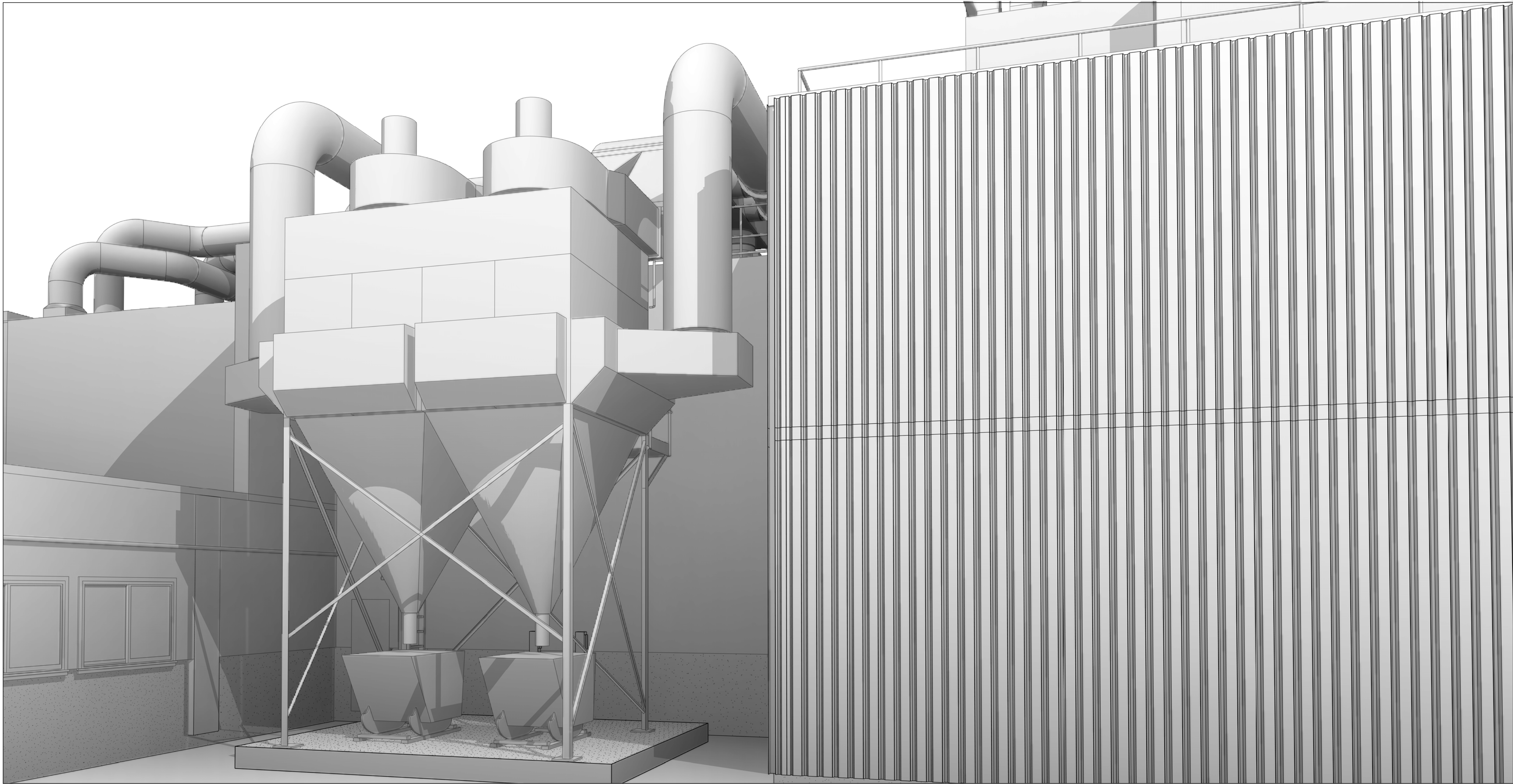
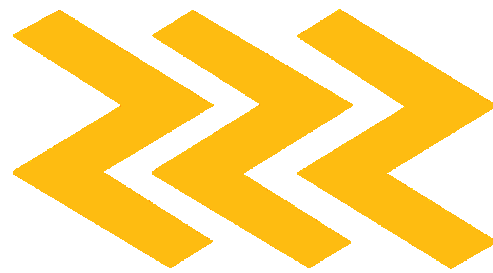


## **Project 1: Blast Bay Upgrade**





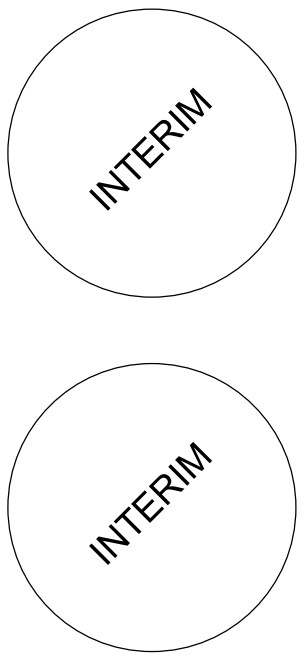


**Ontario  
Northland**

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REGISTRATION



AECOM

ARCHITECTURAL DEMOLITION CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
AD101	REV: 3	GROUND FLOOR DEMOLITION PLAN

ARCHITECTURAL CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
A-101	REV: 3	GROUND FLOOR PLAN & PARTIAL RCP
A-150	REV: 3	BUILDING & WALL SECTIONS
A-401	REV: 3	ENLARGED PARTIAL FLOOR PLAN & DETAILS
A-402	REV: 3	ENLARGED PARTIAL FLOOR PLAN & PARTIAL ROOF PLAN
A-403	REV: 3	ROOF DETAILS
A-404	REV: 3	EXTERIOR ELEVATIONS
A-600	REV: 3	SCHEDULES & DETAILS

STRUCTURAL DEMOLITION CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
SD100	REV: 3	GROUND FLOOR DEMOLITION PLAN

STRUCTURAL CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
S-001	REV: 3	STRUCTURAL GENERAL NOTES
S-002	REV: 3	STRUCTURAL TYPICAL DETAILS
S-101	REV: 3	GROUND FLOOR AND MECHANICAL ROOM MID-HEIGHT PLANS
S-102	REV: 3	ROOF FRAMING PLAN
S-301	REV: 3	ELEVATIONS AND SECTIONS
S-401	REV: 2	ENLARGED PARTIAL PLANS
S-501	REV: 3	SECTION DETAILS

CIVIL TRACK CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
CT-200		INTERIOR EMBEDDED TRACK DETAILS

PROCESS CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
Q001	REV: 4	DEMOLITION GROUND FLOOR PLAN - PROCESS
Q002	REV: 4	DEMOLITION ROOF PLAN - PROCESS
Q003	REV: 4	DEMOLITION ISOMETRIC VIEW - PROCESS
Q100	REV: 4	BUILDING ISOMETRIC - PROCESS
Q101	REV: 4	FOUNDATION PLAN - PROCESS
Q102	REV: 4	LOW LEVEL GROUND FLOOR PLAN - PROCESS
Q103	REV: 4	HIGH LEVEL GROUND FLOOR PLAN - PROCESS
Q104	REV: 4	CEILING LEVEL PLAN - PROCESS
Q105	REV: 4	HIGH ROOF PLAN - PROCESS
Q106	REV: 4	RECLAIM AND M IE ROOM
Q107	REV: 4	REFLECTED CEILING PLAN
Q108	REV: 4	BUILDING SECTIONS - PROCESS
Q109	REV: 4	BUILDING SECTIONS - PROCESS
Q110	REV: 4	BUILDING SECTIONS - PROCESS
Q111	REV: 4	ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS
Q112	REV: 4	ISOMETRIC VIEWS
Q113	REV: 4	3-AXIS MAN LIFT
Q114	REV: 4	CEILING AND WALL PANEL GENERAL ARRANGEMENT
Q115	REV: 4	PROCESS DESIGN NOTES AND SCHEMATICS
Q116	REV: 4	PROCESS SCHEDULES AND SCHEMATICS

PLUMBING CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
P100	REV: 1	ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE
P101	REV: 1	FOUNDATION PLAN - PD
P102	REV: 1	GROUND FLOOR PLAN - PD
P103	REV: 1	HIGH LEVEL PLAN - PD
P104	REV: 1	HIGH ROOF PLAN - PD
P105	REV: 1	BUILDING SECTIONS - PD
P106	REV: 1	BUILDING SECTIONS -PD
P107	REV: 1	BUILDING ISOMETRIC - PD
P108	REV: 1	PARTIAL GROUND FLOOR PLAN
P109	REV: 1	PARTIAL GROUND FLOOR PLAN

FIRE PROTECTION CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
FP100	REV: 1	BUILDING ISOMETRIC - FP
FP101	REV: 1	LOW LEVEL GROUND FLOOR PLAN - FP
FP102	REV: 1	HIGH LEVEL GROUND FLOOR PLAN - FP
FP103	REV: 1	BUILDING ISOMETRIC - FP

MECHANICAL CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
M100	REV: 1	ISOMETRIC VIEW - OVERALL BUILDING - HVAC
M101	REV: 1	GROUND FLOOR PLAN - HVAC
M102	REV: 1	HIGH LEVEL PLAN - HVAC
M103	REV: 1	HIGH ROOF PLAN - HVAC
M104	REV: 1	REFLECTED CEILING PLAN
M105	REV: 1	BUILDING SECTIONS - HVAC
M106	REV: 1	PARTIAL HVAC PLANS
M107	REV: 1	BUILDING SECTIONS - HVAC
M108	REV: 1	BUILDING SECTIONS - HVAC
M109	REV: 1	BUILDING ISOMETRIC - HVAC DUCTWORK
M110	REV: 1	MECHANICAL EQUIPMENT SCHEDULES
M111		HEATING AND CONTROL SCHEMATIC

ELECTRICAL CONTRACT DOCUMENTS		
NO	REV.	SHEET NAME
E-101	REV: 1	LEGEND AND GENERAL NOTES
E-201	REV: 1	GROUND FLOOR POWER AND LIGHTING REMOVAL PLAN
E-202	REV: 1	ROOF REMOVAL POWER PLAN
E-301	REV: 1	GROUND FLOOR CLASSIFICATION PLAN
E-302	REV: 1	GROUND FLOOR LIGHTING PLAN
E-303	REV: 1	GROUND FLOOR POWER PLAN
E-304	REV: 1	ROOF POWER AND FIRE ALARM PLAN
E-305	REV: 1	GROUND FLOOR FIRE ALARM PLAN
E-401	REV: 1	EXISTING / REMOVAL SINGLE LINE DIAGRAM
E-402	REV: 1	NEW SINGLE LINE DIAGRAM
E-403	REV: 1	FIRE ALARM RISER DIAGRAM
E-501	REV: 1	SCHEDULES
E-502	REV: 1	SCHEDULES

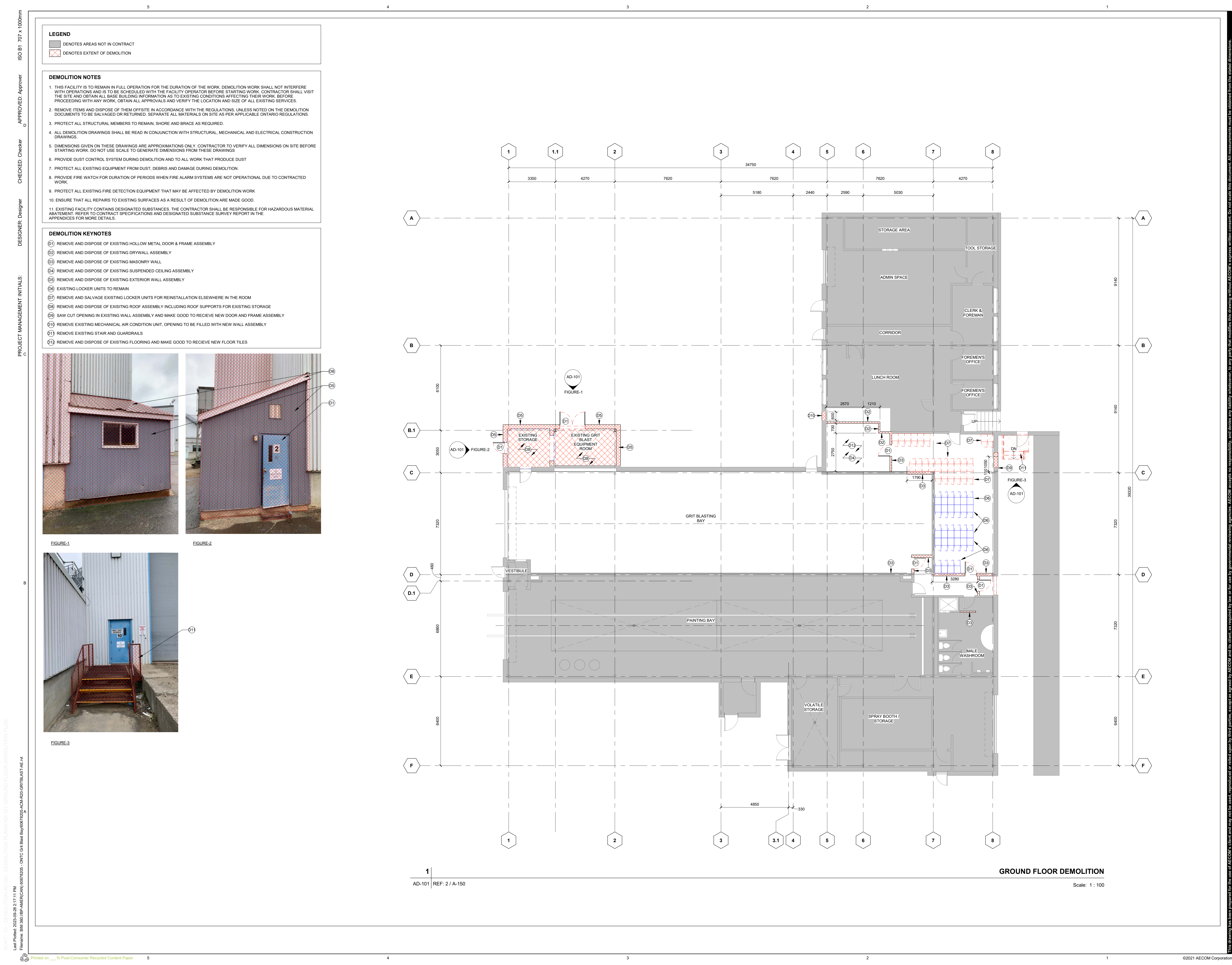
BLAST BAY UPGRADE

915/916 McINTYRE ST. E, NORTH BAY, ON

PROJECT NUMBER: 60678205

ISSUED FOR TENDER - 29/09/2023





**AECOM**

**PROJECT**

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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**REGISTRATION**

INTERIM

INTERIM

**KEY PLAN**

0 2 4 6 8 10m

**ISSUE/REVISION**

No.	DESCRIPTION	DATE
3	ISSUED FOR TENDER	28/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

**PROJECT NUMBER**

60678205

**SHEET TITLE**

**GROUND FLOOR DEMOLITION PLAN**

**SHEET NUMBER**

**AD-101**

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82021 AECOM Corporation



LEGEND

DENOTES AREAS NOT IN CONTRACT

FIRE SAFETY LEGEND

● - - - - -

PATH OF TRAVEL

— · — · —

1 HOUR FIRE RESISTANCE RATING

GENERAL NOTES

1. FOR LOCATION OF EQUIPMENT BASES, SEE BUILDING MECHANICAL, ELECTRICAL AND STRUCTURAL DRAWINGS. CARRY FLOOR FINISHES UP AND OVER EQUIPMENT BASES TO SUIT EQUIPMENT SUPPLIED.

2. FOR LOCATION OF ADDITIONAL ROOF PENETRATIONS SEE BUILDING MECHANICAL, ELECTRICAL, PROCESS DRAWINGS AND ALL SPECIFICATIONS.

3. REFER TO BUILDING MECHANICAL AND ELECTRICAL DRAWINGS FOR ADDITIONAL PENETRATIONS IN MASONRY WALLS. PROVIDE LINTELS OVER ALL OPENINGS AS PER LINTEL SCHEDULE ON STRUCTURAL DRAWINGS. DESIGN LINTELS AS PER REQUIREMENTS OF THE ONTARIO BUILDING CODE (2012).

4. ALL STEEL LINTELS ARE TO BE HOT DIPPED GALVANIZED WITH MINIMUM 200 mm BEARING AT EACH END. PROVIDE BOND BREAKER ON FULL BEARING SURFACE UNDER LOOSE LINTELS.

5. ALL INTERIOR MASONRY OPENINGS ARE TO RECEIVE LINTELS AS DETAILED IN STRUCTURAL DRAWINGS.

6. REINFORCE ALL NEW MASONRY WALLS AS PER STRUCTURAL AND ARCHITECTURAL DETAILS.

7. UNLESS OTHERWISE INDICATED, PLAN DIMENSIONS ARE TO COLUMN GRID ON CENTERLINES, NOMINAL SURFACE OF MASONRY AND FACE OF CONCRETE WALLS.

8. REPEATITIVE FEATURES ARE NOT DRAWN IN THEIR ENTIRETY AND SHALL BE COMPLETELY PROVIDED AS IF DRAWN IN FULL.

9. WHERE DOOR IS LOCATED NEAR CORNER OF ROOM AND IS NOT LOCATED BY DIMENSION ON PLAN OR DETAILS, LOCATE 100 mm FROM FACE OF STUD (WALL) TO FACE OF ROUGH OPENING. LOCATE 150 mm FROM FACE OF WALL TO EDGE OF ROUGH OPENING AT CAST IN PLACE CONCRETE WALLS, AND 200 mm AT CMU WALLS.

10. VERIFY ALL ROUGH-IN DIMENSIONS FOR EQUIPMENT PROVIDED OR INSTALLED AS PART OF THIS CONTRACT.

11. ALL OPENINGS THROUGH FIRE SEPARATION WALLS AND SLABS MUST BE APPROVED U.L.C. RATED FIRE TOP AND SMOKE SEAL ASSEMBLIES.

12. ALL OPENINGS THROUGH EXTERIOR AND INTERIOR NON-RATED WALLS MUST BE PROPERLY SEALED AND CAULKED AND WITH METAL FLASHING (WHERE APPLICABLE) WITH APPROVED ASSEMBLIES. U.N.O.

13. ALL JUNCTIONS OF WALLS WITH CEILING AND FLOOR SLAB TO BE SEALED.

14. DIMENSIONS GIVING TO EXISTING WALLS ARE APPROXIMATION ONLY. CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE.

15. ALL FLOOR DRAINS TO HAVE A 2% MAX SLOPE.

16. ALL DIMENSIONS SHOWN ON ARCHITECTURAL DRAWINGS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

CEILING TYPES

ACT-1

ACT-1 ACOUSTIC CEILING TILE ASSEMBLY

• 610mm x 610mm ACOUSTIC CEILING TILE IN EXPOSED T-BAR SUSPENSION SYSTEM AT 2600mm ABOVE FINISH FLOOR

GYP-1

GYP-1 SUSPENDED GYPSUM CEILING ASSEMBLY

• 41mm CARRYING CHANNELS @ 1200mm O/C

• 13mm METAL STRAPPING @ 410mm O/C

• 16mm GYPSUM BOARD AT 2600mm ABOVE FINISH FLOOR

REFLECTED CEILING LEGEND

☉

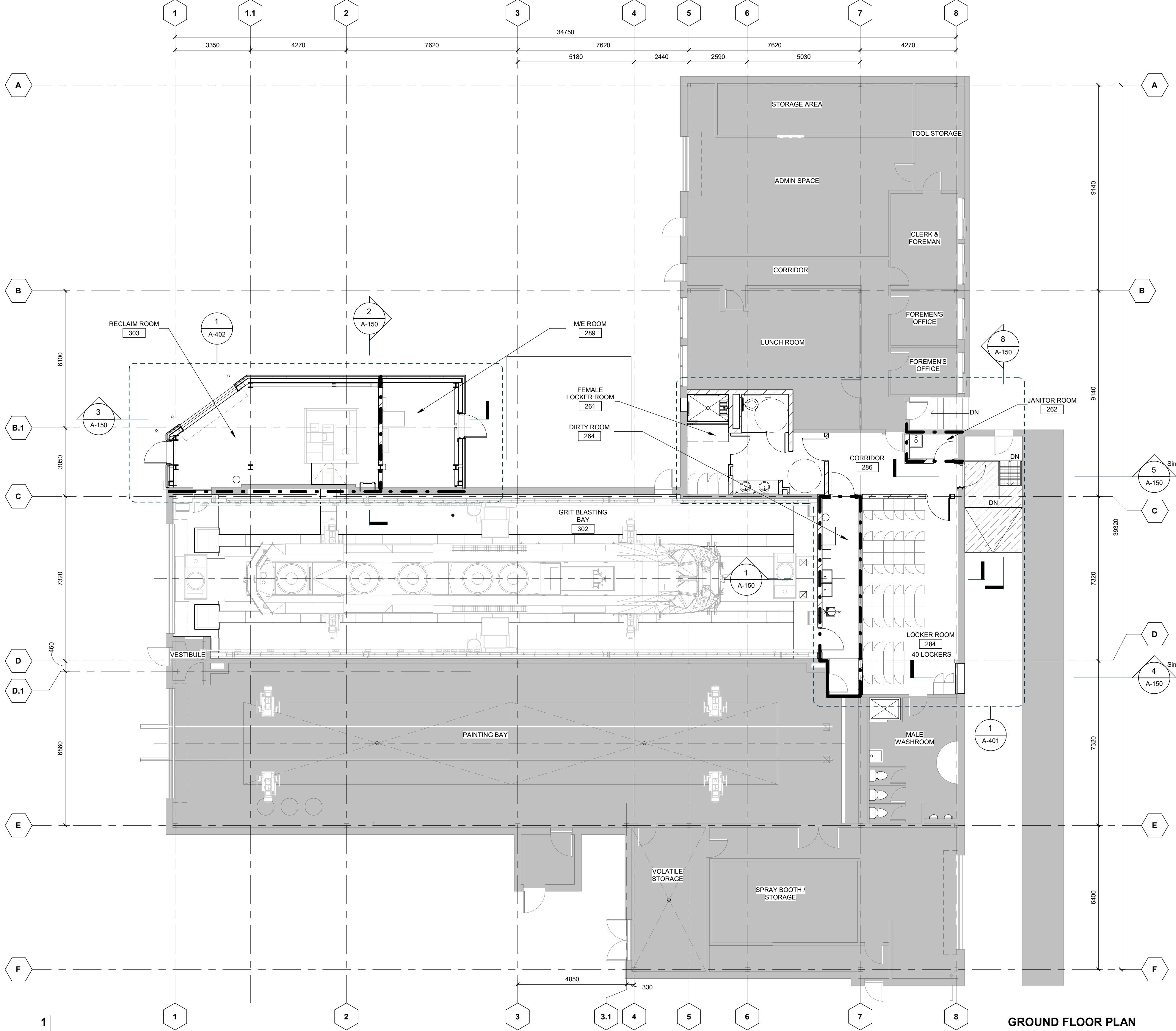
LIGHTING FIXTURES

• REFER TO ELECTRICAL DWGS.

■

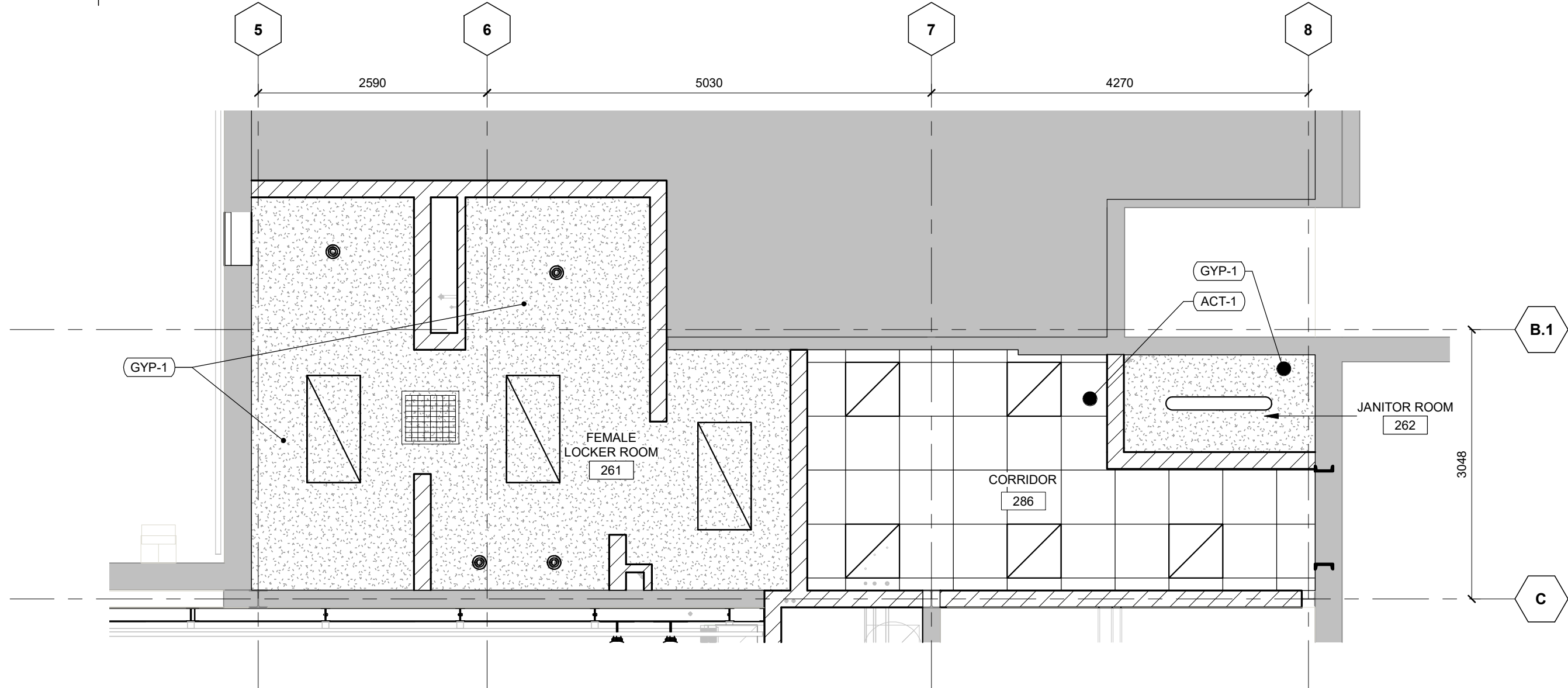
EXHAUST GRILLE

• REFER TO MECHANICAL DWGS.



GROUND FLOOR PLAN

Scale: 1 : 100



PARTIAL GROUND FLOOR REFLECTED CEILING PLAN

Scale: 1 : 50



PROJECT

**BLAST BAY UPGRADE**  
915/918 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

**REGISTERED OWNER:**  
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CONSULTANTS

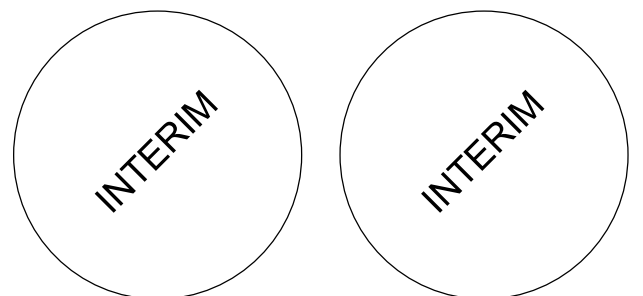
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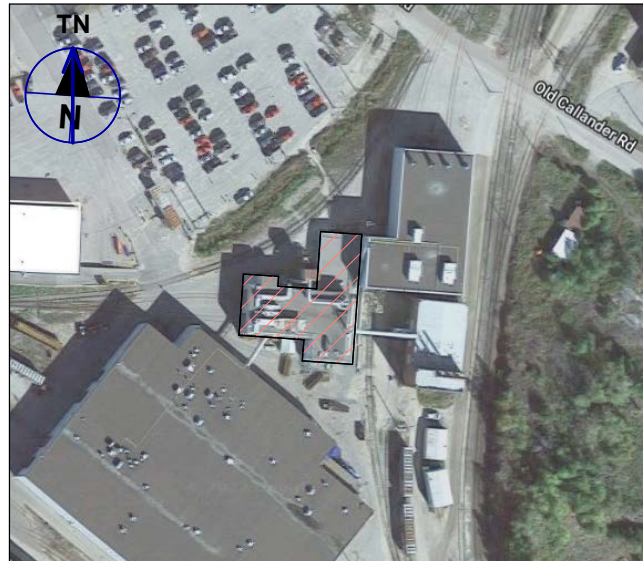
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REGISTRATION



KEY PLAN



ISSUE/REVISION

No.	DESCRIPTION	DATE
3	ISSUED FOR TENDER	28/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

**GROUND FLOOR PLAN & PARTIAL RCP**

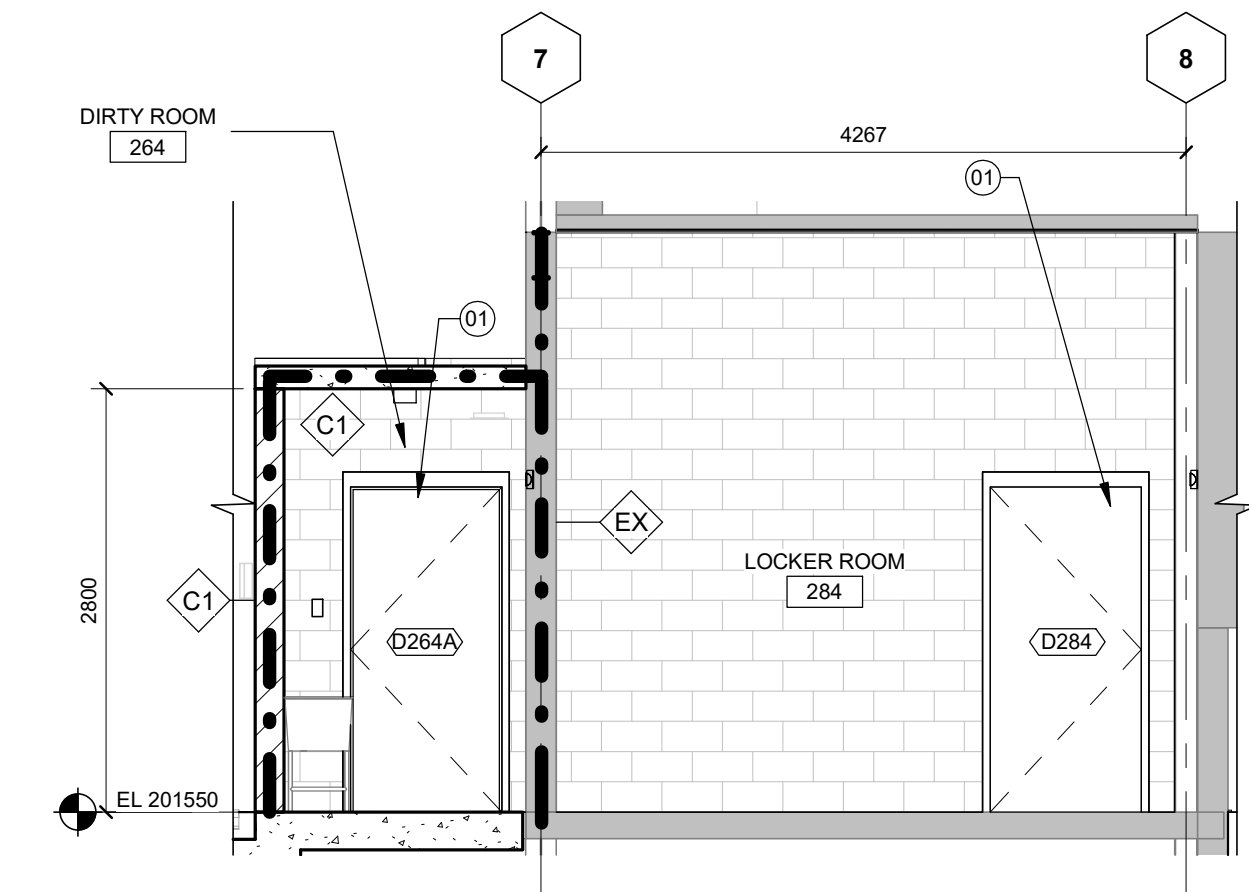
SHEET NUMBER

**A-101**

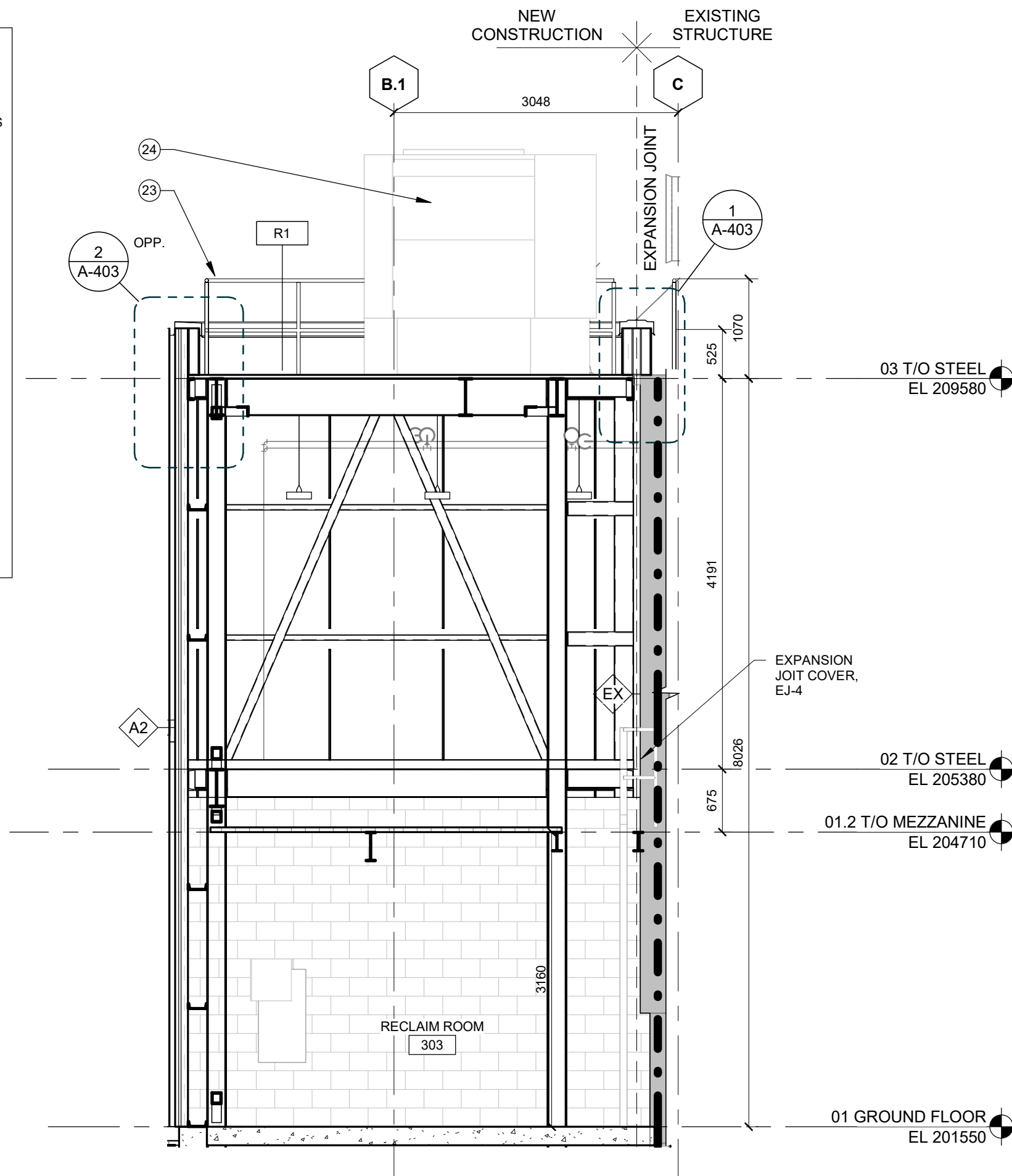


## KEYNOTES

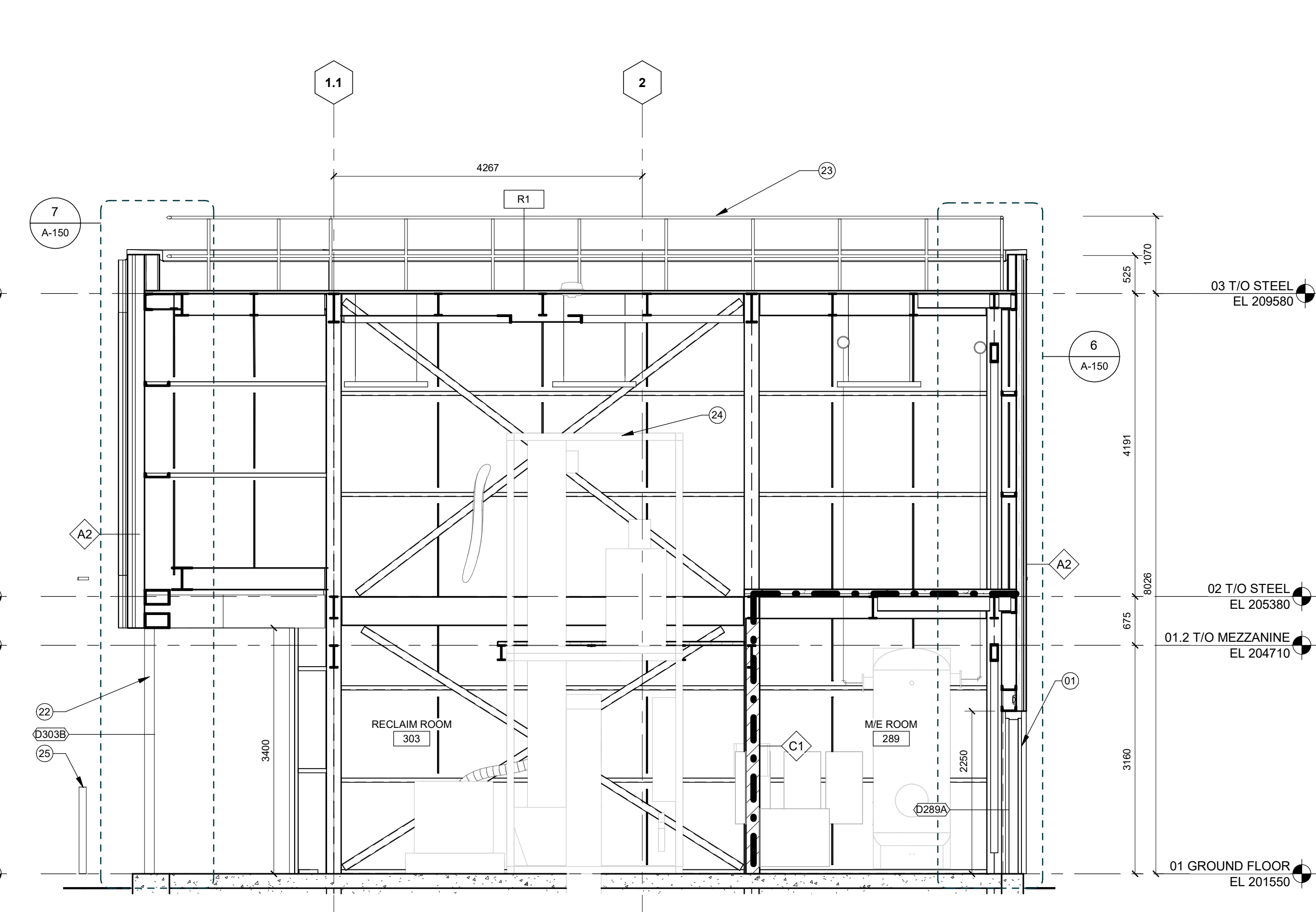
- |      |  |      |   |
|------|--|------|---|
| (01) | HOLLOW METAL DOOR & FRAME ASSEMBLY                                   | (17) | COUNTERTOP  |
| (02) | SINK - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS                 | (18) | METAL CLADDING INFILL PANELS. COLOUR AND PROFILE TO MATCH EXISTING PANELS |
| (03) | SURFACE MOUNTED SOAP DISPENSER                                       | (19) | LOCKERS   |
| (04) | MIRROR   | (20) | CH1 - COAT HOOK   |
| (05) | SURFACE MOUNTED PAPER TOWEL DISPENSER AND DISPOSAL                   | (21) | SOILED COVERALL STORAGE BIN   |
| (06) | TOILET - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS               | (22) | INSULATED THERMALLY BROKEN HOLLOW METAL DOOR AND FRAME ASSEMBLY           |
| (07) | TOILET PAPER HOLDER (TYP OF 1 IN EACH STALL)                         | (23) | GALVANIZED STEEL GUARDRAIL ASSEMBLY                                       |
| (08) | TOILET STALL   | (24) | MECHANICAL EQUIPMENT. REFER TO MECHANICAL DWGS.                           |
| (09) | ROLL-IN SHOWER STALL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS | (25) | GALVANIZED STEEL BOLLARD ASSEMBLY. REFER TO STRUCTURAL DWGS.              |
| (10) | SHS - SHOWER FOLDING SEAT  | (26) | LIGHT FIXTURE. REFER TO ELEC. DWGS.                                       |
| (11) | SHOWER CONTROL - REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS     | (27) | PRIVACY PARTITION C/W DOOR  |
| (12) | GB1 - 610mm LONG 38mm DIA. GRAB BAR                                  | (28) | 600mm X 600mm WIDE ACCESS HATCH, AT 150mm F.F                             |
| (13) | GB2 - 765mm LONG 38mm DIA. GRAB BAR                                  | (29) | S.S. WALL MOUNTED MASK HOOD, TOTAL OF 24 HOOKS                            |
| (14) | GB3 - 1067mm LONG 38mm DIA. GRAB BAR                                 | (30) | EMERGENCY SHOWER & EYE WASH REFER TO MECHANICAL DWGS                      |
| (15) | GB4 - L SHAPED 760mm x 760mm LONG 38mm DIA. GRAB BAR                 | (31) | WASTE BIN   |
| (16) | SHOWER CURTAIN AND ROD   | (32) | PERSONAL LEANING VACUUM STATION   |



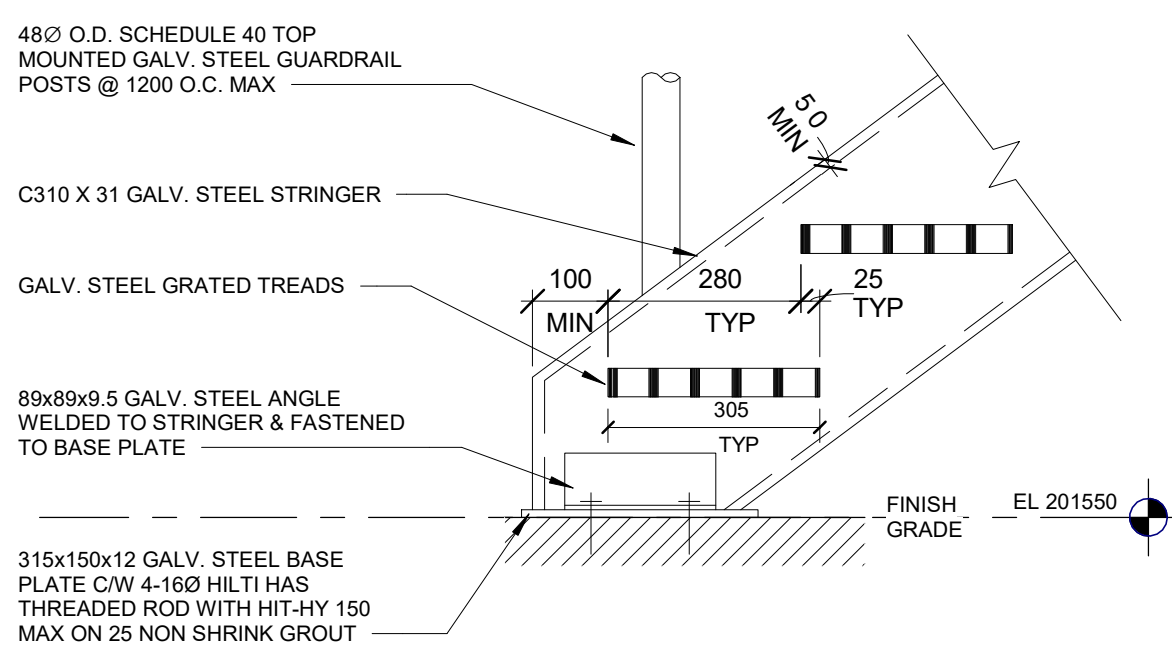
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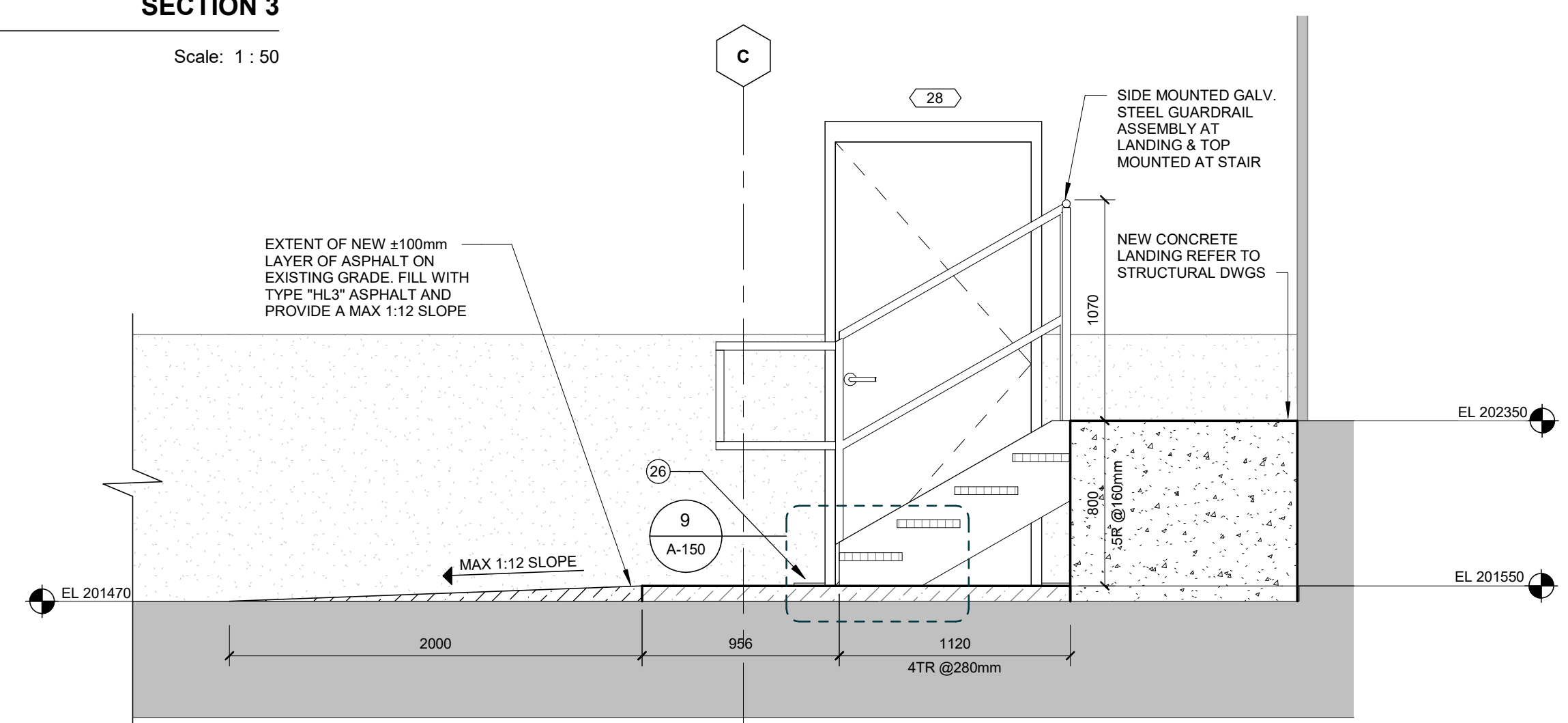
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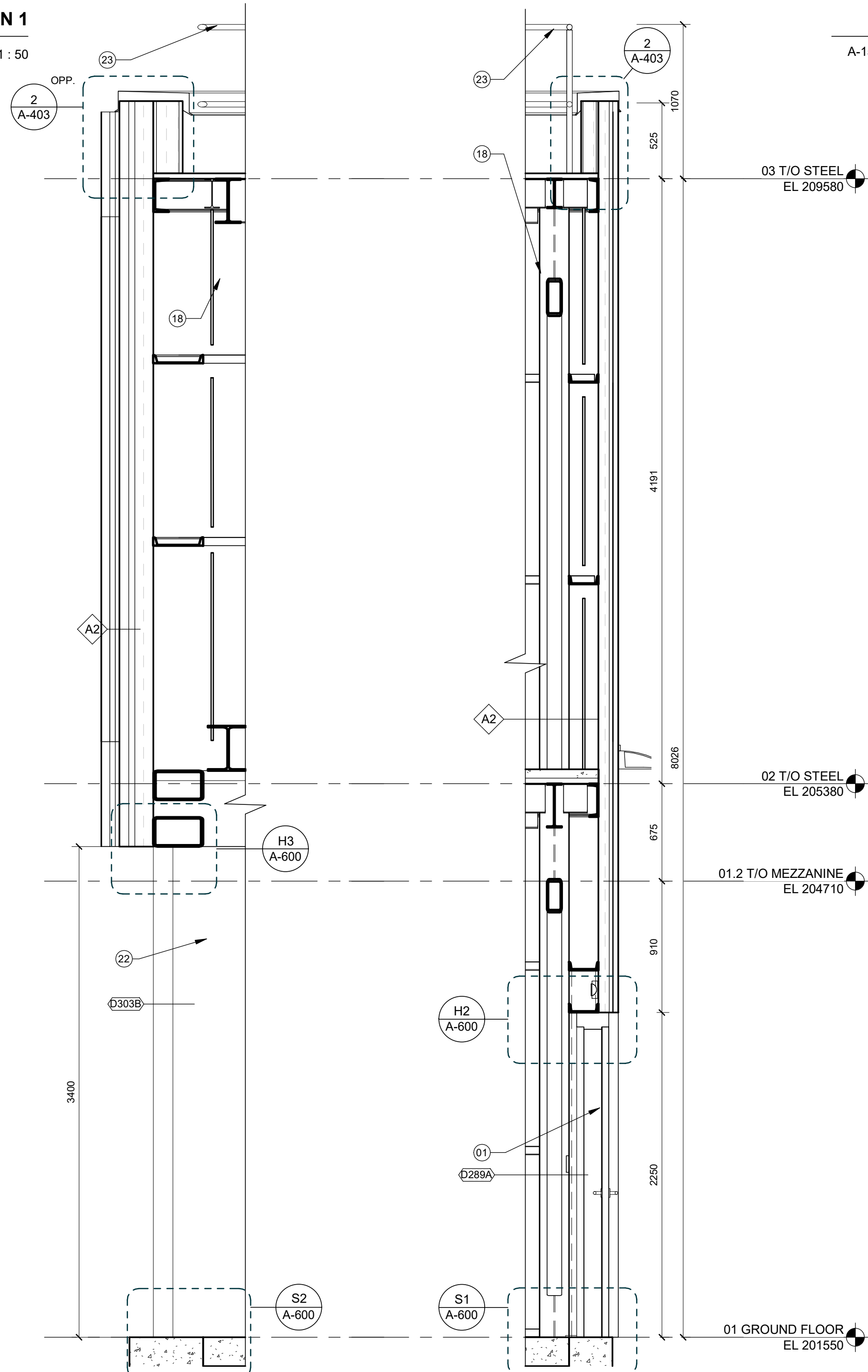
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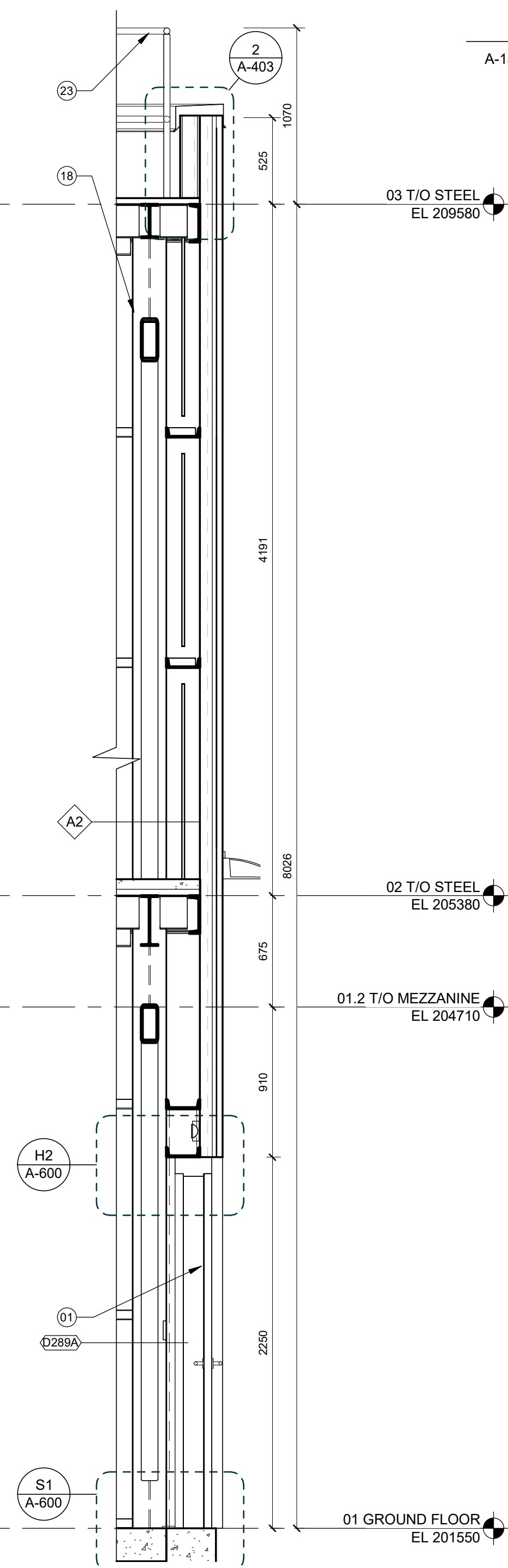
<b>9</b>	<b>STAIR DETAIL</b>
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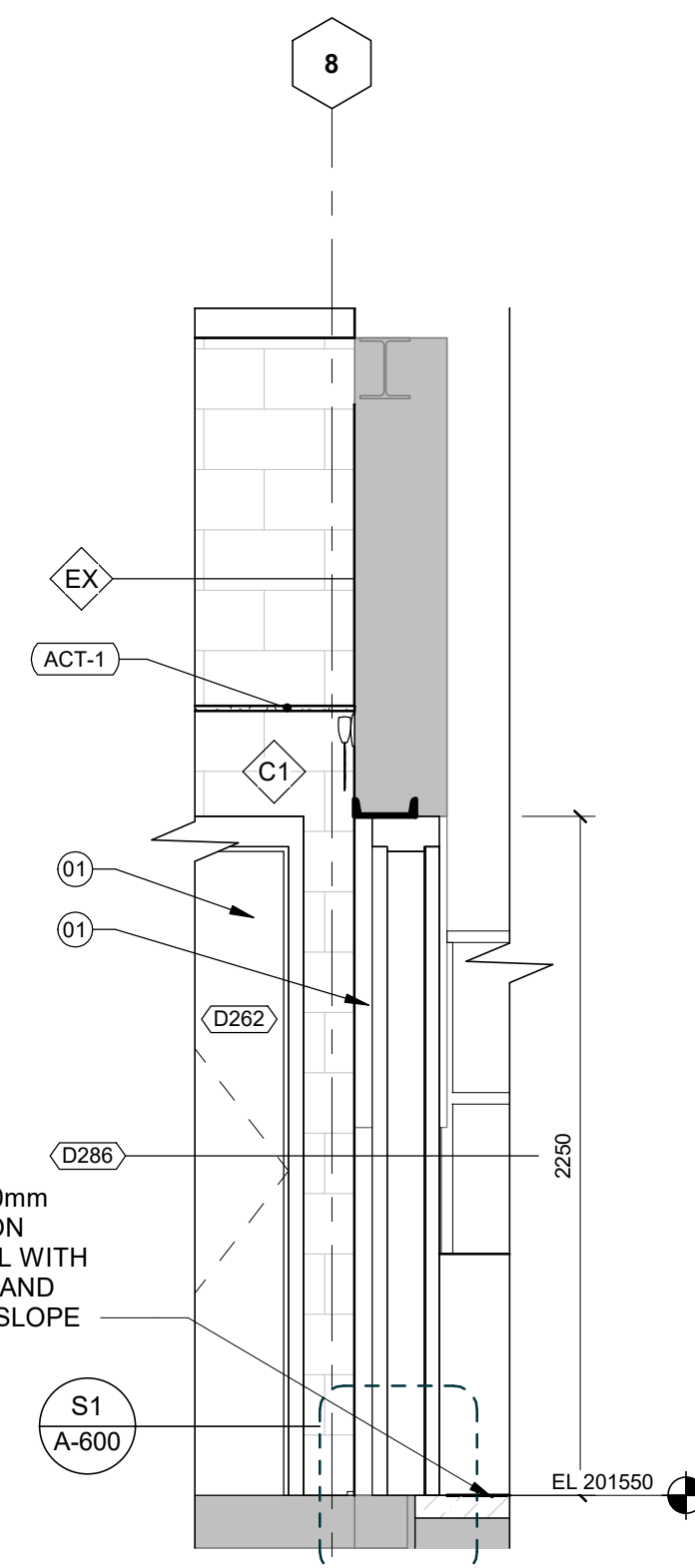
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A-150	REF: 1 / A-101	Scale: 1 : 25



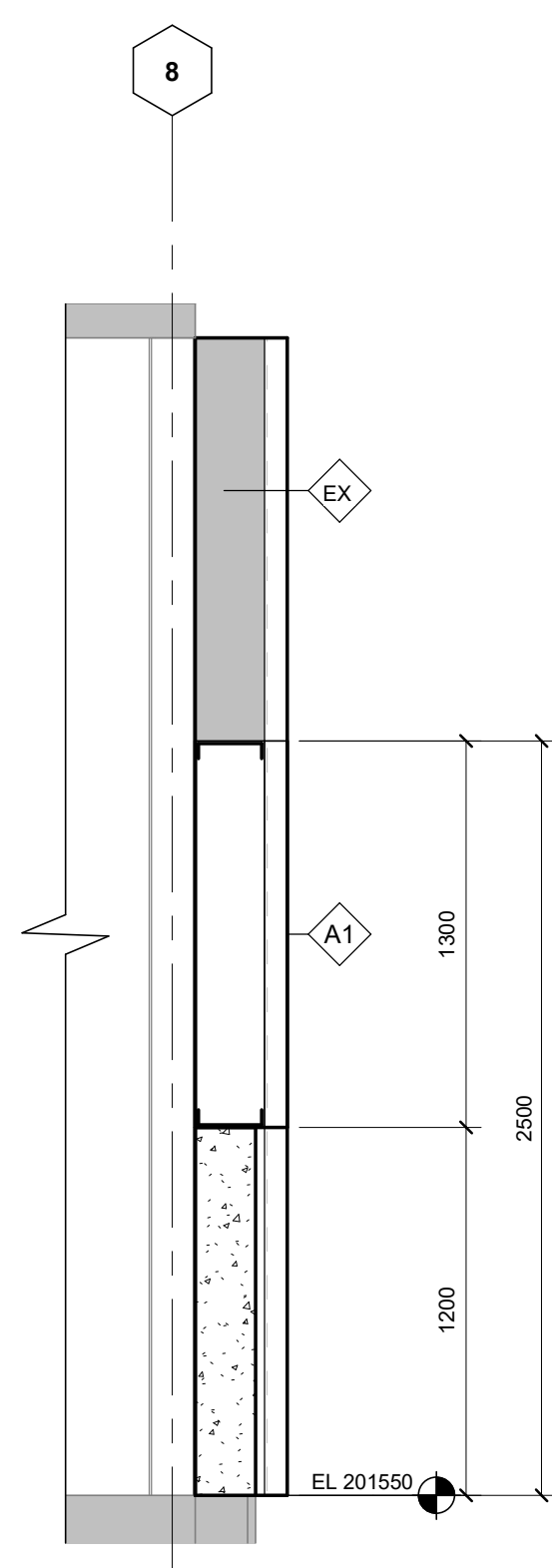
7	<b>WALL SECTION 2</b>	
A-150	REF: 3 / A-150	Scale: 1 : 25



<b>6</b>	<b>WALL SECTION 1</b>
A-150	REF: 3 / A-150 Scale: 1 : 25



5	EXTERIOR WALL SECTION - ENTRANCE DOOR	
A-150	REF: 1 / A-101	Scale: 1 : 25



4	EXTERIOR WALL SECTION - EAST LOCKER ROOM	
A-150	REF: 1 / A-101	Scale: 1 : 25



## PROJECT

**BLAST BAY UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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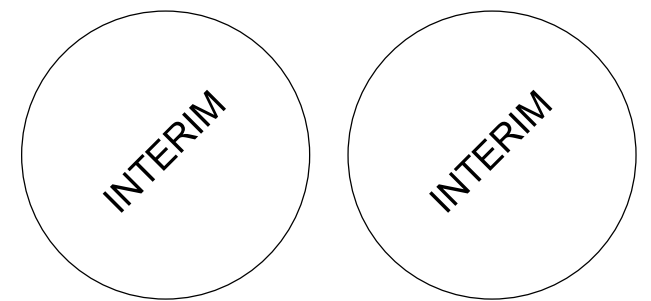
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## REGISTRATION



## KEY PLAN



**ISSUE/REVISION**

[illegible]

## PROJECT NUMBER

60678205

**SHEET TITLE**

## BUILDING & WALL SECTIONS

**SHEET NUMBER**

# A-150





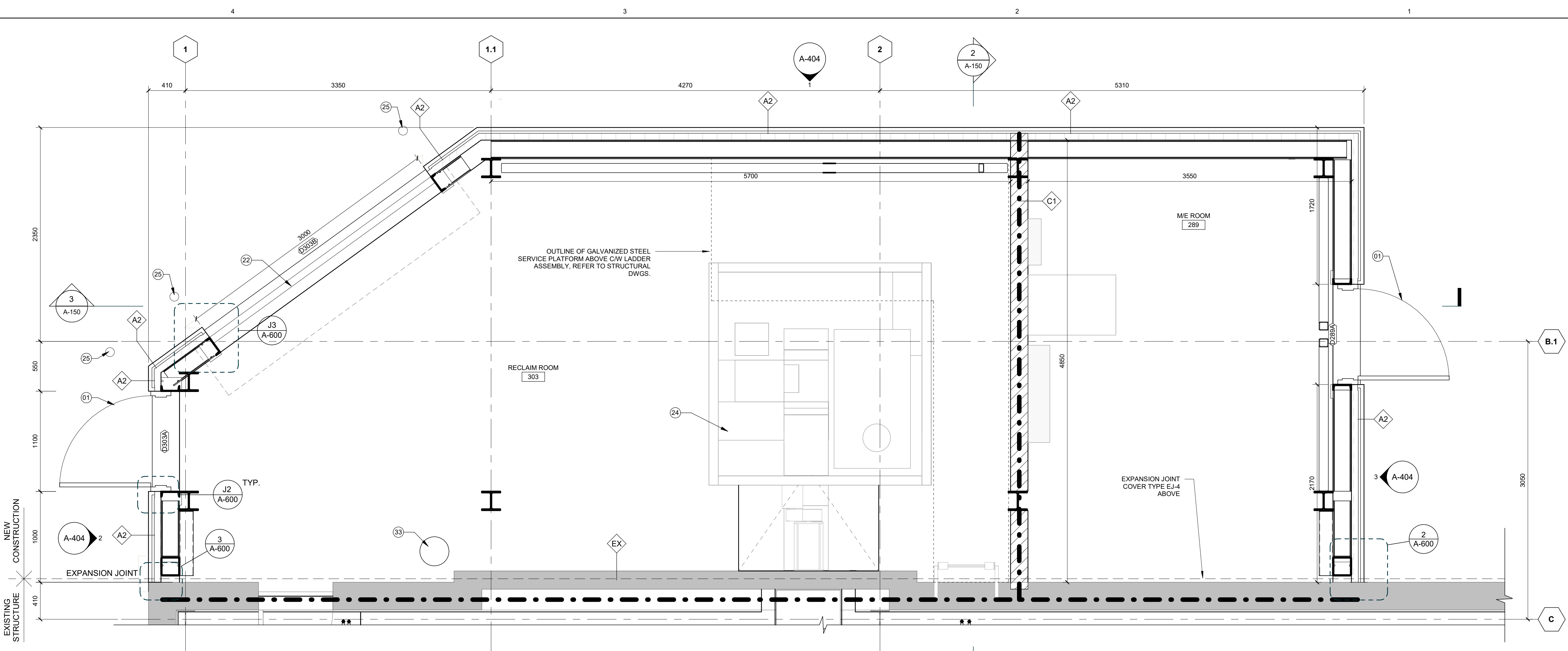


- KEYNOTES**
- 01 HOLLOW METAL DOOR & FRAME ASSEMBLY
  - 02 SINK - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
  - 03 SURFACE MOUNTED SOAP DISPENSER
  - 04 MIRROR
  - 05 SURFACE MOUNTED PAPER TOWEL DISPENSER AND DISPOSAL
  - 06 TOILET - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
  - 07 TOILET PAPER HOLDER (TYP OF 1 IN EACH STALL)
  - 08 TOILET PARTITION C/W DOOR
  - 09 ROLL-IN SHOWER STALL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS
  - 10 SHS - SHOWER FOLDING SEAT
  - 11 SHOWER CONTROL - REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS
  - 12 GB1 - 610mm LONG 38mm DIA. GRAB BAR
  - 13 GB2 - 765mm LONG 38mm DIA. GRAB BAR
  - 14 GB3 - 1067mm LONG 38mm DIA. GRAB BAR
  - 15 GB4 - L SHAPED 760mm x 760mm LONG 38mm DIA. GRAB BAR
  - 16 SHOWER CURTAIN AND ROD
  - 17 COUNTERTOP
  - 18 METAL CLADDING INFILL PANELS. COLOUR AND PROFILE TO MATCH EXISTING PANELS
  - 19 LOCKERS
  - 20 CH1 - COAT HOOK AT 1100mm FF
  - 21 SOILED COVERALL STORAGE BIN
  - 22 INSULATED THERMALLY BROKEN HOLLOW METAL DOOR AND FRAME ASSEMBLY
  - 23 GALVANIZED STEEL GUARDRAIL ASSEMBLY
  - 24 MECHANICAL EQUIPMENT, REFER TO MECHANICAL DWGS.
  - 25 GALVANIZED STEEL BOLLARD ASSEMBLY, REFER TO STRUCTURAL DWGS.
  - 26 ACTIVATOR- WAVE HAND DOOR SWITCH
  - 27 PRIVACY PARTITION C/W DOOR
  - 28 600mm X 600mm WIDE ACCESS HATCH, AT 150mm F.F
  - 29 S.S. WALL MOUNTED MASK HOOK, TOTAL OF 24 HOOKS
  - 30 EMERGENCY SHOWER & EYE WASH REFER TO MECHANICAL DWGS
  - 31 WASTE BIN
  - 32 PERSONAL CLEANING VACUUM STATION
  - 33 EYE WASH - REFER TO MECHANICAL DWGS

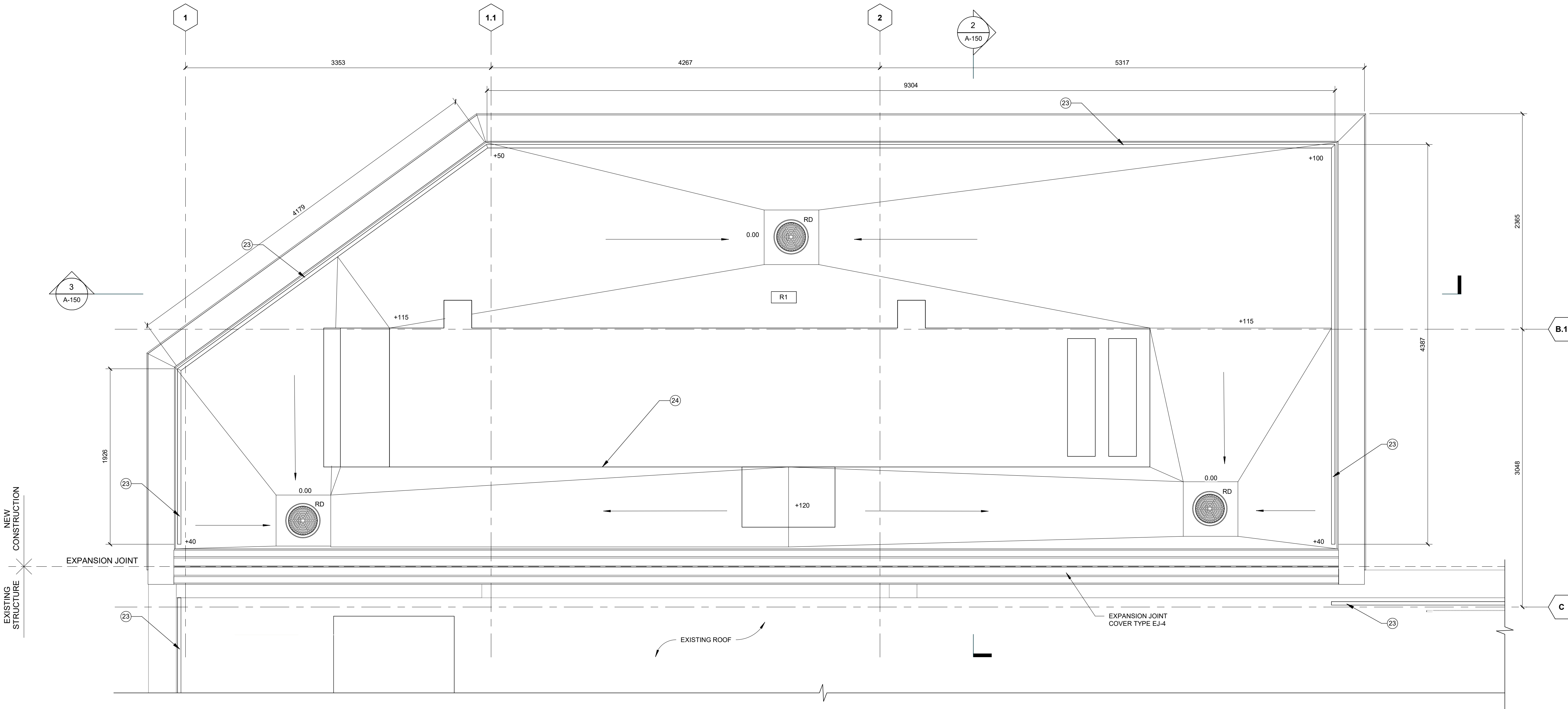
- WALL TYPES**
- A1 EXTERIOR WALL ASSEMBLY
    - 38mm PREFINISHED STEEL CLADDING
    - Z-GIRTS @ 400 O/C
    - 25mm AIR SPACE
    - 75mm SPRAY APPLIED FOAM INSULATION
    - 150mm CONCRETE BLOCK W/ HORIZONTAL TRUSS REINFORCING EVERY SECOND COURSE
  - A2 EXTERIOR WALL ASSEMBLY
    - 38mm PREFINISHED STEEL CLADDING
    - Z-GIRTS @ 400 O/C
    - 25mm AIR SPACE
    - 75mm SPRAY APPLIED FOAM INSULATION
    - PREFINISHED 22ga STEEL LINER PANEL
  - C1 INTERIOR WALL ASSEMBLY
    - 150mm CONCRETE BLOCK
    - HORIZONTAL TRUSS REINFORCING EVERY SECOND COURSE
    - BULLNOSE ON EXPOSED CORNERS
  - C2 INTERIOR WALL ASSEMBLY
    - 90mm CONCRETE BLOCK
    - HORIZONTAL TRUSS REINFORCING EVERY SECOND COURSE
    - BULLNOSE ON EXPOSED CORNERS
  - EX EXISTING WALL TO REMAIN

- ROOF TYPES**
- R1 ROOF ASSEMBLY
    - 2 PLY MODIFIED BITUMEN MEMBRANE
    - 12mm SHEATHING
    - TAPERED INSULATION
    - 2 LAYERS OF 50mm BASE INSULATION
    - VAPOUR RETARDER
    - PROTECTION BOARD
    - 38mm STEEL DECK-REFER TO STRUCT DWGS

- LEGEND**
- DENOTES AREAS NOT IN CONTRACT
- FIRE SAFETY LEGEND**
- PATH OF TRAVEL
  - 1 HOUR FIRE RESISTANCE RATING



1  
A-402 REF: 1 / A-101  
Scale: 1 : 25



4  
A-402 REF: 2 / A-404  
Scale: 1 : 25



PROJECT

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

**REGISTERED OWNER:**  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
555 Oak Street East  
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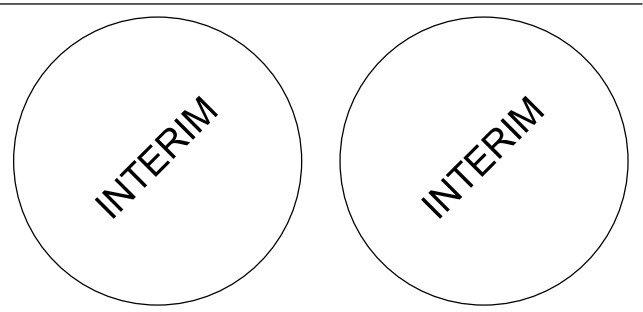
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REGISTRATION



KEY PLAN



SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
3	ISSUED FOR TENDER	28/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

PROJECT NUMBER

60678205

SHEET TITLE

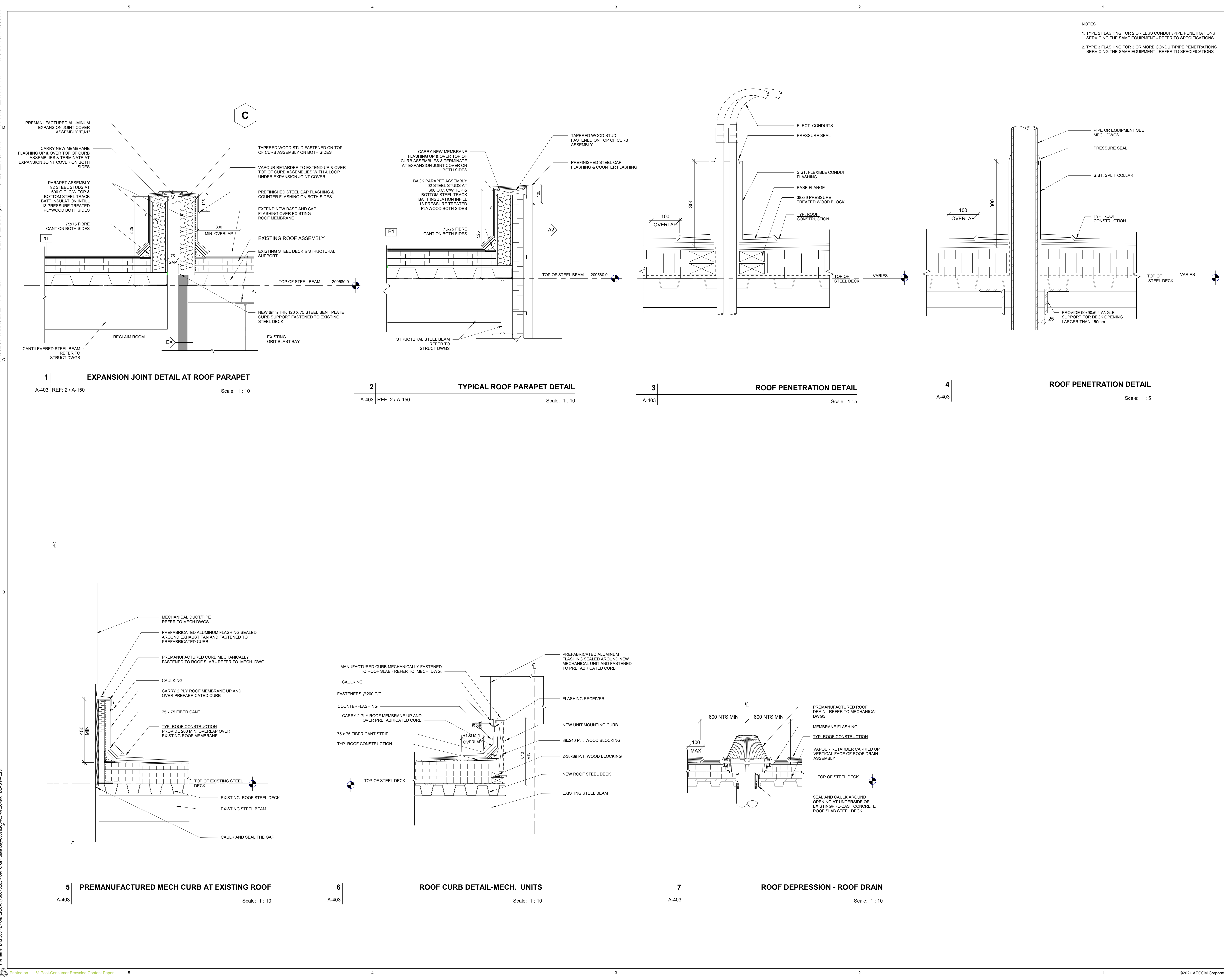
**ENLARGED PARTIAL FLOOR  
PLAN & PARTIAL ROOF PLAN**

SHEET NUMBER

**A-402**



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APPROVED: Approver  
CHECKED: Designer  
DESIGNER: INITIALS: C  
PROJECT MANAGEMENT: INITIALS: C  
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8  
Last Printed: 2023-09-29 2:16:49 PM  
Filename: BM\_360-IBP-AMER(CAN)\_60678205 - ONTC Coll Blast Bay/0678205-AOM-420-GRITBLAST-AE-14



NOTES  
1. TYPE 2 FLASHING FOR 2 OR LESS CONDUIT/PIPE PENETRATIONS SERVICING THE SAME EQUIPMENT - REFER TO SPECIFICATIONS  
2. TYPE 3 FLASHING FOR 3 OR MORE CONDUIT/PIPE PENETRATIONS SERVICING THE SAME EQUIPMENT - REFER TO SPECIFICATIONS

# AECOM

**PROJECT**  
**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

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INTERIM

**KEY PLAN**

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**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
**ROOF DETAILS**

**SHEET NUMBER**  
**A-403**

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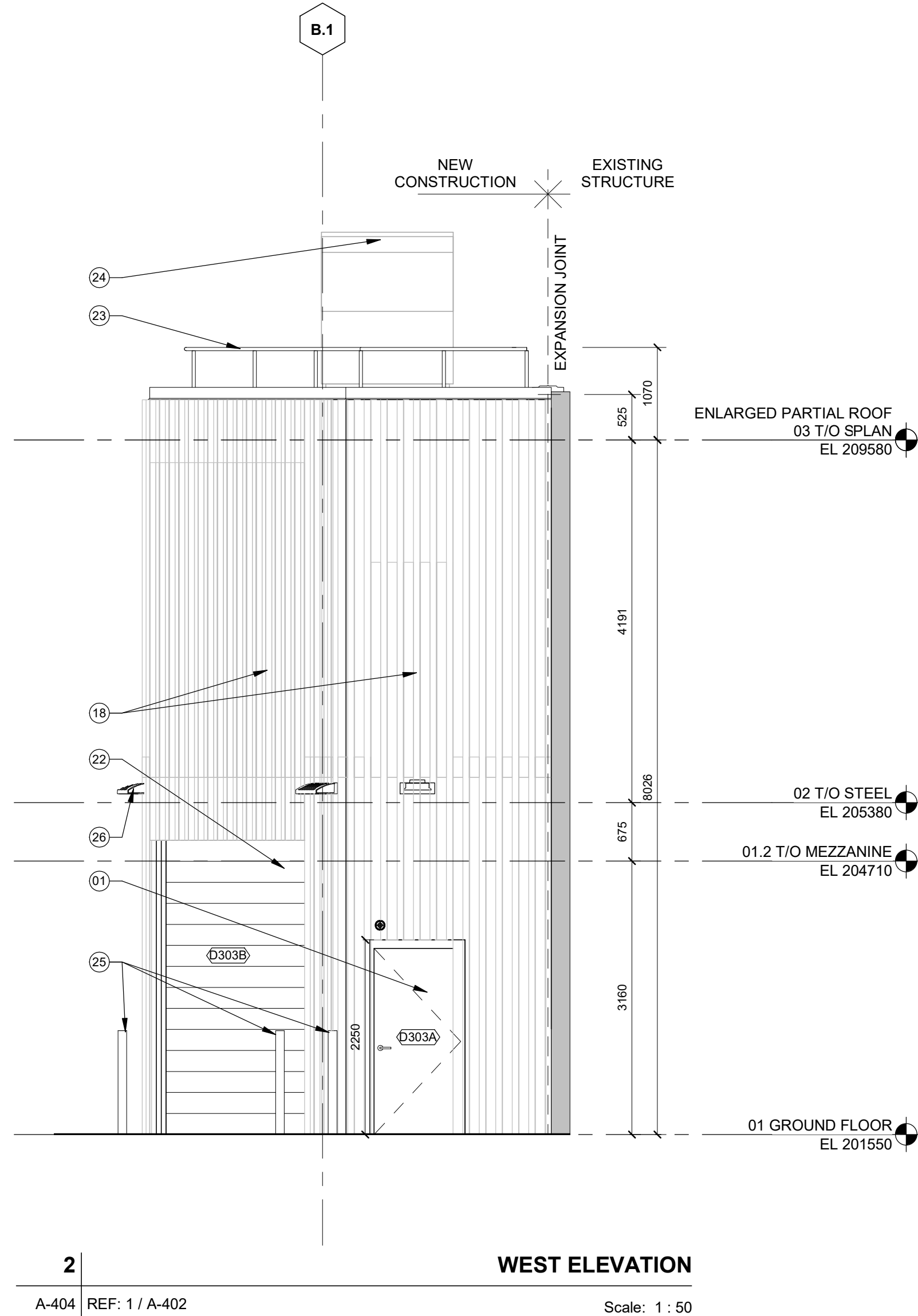
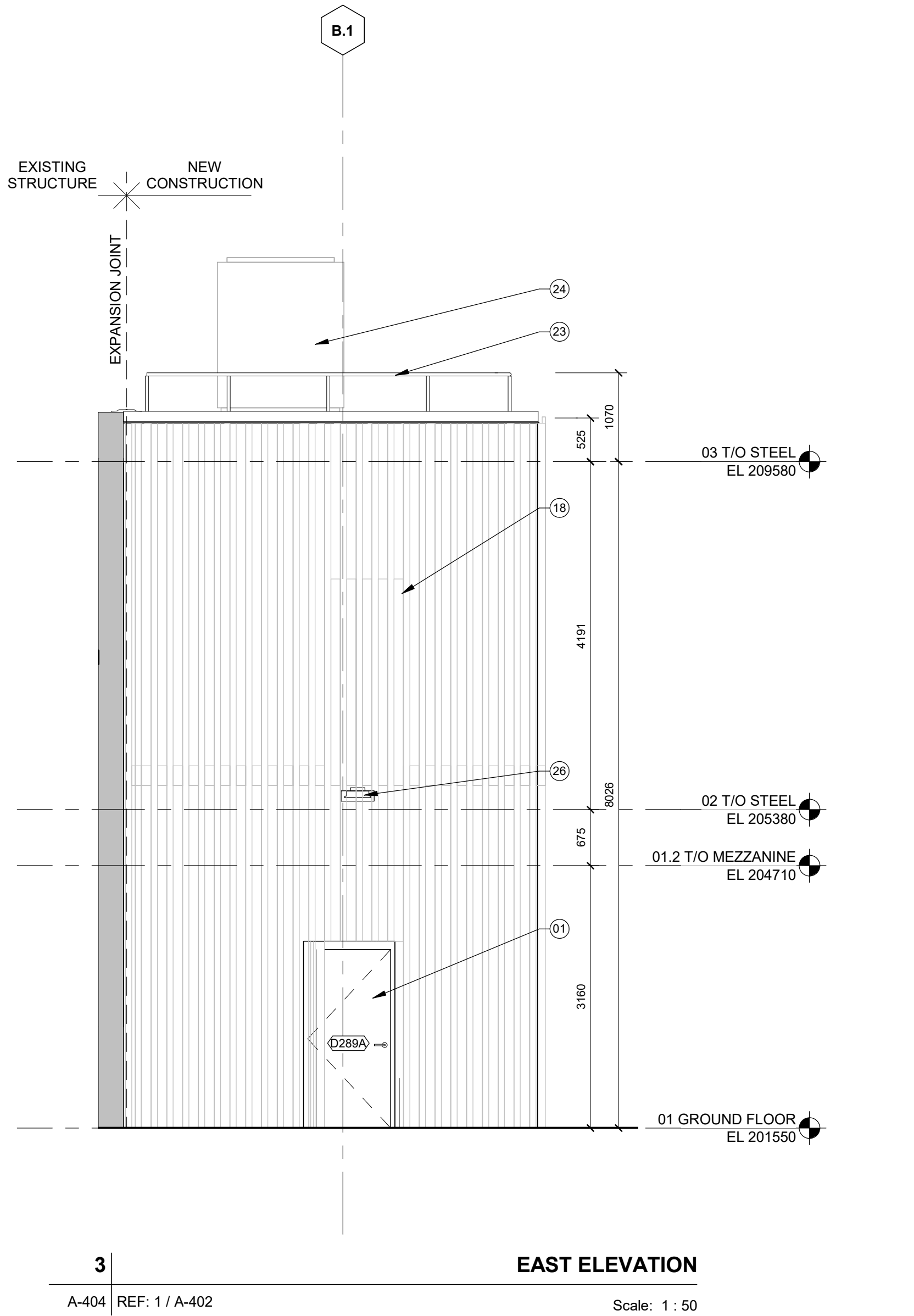
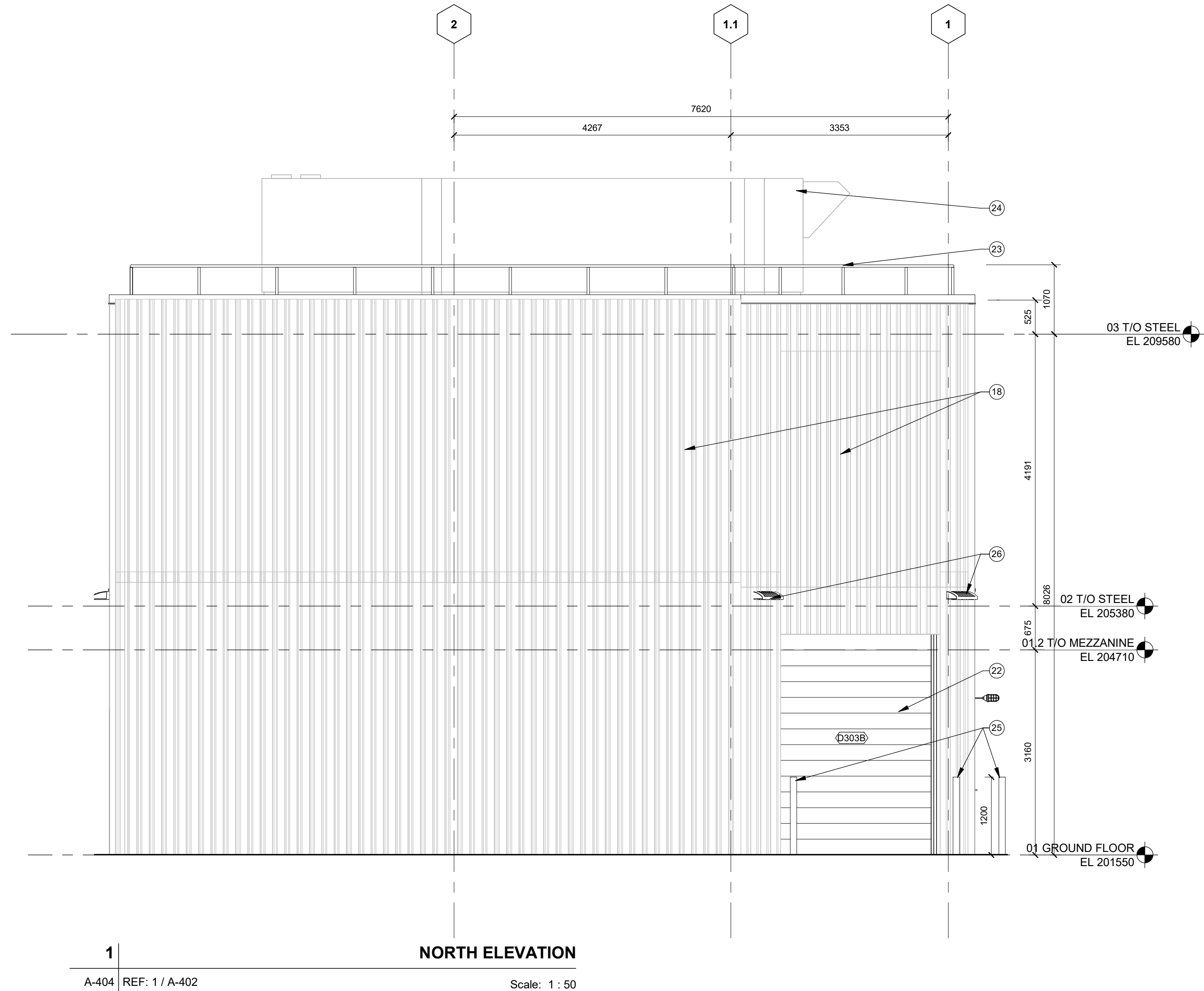
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KEYNOTES

- |   |  |
|---|--|
| 01 HOLLOW METAL DOOR & FRAME ASSEMBLY                                   | 17 COUNTERTOP  |
| 02 SINK - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS                 | 18 METAL CLADDING INFILL PANELS. COLOUR AND PROFILE TO MATCH EXISTING PANELS |
| 03 SURFACE MOUNTED SOAP DISPENSER                                       | 19 LOCKERS   |
| 04 MIRROR   | 20 CH1 - COAT HOOK   |
| 05 SURFACE MOUNTED PAPER TOWEL DISPENSER AND DISPOSAL                   | 21 SOILED COVERALL STORAGE BIN   |
| 06 TOILET - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS               | 22 INSULATED THERMALLY BROKEN HOLLOW METAL DOOR AND FRAME ASSEMBLY           |
| 07 TOILET PAPER HOLDER (TYP OF 1 IN EACH STALL)                         | 23 GALVANIZED STEEL GUARDRAIL ASSEMBLY                                       |
| 08 TOILET STALL   | 24 MECHANICAL EQUIPMENT. REFER TO MECHNICAL DWGS.                            |
| 09 ROLL-IN SHOWER STALL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS | 25 GALVANIZED STEEL BOLLARD ASSEMBLY. REFER TO STRUCTURAL DWGS.              |
| 10 SHS - SHOWER FOLDING SEAT  | 26 LIGHT FIXTURE. REFER TO ELEC. DWGS.                                       |
| 11 SHOWER CONTROL - REFER TO MECHANICAL DRAWINGS & SPECIFICATIONS       | 27 PRIVACY PARTITION C/W DOOR  |
| 12 GB1 - 610mm LONG 38mm DIA. GRAB BAR                                  | 28 600mm X 600mm WIDE ACCESS HATCH. AT 150mm F.F                             |
| 13 GB2 - 765mm LONG 38mm DIA. GRAB BAR                                  | 29 S.S. WALL MOUNTED MASK HOOK. TOTAL OF 24 HOOKS                            |
| 14 GB3 - 1067mm LONG 38mm DIA. GRAB BAR                                 | 30 EMERGENCY SHOWER & EYE WASH REFER TO MECHANICAL DWGS                      |
| 15 GB4 - L SHAPED 760mm x 760mm LONG 38mm DIA. GRAB BAR                 | 31 WASTE BIN   |
| 16 SHOWER CURTAIN AND ROD   | 32 PERSONAL LEANING VACUUM STATION   |



PROJECT

**BLAST BAY UPGRADE**  
915/916 McIntyre St. E, North Bay, ON

CLIENT

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**PRINCIPAL:**  
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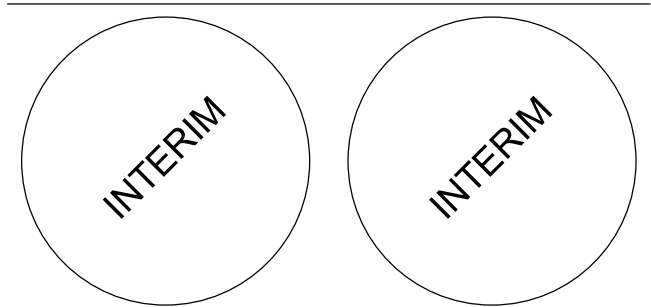
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REGISTRATION



KEY PLAN



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PROJECT NUMBER

60678205

SHEET TITLE

EXTERIOR ELEVATIONS

SHEET NUMBER

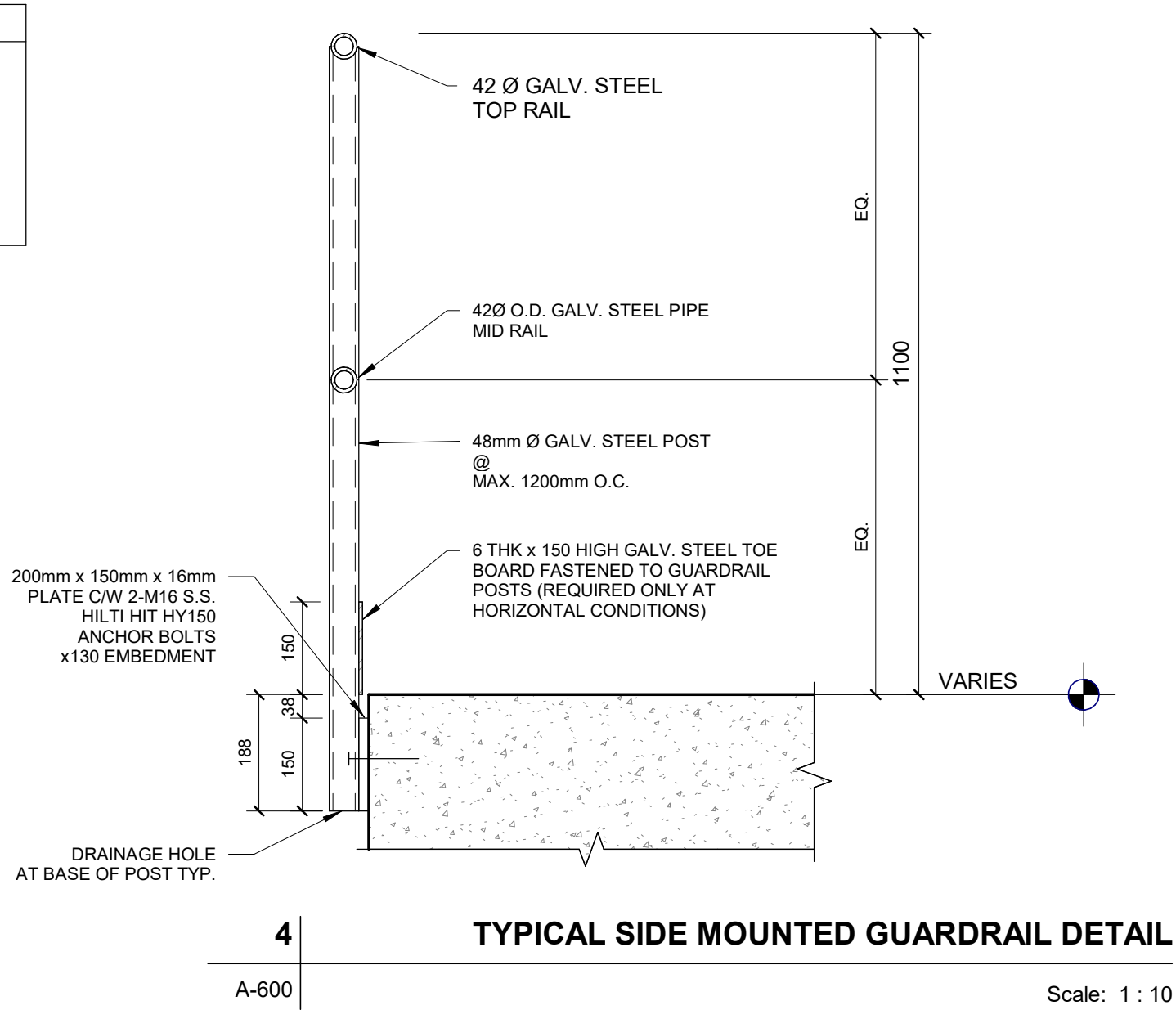
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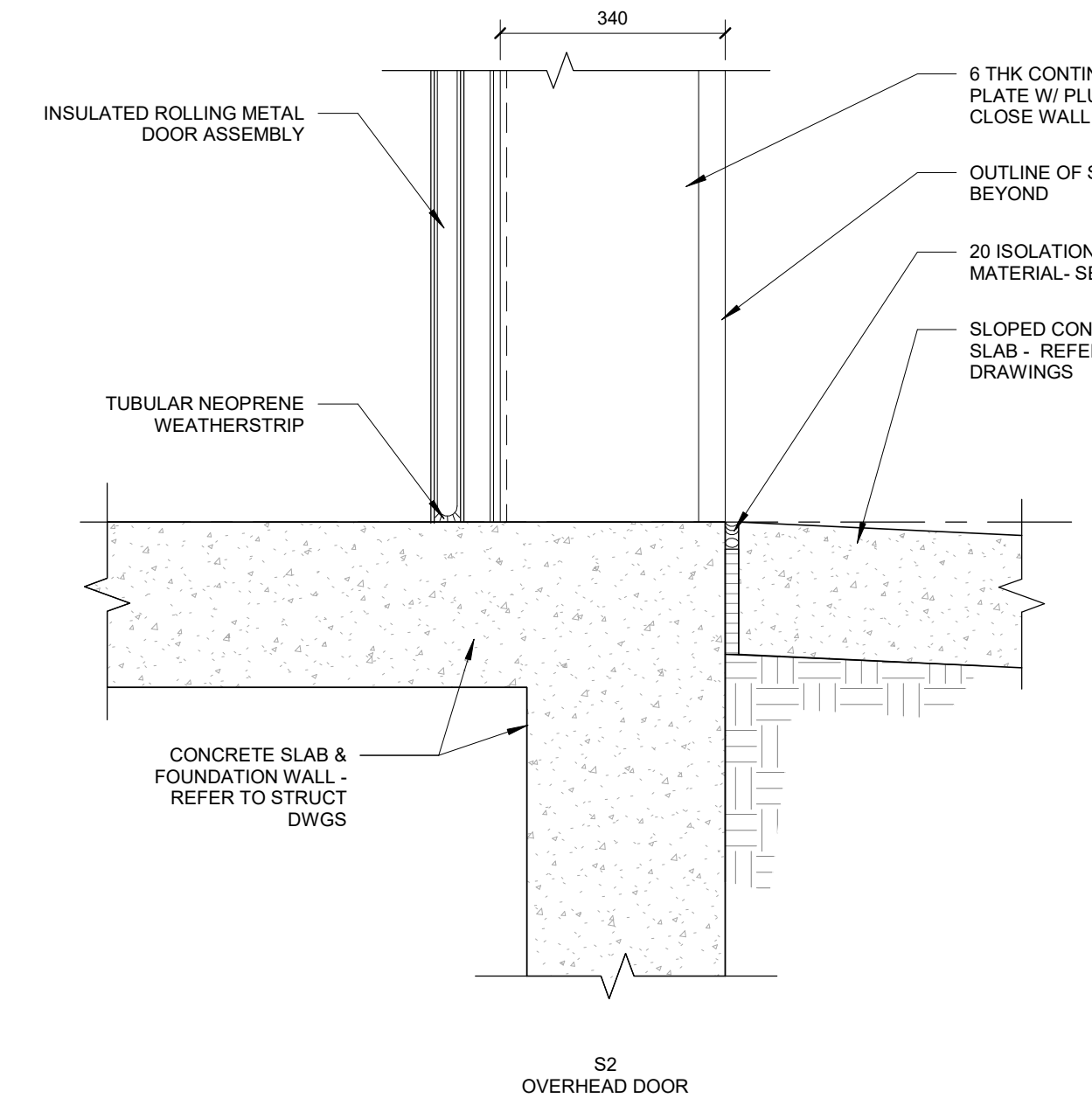
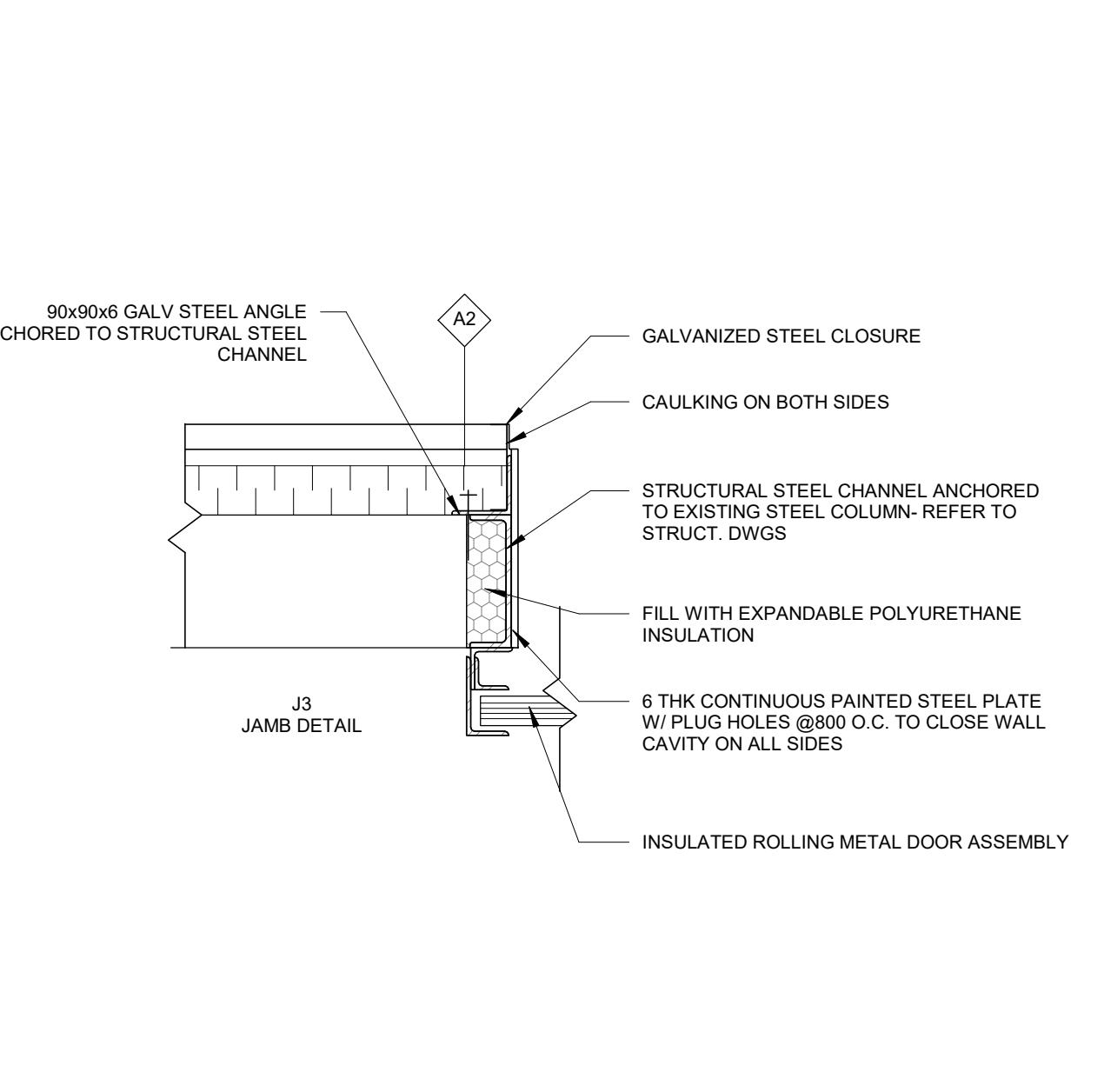
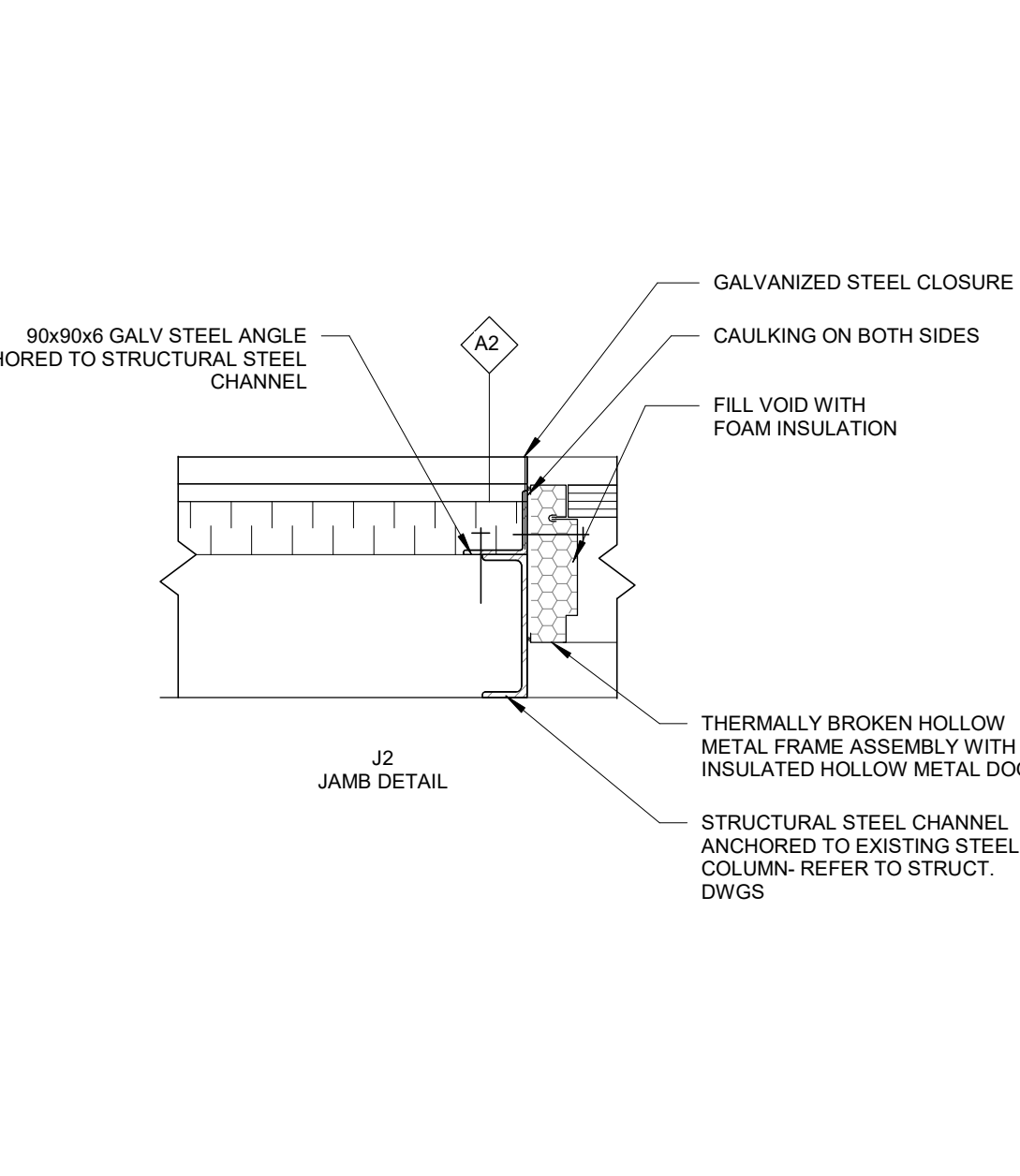
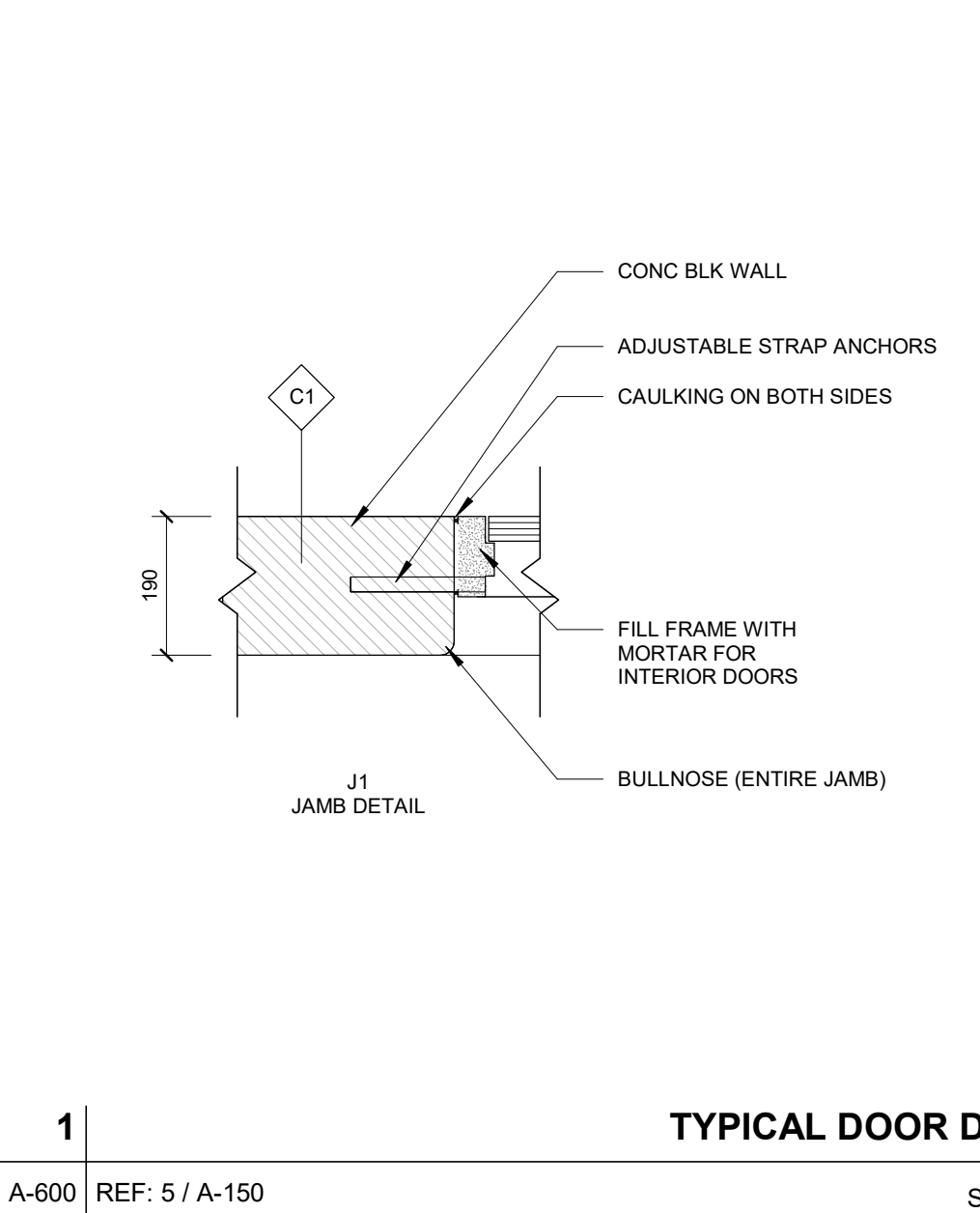
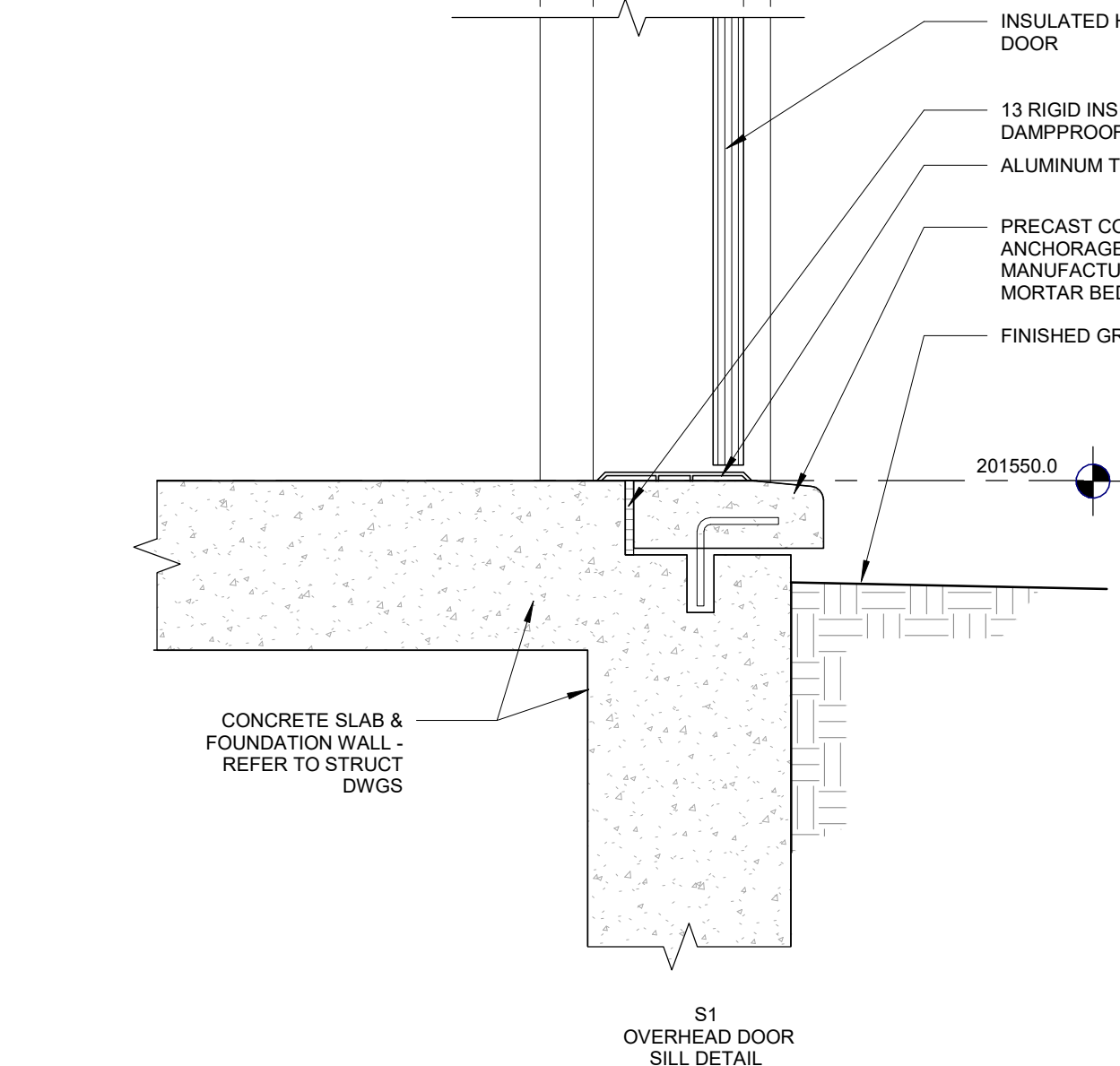
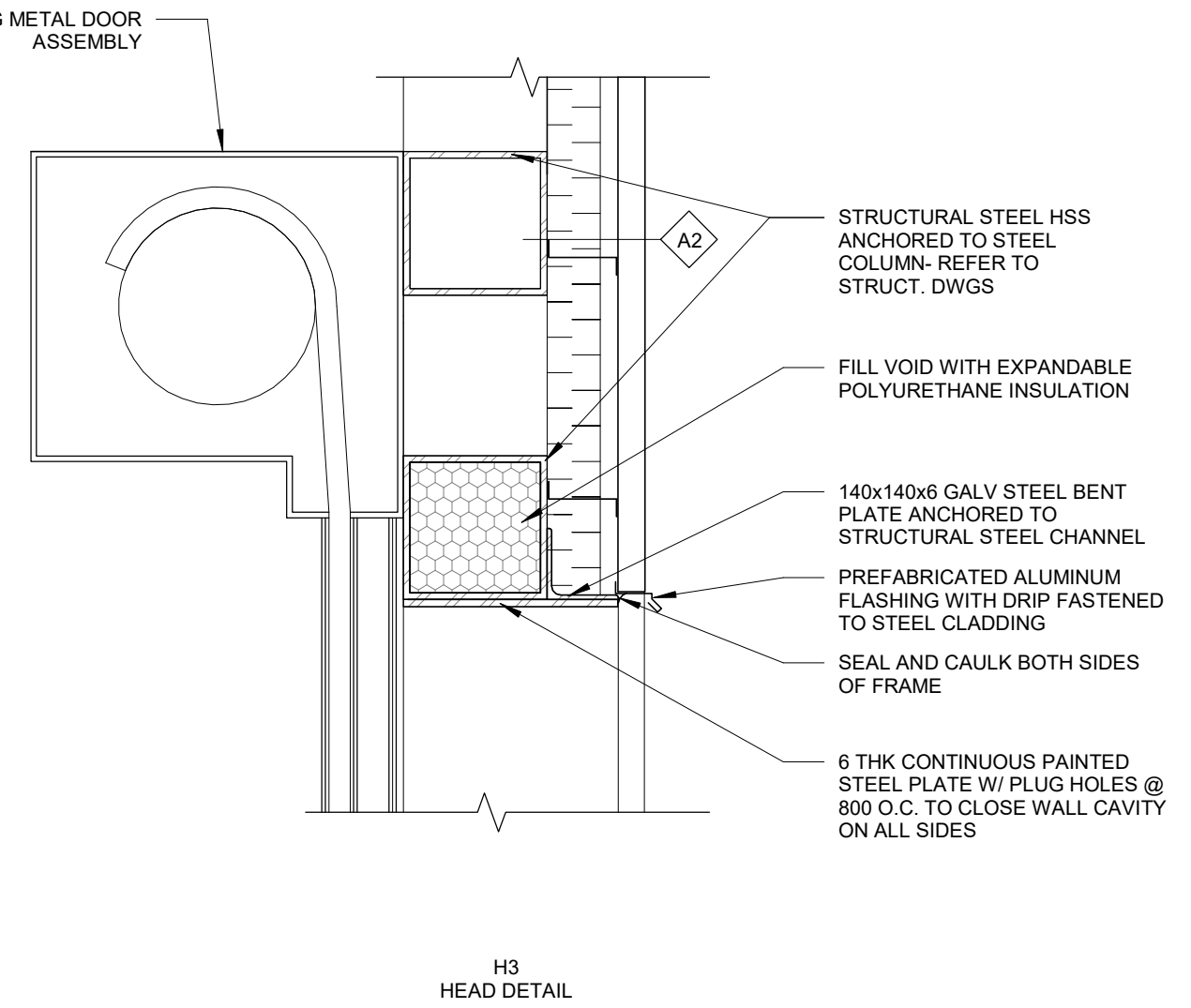
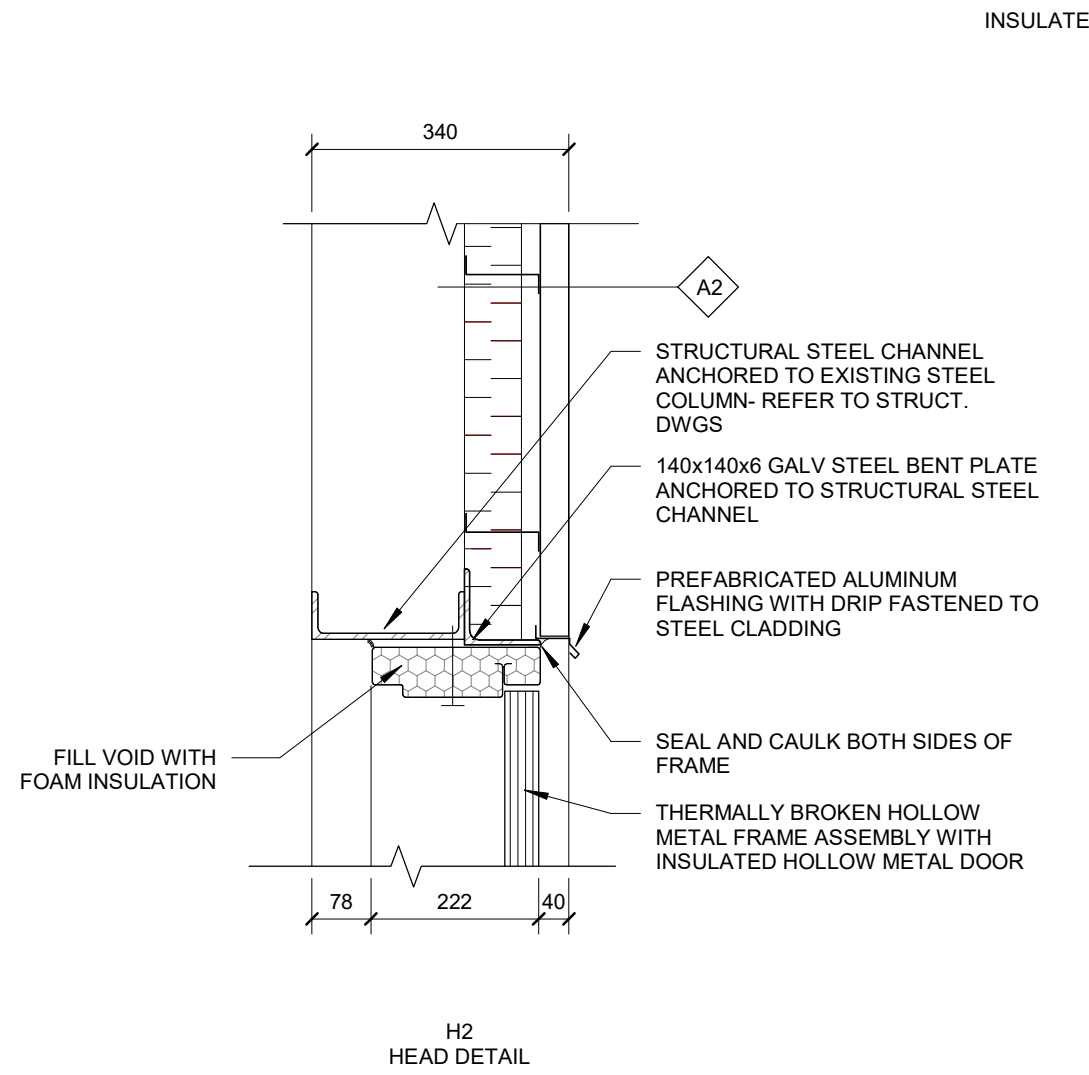
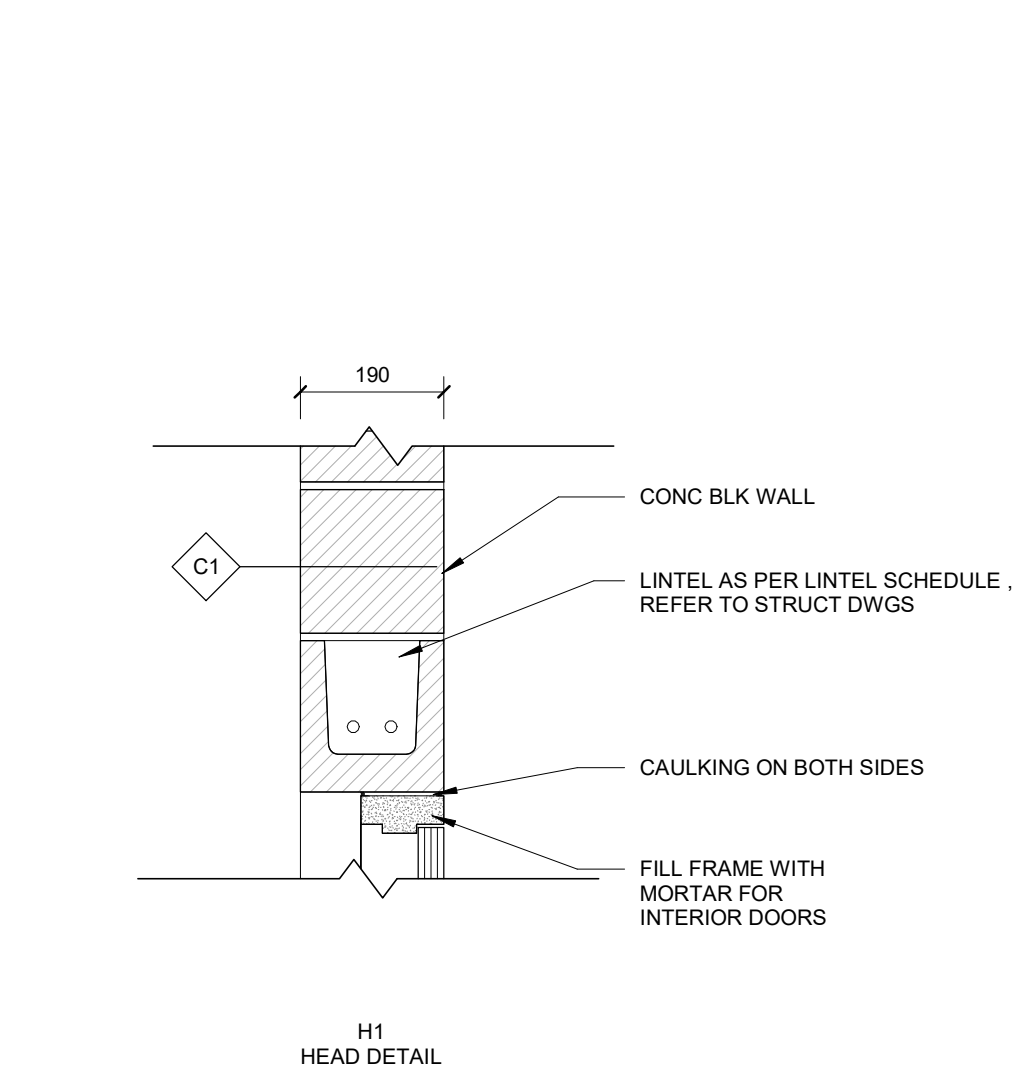
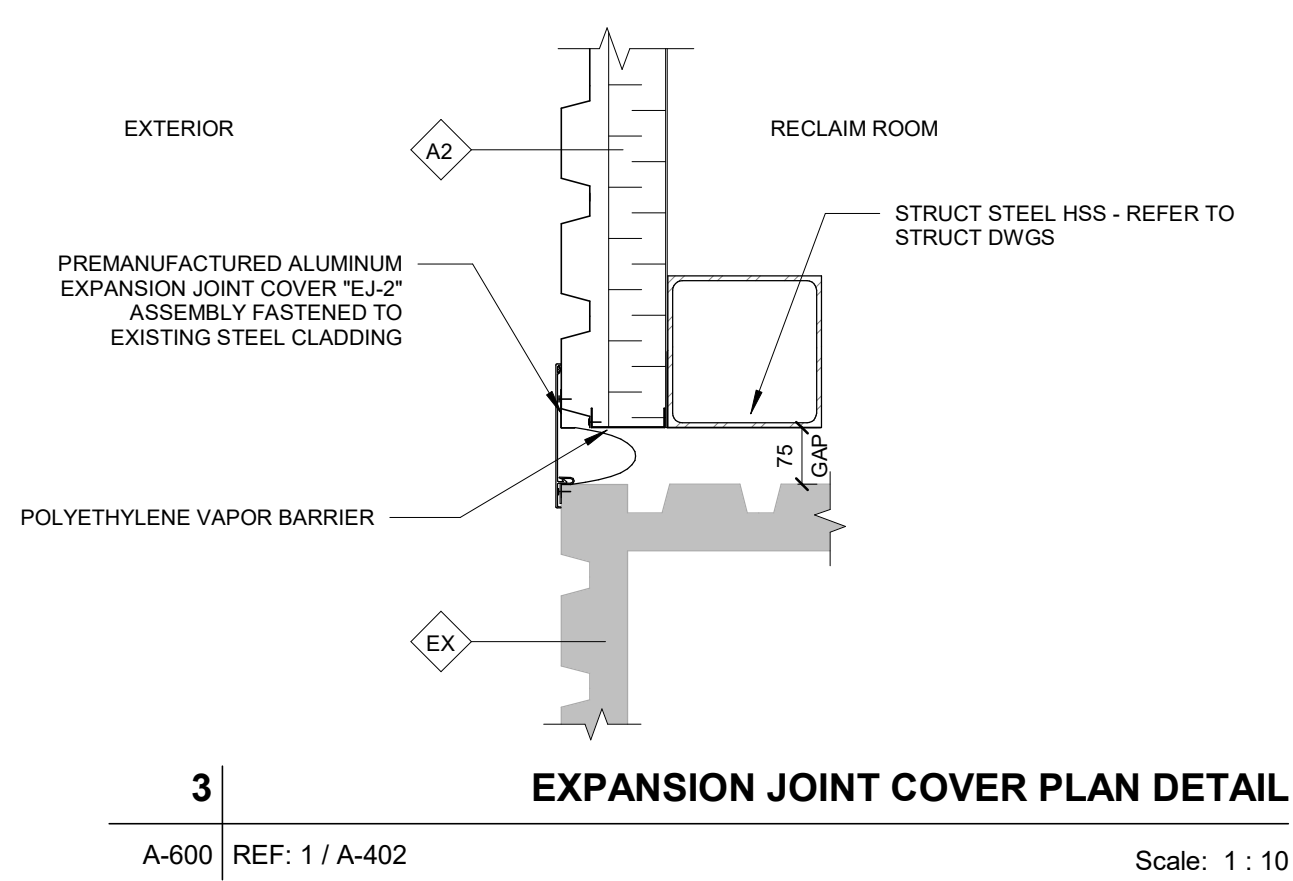
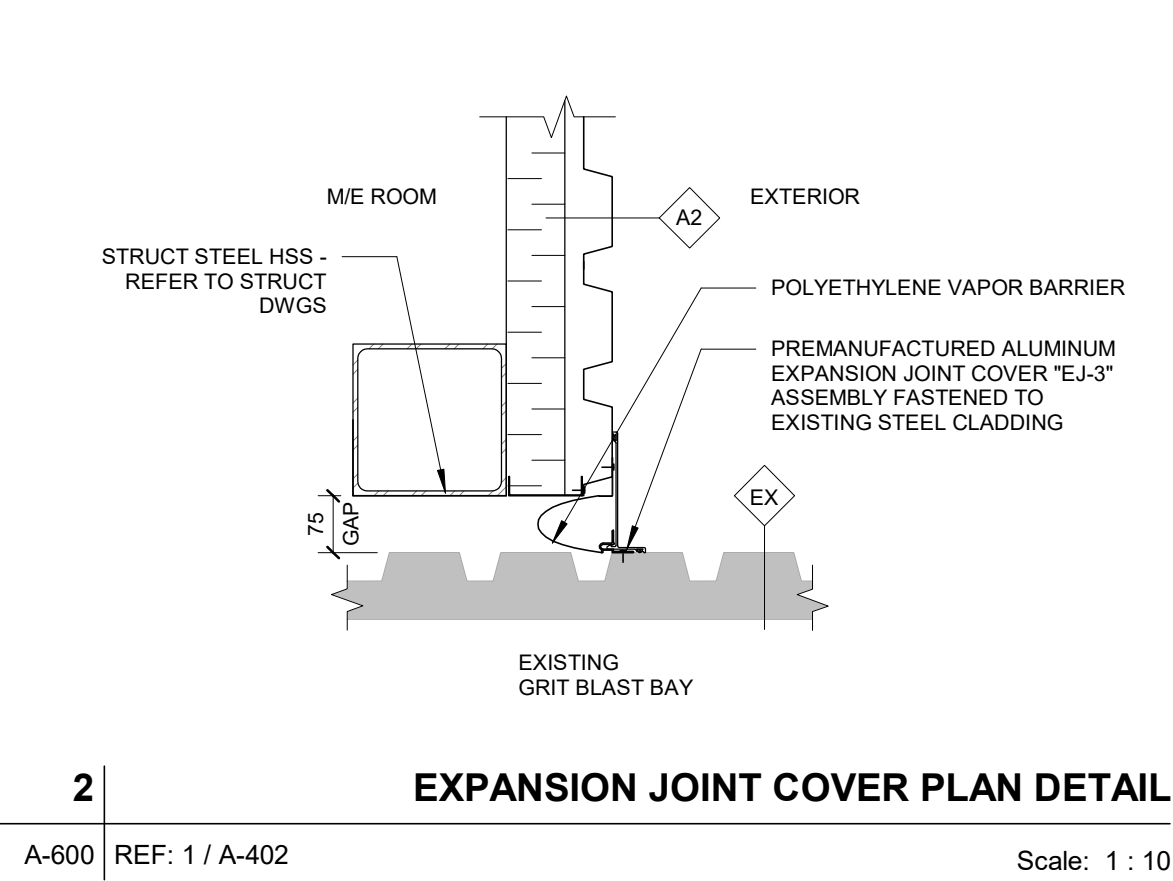
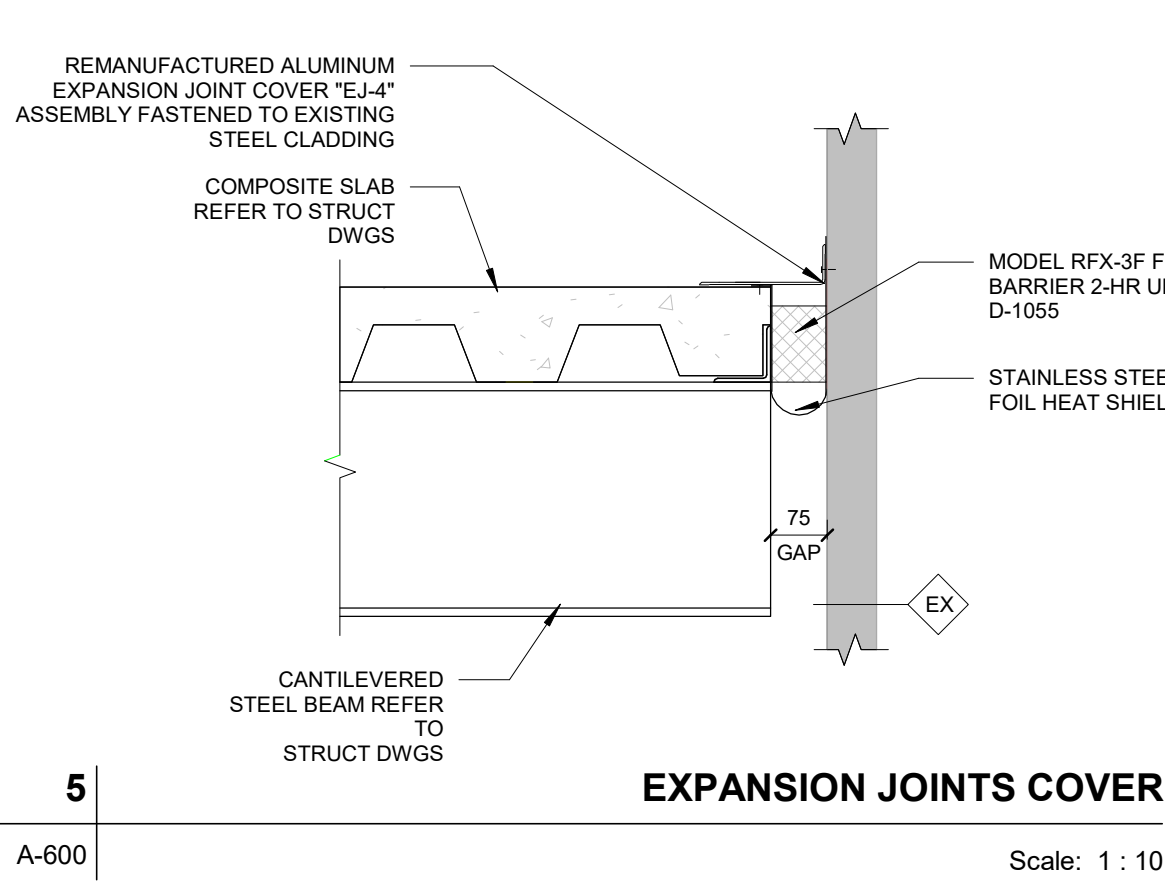
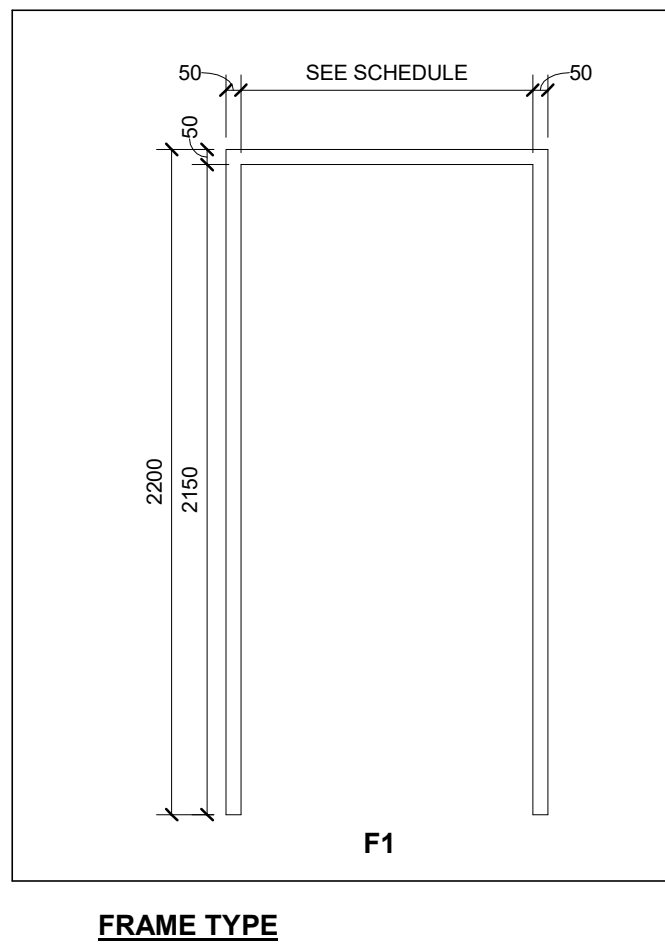
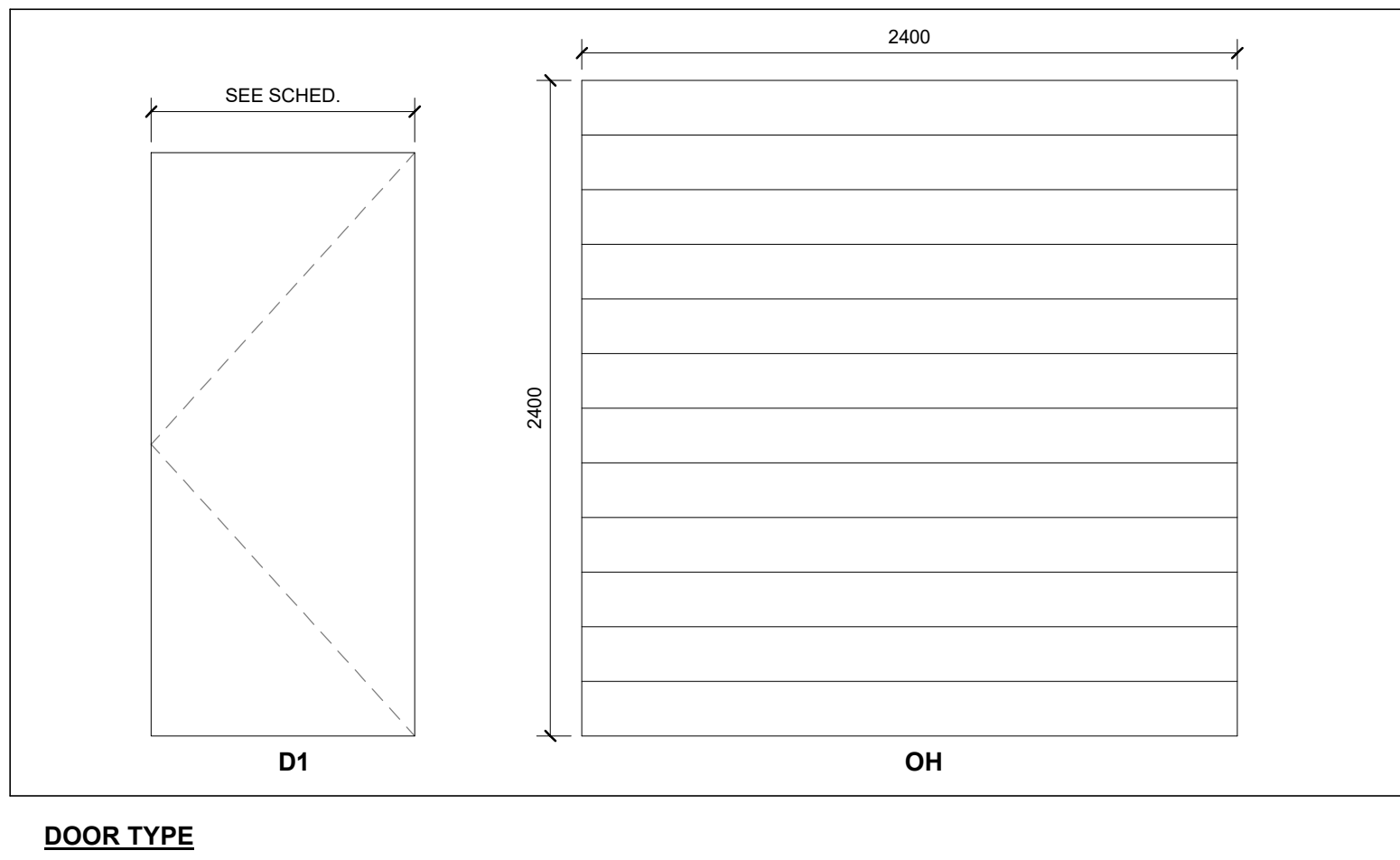
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APPROVED: Approver  
CHECKED: Checker  
DESIGNER: Designer  
PROJECT MANAGEMENT INITIALS:  
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Filename: BM-360-IBP-AMER(CAN) 60678205 - ONTC Grit Blast Bay/60678205-AOM-420-GRITBLAST-AE-H4

ROOM FINISH SCHEDULE															
ROOM NO.	ROOM NAME	FLOOR		NORTH WALL		SOUTH WALL		EAST WALL		WEST WALL		CEILING		HEIGHT	COMMENTS
		MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.		
261	FEMALE LOCKER ROOM	CONC	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	EXISTING	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	EXISTING	PORCELAIN TILE	GYP BD	PAINTED	2600	1HR FIRE RATED CEILING
262	JANITOR ROOM	CONC	PORCELAIN TILE	EXISTING	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	EXISTING	PORCELAIN TILE	CONC BLK	PORCELAIN TILE	GYP BD	PAINTED	2600	
264	DIRTY ROOM	CONC	EPOXY	CONC BLK	PAINTED	EXISTING	PAINTED	EXISTING	PAINTED	CONC BLK	PORCELAIN TILE, UP TO 1600 AFF.	CONC	PAINTED	2600	
284	LOCKER ROOM	CONC	EXISTING TO REMAIN	CONC BLK	PAINTED	EXISTING	PAINTED	EXISTING TO REMAIN	PAINTED	EXISTING	PAINTED	EXISTING	-	-	1HR FIRE RATED CEILING. ALL EXPOSED STRUCT STEEL MEMBERS TO RECIEVE A COATING OF INTUMESCENT FIREPROOFING
286	CORRIDOR	CONC	EPOXY	EXISTING	PAINTED	CONC BLK	PAINTED	EXISTING	PAINTED	CONC BLK	PAINTED	ACT	-	2600	
289	M/E ROOM	CONC	EPOXY	STEEL	-	EXISTING	PAINTED	STEEL	-	EXISTING	-	STEEL	IC	3800	
303	RECLAIM ROOM	CONC	EPOXY	STEEL	-	EXISTING	PAINTED	STEEL	-	STEEL/MASONRY	/ PAINTED	EXP.	-	8000	ONLY MASONRY TO BE PAINTED

ABBREVIATIONS	
CONC	- CONCRETE
CONC BLK	- CONCRETE BLOCK
GALV. STL.	- GALVANIZED STEEL
HM	- HOLLOW METAL
ACT	- ACOUSTIC CEILING TILE
GYP BD	- GYPSUM BOARD CEILING
PREFN.	- PREFINISHED
IC	- INTUMESCENT COATING



DOOR NO.	FROM	TO ROOM	DOOR SIZE (W X H)	DOOR DATA										HARDWARE GROUP	NOTES
				FIRE RATING	DOOR TYPE	MATERIAL	FINISH	GLASS	FRAME TYPE	MATERIAL	FINISH	HEAD TYPE	JAMB TYPE		
D261	CORRIDOR	FEMALE LOCKER ROOM	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	1	ACTIVATOR - WAVE HAND, BOTH SIDES OF THE DOOR
D262	CORRIDOR	JANITOR ROOM	820 X 2150	3/4	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	2	
D264A	CORRIDOR	DIRTY ROOM	1000 X 2150	3/4	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	3	
D264B	GRIT BLASTING BAY	DIRTY ROOM	1000 X 2150	3/4	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	3	
D284	CORRIDOR	LOCKER ROOM	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H1	J1	4	
D286	EXTERIOR	CORRIDOR	950 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H2	J2	5	ACTIVATOR - WAVE HAND, BOTH SIDES OF THE DOOR
D289A	M/E ROOM	EXTERIOR	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H2	J2	6	
D289D	FEMALE LOCKER ROOM	FEMALE LOCKER ROOM	860 X 1480				GALV								
D289E	FEMALE LOCKER ROOM	FEMALE LOCKER ROOM	860 X 1680												
D303A	EXTERIOR	RECLAIM ROOM	1000 X 2150	-	D1	HM	PAINTED	-	F1	HM	PAINTED	H2	J2	6	
D303B	EXTERIOR	RECLAIM ROOM	3000 X 3400	-	OH	GALV. STEEL	PREFIN	-	-	GALV. STEEL	PREFIN	H3	J3	7	REFER TO SPECIFICATION FOR OVERHEAD DOOR AND OPERATOR



## PROJECT

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## CONSULTANTS

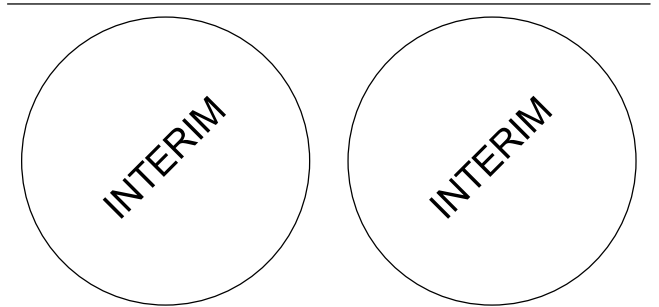
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## REGISTRATION



## KEY PLAN



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## ISSUE/REVISION

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## PROJECT NUMBER

60678205

## SHEET TITLE

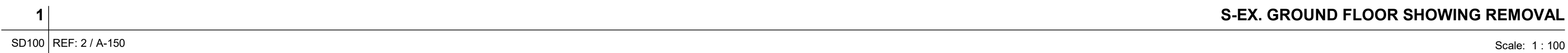
## SCHEDULES & DETAILS

## SHEET NUMBER

**A-600**



- 1.1 DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL IN ACCORDANCE WITH CSA STANDARD - CAN/CSA-S16.1. DEMOLITION WORK IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, STRUCTURAL, ELECTRICAL, MECHANICAL AND PROCESS DEMOLITION AND REFERENCE DRAWINGS, SPECIFICATIONS AND APPENDICES.
- 1.2 CONTRACTOR TO SITE VERIFY AND CONFIRM ALL EXISTING CONDITIONS INCLUDING DEMOLITION ELEVATIONS INDICATED ON CONTRACT DRAWINGS PRIOR TO DEMOLITION. REPORT ANY DISCREPANCIES TO CONSULTANTS.
- 1.3 REFER TO SPECIFICATIONS FOR DISMANTLING/REMOVAL/STORAGE AND REUSE OF EXISTING MATERIALS.
- 1.4 CONTRACTOR TO INSTALL INTERIOR/EXTERIOR INSULATION & WATERTIGHT HOARDING TO SEPARATE PUBLIC FROM CONSTRUCTION ZONES AND PROVIDE REQUIRED SAFE MEANS OF EGRESS FROM ALL ZONES OF THE EXISTING BUILDING AT ALL TIMES TO THE APPROVAL OF AUTHORITIES HAVING JURISDICTION.
- 1.5 PROVIDE DUST AND DEBRIS PROTECTION TO MATERIALS TO REMAIN & AREAS OUTSIDE THE ZONE OF WORK IN ACCORDANCE WITH SPECIFICATIONS.
- 1.6 MAKE PROVISIONS TO JOIN NEW WORK TO EXISTING AND TO INSTALL NEW SUPPORTING MEMBERS, ANCHORS, AND OTHER ITEMS NECESSARY FOR COMPLETION OF WORK. PROVIDE TEMPORARY BRACING FOR SUPPORT WHERE REQUIRED PRIOR TO DEMOLITION (COORDINATE THIS ITEM WITH STRUCTURAL DRAWINGS).
- 1.7 MAINTAIN THE EXISTING BUILDING WATER-TIGHTNESS AT THE AREAS BEING ALTERED FROM WHERE EXISTING FLOOR, ROOF, OR WALL ASSEMBLIES ARE EXPOSED TO THE OPEN.
- 1.8 CUT OFF, CAP, REROUT, OR REMOVE EXISTING SERVICES WHICH ARE AFFECTED BY THE ALTERATIONS. RESTORE, ALL FIRE RATINGS TO EXISTING REMAINED WALLS/FLOOR/SLAB AFTER ANY ARCH. M/E & PROCESS REMOVAL/ALTERATION.
- 1.9 ALL EXISTING WALL OPENINGS AFTER ANY ARCH. M/E & PROCESS REMOVAL/ALTERATION TO BE FILLED WITH NON-SHRINK GROUT OR MATERIALS SIMILAR TO EXISTING WALLS.
- 1.10 CONTRACTOR TO IDENTIFY EXISTING FIRE RATINGS OF EXISTING FLOORS, WALLS AND ROOFS WHERE EXISTING OPENINGS TO BE COVERED OR INFILLED, AND IF REQUIRED, PROVIDE ULC APPROVED ASSEMBLIES TO COVER EXISTING OPENINGS TO MAINTAIN THE INTEGRITY OF THE FIRE RATED ASSEMBLY.
- 1.11 REPAIR AND MAKE GOOD ALL DAMAGED SURFACES WITH NEW MATERIALS TO MATCH EXISTING.
- 1.12 ALL DISCARDED UNDERGROUND BASEMENTS, CHAMBERS, OPENINGS, VOIDS OR PIPES IN THE DESIGNATED DEMOLITION AREAS, SHALL BE BACK FILLED WITH GRANULAR "B" AS SUB-BASE AND MINIMUM 600MM THICK PLANTING SOIL ON TOP. REFER TO SPECIFICATIONS FOR THE DETAIL PROCEDURES AND REQUIREMENTS.
- 1.13 AT NO TIME SHALL THE CONTRACTOR ALLOW HEAVY EQUIPMENT, TOOLS OR MATERIALS TO EITHER IMPACT OR REST ATOP THE EXISTING STRUCTURES BEYOND THE LOAD LIMITS AS INDICATED ON THE EXISTING DESIGN DRAWINGS. DEMOLITION OF LARGE, HEAVY ITEMS SHALL BE PLANNED IN COORDINATION WITH THE OWNER AND THE ENGINEER TO AVOID LOAD-BASED ISSUES.
- 1.14 AT NO TIME SHALL THE CONTRACTOR ALLOW HEAVY CRANES OR LIFTING EQUIPMENT APPROACH TO THE TOP OF RETAINING WALLS OR BASEMENT WALLS WITHOUT SUBMISSION OF A PLAN FOR THE APPROVAL OF THE OWNER AND THE ENGINEER.
- 1.15 MAKE PROVISIONS TO INSTALL NEW SUPPORTS FOR REMAINED PIPES, DUCTS & TRAY AFTER ANY ARCH. M/E & PROCESS REMOVAL OR ALTERNATION. SUGGESTED SEQUENCES OF STRUCTURAL DEMOLITION



1. REFER TO AS BUILT DRAWING 5473-S15 FOR DETAILS OF EXISTING BUILDING FOUNDATION AND SLAB ON GRADE

 DENOTES EXISTING TO BE REMOVED



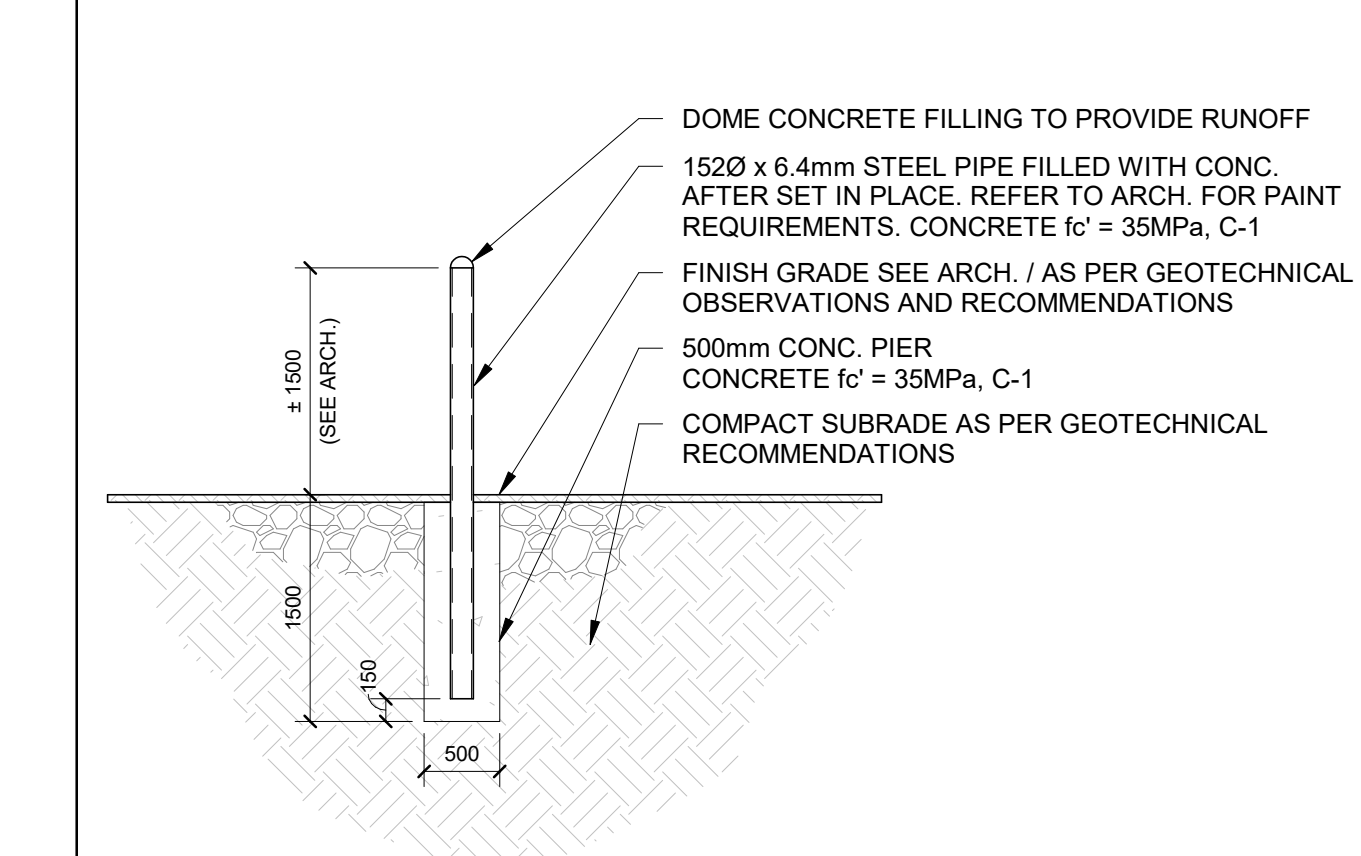




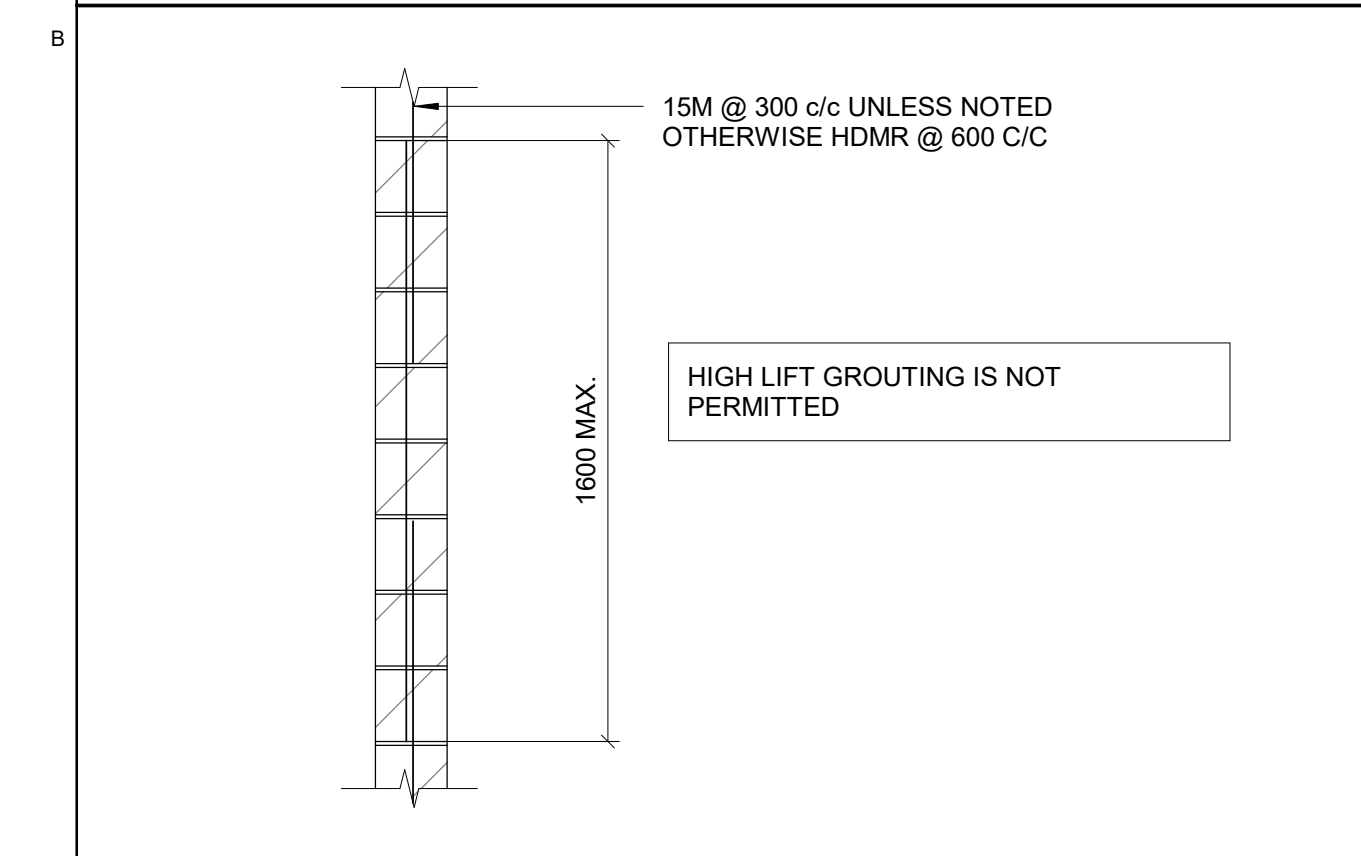


AB	ANCHOR BOLT	FD	FLOOR DRAIN	PL	PLY	PLATE	
ADDL	ADDITIONAL	FDN	FOUNDATION	PLY	PLYWOOD	PLYWOOD	
AHR	ANCHOR	FF	FAR FACE	PRO	PROST	PROST	
ALT	ALTERNATE	FFE	FINISHED FLOOR	RC	ROOF	ROOF DRAIN	
ALUM	ALUMINUM	FG	FINISHED GRADE	REIN	REINFORCE	REINFORCE	
APVD	APPROVED	FT	FOOTING	REIN	REINFORCE	REINFORCE	
BOT	BOTTOM	FTC	FOOTING	SDI	SDI	SDI	
BEW	BOTTOM EACH WAY	GALV	GALVANIZED	SIM	SIMILAR	SIMILAR	
		(HOT DIP)	(HOT DIP)	SOG	SLAB ON GRADE	SLAB ON GRADE	
BF	BOTTOM FACE	GVL	GRAVEL	SS	SPECIFICATIONS	SPECIFICATIONS	
BL	BOTTOM LOWER LAYER	HAS	HEADED ANCHOR	STD	STANDARD	STANDARD	
BUL	BOTTOM UPPER LAYER	HOR	HORIZONTAL	STF	STIFFENER	STIFFENER	
BM	BEAM	HEF	HORIZONTAL	STR	STRAIGHT	STRAIGHT	
BRG	BEARING	HFF	HORIZONTAL	STRU	STRUCTURE	STRUCTURE	
c/c	CENTER TO CENTER	HIF	HORIZONTAL	SYMM	SYMMETRICAL	SYMMETRICAL	
CHKD PL	CHECKERED PLATE	HK	HOOK	T&B	TOP & BOTTOM	TOP & BOTTOM	
CJ	CONSTRUCTION JOINT	HNF	HORIZONTAL	TSD	TO BE DETERMINED	TO BE DETERMINED	
CL	CENTER LINE	HOF	HORIZONTAL	TEW	TOP EACH WAY	TOP EACH WAY <td>TOP FACE</td>	TOP FACE
CLR	CLEARANCE	HP	HIGH POINT	THK	THICK	THICK	
COL	COLUMN	IF	INSIDE FACE	TI	TIE JOIST	TIE JOIST	
CONC	CONCRETE	INT	INTERIOR	TLL	TOP LOWER LAYER	TOP LOWER LAYER	
CONN	CONNECTION	IJ	ISOLATION	T/O	TOP OF	TOP OF	
CTR	CENTER	JO	JOIST	TOC	TOP OF CONCRETE	TOP OF CONCRETE	
CTRD	CENTERED	JT	JOINT	TOF	TOP OF CURB	TOP OF CURB	
DBA	DEFORMED	LG	LONG	TOW	TOP OF FOOTING/FLOOR	TOP OF FOOTING/FLOOR	
DBS	BAR ANCHOR	LL	LIVE LOAD	TOS	TOP OF STEEL	TOP OF STEEL	
DIA	DIAGONAL	LLV	LONG LEG VERTICAL	TRANS	TRANSVERSE	TRANSVERSE	
DIR	DIRECTION	LNTL	LONGITUDINAL	TUL	TOP UPPER LAYER	TOP UPPER LAYER	
DWG	DRAWING	LP	LOW POINT	TYP	TYPICAL	TYPICAL	
DWLS	DOWELS	MAX	MAXIMUM	UNO	UNLESS NOTED	UNLESS NOTED	
EA	EACH	MB	MACHINE BOLT	U/S	UNDER SIDE OF	UNDER SIDE OF	
EE	EACH END	MIN	MINIMUM	VERT	VERTICAL	VERTICAL	
EF	EACH FACE	NF	NEAR FACE	VEF	VERTICAL EACH FACE	VERTICAL EACH FACE	
EL	ELEVATION	NIC	NOT IN CONTRACT	VFF	VERTICAL FAR FACE	VERTICAL FAR FACE	
EP	EPOXY	NTS	NOT TO SCALE	VIF	VERTICAL INSIDE FACE	VERTICAL INSIDE FACE	
EQL SP	EQUALLY SPACED	OC	ON CENTER	VNF	VERTICAL NEAR FACE	VERTICAL NEAR FACE	
ES	EACH SIDE	OD	OUTER DIAMETER	VOF	VERTICAL OUTSIDE FACE	VERTICAL OUTSIDE FACE	
EW	EACH WAY	OF	OUT TO OUT	WS	WATERSTOP	WATERSTOP	
EJ	EXPANSION JOINT	OPNG	OPENING	WWF	WELDED WIRE FABRIC	WELDED WIRE FABRIC	
EXIST	EXISTING	PJ	PARTIAL JOINT				
EX	EXISTING	PJF	PREMOLDED JOINT FILLER				
EXT	EXTERIOR						

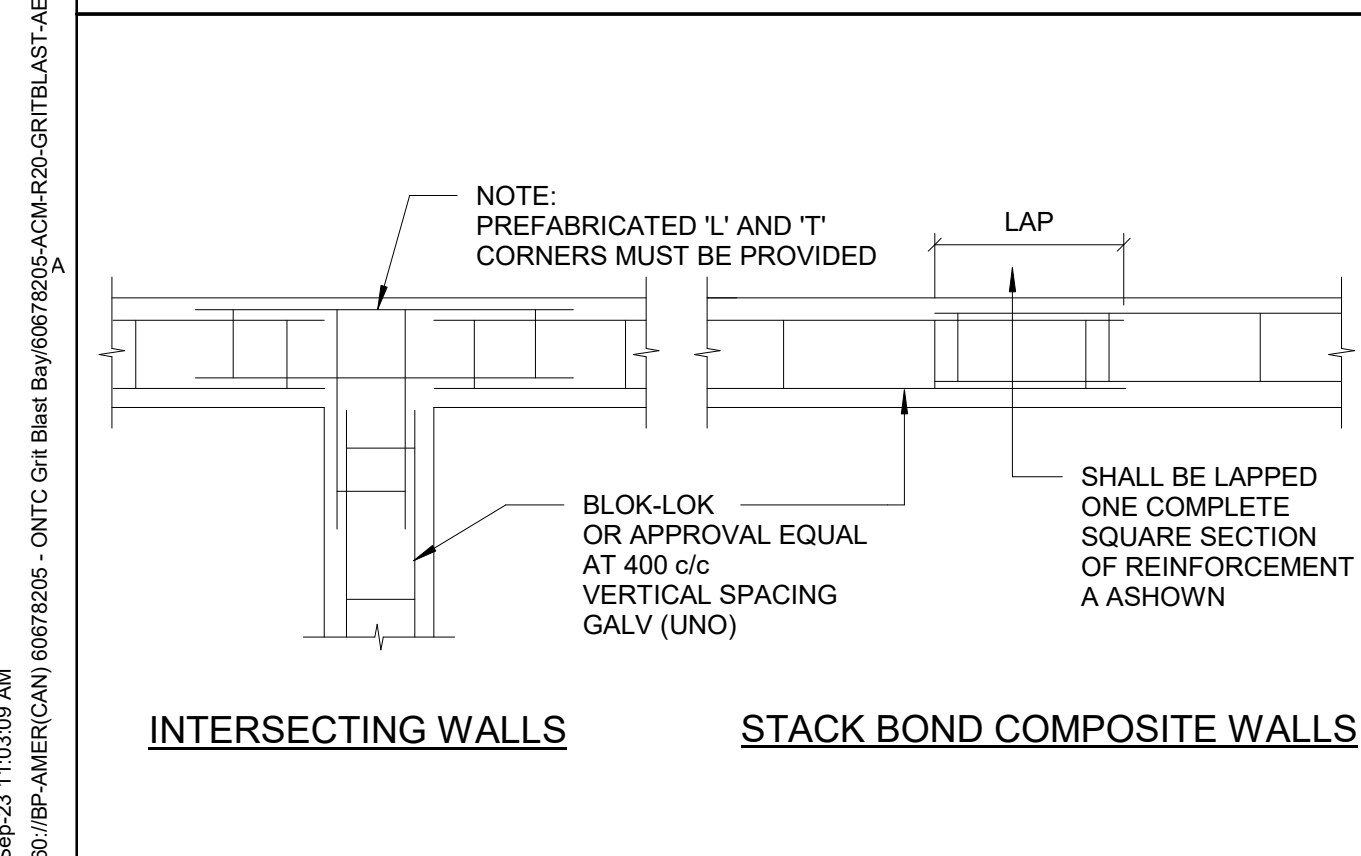
1	STRUCTURAL ABBREVIATIONS	NTS
S-002		



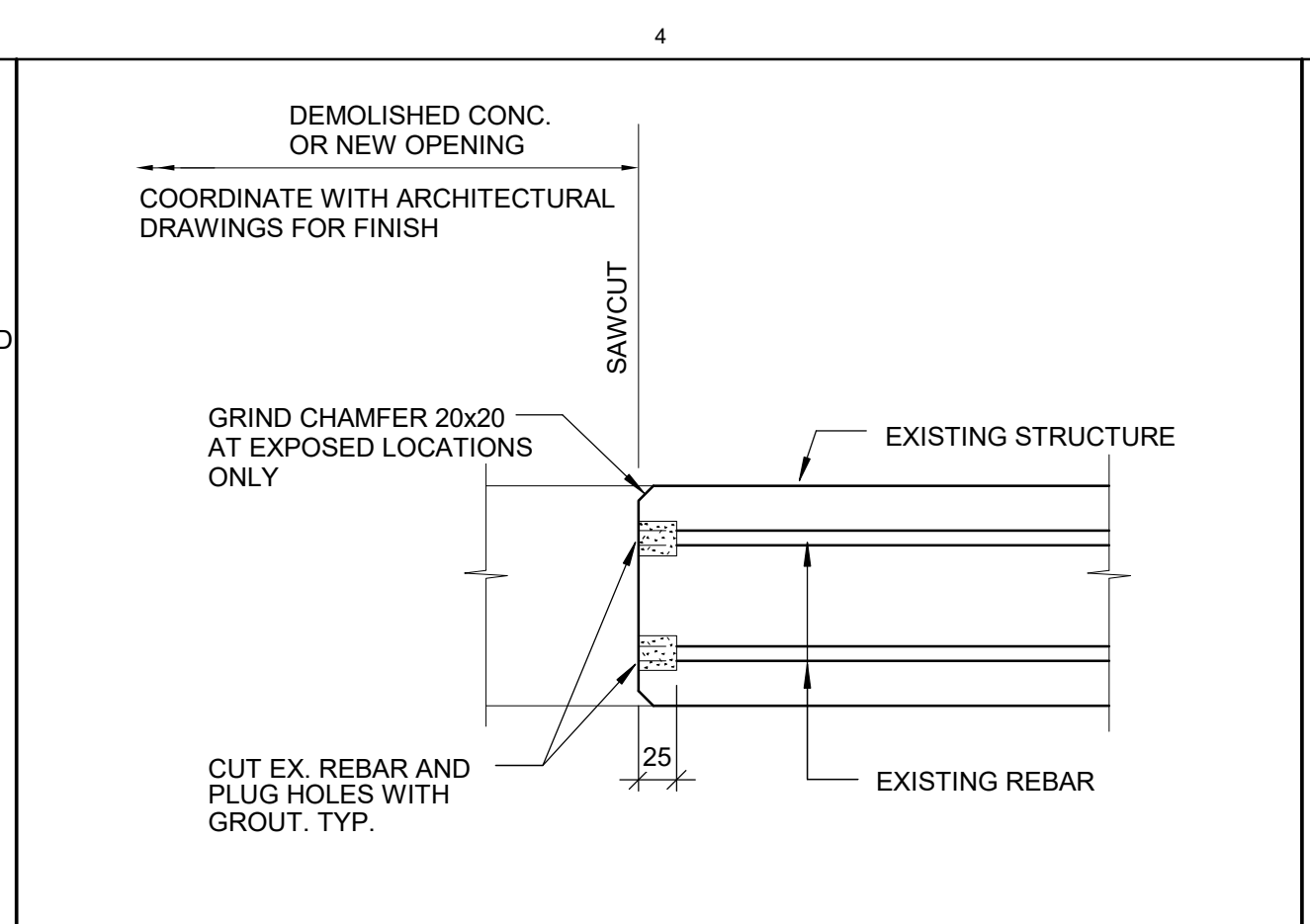
8	TYP. BOLLARD AT GRADE	Scale: 1 : 50
S-002		



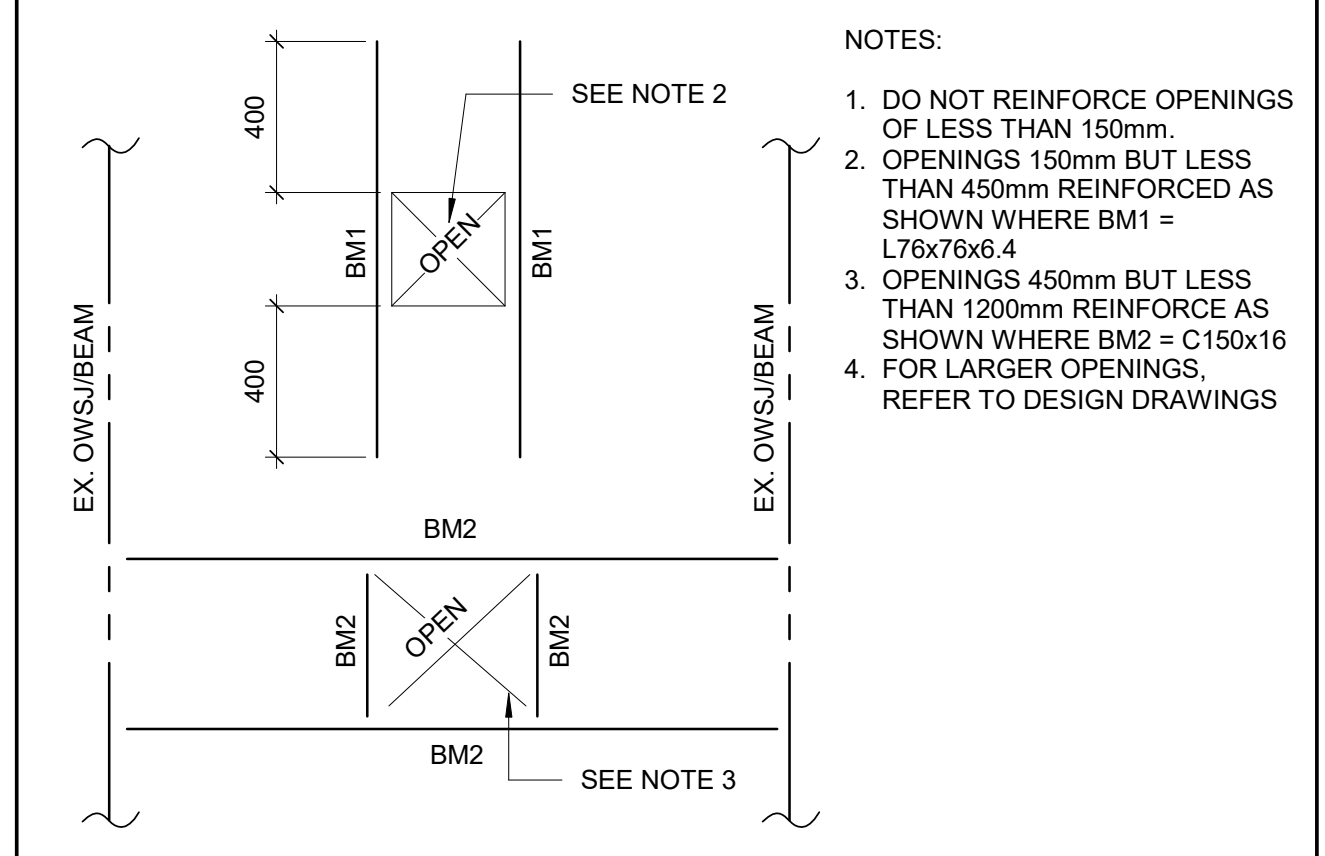
10	TYPICAL CONCRETE BLOCK WALL VERTICAL REINFORCEMENT	Scale: 1 : 20
S-002		



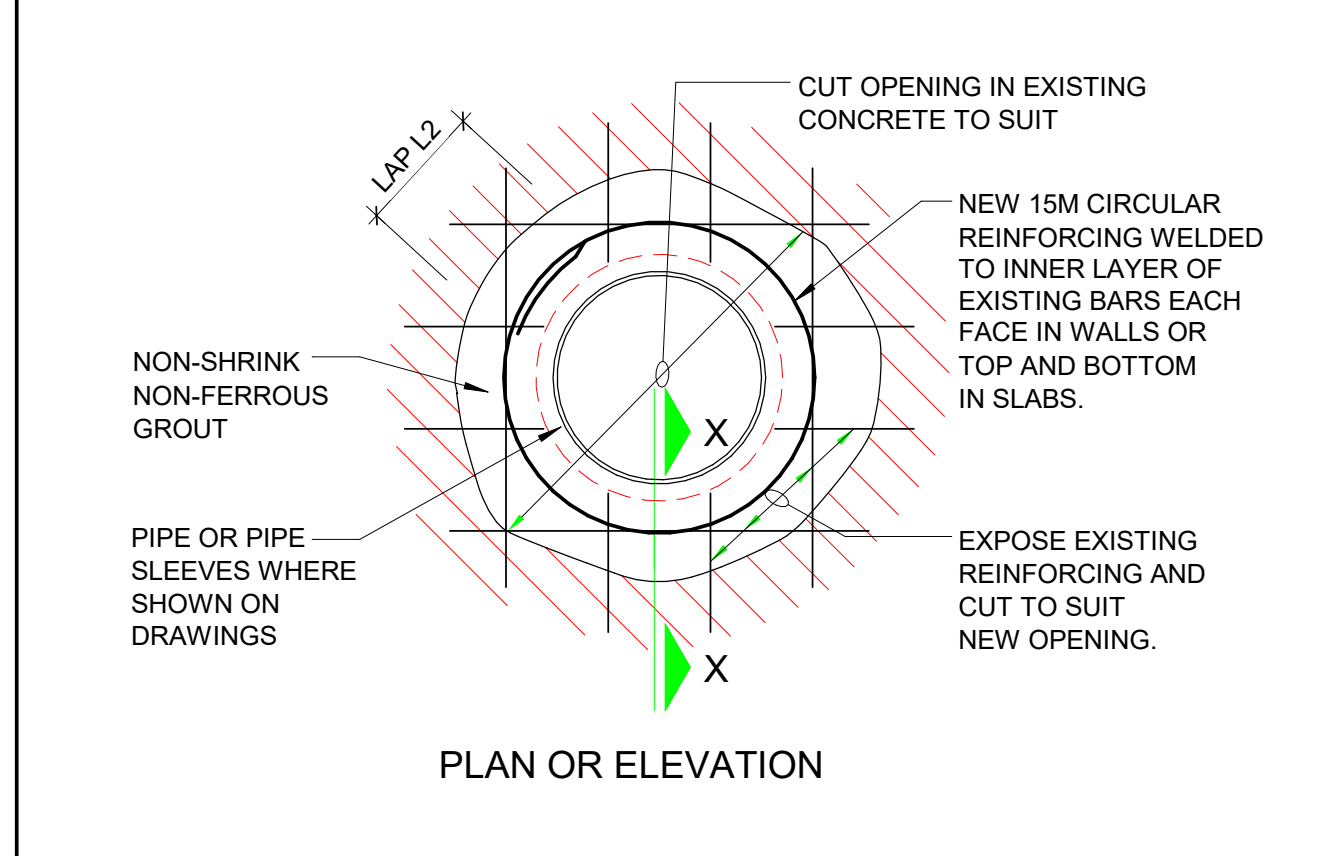
12	TYPICAL CONCRETE BLOCK WALL REINFORCEMENT	Scale: 1 : 20
S-002		



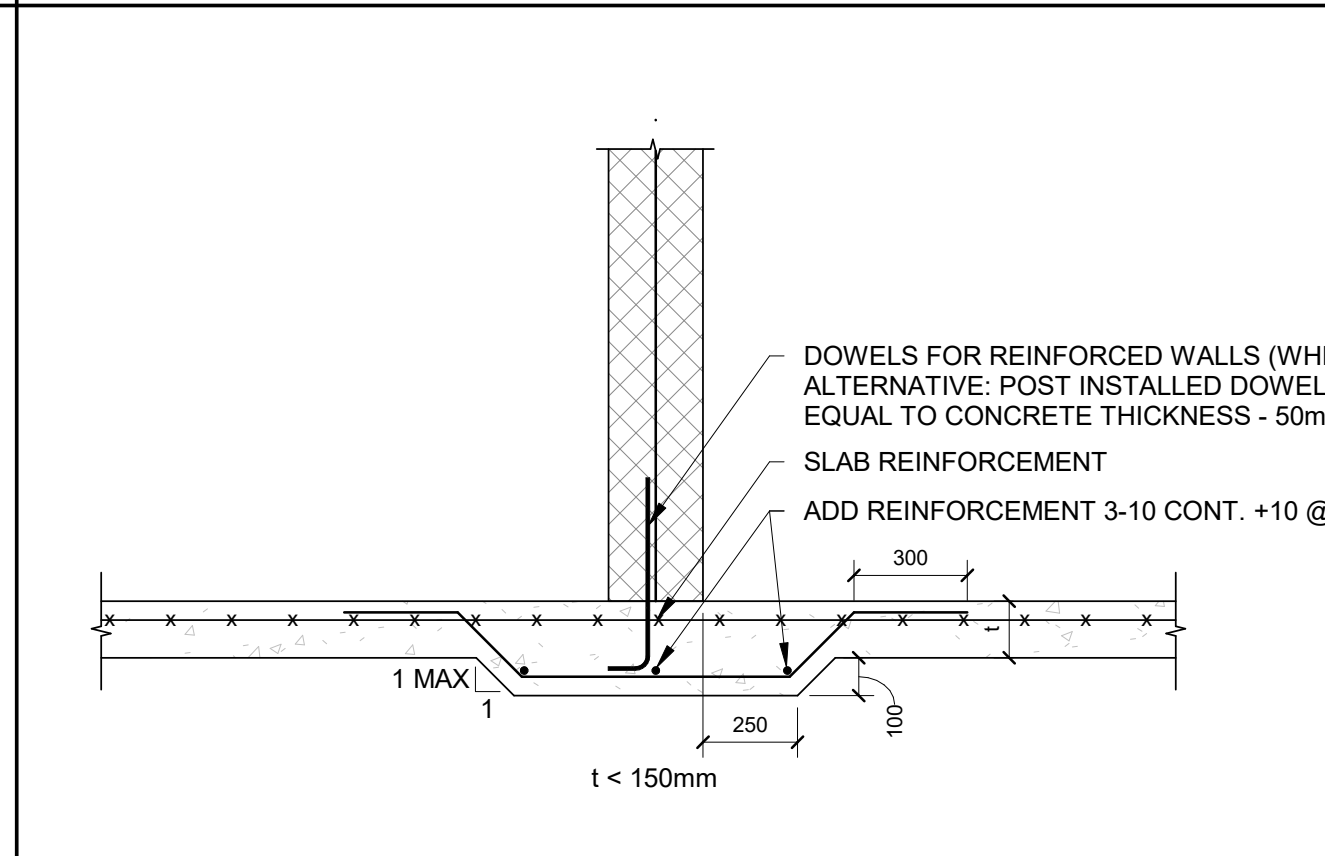
2	NEW OPENING THROUGH EXISTING CONCRETE	Scale: 1 : 10
S-002		



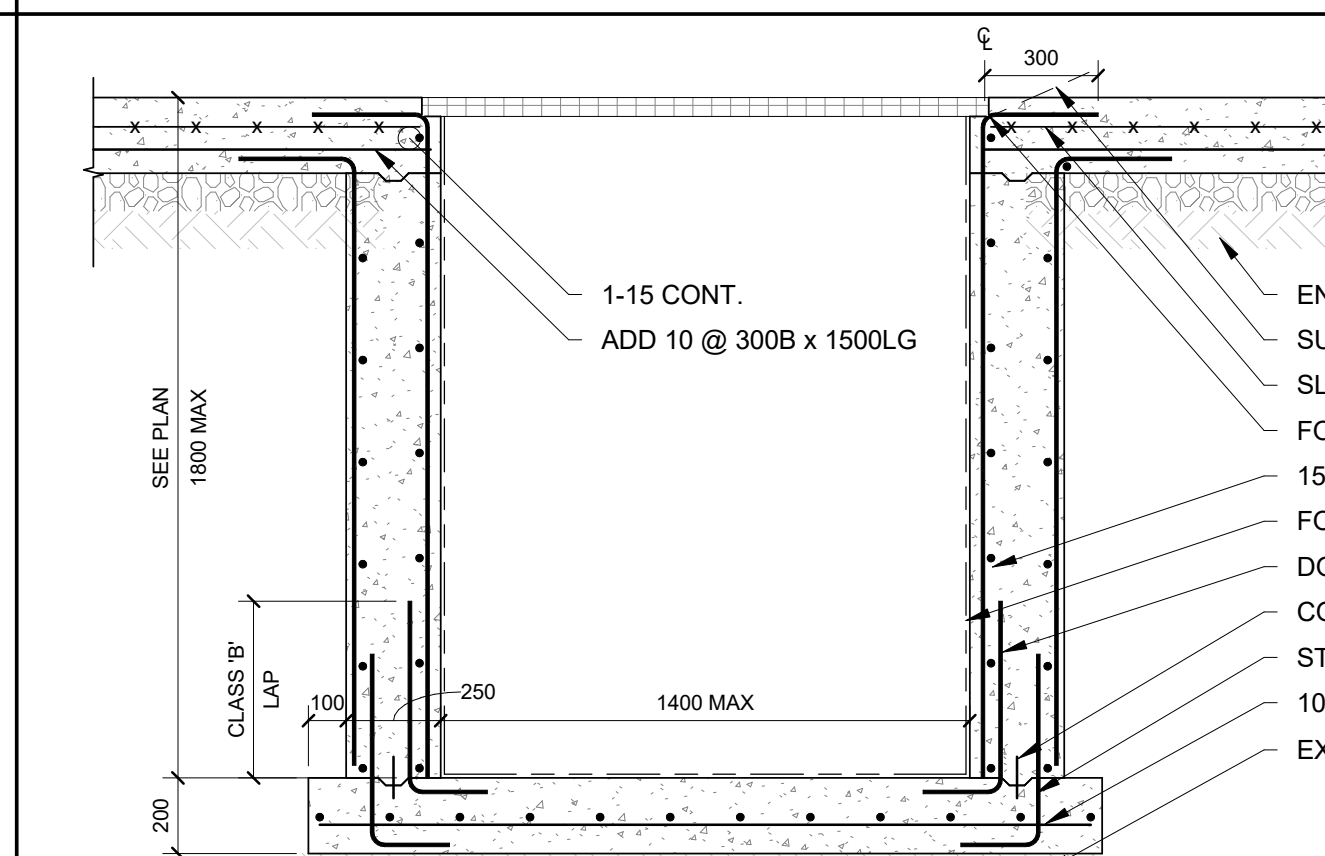
5	OPENINGS IN STEEL DECK	Scale: 1 : 20
S-002		



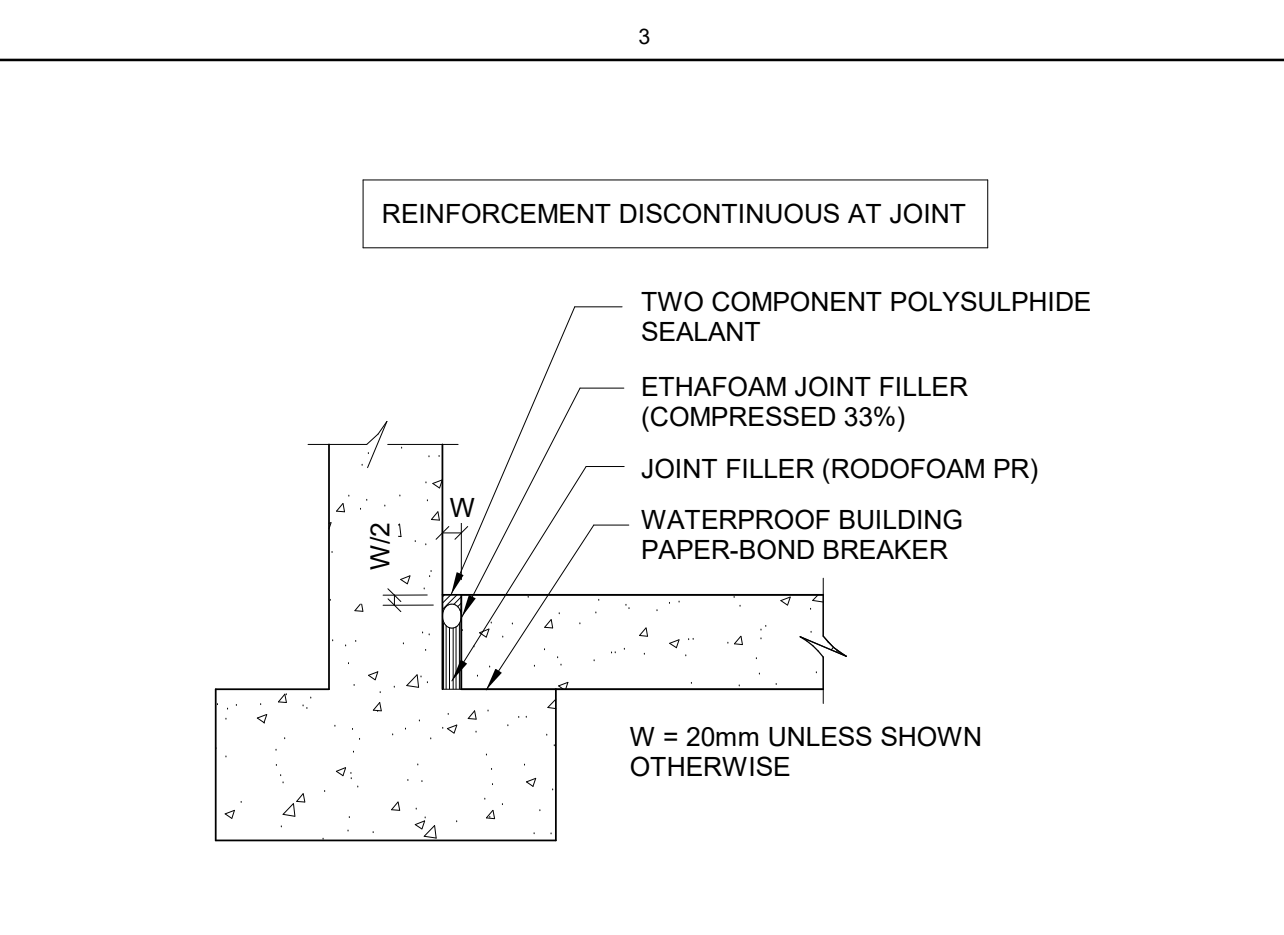
9	NEW PIPE OPENINGS (OPENING LESS THAN 500 DIA.) IN EXISTING WALLS AND SLABS (TYP UNO)	Scale: 1 : 20
S-002		



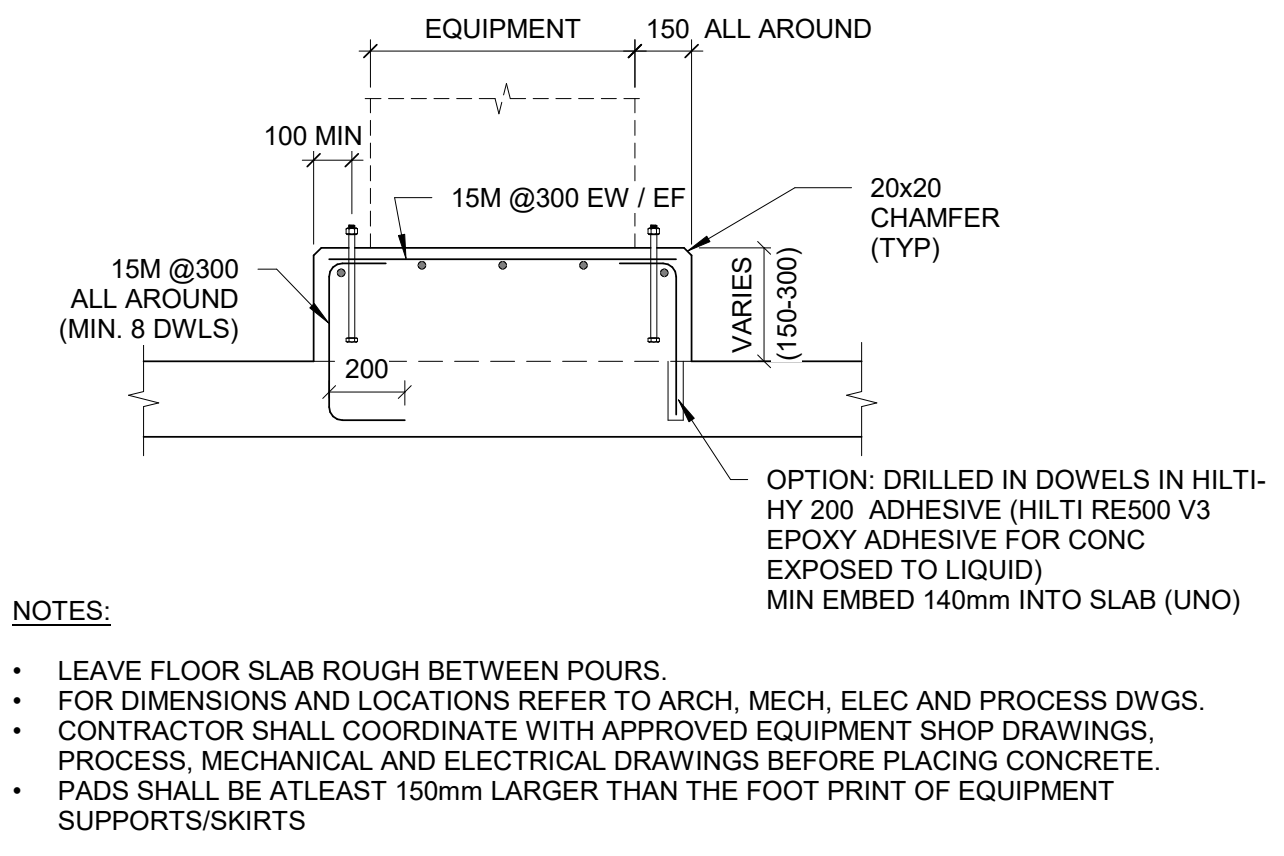
11	MASONRY PARTITIONS AT SLAB ON GRADE	Scale: 1 : 20
S-002		



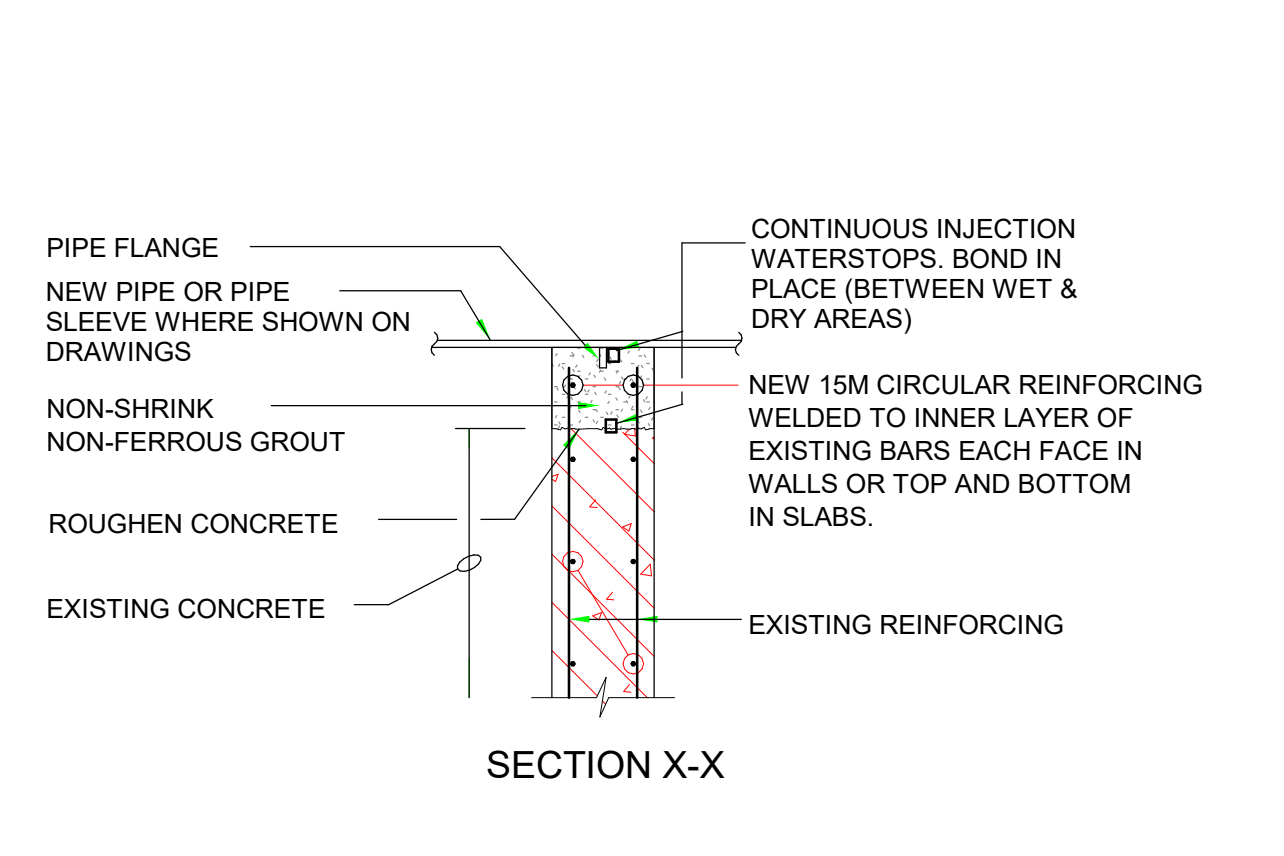
13	SUMP PIT	Scale: 1 : 20
S-002		



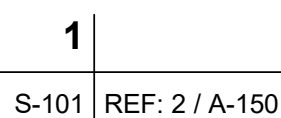
3	TYPICAL ISOLATION JOINT	Scale: 1 : 20
S-002		



6	TYPICAL INTERNAL CONCRETE PAD DETAIL (UNO)	Scale: 1 : 20
S-002		



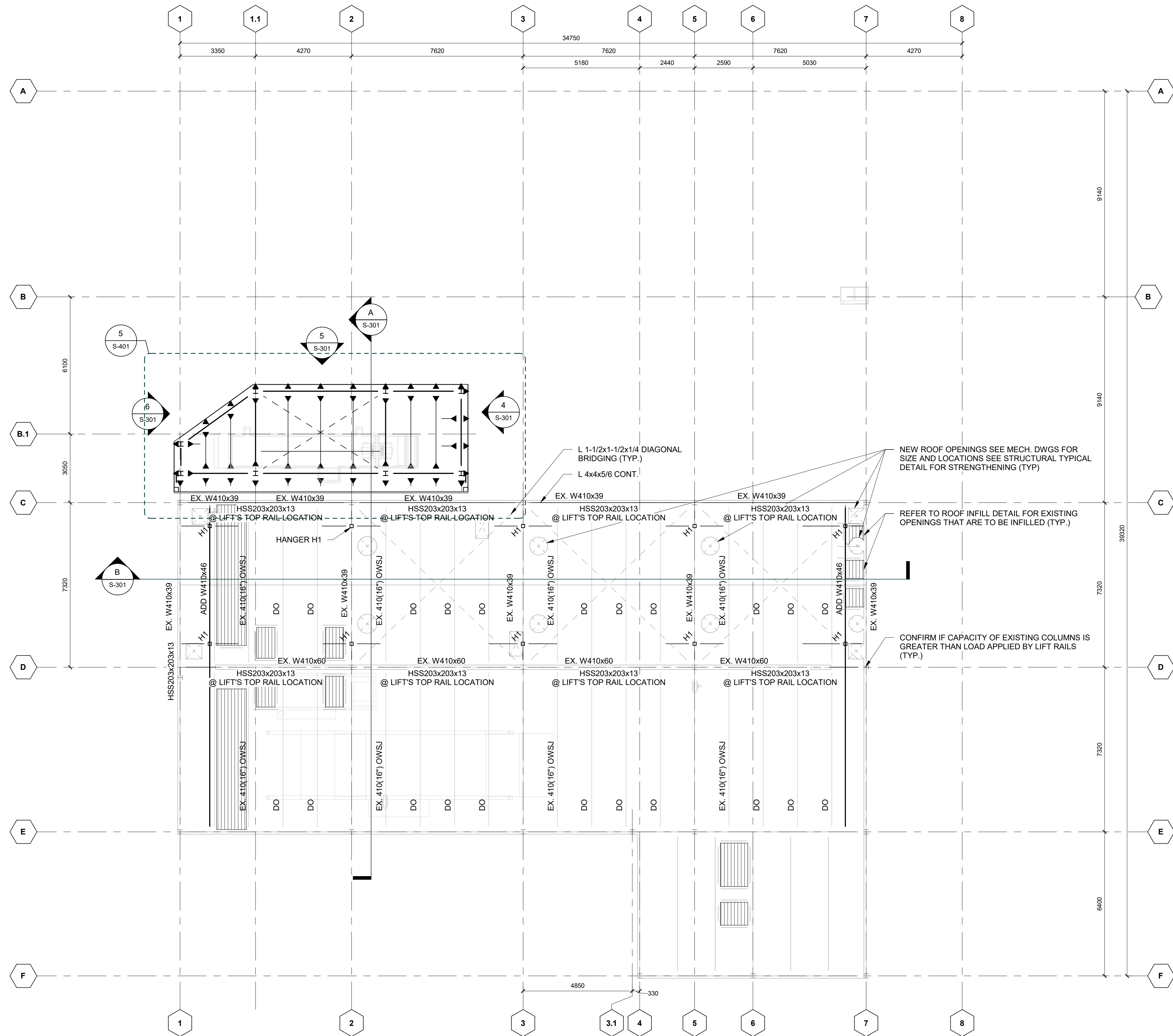




Scale: 1 : 100







1	ROOF FRAMING PLAN	
S-102	REF: 2 / A-150	Scale: 1 : 100



## PROJECT

**BLAST BAY UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
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Cell: --  
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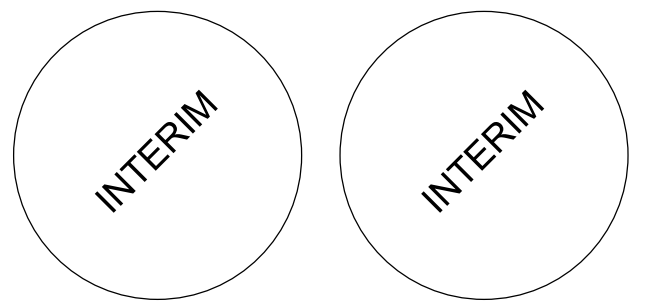
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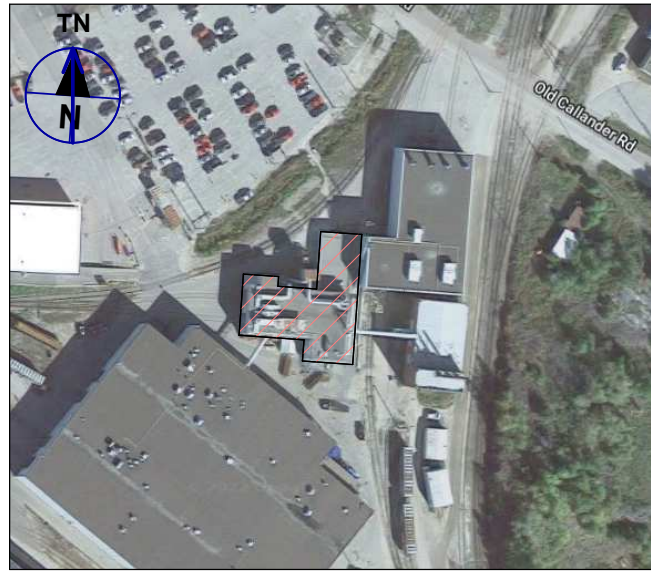
**BUILDING CODE CONSULTANT:**  
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## REGISTRATION



## KEY PLAN



SEE DRAWING FOR SCALE

## ISSUE/REVISION

[illegible]

## PROJECT NUMBER

60678205

**SHEET TITLE**

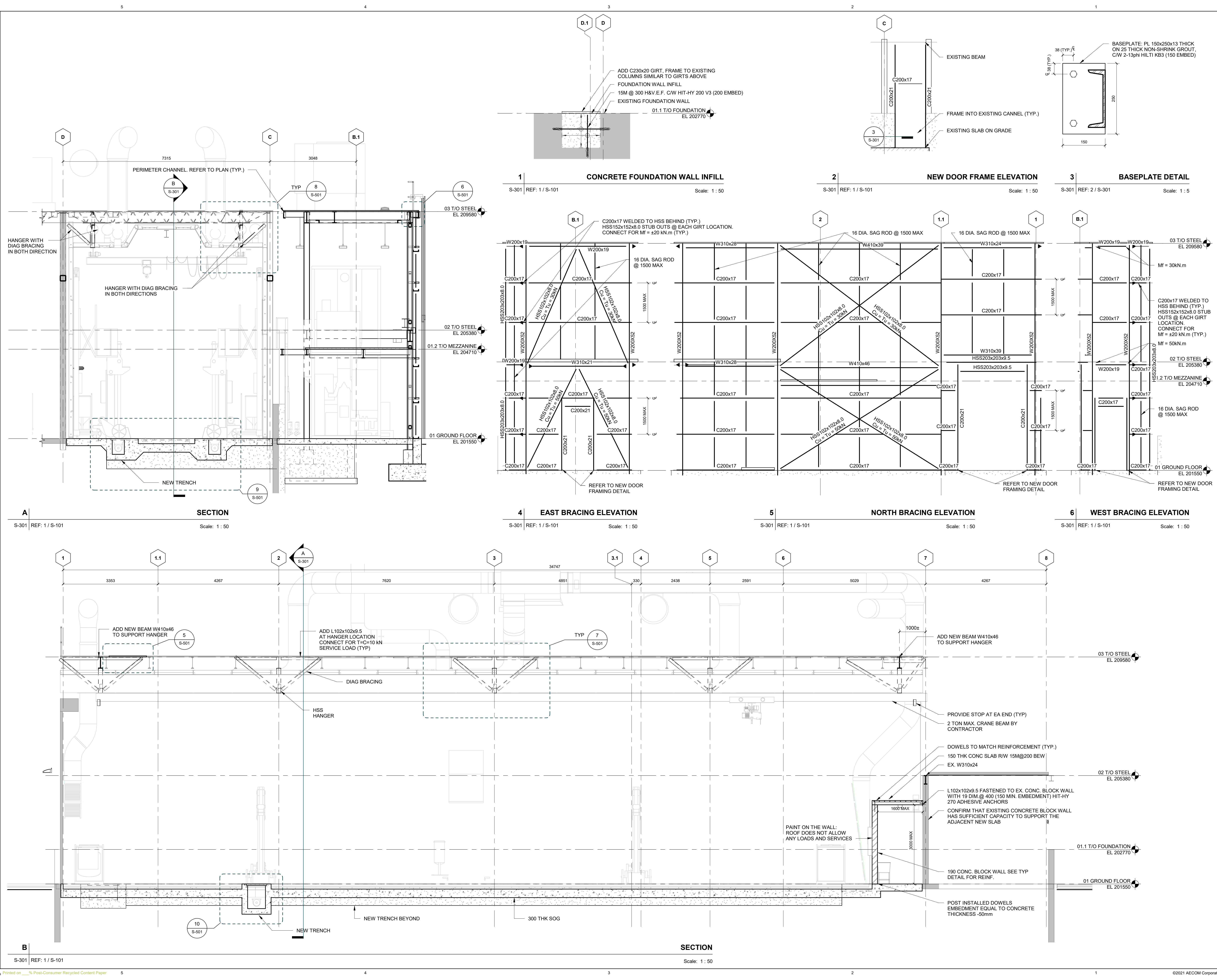
## ROOF FRAMING PLAN

**SHEET NUMBER**

**S-102**



ISO B1 707 x 100mm  
APPROVED: Approver  
CHECKED: Checker  
DESIGNER: LH  
PROJECT MANAGEMENT INITIALS: C  
B  
A  
SHEET: 04 - PROJECT DELIVERY STRUCTURAL S-301 ELEVATIONS AND SECTIONS  
Last Printed: 29-Sep-23 11:03:17 AM  
Filename: BM\_360\_IJB-AMER(CAN)\_60678205 - ONTC Coll Blast Bay/0678205-ACM-R20-GRIBLAST-AE.rvt



# AECOM

**PROJECT**

**BLAST BAY UPGRADE**  
915/916 McIntyre St. E. North Bay, ON

**CLIENT**

**REGISTERED OWNER:**  
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**REGISTRATION**

INTERIM

INTERIM

**KEY PLAN**

**SEE DRAWING FOR SCALE**

**ISSUE/REVISION**

No.	DESCRIPTION	DATE
3	ISSUED FOR TENDER	28/09/2023
2	ISSUED FOR 100% CLIENT REVIEW	21/07/2023
1	ISSUED FOR 60% CLIENT REVIEW	31/03/2023

**PROJECT NUMBER**

60678205

**SHEET TITLE**

**ELEVATIONS AND SECTIONS**

**SHEET NUMBER**

**S-301**

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BASEPLATE SCHEDULE			
MARK	SIZE	ANCHORAGE	
BP1	350x350x19	4-25mm ANCHOR BOLTS x 200 EMBEDMENT FROM TOP OF PIER + 50 HOOK	
BP2	350x350x19	4-25mm ANCHOR BOLTS x 650 EMBEDMENT FROM TOP OF PIER + 50 HOOK	

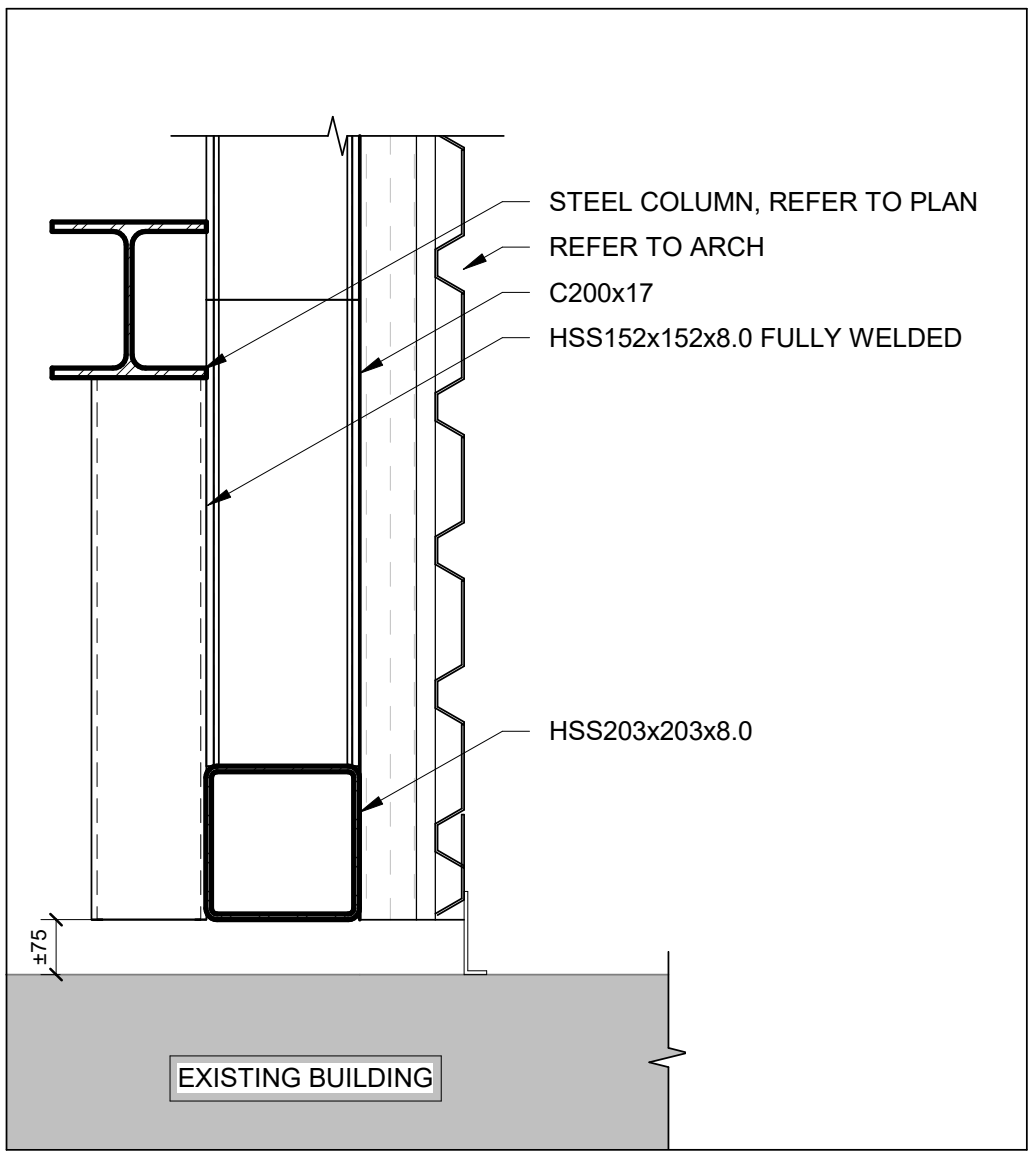
REMARKS
PROVIDE ANCHOR BOLTS WITH DOUBLE NUT AND WASHER AT BOLT END

NOTES:

- CENTER BASEPLATE ON PIERS, CENTER COLUMNS ON BASEPLATE
- PROVIDE 50mm NON-SHRINK, NON-METALLIC GROUT BELOW PLATE. ENSURE BASEPLATE IS LEVELED

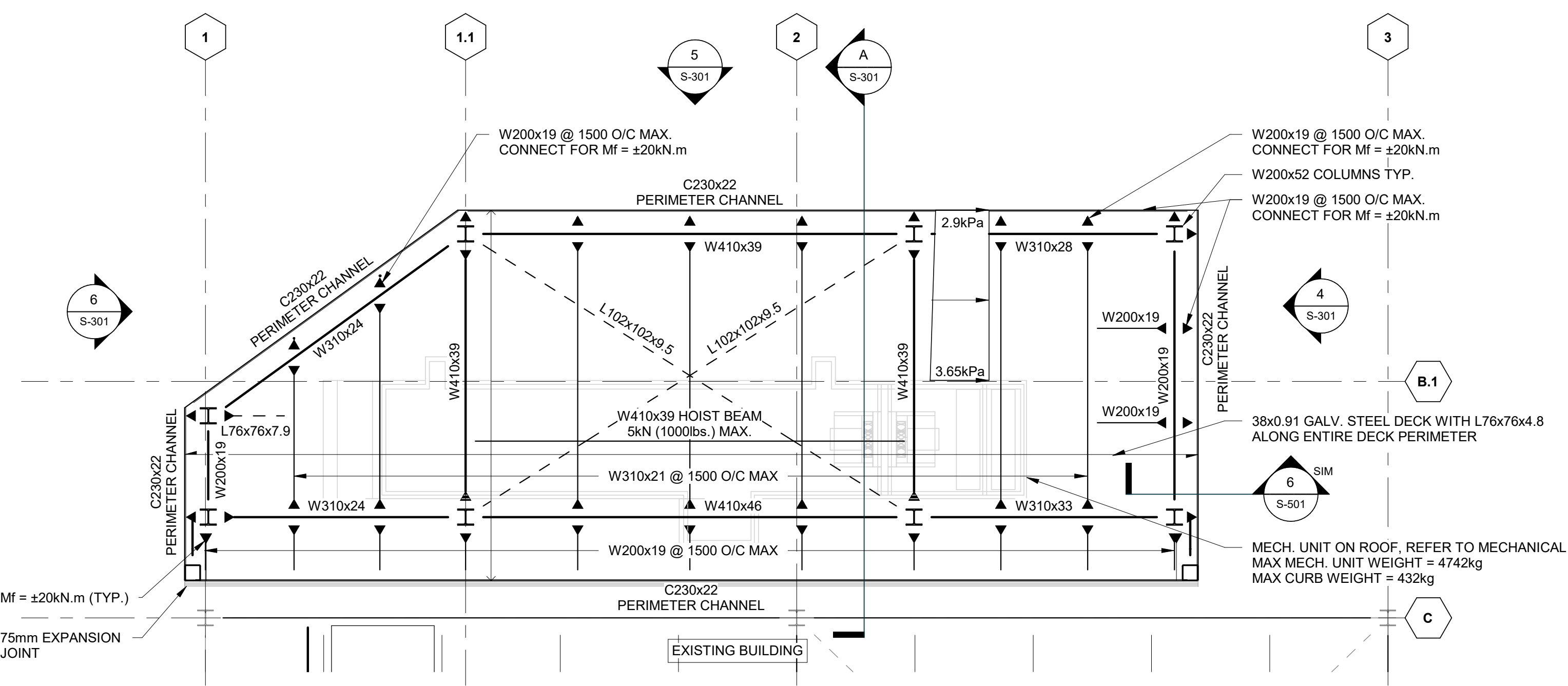
PIER SCHEDULE			
MARK	SIZE	ANCHORAGE	
P1	475x475	4-20M + 10M CLOSED STIRRUP @ 250 O/C	

FOOTING SCHEDULE			
MARK	SIZE	REINFORCEMENT	
F1	1200x1200x600 DP	20M @ 300 B.E.W.	
F2	1500x1500x600 DP	20M @ 300 TAB E.W.	
SF1	600x300 DP	HOOK TOP-REBAR 3-15B CONT	



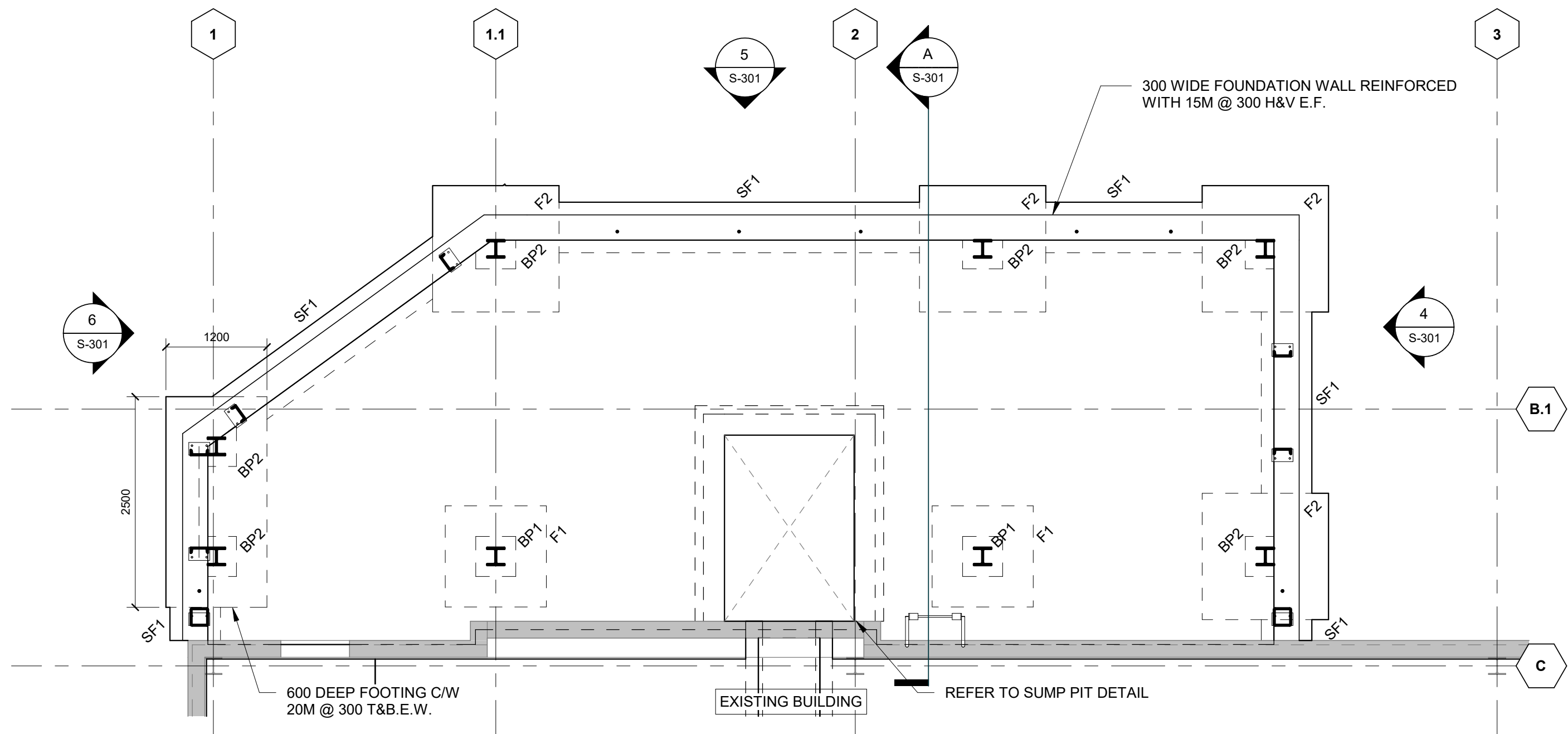
6 GIRT STUB OUT CONNECTION

S-401 REF: 3 / S-401 Scale: 1 : 10



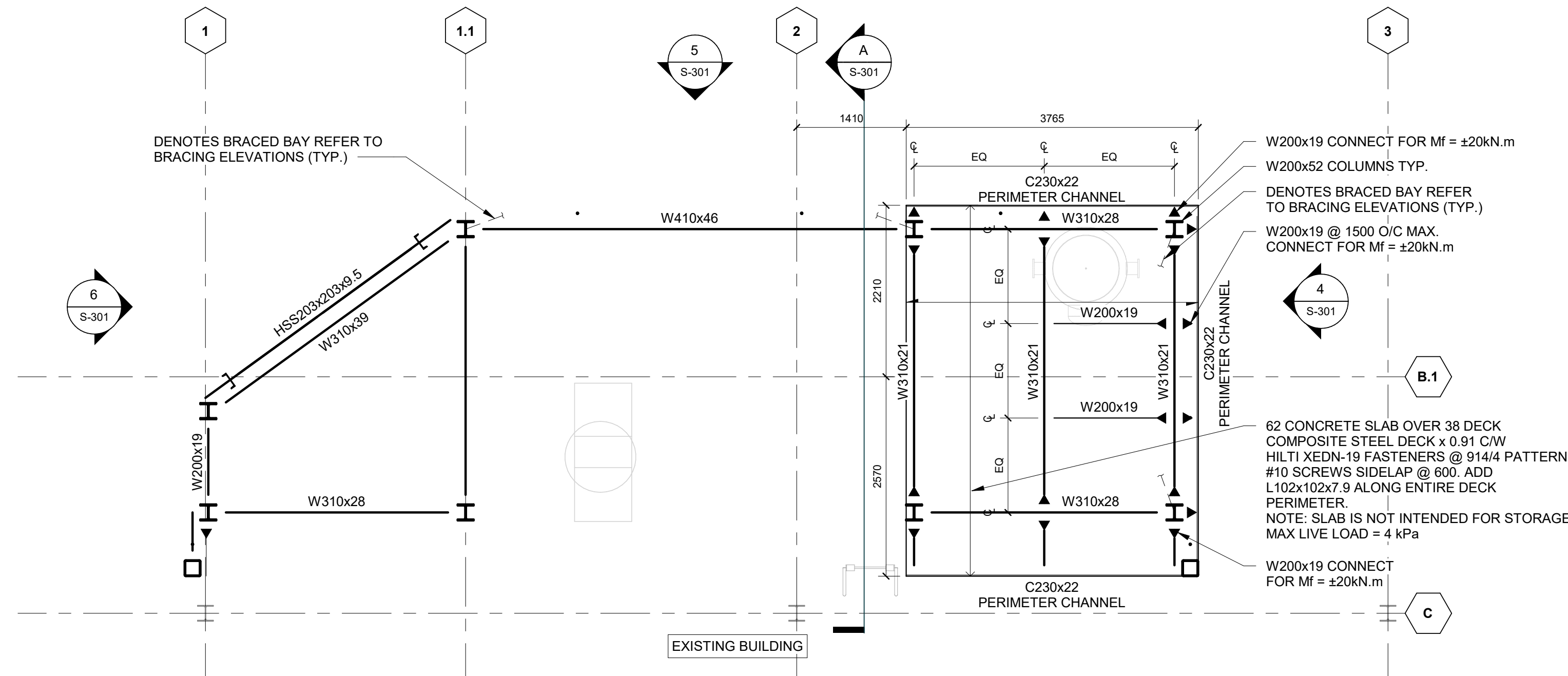
LEVEL 03 MECHANICAL ROOM ROOF PLAN

S-401 REF: 1 / S-102 Scale: 1 : 50



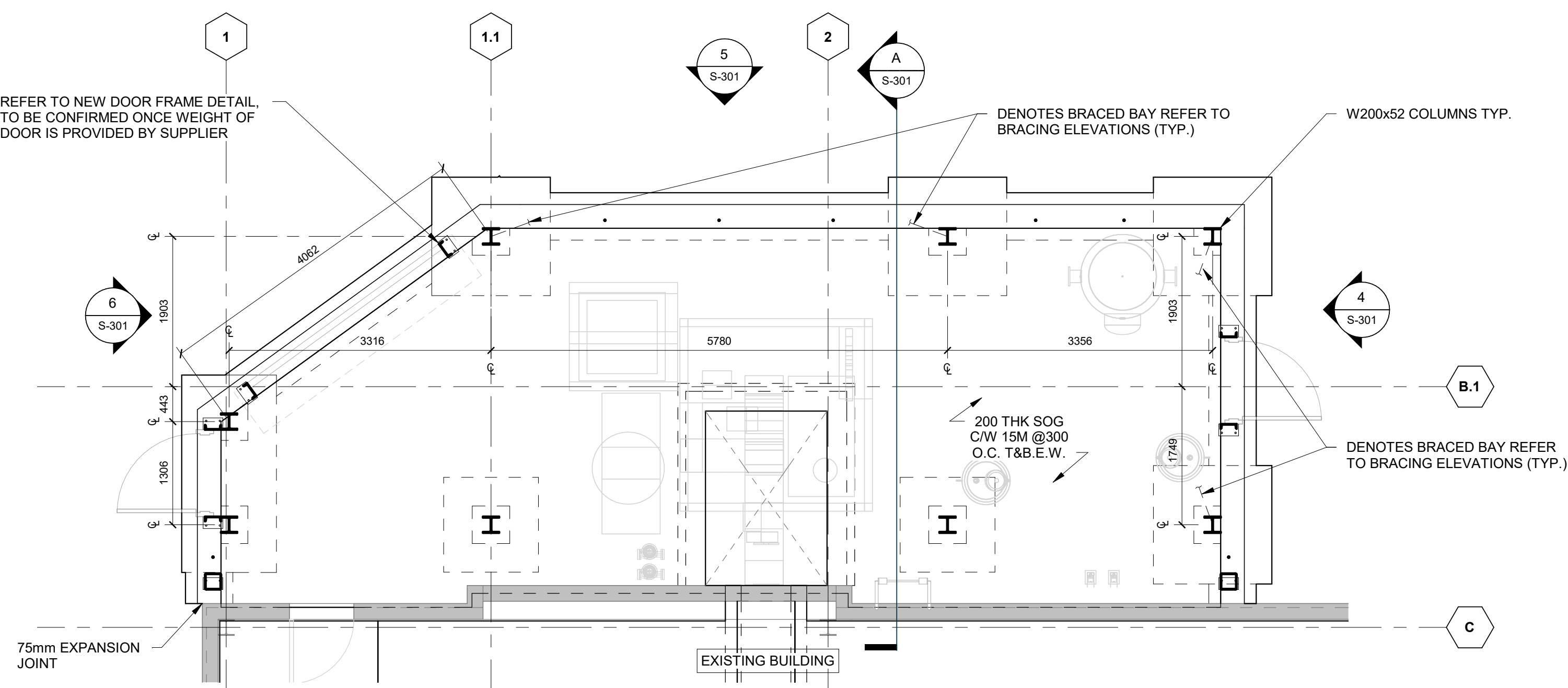
MECHANICAL ROOM FOUNDATION PLAN

S-401 REF: 2 / A-150 Scale: 1 : 50



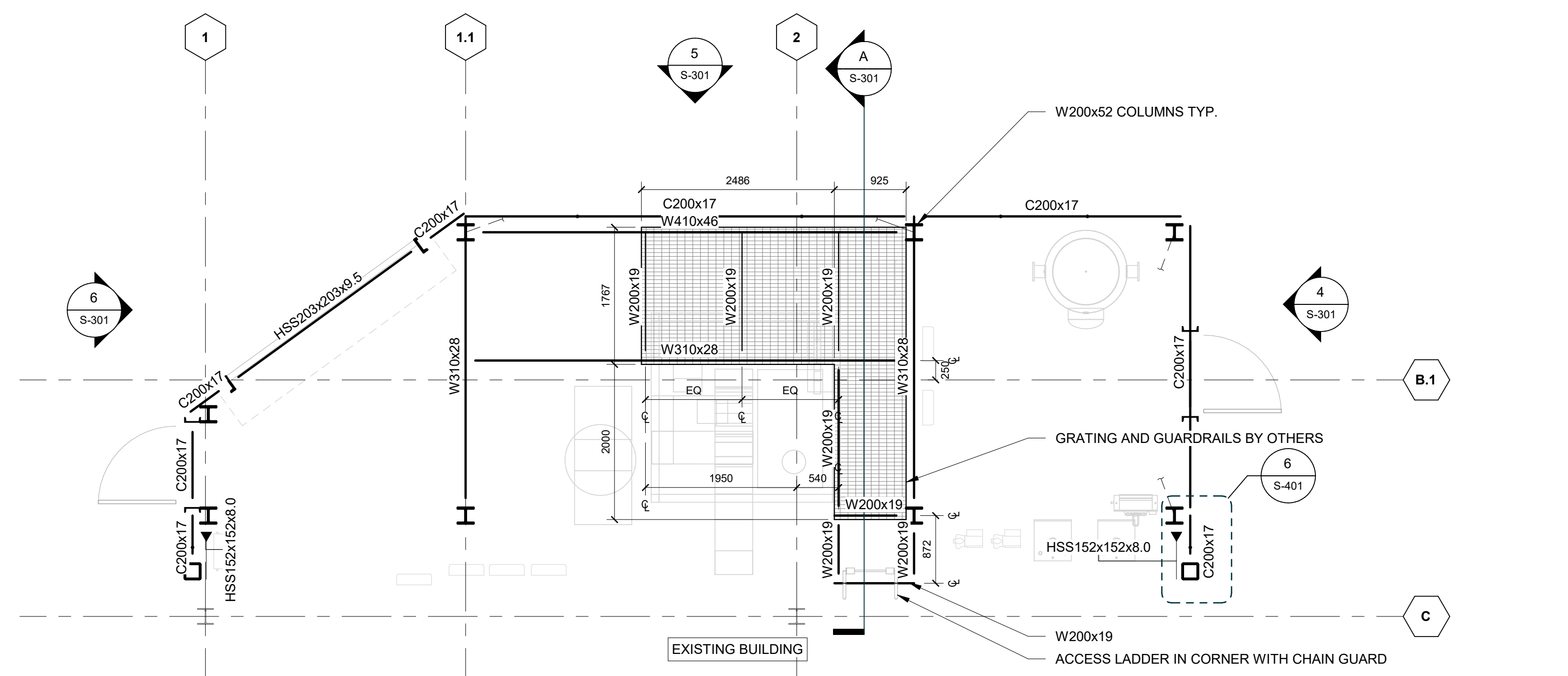
LEVEL 02 MECHANICAL ROOM T/O STEEL PLAN

S-401 REF: 2 / A-150 Scale: 1 : 50



LEVEL 01 MECHANICAL ROOM PLAN

S-401 REF: 1 / S-101 Scale: 1 : 50



LEVEL 01.2 MECHANICAL ROOM MEZZANINE T/O STEEL PLAN

S-401 REF: 2 / A-150 Scale: 1 : 50



PROJECT

BLAST BAY UPGRADE  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

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CONSULTANT

PRINCIPAL:  
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Email: gabriel.colombani@aecom.com

CONSULTANTS

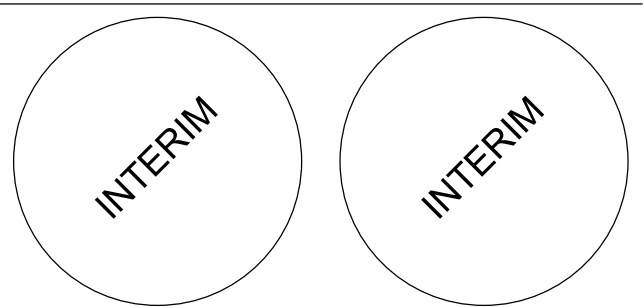
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REGISTRATION



KEY PLAN



SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
2	ISSUED FOR TENDER	29/09/2023
1	ISSUED FOR 100% CLIENT REVIEW	21/07/2023

PROJECT NUMBER

60678205

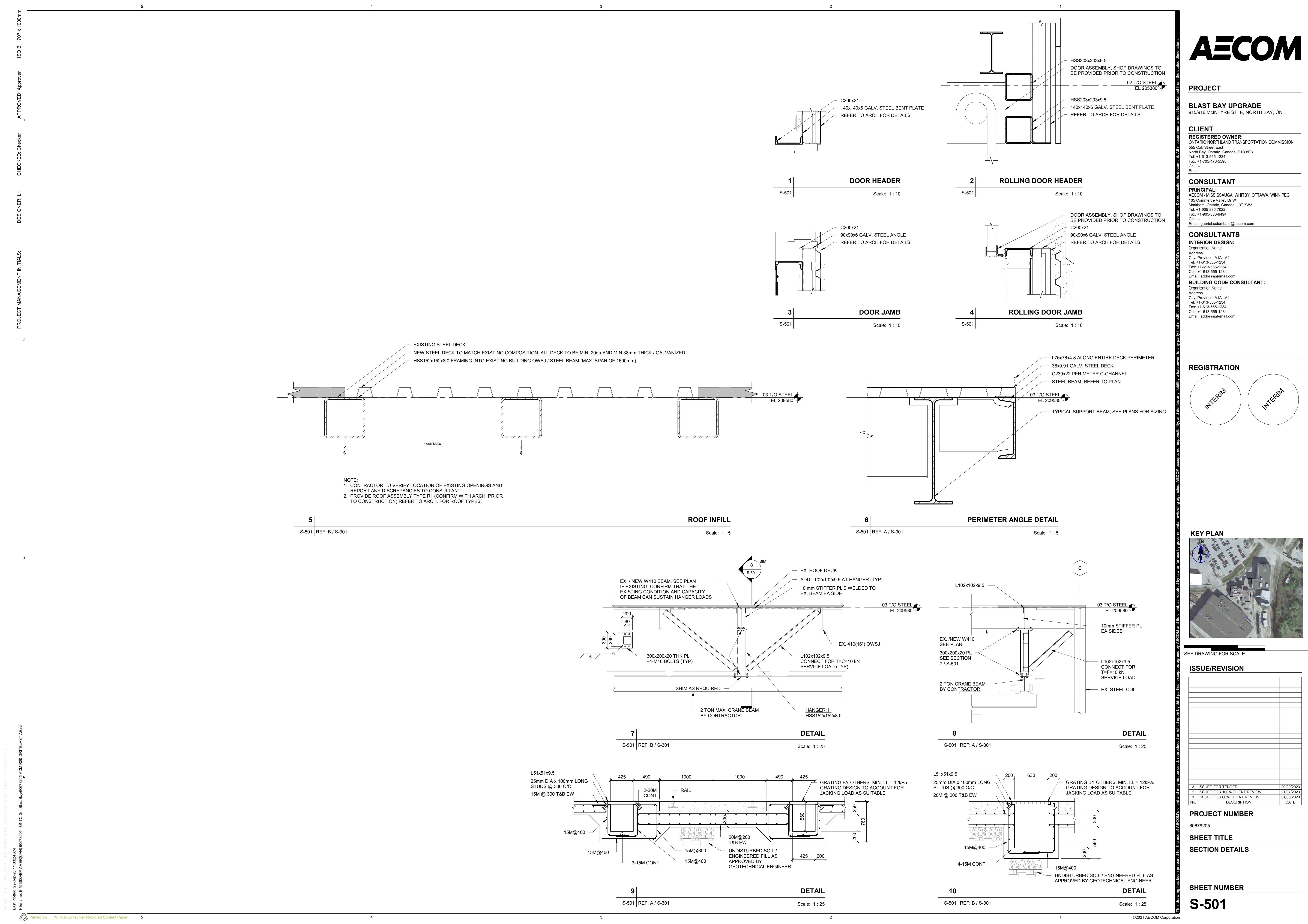
SHEET TITLE

ENLARGED PARTIAL PLANS

SHEET NUMBER

S-401





SC07T\_04 - PROJECT DELIVERY STRUCTURAL S-501 SECTION DETAILS  
Last Printed: 29-Sep-23 11:03:24 AM  
Filename: BM\_360\_1BP-AMER(CAN)\_60678205 - ONTC Coll Blast Bay\60678205-AOM-R20-GRITBLAST-AE-14



PROJECT

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Email: gabriel.colombani@aecom.com

CONSULTANTS

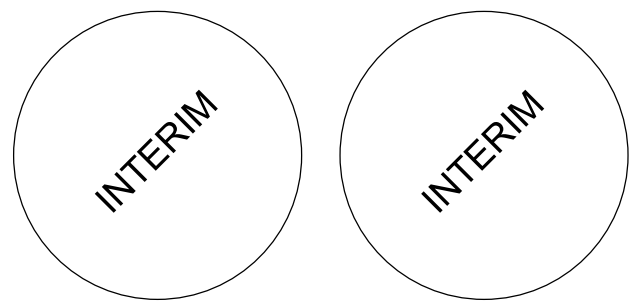
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REGISTRATION



KEY PLAN



SEE DRAWING FOR SCALE

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PROJECT NUMBER

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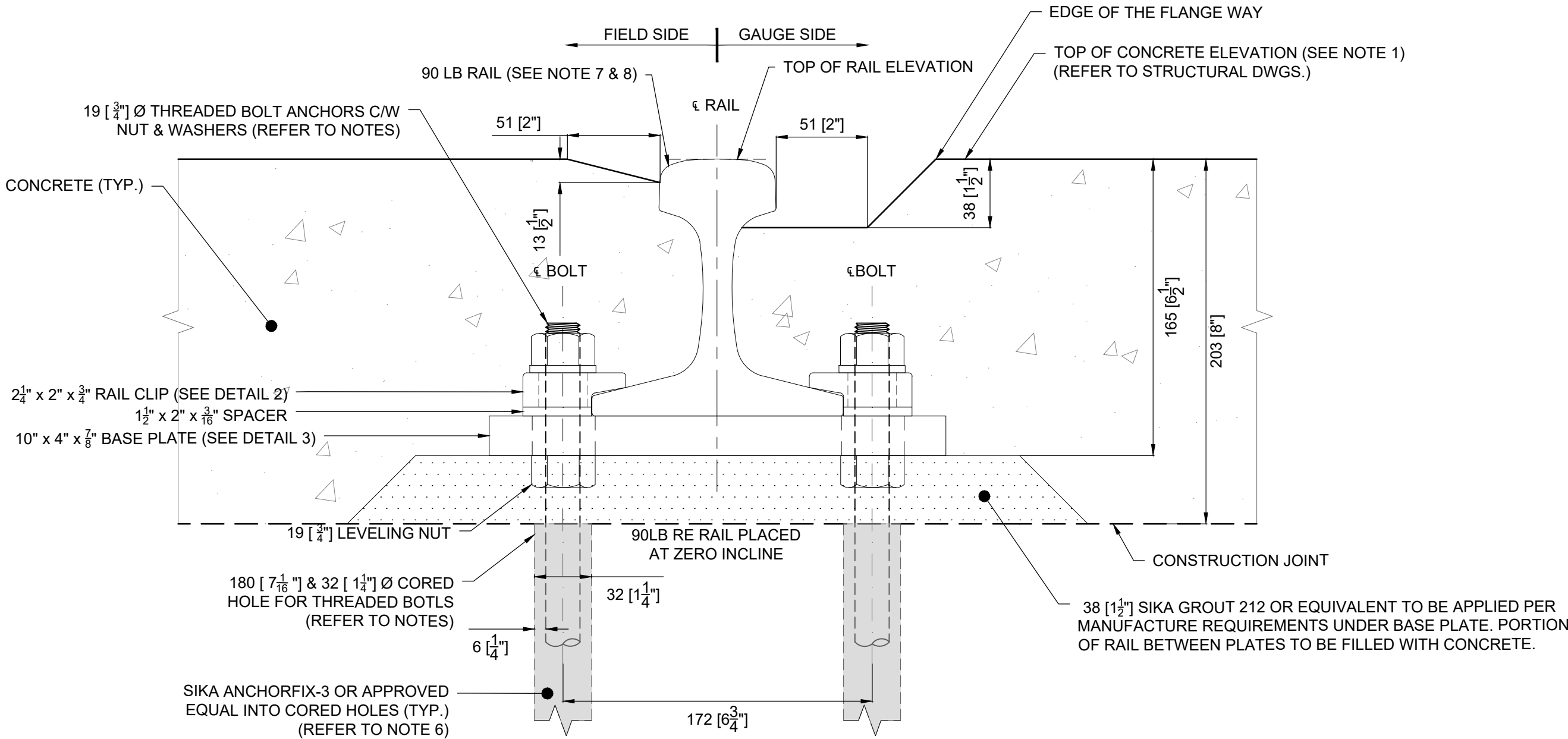
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SECTION DETAILS

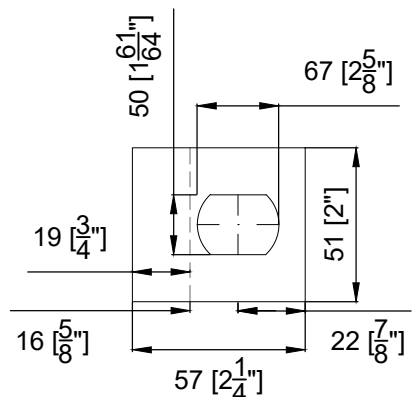
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S-501

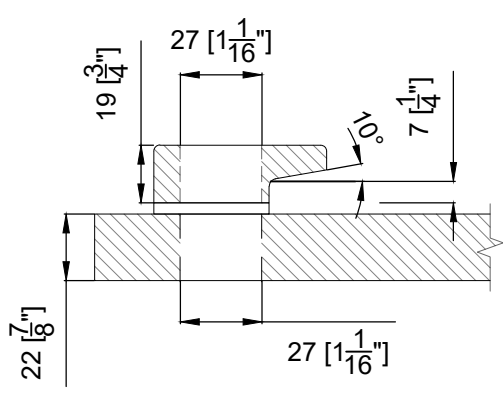




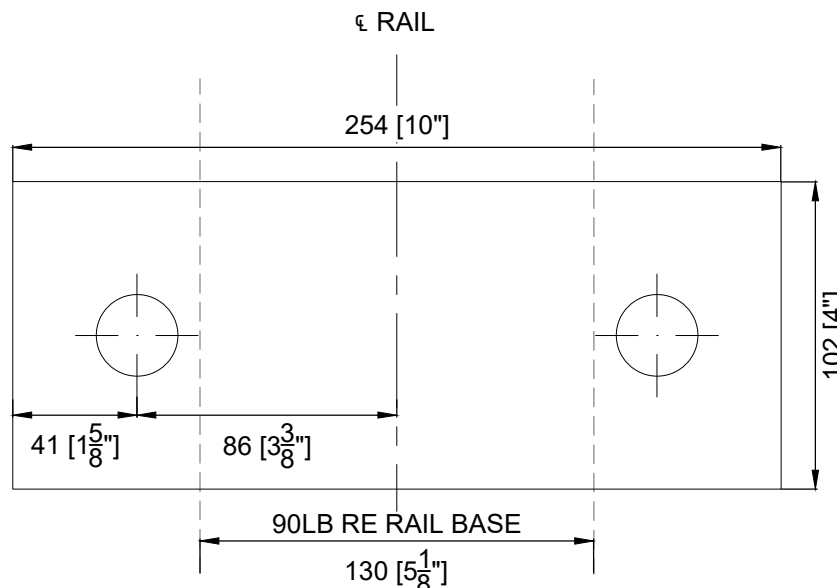
DETAIL  
TYP. LEFT RAIL FASTENING DETAIL



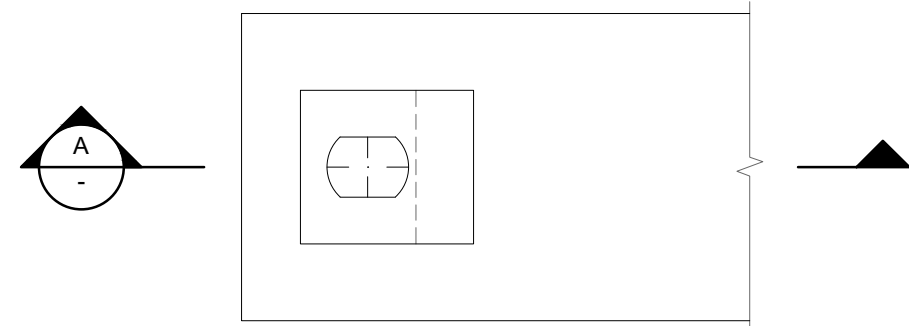
DETAIL  
2 1/4" x 2" x 3/4" RAIL CLIP



SECTION  
PLATE ASSEMBLY (TYP.)



DETAIL  
10" x 4" x 7/8" PLATE



PLAN  
PLATE ASSEMBLY (TYP.)

GENERAL

- 1) APPLICABLE FOR TRACK THAT IS EMBEDDED WITHIN CONCRETE SLAB ONLY.
- 2) BASE PLATE & FASTENING TO BE SPACED AT 0.9m [3'] C/C.
- 3) BETWEEN BASE PLATES, GROUT TO BE FILLED UP TO THE BASE OF RAIL AND ENSURE THAT THERE ARE NO VOIDS BETWEEN THE BASE OF RAIL AND FIRST CONCRETE POUR.
- 4) CONTRACTOR TO VERIFY LOCATION OF ALL REBAR PRIOR TO CORING AND CONFIRM THAT CORING WILL NOT IMPACT THE REBAR.
- 5) REFER TO STRUCTURAL DESIGN PACKAGE FOR CONCRETE AND REBAR DETAIL.
- 6) MINIMUM CORING DIMENSIONS TO BE CONFIRMED BASED ON SIKA ANCHORFIX-3 REQUIREMENTS.
- 7) 90 LB RAIL SHALL BE USED AND SUPPLIED BY THE CLIENT. CONTRACTOR TO SUPPLY/INSTALL 90LB WELD KITS FOR CONNECTION BACK TO THE EXISTING TRACK.
- 8) ALL RAIL JOINTS SHALL BE WELDED.
- 9) CONTRACTOR TO VERIFY EXISTING SITE CONDITION AND MATCH MATERIAL AND TRACK STRUCTURE DESIGN. CONTRACTOR TO NOTIFY ENGINEER OF ANY DISCREPANCIES IN THE FIELD DURING CONSTRUCTION.
- 10) EXISTING STOP BLOCKS ARE TO BE SAVED AND TO BE TIED INTO DURING TRACK CONSTRUCTION.
- 11) RAIL TO EXTEND 10FT BEYOND THE BUILDING SLAB FOR TIE IN WITH EXTERIOR TRACK.
- 12) ALL TRACKWORK MATERIALS AND INSTALLATION TO BE COMPLAINT WITH MTR MANUAL OF TRACK REQUIREMENTS UNLESS OTHERWISE SPECIFIED.

MATERIAL

STRUCTURAL STEEL

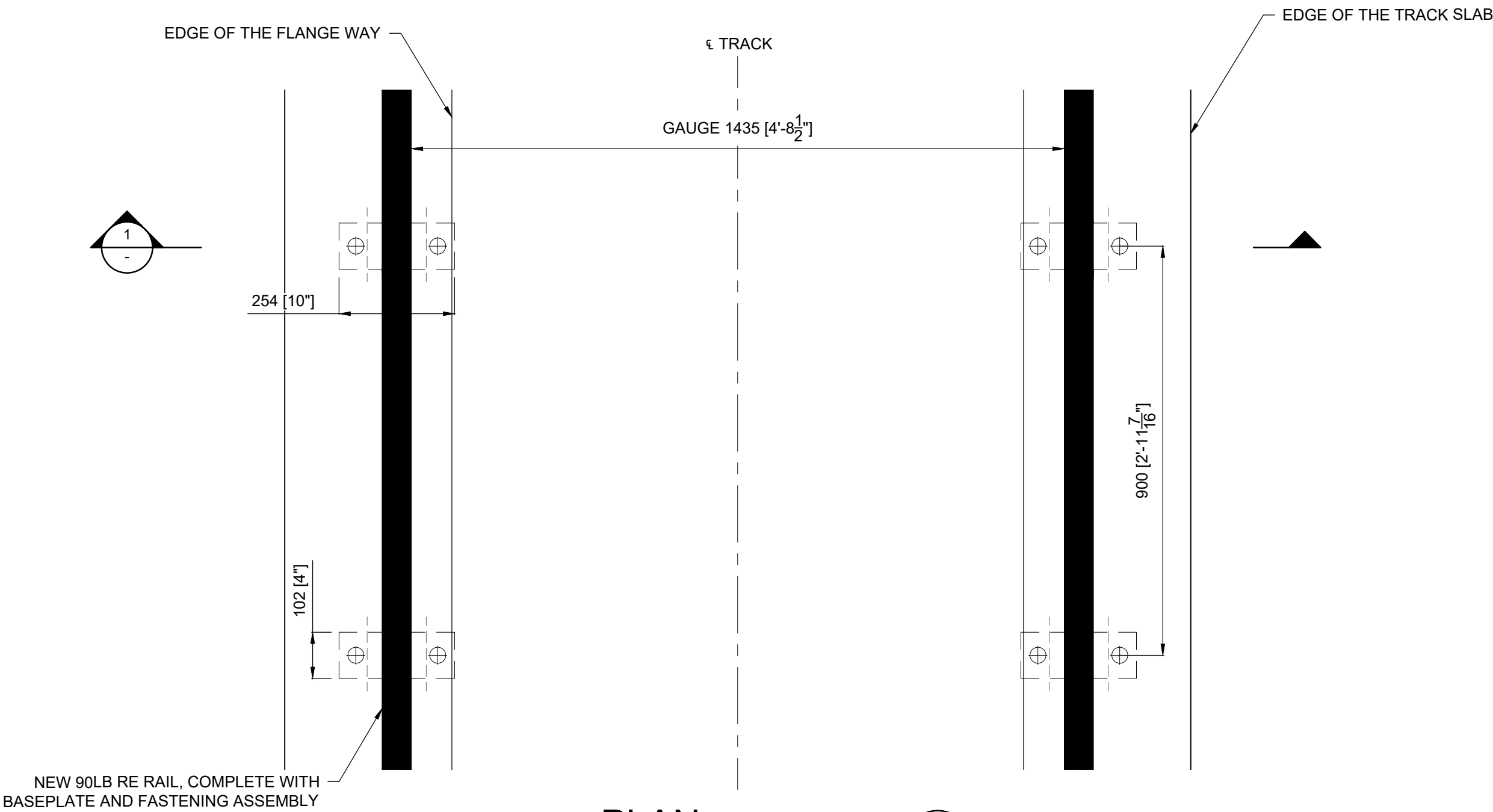
- ALL STEEL PLATES, CLAMPS, (AND SHIMS) SHALL CONFORM TO CSA G40.20/G40.21, GRADE 300W.

HIGH STRENGTH BOLTS

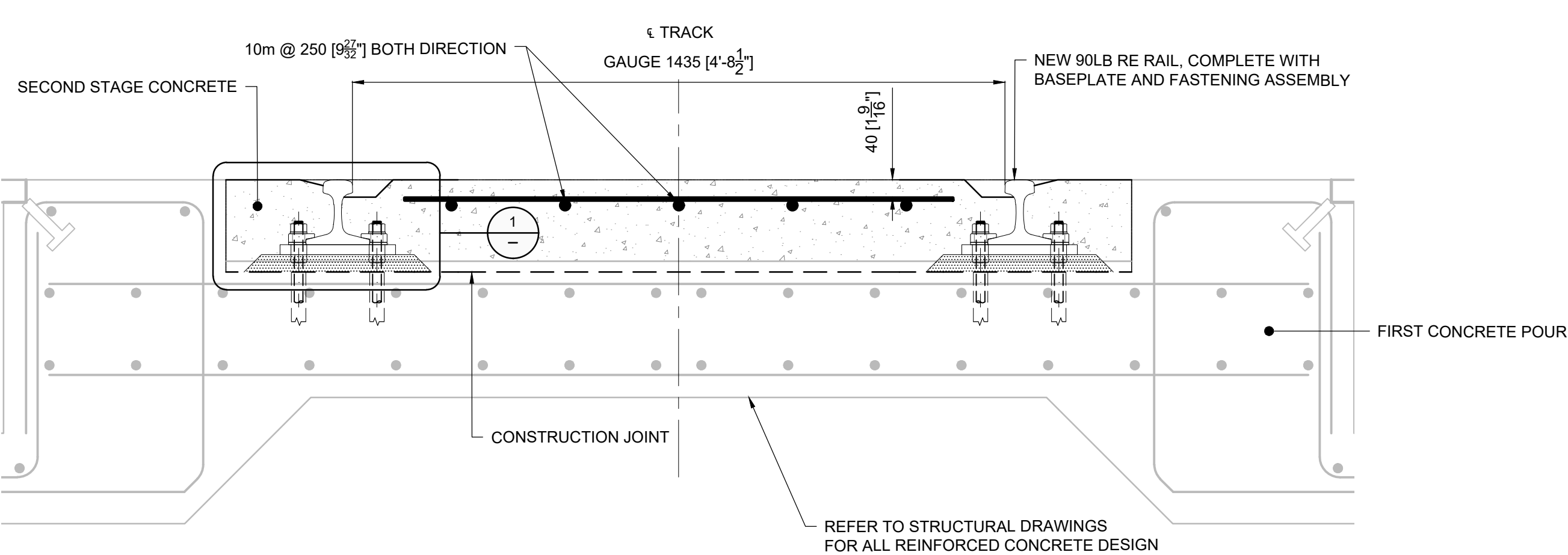
- HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A325, TYPE 1, C/W NUTS, WASHERS, AND HELICAL SPRING WASHERS.
- NUTS SHALL CONFORM TO ASTM A563 GRADE DH, HEAVY HEX NUTS.
- WASHERS SHALL CONFORM TO ASTM F436, TYPE 1, HARDENED STEEL WASHERS.

CONCRETE

- CONCRETE SPECIFICATIONS TO MATCH STRUCTURAL BASE SLAB.



PLAN  
INTERIOR EMBEDDED TRACK



SECTION  
INTERIOR EMBEDDED TRACK

MATERIAL LIST		
ITEM	QUANTITY	UNIT
90LB RE RAIL - INTERIOR (SUPPLIED BY ONTC)	60	Lin.m
90LB RE RAIL - EXTERIOR (SUPPLIED BY ONTC)	6	Lin.m
RAIL CLIP	136	EA.
BASE PLATE	68	EA.
ANCHOR BOLTS (c/w FASTENING ASSEM.)	136	EA.
SPACER	136	EA.
SIKA GROUT PAD (68 TOTAL)	0.08	m³



PROJECT

GRIT BLAST  
915/916 McIntyre St. E, North Bay, ON

CLIENT

REGISTERED OWNER:  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
555 Oak Street East  
North Bay, Ontario, Canada, P1B 8E3  
Tel: +1-805-886-7022  
Fax: +1-905-886-9494  
Cell: --  
Email: --

CONSULTANT

PRINCIPAL:  
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Fax: +1-905-886-9494  
Cell: --  
Email: gabriel.colombani@aecom.com

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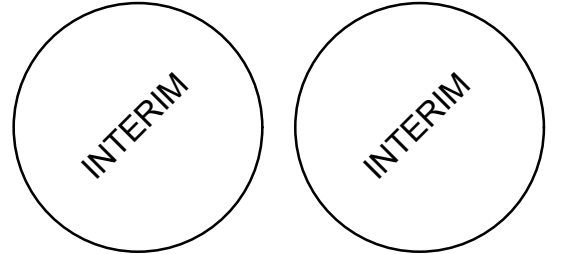
INTERIOR DESIGN:

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City, Province, A1A 1A1  
Tel: +1-613-555-1234  
Fax: +1-613-555-1234  
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REGISTRATION



KEY PLAN



SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	29/09/2023

PROJECT NUMBER

60678205

SHEET TITLE

BLAST BAY UPGRADE  
INTERIOR EMBEDDED  
TRACK DETAILS

SHEET NUMBER

CT-200





PHOTO A - EXISTING DUST COLLECTOR.



PHOTO C - EXISTING BLAST BAY EXTERIOR WALL - ALONG GRID 'C'.

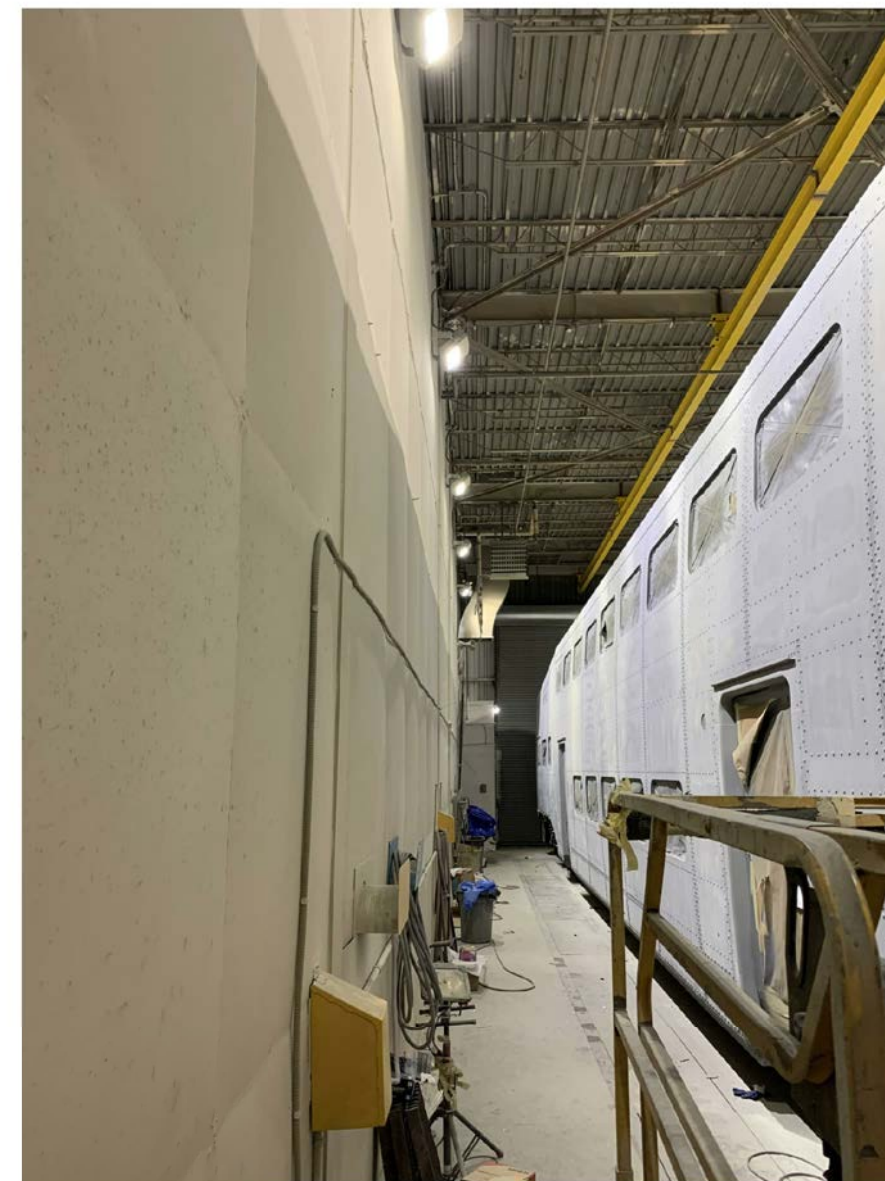
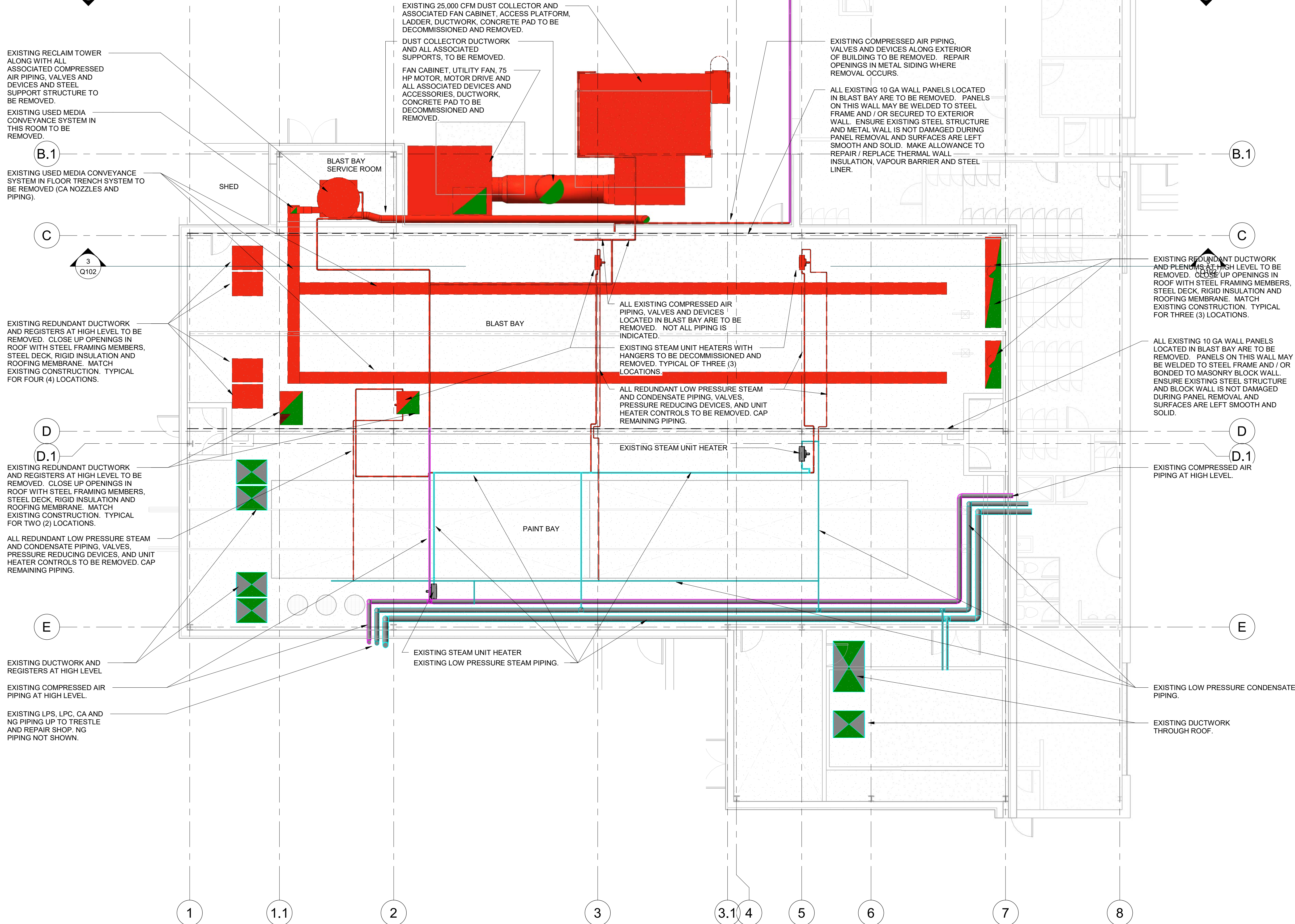


PHOTO D - EXISTING BLAST BAY INTERIOR WALL ALONG GRID 'D'.



PHOTO B - EXISTING DUST COLLECTOR FAN CABINET.



GROUND FLOOR PLAN - PROCESS

Scale: 1 : 75

AECOM

PROJECT

BLAST BAY UPGRADE  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

REGISTERED OWNER:  
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North Bay, Ontario, Canada, P1B 8E3  
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Fax: +1-705-476-5598  
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Email: --

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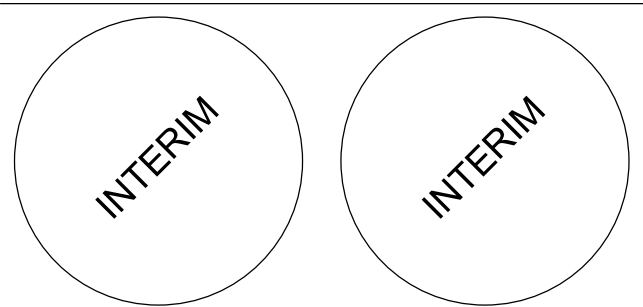
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Cell: +1-613-555-1234  
Email: address@email.com

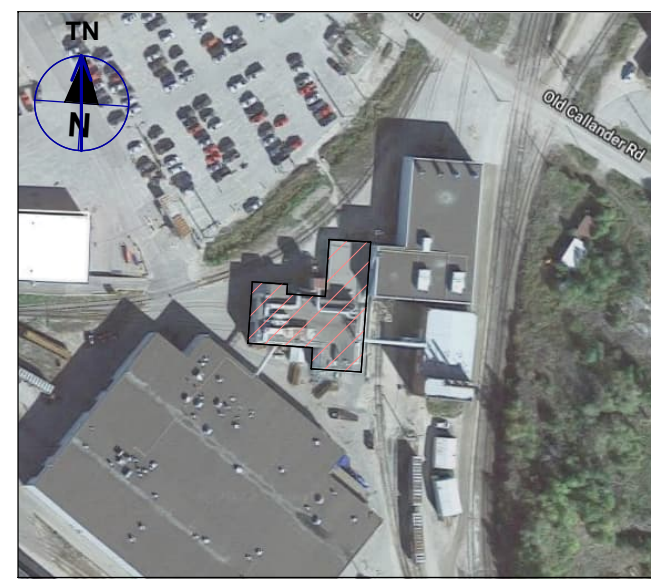
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REGISTRATION



KEY PLAN



SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

SHEET TITLE

DEMOLITION GROUND FLOOR  
PLAN - PROCESS

SHEET NUMBER

Q001





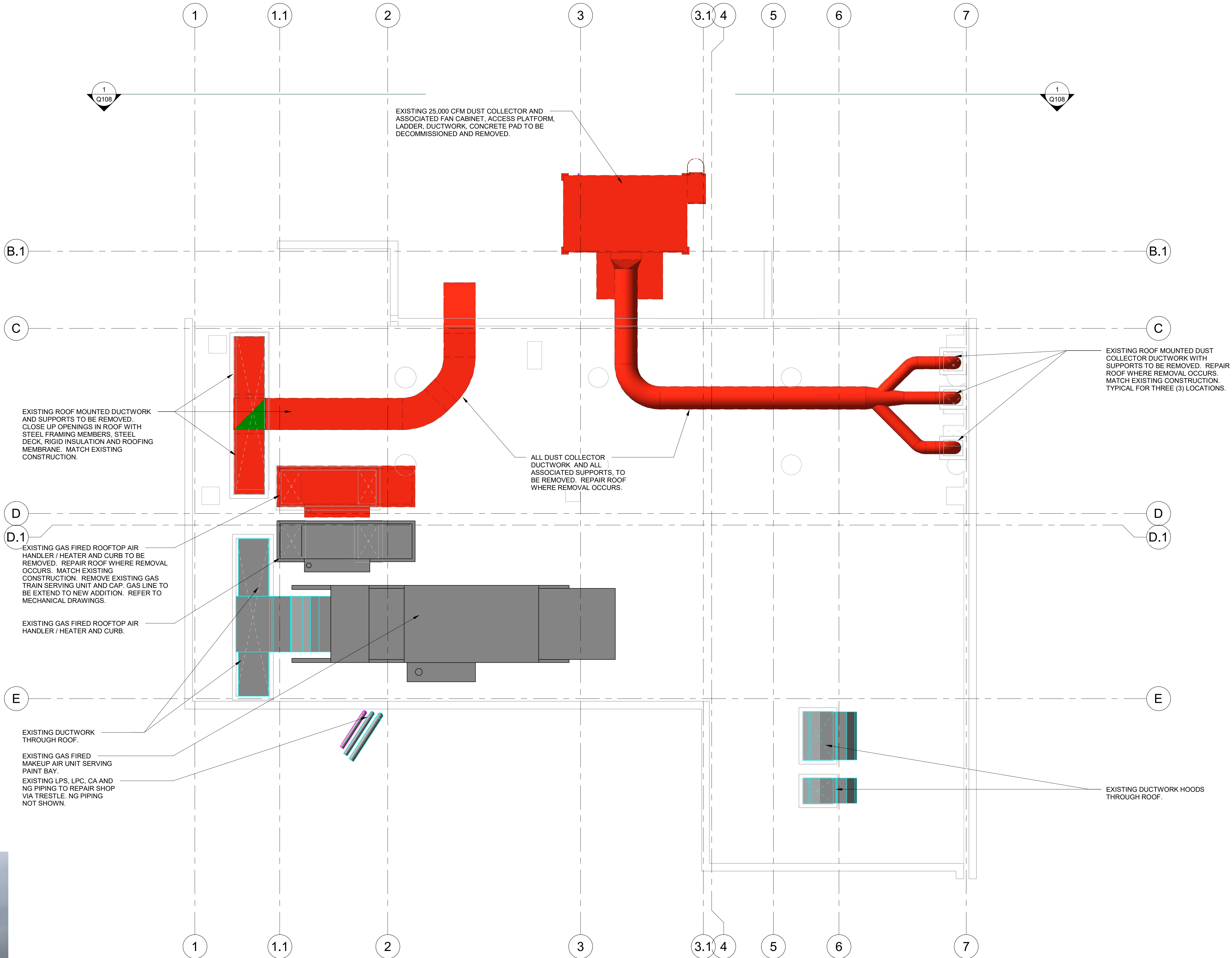
PHOTO E - EXISTING DUST COLLECTOR (HIGH LEVEL).



PHOTO F - EXISTING DUST COLLECTOR DUCTWORK AND GAS FIRED ROOFTOP AIR HANDLER / HEATER.



PHOTO G - EXISTING DUST COLLECTOR DUCTWORK.



1  
Q002 REF: 1 / Q108  
HIGH ROOF LEVEL PLAN - PROCESS DEMO  
NTS



PROJECT

BLAST BAY UPGRADE  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

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CONSULTANTS

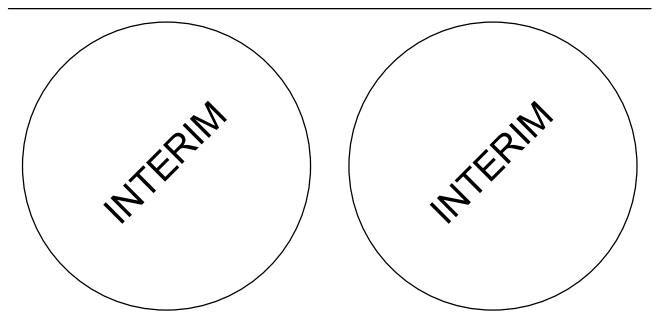
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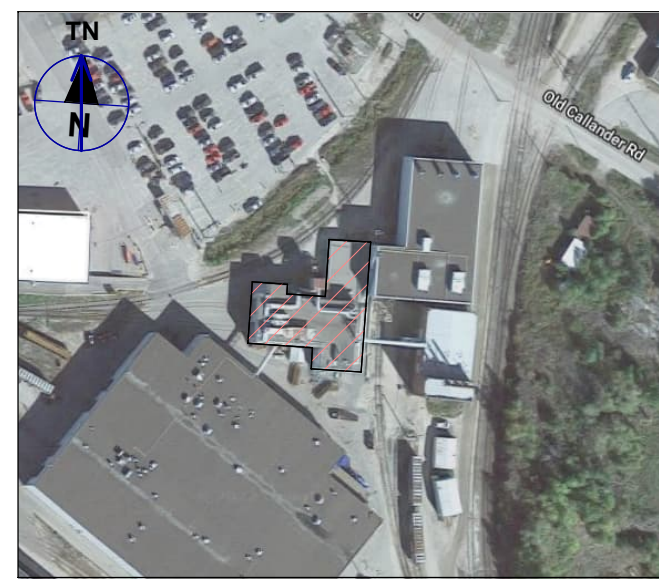
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KEY PLAN



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No.	ISSUED FOR TENDER	DESCRIPTION	DATE
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PROJECT NUMBER

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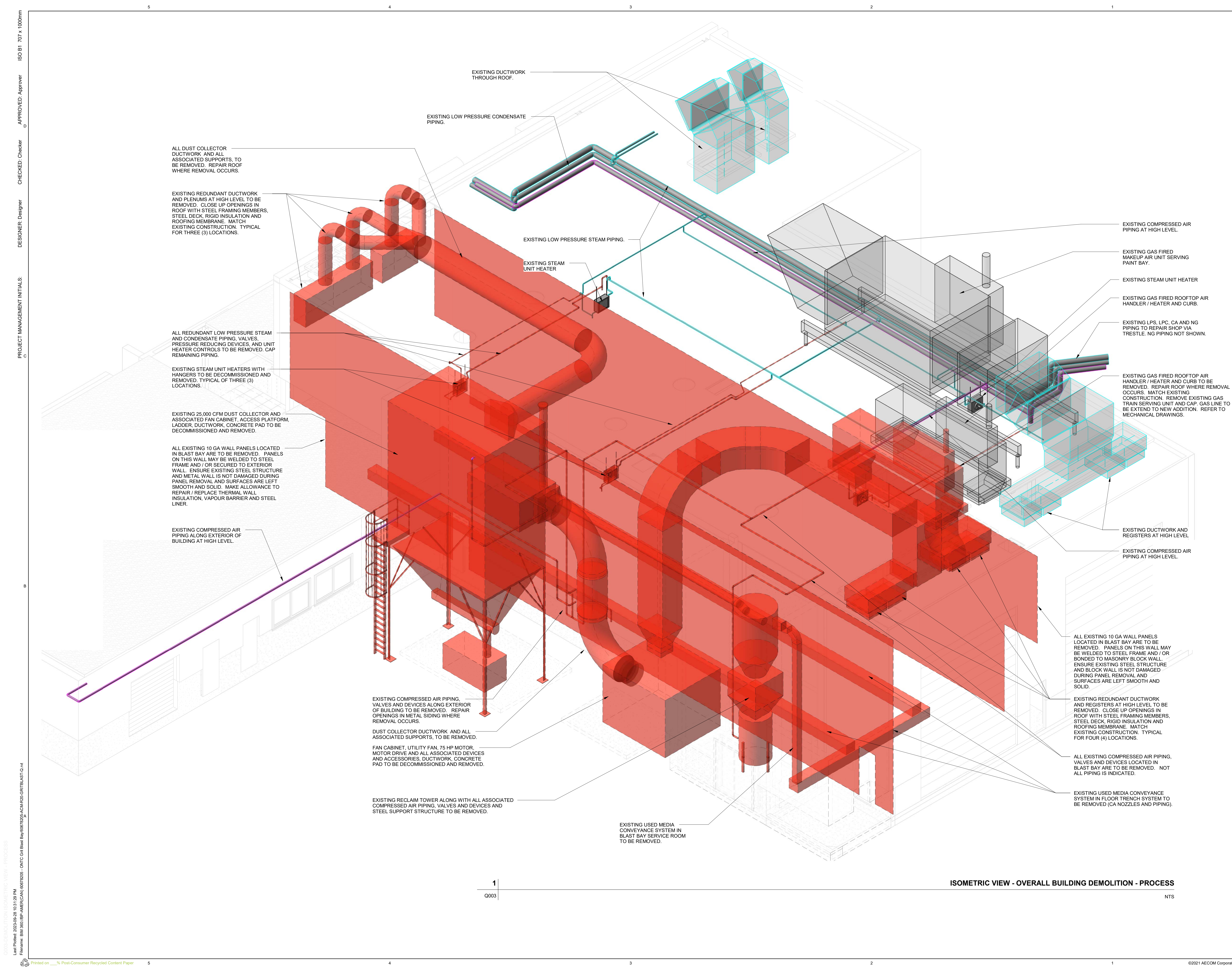
SHEET TITLE

DEMOLITION ROOF PLAN -  
PROCESS

SHEET NUMBER

Q002





Q003 DEMOLITION ISOMETRIC VIEW - PROCESS  
Last Printed: 2023-09-29 10:31:29 PM  
Filename: BM\_360\_IBP-AMER(CAN)\_60678205 - ONTC Coll Blast Bay/0678205-ACM-R20-GRIBLAST-Q 04

ISO B1 707 x 100mm  
APPROVED: Approver  
CHECKED: Checker  
DESIGNER: Designer  
PROJECT MANAGEMENT INITIALS:  
8  
5  
4  
3  
2  
1

# AECOM

**PROJECT**

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
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INTERIM

**KEY PLAN**

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**ISSUE/REVISION**

No.	DESCRIPTION	DATE
4	ISSUED FOR TENDER	2023/09/29

**PROJECT NUMBER**

60678205

**SHEET TITLE**

**DEMOLITION ISOMETRIC VIEW - PROCESS**

**SHEET NUMBER**

**Q003**

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5

4

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2

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Q001	DEMOLITION GROUND FLOOR PLAN - PROCESS
Q002	DEMOLITION ROOF PLAN - PROCESS
Q003	DEMOLITION ISOMETRIC VIEW - PROCESS
Q100	BUILDING ISOMETRIC - PROCESS
Q101	FOUNDATION PLAN - PROCESS
Q102	LOW LEVEL GROUND FLOOR PLAN - PROCESS
Q103	HIGH LEVEL GROUND FLOOR PLAN - PROCESS
Q104	CEILING LEVEL PLAN - PROCESS
Q105	HIGH ROOF PLAN - PROCESS
Q106	RECLAIM AND M/E ROOM
Q107	REFLECTED CEILING PLAN
Q108	BUILDING SECTIONS - PROCESS
Q109	BUILDING SECTIONS - PROCESS
Q110	BUILDING SECTIONS - PROCESS
Q111	ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS
Q112	ISOMETRIC VIEWS
Q113	3-AXIS MAX LIFT
Q114	CEILING AND WALL PANEL GENERAL ARRANGEMENT
Q115	PROCESS DESIGN NOTES AND SCHEMATICS
Q116	PROCESS SCHEDULES AND SCHEMATICS

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Q102-LOW LEVEL GROUND FLOOR PLAN - PROCESS  
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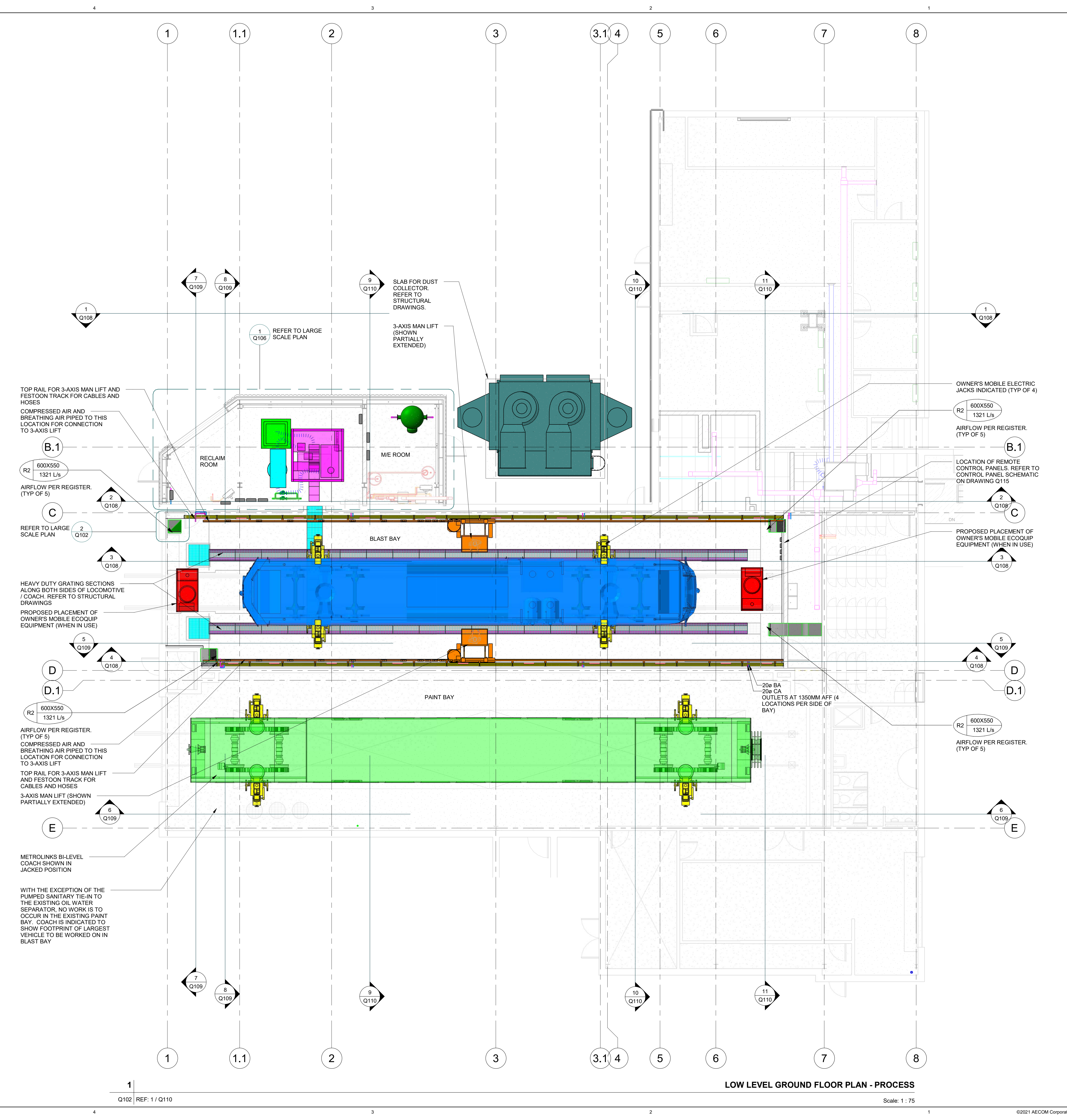
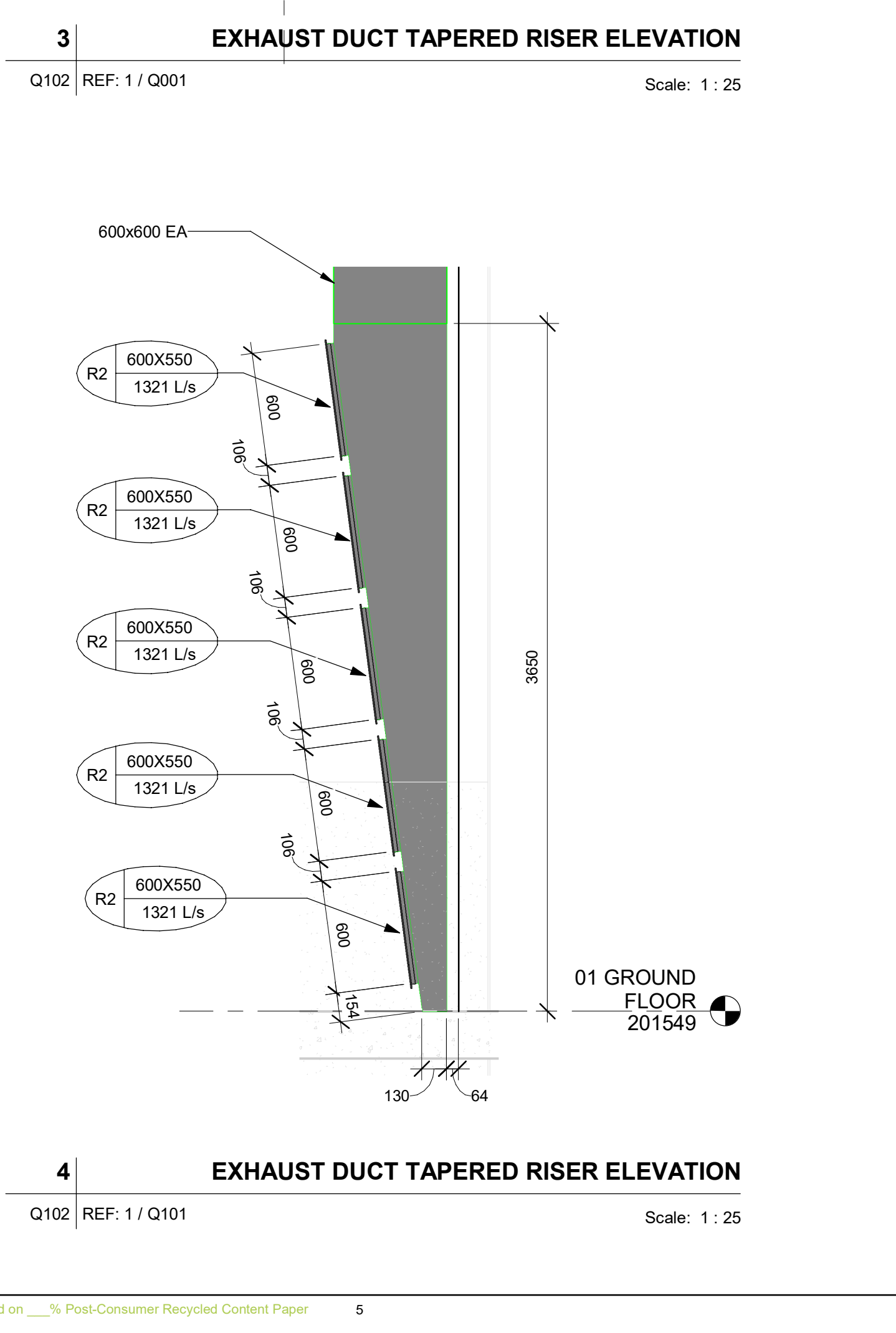
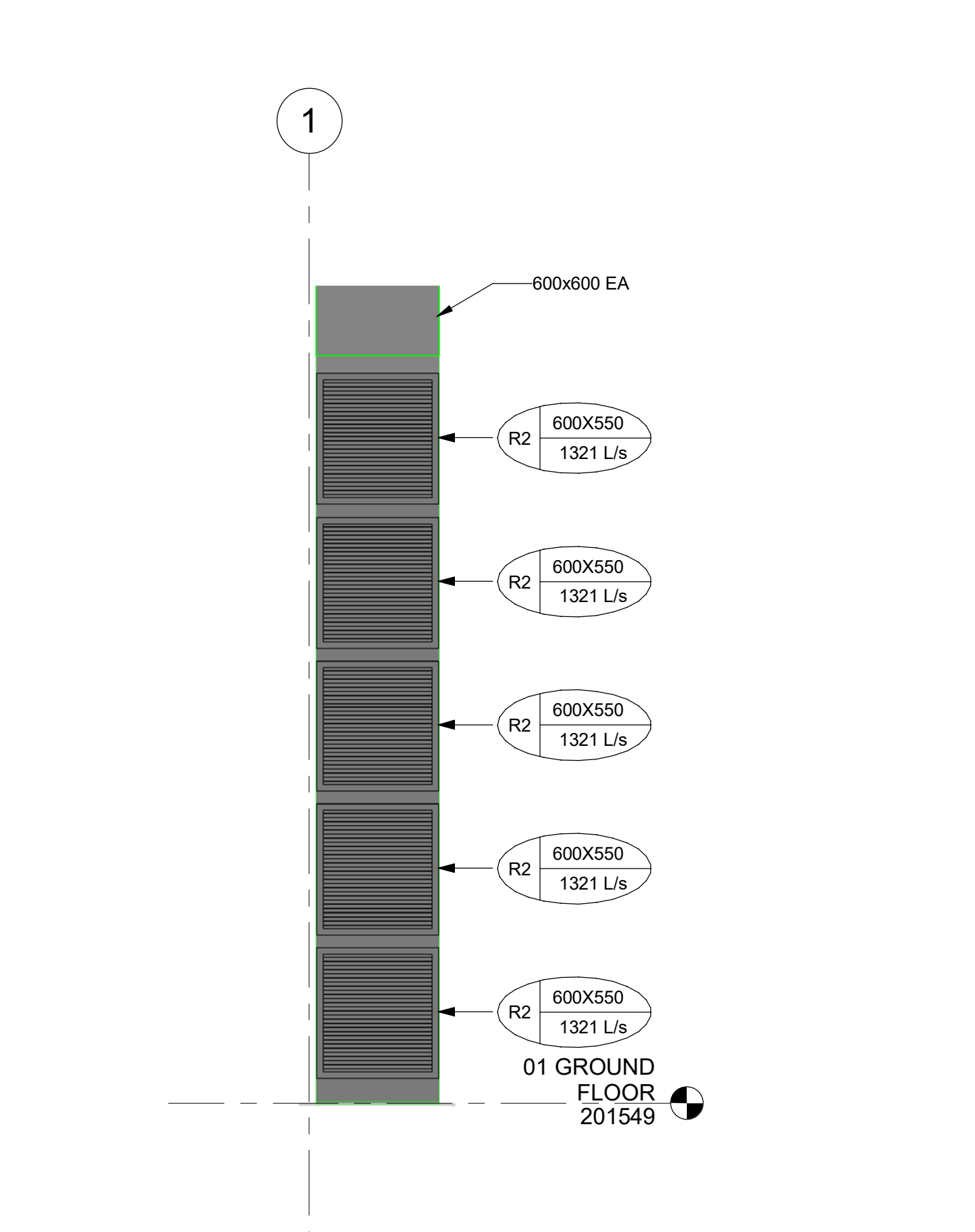
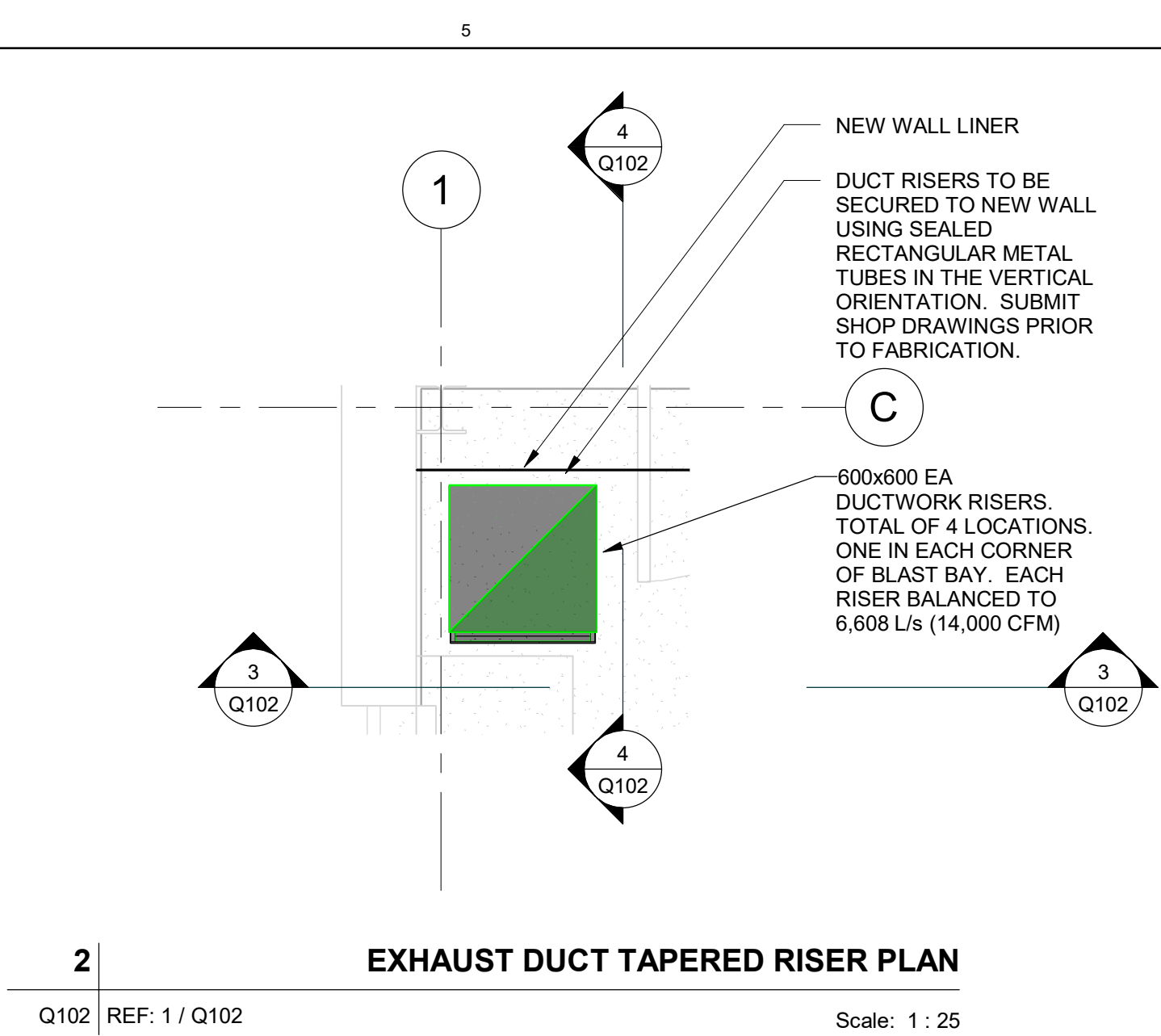
DESIGNER: CFL  
CHECKED: CB  
APPROVED: POK  
ISO B1 707 x 100mm

PROJECT MANAGEMENT INITIALS:

C

B

A



# AECOM

**PROJECT**  
**BLAST BAY UPGRADE**  
915/916 MONTYRE ST. E. NORTH BAY, ON

**CLIENT**  
**REGISTERED OWNER:**  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
555 Oak Street East  
North Bay, Ontario, Canada, P1B 8E3  
Tel: +1-613-555-1234  
Fax: +1-705-476-5598  
Cell: --  
Email: --

**CONSULTANT**  
**PRINCIPAL:**  
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Fax: +1-905-886-9494  
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**CONSULTANTS**  
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**BUILDING CODE CONSULTANT:**  
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Address  
City, Province, A1A 1A1  
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Fax: +1-613-555-1234  
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Email: address@email.com

**REGISTRATION**  
INTERIM INTERIM

**KEY PLAN**

**SEE DRAWING FOR SCALE**

**ISSUE/REVISION**

No.	DESCRIPTION	DATE
4	ISSUED FOR TENDER	2023/09/29
3	ISSUED FOR 60% CLIENT REVIEW	2023/03/31
2	ISSUED FOR CLIENT REVIEW	2023/01/26
1	ISSUED FOR CLIENT REVIEW	2022/11/03

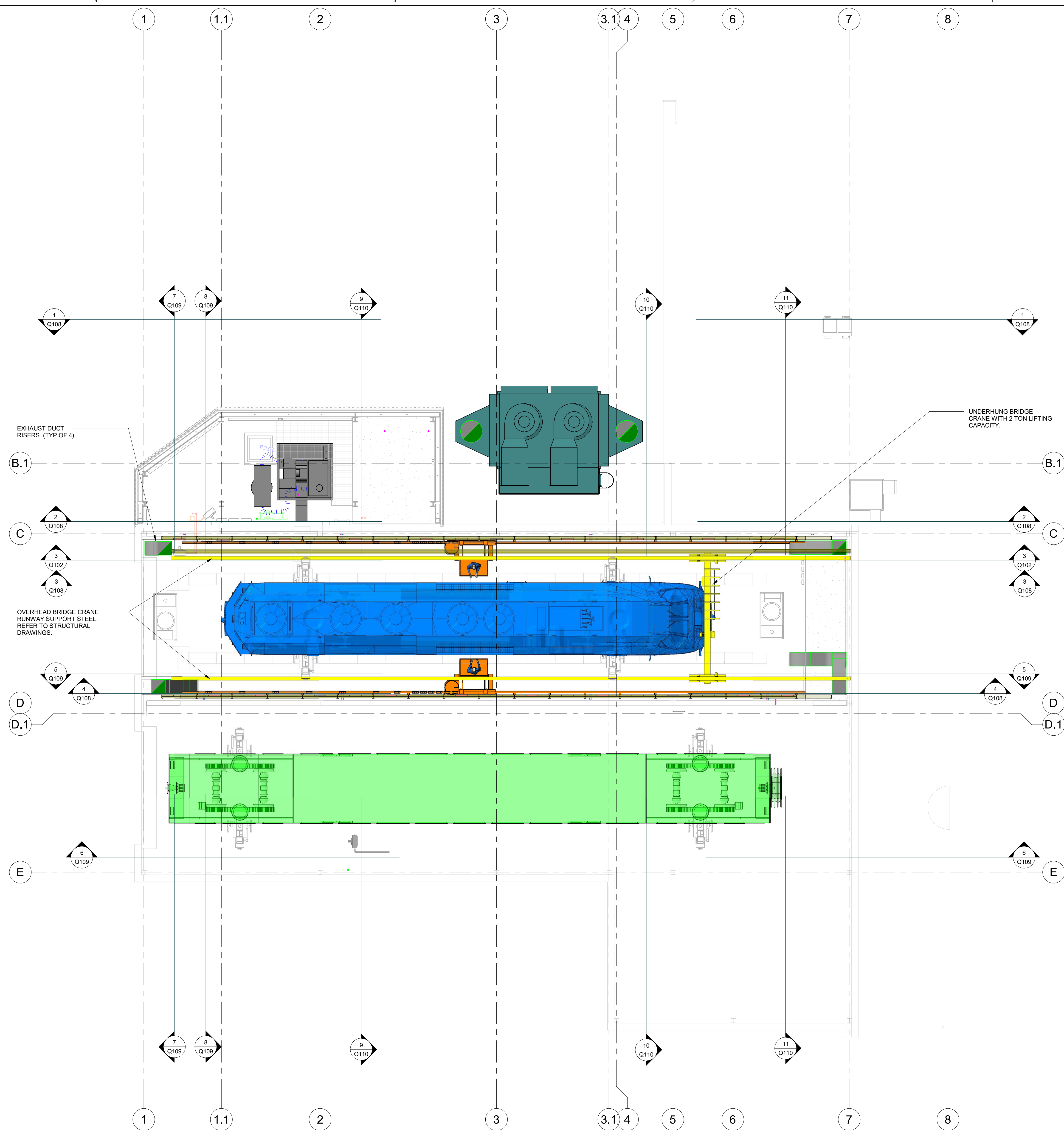
**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
**LOW LEVEL GROUND FLOOR PLAN - PROCESS**

**SHEET NUMBER**  
**Q102**

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1	
Q103	REF: 1 / Q110

### HIGH LEVEL GROUND FLOOR PLAN - PROCESS

Scale: 1 : 75



## PROJECT

**BLAST BAY UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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Fax: +1-905-886-9494  
Cell: --  
Email: gabriel.colombani@aecom.com

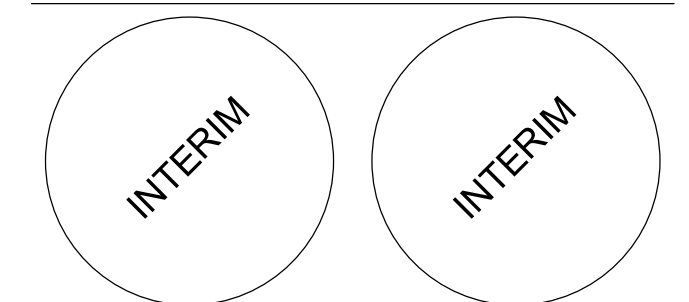
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## REGISTRATION



## KEY PLAN



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**ISSUE/REVISION**

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## PROJECT NUMBER

60678205

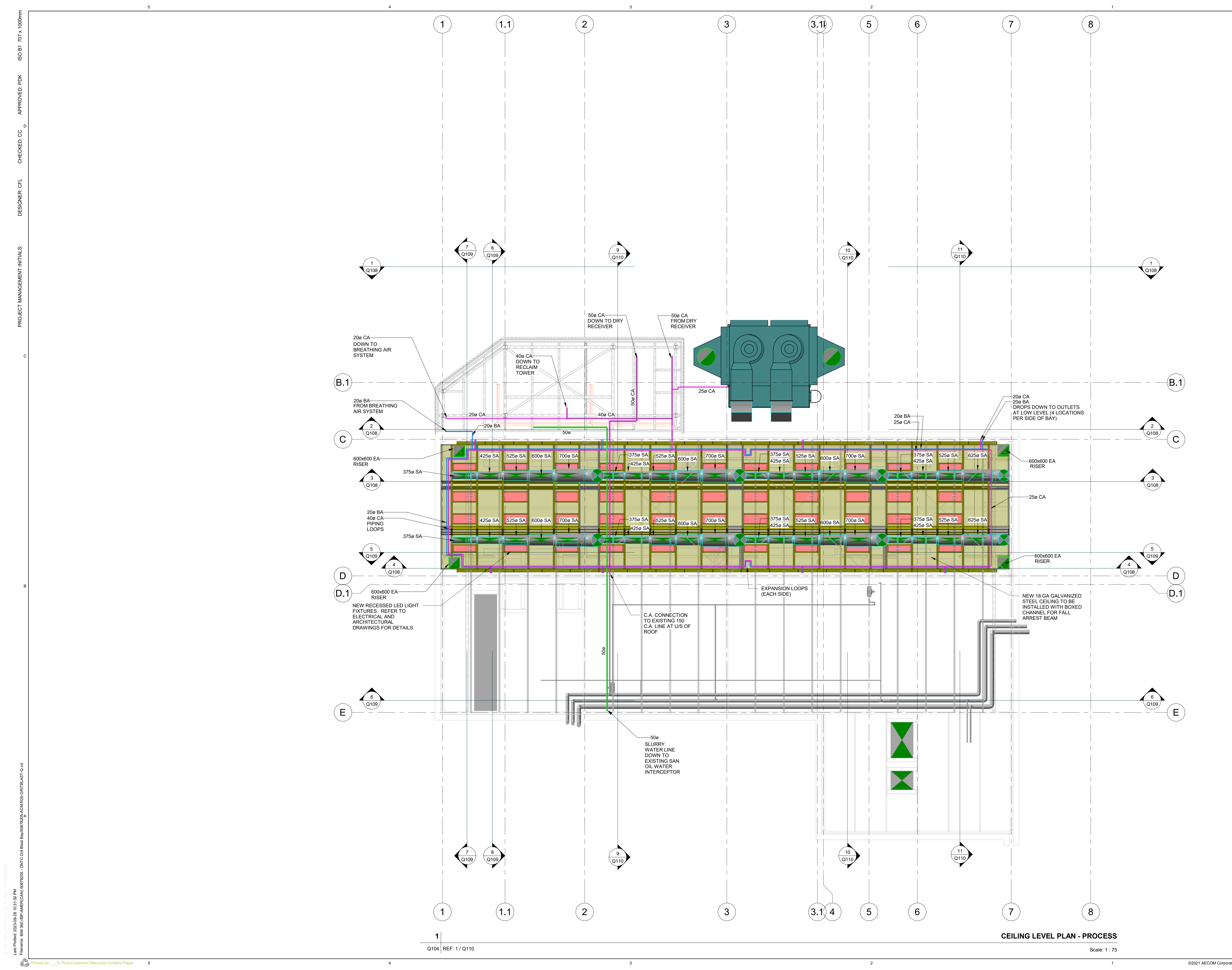
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### HIGH LEVEL GROUND FLOOR PLAN - PROCESS

**SHEET NUMBER**

**Q103**





Q104-CEILING LEVEL PLAN - PROCESS  
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**PROJECT**

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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555 Oak Street East  
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**KEY PLAN**

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**ISSUE/REVISION**

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3	ISSUED FOR 60% CLIENT REVIEW	2023/03/31
2	ISSUED FOR CLIENT REVIEW	2023/01/26

**PROJECT NUMBER**

60678205

**SHEET TITLE**

**CEILING LEVEL PLAN - PROCESS**

**SHEET NUMBER**

**Q104**



## PROJECT

## BLAST BAY UPGRADE

915/916 McINTYRE ST. E, NORTH BAY, ON

## CLIENT

**REGISTERED OWNER:**  
ONTARIO NORTHLAND TRANSPORT

ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
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Fax: +1-905-886-9494  
Cell: --  
Email: [gabriel.colombani@aecom.com](mailto:gabriel.colombani@aecom.com)

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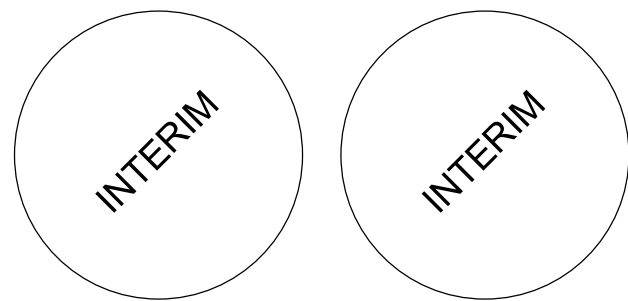
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## REGISTRATION



## KEY PLAN



SEE DRAWING FOR SCALE

## ISSUE/REVISION

[illegible]

## PROJECT NUMBER

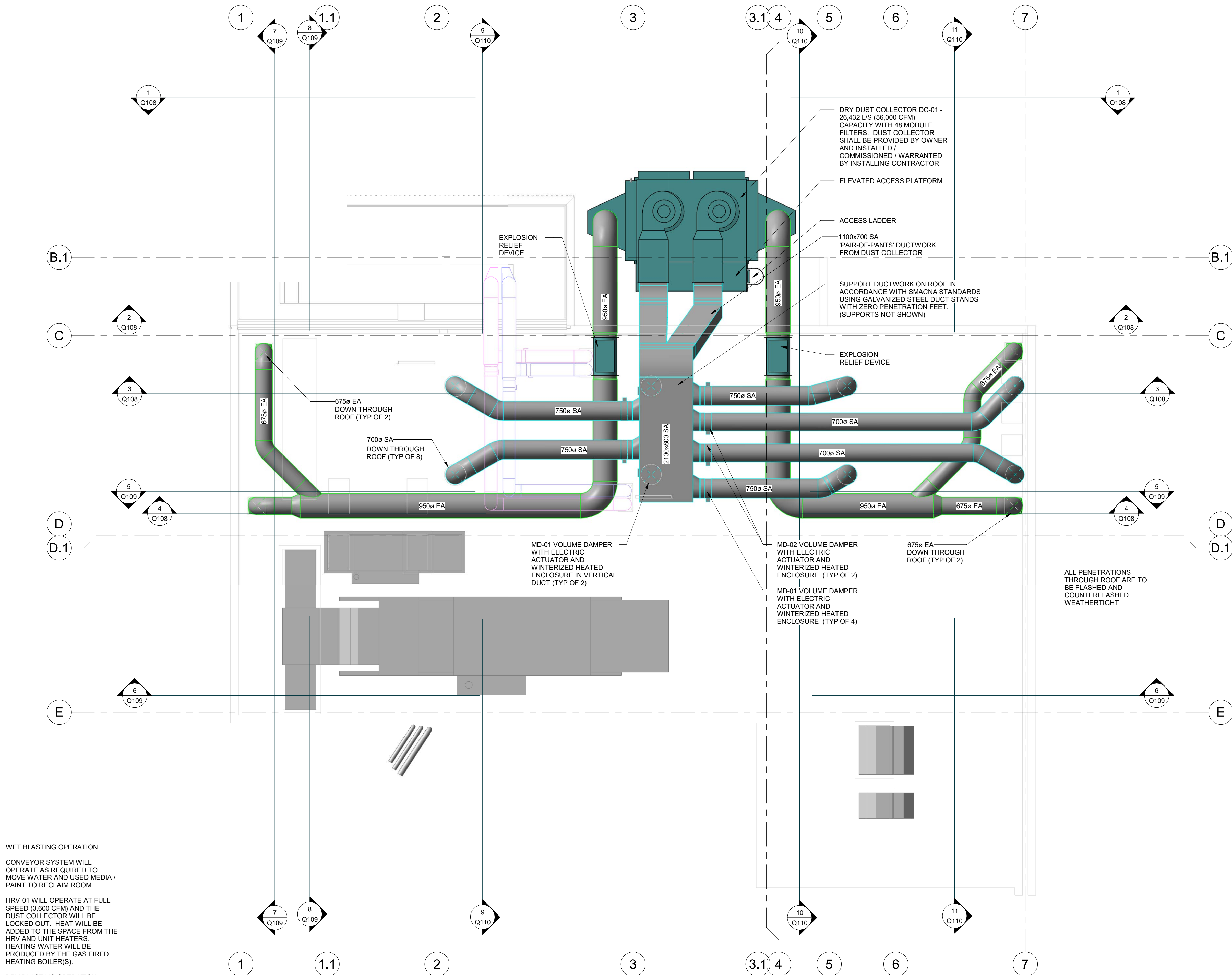
60678205

**SHEET TITLE**

## HIGH ROOF PLAN - PROCESS

**SHEET NUMBER**

**Q105**



### WET BLASTING OPERATION

CONVEYOR SYSTEM WILL  
OPERATE AS REQUIRED TO  
MOVE WATER AND USED MEDIA /  
PAINT TO RECLAIM ROOM

HRV-01 WILL OPERATE AT FULL SPEED (3,600 CFM) AND THE DUST COLLECTOR WILL BE LOCKED OUT. HEAT WILL BE ADDED TO THE SPACE FROM THE HRV AND UNIT HEATERS. HEATING WATER WILL BE PRODUCED BY THE GAS FIRED HEATING BOILER(S).

### DRY BLASTING OPERATION

CONVEYOR SYSTEM WILL  
OPERATE AS REQUIRED TO  
MOVE USED MEDIA / PAINT TO  
RECLAIM ROOM.

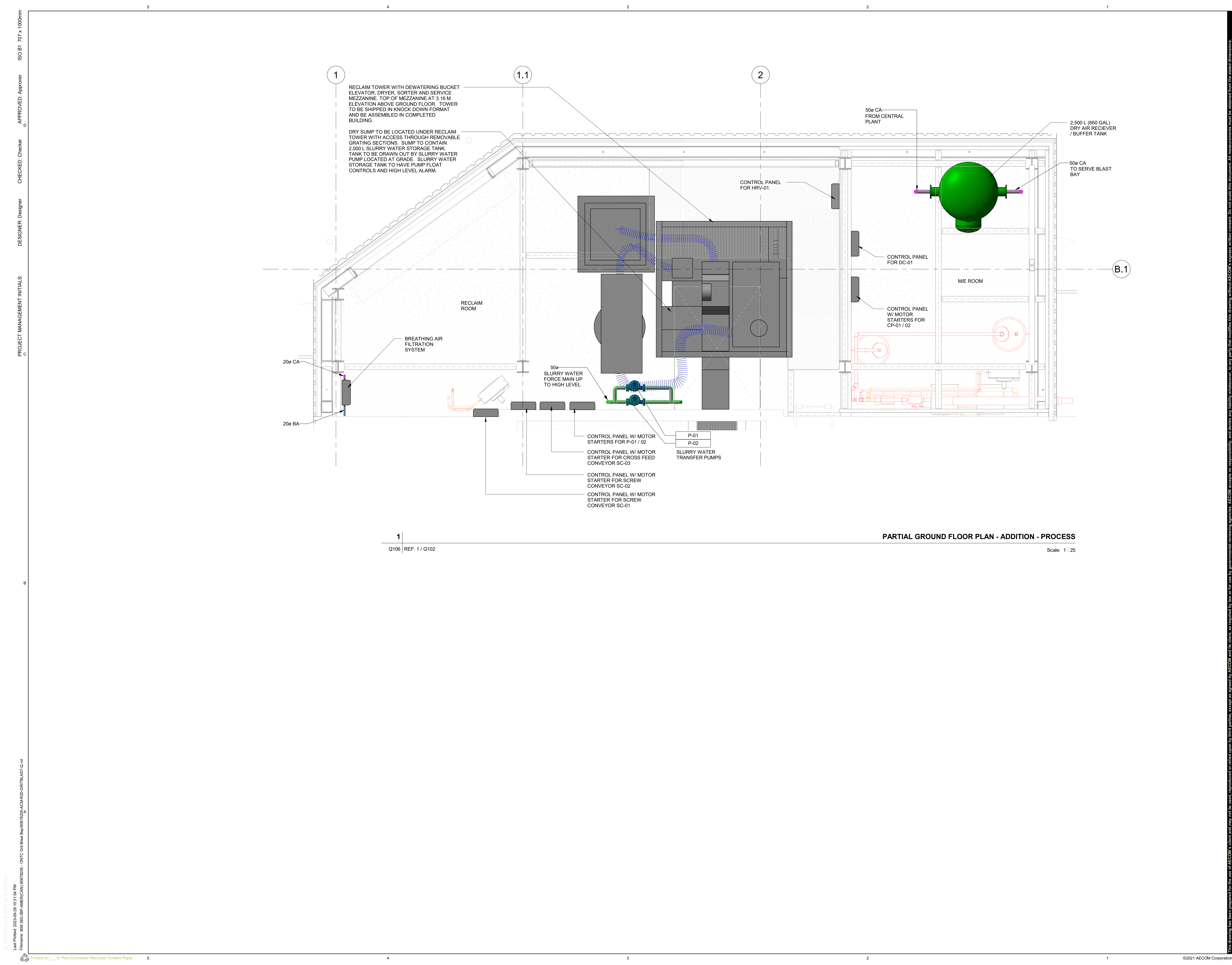
DUST COLLECTOR DC-01 WILL OPERATE AT 100% CAPACITY TO PROVIDE CLEAN AIR IN A DOWNBLAST ARRANGEMENT AND EXHAUST THE AIR FROM LOW LEVEL IN EACH CORNER OF THE BLAST BAY. HRV-01 WILL ALSO OPERATE. HEAT FROM THE DUST COLLECTOR MOTORS WILL BE USED TO HEAT THE SPACE ALONG WITH THE UNIT HEATER AT THE O/H DOOR.

1	
Q105	REF: 1 / Q108

## HIGH ROOF LEVEL PLAN - PROCESS

Scale: 1 : 75





ISO B1 707 x 100mm

APPROVED: Approver

CHECKED: Checker

DESIGNER: Designer

PROJECT MANAGEMENT INITIALS:

5

4

3

2

1

Q106-RECLAIM AND M/E ROOM

Last Printed: 2023-09-29 10:21:54 PM

Filename: BM\_360-IBP-AMER(CAN)\_60678205 - ONTC Gilt Blast Bay\60678205-ACM-R20-GRITBLAST-Q106

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#### PROJECT

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

#### CLIENT

**REGISTERED OWNER:**  
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555 Oak Street East  
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Fax: +1-705-476-5598  
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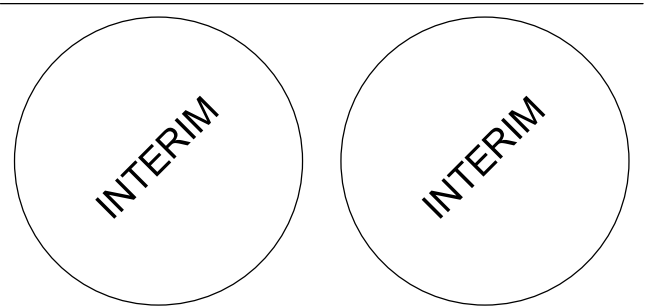
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#### REGISTRATION



#### KEY PLAN



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#### ISSUE/REVISION

No.	DESCRIPTION	DATE
4	ISSUED FOR TENDER	2023/09/29

#### PROJECT NUMBER

60678205

#### SHEET TITLE

RECLAIM AND M/E ROOM

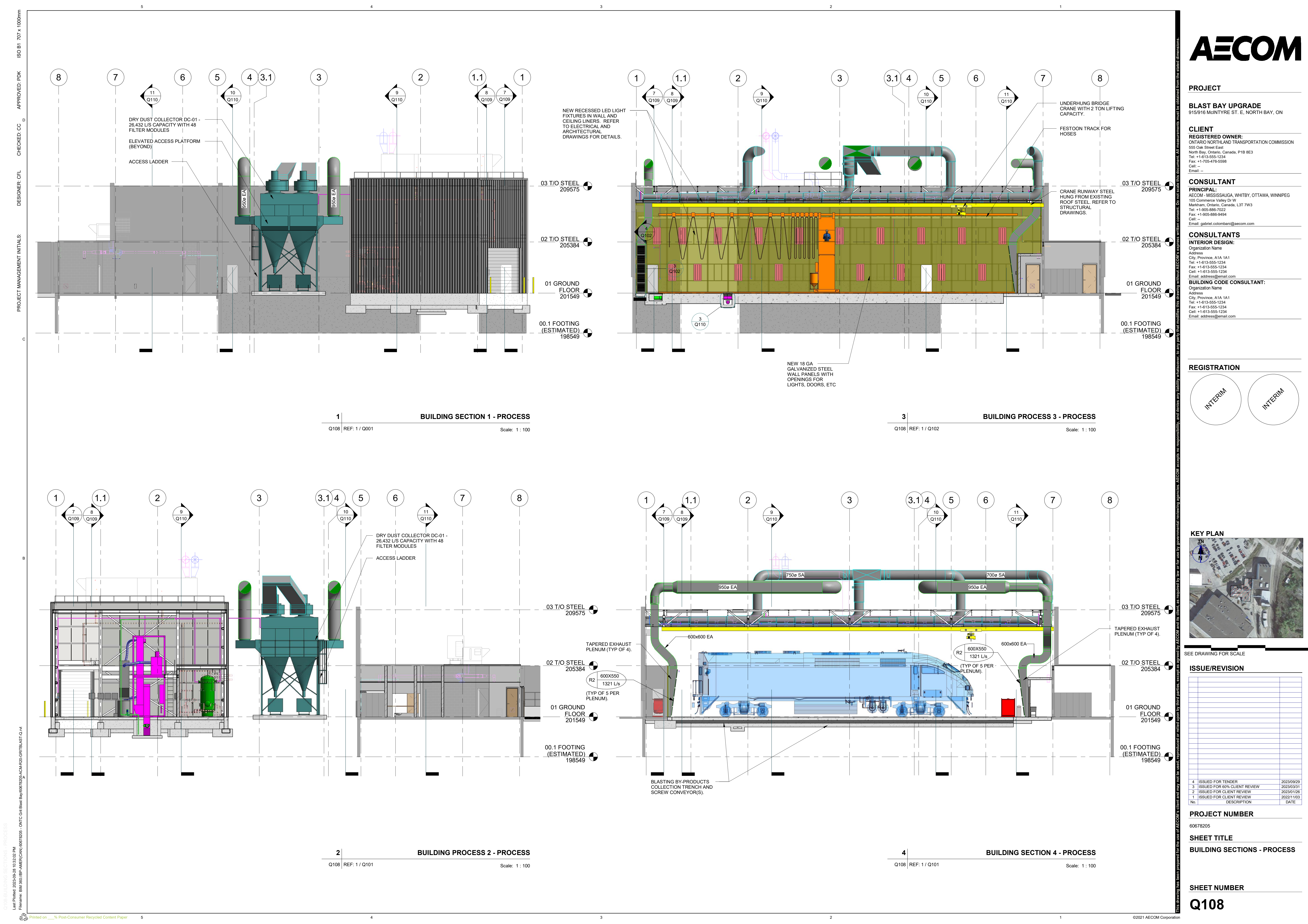
#### SHEET NUMBER

**Q106**









ISO B1 707 x 100mm  
APPROVED: PKK  
CHECKED: CC  
DESIGNER: CFL  
PROJECT MANAGEMENT INITIALS:  
Q108-BUILDING SECTIONS - PROCESS  
Last Project: 2023-09-29 10:32:05 PM  
Filename: BM\_360-IBP-AMER(CAN)\_60678205 - ONTIC Coll Blast Bay/60678205-ACM-R20-GRIBLAST-Q108

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4	ISSUED FOR TENDER	2023/09/29
3	ISSUED FOR 60% CLIENT REVIEW	2023/03/31
2	ISSUED FOR CLIENT REVIEW	2023/01/26
1	ISSUED FOR CLIENT REVIEW	2022/11/03

**PROJECT NUMBER**

60678205

**SHEET TITLE**

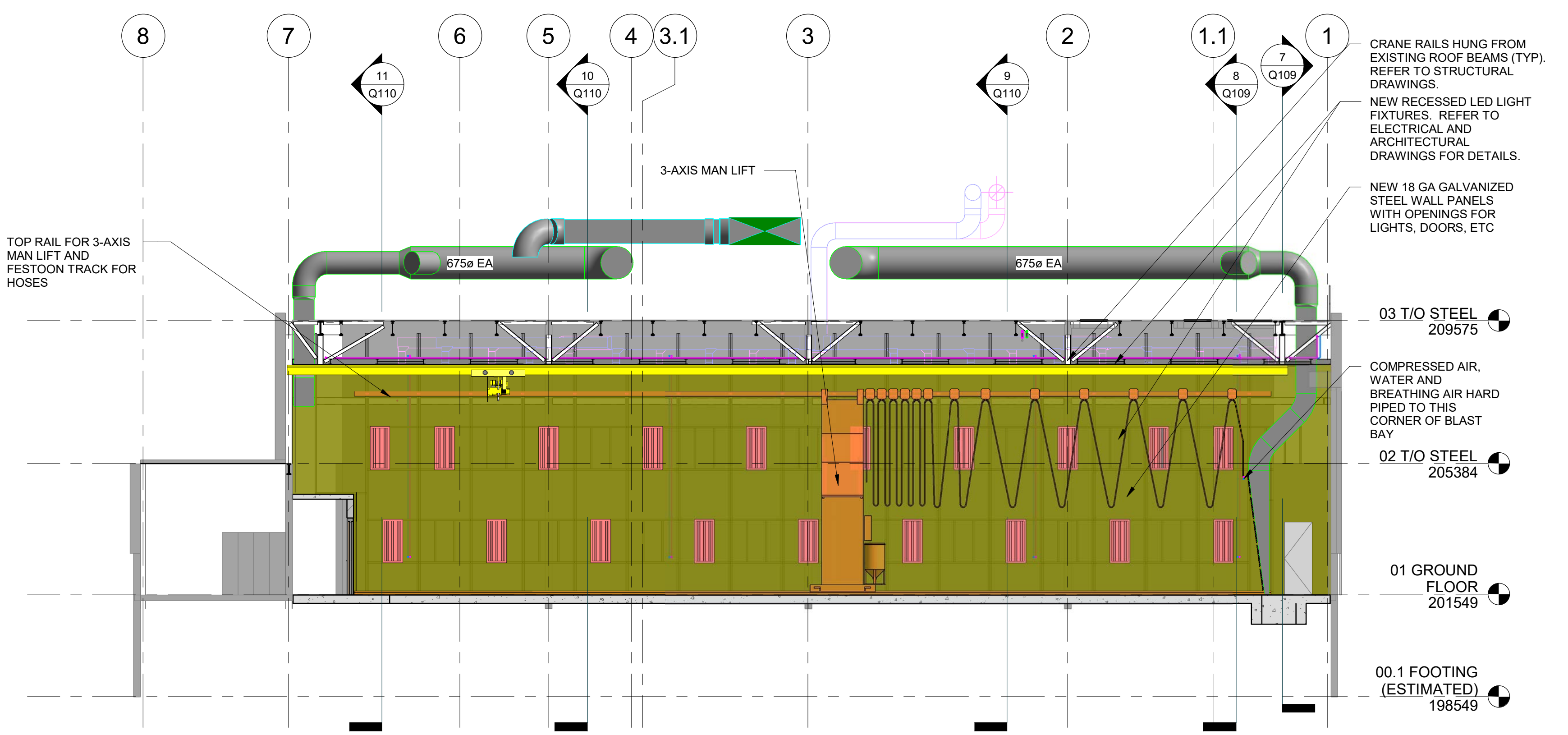
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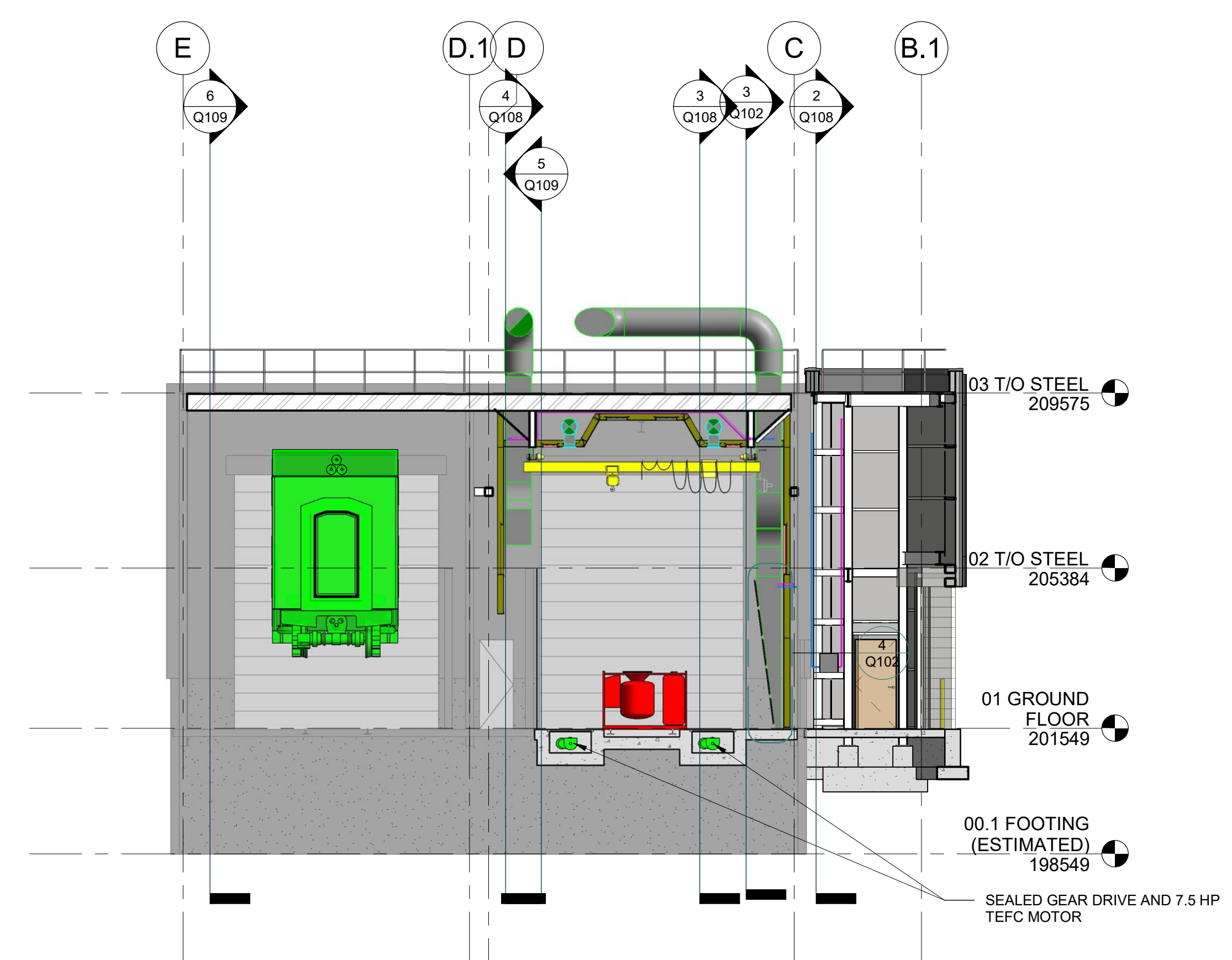
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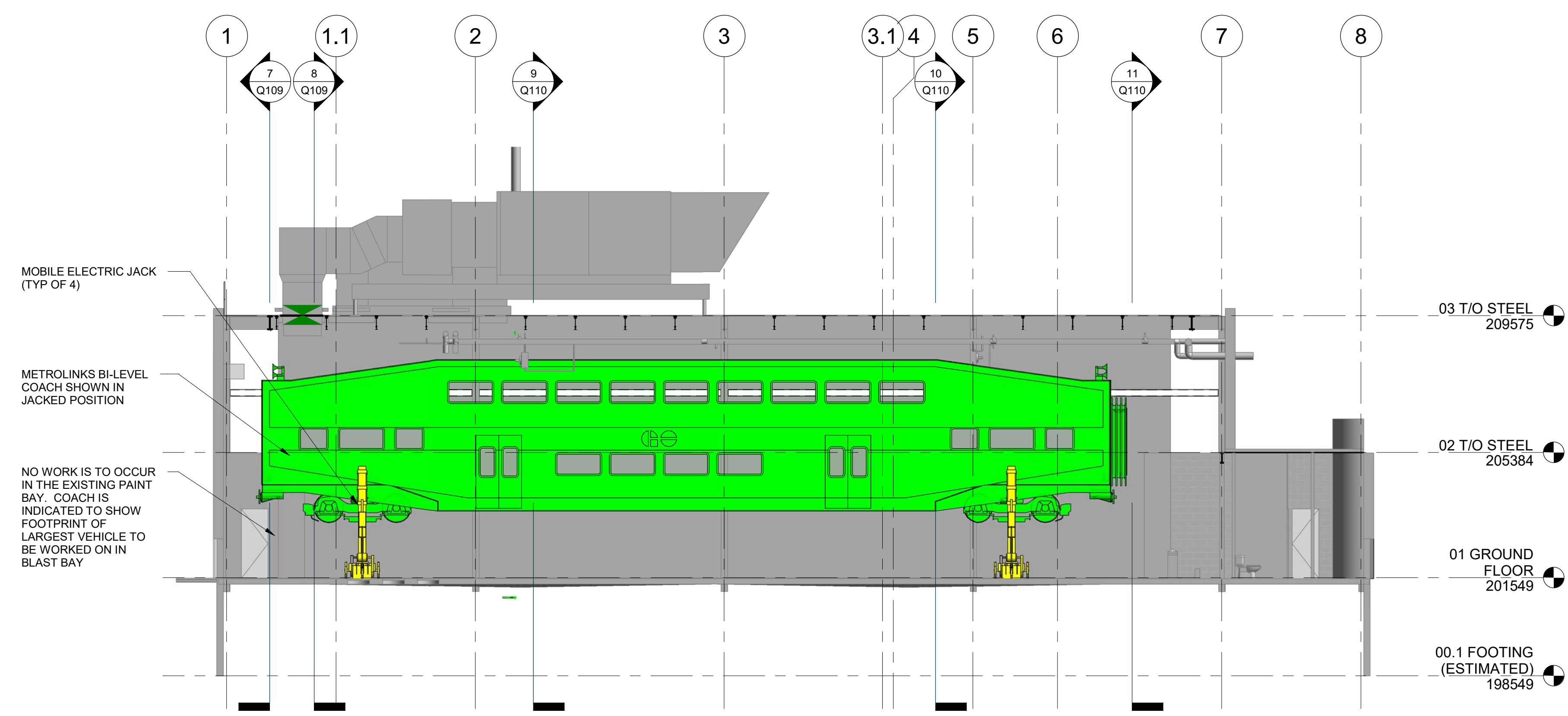




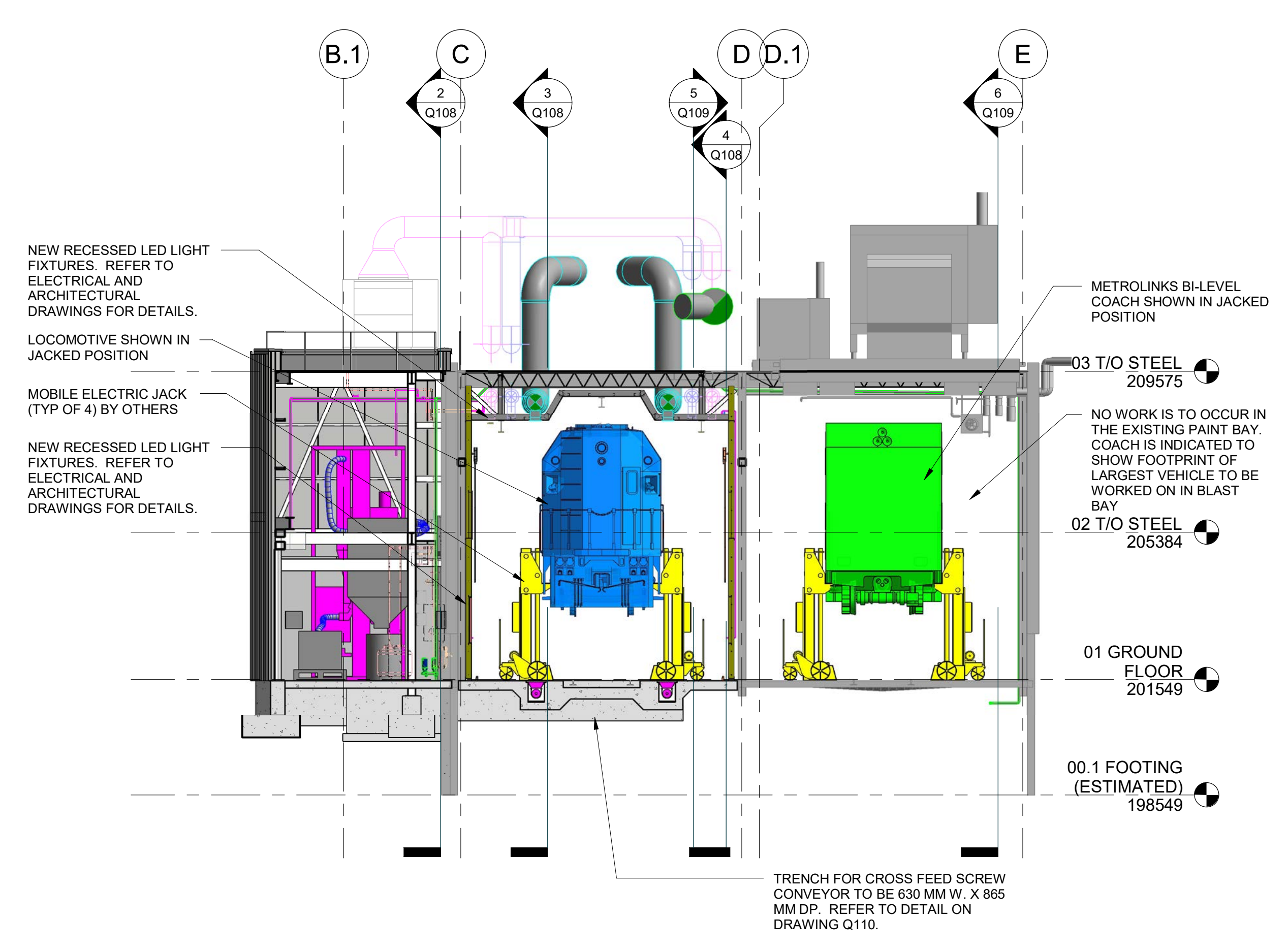
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Q109	REF: 1 / Q101
	Scale: 1 : 100



<b>7</b>	<b>BUILDING SECTION 7 - PROCESS</b>	
Q109	REF: 1 / Q101	Scale: 1 : 100



<b>6</b>	<b>BUILDING SECTION 6 - PROCESS</b>
Q109 REF: 1 / Q101	Scale: 1 : 100



<b>8</b>	<b>BUILDING SECTION 8 - PROCESS</b>
Q109 REF: 1 / Q101	Scale: 1: 100



## PROJECT

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915/916 MCINTYRE ST. E, NORTH BAY, ON

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**REGISTERED**

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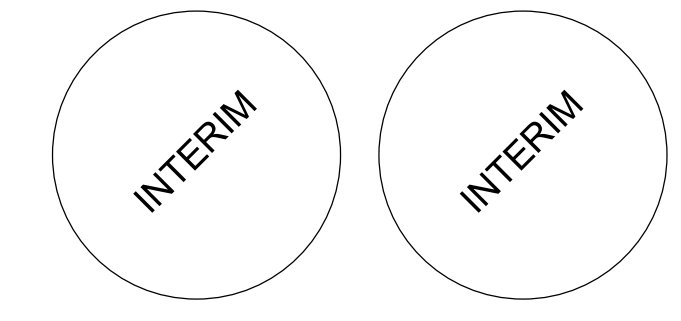
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## REGISTRATION



## KEY PLAN



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**ISSUE/REVISION**

[illegible]

## PROJECT NUMBER

60678205

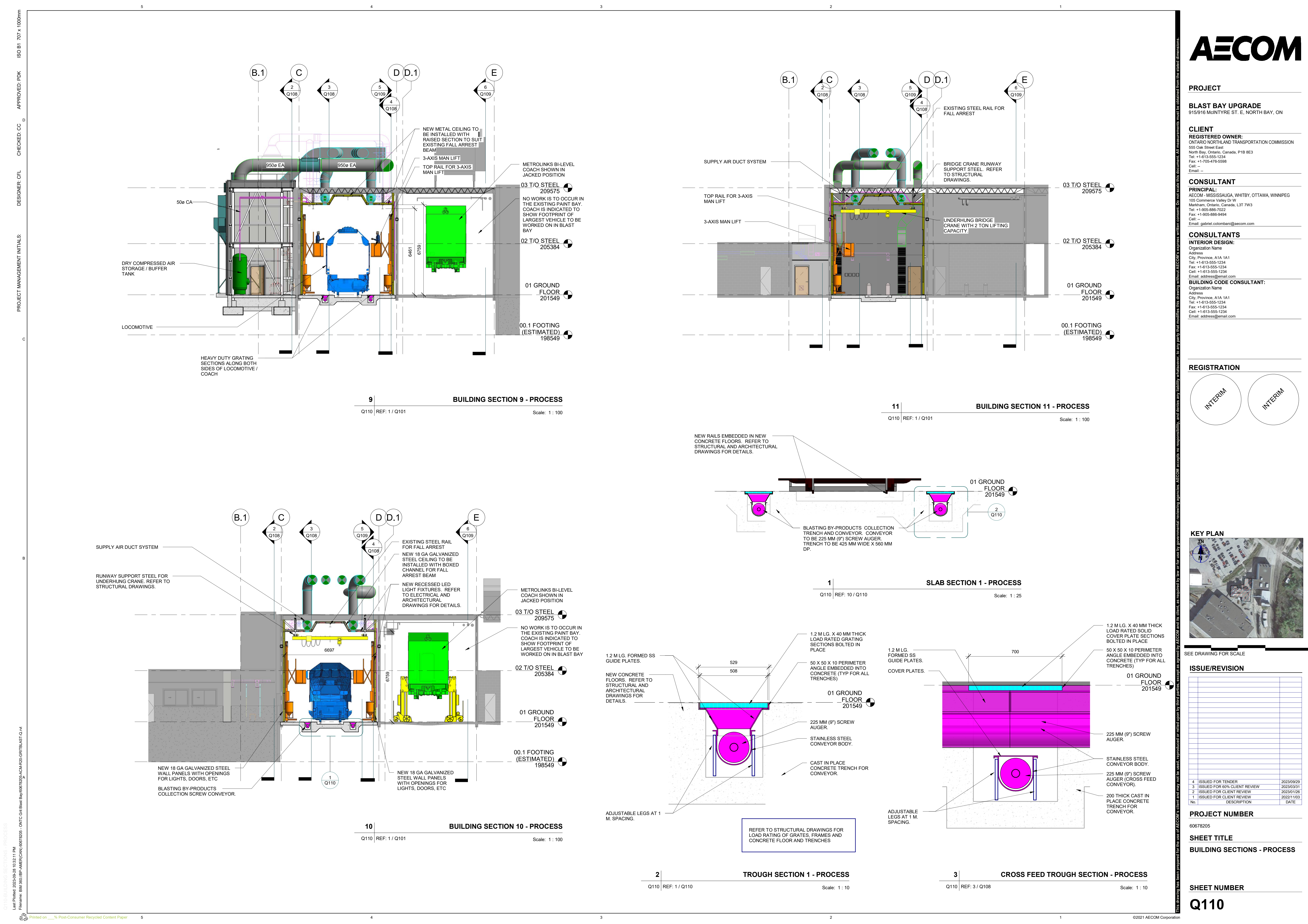
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**BUILDING SECTIONS - PROCESS**

**SHEET NUMBER**

**Q109**





PROJECT

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CONSULTANT

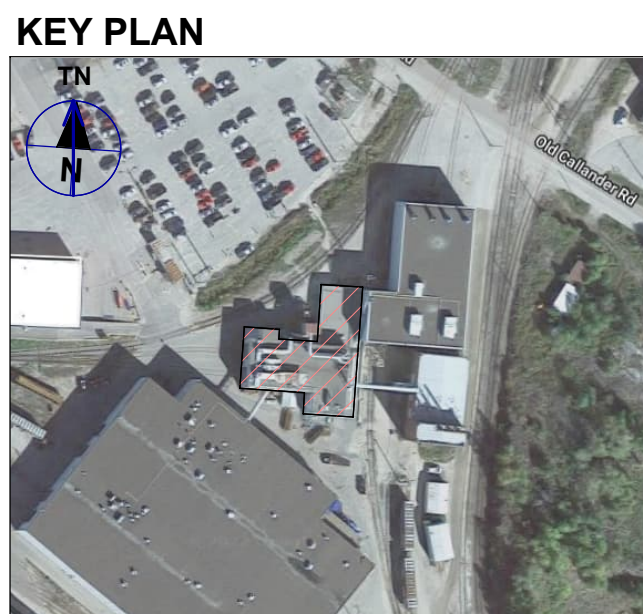
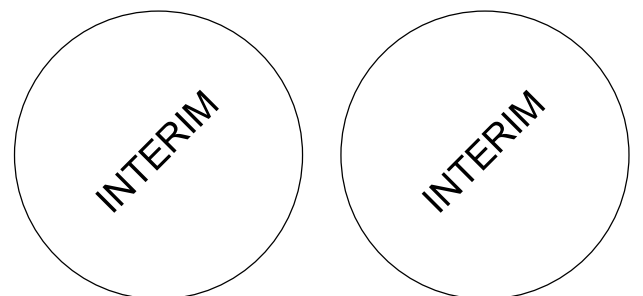
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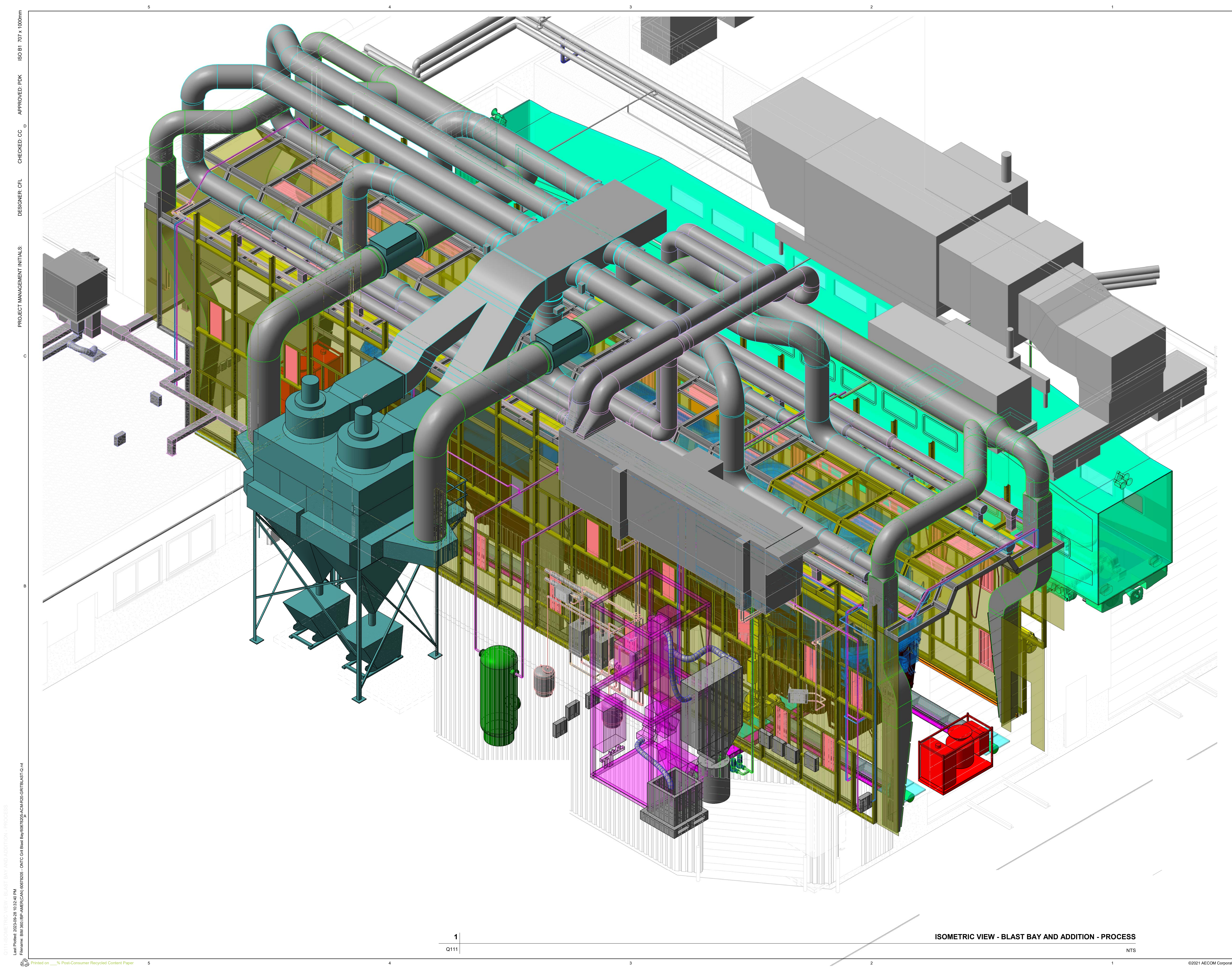
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BUILDING SECTIONS - PROCESS

SHEET NUMBER

**Q110**





Q111-ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS  
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Filename: BM-360-IBP-AMER(CAN) 60678205 - ONTO Gtl Blast Bay\60678205-ACM-R20-GRIBLAST-Q111

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**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
**ISOMETRIC VIEW - BLAST BAY AND ADDITION - PROCESS**

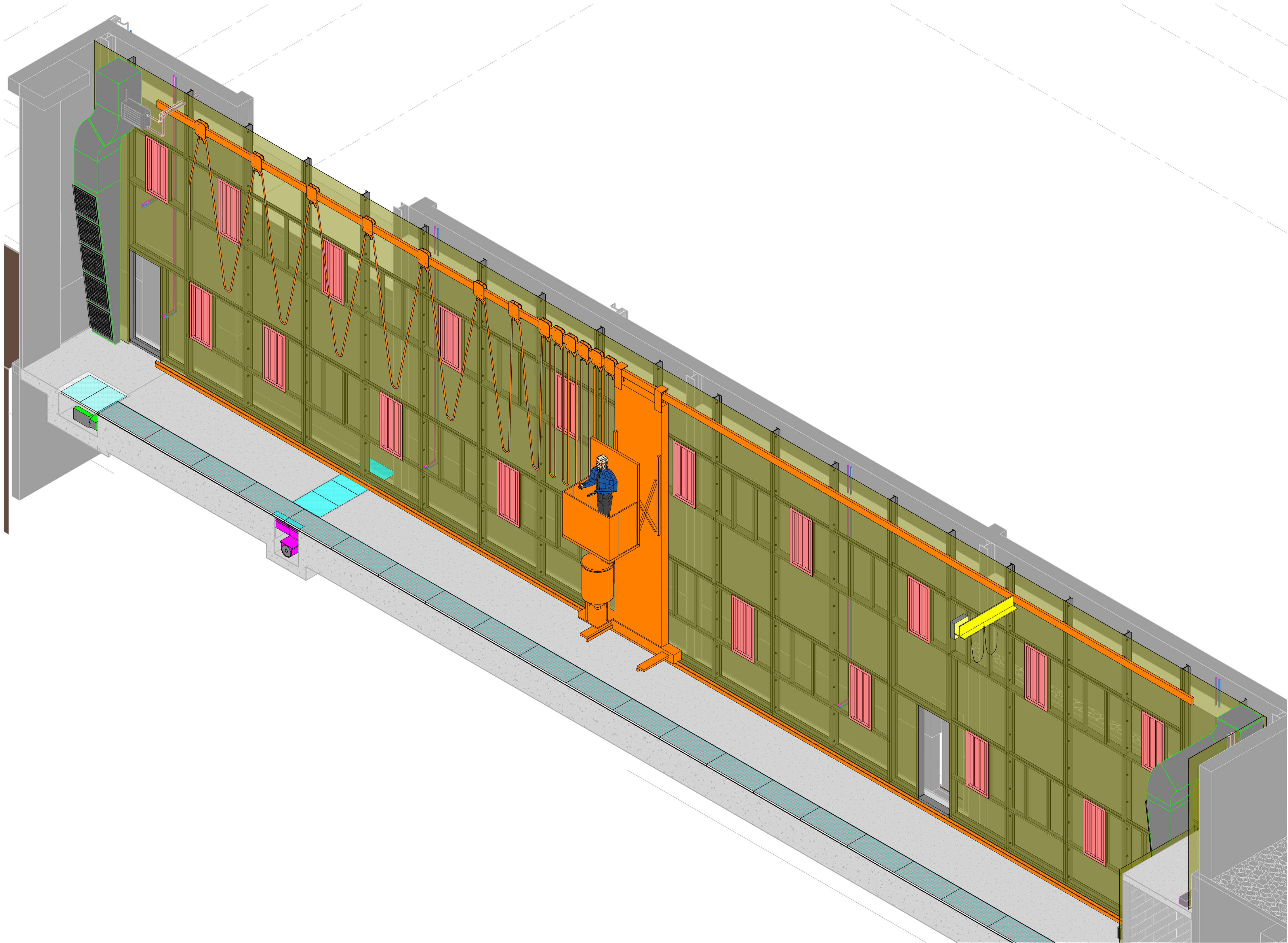
**SHEET NUMBER**  
**Q111**

602021 AECOM Corporation



## Q112





1 ISOMETRIC VIEW - BLAST BAY - NEW 3-AXIS MAN LIFTS  
Q113 NTS



PROJECT

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

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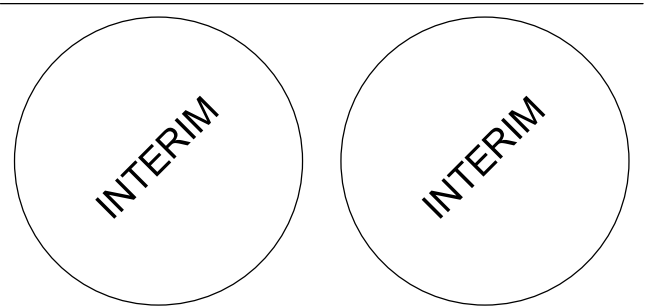
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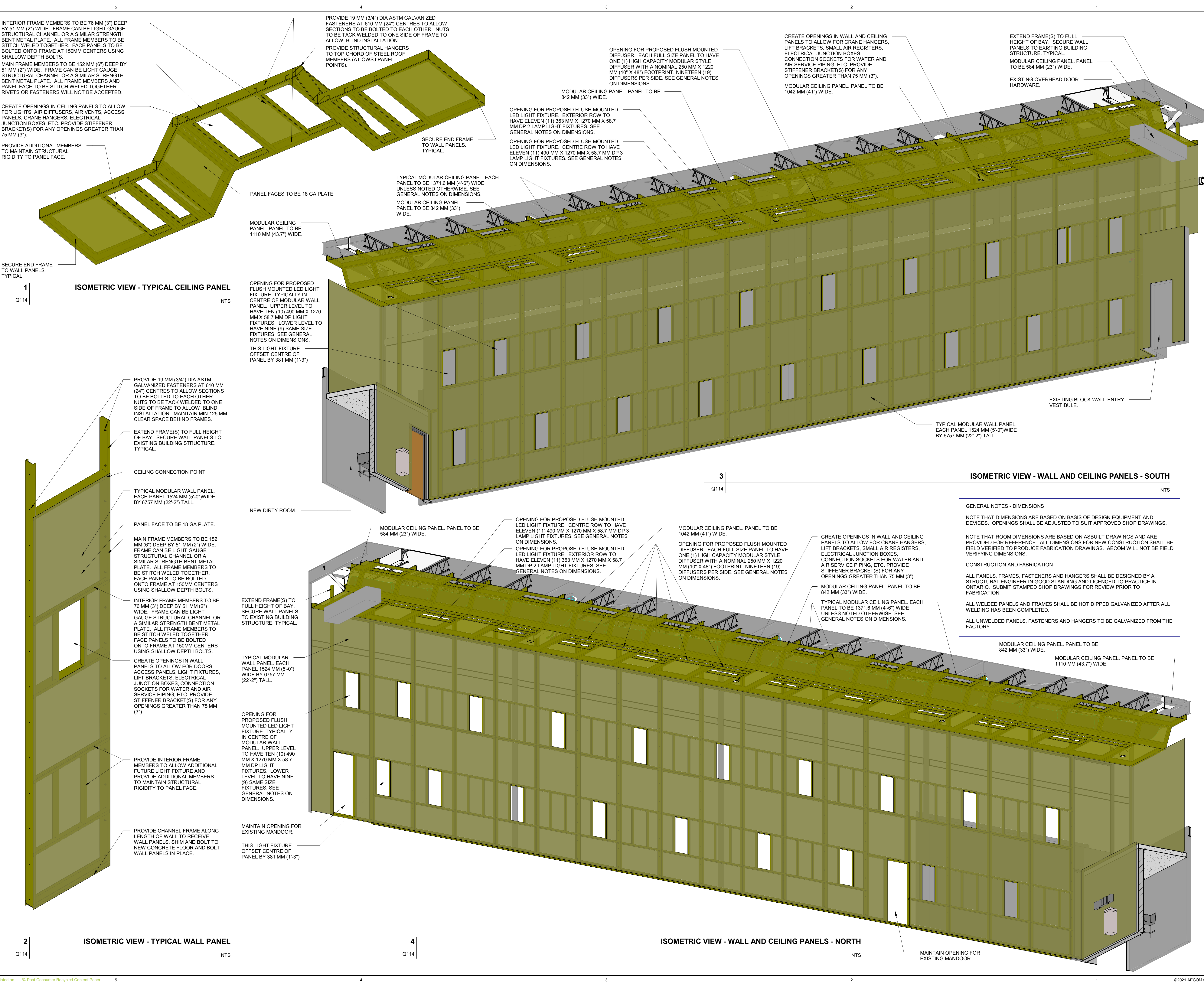
3-AXIS MAN LIFT

SHEET NUMBER

**Q113**



ISO B1 707 x 1000mm  
APPROVED: Approver  
CHECKED: Checker  
DESIGNER: Designer  
PROJECT MANAGEMENT INITIALS:  
Q114-CEILING AND WALL PANEL GENERAL ARRANGEMENT  
Last Printed: 2023-09-29 10:33:15 PM  
Filename: BM-360-IBP-AMER(CAN)-06078205 - ONTC Galt Blast Bay/06078205-ACM-R02-GRITBLAST-Q114



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**CEILING AND WALL PANEL GENERAL ARRANGEMENT**

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CHECKED: Checker

DESIGNER: Designer

PROJECT MANAGEMENT INITIALS:

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Q115-PROCESS DESIGN NOTES AND SCHEMATICS

Last Printed: 2023-09-29 10:33:14 PM

Filename: BM\_360-IBP-AMER(CAN)\_60678205 - ONTC Call Blast Bay/60678205/ACM-R02-GRITBLAST-Q115

1

2

3

2

1

1. DESIGN NOTES

1. NORTH BAY CLIMATIC CONDITIONS

1. EXTERIOR: JANUARY 1% DB -30C

2. EXTERIOR: JULY 2.5% DBWB: 28C /22C

1. INTERIOR SPACE DESIGN SET POINTS:

1. WORK AREAS: DB: 18C

2. PERSONNEL AREAS: HEATING: DB: 21C; COOLING: 23C

1. BLAST ROOM HVAC

1. HEATING WILL BE PROVIDED PRIMARILY BY HYDRONIC UNIT HEATER(S), AND BY REHEAT COIL IN THE ROOF MOUNTED HEAT RECOVERY VENTILATOR (HRV).

2. NO MECHANICAL COOLING

3. FREE COOLING AS PROVIDED BY AIR MOVEMENT FROM HEAT RECOVERY VENTILATOR (HRV).

4. GENERAL VENTILATION AVAILABLE FROM HEAT RECOVERY UNIT.

5. RECIRCULATING FILTERING DUST COLLECTOR USED DURING DRY BLASTING

6. HRV USED DURING WET BLASTING. HRV MAY ALSO BE USED FOR DRY BLASTING.

2. PROCESS KEY ASSUMPTIONS:

2.1 GENERAL

1. THE BLASTING PROCESS PERFORMED IN THE BLAST ROOM WILL USE BOTH DRY BLASTING AND WET (VAPOUR) BLASTING SYSTEMS.

1. BLASTING IS CURRENTLY OPERATING APPROXIMATELY 12 HOURS PER DAY WITH TWO PERSONS BLASTING.

2. DRY AND WET BLASTING WILL NOT OCCUR ON THE SAME DAY.

3. THE MEDIA RECLAMATION WILL BE REQUIRED DURING BOTH WET AND DRY BLASTING OPERATIONS.

4. OUTSIDE AND/OR RECIRCULATED FILTERED VENTILATION AIR WILL BE SUPPLIED FROM OVERHEAD, DOWNWARD ALONG THE LENGTH OF THE ESTIMATED BODY LINE OF TYPICAL RAIL VEHICLES.

5. BYPRODUCT COLLECTION TRENCHES WITH TROUGHED AUGERS ARE LOCATED JUST OUTBOARD OF RAIL VEHICLE BODY LINE WILL COLLECT DIRECT DROP OUT PARTICLES AND LIQUID. PROCESS WILL STILL REQUIRE ONGOING SWEEPING / SQUEEGEING TO TRENCHES.

2.2 PURIFIED BREATHING AIR (PBA) SYSTEM

1. FILTERING, NON-CATALYSING TYPE SYSTEM, WITH CONTINUOUS CARBON MONOXIDE MONITORING.

2. SUPPLIED FROM MAIN SITE COMPRESSED AIR SYSTEM.

1. MAIN SITE COMPRESSED AIR SYSTEM NOT NORMALLY EXPOSED TO CARBON MONOXIDE (CO) CONTAMINATION AT COMPRESSOR AIR INTAKES, OR OTHERWISE, THIS NO CO CATALYSING REQUIRED.

3. DISTINCT PBA SYSTEM QUICK COUPLINGS TO PREVENT PBA END USER CONNECTION TO REGULAR COMPRESSED AIR AND VICE VERSA.

4. A MAXIMUM OF 3 PBA END USERS AT ANY TIME.

1. USING FULL BLASTING HOODS

2. ALLOWED MAXIMUM OF 15 CUBIC FEET PER MINUTE (6.5 LITRES PER SECOND) PER END USER.

5. CONTINUOUS INTEGRAL PBA VENDOR FILTRATION UNIT CARBON MONOXIDE MONITORING, WITH ADDITIONAL REMOTE ALARMING TO BE PROVIDED BY CONTRACTOR.

6. NO PBA HUMIDIFICATION PROVIDED IN THIS CONTRACT. ANY HUMIDIFICATION REQUIREMENTS TO BE PROVIDED AT END USER HOOD CONNECTION BY ONTC AS REQUIRED ON INDIVIDUAL BASIS. NOT IN CONTRACT.

2.3 DRY ABRASIVE BLASTING, (EXISTING BLASTING EQUIPMENT)

1. COMPRESSED AIR DRIVEN, PORTABLE PRESSURE POT SYSTEMS.

1. WILL BE MOUNTED ON THE BASE FRAME OF THE NEW 3 AXIS PERSONNEL LIFTS.

2. BLASTING ABRASIVE (MEDIA) MAY INCLUDE BUT IS NOT LIMITED TO SILICONE DIOXIDE / ALUMINUM OXIDE BASED, AND NON FERRITE AND FERRITE BASED PRODUCTS.

3. ASSUMED MEDIA MAXIMUM DENSITY: 150 LBS/CU.FT. (2400 KG/M3)

2. DRY BLASTING BY-PRODUCTS:

1. MEDIA AND BY-PRODUCTS (REMOVED PARTICLES SUCH AS IRON BASED (RUST) PARTICLES, PAINTS, BODY FILLERS, ETC.)

1. DROPPING OUT TO FLOOR AND AIRBORNE PARTICULATE

2. ASSUMED MEDIA AND PARTICULATE MAXIMUM DENSITY: 150 LBS/CU.FT. (2400 KG/M3)

3. ESTIMATED DRY BLASTING PRODUCT GENERATED:

1. PARTICLES AND BY-PRODUCTS: 400 LBS/ HR. (185 KG/HR.)

2.4 VAPOUR (WET) ABRASIVE BLASTING (EXISTING BLASTING EQUIPMENT)

1. USING WATER AND MEDIA MIXTURE

1. CURRENTLY USING GRACO ECOQUIP EQS (SKID) SYSTEM, WITH INTEGRAL WATER TANK.

2. AIR POWERED GRACO PISTON PUMP PROVIDES HIGH PRESSURE FLOW OF ABRASIVE IN WATER.

3. ONLY ONE ECOQUIP UNIT USED AT ANY TIME.

4. TWO BLASTING HOSES/NOZZLES USED SIMULTANEOUSLY CONNECTED TO THE SINGLE ECOQUIP UNIT.

5. APPROXIMATE SYSTEM CAPACITIES (AS TAKEN FROM PUBLICATION "INSTRUCTIONS ECOQUIP 2" EQS, EOC, AND EO TRAILER UNIT VAPOR ABRASIVE BLAST SYSTEM" GRACO DOC # 3A7467E REV. E)

1. MAXIMUM WATER CAPACITY: 115 USG (435 LITRES)

2. MAXIMUM ABRASIVE CAPACITY: 880 LBS (400KG) BASED ON #80 GRIT GARNET MEDIA

2. VAPOUR BLASTING BY-PRODUCTS:

1. WET SOUPY-SLURRY CONSISTING OF:

1. WATER, LIQUID DROPLETS, AND MIST IN AIR

2. WETTED MEDIA (AS PER DRY MEDIA), AND

3. WETTED BY-PRODUCTS (AS PER DRY BLASTING)

2. ASSUMED WATER/WETTED MEDIA AND PARTICULATE DENSITY:

1. 100 LBS/ CU.FT.

3. ESTIMATED WET BLASTING PRODUCT GENERATED:

1. BASED ON USE OF ONLY ONE ECOQUIP UNIT, THAT IS FILLED APPROXIMATELY EVERY 4 HOURS DURING NORMAL BLASTING ACTIVITIES.

2. AVERAGE OF 220 LBS OF MEDIA IN 35 GALLONS OF WATER PER HOUR (100KG OF MEDIA IN 145 KG (145 LITRES) OF WATER PER HOUR).

4. WATER ONLY

1. OCCASIONAL ROOM FLOOR WASHDOWN MAY OCCUR AFTER WET BLASTING.

2. TRACES OF MEDIA OR PARTICULATES MAY BE PRESENT.

3. ESTIMATED 10 USGPM (380 LITRES/MINUTE) FLOW.

2.5 USED MEDIA TRANSPORT AND RECLAIM SYSTEM

1. ALL PRODUCTS AND BY-PRODUCTS OF BLASTING WILL BE TRANSFERRED BY TROUGHED SCREW CONVEYORS TO THE RECLAIM ROOM.

2. RECLAIM SYSTEM WILL PROVIDE FOLLOWING PROCESS:

1. PRIMARY DEWATERING AS REQUIRED

2. MEDIA-BY-PRODUCT DRYING AS REQUIRED

3. DRY/DRYED MEDIA RECLAMATION

4. CONTAMINANT DISCHARGE

5. REUSABLE MEDIA DISCHARGE

2.6 VAPOUR (WET) BLASTING WASTE WATER COLLECTION AND TRANSFER SYSTEM

1. WATER FROM VAPOUR (WET) BLASTING, AND FROM OTHER ROOM ACTIVITIES (FLOOR WASHING, ETC.) WILL FLOW VIA SCREW CONVEYOR NON-SLOPED TROUGHS TO THE RECLAIM AREA.

2. SOME RESIDUAL LIQUID IS ANTICIPATED DUE NON-SLOPED TROUGHS.

3. VENDOR MEDIA RECLAIM SYSTEM WILL PROVIDE PRIMARY SEPARATION OF WATER FROM THE WET BLASTING MEDIA AND BY PRODUCTS.

4. SEPARATED WASTE WATER WILL DRAIN FROM VENDOR MEDIA RECLAIM SYSTEM BY GRAVITY INTO LOWER LEVEL COLLECTION/HOLDING TANK.

5. FLOAT CONTROLLED DUTY / STANDBY PUMPS WILL NORMALLY TRANSFER TANK CONTENTS TO EXISTING SITE OIL-WATER SEPARATOR AND SANITARY SEWER SYSTEM.

6. FERRITE AND FERRITE BASED PRODUCTS.

1. MANUAL PUMP SHUT OFF ON CONTROLLER WILL PREVENT AUTOMATIC PUMP ACTUATION AND STOP/PREVENT TRANSFER OF TANK CONTENTS IN THE EVENT OF SUSPECTED WASTE WATER CONTAMINANTS NOT SUITABLE FOR DISCHARGE TO OIL-WATER SEPARATOR AND SANITARY SYSTEM.

2.7 COMPRESSED AIR SUPPLY

1. NEW DEMANDS IN THE BLAST ROOM AREA (AVERAGED VALUES):

1. 3-AXIS PERSONNEL LIFTS: 80 CFM EACH, WITH 80% SIMULTANEOUS USE FACTOR = 140 CFM

2. DUST COLLECTOR FILTER: PULSE OF LESS THAN 250 MILLISECONDS WITH EQUIVALENT RATE OF 25 CFM.

3. PURIFIED BREATHING AIR SYSTEM: 50 CFM.

4. MEDIA RECLAIM SYSTEM FILTER: PULSE OF LESS THAN 250 MILLISECONDS PULSE WITH EQUIVALENT FLOW RATE ESTIMATED AT 6 CFM.

2. ALL NEW DEMAND WILL BE ACCOMMODATED BY THE EXISTING CENTRALIZED COMPRESSED AIR SYSTEM, ABLE TO PROVIDE APPROXIMATELY 800 SCFM AFTER DESSICANT DRYER PURGE ALLOWANCE OF 180 SCFM.

3. EXISTING SYSTEM HAS DESSICANT AIR DRYER ABLE TO PROVIDE PRESSURE DEWPOINT TO AT LEAST -40C. THUS NO ADDITIONAL AIR DRYING REQUIRED FOR OUTSIDE AIR SUPPLIES.

3. BLAST ROOM PROCESS EQUIPMENT AND VENTILATION CONTROL SEQUENCES

NOTE: THE FOLLOWING INFORMATION DOES NOT INCLUDE:

1. THE OWNER SUPPLIER / EXISTING ECOQUIP VAPOR BLASTING AND DRY BLASTING EQUIPMENT OPERATION. REFER TO EXISTING VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

2. BLAST ROOM HEATING SYSTEM. REFER TO HVAC CONTROL SEQUENCE, PRODUCT SPECIFICATION SECTIONS, AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUALS.

3.1 PURIFIED BREATHING AIR (PBA) SYSTEM

1. FILTRATION PANEL LOCATED IN RECLAIM ROOM

2. AIR SUPPLIED FROM GENERAL SHOP COMPRESSED AIR SYSTEM.

3. 120 V ELECTRICAL POWER FOR INTEGRAL CARBON MONOXIDE (CO) MONITOR "ON"

4. COMPRESSED AIR SUPPLY VALVE TO PBA FILTRATION UNIT "OPEN"

5. VENDOR PACKAGE PROVIDES ONGOING AIR FILTRATION ACCORDING TO DOWNSTREAM DEMAND AND CONTINUOUSLY MONITORS FOR PRESENCE OF CARBON MONOXIDE IN THE PURIFIED AIR.

6. CARBON MONOXIDE DETECTED

1. LOCAL VENDOR PACKAGE SYSTEM ALARM AT PBA SYSTEM

2. CONTRACTOR PROVIDED ADDITIONAL REMOTE VISUAL AND AUDIBLE ALARM AT TWO LOCATIONS BLAST ROOM. REFER TO SCHEMATICS.

7. ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3.2 PERSONNEL LIFTS

1. 3 AXIS WALL MOUNTED LIFTS, WITH PROVISION FOR ON-BOARD DRY BLAST POTS (MAXIMUM 20 INCH DIAMETER, 600 LB. WEIGHT).

2. POWERED BY ONTC MAIN COMPRESSED AIR SYSTEM.

3. FULL LENGTH TRAVEL ON EACH SIDE OF BOOTH

4. ONTC FACILITY MAIN COMPRESSED AIR SYSTEM IN OPERATION.

5. LIFT SUPPLY COMPRESSED AIR SUPPLY VALVE OPEN

1. PERSONNEL LIFTS OPERATIONAL USING VENDOR PROVIDED PNEUMATIC CONTROLS ON LIFT.

6. ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3.3 IN-FLOOR SCREW CONVEYORS (AUGERS)

1. TYPICAL FOR ALL 3 CONVEYORS:

1. NORTH LONG CONVEYOR

2. SOUTH LONG CONVEYOR

3. CROSS CONVEYOR TO RECLAIM ROOM.

2. CONTROLS

1. SHALL BE PROVIDED VIA MOTOR STARTER BY ELECTRICAL DIVISION, FOR EACH OF THE THREE CONVEYORS, THAT INCLUDES

2. ADJUSTABLE TIMED SHUTDOWN UPON SELECTION OF "OFF-SHUTDOWN"

3. ADJUSTABLE MINIMUM 0 TO 120 MINUTES.

3. MAIN BREAKER IN ELECTRICAL ROOM "ON"

4. REMOTE CONTROL PANEL IN BLAST ROOM

1. SYSTEM ON / OFF-SHUTDOWN SWITCH TURNED "ON"

2. CONVEYOR DIRECTION:

1. NORMALLY IN FORWARD

3. CONVEYOR RUNS IN SELECTED DIRECTION.

4. "OFF-SHUTDOWN" SELECTED

1. SYSTEM CONTINUES TO OPERATE FOR PRESET AMOUNT OF TIME BEFORE SHUTTING DOWN.

1. DURATION ADJUSTABLE FROM MOTOR STARTER ONLY ( 0 TO 120 MINUTES)

5. EMERGENCY STOP

1. ALL CONVEYORS STOP

6. ALSO REFER TO ELECTRICAL, PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3.4 MEDIA RECLAIM SYSTEM

1. VENDOR SUPPLIED ELECTRICAL CONTROL PANEL WITH INTEGRAL MOTOR STARTERS.

2. MAIN PANEL IN RECLAIM ROOM, AND REMOTE PANEL IN BLAST ROOM

3. MAIN BREAKER IN ELECTRICAL ROOM "ON"

4. VENDOR CONTROL MAIN PANEL IN RECLAIM ROOM PROVIDES FULL CONTROL OF RECLAIM SYSTEM COMPONENTS, INCLUDING BUT NOT LIMITED TO:

1. PRIMARY DEWATERING OF WET SPENT MEDIA SLURRY

2. USED MEDIA LIFT SYSTEM FROM CROSS AUGER DISCHARGE TO RECLAIM INLET ON MAIN FLOOR

3. RECLAIM SYSTEM INLET AND BUCKET ELEVATOR TO DRYER / RECLAIM SECTION

4. DRYER CONTROL.

5. RECLAIM SYSTEM DUST COLLECTOR.

6. CONTAMINANTS AND CLEANED USED MEDIA DISCHARGE SYSTEM.

2. CONTROL SELECTED AS "REMOTE" (FOR REMOTE PANEL IN BLAST ROOM)

1. BLAST ROOM PANEL ACTIVATED.

5. REMOTE CONTROL PANEL IN BLAST ROOM

1. INCLUDES:

1. SYSTEM "ON" INDICATION.

2. FILTER CHANGE INDICATION.

3. EMERGENCY STOP

2. SWITCH TO "ON"

1. SYSTEM OPERATES AUTOMATICALLY.

3. SWITCH TO "OFF-SHUTDOWN"

1. SYSTEM CONTINUES TO OPERATE UNTIL NO INCOMING MEDIA IS DETECTED BY VENDOR MAIN CONTROL PANEL/PACKAGE.

6. ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3.5 BLAST ROOM HRV VENTILATION (OUTSIDE AIR)

1. ROOF MOUNTED HRV SYSTEM

1. OPERATED WHEN VAPOUR (WET) BLASTING

2. MAY ALSO BE OPERATED FOR GENERAL VENTILATION, AND DURING DRY BLASTING.

3. VENDOR CONTROL PACKAGE IN RECLAIM ROOM PROVIDES ALL SYSTEM CONTROL INCLUDING BUT NOT LIMITED TO:

1. CORE DAMPER CONTROL

2. FAN/BLOWER CONTROL

3. INTAKE AIR PREHEATING

4. DISCHARGE TEMPERATURE CONTROL.

5. PROGRAMMABLE TIMED OPERATION (HOURS AND DAYS)

6. FILTER CONDITION MONITORING.

7. SELECTION OF REMOTE PANEL OPERATION (LOCAL / REMOTE)

8. ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

3. MAIN BREAKER IN RECLAIM ROOM "ON"

1. UNIT OPERATES FROM DAILY PROGRAMMED SEQUENCE

4. REMOTE HRV PANEL IN BLAST ROOM

1. INCLUDES:

1. SYSTEM "ON" INDICATION.

2. FILTER CHANGE INDICATION

3. OVERRIDE

1. WITH PRESET TIMED OPERATION (ADJUSTABLE 0 TO 120 MINUTES AT MAIN PANEL)

2. OVERRIDE SELECTED

1. HRV ACTIVATES OR CONTINUES TO OPERATE FOR PRESET TIME FROM TIME OF OVERRIDE SELECTION.

3. FILTER PRESSURE LOSS EXCEEDS PRESET VALUE.

1. FILTER CHANGEOUT ALARM ON BLAST ROOM PANEL.

3.6 BLAST ROOM DUST COLLECTION - FOR DRY BLASTING

1. EXTERIOR RECIRCULATING FILTERING DUST COLLECTOR.

1. OPERATED ONLY WHEN DRY BLASTING. DO NOT USE DURING ACTIVE VAPOUR (WET) BLASTING.

2. ROOM VENTILATION (OUTSIDE AIR) MAY BE PROVIDED BY OPERATING THE SEPARATE HRV DURING DRY BLASTING.

3. DUST COLLECTOR RETURNING AIR VOLUME IS CONSTANT BUT CAN BE DISTRIBUTED TO PROVIDE HIGHER VOLUMES IN SELECTED PORTION OF BLAST ROOM, (WEST / CENTER / EAST / ALL) BY DAMPERS CONTROLLED FROM DUST COLLECTOR CONTROLLER.

2. VENDOR CONTROL PACKAGE PROVIDES ALL SYSTEM CONTROL INCLUDING BUT NOT LIMITED TO:

1. SUPPLY (RETURN) AIR DISTRIBUTION VOLUME CONTROL DAMPERS FOR SELECTED ROOM AREA. (WEST / CENTER / EAST / ALL)

1. INCLUDING FAN SHUTDOWN AS APPROPRIATE FOR DAMPER ACTUATION PERIODS.

2. DUST COLLECTION SYSTEM FANS

3. FILTER BLOW DOWN AND MONITORING.

4. EXPLOSION PROTECTION

5. ALSO REFER TO PRODUCT SPECIFICATION SECTION AND TO VENDOR OPERATION AND MAINTENANCE (O&M) MANUAL.

6. EMERGENCY STOP - IMMEDIATE SHUT DOWN OF SYSTEM OPERATION, EXCEPT FOR ANY COMPONENTS REQUIRED TO MAINTAIN SAFETY.

3. MAIN BREAKER IN ELECTRICAL ROOM "ON".

4. REMOTE DUST COLLECTOR CONTROL PANEL IN BLAST ROOM.

1. DESIRED ACTIVE ROOM AREA SELECTED: (WEST / CENTER / EAST / ALL)

2. SYSTEM ON / OFF-SHUTDOWN SWITCH TO "ON"

3. VENDOR CONTROL ACTUATES APPROPRIATE SUPPLY AIR DAMPERS TO DISTRIBUTE AIR AS FOLLOWS:

1. SELECTED ZONE: REFER TO AIRFLOW BLOCK DIAGRAM ON DRAWING Q107

2. ALL OTHER ZONES: REMAINDER OF RETURNING VOLUME DISTRIBUTED APPROXIMATELY EQUALLY.

3. REFER TO SCHEMATIC DRAWING

4. DUST COLLECTION SYSTEM FAN(S) ACTIVATES AND OPERATES ACCORDING TO VENDOR PACKAGE CONTROL SEQUENCES.

5. ACTIVE BLASTING ZONE SELECTION MANUALLY CHANGED TO ANOTHER ZONE:

1. DUST COLLECTOR AIRFLOW REDUCED OR STOPPED ACCORDING TO SYSTEM DESIGN.

2. DUST COLLECTOR CONTROLLER REPOSITIONS DUCT DAMPERS TO SUIT.

3. DUST COLLECTOR RESUMES FULL AIRFLOW.

6. SYSTEM "OFF-SHUTDOWN" SELECTED

1. SYSTEM CONTINUES TO OPERATE FOR PRESET AMOUNT OF TIME BEFORE SHUTTING DOWN.

1. ADJUSTABLE FROM MAIN CONTROL PANEL ONLY ( 0 TO 120 MINUTES)

7. EMERGENCY STOP - IMMEDIATE SHUT DOWN OF SYSTEM OPERATION, EXCEPT FOR ANY COMPONENTS REQUIRED TO MAINTAIN SAFETY.

3.7 SPENT BLAST MEDIA DEWATERING (SLURRY) TRANSFER PUMPS

1. PUMP VENDOR CONTROL PACKAGE IN RECLAIM ROOM, INCLUDES

1. HAND/OFF/AUTO FOR EACH PUMP

2. MAIN BREAKER IN ELECTRICAL ROOM "ON"

2. ONE OR BOTH PUMPS IN "AUTO".

1. VENDOR PACKAGE PROVIDES AUTOMATIC CONTROL AND TRANSFER OF TANK CONTENTS BASED ON FLOAT LEVELS.

2. LIQUID LEVEL REACHES PUMP START FLOAT (SECOND FROM BOTTOM)

1. VENDOR PACKAGE PROVIDES ALTERNATING PUMP SELECTION AT EACH NEW PUMP ACTIVATION.

2. VENDOR PACKAGE SELECTED PUMP STARTS.

3. LIQUID LEVEL REACHES LOWEST FLOAT

1. ACTIVE PUMP STOPS.

4. LIQUID REACHES THIRD FLOAT FROM BOTTOM (HIGH LEVEL)

1. STANDBY PUMP ACTIVATES (IF SECOND PUMP ALSO IN AUTO)

5. LIQUID REACHES FOURTH FLOAT FROM BOTTOM (HIGH HIGH)

1. HIGH LEVEL ALARM GENERATED AT PUMP PANEL.

2. REMOTE VISUAL AND AUDIBLE ALARM GENERATED AT REMOTE INDICATOR PANEL IN BLAST ROOM.

3. ALARM SILENCE ONLY FROM MAIN PANEL.

3. BOTH PUMPS IN "OFF"

1. NO PUMPING OCCURS - LIQUID IS HELD IN TANK.

2. LIQUID REACHES TOP FLOAT (FOURTH FLOAT FROM BOTTOM)

1. HIGH LEVEL ALARM GENERATED AT PUMP PANEL.

2. REMOTE VISUAL AND AUDIBLE ALARM GENERATED AT REMOTE INDICATOR PANEL IN BLAST ROOM.

3. ALARM SILENCE ONLY FROM MAIN PANEL.

RECLAIM ROOM

BLAST ROOM

CP-01 / 02  
CIRC PUMP  
CONTROL  
PANEL

HRV-01 HEAT  
RECOVERY  
VENTILATOR  
CONTROL  
PANEL

DC-01 MAIN  
PANEL /  
VFD'S

M / E ROOM

BLAST ROOM

PBA PURIFIED  
BREATHING  
AIR SYSTEM  
CONTROL  
PANEL

CUSTOM CO  
REMOTE  
ALARMING  
SYSTEM

MR-01 MEDIA  
RECLAIM  
SYSTEM  
CONTROL  
PANEL

SC-01  
SCREW  
CONVEYOR  
MOTOR  
STARTER

SC-02  
SCREW  
CONVEYOR  
MOTOR  
STARTER

SC-03  
SCREW  
CONVEYOR  
MOTOR  
STARTER

CO VISUAL  
/ AUDIBLE  
ALARM

LOCATED IN  
NW CORNER  
OF BLAST  
BAY

REMOTE  
PANEL

LOCATED IN  
NE CORNER  
OF BLAST  
BAY. REFER  
TO PLAN

CO VISUAL  
/ AUDIBLE  
ALARM

LOCATED IN  
SE CORNER  
OF BLAST  
BAY

REMOTE  
PANEL

LOCATED IN  
NE CORNER  
OF BLAST  
BAY. REFER  
TO PLAN

REMOTE  
PANEL

LOCATED IN  
NE CORNER  
OF BLAST  
BAY. REFER  
TO PLAN

REMOTE  
PANEL

LOCATED IN  
NE CORNER  
OF BLAST  
BAY. REFER  
TO PLAN

E-STOP  
LOCATED AT  
GRIDS 'C-2'

E-STOP  
LOCATED AT  
GRIDS 'C-5'

E-STOP  
LOCATED AT  
GRIDS 'D-2'

E-STOP  
LOCATED AT  
GRIDS 'D-5'

E-STOP  
LOCATED AT  
GRIDS 'C-2'

E-STOP  
LOCATED AT  
GRIDS 'C-5'

E-STOP  
LOCATED AT  
GRIDS 'D-2'

E-STOP  
LOCATED AT  
GRIDS 'D-5'

1

Q115

CONTROL PANEL SCHEMATIC

NTS

NOTE: ALL DEVICES INDICATED HERE IN SHALL BE PROVIDED BY THE INDIVIDUAL EQUIPMENT VENDORS AND INSTALLED BY THE ELECTRICAL CONTRACTOR UNLESS NOTED OTHERWISE.

PROJECT

BLAST BAY UPGRADE

915/916 MONTYRE ST. E. NORTH BAY, ON

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4 ISSUED FOR TENDER

No. DESCRIPTION

2023/09/29

DATE

PROJECT NUMBER

60678205

SHEET TITLE

PROCESS DESIGN NOTES AND SCHEMATICS

SHEET NUMBER

Q115

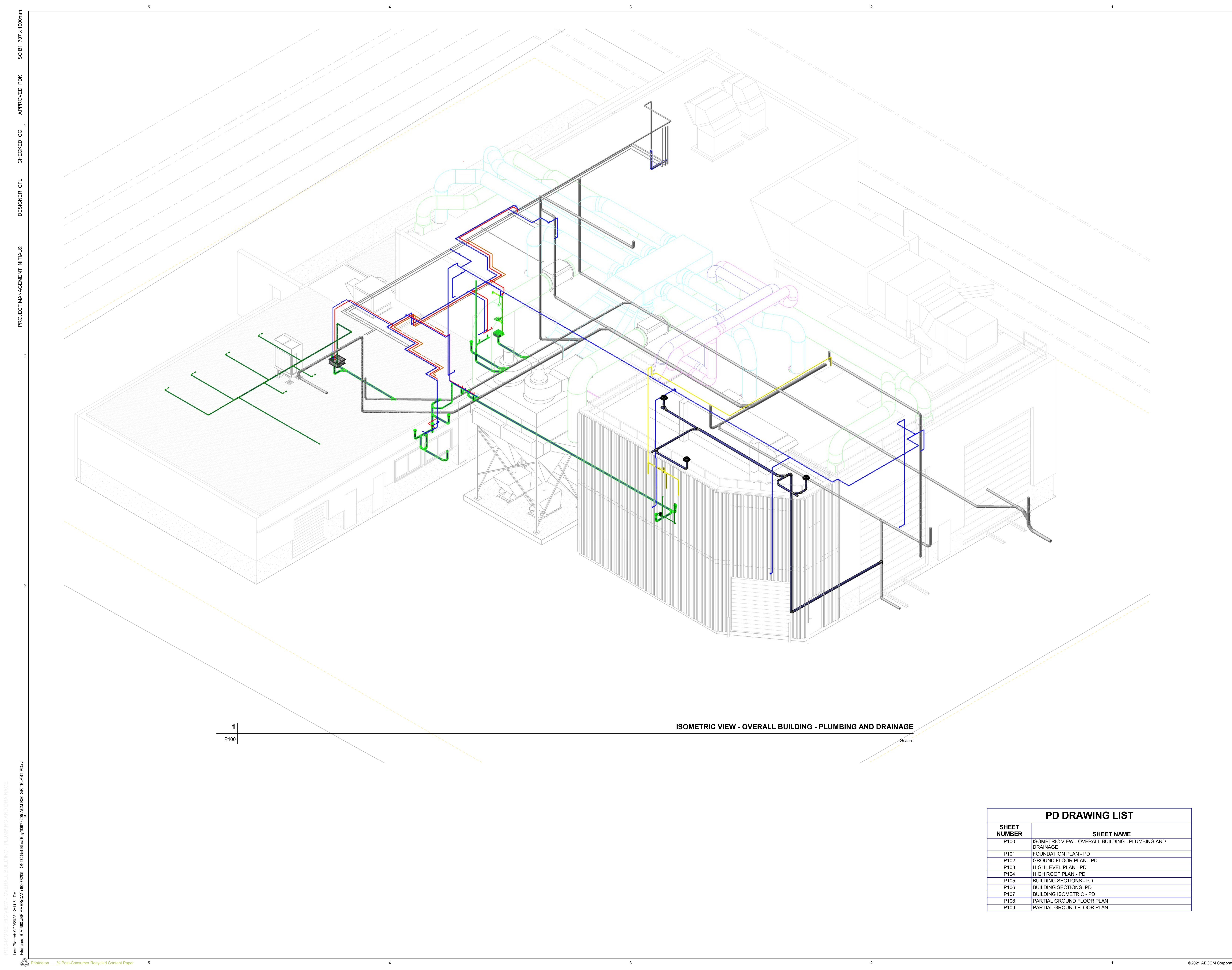
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DESIGNER: CFL  
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C  
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P100

PD00-ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE  
Last Printed: 9/25/2023 12:11:51 PM  
Filename: BM\_360\_JRP-AMER(CAN)\_60678205 - ONTC Grit Blast Upgrade AECOM A20-GRITBLAST-PD-04

PD DRAWING LIST	
SHEET NUMBER	SHEET NAME
P100	ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE
P101	FOUNDATION PLAN - PD
P102	GROUND FLOOR PLAN - PD
P103	HIGH LEVEL PLAN - PD
P104	HIGH ROOF PLAN - PD
P105	BUILDING SECTIONS - PD
P106	BUILDING SECTIONS - PD
P107	BUILDING ISOMETRIC - PD
P108	PARTIAL GROUND FLOOR PLAN
P109	PARTIAL GROUND FLOOR PLAN

**PROJECT**

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

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No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

**PROJECT NUMBER**

60678205

**SHEET TITLE**

**ISOMETRIC VIEW - OVERALL BUILDING - PLUMBING AND DRAINAGE**

**SHEET NUMBER**

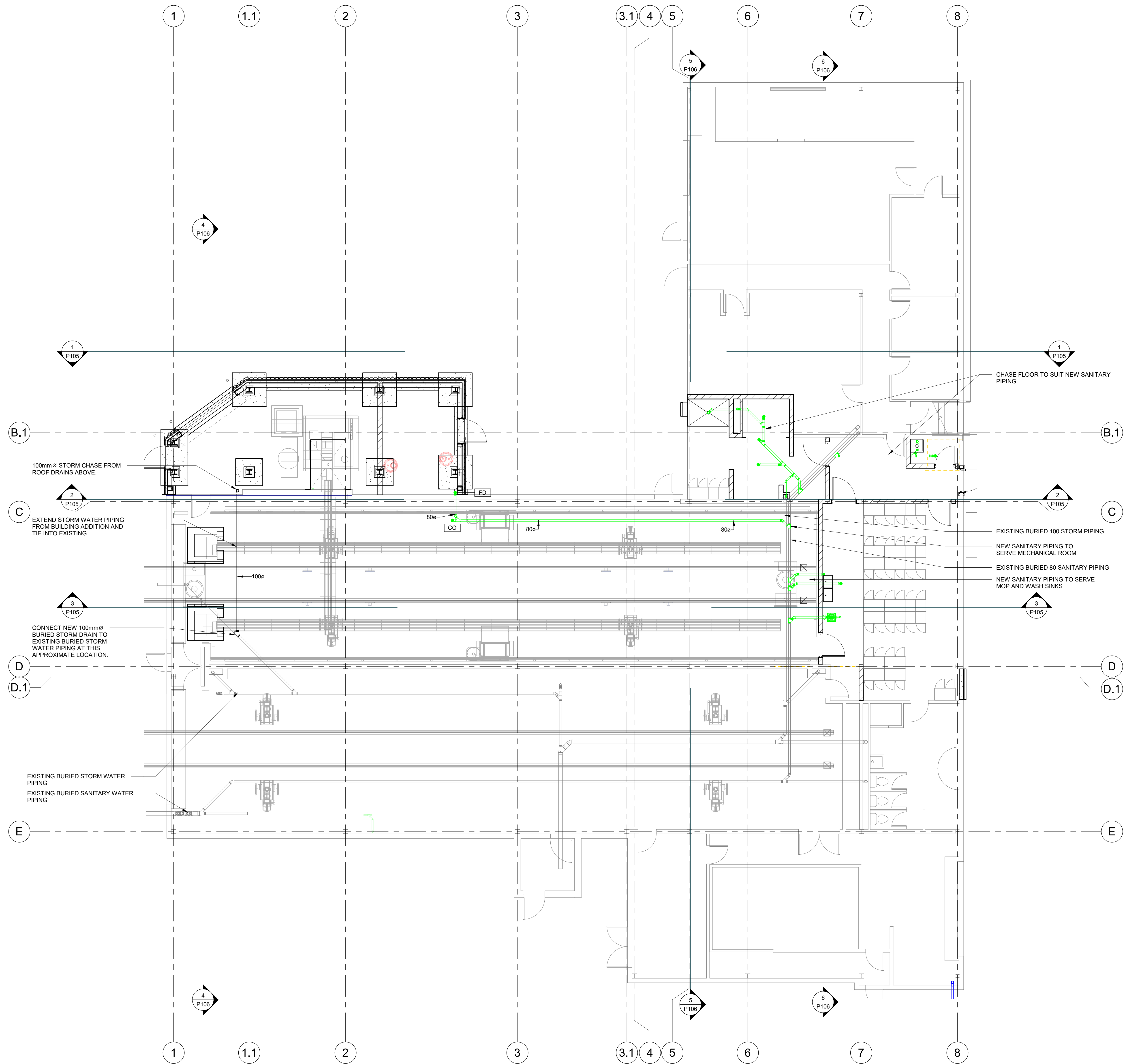
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## PROJECT

**GRIT BLAST UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

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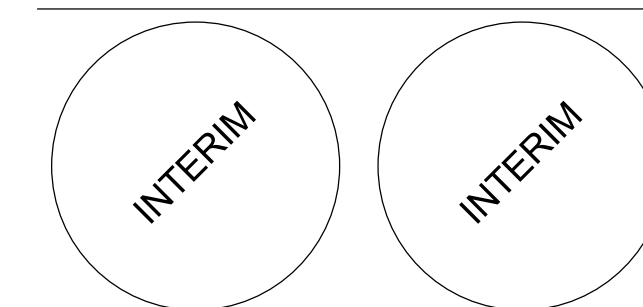
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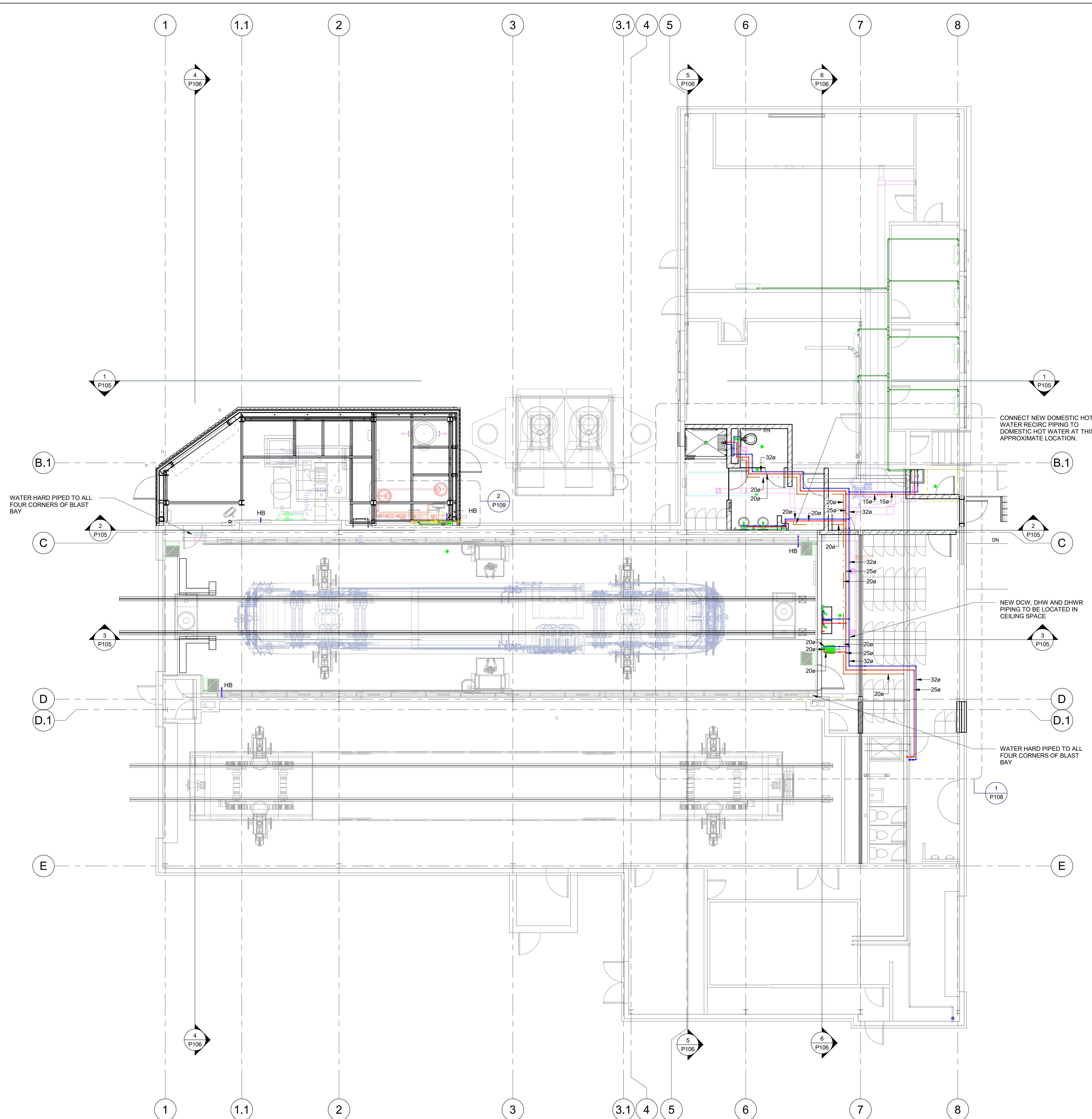
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**FOUNDATION PLAN - PD**

**SHEET NUMBER**

**P101**





### LOW LEVEL GROUND FLOOR PLAN - HVAC

Scale: 1 : 7



## PROJECT

**GRIT BLAST UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

## CLIENT

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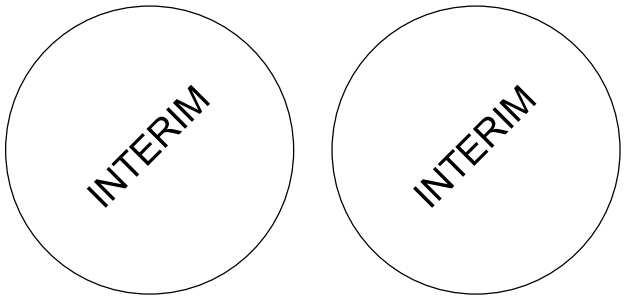
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CONNECT NEW DOMESTIC HOT  
WATER RECIRC PIPING TO  
DOMESTIC HOT WATER AT THIS  
APPROXIMATE LOCATION.

## REGISTRATION



## KEY PLAN



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1	ISSUED FOR TENDER	2023/07/28
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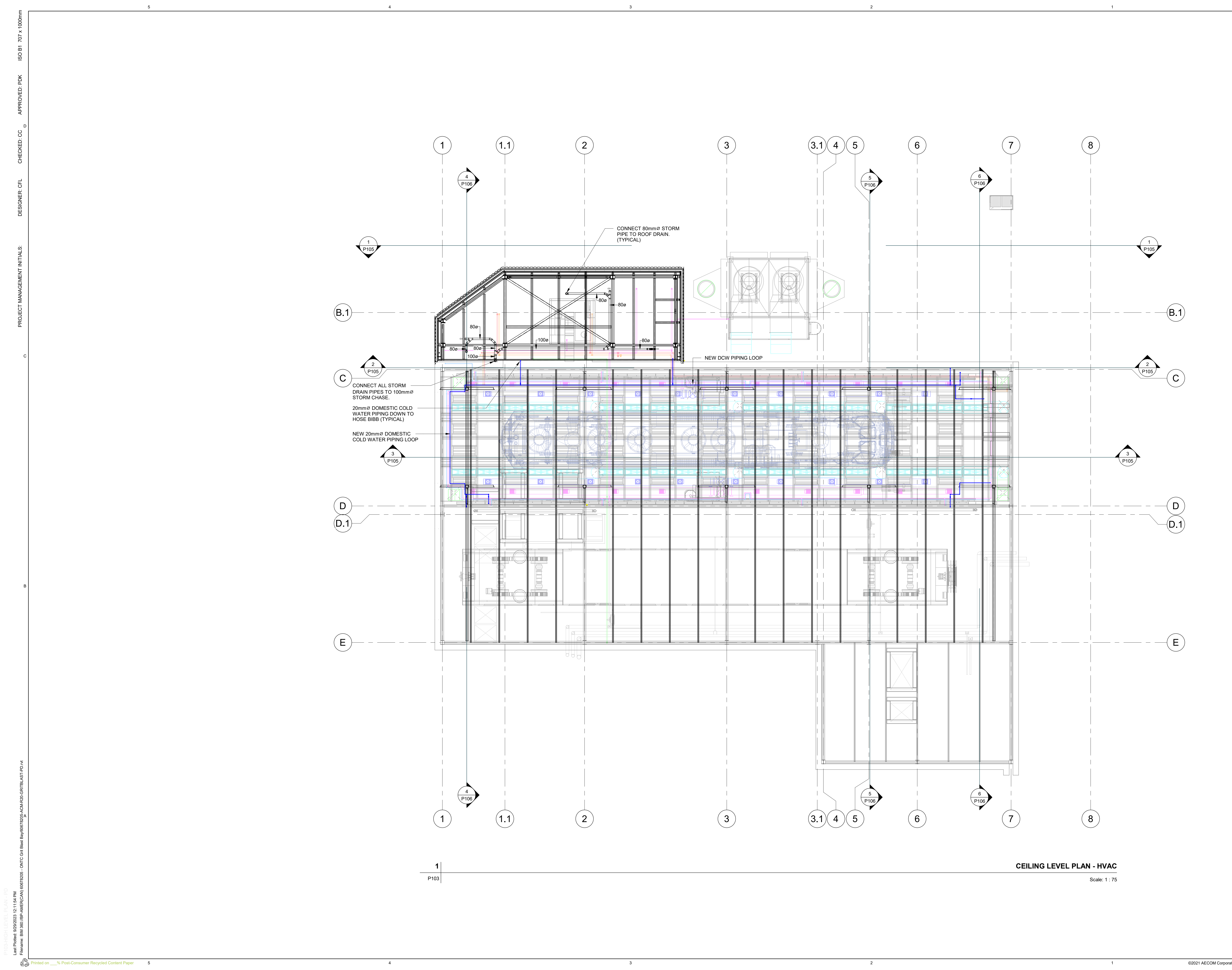
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## GROUND FLOOR PLAN - PD

**SHEET NUMBER**

# P102





# AECOM

**PROJECT**

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

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**SHEET TITLE**

HIGH LEVEL PLAN - PD

**SHEET NUMBER**

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CHECKED: CC

DESIGNER: CFL

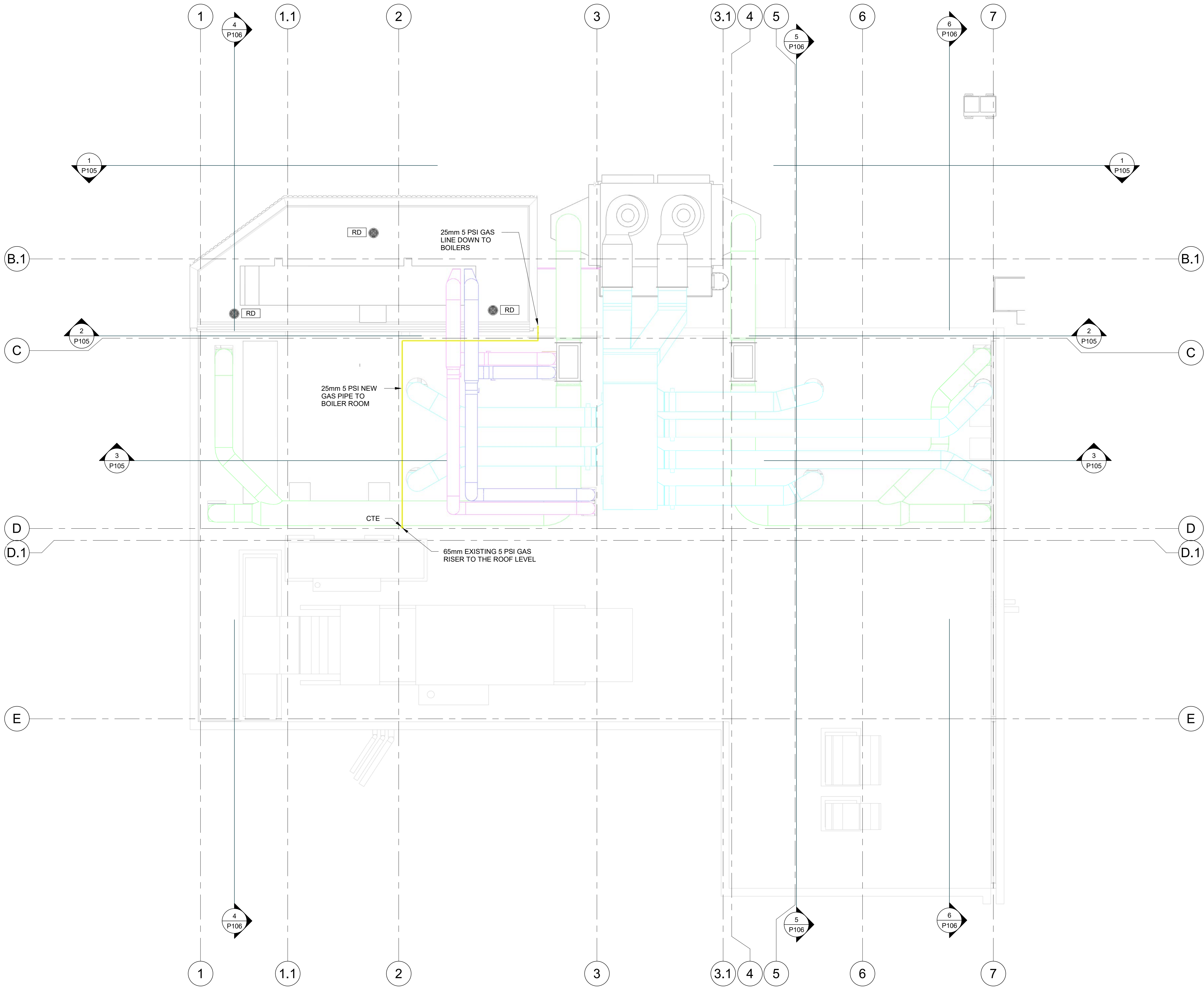
PROJECT MANAGEMENT INITIALS:

Scale: 1 : 75

CEILING LEVEL PLAN - HVAC

P103





1

P104 | REF: 1 / P105

HIGH ROOF LEVEL PLAN - PD

Scale: 1 : 75



PROJECT

GRIT BLAST UPGRADE  
915/916 MCINTYRE ST. E, NORTH BAY, ON

CLIENT

REGISTERED OWNER:  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
555 Oak Street East  
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Fax: +1-705-476-5598  
Cell: --  
Email: --

CONSULTANT

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Fax: +1-905-886-9494  
Cell: --  
Email: gabriel.colombani@aecom.com

CONSULTANTS

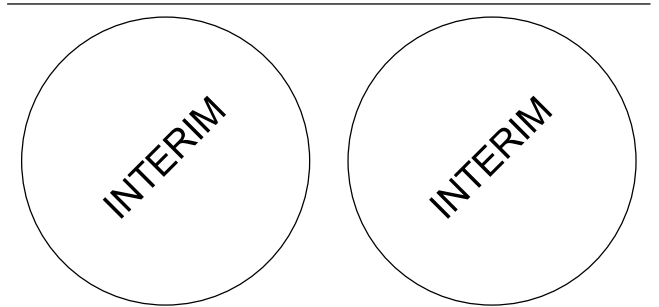
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REGISTRATION



KEY PLAN



SEE DRAWING FOR SCALE

ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

60678205

SHEET TITLE

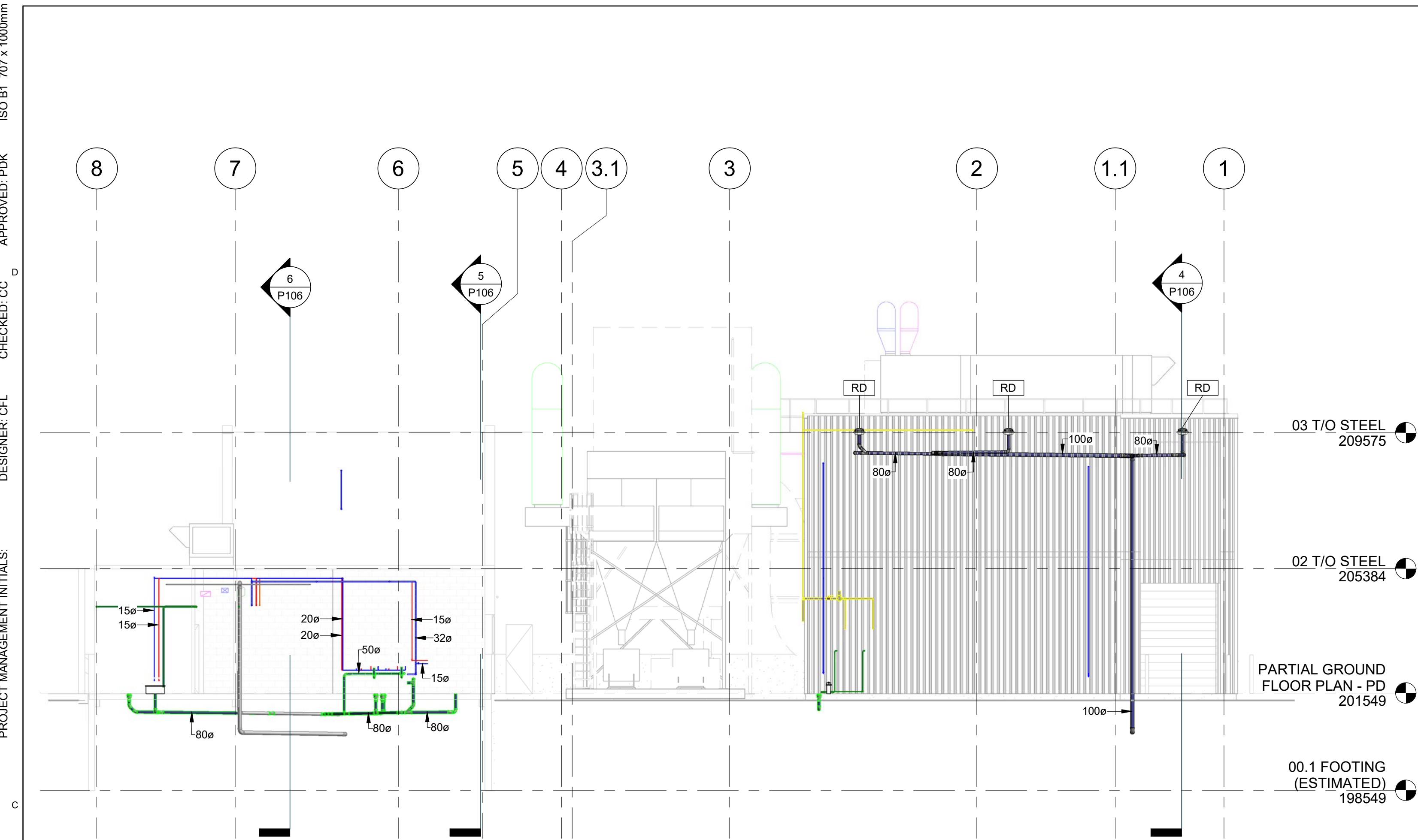
HIGH ROOF PLAN - PD

SHEET NUMBER

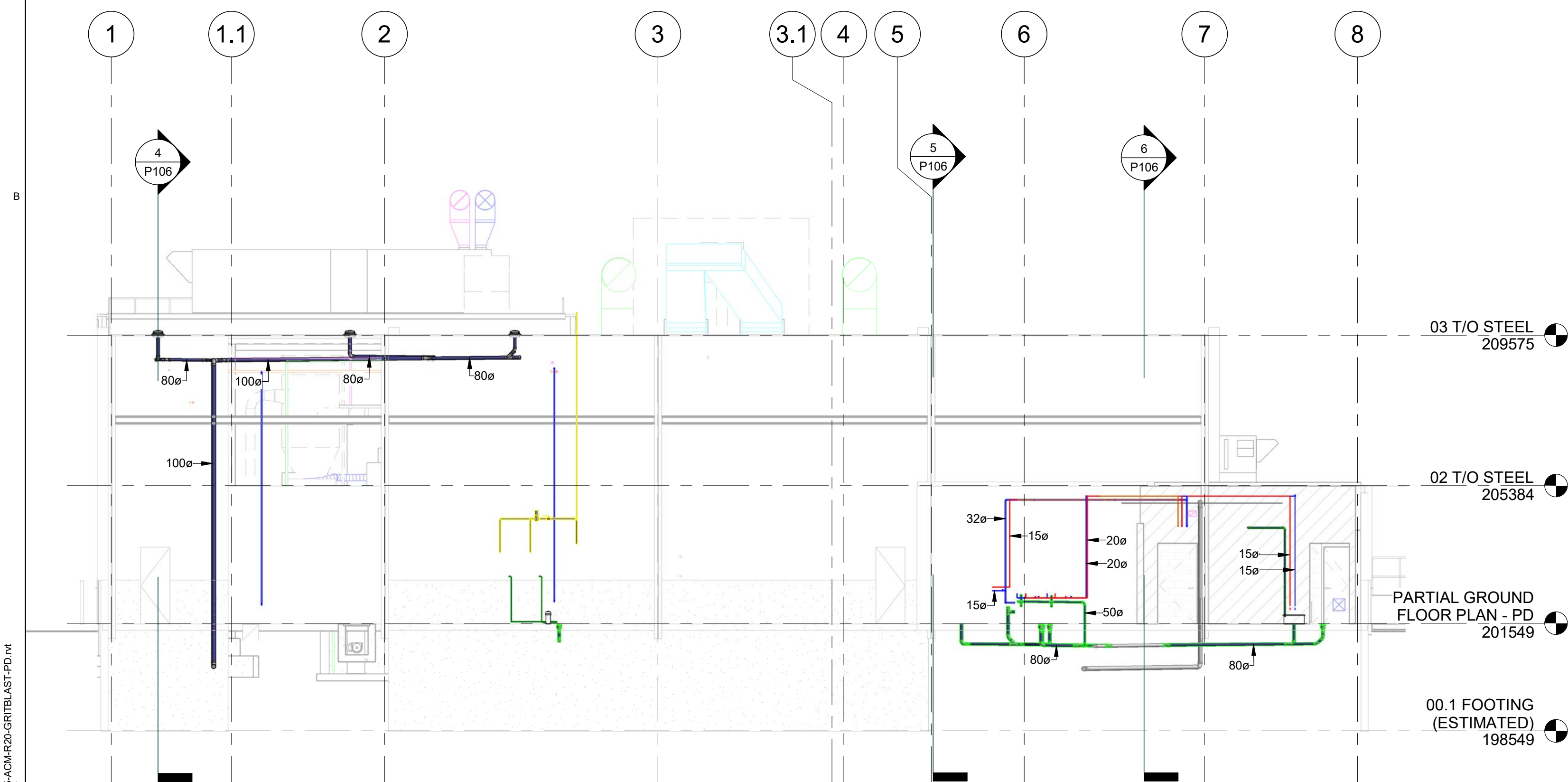
P104

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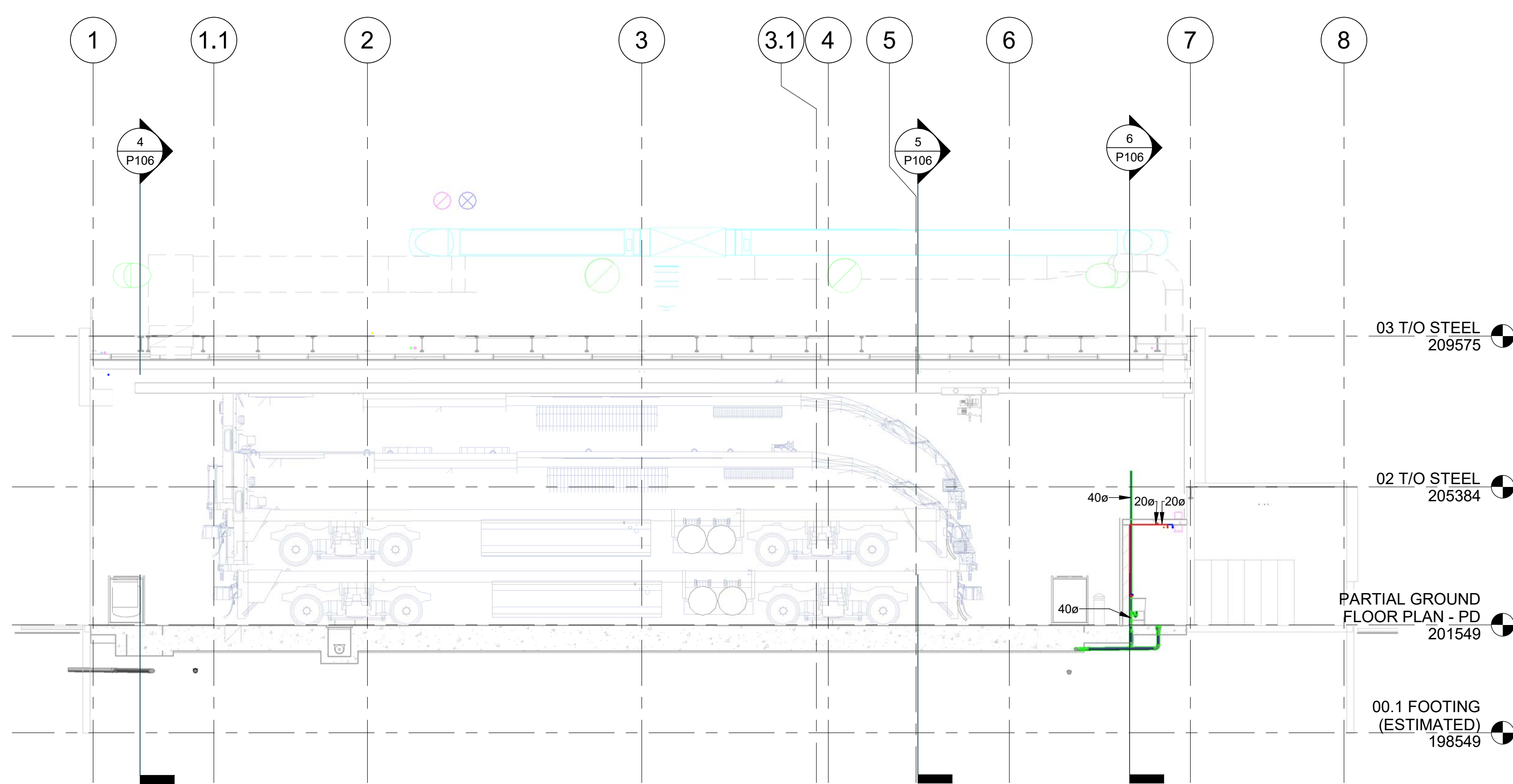




1 | BUILDING SECTION 1 - PD  
P105 REF: 1 / P101  
Scale: 1 : 100



2 | BUILDING SECTION 2 - PD  
P105 REF: 1 / P101  
Scale: 1 : 100



3 | BUILDING SECTION 3 - PD  
P105 REF: 1 / P101  
Scale: 1 : 100



#### PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

#### CLIENT

**REGISTERED OWNER:**  
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Email: gabriel.colombani@aecom.com

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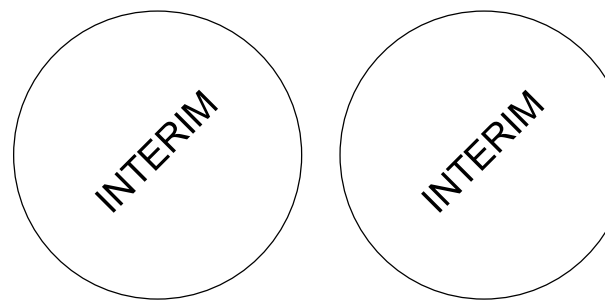
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#### REGISTRATION



#### KEY PLAN



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#### ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

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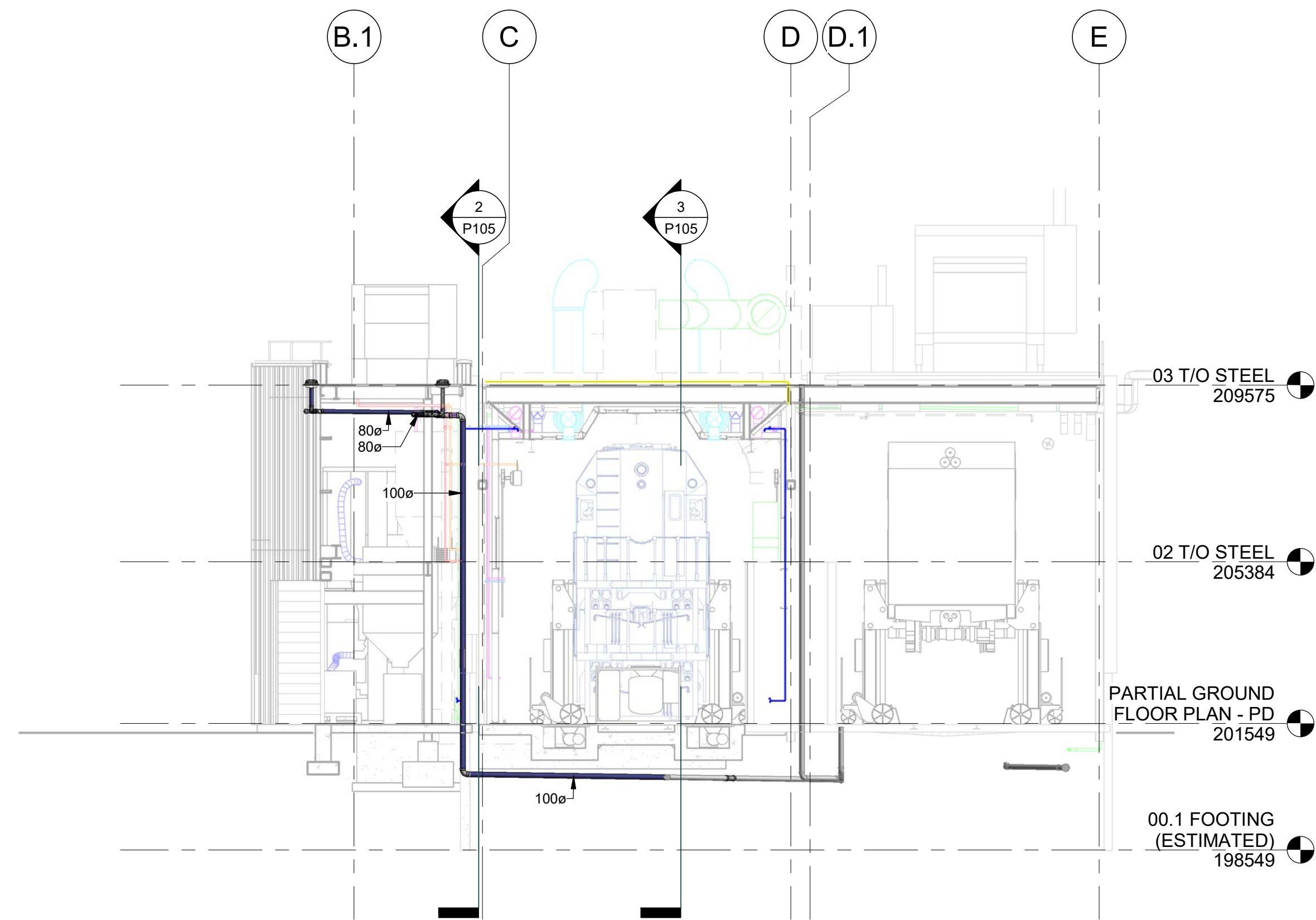
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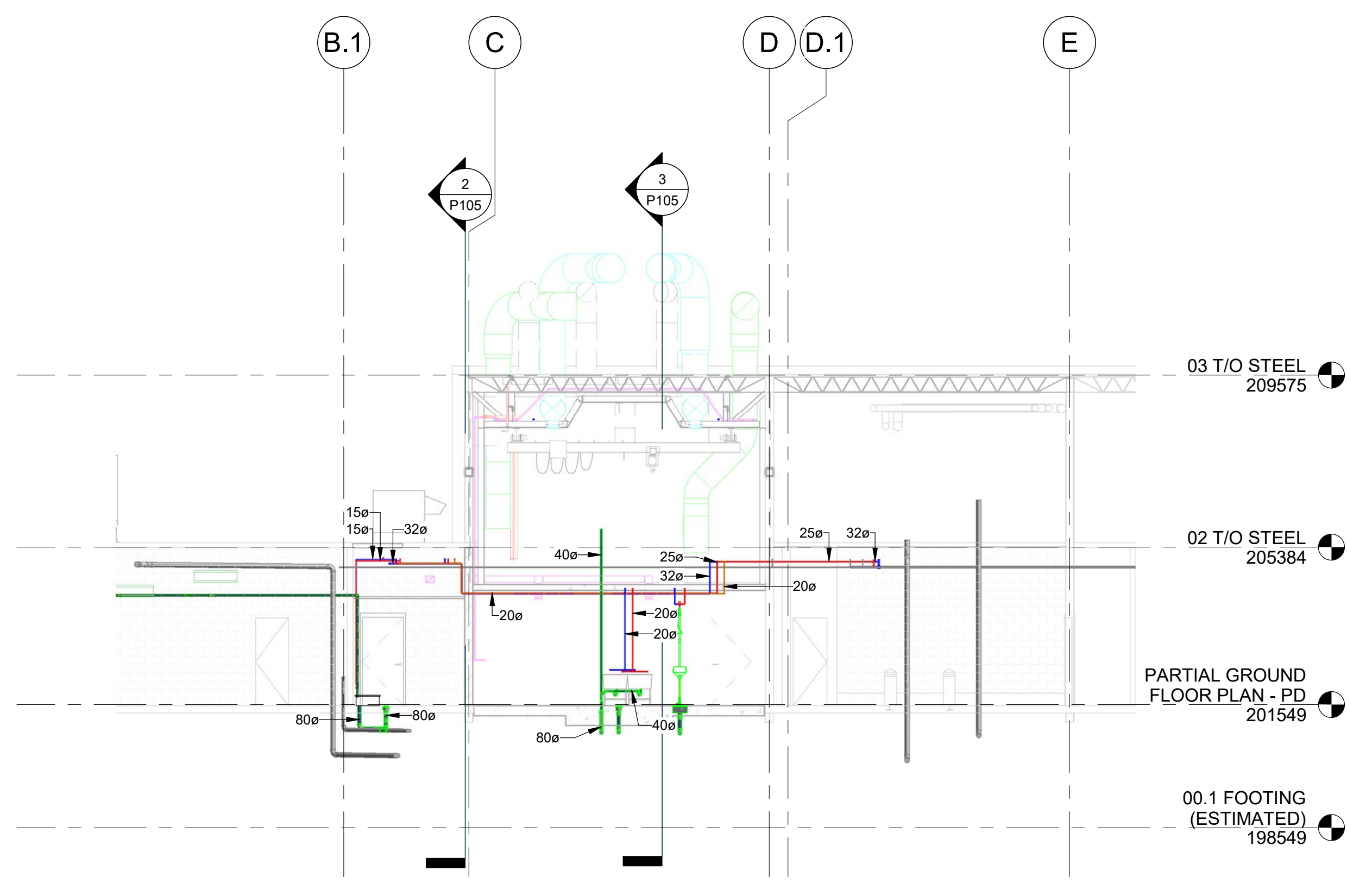
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**P105**

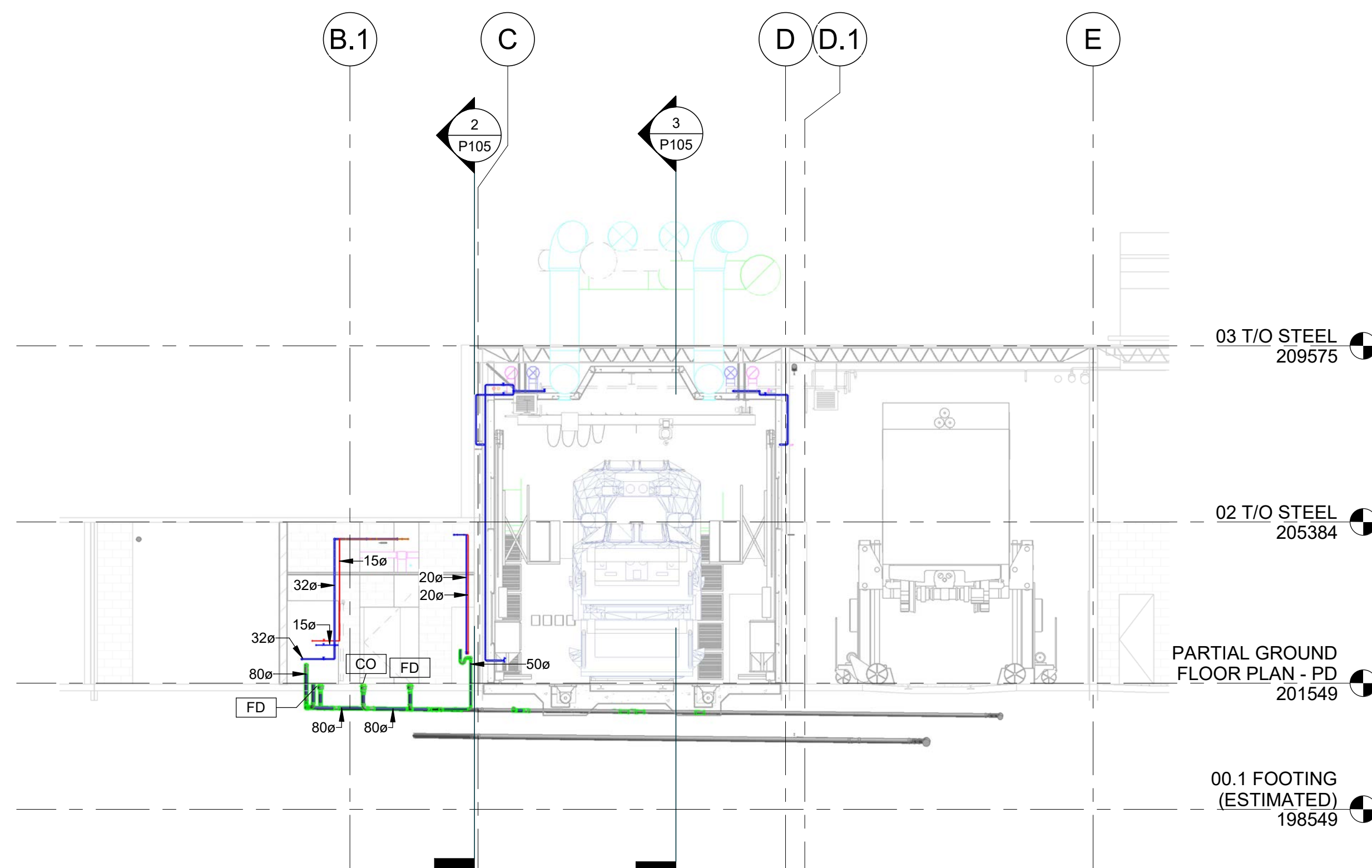




<b>4</b>	<b>BUILDING SECTION 4 - PD</b>
P106	REF: 1 / P101
	Scale: 1 : 100



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<b>5</b>	<b>BUILDING SECTION 5 - PD</b>
P106	REF: 1 / P101
	Scale: 1: 100



## PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

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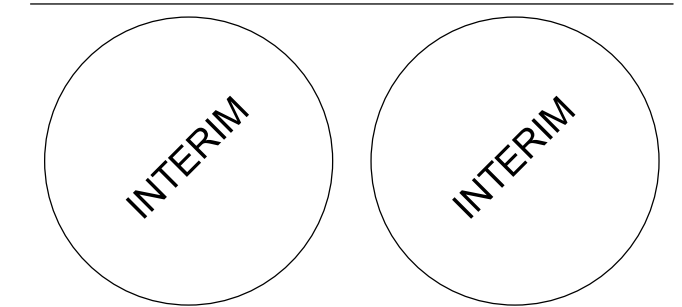
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## REGISTRATION



## KEY PLAN



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**ISSUE/REVISION**

[illegible]

## PROJECT NUMBER

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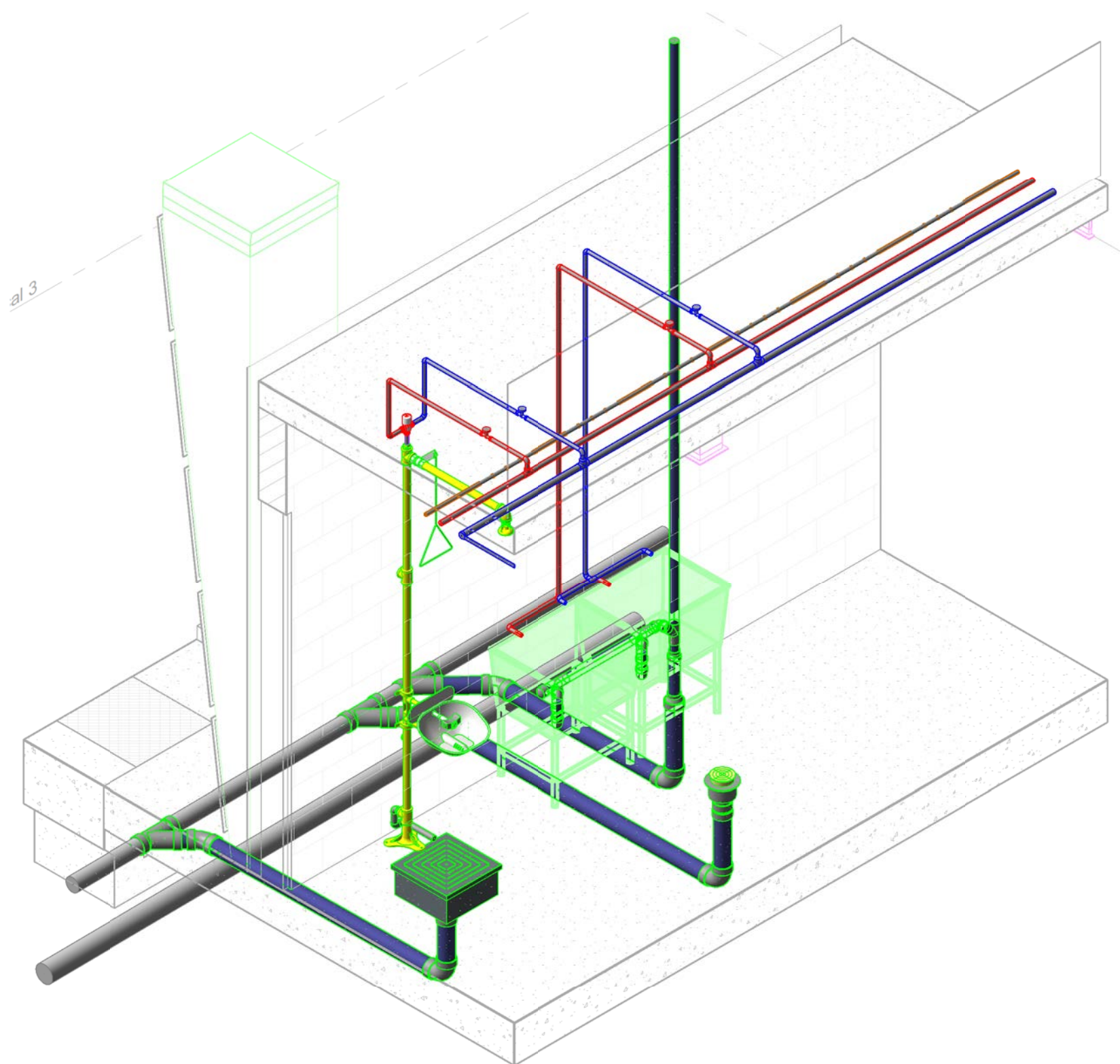
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**BUILDING SECTIONS -PD**

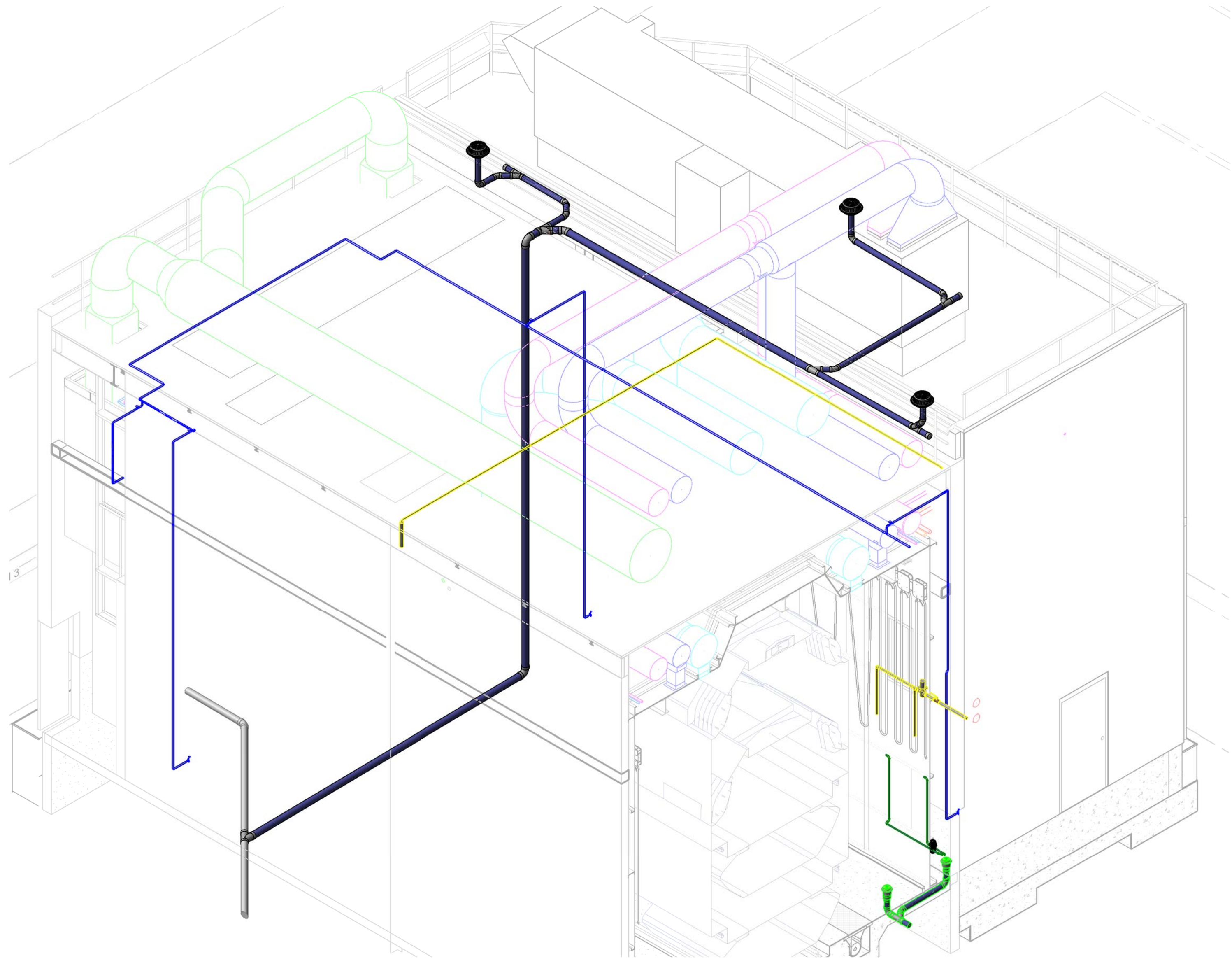
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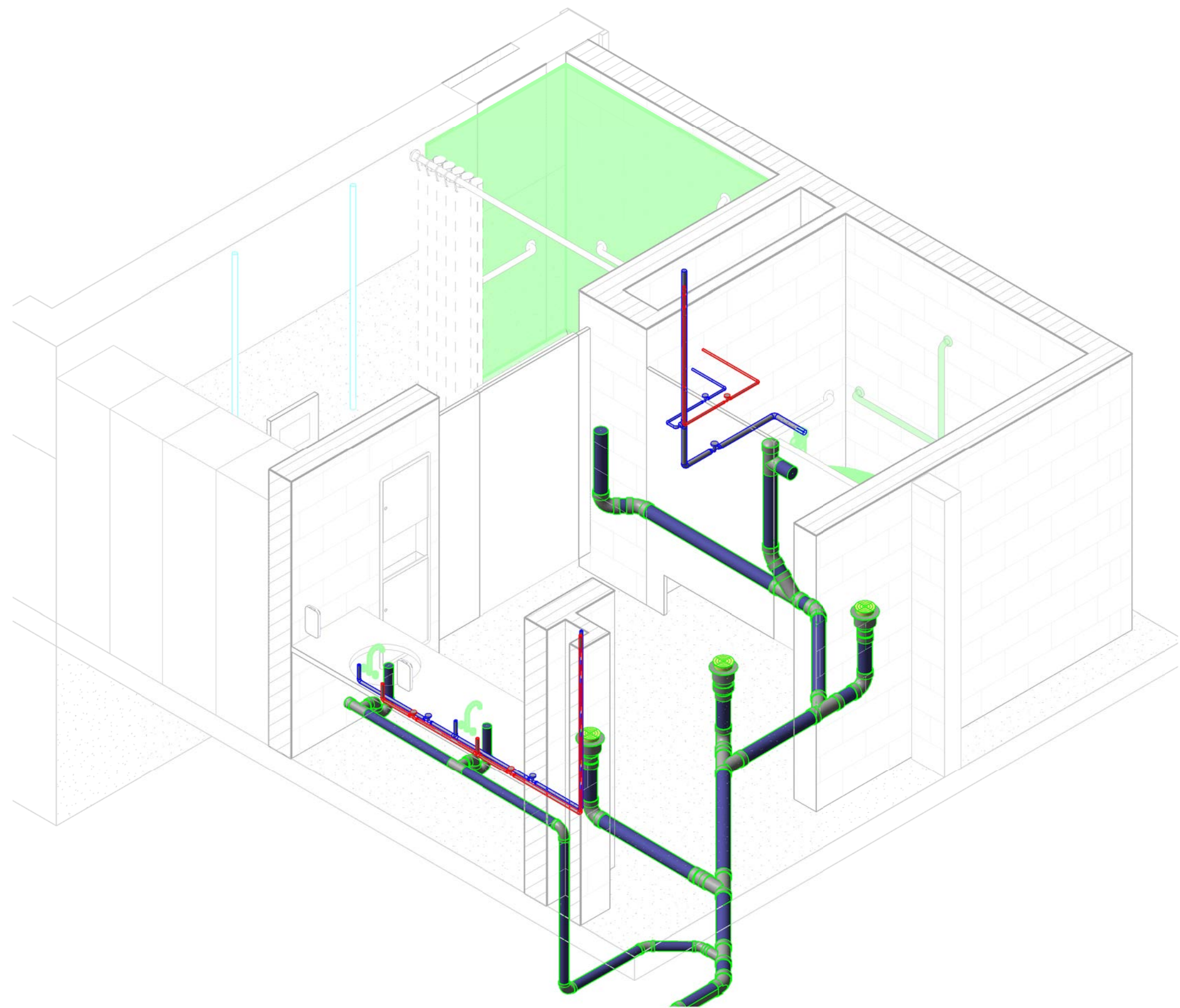




1 ISOMETRIC VIEW - DIRTY ROOM - PD  
P107 Scale:



3 ISOMETRIC VIEW - BUILDING ADDITION - PD  
P107 Scale:



2 ISOMETRIC VIEW - WOMENS WR / LOCKERS - PD  
P107 Scale:



#### PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

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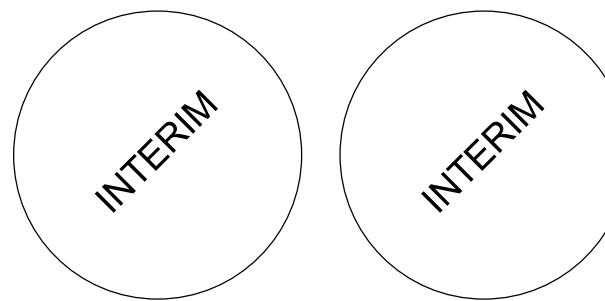
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#### KEY PLAN



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#### ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

#### PROJECT NUMBER

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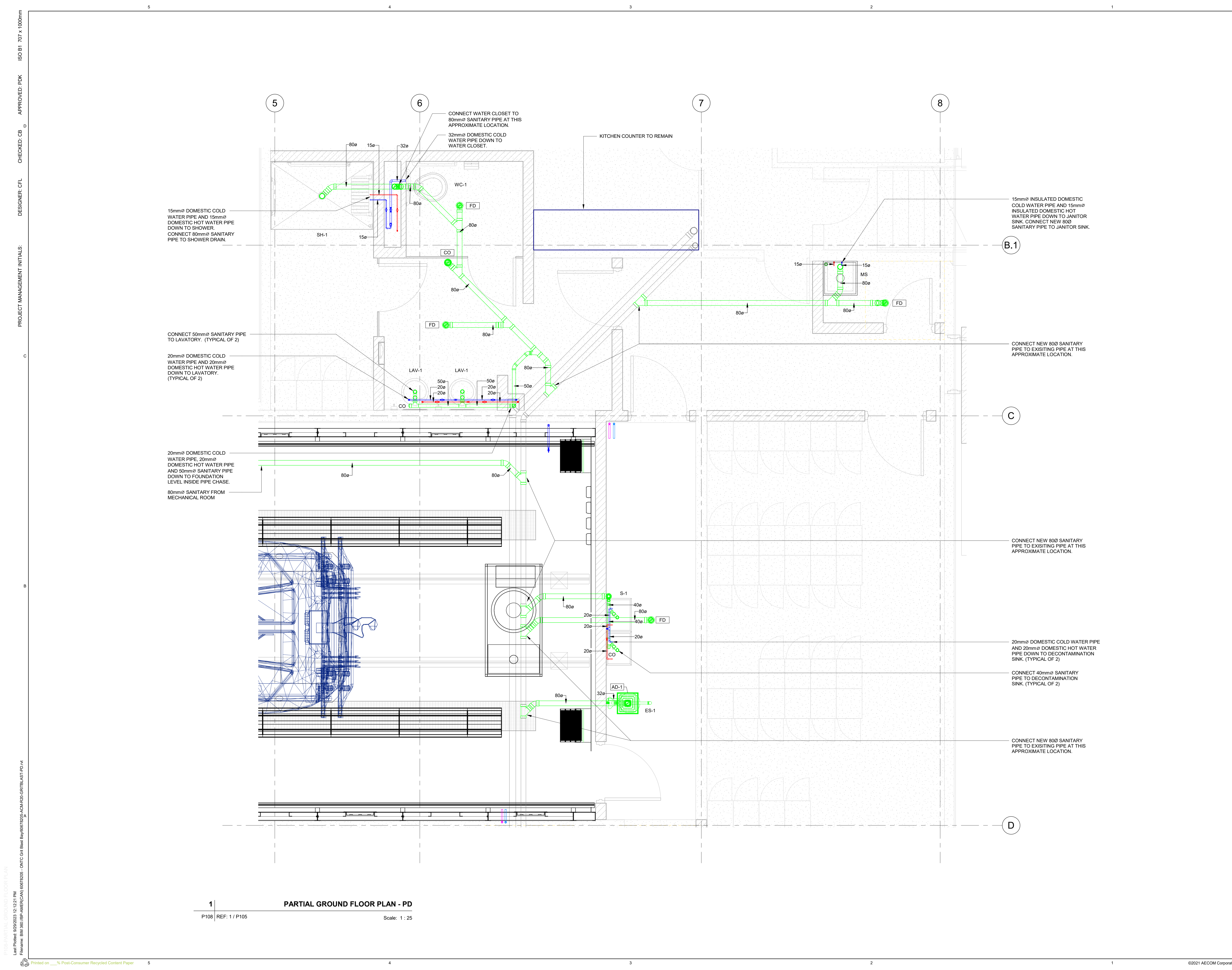
#### SHEET TITLE

**BUILDING ISOMETRIC - PD**

#### SHEET NUMBER

**P107**





ISO B1 707 x 100mm  
APPROVED: PKK  
DESIGNER: CFL  
PROJECT MANAGEMENT INITIALS:  
C  
B

Partial Ground Floor Plan  
Last Printed: 9/25/2023 12:12:21 PM  
Filename: BM\_360\_RBP-AMER(CAN)\_60678205 - ONTC Grit Blast Upgrade ACOM R20-GRITBLAST-FD-V4

1 | PARTIAL GROUND FLOOR PLAN - PD  
P108 REF: 1 / P105 Scale: 1 : 25

# AECOM

**PROJECT**  
**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**  
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**REGISTRATION**  
INTERIM  
INTERIM

**KEY PLAN**

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**ISSUE/REVISION**

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
PARTIAL GROUND FLOOR PLAN

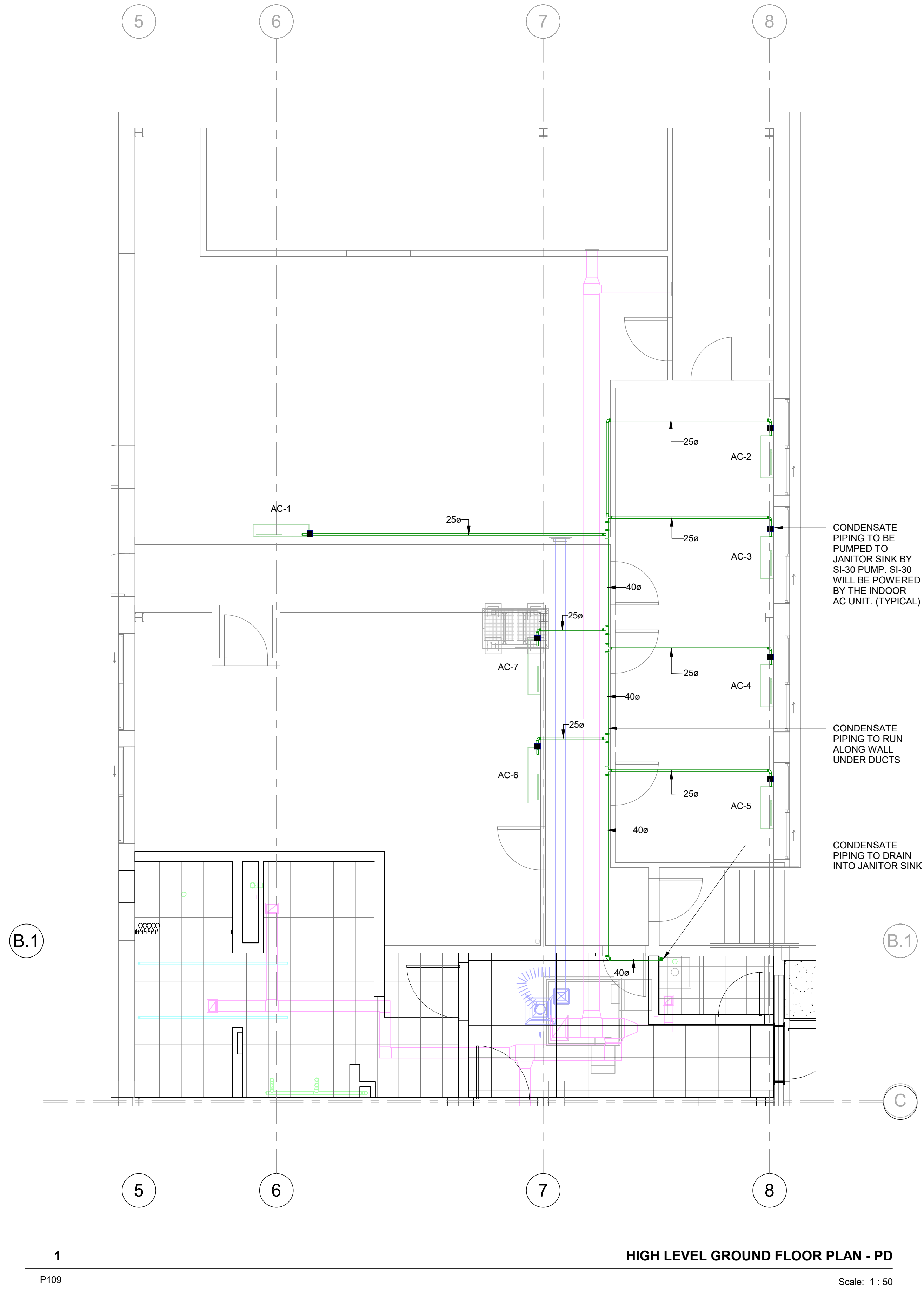
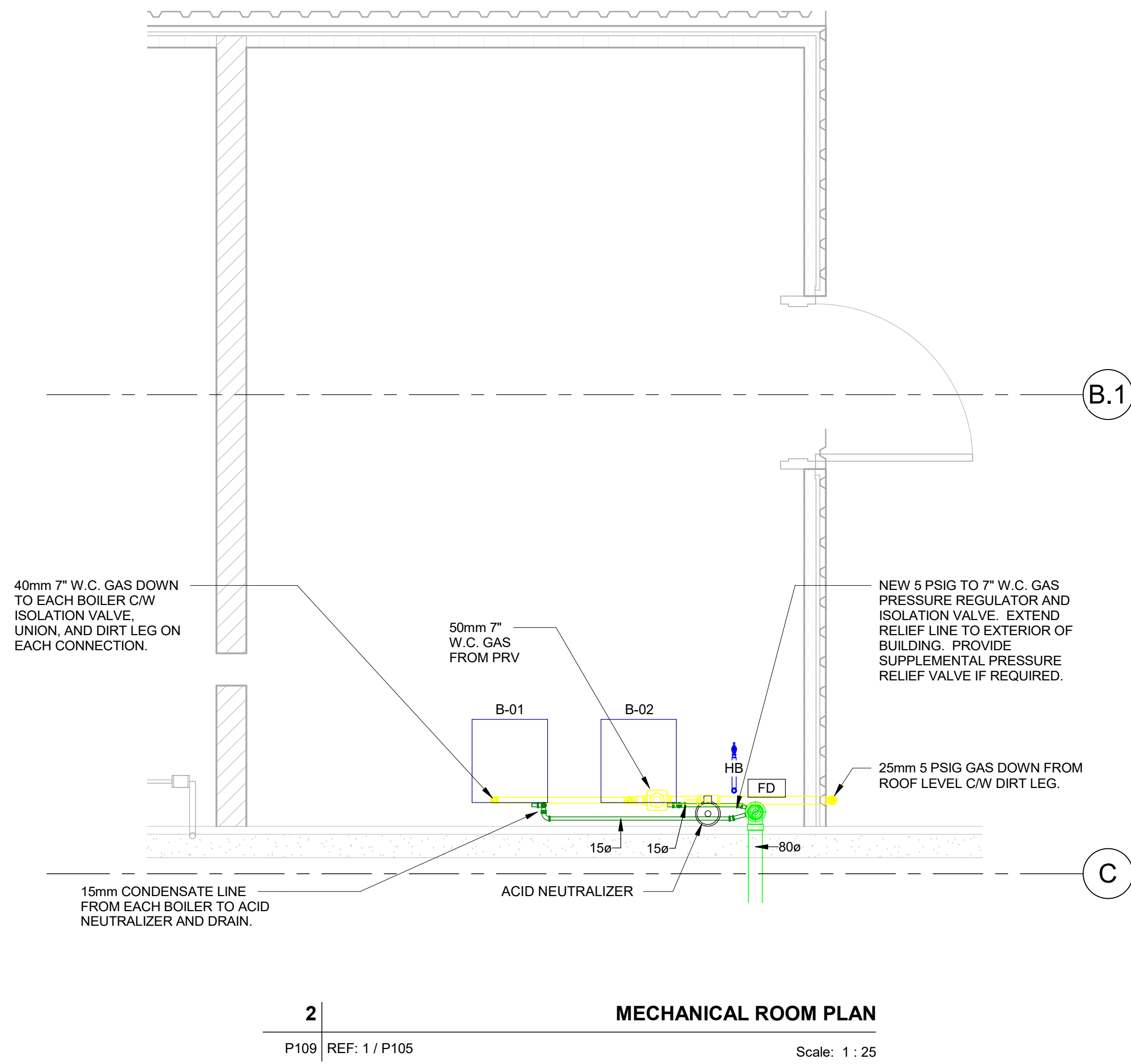
**SHEET NUMBER**  
**P108**

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## PROJECT

**GRIT BLAST UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

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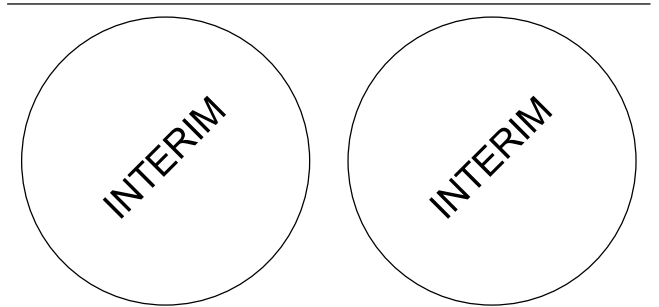
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## REGISTRATION



## KEY PLAN



SEE DRAWING FOR SCALE

## ISSUE/REVISION

[illegible]

## PROJECT NUMBER

60678205

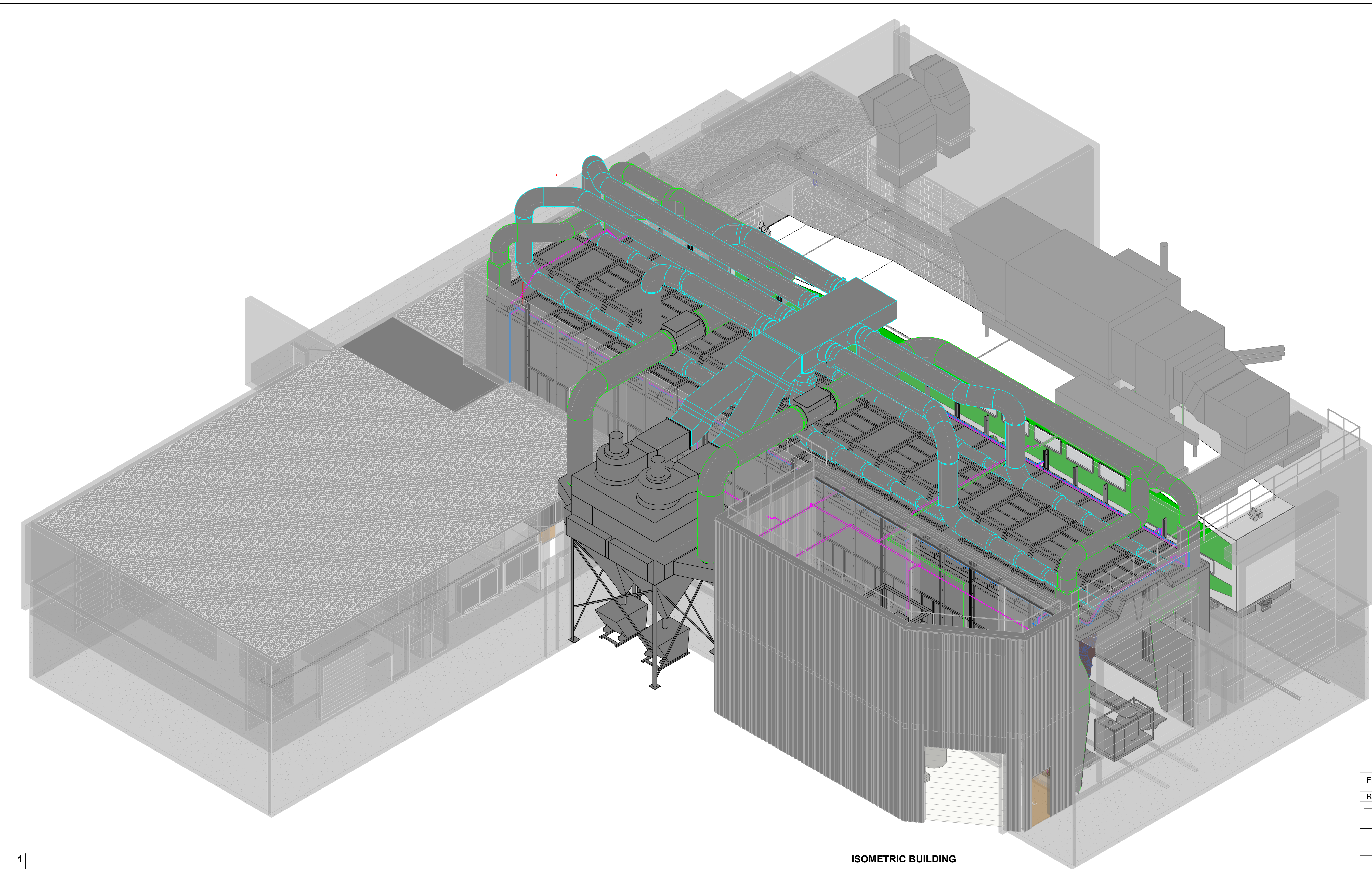
**SHEET TITLE**

### PARTIAL GROUND FLOOR PLAN

**SHEET NUMBER**

**P109**





ISOMETRIC BUILDING

Scale:

## GENERAL NOTES

- OBTAIN AND PAY FOR ALL REQUIRED PERMITS.
- PROVIDE SHOP DRAWINGS TO THE CONSULTANT FOR REVIEW. ALL SHOP DRAWINGS MUST BE REVIEWED, STAMPED AND SIGNED BY THE CONTRACTOR PRIOR TO SUBMITTING TO THE CONSULTANT. REVIEW SHALL INCLUDE VERIFYING UNIT DIMENSIONS AND CLEARANCES.
- MAINTAIN RECORD DRAWINGS ON AN ON-GOING BASIS. DRAWINGS SHALL BE AVAILABLE FOR PERIODIC REVIEW BY THE OWNER DURING CONSTRUCTION.
- ALL WORK SHALL COMPLY WITH APPLICABLE CODES.
- INSTRUCT AND TRAIN THE OWNER AND/OR THEIR DELEGATES ON PROPER OPERATION OF SYSTEM.
- CONTRACTOR TO PERFORM INTEGRATED SYSTEM TESTING OF FIRE PROTECTION SYSTEM IN ACCORDANCE WITH CAN ULC S1001 AFTER THE NEW FIRE ALARM SYSTEM IS IN PLACE AND TIED TO THE NEW.
- DO NOT SCALE DRAWINGS. THE LOCATIONS OF ALL ITEMS SHOWN ON THE DRAWINGS OR SPECIFIED THAT ARE NOT DEFINITELY FIXED BY DIMENSIONS ARE APPROXIMATE ONLY. THE EXACT LOCATIONS NECESSARY TO SECURE THE BEST CONDITIONS AND RESULTS MUST BE DETERMINED BY THE SITE CONDITIONS. REVIEW ALL REVISIONS WITH THE OWNER.
- FLOOR PLAN SHALL BE READ IN CONJUNCTION WITH SCHEMATICS, DETAILS AND SPECIFICATION. NEITHER THE DRAWINGS NOR THE SPECS SHALL BE USED ALONE. MISINTERPRETATION OF ANY REQUIREMENTS OF EITHER PLANS OR SPECIFICATIONS SHALL NOT CHANGE THE REQUIREMENTS OR INTENT OF THE SPECS FOR PROPER COMPLETION OF THE WORK TO THE FULL APPROVAL OF THE CONSULTANT AND THE OWNER.
- SHOULD ANY DISCREPANCY APPEAR BETWEEN THE DRAWINGS AND SPECIFICATIONS, SPECIFICATIONS TAKE PRECEDENCE OVER THE DRAWINGS. IF THERE IS DOUBT AS TO THE TRUE MEANING AND INTENT OF EITHER THE DRAWINGS OR THE SPECIFICATIONS, A RULING SHALL BE OBTAINED FROM THE OWNER BEFORE SUBMITTING THE TENDER.
- PRIOR TO COMMENCEMENT OF WORK, ORDERING OF EQUIPMENT AND/OR FABRICATING MATERIALS, THE CONTRACTOR SHALL VISIT THE SITE TO VERIFY EXISTING CONDITIONS. THIS SHALL BE DONE IN ORDER TO CONFIRM THAT EQUIPMENT AND SERVICES CAN BE INSTALLED SHOWN ON DRAWINGS AND SPECIFIED. IT IS THE CONTRACTOR RESPONSIBILITY TO NOTIFY THE OWNER OF ANY DISCREPANCIES, COMMISSIONS, AND/OR INTERFERENCES PRIOR TO COMMENCEMENT OF WORK.
- CONTRACTOR SHALL REVIEW THE APPLICABLE DESIGNATED SUBSTANCE SURVEY.

## DEMOLITION NOTES

- EVERY EFFORT HAS BEEN MADE TO OUTLINE THE DEMOLITION SCOPE OF WORK. HOWEVER, THE DEMOLITION DRAWINGS REPRESENT ONLY THE GENERAL LOCATION AND NUMBER OF DEVICES, EQUIPMENT, ETC. TO ASSIST IN EVALUATING THE DEMOLITION SCOPE OF WORK. DRAWINGS ARE BASED ON PREVIOUS AS-BUILTS OR FIELD EVALUATION.
- THE CONTRACTOR IS STRONGLY ADVISED TO REVIEW THE SITE PRIOR TO BID. CONTRACTOR SHALL INCLUDE FOR ALL COSTS ASSOCIATED WITH ACCESSING, REMOVING, REINSTALLING AND PROTECTING EQUIPMENT AND WORK AREAS.
- CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF FIRE-SEPARATIONS AS REQUIRED FOR DEMOLITION / INSTALLATION OF NEW EQUIPMENT AND PIPING.
- CONTRACTOR TO DETERMINE THE MOST EFFICIENT METHOD OF COMPLETING THE WORK AND TO FORMULATE A CONSTRUCTION SCHEDULE AND PROVIDE TO CLIENT FOR APPROVAL PRIOR TO COMMENCEMENT OF WORK.
- BE RESPONSIBLE AND PAY FOR ANY DAMAGE TO THE EXISTING BUILDING INCURRED BY WORK OF THIS DIVISION, OR REPAIR TO THE SATISFACTION OF THE OWNER.
- CARRY OUT THE WORK WITH A MINIMUM OF NOISE, DUST AND DISTURBANCE.
- PROVIDE DAILY CLEAN UP AND PROPER DISPOSAL OF DEBRIS GENERATED BY DAILY OPERATIONS. ON COMPLETION OF THE WORK ALL TOOLS, SURPLUS MATERIALS AND WASTE MATERIALS SHALL BE REMOVED AND THE PREMISES LEFT IN A CLEAN AND PERFECT CONDITION.

### FP DRAWING LIST

SHEET NUMBER	SHEET NAME
FP100	BUILDING ISOMETRIC - FP
FP101	LOW LEVEL GROUND FLOOR PLAN - FP
FP102	HIGH LEVEL GROUND FLOOR PLAN - FP
FP103	BUILDING ISOMETRIC - FP
FP104	FOUNDATION PLAN - FP
FP105	CEILING LEVEL PLAN - FP
FP106	REFLECTED CEILING PLAN
FP107	BUILDING SECTIONS - FP
FP108	BUILDING SECTIONS - FP
FP109	BUILDING SECTIONS -FP

### HAZARD CLASSIFICATION SCHEDULE

HAZARD CLASSIFICATION	OCCUPANCIES
1	LIGHT OFFICES, CORRIDORS, STAIRS, WASHROOMS, LUNCH ROOMS, TRAINING ROOM
2	ORDINARY GROUP 1 STORAGE ROOMS & TOOL CRIBS, MECHANICAL ROOMS, DIRTY ROOM, ELECTRICAL ROOM
3	ORDINARY GROUP 2 GRIT BLASTING BAY, RECLAIM / STORAGE AREA

### FIRE LEGEND - PIPING

REFER	DESCRIPTION
	VALVE
	PUMP
	WATER METER
	BACK FLOW VALVE
CTE	CONNECT TO EXISTING
	PORTABLE FIRE EXTINGUISHER (WALL HUNG / SURFACE MOUNTED)
	FIRE DEPARTMENT CONNECTION
	STRAINER
	DRAIN COCK
	BACK WATER VALVE
	PRESSURE GAUGE
	WET SPRINKLER PIPE
	FLOW SWITCH
	COMPRESSOR
	CHECK VALVE
	ALARM CHECK VALVE
	ELECTRIC CONTROL VALVE
	ELECTRONICALLY SUPERVISED VALVE
	PIPE ELBOW DROP
	PIPE ELBOW RISE
	PIPE TEE DROP
	PIPE TEE RISE
FMA	ANNUNCIATE PANEL
SCP	SUPPRESSION SYSTEM CONTROL PANEL
SGP	SUPPRESSION SYSTEM GRAPHIC PANEL
	SUPPRESSION SYSTEM ABORT STATION
	SUPPRESSION SYSTEM DISCHARGE
	SUPPRESSION SYSTEM MANUAL STATION
	SIDEWALL SPRINKLER HEADS PENDANT
	SIDEWALL SPRINKLER HEADS UPRIGHT
	SPRINKLER HEADS PENDANT
	SPRINKLER HEADS UPRIGHT
	TEMPERATURE SENSOR
	PRESSURE SENSOR
FFD	FUNNEL FLOOR DRAIN

## PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

## CLIENT

**REGISTERED OWNER:**  
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## CONSULTANTS

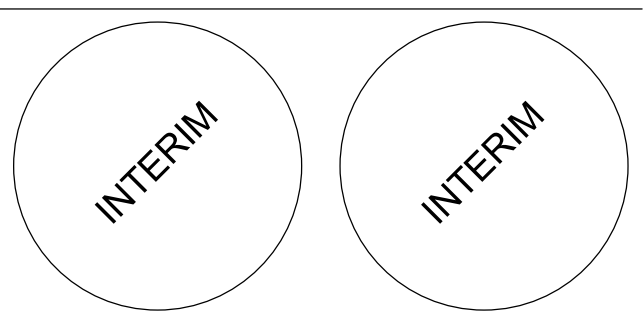
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## KEY PLAN



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## ISSUE/REVISION

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1	ISSUED FOR TENDER	2023/07/28

## PROJECT NUMBER

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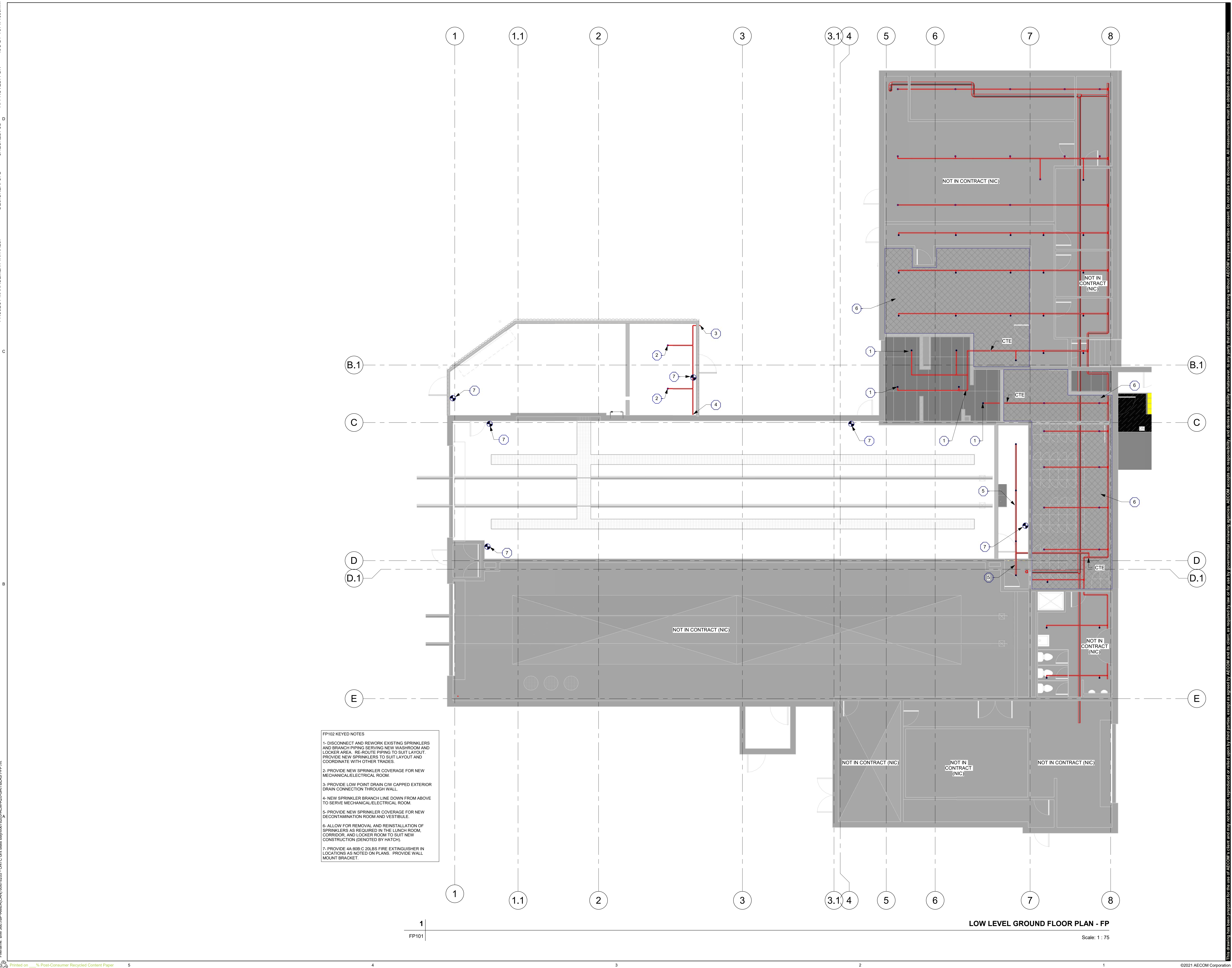
## SHEET TITLE

**BUILDING ISOMETRIC - FP**

## SHEET NUMBER

**FP100**





# AECOM

**PROJECT**

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

**CLIENT**

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Email: address@email.com

**REGISTRATION**

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**KEY PLAN**

SEE DRAWING FOR SCALE

**ISSUE/REVISION**

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

**PROJECT NUMBER**

60678205

**SHEET TITLE**

**LOW LEVEL GROUND FLOOR PLAN - FP**

**SHEET NUMBER**

**FP101**

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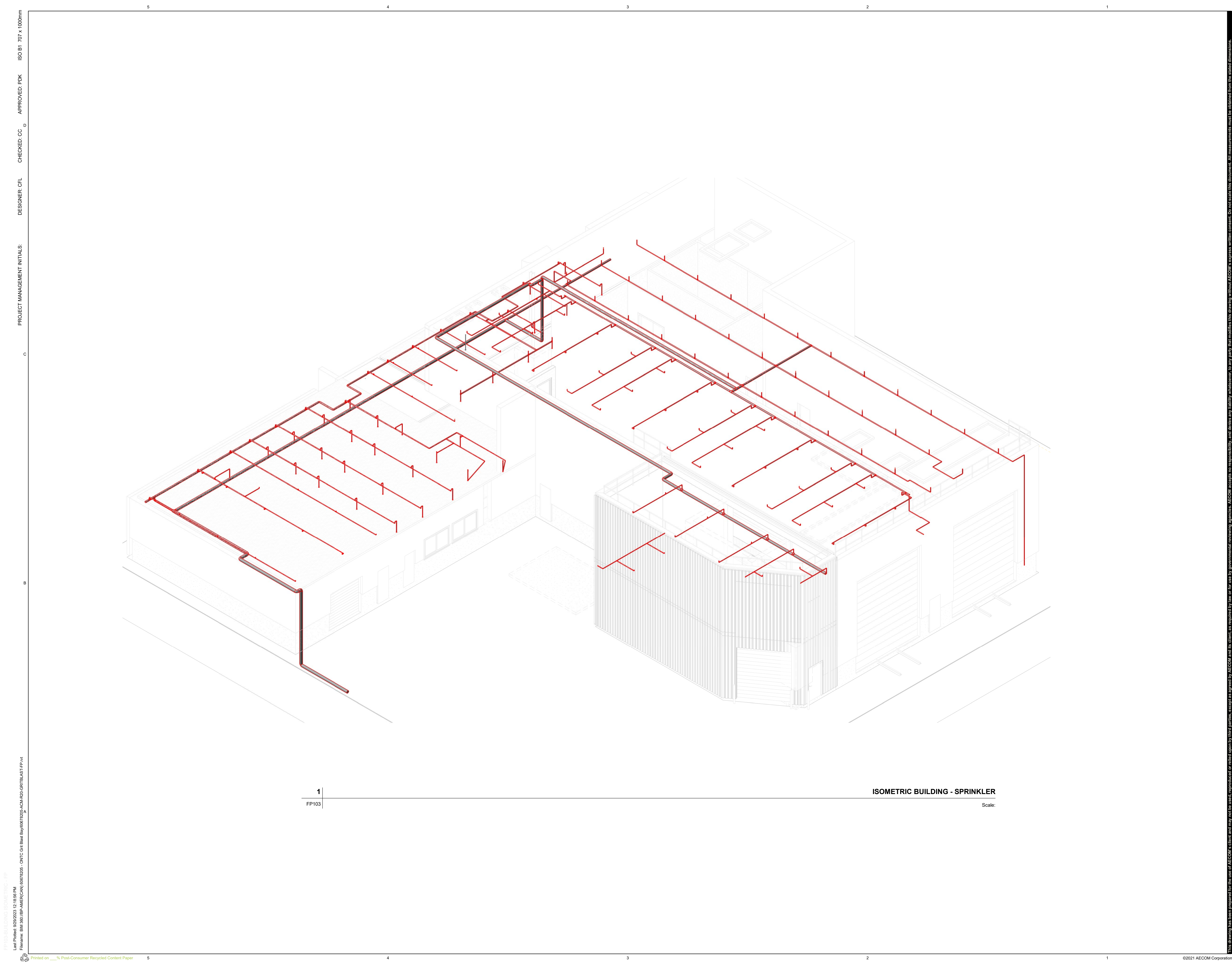
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1  
FP103

ISOMETRIC BUILDING - SPRINKLER

Scale:



PROJECT

GRIT BLAST UPGRADE  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

REGISTERED OWNER:  
ONTARIO NORTHLAND TRANSPORTATION COMMISSION  
555 Oak Street East  
North Bay, Ontario, Canada, P1B 8E3  
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Email: --

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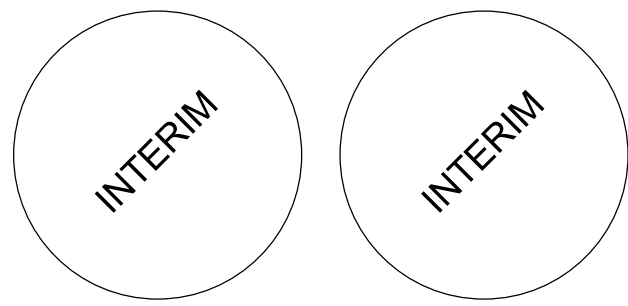
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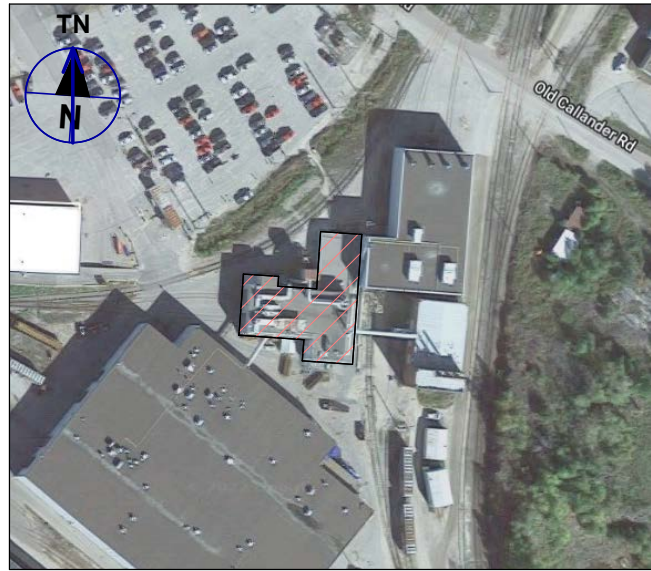
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REGISTRATION



KEY PLAN



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ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

60678205

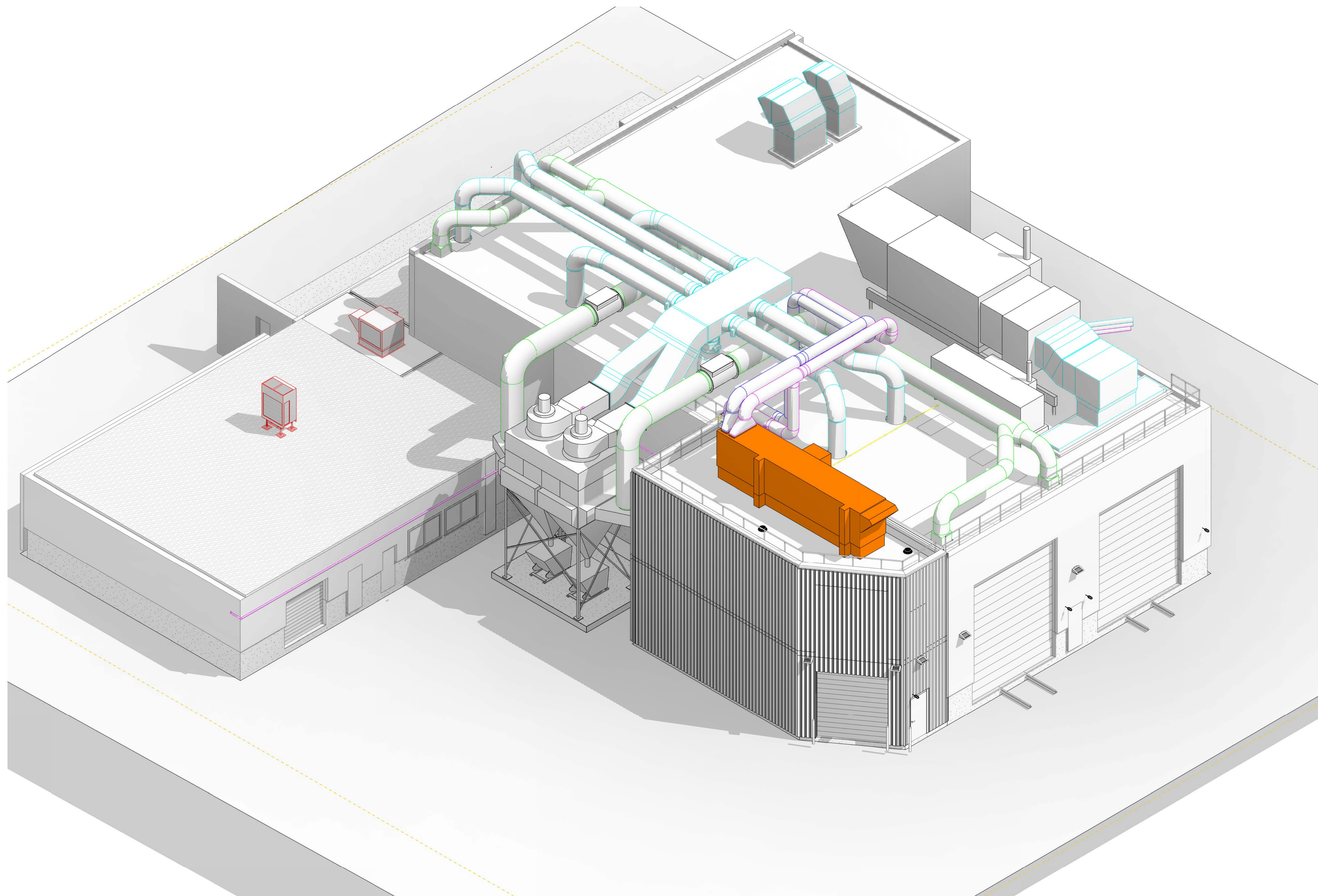
SHEET TITLE

BUILDING ISOMETRIC - FP

SHEET NUMBER

FP103





Scale:

HVAC DRAWING LIST	
SHEET NUMBER	SHEET NAME
M100	ISOMETRIC VIEW - OVERALL BUILDING - HVAC
M101	GROUND FLOOR PLAN - HVAC
M102	HIGH LEVEL PLAN - HVAC
M103	HIGH ROOF PLAN - HVAC
M104	REFLECTED CEILING PLAN
M105	BUILDING SECTIONS - HVAC
M106	PARTIAL HVAC PLANS
M107	BUILDING SECTIONS - HVAC
M108	BUILDING SECTIONS - HVAC
M109	BUILDING ISOMETRIC - HVAC DUCTWORK
M110	MECHANICAL EQUIPMENT SCHEDULE
M111	HEATING AND CONTROL SCHEDULE



## PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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Fax: +1-905-886-9494  
Cell: --  
Email: [gabriel.colombani@aecom.com](mailto:gabriel.colombani@aecom.com)

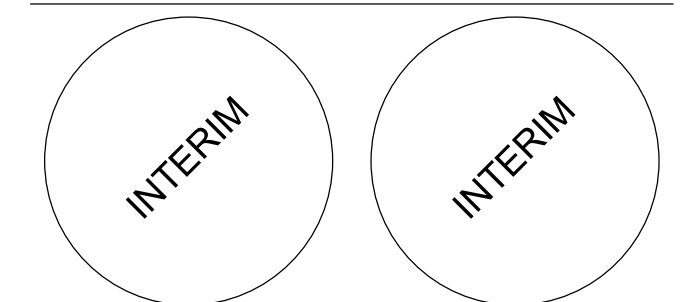
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Email: address@email.com

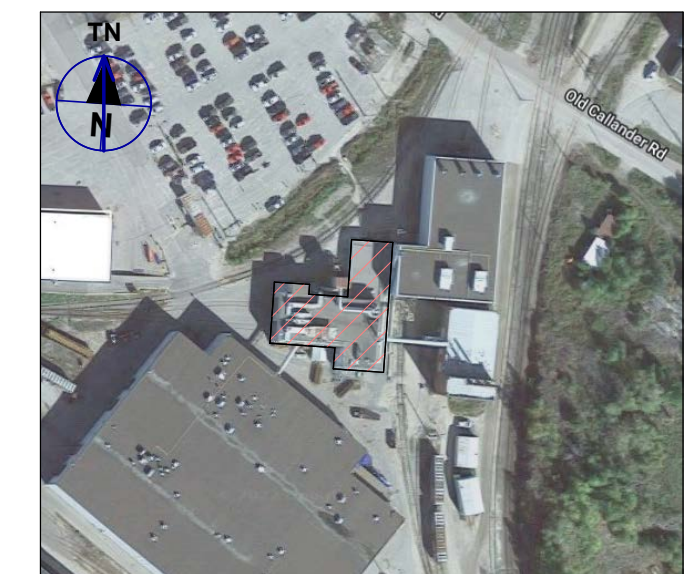
**BUILDING CODE CONSULTANT:**

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Cell: +1-613-555-1234  
Email: address@email.com

## REGISTRATION



### KEY PLAN



SEE DRAWING FOR SCALE

**ISSUE/REVISION**

[illegible]

## PROJECT NUMBER

60678205

**SHEET TITLE**

ISOMETRIC VIEW - OVERALL  
BUILDING - HVAC

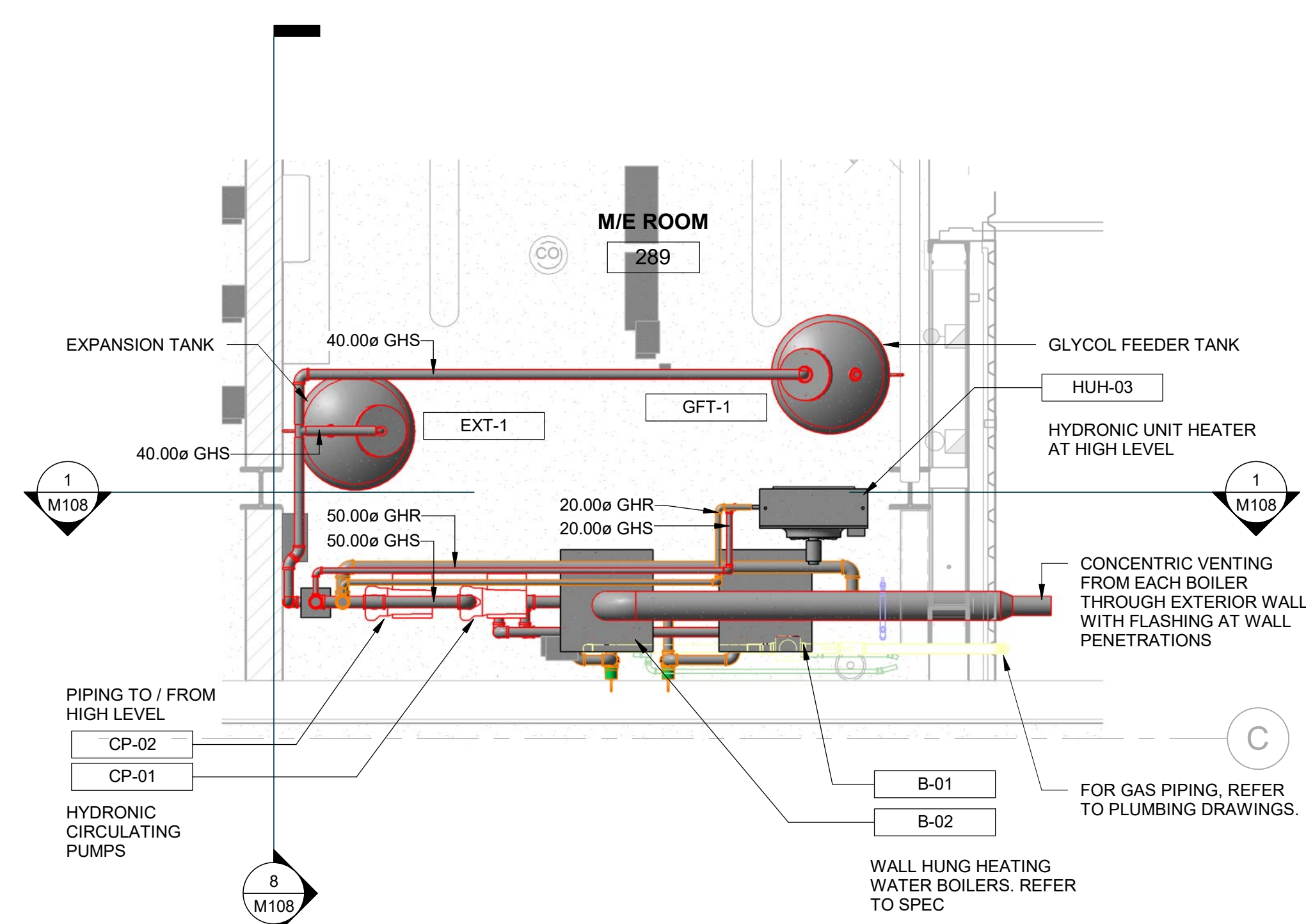
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## M100

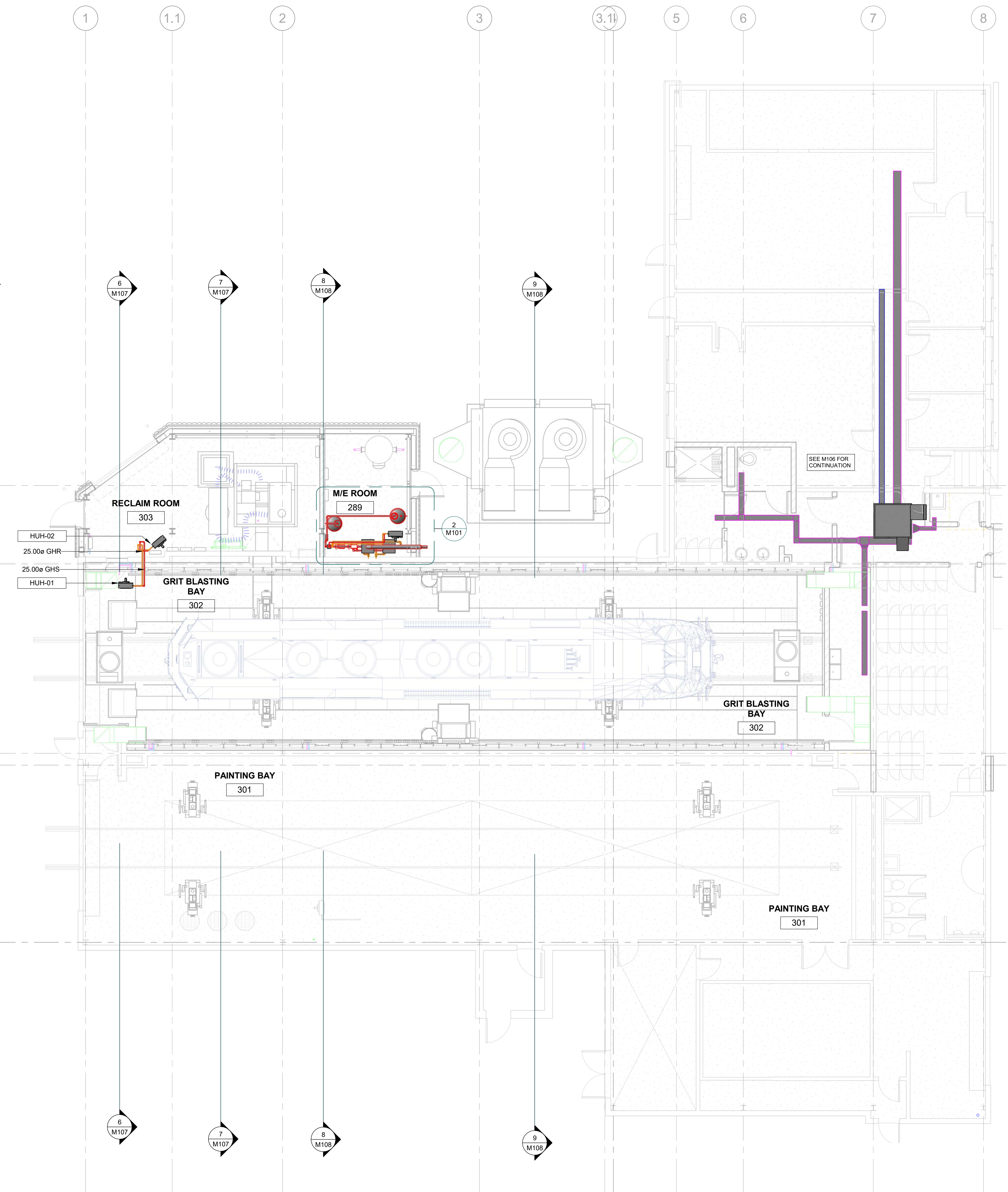


M101-GROUND FLOOR PLAN - HVAC  
Last Printed: 9/25/2023 12:26:13 PM  
Filename: BM\_360\_HRP-AMER(CAN)\_60678205 - ONTC Grit Blast Bay/60678205-ACM-R20-GRITBLAST-M101

PROJECT MANAGEMENT INITIALS:  
DESIGNER: CFL  
CHECKED: CB  
APPROVED: POK  
ISO B1 707 x 100mm



2  
PARTIAL M/E ROOM FLOOR PLAN - HVAC  
M101 REF: 1 / M101  
Scale: 1 : 25



1  
GROUND FLOOR PLAN - HVAC  
M101 REF: 1 / M105  
Scale: 1 : 75

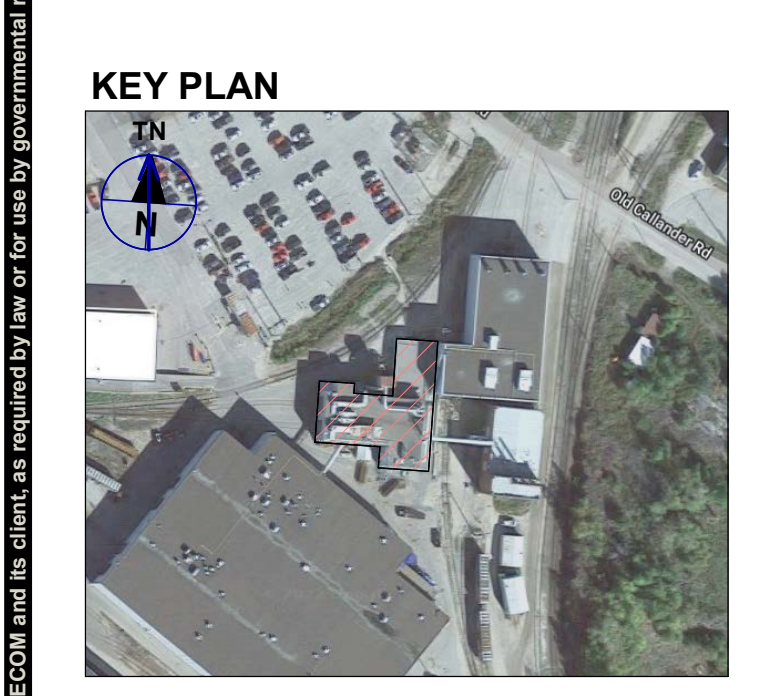
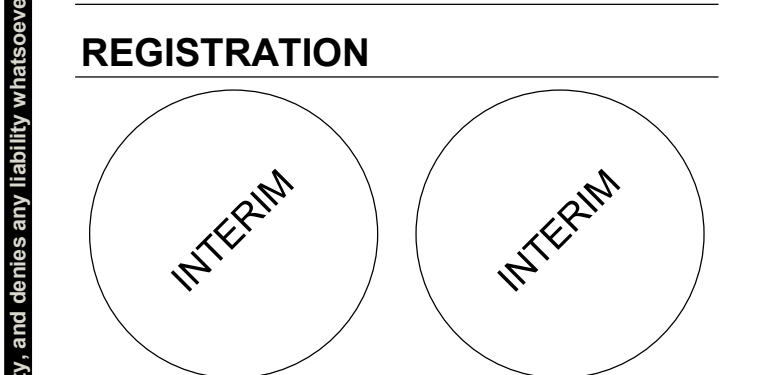


PROJECT  
GRIT BLAST UPGRADE  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT  
REGISTERED OWNER:  
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ISSUE/REVISION		
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1	ISSUED FOR TENDER	2023/07/28

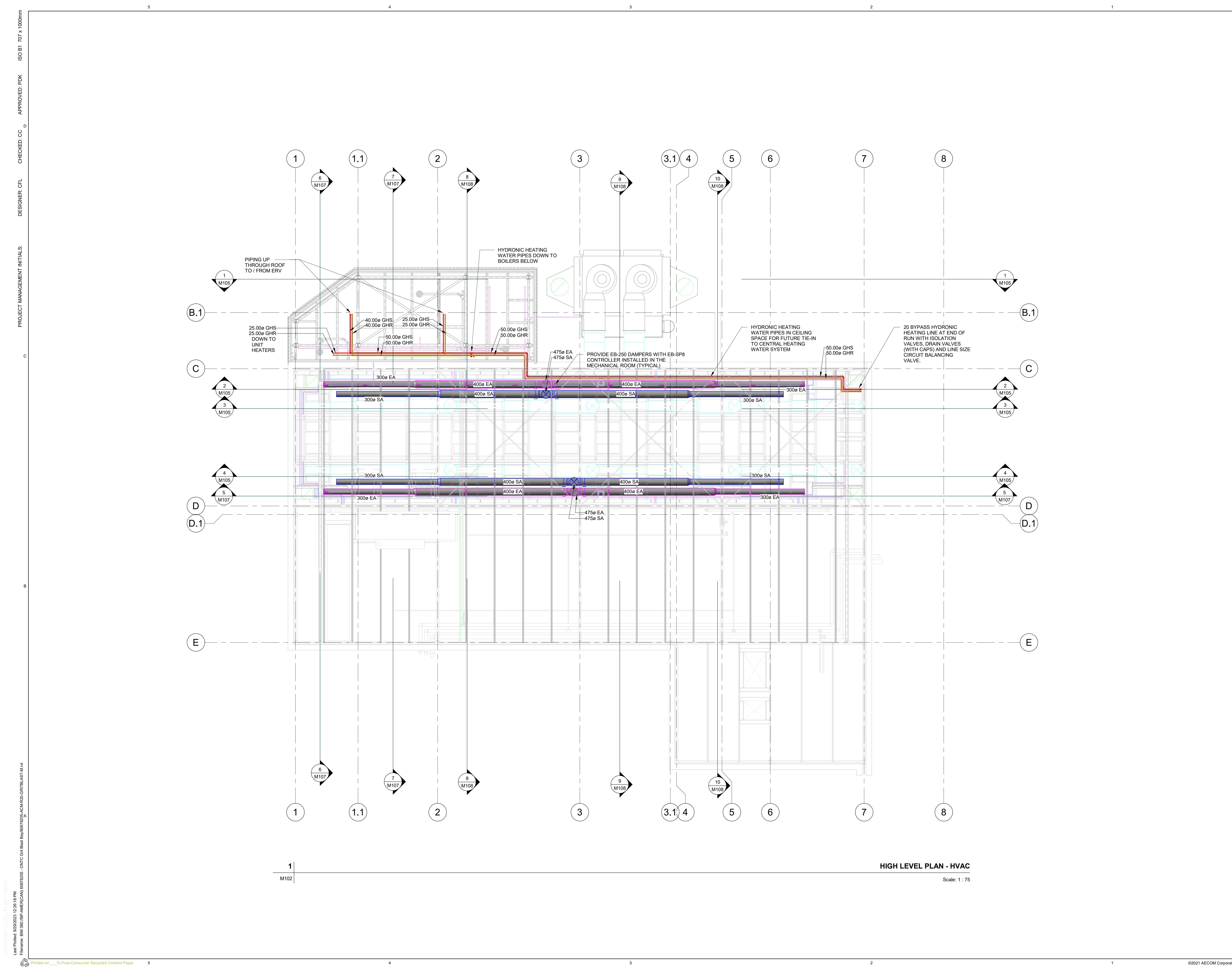
PROJECT NUMBER  
60678205

SHEET TITLE  
GROUND FLOOR PLAN - HVAC

SHEET NUMBER  
M101

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M102-HIGH LEVEL PLAN - HVAC  
Last Printed: 9/25/2023 12:26:18 PM  
Filename: BM-360-JBP-AMER(CAN) 60678205-ONTIC Oil Blast Bay\0678205-ACM-R20-GRITBLAST-M102

HIGH LEVEL PLAN - HVAC  
Scale: 1: 75

**PROJECT**

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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**REGISTRATION**

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**KEY PLAN**

SEE DRAWING FOR SCALE

**ISSUE/REVISION**

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/26

**PROJECT NUMBER**

60678205

**SHEET TITLE**

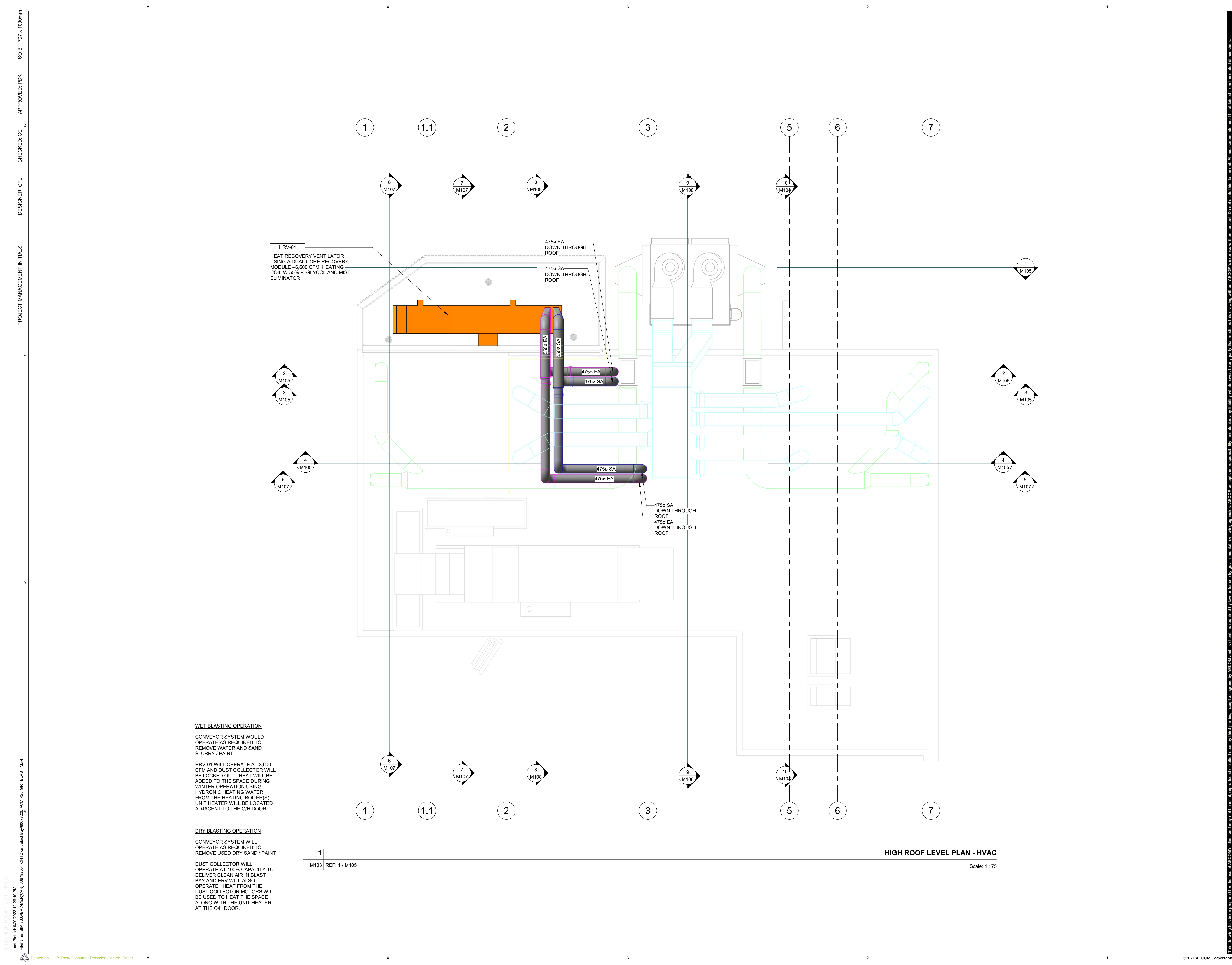
HIGH LEVEL PLAN - HVAC

**SHEET NUMBER**

M102

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**WET BLASTING OPERATION**  
CONVEYOR SYSTEM WOULD OPERATE AS REQUIRED TO REMOVE WATER AND SAND SLURRY / PAINT  
HRV-01 WILL OPERATE AT 3,600 CFM AND DUST COLLECTOR WILL BE LOCKED OUT. HEAT WILL BE ADDED TO THE SPACE DURING WINTER OPERATION USING HYDRONIC HEATING WATER FROM THE HEATING BOILER(S). UNIT HEATER WILL BE LOCATED ADJACENT TO THE O/H DOOR.

**DRY BLASTING OPERATION**  
CONVEYOR SYSTEM WILL OPERATE AS REQUIRED TO REMOVE USED DRY SAND / PAINT  
DUST COLLECTOR WILL OPERATE AT 100% CAPACITY TO DELIVER CLEAN AIR IN BLAST BAY AND ERV WILL ALSO OPERATE. HEAT FROM THE DUST COLLECTOR MOTORS WILL BE USED TO HEAT THE SPACE ALONG WITH THE UNIT HEATER AT THE O/H DOOR.

1  
M103 REF: 1 / M105

HIGH ROOF LEVEL PLAN - HVAC  
Scale: 1 : 75



PROJECT

GRIT BLAST UPGRADE  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

REGISTERED OWNER:  
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Fax: +1-905-886-9494  
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Email: gabriel.colombani@aecom.com

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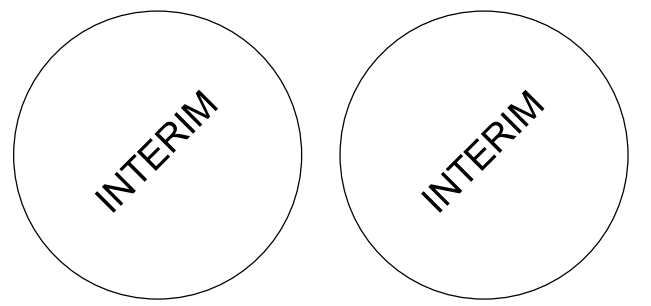
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REGISTRATION



KEY PLAN



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ISSUE/REVISION

No.	DESCRIPTION	DATE
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PROJECT NUMBER

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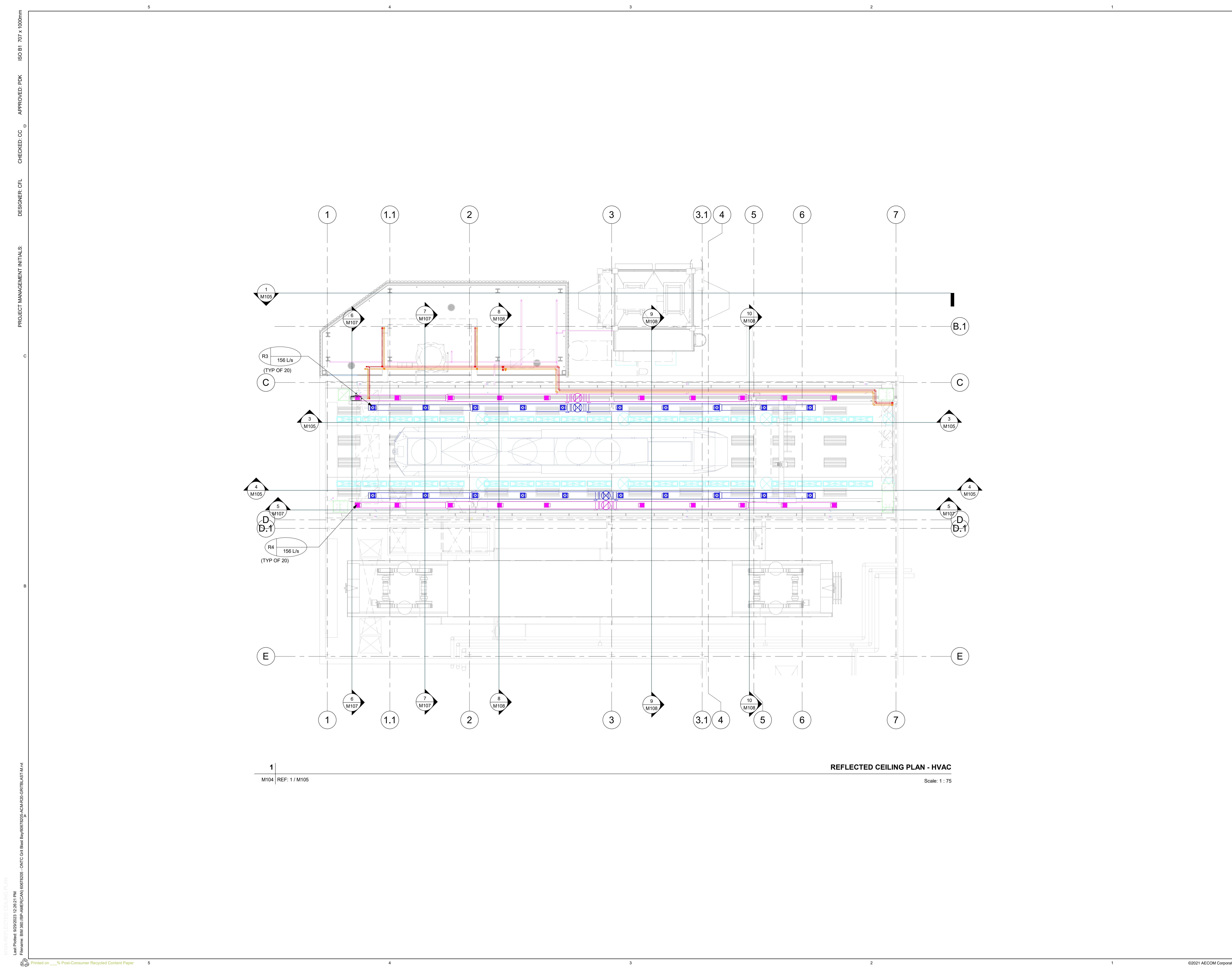
SHEET TITLE

HIGH ROOF PLAN - HVAC

SHEET NUMBER

M103





ISO B1 707 x 1000mm  
APPROVED: PKK  
DESIGNER: CFL  
PROJECT MANAGEMENT INITIALS:  
C  
B  
M104-REFLECTED CEILING PLAN  
Last Printed: 9/25/2023 12:28:21 PM  
Filename: BM\_360\_JRP-AMER(CAN)\_05078205 - ONTC Grl Blast Bay\05078205-ACM-R20-GRITBLAST-M104

# AECOM

**PROJECT**

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**

**REGISTERED OWNER:**  
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555 Oak Street East  
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**KEY PLAN**

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**ISSUE/REVISION**

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

**PROJECT NUMBER**

60678205

**SHEET TITLE**

REFLECTED CEILING PLAN

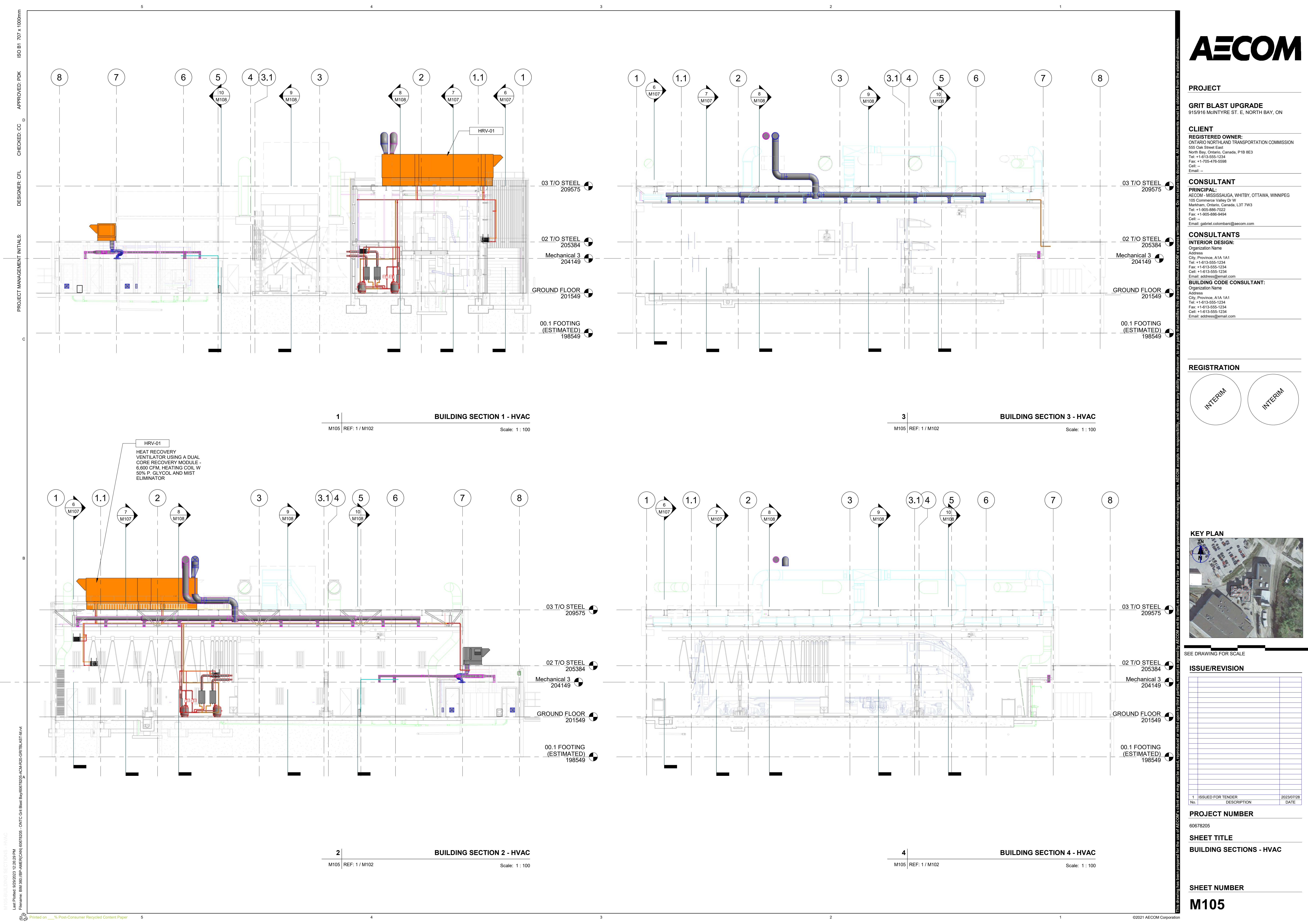
**SHEET NUMBER**

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APPROVED: PKK  
DESIGNER: CFL  
PROJECT MANAGEMENT INITIALS:  
Last Printed: 9/25/2023 12:26:29 PM  
Filename: BM\_360\_IJB-AMER(CAN)\_06078205 - ONTC Coll Blast Bay\06078205-ACM-R20-GRITBLAST-M105

# AECOM

**PROJECT**  
**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

**CLIENT**  
**REGISTERED OWNER:**  
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**REGISTRATION**

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**KEY PLAN**

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ISSUE/REVISION		
No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
BUILDING SECTIONS - HVAC

**SHEET NUMBER**  
M105

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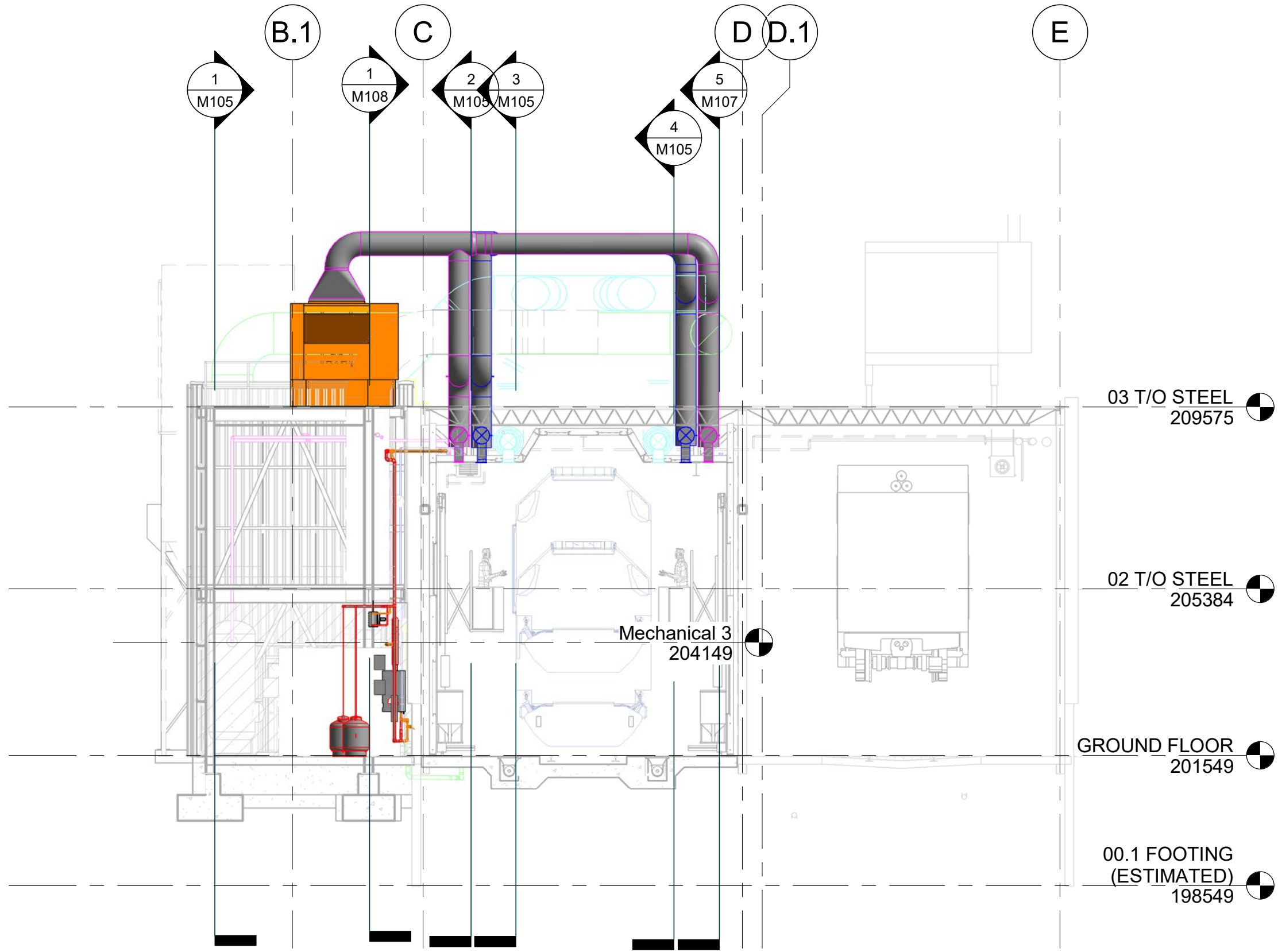




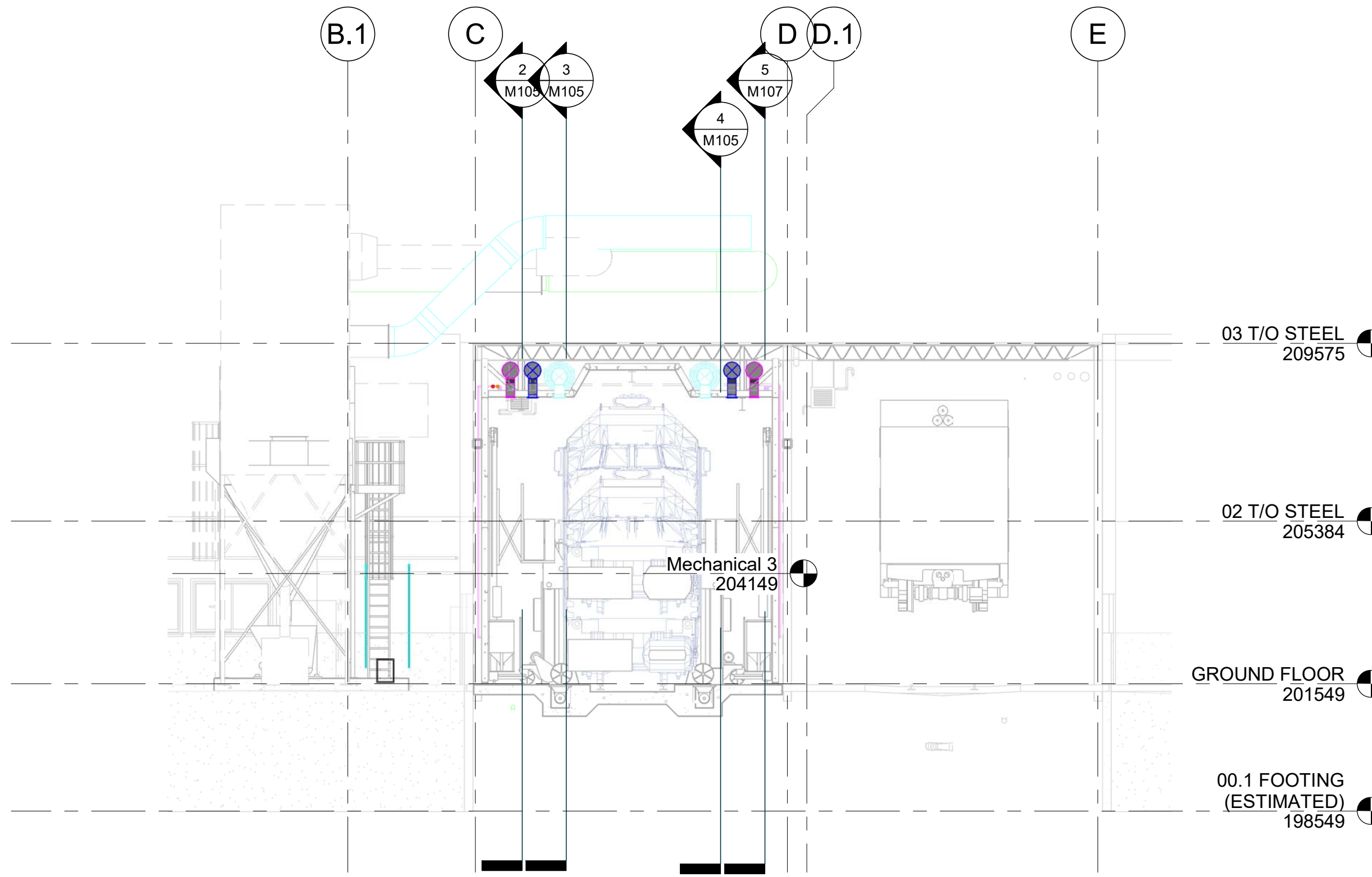




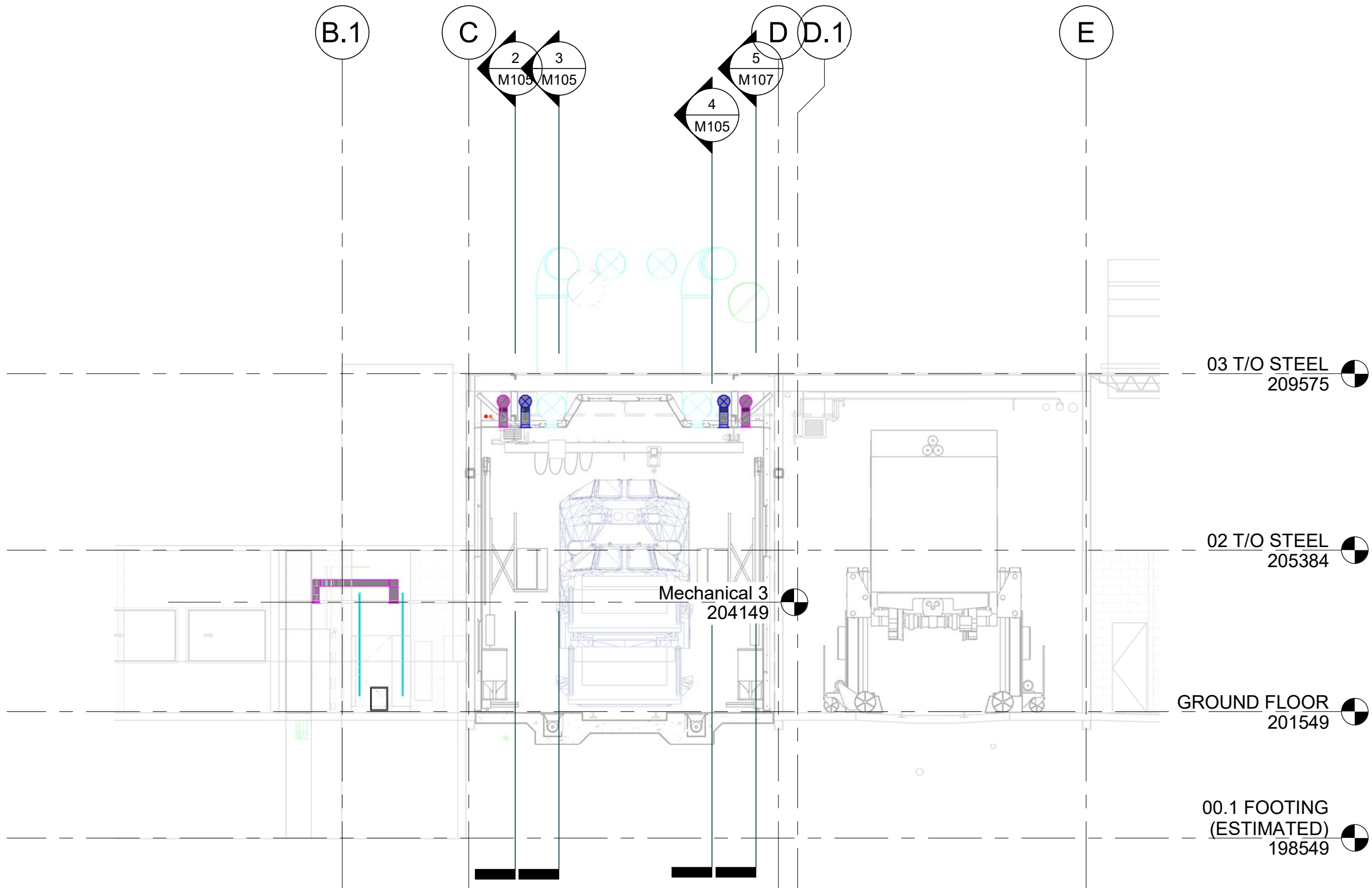




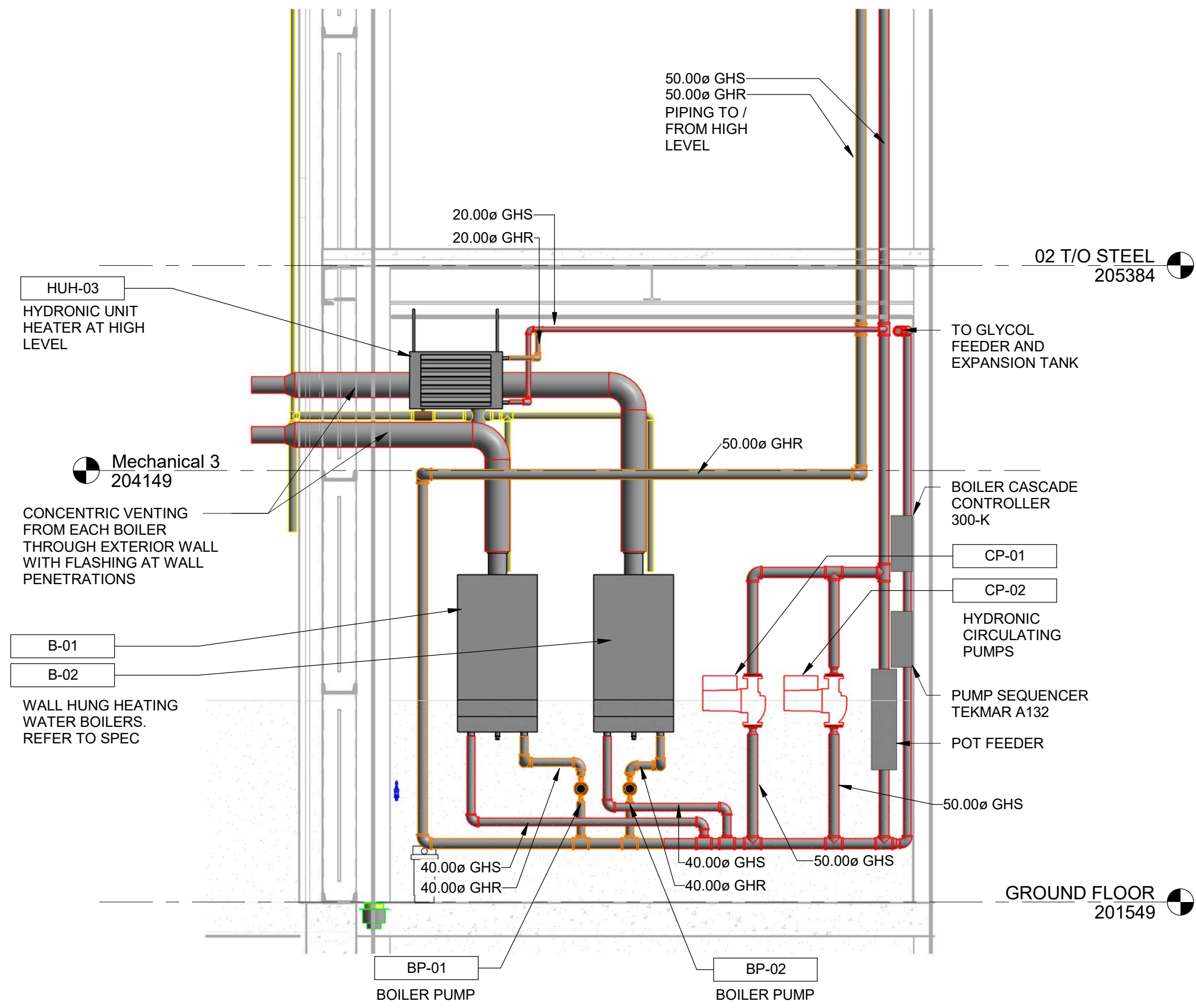
8 BUILDING SECTION 8 - HVAC  
M108 REF: 1 / M101 Scale: 1 : 100



9 BUILDING SECTION 9 - HVAC  
M108 REF: 1 / M101 Scale: 1 : 100



10 BUILDING SECTION 10 - HVAC  
M108 REF: 1 / M102 Scale: 1 : 100



1 BUILDING SECTION 11 - HVAC  
M108 REF: 2 / M101 Scale: 1 : 25

## PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

## CLIENT

**REGISTERED OWNER:**  
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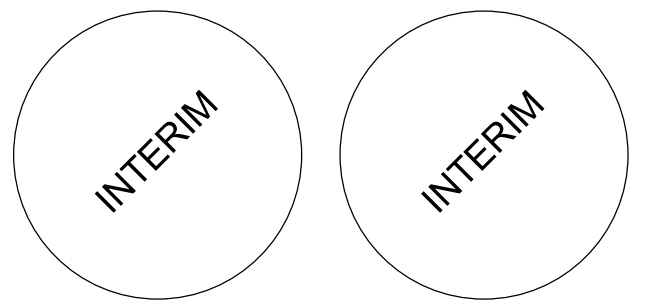
### INTERIOR DESIGN:

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## KEY PLAN



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## ISSUE/REVISION

No.	DESCRIPTION	DATE
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## PROJECT NUMBER

60678205

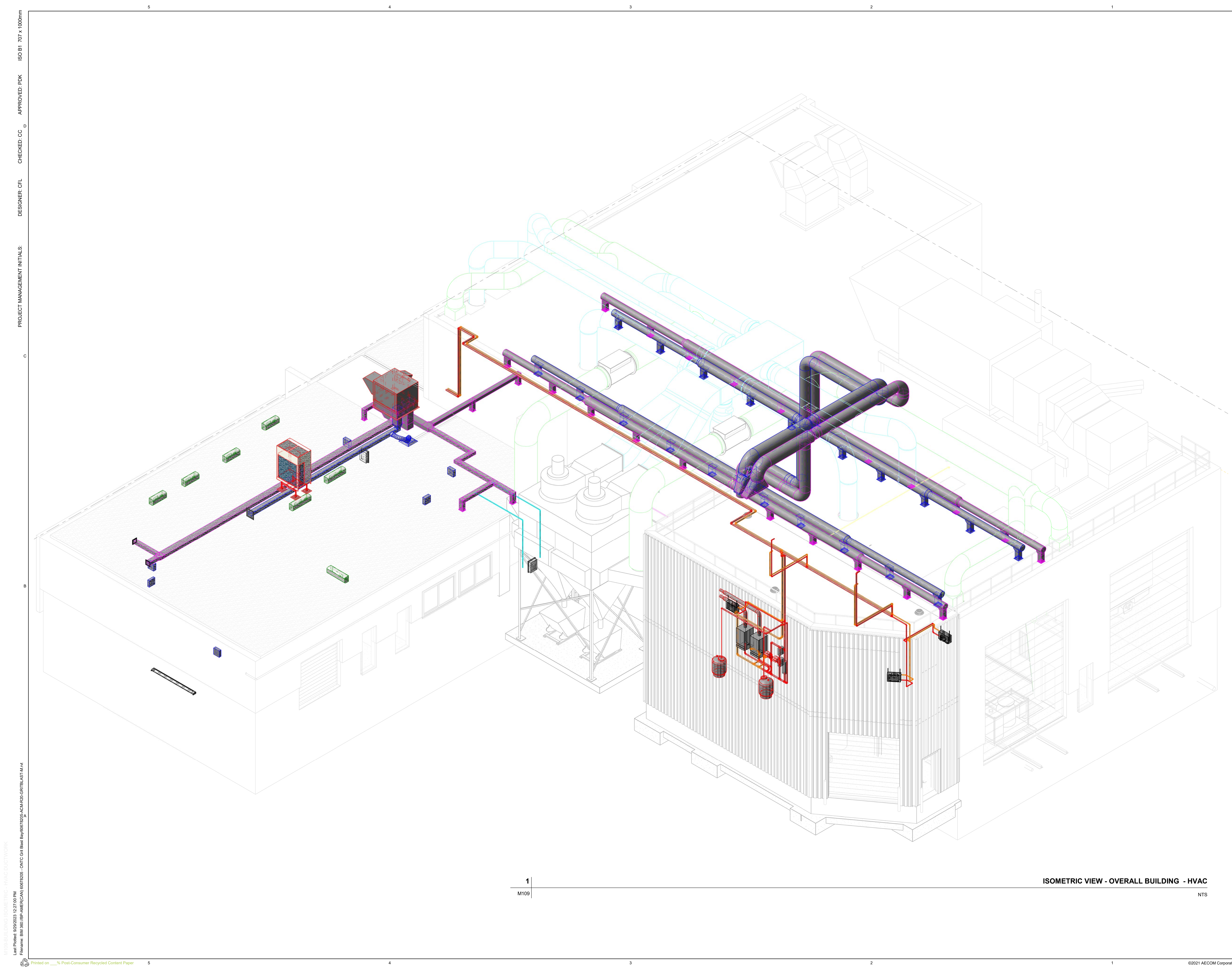
## SHEET TITLE

**BUILDING SECTIONS - HVAC**

## SHEET NUMBER

**M108**





ISO B1 707 x 100mm  
APPROVED: PDK  
DESIGNER: CFL  
PROJECT MANAGEMENT INITIALS:  
C  
B  
M109-BUILDING ISOMETRIC - HVAC DUCTWORK  
Last Printed: 9/25/2023 12:27:00 PM  
Filename: BM\_360\_JBP-AMER(CAN)\_60678205 - ONTC Grl Blast Bay\60678205-ACM-R20-GRITBLAST-M109

1  
M109

ISOMETRIC VIEW - OVERALL BUILDING - HVAC  
NTS



PROJECT

**GRIT BLAST UPGRADE**  
915/916 MCINTYRE ST. E. NORTH BAY, ON

CLIENT

**REGISTERED OWNER:**  
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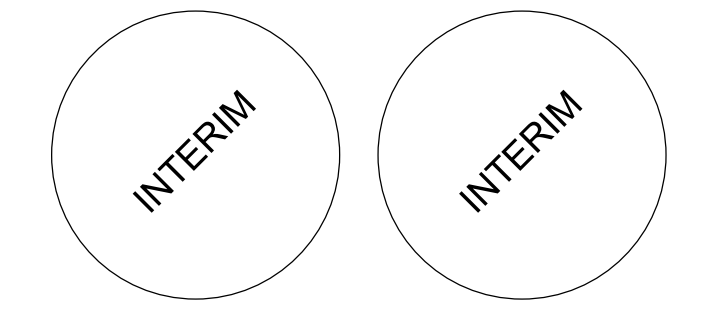
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REGISTRATION



KEY PLAN



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ISSUE/REVISION

No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/07/28

PROJECT NUMBER

60678205

SHEET TITLE

**BUILDING ISOMETRIC - HVAC  
DUCTWORK**

SHEET NUMBER

**M109**

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GENERAL				SUPPLY FAN SYSTEM / ARRAY																																
TAG	MANUFACTURER	MODEL	AREA SERVED	AIRFLOW TOTAL	EXTERNAL STATIC PRESSURE	TOTAL STATIC PRESSURE	QUANTITY OF FAN / MOTORS	AIRFLOW PER FAN	FAN / MOTOR TYPE	FAN ARRANGEMENT N (X) X H	FAN WHEEL SIZE	FAN MOTOR NOMINAL POWER	FAN MOTOR BRAKE POWER	FAN / MOTOR RPM	FAN / MOTOR DRIVE / CONTROL	BARE FAN SOUND POWER WITH COPLANER SILENCER (dB re: 10E-12 watts)																				
																INLET						OUTLET														
																	63	125	250	500	1K	2K	4K	8K	LwA	Lw	63	125	250	500	1K	2K	4K	8K	LwA	Lw
ERV-01	COOK	ERV-1500	OFFICES & WASHROOMS	354 L/s	186.82 Pa		1	354 L/s	---	1 X 1 ARRAY		0.4 kW		1153	COMMON VFD		77	75	79	76	76	72	69	63	80	84	81	87	76	72	69	67	63	58	77	
HRV-01	TEMPEFF	RGL-4000	BLASTING AREA	1699 L/s	912.22 Pa	970.48 Pa	1	1699 L/s	ANPA181TEAO	1 X 1 ARRAY	-	3.7 kW	0.0 kW	1755	COMMON VFD		77	75	79	76	76	72	69	63	80	84	81	87	76	72	69	67	63	58	77	

[illegible]

TAG	OUTPUT	PRE-HEATING COIL																OUTPUT	RE-HEATING COIL																	
		FLUID SIDE								GENERAL									FLUID SIDE								GENERAL									
		AIRFLOW PER COIL	NUMBER OF COILS	FACE VELOCITY	WIDTH (IN)	HEIGHT (IN) (PER COIL)	AIR PRESSURE DROP	MEDIUM	FLOW	EWT	LWT	MAXIMUM PRESSURE DROP	NUMBER OF ROWS	CONNECTION DIAMETER	FIN MATERIAL	FPI	TUBE DIA		TUBE MATERIAL	AIRFLOW PER COIL	NUMBER OF COILS	FACE VELOCITY	WIDTH (MM)	HEIGHT (MM) (PER COIL)	MAXIMUM PRESSURE DROP	MEDIUM	FLOW	EWT	LWT	MAXIMUM PRESSURE DROP	NUMBER OF ROWS	CONNECTION DIAMETER	FIN MATERIAL	FPI	TUBE DIA	TUBE MATERIAL
ERV-01	9.0 kW	354 L/s	1	0.203 m/s	305	305	0.00 Pa	ELECTRIC				0	0.00	ALUMINUM	0	0.00	COPPER	10.0 kW	354 L/s	1	0.000 m/s	406	406		ELECTRIC											
HRV-01	66.2 kW	1699 L/s	1	2.393 m/s	44	25	12.44 Pa	50 / 50 GLYCOL / WATER	1.58 L/s	71 °C	60 °C	15602.48 Pa	1	1.50	ALUMINUM	14	0.50	COPPER	20.8 kW	1699 L/s	1	2.393 m/s	44	25	9.95 Pa	50 / 50 GLYCOL / WATER	0.50 L/s	71 °C	60 °C	16678.51 Pa	1	0.75	ALUMINUM	14	0.50	COPPER

		ENERGY RECOVERY SECTION																																																			
ARRANGEMENT / TYPE		AIRSIDE						SUMMER																		WINTER																											
		AIR FLOW				MAX PRESSURE DROPS		OUTDOOR			SUPPLY			RETURN			EXHAUST			CAPACITY			EFFECTIVENESS (%)			OUTDOOR			SUPPLY			SUPPLY - DEFROST			RETURN			EXHAUST			EXHAUST - DEFROST			CAPACITY			EFFECTIVENESS (%)						
TAG		OUTDOOR	SUPPLY	RETURN	EXHAUST	OUTDOOR / SUPPLY	RETURN / EXHAUST	DBT	WBT	RH	DBT	WBT	RH	DBT	WBT	RH	DBT	WBT	RH	SENSE	LAT	TOT	SENSE	LAT	TOT	DBT	WBT	RH	DBT	WBT	RH	DBT	WBT	RH	DBT	WBT	RH	DBT	WBT	RH	SENSE	LAT	TOT	SENSE	LAT	TOT	FROST CONTROL						
ERV-01	WHEEL	354 L/s	354 L/s	354 L/s	354 L/s			28 °C	22 °C	61.2	24 °C	24 °C	52.8	24 °C	18 °C	50	27 °C	21 °C	59.3							-14 °C	-16 °C	29.2	16 °C	9 °C	42.5	0 °C	0 °C	0	22 °C	13 °C	35	-8 °C	-9 °C	73.5							17.7 kW						
HRV-01	ENERGY PLATE	1699 L/s	1699 L/s	1699 L/s	1699 L/s	151.79 Pa	151.79 Pa	33 °C	23 °C	45.4	27 °C	21 °C	62.4	-18 °C	-18 °C	0	26 °C	22 °C	78.3	11.8 kW	0.0 kW	11.8 kW	79.9	0	79.9	-1 °C	-7 °C	0	23 °C	15 °C	45	-18 °C	-18 °C	0	-18 °C	-13 °C	0	-24 °C	-24 °C	83	-18 °C	-18 °C	0	48.9 kW	39.6 kW		88.6 g	72.94	58.8	65.87	FACE AND BYPASS ON OUTDOOR AIR		

TAG	OUTDOOR AIR								RETURN AIR FILTER				ELECTRICAL		COMMENTS
	PRE-FILTER				GAS PHASE / FINAL FILTER				TYPE	DEPTH	MERV RATING	FACE VELOCITY	VOLTS	PHASE	
	TYPE	DEPTH	MERV RATING	FACE VELOCITY	TYPE	DEPTH	MERV RATING	FACE VELOCITY							
ERV-01	FLAT	0	8		FLAT	0	0		FLAT		8		460 V	3	ENERGY RECOVERY VENTILATOR INTERNAL BELT DRIVE ARR V. TWO SEPERATE POWER SUPPLY, 20 A FOR UNIT & 15 A FOR RE-HEATER TWO TIER HORIZONTAL
HRV-01	FLAT	51	10	2.027 m/s	FLAT	51	10	2.027 m/s	N/A	0	0	0.000 m/s	480 V	3	

TAG	LOCATION	MANUFACTURER	PRODUCT #	WATTS	ELECTRICAL		FREQUENCY	UNIT WEIGHT	COMMENTS
					VOLTAGE	PH			
EBBH-1	STORAGE AREA	OAC	ODI2008	2000	208 V	1	60	11 kg	

TAG	LOCATION	MANUFACTURER	PRODUCT #	PERFORMANCE	ELECTRICAL		FREQUENCY	UNIT WEIGHT	COMMENTS
				HEATING	VOLTAGE	PH			
EFFH-1	CORRIDOR	OAC	OAC02008-T	2.0 kW	208 V		60	11 kg	

TAG	LOCATION	MANUFACTURER	PRODUCT #	FLUID TYPE	PRESSURE (@101.7°C)	PERFORMANCE	ELEMENT	ELEMENT LENGTH (M)	E.A.T. (C)	COMMENTS
WF-1	WASHROOM	SIGMA CORP	SWE-30SS	STEAM	690.00 Pa	743 W/ M	24C12S	0.61	18	

TAG	ASSOCIATED CONDENSER	ROOM NAME	MANUFACTURER	MODEL	COOLING OUTPUT	HEAT OUTPUT	AIR FLOW	MAX SOUND LEVEL dB(A)	ELECTRICAL				UNIT WEIGHT	COMMENTS
									VOLTAG	PHASE	MCA	MOOP		
AC-1	CJ-1	ADMIN SPACE	Daikin	FXAQ18PVJU	5.3 kW	5.9 kW	235.97 L/s	43	230 V	1	0.4 A	15.0 A	14 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.
AC-2	CJ-1	CLERK & FOREMAN	Daikin	FXAQ18PVJU	2.2 kW	2.5 kW	76.5 L/s	36	230 V	1	0.4 A	15.0 A	12 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.
AC-3	CJ-1	CLERK & FOREMAN	Daikin	FXAQ18PVJU	2.2 kW	2.5 kW	76.5 L/s	36	230 V	1	0.4 A	15.0 A	12 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.
AC-4	CJ-1	FOREMAN'S OFFICE	Daikin	FXAQ18PVJU	2.2 kW	2.5 kW	76.5 L/s	36	230 V	1	0.4 A	15.0 A	12 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.
AC-5	CJ-1	FOREMAN'S OFFICE	Daikin	FXAQ18PVJU	2.2 kW	2.5 kW	76.5 L/s	36	230 V	1	0.4 A	15.0 A	12 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.
AC-6	CJ-1	LUNCH AREA	Daikin	FXAQ18PVJU	5.3 kW	5.9 kW	235.97 L/s	43	230 V	1	0.4 A	15.0 A	14 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.
AC-7	CJ-1	LUNCH AREA	Daikin	FXAQ18PVJU	5.3 kW	5.9 kW	235.97 L/s	43	230 V	1	0.4 A	15.0 A	14 kg	INDOOR UNIT C/W/ FIELD MOUNTED INTEGRAL CONDENSATE DRAIN PUMP. IF CONDENSATE PUMP FAILS INDOOR UNIT SHALL SHUT DOWN.

TAG	LOCATION	SERVING	MANUFACTURER	MODEL	PERFORMANCE		SOUND LEVEL (dBA)	ELECTRICAL				UNIT WEIGHT	COMMENTS
					COOLING	HEATING		VOLTAGE	PH	MCA	MCP		
CU-1	ROOF	INDOOR AC UNITS	Daikin	RXLQ72TATJA	21.1 kW	23.7 kW	79	460 V	3	61 A	70 A	330 kg	

TAG	LOCATION / AREA SERVED	AIRFLOW	HEATING CAP	COIL EWT	COIL LWT	FLUID TYPE	WATER PD	FAN CAP	HC FLOW	MOTOR RPM	VOLTAGES	PHASE	MCA	MOCP	COMMENTS
HUH-01	GRIT BLAST BAY NORTHWEST DOOR POCKET	576 Lbs	8.9 kW	71 °C	54 °C	50% PROP GLYCOL	62.05 Pa	93	0.13 L/s	1550	115 V	1	1.8 A	5.0 A	SUSPENDED, UNFUSED DISCONNECT, STARTER WITH OVERLOADS, PSC MOTOR, INTEGRAL THERMOSTAT, SPEED CONTROLLER, AQUASTAT, ADJUSTABLE VERTICAL FINS, WHITE PAINTED CABINET
HUH-02	RECLAIM AREA	576 Lbs	8.9 kW	71 °C	54 °C	50% PROP GLYCOL	62.05 Pa	93	0.13 L/s	1550	115 V	1	1.8 A	5.0 A	SUSPENDED, UNFUSED DISCONNECT, STARTER WITH OVERLOADS, PSC MOTOR, INTEGRAL THERMOSTAT, SPEED CONTROLLER, AQUASTAT, ADJUSTABLE VERTICAL FINS, WHITE PAINTED CABINET
HUH-03	M/E ROOM	576 Lbs	8.9 kW	71 °C	54 °C	50% PROP GLYCOL	62.05 Pa	93	0.13 L/s	1550	115 V	1	1.8 A	5.0 A	SUSPENDED, UNFUSED DISCONNECT, STARTER WITH OVERLOADS, PSC MOTOR, INTEGRAL THERMOSTAT, SPEED CONTROLLER, AQUASTAT, ADJUSTABLE VERTICAL FINS, WHITE PAINTED CABINET

TAG	FUNCTION	MANUFACTURER	MODEL	LOCATION	MEDIUM	FLOW	HEAD (M)	MOTOR POWER (W)	MOTOR RPM	VOLTAGE	PH	HZ	MCA	MCOP	COMMENTS
BP-01	BOILER PUMP	GRUNDFOS	UPS 28-150F	MECHANICAL ROOM	50% PROPYLENE GLYCOL	3.30 L/s	14	350		208 V	1	60	0 A	0 A	FLA 1.7 AMPS
BP-02	BOILER PUMP	GRUNDFOS	UPS 28-150F	MECHANICAL ROOM	50% PROPYLENE GLYCOL	3.30 L/s	14	350		208 V	1	60	0 A	0 A	FLA 1.7 AMPS
CP-01	HYDRONIC CIRCULATING PUMP	BELL & GOSSETT	ECOCIRC XL - 70-145	MECHANICAL ROOM	50% PROPYLENE GLYCOL	2.80 L/s	9.144	462	2444	230 V	1	60	0 A	0 A	CAST IRON ECOCIRC XL CIRCULATOR IS DESIGNED FOR CLOSED LOOP HYDRONIC HEATING AND COOLING SYSTEMS PUMPING WATER/GLYCOL MIX. FLA 6 AMPS
CP-02	HYDRONIC CIRCULATING PUMP	BELL & GOSSETT	ECOCIRC XL - 70-145	MECHANICAL ROOM	50% PROPYLENE GLYCOL	2.80 L/s	9.144	462	2444	230 V	1	60	0 A	0 A	CAST IRON ECOCIRC XL CIRCULATOR IS DESIGNED FOR CLOSED LOOP HYDRONIC HEATING AND COOLING SYSTEMS PUMPING WATER/GLYCOL MIX. FLA 6 AMPS

TAG	MANUFACTURER	MODEL	TYPE	LOCATION	FUEL	INPUT		OUTPUT		EFFICIENCY	ELECTRICAL	COMMENTS
						KW	KW	KW	KW			
B-01	VISSMANN	VITODENS 200-W	BOLIER	MECHANICAL ROOM	GAS	33-15	30-45	93.5%	120/160			WALL MOUNTED, GAS FIRED CONDENSING BOILER WITH MODULATING STAINLESS STEEL MATRIX CYLINDER BURNER, STAINLESS STEEL INOX-RADIAL HEAT EXCHANGER AND VITOTRONIC 20 HO1B CONTROL UNIT. PROVIDE UNIT WITH OUTDOOR TEMP SENSOR, PRESSURE RELIEF VALVE, LOW GAS PRESSURE SWITCH AND ACID NEUTRALIZING KIT
B-02	VISSMANN	VITODENS 200-W	BOLIER	MECHANICAL ROOM	GAS	33-15	30-45	93.5%	120/160			WALL MOUNTED, GAS FIRED CONDENSING BOILER WITH MODULATING STAINLESS STEEL MATRIX CYLINDER BURNER, STAINLESS STEEL INOX-RADIAL HEAT EXCHANGER AND VITOTRONIC 20 HO1B CONTROL UNIT. PROVIDE UNIT WITH OUTDOOR TEMP SENSOR, PRESSURE RELIEF VALVE, LOW GAS PRESSURE SWITCH AND ACID NEUTRALIZING KIT

TAG	MANUFACTURER	MODEL	TYPE	LOCATION	CAPACITY	ELECTRICAL	COMMENTS
GFT-1	AXIOM	SF-100	BLADDER TANK	MECHANICAL ROOM	208 L	115 VAC	

TAG	MANUFACTURER	TYPE	LOCATION	CAPACITY	COMMENTS
EXT-1	AMTROL	BLADDER TANK	MECHANICAL ROOM	200 L	

TAG	MANUFACTURER	FUNCTION	MODEL	COMMENTS
R3	PRICE INDUSTRIES	MODULAR INDUSTRIAL GRILLE	IMG1	
R4	PRICE INDUSTRIES	LOUVER FACE GRILLE RETURN	630 SERIES	
R5	PRICE INDUSTRIES	RETURN GRILLE	82 SERIES	
R6	PRICE INDUSTRIES	SQUARE CONE DIFFUSER	SCD	
R7	PRICE INDUSTRIES	CURVED VANE DIRECTIONAL DIFFUSER	CVD	
R8	PRICE INDUSTRIES	WALL GRILLE	635	



## PROJECT

**GRIT BLAST UPGRADE**  
915/916 McINTYRE ST. E, NORTH BAY, ON

**CLIENT**

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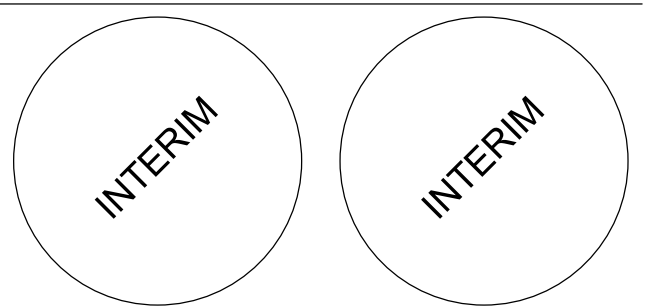
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## REGISTRATION



## KEY PLAN



SEE DRAWING FOR SCALE

### ISSUE/REVISION

[illegible]

## PROJECT NUMBER

60678205

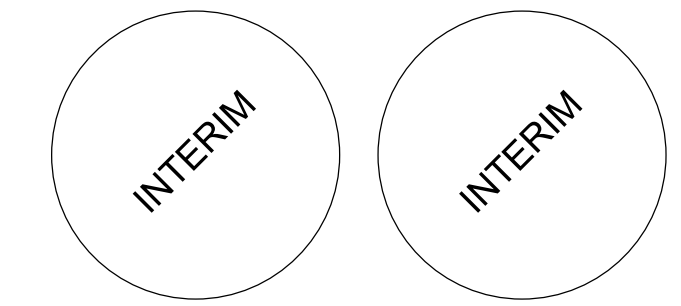
**SHEET TITLE**

## MECHANICAL EQUIPMENT SCHEDULES

**SHEET NUMBER**

## M110





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**ISSUE/REVISION**

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PROJECT NUMBER

60678205

**SHEET TITLE**

## HEATING AND CONTROL SCHEMATIC

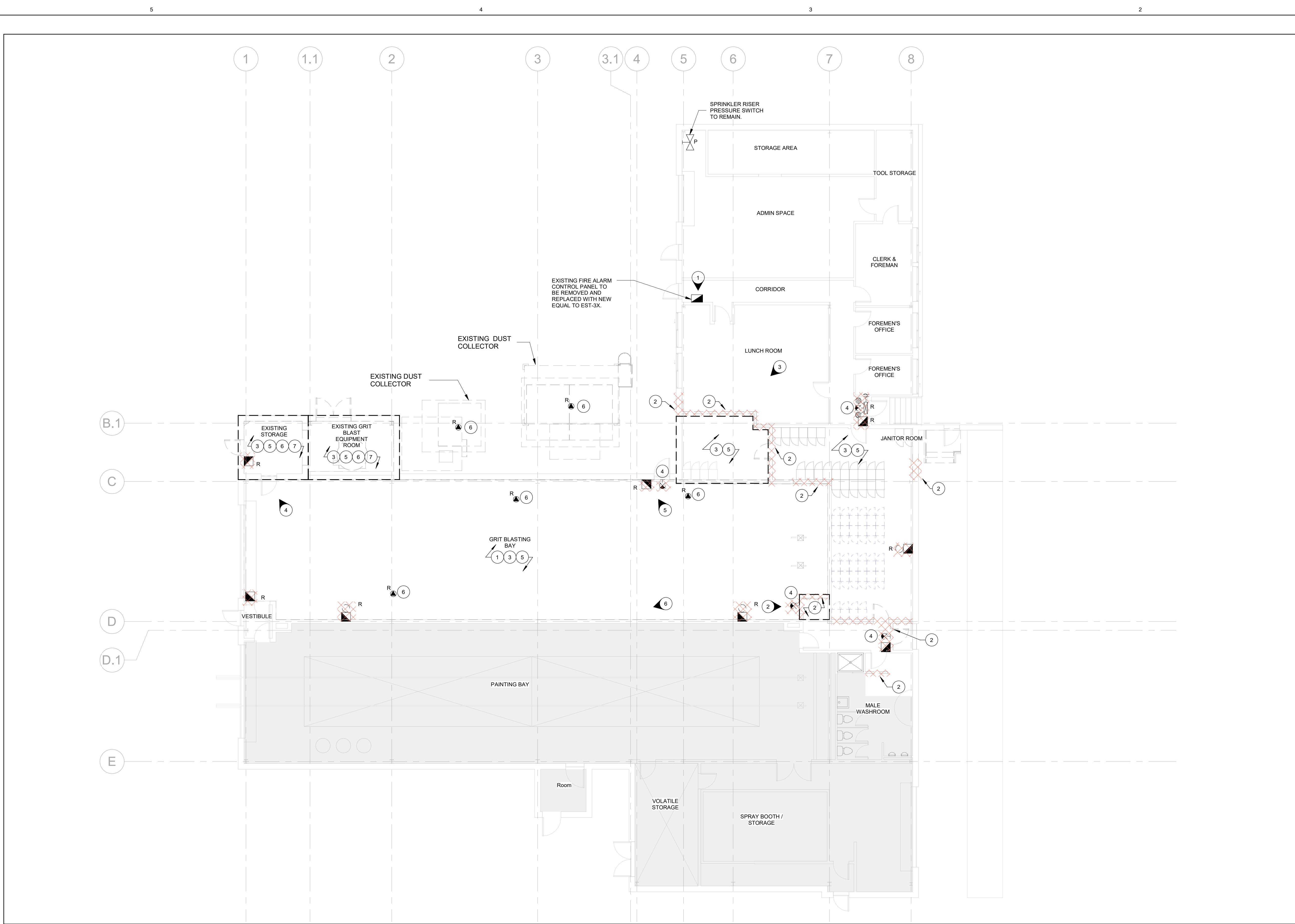
**SHEET NUMBER**

## M111









1  
E-201 REF: 2 / E-302  
GROUND FLOOR POWER AND LIGHTING REMOVAL PLAN  
Scale: 1 : 100

REMOVAL KEYNOTES	
NUMBER	KEYNOTE
1	DISCONNECT AND REMOVE DEVICES WITHIN BLAST BAY, INCLUDING EXISTING LIGHTING FIXTURES AND FIRE ALARM DEVICES. TEST AND INSPECT EXISTING POWER OUTLETS AND MAKE GOOD AS REQUIRED.
2	TYPICAL: DISCONNECT AND REMOVE ELECTRICAL DEVICES AND WIRING TO SUPPORT DEMOLITION OF WALL.
3	DISCONNECT AND REMOVE EXISTING LIGHT FIXTURES, WIRING AND ASSOCIATED CONTROLS BACK TO SOURCE.
4	DISCONNECT AND REMOVE EXIT AND EMERGENCY LIGHT. TEST AND INSPECT EXISTING CIRCUIT. RETAIN CIRCUIT IF SUITABLE.
5	DISCONNECT AND REMOVE EXISTING FIRE ALARM DEVICES (BELLS, PULL STATION, ETC.), TO BE REPLACED WITH NEW. RETAIN WIRING IF SUITABLE, AND CONNECT TO NEW FIRE ALARM CONTROL PANEL.
6	DISCONNECT AND REMOVE WIRING FOR PROCESS AND MECHANICAL EQUIPMENT THROUGH CONTROL PANELS (INCLUSIVE OF DISCONNECTS AND MAINTENANCE RECEPTACLES WHERE APPLICABLE). COORDINATE REMOVALS WITH MECHANICAL TRADES.
7	NOTED AREAS ARE TO UNDERGO COMPLETE DEMOLITION. DISCONNECT AND REMOVE ALL ELECTRICAL SYSTEMS AND DEVICES TO SUPPORT THIS DEMOLITION.



1 FIRE ALARM PANEL



2 GRIT BLAST



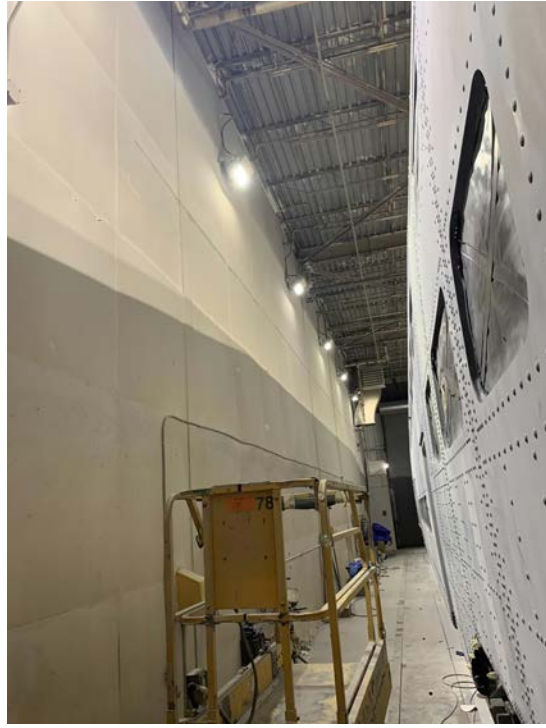
3 LUNCH ROOM



4 GRIT BLAST



5 GRIT BLAST



5 GRIT BLAST



6 2ND FLOOR ELECTRICAL ROOM



## PROJECT

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E., NORTH BAY, ON

## CLIENT

**REGISTERED OWNER:**  
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## REGISTRATION

## KEY PLAN



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## ISSUE/REVISION

ISSUED FOR TENDER	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/09/29

## PROJECT NUMBER

60678205

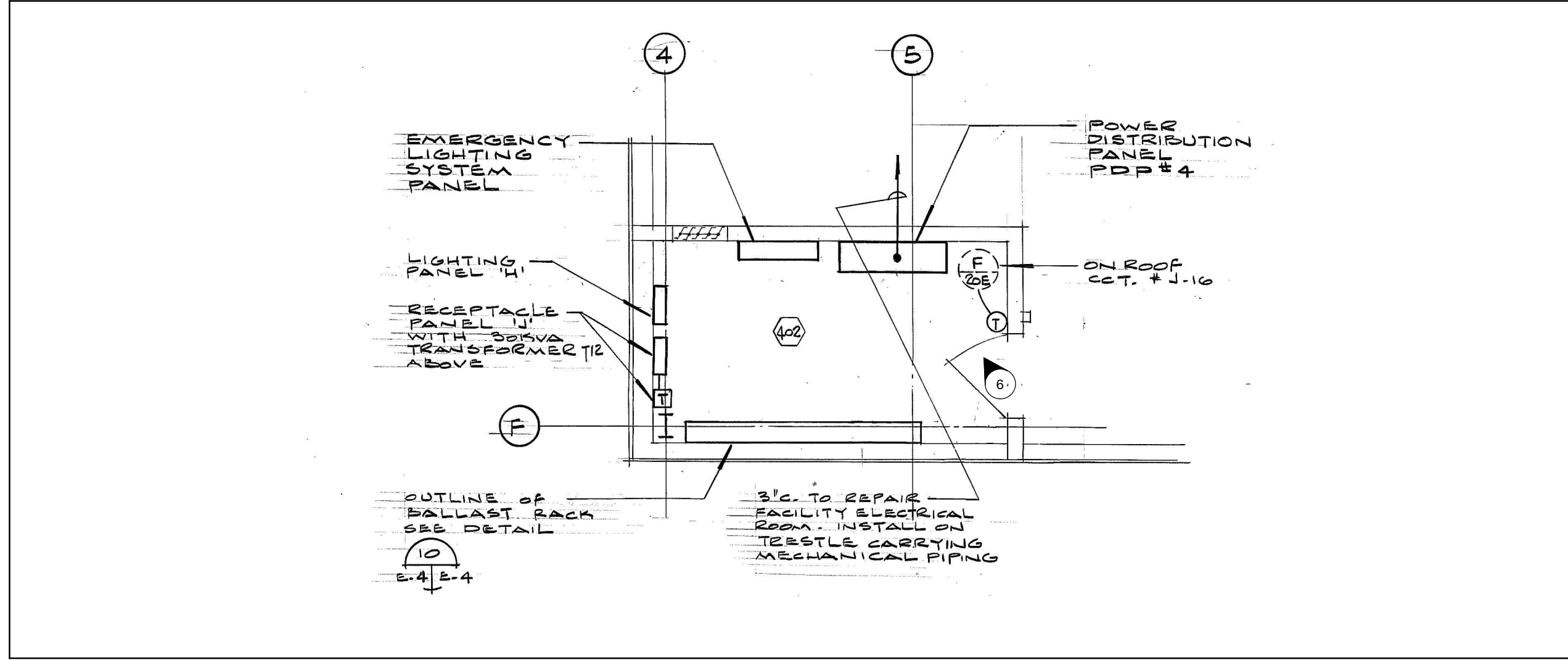
## SHEET TITLE

**GROUND FLOOR POWER AND  
LIGHTING REMOVAL PLAN**

## SHEET NUMBER

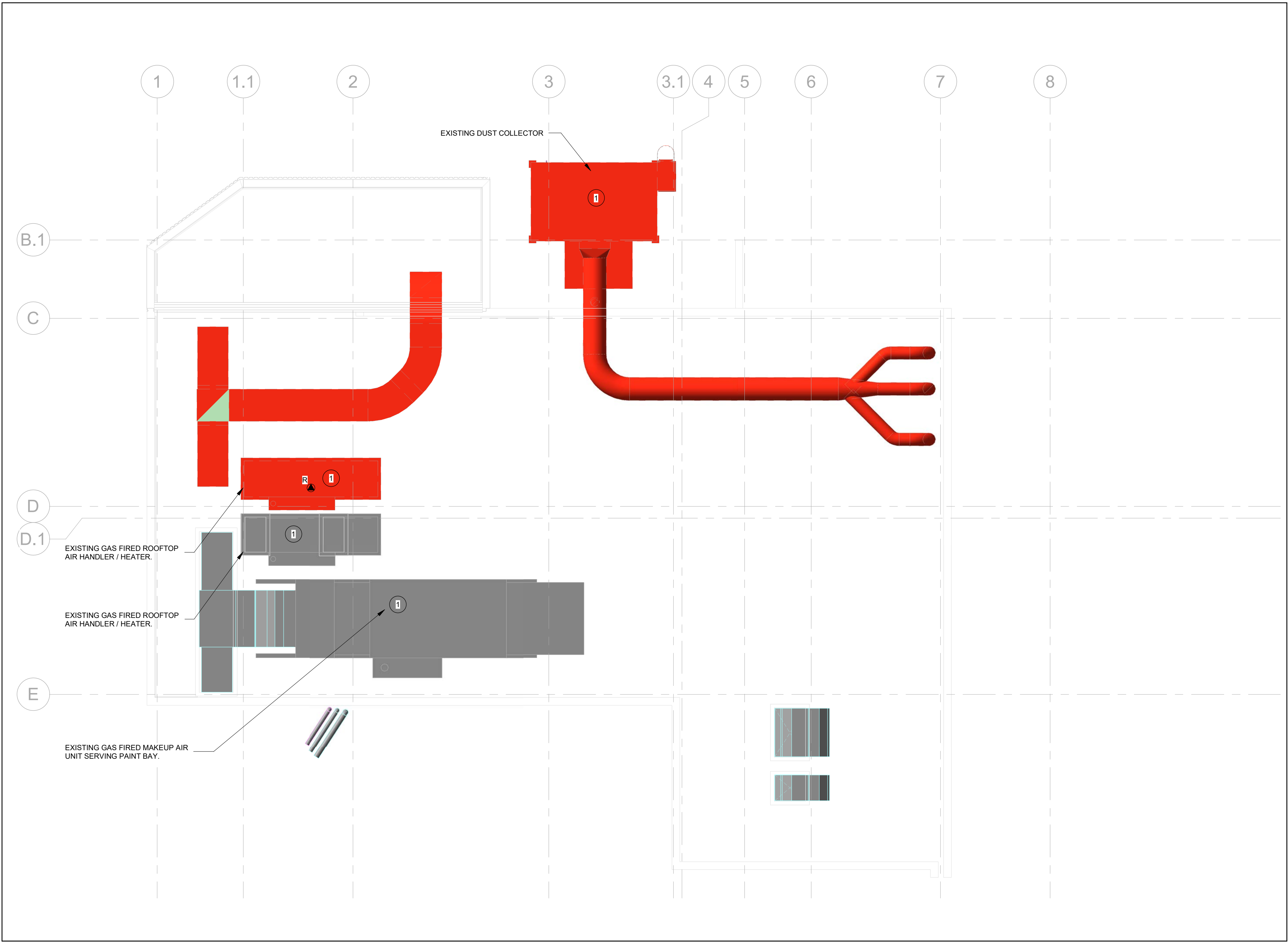
**E-201**

PURPOSE, DESIGN INTENT AND SCOPE OF WORK:	
EXISTING GRIT BLAST SHOP TO BE RENOVATED WITH NEW EQUIPMENT TO SUPPORT THE GRIT BLAST PROCESS, ALONG WITH REPLACEMENT OF EXISTING GRIT BLAST STORAGE AND EQUIPMENT ROOMS AND RENOVATIONS TO SUPPORT SPACES AROUND THE GRIT BLAST BAY. ELECTRICAL SCOPE OF WORK TO INCLUDE:	
<b>A. LIGHTING</b> <ul style="list-style-type: none"><li>REMOVAL OF EXISTING LIGHTING AND LIGHTING CONTROLS WITHIN GRIT BLAST BAY AND OTHER NOTED AREAS OF WORK.</li><li>PROVIDE NEW LIGHTING AND LIGHTING CONTROLS WITHIN GRIT BLAST BAY AND OTHER NOTED AREA OF WORK.</li></ul>	<b>E. POWER CONNECTION TO HVAC</b> <ul style="list-style-type: none"><li>DISCONNECT POWER CONNECTION TO EXISTING HVAC UNITS BEING DEMOLISHED.</li><li>PROVIDE CONNECTION TO NEW HVAC UNITS</li></ul>
<b>B. FIRE ALARM</b> <ul style="list-style-type: none"><li>DISCONNECT AND REMOVE EXISTING FIRE ALARM DEVICES LOCATED WITHIN THE AREA OF WORK, TO BE REPLACED WITH NEW, AS INDICATED ON PLANS.</li><li>DISCONNECT AND REMOVE EXISTING FIRE ALARM CONTROL PANEL AND REPLACE WITH NEW, EQUAL TO EST-3X. CONNECT EXISTING TO REMAIN, AND NEW DEVICES.</li><li>PROVIDE COMPLETE FIRE ALARM TESTING AND VERIFICATION IN ACCORDANCE WITH THE LATEST EDITION OF ULC 5537.</li><li>PROVIDE INTEGRATED SYSTEMS TESTING IN ACCORDANCE WITH ULC S1001.</li></ul>	<b>F. POWER CONNECTION TO PROCESS EQUIPMENT</b> <ul style="list-style-type: none"><li>DISCONNECT POWER CONNECTION TO EXISTING GRIT BLAST PROCESS EQUIPMENT BEING DEMOLISHED.</li><li>PROVIDE POWER CONNECTION TO NEW GRIT BLAST EQUIPMENT.</li><li>PROVIDE RECEPTACLES WITHIN AREA OF WORK SATISFYING OESC.</li><li>ALL DEVICES INTENDED TO BE EXISTING TO REMAIN THAT ARE WITHIN THE AREA OF WORK SHALL BE TESTED, INSPECTED AND MADE GOOD AS REQUIRED.</li></ul>
<b>C. PUBLIC ACCESS</b> <ul style="list-style-type: none"><li>DISCONNECT EXISTING PUBLIC ACCESS DEVICES TO SUPPORT CONSTRUCTION ACTIVITIES. RE-INSTATE PUBLIC ACCESS DEVICES ONCE CONSTRUCTION ACTIVITIES COMPLETE.</li></ul>	<b>G. POWER GENERAL/MISCELLANEOUS</b> <ul style="list-style-type: none"><li>CARRY AN ALLOWANCE FOR ADDITIONAL RECEPTACLES (TO BE FED FROM SPARE BREAKERS AT PP-2A) AS FOLLOWS:<ul style="list-style-type: none"><li>(2) IN RECLAIM ROOM</li><li>(2) IN ME ROOM</li><li>(2) IN GRIT BLAST BAY</li></ul></li></ul>
<b>D. DISTRIBUTION</b> <ul style="list-style-type: none"><li>PROVIDE NEW PANELBOARDS, TRANSFORMERS, STARTERS AND OTHER COMPONENTS AS ILLUSTRATED ON THE SINGLE LINE DIAGRAM.</li></ul>	



2  
E-201  
2ND FLOOR ELECTRICAL ROOM  
Scale: N.T.S.





**1** ROOF REMOVAL POWER PLAN  
E-202 REF: 2 / E-302 Scale: 1 : 100

ROOF REMOVAL POWER PLAN KEYNOTES	
NUMBER	KEYNOTE
1	DISCONNECT AND REMOVE WIRING FOR PROCESS AND MECHANICAL EQUIPMENT THROUGH CONTROL PANELS (INCLUSIVE OF DISCONNECTS AND MAINTENANCE RECEPTACLES WHERE APPLICABLE). COORDINATE REMOVALS WITH MECHANICAL TRADES.



PROJECT

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E., NORTH BAY, ON

CLIENT

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REGISTRATION

KEY PLAN



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No.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	2023/09/29

PROJECT NUMBER

60678205

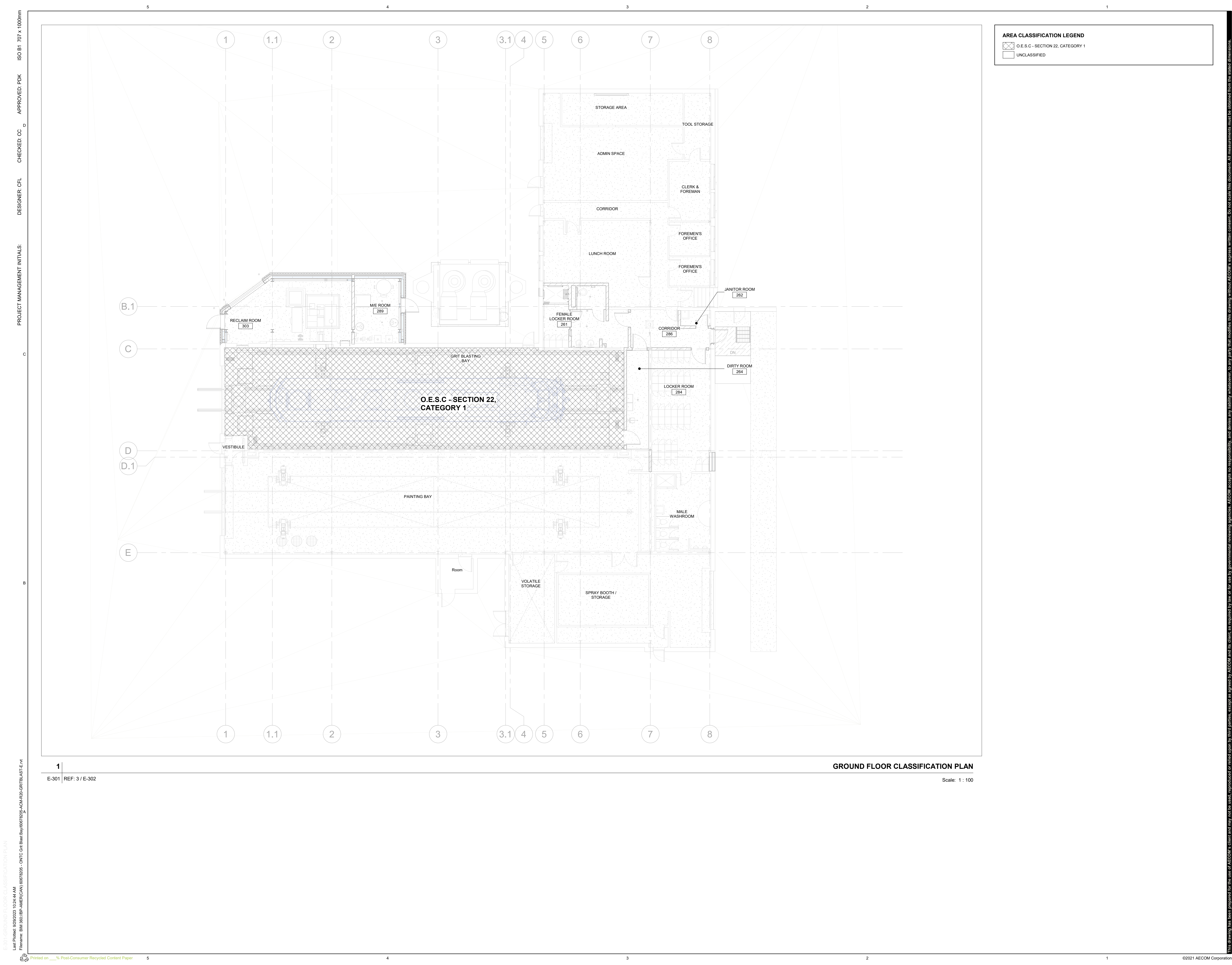
SHEET TITLE

ROOF REMOVAL POWER PLAN

SHEET NUMBER

E-202





PROJECT

**BLAST BAY UPGRADE**  
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KEY PLAN



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SHEET TITLE

**GROUND FLOOR  
CLASSIFICATION PLAN**

SHEET NUMBER

**E-301**













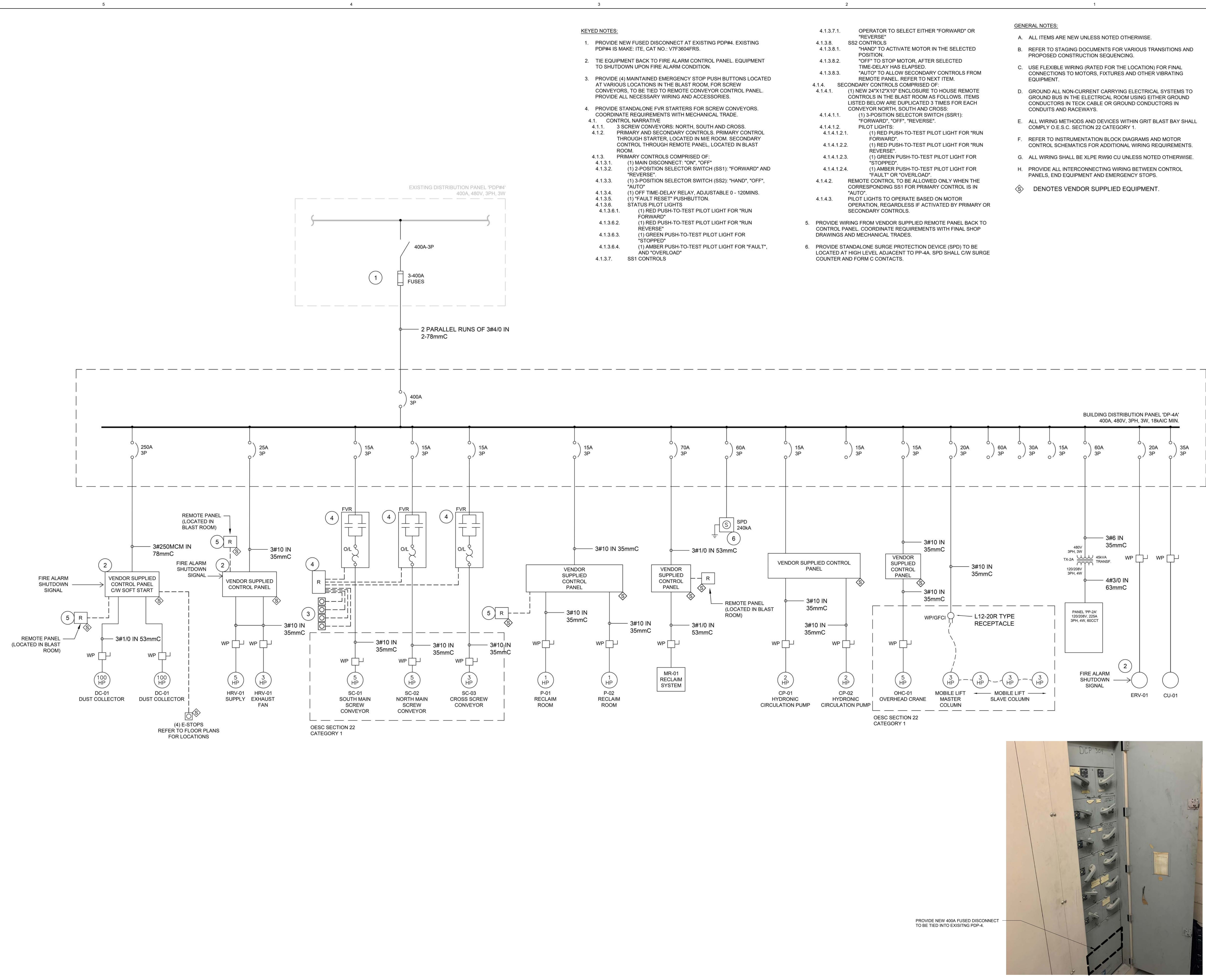










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**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
FIRE ALARM RISER DIAGRAM

**SHEET NUMBER**  
E-403

**FIRE ALARM INTENT AND SCOPE OF WORK:**

1. DISCONNECT AND REMOVE EXISTING FIRE ALARM DEVICES LOCATED WITHIN THE AREA OF WORK, TO BE REPLACED WITH NEW, AS INDICATED ON PLANS.
2. DISCONNECT AND REMOVE EXISTING FIRE ALARM CONTROL PANEL AND REPLACE WITH NEW, EQUAL TO EST-3X. CONNECT EXISTING TO REMAIN, AND NEW DEVICES.
3. PROVIDE COMPLETE FIRE ALARM TESTING AND VERIFICATION IN ACCORDANCE WITH THE LATEST EDITION OF ULC S637.
4. PROVIDE INTEGRATED SYSTEMS TESTING IN ACCORDANCE WITH ULC S1001.

**NOTES:**

1. ENTIRE ALARM SYSTEM SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH CANULC-5524 AND CANULC 5537, APPLICABLE EDITIONS. ALLOW FOR (2) TEST PERIODS TO SUIT PROJECT PHASING.
2. REFER TO FLOOR PLAN FOR ACTUAL QUANTITIES OF DEVICES.
3. REFER TO APPROVED SPRINKLER CONTRACTOR DRAWINGS FOR EXACT LOCATION AND QUANTITIES OF MONITORED SPRINKLER EQUIPMENT.
4. MOUNT MANUAL PULL STATIONS SO THAT THE CENTER IS 1200mm AFF.
5. MOUNT WALL MOUNTED AUDIBLE SIGNAL DEVICES SO THAT THE TOP IS NOT LESS THAN 150mm BELOW FINISHED CEILING AND LESS THAN 2300mm AFF.

**CLIENT**  
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**REGISTRATION**

**KEY PLAN**

SEE DRAWING FOR SCALE

**PROJECT NUMBER**  
60678205

**SHEET TITLE**  
FIRE ALARM RISER DIAGRAM

**SHEET NUMBER**  
E-403

**PROJECT**

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

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**SHEET TITLE**  
FIRE ALARM RISER DIAGRAM

**SHEET NUMBER**  
E-403

**PROJECT**

**BLAST BAY UPGRADE**  
915/916 MCINTYRE ST. E, NORTH BAY, ON

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**REGISTRATION**

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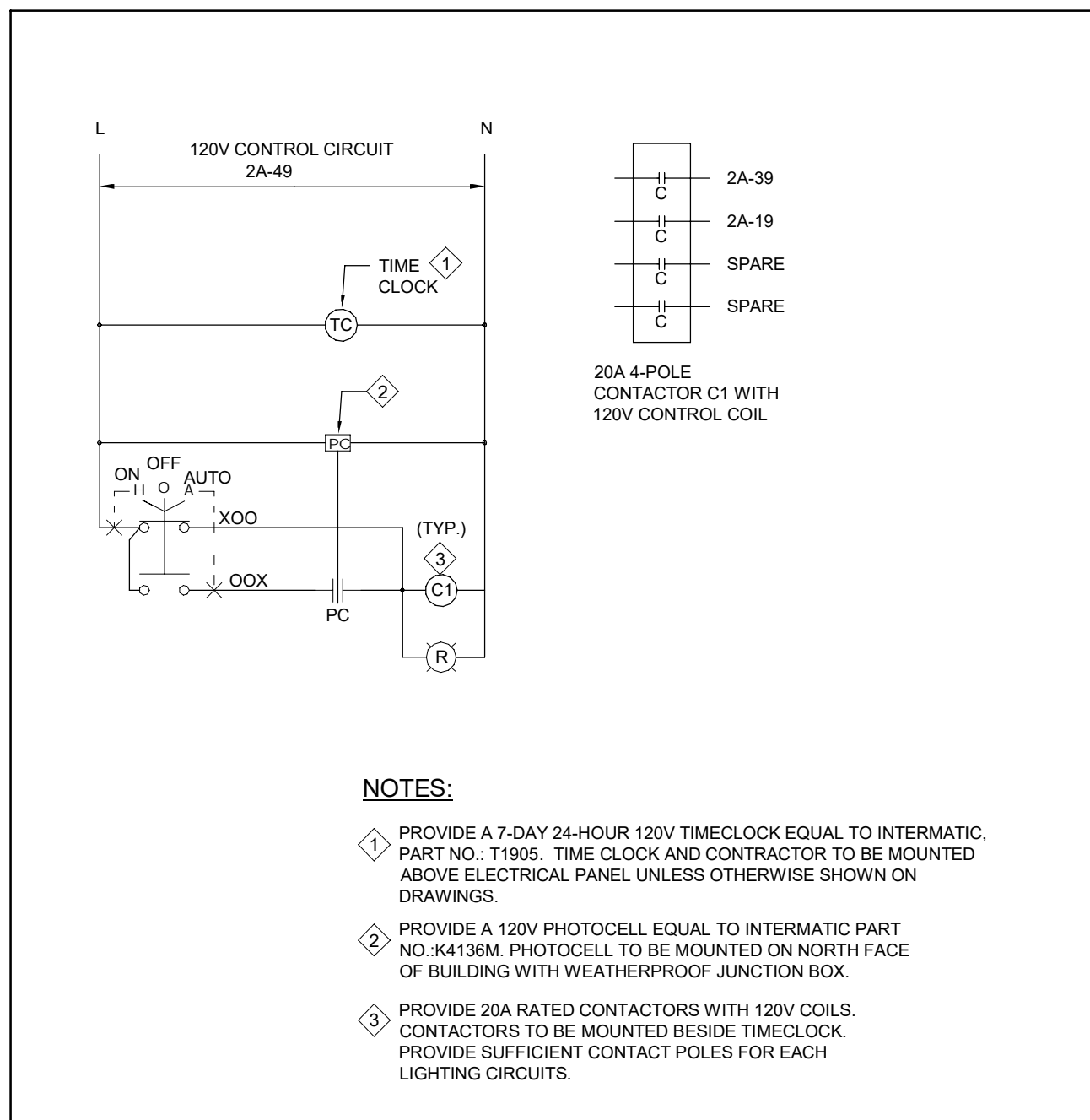
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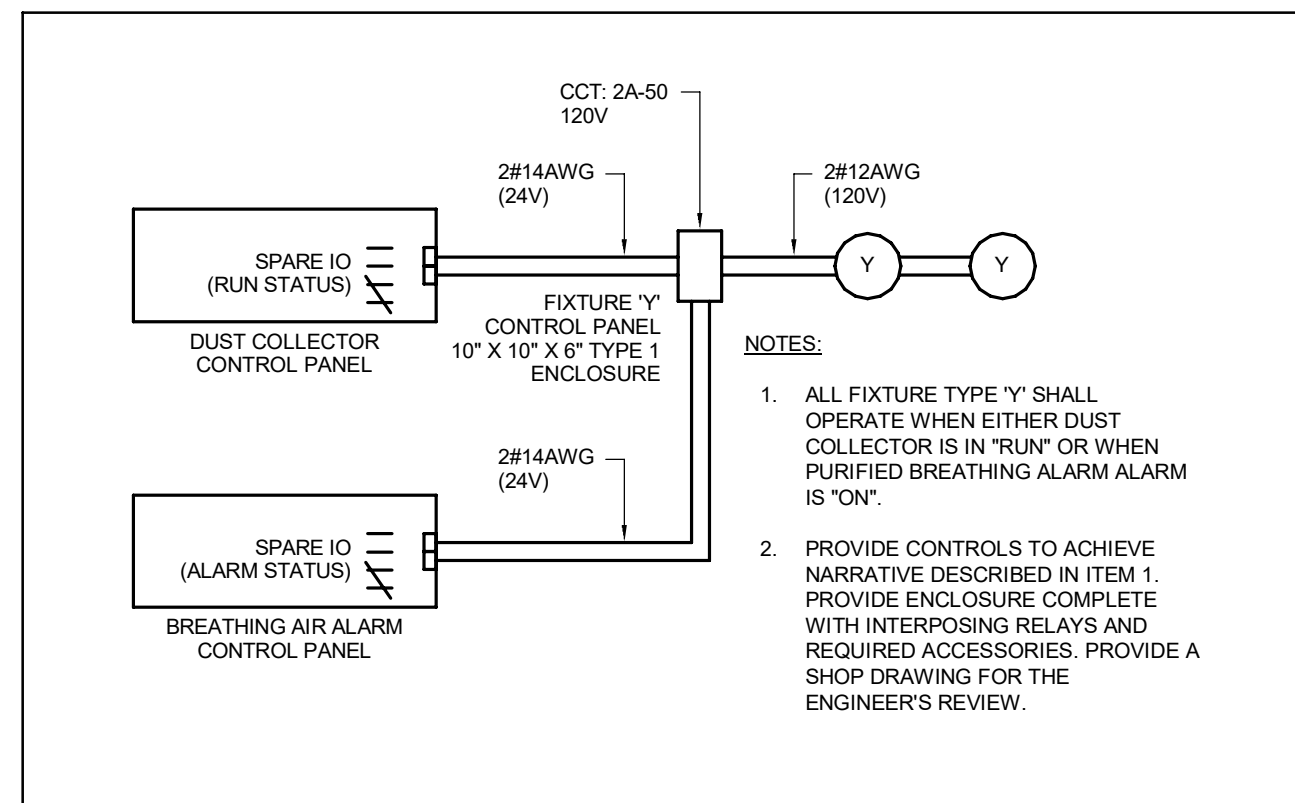
**SHEET TITLE**  
FIRE ALARM RISER DIAGRAM

**SHEET NUMBER**  
E-403
















1	EXTERIOR LIGHTING CONTROL SCHEMATIC
E-501	Scale: N.T.S.



2	<b>FIXTURE 'Y' CONTROL BLOCK DIAGRAM</b>
E-501	Scale: N.T.S.





SITE LIGHTING FIXTURE SCHEDULE										
TYPE	IMAGE	MANUFACTURER / MODEL	DESCRIPTION	INPUT WATTS	VOLT	CCT	LAMP	MOUNTING	CAT.#	NOTES
W		COOPER / GWC OR APPROVED EQUAL	4874 LUMEN	34W	120	4000	LED	WALL MOUNTED @ 9" (2743mm) UNLESS NOTED OTHERWISE	GWC-SA1A-740-U-SL2- AP-BPC-QA/RA1013	LED WALL MOUNT LIGHT FIXTURE C/W PHOTO CONTROL.

INTERIOR LIGHTING FIXTURE SCHEDULE									
TYPE	IMAGE	MANUFACTURER / MODEL	DESCRIPTION	INPUT WATTS	VOLT	LAMP	MOUNTING	CAT.#	NOTES
A1		COOPER / METALUX 24AC OR APPROVED EQUAL	4620 LUMEN	40W	120	LED	CEILING RECESSED	24FPSL2SCT3 C/W DF-24W-U	2'x4' (609.6MMx1219.2MM) LED FLAT PANEL C/W DRYWALL FRAM KIT.
A2		COOPER / METALUX 22AC OR APPROVED EQUAL	2460 LUMEN	22W	120	LED	GRID RECESSED	22FPSL2SCT3	2'x2' (609.6MMx609.6MM) LED FLAT PANEL.
B1		COOPER / HALO COMMERCIAL OR APPROVED EQUAL	1271 LUMEN	15W	120	LED	RECESSED	SMD6R-12-9S-WH	6" (152.4MM) ROUND POT LIGHT. LIGHT FIXTURE IS WATER RESISTANT.
B2		COOPER / HALO COMMERCIAL OR APPROVED EQUAL	1271 LUMEN	15W	120	LED	RECESSED	SMD6R-12-9S-WH	6" (152.4MM) ROUND POT LIGHT. LIGHT FIXTURE IS WATER RESISTANT.
D1		COLUMBIA OR APPROVED EQUAL	5170 LUMEN	42W	120	LED	SUSPENDEED	LXEM4-40ML-RA-EU C/W XEHC	4'x7" (1219.2MMx177.8MM) LED LIGHT FIXTURE C/W CHAIN HANGER KIT.
D2		COLUMBIA OR APPROVED EQUAL	5170 LUMEN	42W	120	LED	SUSPENDEED	LXEM4-40ML-RA-EU C/W XEHC	4'x7" (1219.2MMx177.8MM) LED LIGHT FIXTURE C/W CHAIN HANGER KIT.
F		PEERLESS OR APPROVED EQUAL	4200 LUMEN	35W	120	LED	SUSPENDEED	AP2W-4-42-40K-A1-LT-P-C6-N-MV	51.75"x6.75" (1314.45MMx171.45MM) LED LIGHT FIXTURE C/W 12FT POWER CORD.
G		LDPI	5450 LUMEN	43W	120	LED	RECESSED	LE485-43-V1-A-D1-4-WH-H	51.9"x13.06" (1318MMx332MM) LED RECESSED MOUNT FRONT ACCESS C/W TEMPERED GLASS LENS.

VISUAL FIXTURE SCHEDULE							
TYPE	IMAGE	MANUFACTURER / MODEL	VOLT	LAMP	MOUNTING	CAT.#	NOTES
X		EDWARDS SIGNALING	120	LED	WALL MOUNTED @9"(2743mm)UNLESS NOTED OTEHRWISE	105XBMB120A	
Y		EDWARDS SIGNALING	120	LED	WALL MOUNTED @9"(2743mm)UNLESS NOTED OTEHRWISE	105XBMA120A	

LIGHTING CONTROLS MATRIX							
SPACE TYPE	ROOM NAMES	MANUAL SWITCH	DIMMING	OCCUPANCY SENSING	PLUG LOAD CONTROL	SCHEDULE TIMER	NOTES
ENTRIES & CORRIDORS	CORRIDOR (286)			x		x	SCHEDULED DAY TIME FULL ON, SCHEDULED NIGHT TIME DIMMING TO 30%. AUTO FULL ON WITH OCCUPANCY SENSING OVERNIGHT.
LOCKER ROOM	LOCKER ROOM (284)	x		x			AUTO DIM TO 50% AFTER 150 SECONDS AND FULL OFF AFTER 5 MIN
DIRTY ROOM	DIRTY ROOM (284)	x					AUTO OFF AFTER 15 MIN. LOCAL CONTROL FOR RECESSED POT LIGHTS
JANITOR ROOM	JANITOR ROOM (282)	x		x			AUTO OFF AFTER 15 MIN. LOCAL CONTROL FOR RECESSED POT LIGHTS
FEMALE LOCKER ROOM	FEMALE LOCKER ROOM (261)	x		x			AUTO DIM TO 50% AFTER 150 SECONDS AND FULL OFF AFTER 5 MIN
SERVICE ROOM	M/E ROOM (289) RECLAIM (303)	x					
GRIT BLASTING BAY	GRIT BLAST BAY 302	x					(2) 3-WAY SWITCH BANKS AT ENTRY TO GRIT BLAST BAY

**NOTES:**  
1. LIGHTING CONTROL DEVICES SHOWN ON NEW LIGHTING PLANS ARE DIAGRAMATIC. COORDINATE EXACT QUANTITIES AND LOCATION OF DEVICES AND EQUIPMENT WITH THE LIGHTING CONTROL SUPPLIER.  
2. PROVIDE ROOM CONTROLLERS WITH APPLICABLE FEATURES TO MEET LIGHTING CONTROLS MATRIX REQUIREMENTS AND SPECIFICATIONS SECTION 26 09 24 - LIGHTING CONTROL DEVICES.  
3. PROVIDE ONE (1) LIGHTING ZONE PER ROOM UNLESS INDICATED OTHERWISE ON THE LIGHTING PLANS.

EMERGENCY LIGHTING FIXTURE SCHEDULE									
TYPE	IMAGE	MANUFACTURER / MODEL	DESCRIPTION	INPUT WATTS	VOLT	LAMP	MOUNTING	CAT.#	NOTES
EX-1		LUMACELL/ LD SERIES OR APPROVED EQUAL	SINGLE FACE EXIT SIGN	2.5W	120	LED	CEILING / WALL	LD1BAAC3	WALL OR CEILING MOUNTED AS PER SYMBOLS ON PLANS TO BE CONNECTED TO EMERGENCY LIGHTING CIRCUITS
EXM-1		LUMACELL/ LAC SERIES OR APPROVED EQUAL	SINGLE FACE COMBO EMERGENCY + EXIT LIGHT	12.5	120	LED	WALL	LAC1B12502LD9	TO BE CONNECTED TO EMERGENCY LIGHTING CIRCUITS
EM-1		LUMACELL/ MQM SERIES OR APPROVED EQUAL	DOUBLE HEAD REMOTE LAMP	10W	120	LED	WALL	MQM2LD9	TO BE CONNECTED TO EMERGENCY LIGHTING CIRCUITS
EM-2		LUMACELL/ RGC SERIES OR APPROVED EQUAL	DOUBLE HEAD REMOTE LAMP + BATTERY	10W	120	LED	WALL	RG12C722LD9ZD	TO BE CONNECTED TO EMERGENCY LIGHTING CIRCUITS

**AECOM**

## PROJECT

**BLAST BAY UPGRADE**  
915/916 McIntyre St. E, North Bay, ON

**CLIENT**

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## REGISTRATION

## KEY PLAN



SEE DRAWING FOR SCALE

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## PROJECT NUMBER

60678205

**SHEET TITLE**

## SCHEDULES

**SHEET NUMBER**

**E-501**



[illegible]

PROJECT NUMBER

60678205

**SHEET TITLE**

**SHEET NUMBER**

**E-502**

DESCRIPTION	Wre	BRK LCK	BREAKER	CONN. LOAD (W)	DIVER. FACTOR (%)	DEMAND LOAD (W)	CCT	PHASE	CCT	DEMAND LOAD (W)	DIVER. FACTOR (%)	CONN. LOAD (W)	BREAKER	BRK LCK	Wire	DESCRIPTION
B-01 GAS FIRED BOILER MERM.			20A-1P	120	0.75	90	1	A	2	100	1	100	20A-1P			HUH-01 HYDR. HEAT. BLAST BAY
BP-02			15A-2P	175	0.75	131.25	3	B	4	100	1	100	20A-1P			HUH-02 HYDR. HEAT. BLAST BAY
				175	0.75	131.25	5	C	6	100	1	100	20A-1P			HUH-03 HYDR. HEAT. BLAST BAY
GLYCOL FEEDER TANK REC.			20A-1P	300	0.75	225	7	A	8	120	1	120	20A-1P			B-02 GAS FIRED BOILER MERM.
BP-01			15A-2P	175	0.75	131.25	9	B	10	1200	1	1200	20A-1P			GRIT BLAST BAY LIGHTING
				175	0.75	131.25	11	C	12	1200	1	1200	20A-1P			GRIT BLAST BAY LIGHTING
GRIT BLAST BAY LIGHTING			20A-1P	1200	1	1200	13	A	14	500	1	500	20A-1P			FEMALE LOCKER RM. LTG.
MECH/ELEC RM. LTG.			20A-1P	400	1	400	15	B	16	500	1	500	20A-1P			DECONT. RM. LOCKER RM. LTG.
CORRIDOR LTG.			20A-1P	200	1	200	17	C	18	562.5	0.75	750	20A-1P			OUTDOOR MANT. REC.
WALLPACK OUTDOOR LTG.			20A-1P	500	1	500	19	A	20	37.5	0.75	50	15A-2P			AC-04
AC-01			15A-2P	50	0.75	37.5	21	B	22	37.5	0.75	50	15A-2P			AC-05
AC-02			15A-2P	50	0.75	37.5	23	C	24	37.5	0.75	50	15A-2P			AC-06
AC-03			15A-2P	50	0.75	37.5	25	A	26	37.5	0.75	50	15A-2P			AC-07
				50	0.75	37.5	27	B	28	37.5	0.75	50	15A-2P			AC-07
				50	0.75	37.5	29	C	30	37.5	0.75	50	15A-2P			AC-07
				50	0.75	37.5	31	A	32	37.5	0.75	50	15A-2P			AC-07
MERECLAIM RM. REC.			20A-1P	700	0.75	525	33	B	34	37.5	0.75	50	15A-2P			EBBH-1 ELECTRIC HEATER
FEMALE LOCKER RM. REC.			20A-1P	100	0.75	75	35	C	36	750	0.75	1000	15A-2P			EBBH-1 ELECTRIC HEATER
CORRIDOR REC.			20A-1P	300	0.75	225	37	A	38	750	0.75	1000	15A-2P			EBBH-1 ELECTRIC HEATER
OUTDOOR LIGHTING CONTROL			20A-1P	200	0.75	150	39	B	40	750	0.75	1000	15A-2P			EBBH-1 ELECTRIC HEATER
JANITOR RM. REC.			20A-1P	400	0.75	300	41	C	42	750	0.75	1000	15A-2P			EBBH-1 ELECTRIC HEATER
RECLAIM RM. MOTORIZED DOOR			60A-1P	5760	0.75	4320	43	A	44	90	0.75	120	15A-1P			BOILER CONTROLLER AND PUMP SEQUENCER
ROOFTOP MAINTENANCE RECEPTACLE			20A-1P	1200	0.75	900	45	B	46	562.5	0.75	750	20A-1P			DECONTAMINATION ROOM REC.
ROOFTOP MAINTENANCE RECEPTACLE			20A-1P	1200	0.75	900	47	C	48	0			20A-1P			FIXTURE X
EXTERIOR LIGHTING CONTROL			20A-1P	700	0.75	525	49	A	50	0			20A-1P			FIXTURE Y
SPARE			20A-1P			0	51	B	52	0			20A-1P			BREATHING AIR ALARM PANEL
SPARE			20A-1P			0	53	C	54	0						
SPARE			20A-1P			0	55	A	56	0						
SPARE			20A-1P			0	57	B	58	0						
SPARE			20A-1P			0	59	C	60	0						
PANEL ID:	PP-2A						DEMAND LOAD A (W)					8832.5	NOTES.			
LOCATION:	ELEC/MECH. ROOM						DEMAND LOAD B (W)					5537.5				
PANEL SIZE:	60						DEMAND LOAD C (W)					5250				
MAINS:	225A						TOTAL DEMAND LOAD / W					19620				
Main Breaker:	ML.O.															
VOLTAGE:	120/208V															
PHASE:	3PH															
WRE:	4W															
LUGS:	LUGS															
INT. RATING:	10 KARMS SYS															
MOUNTING:	RECESSED															
ENCLOSURE:	NEMA 1															
							DEMAND CURRENT A (A)					24.52				
							DEMAND CURRENT B (A)					15.37				
							DEMAND CURRENT C (A)					14.57				
							TOTAL DEMAND CURRENT (A)					54.46				



Ontario Northland Transportation Commission

# **Blast Bay Upgrade**

Project No: 60678205

Issued for Tender – September 29, 2023

# **Project Manual**



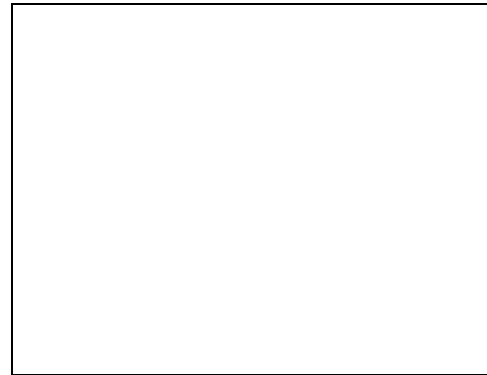




**ELECTRICAL (E) ENGINEER OF RECORD:**

\_\_\_\_\_  
Electrical Engineer of Record

**September 29, 2023**  
\_\_\_\_\_  
Date



**TRACK (T) ENGINEER OF RECORD:**

\_\_\_\_\_  
Civil Engineer of Record

**September 29, 2023**  
\_\_\_\_\_  
Date





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**END OF SECTION**



1 General

**1.1 REFERENCE STANDARDS**

- .1 Conform to latest date of issue of referenced standards in effect on date of submission of bids, except where a specific date or issue is specifically noted.

**1.2 SPECIAL PROJECT PROCEDURES**

- .1 Existing premises will maintain operation during business hours. Work may be performed during these hours. Carry out work in such a manner as to cause a minimum of noise and interference to the use of the existing building. Conform to the requirements of the building management. Be responsible for any overtime work required after business hours.
- .2 Co-ordinate construction activities and use of premises with Owner and building management.
- .3 Maintain operations of building services, data, telephone and alarm. Ensure no interruptions of these services during execution of the Work.
- .4 Provide adequate protection against dust, water and other damages to Owner's electronic and computer equipment, fittings and furniture. Use covers acceptable to the Owner. Remove protection after each work period.
- .5 Be responsible for temporary relocation and reinstatement of Owner's existing furniture and fittings required for the execution of the Work.

**1.3 WORK PROVIDED BY OWNER OR PERFORMED UNDER SEPARATE CONTRACTS**

- .1 The term "NIC" means that work of this Project which is not being performed or provided by the Contract; the term means "Not In This Contract" or "Not a Part of The Work to be Performed or Provided by The Contractor".
- .2 "NIC" work is specified and/or indicated on the Drawings as an aid to the Contractor in scheduling the amount of time and materials necessary for the completion of the Contract.

**1.4 DIVISION OF WORK**

- .1 Work specified in the Specifications is divided into Sections for reference purposes only. Division of work between Contractor and Subcontractors is the Contractor's responsibility. The Owner and Consultant assume no responsibility to act as an arbitrator to establish subcontract limits between Sections or Divisions of the Work.

**1.5 CASH ALLOWANCES**

- .1 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing the Work.
- .2 The Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .3 The Owner reserves the right to call competitive tenders for portions of the work to be paid for out of any or all cash allowances. The relationship of the Contractor and the trades performing portions of the work to be paid out of cash allowances shall be such as between the Contractor and his Subcontractors.
- .4 Unexpended amounts of cash allowances maybe reallocated to other specific cash allowances at the sole discretion of the Consultant.
- .5 Unexpended amounts of cash allowances shall be deducted from the Contract Price at completion of the Work.



- .6 Amount of cash allowance of \$35,000.00 (Thirty-Five Thousand Dollars) for the following Work:
  - .1 Supply and installation of door hardware.
  - .2 Testing and inspection for Owner's quality control, including but not necessarily limited to:
    - .1 Structural steel.
    - .2 Mechanical equipment.
    - .3 Electrical equipment.
- .7 Amount of cash allowance of \$30,000.00 (Thirty Thousand Dollars) for the following Work:
  - .1 Electrical items related to Process and Mechanical in the provision of additional control panels and associated wiring.

#### **1.6 EXAMINATION OF EXISTING CONDITIONS**

- .1 Submission of bid shall be deemed evidence that Contractor has examined the site and is familiar with conditions under which work will be done and obtained all information which may be necessary for proper execution of Contract.
- .2 Signing of Contract indicates acceptance by Contractor of conditions under which work will be done.
- .3 Extra payments will not be authorized for work that could have been determined by a careful examination of site and existing conditions.

#### **1.7 EXAMINATION OF SURFACES DURING CONSTRUCTION**

- .1 Before executing work against surfaces prepared by other Sections, examine such surfaces. Do not accept defective surfaces, or do any work to or on them, until the defects are remedied.
- .2 Commencement of work shall indicate acceptance of surfaces and responsibility concerning the conditions of same.

#### **1.8 EXISTING SERVICES**

- .1 Cut off, cap, divert or remove existing water, gas, electric and other services in areas being altered which are affected by the changes as required or as directed by the municipal authorities and the utility company concerned, and the Consultant. Protect and maintain active services to the existing building.
- .2 If required by the Consultant, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to the Consultant for review before the commencement of work.

#### **1.9 MAKING GOOD**

- .1 Make good materials and finishes which are damaged or disturbed during the process of demolition, additions and reconstruction under the Contract.
- .2 Where existing work is to be made good, match new work exactly with the old work in material, form, construction and finish unless otherwise noted or specified.
- .3 Protect work in the existing building, such as floors, finishes, trim, etc., as completely as possible to hold the replacing of damaged work to a minimum.
- .4 Preparation for new finishes:
  - .1 Remove existing finishes, including painting.
  - .2 Fill cracks and depressions with suitable filler and finish smooth, as recommended by the manufacturer of the new finishes.
  - .3 Grind protrusions level with substrates and finish smooth.



- .4 Remove all evidences of existing adhesive, grease, oil, soil and other encrustations of foreign material by washing, scraping and grinding if necessary.
- .5 Clean and prepare substrates to receive new work.

#### **1.10 CUTTING AND PATCHING**

- .1 Perform cutting, fitting, and patching to complete the Work.
- .2 Remove and replace defective and non-conforming work.
- .3 Perform work to avoid damage to other work.
- .4 Prepare proper surfaces to receive patching and finishing.
- .5 Cut rigid materials using power saw or core drill. Pneumatic or impact tools not allowed.
- .6 Restore work with new products to match existing in accordance with Contract Documents.
- .7 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .8 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated material, full thickness of construction element to match rating of and compatible with adjacent construction.
- .9 Refinish surfaces to match adjacent finishes; for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

#### **1.11 DISPOSAL OF WASTE**

- .1 General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - .1 Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - .2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- .2 Burning: Do not burn waste materials.
- .3 Disposal: Transport waste materials off Owner's property and legally dispose of them.

#### **1.12 SALVAGING DEMOLITION WASTE**

- .1 Salvaged Items for Reuse in the Work:
  - .1 Clean salvaged items.
  - .2 Pack or crate items after cleaning. Identify contents of containers.
  - .3 Store items in a secure area until installation.
  - .4 Protect items from damage during transport and storage.
  - .5 Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

#### **1.13 RECYCLING CONSTRUCTION WASTE**

- .1 General: Separate recyclable materials by type from waste.
- .2 Stockpile materials away from demolition area, do not intermix with other materials.
- .3 Packaging:



- .1 Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
- .2 Polystyrene Packaging: Separate and bag materials.
- .3 Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- .4 Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- .4 Wood Materials:
  - .1 Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - .2 Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

#### 1.14 FIRE SAFETY DURING CONSTRUCTION

- .1 Provide fire prevention and protection measures to existing building as required by all authorities having jurisdiction.
- .2 Maintain exits, including stairways and exterior doors to the outside. Provide acceptable alternative exits where an existing exit is blocked off or deleted due to construction activities.
- .3 Where access to an exit through construction area is absolutely necessary, clearly define, protect and separate access from the construction area by a smoke tight fire separation equivalent to minimum 3/4 hour fire resistance rating.

#### 1.15 SAFETY MEASURES

- .1 Comply with the safety regulations of the Occupational Health and Safety Act and authorities having jurisdiction for the safety of the Work.
- .2 Be responsible to provide full safety program for workers including management, labour, delivery drivers, service personnel and others involved for services on site. Arrange for pre-project meeting related to safety, joint safety inspections, site safety training and safety committees complete with accident investigation procedures.
- .3 Prior to commencement of execution of Work, design fire safety plan in conjunction with local Fire Chief. Post fire plan throughout the Work. Do not allow accumulation of waste that may constitute fire hazard.
- .4 Comply with requirements of Acts and Regulations with respect to health and safety. Before commencement of Work, and throughout Contract, maintain on site, and readily accessible to all those who may be exposed to hazardous materials, list of hazardous materials proposed for use on Site or Workplace together with current Materials Safety Data Sheet (MSDS).
- .5 Ensure hazardous materials used and/or supplied on site are labelled in accordance with WHMIS requirements. Provide detailed written procedures for safe handling, storage and use of such hazardous materials including special precautions, safe clean up and disposal procedures. Conform to Environmental Protection Act for disposal requirements.
- .6 Ensure that those who handle, and/or are exposed to, or are likely to handle or be exposed to, hazardous materials are fully instructed and trained in accordance with WHMIS requirements.
- .7 Watch work area for minimum of 30 minutes after hot work is completed. Provide Site fire security when required by local building department and/or municipal fire department. Ensure that water supply is adequate for fire fighting.
- .8 Provide and maintain in working order, suitable Underwriters' labelled fire extinguishers and locate in suitable positions, to approval of authorities having jurisdiction. Such extinguishers shall be maintained to requirements of ULC.



- .9 Store all rags and waste containing oil, grease or other flammable materials in an approved metal container and remove from Site at end of each working day.
- .10 Only fire resistant tarpaulins are permitted on Site.
- .11 Notify Fire Department and Consultant immediately should a fire of any nature occur whether fire has been extinguished or not.
- .12 If any claim is made by anyone against Contractor or any Subcontractor on account of any accident or damage, promptly report facts in writing to Owner, giving full details of claim.

#### 1.16 PROJECT MEETINGS

- .1 Schedule and administer project progress meetings throughout progress of work.
- .2 Distribute written notice of each meeting four days in advance of meeting date to Consultant and Owner.
- .3 Distribute agenda to attendees one day before meeting.
- .4 Provide physical space and make arrangements for meetings.
- .5 Record minutes. Include significant proceedings and decisions. Identify 'action by' parties.
- .6 Reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants, affected parties not in attendance, Consultant and Owner.

#### 1.17 SUBMITTALS

- .1 Administrative
  - .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the Work.
  - .2 Work affected by submittal shall not proceed until review is complete.
  - .3 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of the Work and Contract Documents.
  - .4 Verify field measurements and affected adjacent Work are co-ordinated.
- .2 Shop Drawings and Product Data
  - .1 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connection, explanatory notes and other information necessary for completion of Work.
  - .2 Adjustments made on shop drawings by Consultant are not intended to change Contract Price.
  - .3 Make changes in shop drawings as consultant may require.
  - .4 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
  - .5 Submit product data sheets or brochures for requirements requested in specification Sections and as Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.
- .3 Samples
  - .1 Submit samples for review as requested in respective specification Sections.
  - .2 Deliver samples prepaid to Consultant's business address.



- .4 Operating Maintenance Manuals
  - .1 Two weeks prior to Substantial Performance of the Work, submit to Consultant, three copies of operating and maintenance manuals.
  - .2 Manuals to contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information.
  - .3 Bind contents in a three-ring, hard covered, plastic jacketed binder. Organize contents into applicable categories of work, parallel to specifications Sections.
- .5 Record Drawings
  - .1 After award of Contract, Consultant will provide a set of transparency drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Consultant.
  - .2 Record locations of concealed components of mechanical and electrical services.
  - .3 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Consultant.
  - .4 On completion of Work and prior to final inspection, submit record documents to Consultant.

#### **1.18 OWNER'S QUALITY CONTROL**

- .1 Independent inspection/testing agencies may be engaged by Owner for purpose of inspecting and/or testing portions of Work. Costs shall be paid out of cash allowance.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.

#### **1.19 SITE SIGNS**

- .1 Signs on the Project will be restricted to one sign showing the name of the Project and the names of Owner, Consultant and Consultants, as designed by the Consultant and supplied and erected by the Contractor.
- .2 Do not exhibit on the site other advertisements or signs other than those required by authorities having jurisdiction, unless otherwise approved by the Consultant, in writing.

#### **1.20 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

- .1 Co-ordination
  - .1 Co-ordinate with the building management use of temporary controls and facilities not provided under this Contract, including but not necessarily limited to material delivery, unloading and hoisting. Make prior arrangements and schedule use at times acceptable to the building management. Be responsible for payment for use of such facilities.
- .2 Installation/Removal
  - .1 Provide construction facilities and temporary controls in order to execute work expeditiously. Remove from site all such work after use.
    - .1 Ensure no damage to finishes after the removal.
- .3 Hoisting and Delivery
  - .1 Material unloading and hoisting will be restricted to after hours.
  - .2 Arrange for delivery and unloading of materials at areas designated by the building management. Do not interfere with vehicular traffic on the streets and pedestrian traffic on the sidewalks.



- .4 Security Provisions
  - .1 Maintain and conform to existing security provisions required by the building management. Do not compromise such provisions.
- .5 Guard Rails and Barricades
  - .1 Erect hoarding and barricades to protect public, workers, public and private property from injury or damage. Provide lockable doors within hoarding for access to site by workers.
  - .2 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
  - .3 Provide as required by governing authorities having jurisdiction.
- .6 Weather Enclosures
  - .1 Provide weathertight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
  - .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work area for temporary heat.
- .7 Access Road, Parking and Traffic Control
  - .1 Provide access roads as may be necessary to provide safe and adequate access for materials, products and other supplies. Provide and maintain access sidewalks, roadways, and similar facilities as may be required for access to the Work.
  - .2 Do not block public roads, or impede traffic during work of this Project and if required to temporary block traffic then provide flag person to direct traffic acceptable to Municipal authorities. Remove accumulations of ice and snow from areas providing access to Site. Ensure that access is available for emergency vehicles. Comply with fire plan for vehicular traffic.
  - .3 Provide roads, walks, ramps, stairs and other such means of access as necessary. Maintain temporary entrances to building(s) including enclosed hoarding as required. Maintain access to existing service entrance(s) at all times, including ready access for fuel oil trucks and delivery vehicles. Bridge excavations with construction to safely support any load that could be imposed or provide personnel to assist in deliveries to building(s) as required.
  - .4 Do not be nuisance to public traffic any time. Manage construction traffic by using designated roads and by providing trained flag persons to direct public traffic as appropriate.
  - .5 Construction Parking: Parking on site is limited to the space available. Owner will not be responsible for parking fines incurred by Contractor, Sub-Contractors or their employees.
- .8 Dust Tight Screens
  - .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
  - .2 Maintain and relocate protection until such Work is complete.
- .9 Site Storage/Loading
  - .1 Confine the Work and operations of employees to limits indicated by Contract Documents. Do not unreasonably encumber premises with Products.
  - .2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.
- .10 Sanitary Facilities



- .1 Provide sufficient sanitary facilities for workers in accordance with local health authorities.
- .2 Maintain in clean condition.
- .3 Existing facilities as designated may be used during construction period.
- .11 Water and Power Supply
  - .1 The Owner will provide and pay for a continuous supply of water, power for construction use as available from the existing facilities. Provide hoses, extensions, connections, and transformers as required for execution of the Work. Provide extra supply if the existing facilities are insufficient or not suitable for construction use.
  - .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .12 Temporary Lighting
  - .1 Provide temporary lighting required during construction period, including attendance and maintenance.
  - .2 Maintain lighting at levels required by Sections doing the work.
- .13 Temporary Heating
  - .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
  - .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders not permitted.
  - .3 Maintain temperatures at levels required by Sections doing the work.
  - .4 Ventilate heated areas and keep building free of exhaust or combustion gases.
  - .5 Permanent heating system of building, or portions thereof, may be used when available. Be responsible for damage thereto. Replace filters with new ones prior to Substantial Performance.
- .14 Temporary Contractor's Office:
  - .1 Contractor's Office: Of sufficient size to accommodate needs of workers. Maintain office dry, clean, well lighted, properly ventilated and heated to 20 deg C (68 deg F) complete with telephone and facsimile services. Furnish office tables, chairs, racks for drawings, filing cabinets and shelves. Install electrical lighting system to provide approved lighted environment.
  - .2 .
- .15 Equipment/Tool/Materials Storage
  - .1 Provide and maintain, in clean and orderly condition, lockable areas for storage of tools, equipment and materials.
  - .2 Locate materials on site in manner to cause least interference with work activities.
- .16 Project Cleanliness
  - .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris.
  - .2 Remove waste material and debris from site at end of each working day. Do not burn waste materials on site.
  - .3 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- .17 Noise and Vibration Control



- .1 Control noise and vibration generated by Work. Respond immediately to complaints of noise and vibration received from public, authorities, or Consultant.

## 1.21 MATERIAL AND EQUIPMENT

- .1 Product and Material Quality
  - .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
  - .2 Whenever Products are specified exclusively by trade name, manufacturer's name or by catalogue reference, use only those items, unless written approval for substitution is obtained from Consultant.
  - .3 Where the Specifications include "or other approved equivalents" clause, substitutions proposed with bid submission or after award of Contract will be considered only under the following conditions:
    - .1 if the materials and products specified are not available; or
    - .2 if substitute materials and products to those specified, which are brought to the attention of and considered by the Consultant as equivalent to those specified, will not change the Contract Price and Contract Time; or
    - .3 if substitute materials and products to those specified, which are brought to the attention of and considered by the Consultant as superior to those specified, will not change the Contract Price and Contract Time; or
    - .4 if a material or product is specified together with a requirement for performance and, in the opinion of the Contractor, the specified material or product will not produce the required results.
  - .4 There is no obligation on the part of the Consultant or Owner to accept proposed substitutions. Acceptance of proposed substitutions by Owner does not relieve the Contractor's responsibility under the Contract.
  - .5 Defective Products, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
  - .6 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .2 Storage, Handling and Protection
  - .1 Handle and store Products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
  - .2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seals and labels intact.
- .3 Manufacturer's Instructions
  - .1 Unless otherwise indicated in specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
  - .2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.



- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and reinstallation at no increase to Contract Price.
- .4 Workmanship
  - .1 Workmanship shall be best quality, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.
  - .2 Do not employ any unfit person or anyone unskilled in their required duties.
  - .3 Decisions as to quality or fitness of workmanship in cases of dispute rest solely with Consultant, whose decision is final.
- .5 Concealment
  - .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
  - .2 Before installation, inform Consultant if there is a contradictory situation. Install as directed by Consultant.

## 1.22 CONTRACT CLOSEOUT

- .1 Final Cleaning
  - .1 When the Work is Substantially Performed, remove surplus products, tools construction machinery and equipment not required for performance of remaining Work.
  - .2 Leave work broom clean before inspection process commences.
  - .3 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
  - .4 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls ceilings.
  - .5 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
  - .6 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
  - .7 Broom clean and wash exterior walks, steps and surfaces.
  - .8 Remove dirt and other disfigurements from exterior surfaces.
- .2 Systems Demonstration
  - .1 Prior to final inspection, demonstrate operation of each system to Owner.
  - .2 Instruct personnel in operation, adjustment, and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.
- .3 Documents
  - .1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers.
  - .2 Submit material prior to final application for payment.
  - .3 Submit three copies of Project Record Manual consisting of operation and maintenance data and one set of record (as-built) drawings white prints.
  - .4 Provide warranties fully executed and notarized.
  - .5 Execute transition of Performance Bond to warranty period requirements.



.4 Inspection/Takeover Procedures

- .1 Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected and building is clean and in condition for occupancy. Notify Consultant in writing, of satisfactory completion of the Work and request an inspection.
- .2 During Consultant inspection, a list of deficiencies and defects will be tabulated. Correct same.
- .3 When Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been performed, make application for certificate of Substantial Performance.
- .4 Conform to OAA/OGCA Document No.100 for takeover procedures.
- .5 Submit a final statement of accounting giving total adjusted Contract Price, previous payments, and monies remaining due.
- .6 Consultant will issue a final change order reflecting approved adjustments to Contract Price not previously made.

2 Products

**Not Used**

3 Execution

**Not Used**

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.

**1.2 SUMMARY**

- .1 Review drawings, site conditions, and other specification sections to ascertain the extent and nature of work of this section.
- .2 The Work of this Section includes, but not limited to the following:
- .1 Demolish and removal of portions of existing concrete slab, and roofing materials, as indicated on drawings.
  - .2 Disconnect/cap existing service in areas of demolition.
  - .3 Dispose of demolished materials except where required to be salvaged or reused.
  - .4 Refer to demolition notes indicated on drawings.
- .3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

**1.3 DEFINITIONS**

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

**1.4 EXAMINATION**

- .1 Visit and examine the site and note all characteristics and irregularities affecting Work of this Section. Submit a pre-demolition inspection report. Ensure the Owner of premises being inspected is represented at inspection.
- .2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.
- .3 Where applicable, examine adjacent tenancies not part of the scope of work. Determine extent of protection required to areas and related components not subject to demolition.
- .4 Stop work and notify the Consultant should suspected hazardous materials are encountered during work of this Section.

**1.5 SUBMITTALS**

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:



- .1 Prepare schedule in conjunction with overall project schedule, and outline proposed methods in writing. Obtain approval before commencing demolition work, and indicate the following:
  - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity
  - .2 Interruption of utility services
  - .3 Coordination for shutoff, capping, and continuation of utility services
- .3 Submit drawings for demolition of structural elements bearing the seal of a professional engineer licensed to design structures and registered in the Province of Ontario.

#### 1.6 QUALITY ASSURANCE

- .1 Conform to requirements of all authorities having jurisdiction.
- .2 Comply with applicable requirements of CSA S350 Code of Practice for Safety in Demolition of Structures".
- .3 Work of this Contract shall be executed by an approved company having a minimum of five (5) years continuous experience and able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.
- .4 Perform cutting and coring, where applicable, by a firm specializing in this type of work, able to produce evidence of successful completion of similar work over a period of at least five (5) years immediately prior to date of contract.
- .5 Apply for, secure, arrange and pay for all permits, notices and inspections necessary for proper execution and completion of work in this Section.
- .6 Professional Engineer Qualifications: Procure the services of a professional engineer who is experienced in providing relevant engineering services to perform the following:
  - .1 Review portions of the Work requiring structural performance, prepare plan of action, engineer temporary shoring and bracing, and Provide site administration and inspection for work of this Section.

#### 1.7 PROTECTION

- .1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.
- .2 Cease operations and notify Consultant if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Consultant.
- .3 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.
- .4 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.
- .5 Temporarily suspended work that is without continuous supervision shall be closed to prevent entrance of unauthorized persons.

#### 1.8 REMAINING AND ADJACENT STRUCTURES

- .1 Do not interfere with, encumber, endanger or create nuisance, from any cause due to demolition work, to public property or any adjacent attached and/or detached structures in possession of Owner or others, which are to remain, whether occupied or unoccupied during this work.



- .2 Make good damage to such structures resulting from work under this Section at no cost to Owner. Make good adjacent building surfaces damaged by work of this Section.

#### 1.9 PROTECTION OF SERVICES AND STRUCTURES

- .1 Take necessary precautions to guard against movement, settlement or collapse of existing adjacent utility services, public property and/or structures, whether to remain or not. If these or other unforeseen conditions develop, take immediate emergency measures, report to Consultant, confirm in writing, and await instructions before proceeding with any further related demolition work.
- .2 Prior to saw cutting or core drilling of existing concrete slabs, use ground penetrating radar (GPR) to detect utilities and structural reinforcing. Concrete X-Rays can be used when access to both sides of concrete slab is accessible for placement of required x-ray film.

#### 1.10 EXISTING SERVICES

- .1 Prior to start of demolition disconnect all electrical and telephone service lines in the areas to be demolished. Post warning signs on all electrical lines and equipment which must remain energized to serve other areas during period of demolition. Disconnect electrical and telephone service lines in demolition areas to the requirements of local authority having jurisdiction.
- .2 In each case, notify the affected utility company in advance and obtain approval where required before commencing with the work on main services.
- .3 Arrange with utility companies for locating of such services and for disconnection of existing services owned by utility companies and which will be disconnected by said utility companies, provided such services do not interfere with adjacent tenancy operators.
- .4 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.
- .5 Existing services are to be maintained where required for normal tenant operation during regular hours of operation and/or as deemed necessary by Owner.

#### 1.11 EXISTING WARRANTIES

- .1 Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

### 2 Products

#### 2.1 DEBRIS, SALVAGED MATERIAL AND EQUIPMENT DISPOSAL

- .1 All materials and or equipment salvaged from demolition work becomes property of demolition Contractor unless designated otherwise.
- .2 At no cost to Owner repair or replace material and/or equipment scheduled to remain which is damaged by demolition work. Do not sell any salvaged material or equipment directly from project site.
- .3 Remove waste debris continually and entirely from project site during demolition work. Do not load vehicles transporting such debris beyond their safe capacity or in a manner which might cause spillage on public or private property. If spillage does occur, clean up immediately to prevent traffic hazards or nuisance.

#### 2.2 PROTECTION

- .1 Temporary Protection:
  - .1 Erect temporary hoarding protection, as indicated in Section 01 56 00, to enclose openings in exterior walls, and/or provide security to partially occupied interior spaces.



- .2 Erect temporary dust screens, as indicated in Section 01 50 00 – Temporary Facilities and Controls, to prevent dust and debris to enter areas of the building which are not scheduled for demolition. Remove temporary dust screens when no longer required.

## **2.3 REPAIR MATERIALS**

- .1 Use repair materials identical to existing materials:
  - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - .2 Use a material whose installed performance equals or surpasses that of existing material.
  - .3 Comply with material and installation requirements specified in individual Specification Sections.
- .2 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- .3 Fireproofing: Patch and repair all fireproofing damaged during demolition of adjacent surfaces with compatible fireproofing materials. Provide test reports from fireproofing manufacture warranting installation, adhesion and compatibility between existing and new fireproofing materials.

## **2.4 EXISTING MATERIALS**

- .1 Items to be retained for re-use in new construction include, but are not limited to the following:
  - .1 Lockers to remain or to be relocated as indicated in the drawing.

## **3 Execution**

### **3.1 GENERAL**

- .1 Exercise caution in dismantling, disconnecting of work adjacent to existing work designated to remain.
- .2 Carry out demolition in a manner to cause as little inconvenience to the adjacent properties as possible.
- .3 Carry out demolition in an orderly and careful manner.
- .4 Demolition by explosives is not permitted.
- .5 Selling or burning of materials on site is not permitted.
- .6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated run-off or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.
- .7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.
- .8 At end of each day's work, leave in safe condition so that no part is in danger of toppling or falling.

### **3.2 SAFETY AND SECURITY**

- .1 Maintain security of the building at all times during demolition work.
- .2 Provide and maintain fire prevention equipment and alarms accessible during demolition.

### **3.3 ACCESS ROUTES**

- .1 Restrict operations to designated access routes.



- .2 Do not obstruct roads, parking lots, sidewalks, hydrants and the like.

### 3.4 SELECTIVE DEMOLITION

- .1 Provide necessary shoring and supports to assure safety of structure prior to cutting and coring.
- .2 Where practical, sawcut and remove material as required.
- .3 Where sawcutting is not appropriate, use suitable hand tools.
- .4 Demolish, cut-out and remove from site all other work noted on drawings or required to permit new construction.
- .5 Do not allow water to accumulate or flow beyond work area. Provide receptacles and mop-up as work proceeds.
- .6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.
  - .1 Provide bond beams in new openings cut into existing concrete masonry unit walls.
  - .2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.
- .7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.
- .8 Masonry:
  - .1 Demolish masonry walls in small sections of not more than 2 sq.m. Where only parts of a wall is to be demolished, install adequate support for adjacent parts. Do not permit masonry to fall in mass from one level to another.
    - .1 Clean and stack reusable masonry units.
- .9 Cladding:
  - .1 Where only part or parts of cladding is to be demolished, dismantle, to prevent damage to adjacent cladding. Remove girts, channels, or cross bracing, unless otherwise indicated.
  - .2 Form openings in siding such that edges are left straight, clean and not ragged. Where openings abut flashings, ducts or similar items projecting through, or forming integral part of cladding system, preserve and support as required unless otherwise shown.
- .10 Demolish completely all ceiling panels and grid as indicated.
- .11 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
  - .1 Prepare existing surfaces schedule to receive new finish by grinding, filling, over-coating, stripping, washing, etching, shot blasting or other chemical or mechanical means, as required to ensure satisfactory installation of new finish.
- .12 Roofs:
  - .1 Where sections of roof are removed or where new roofing are required, remove overburden to expose membrane. Cut back minimum of 230 mm outside line of opening or removal area to facilitate future flashing.
  - .2 Remove membrane, insulation and vapour barrier over area to be demolished. Cut roof decking with power tools to ensure straight edges. Leave free ends 300 mm maximum in length, unless adequately supported.
  - .3 Supply and install plywood catchboard immediately under areas to be cut, to protect structure interior from falling debris. Install catchboard in combination with dust/weather protection.



### 3.5 PATCHING AND REPAIRING

- .1 Floors and Walls:
  - .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
  - .2 Provide an level and smooth surface having uniform finish colour, texture, and appearance.
  - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
  - .4 Patch with durable seams that are as invisible as possible.
  - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  - .6 Patch any existing areas adjoining / adjacent to new construction in good workmanship, filling and finishing gaps between finishes to allow new work to blend seamlessly with existing work.
  - .7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
  - .8 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- .2 Ceilings: patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
- .3 Exterior Walls: Where existing doors and/or windows are schedule to be removed during demolition, patch and repair exterior walls using similar wall construction techniques as adjacent wall construction. Ensure compatibility between insulation, air barrier and vapour retarder, providing continuous air and vapour control and wall R-Value between existing and new construction. Provide exterior and interior finish materials, matching existing adjacent materials, to provide an even-plane surface of uniform appearance.

### 3.6 EXCESSIVE DEMOLITION

- .1 Where excessive demolition occurs, be responsible for cost of replacing such work.
- .2 Consultant shall determine extent of such 'over-demolition' and method of rectification.

### 3.7 COMPLETION

- .1 Leave project site as directed, reasonably clean and presentable, free from above grade debris, any salvaged material and/or equipment except those designated to remain.
- .2 Maintain access to exits clean and free of obstruction during removal of debris.

**END OF SECTION**



1 General

1.1 SUMMARY

- .1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete formwork and falsework installation.

1.2 RELATED REQUIREMENTS

- .1 Section 03 20 00 - Concrete Reinforcing
- .2 Section 03 30 00 - Cast-in-Place Concrete
- .3 Section 07 92 00 - Joint Sealants

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
  - .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA O86-09, Engineering Design in Wood
  - .3 CSA O121-08, Douglas Fir Plywood.
  - .4 CSA O151-09, Canadian Softwood Plywood.
  - .5 CSA O153-M1980, Poplar Plywood.
  - .6 CSA O325-07 (R2012), Construction Sheathing.
  - .7 CSA O437 Series-93, Standards for OSB and Waferboard.
  - .8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
  - .9 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.
  - .10 CSA-S413-07, Parking Structures
- .2 American Concrete Institute (ACI):
  - .1 ACI 347-04, Guide to Formwork of Concrete.
- .3 National Lumber Grades Authority (NLGA):
  - .1 Standard Grading Rules for Canadian Lumber, 2010.

1.4 DEFINITION

- .1 Architectural Concrete — Concrete that is exposed as an interior or exterior surface in the completed structure that contributes to the visual character of the completed structure.

1.5 DESIGN REQUIREMENTS

- .1 Design formwork in accordance with CSA S269.1, CAN/CSA S269.3-M and CSA A23.1 Clause 6.5 – Formwork. For Architectural Concrete, provide formwork that conforms to the requirements of CSA A23.1 Clause 8.3.4 – Formwork for Special Architectural Finishes.
- .2 Design and engineer falsework and formwork including shoring and bracing to resist loads due to wet concrete, forms, wind, dead loads, construction live loads and forces arising from use of equipment to place concrete without differential settlement between them and to ensure finished concrete within the tolerances required by CSA-A23.1/A23.2.
- .3 Design forms for concrete exposed to view or to carry finish, with maximum deflection of 1/400th of span.



- .4 When high range water reducer (superplasticizer) is used in concrete mix, design forms for full hydrostatic pressure.
- .5 Make joints in forms watertight.
- .6 Design formwork to meet variations from a reference system specified in CSA A23.1 Clause 6.4.6.

#### 1.6 SUBMITTALS

- .1 Submit in accordance with Division 1 Sections – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Indicate the method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and comply with CAN/CSA S269.3-M for formwork drawings.
  - .2 Shop drawings shall indicate:
    - .1 Layout of panel joints, and tie hole pattern.
    - .2 Method of sealing form tie hole.
    - .3 Coordinate with details where shown on the Contract Drawings.
  - .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
  - .4 Indicate sequences of erection and removal of formwork/falsework.
  - .5 Include full details and locations of splices.
  - .6 Each shop drawing submission shall be stamped and signed by a qualified professional engineer licensed to practice in the each respective province.
- .3 Product Data:
  - .1 Submit the manufacturer's Product data sheets including materials, allowable loading, installation, application and maintenance, and instructions for the applicable items listed:
    - .1 Proprietary scaffolding.
    - .2 Shoring beams.
    - .3 Lumber for formwork and falsework.
    - .4 Plywood for formwork and falsework.
    - .5 Tubular column forms.
    - .6 Form release agent.
    - .7 Form ties.
    - .8 Manufacturer's details and specifications for proprietary materials used in formwork liners and coatings.
- .4 Submit one sample for each of the following items:
  - .1 Form ties.

#### 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Place materials defined as hazardous or toxic waste in designated containers.



- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOCs.

## 2 Products

### 2.1 MATERIALS

- .1 For concrete with special architectural features, use formwork materials in accordance with CSA A23.1/A23.2.
- .2 Plywood: CSA O121, G1S; Douglas Fir plywood, sheets as large as practical, minimum 19 mm thick, seven ply, exterior grade, waterproof glue, edges sealed with oil based sealer.
- .3 Prefabricated steel forms: CSA S136; Free of irregularities, dents, sags, rust, and materials that can discolour concrete finish
- .4 Steel forms: seamless, steel plates, internally treated with release material.
- .5 Tubular column forms: Round, spirally wound laminated fibre forms free of dents and other irregularities, complete with seamless plastic liner, internally treated with form release agent.
- .6 Form ties:
  - .1 For concrete not designated 'Architectural Concrete', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .2 For Architectural Concrete, use snap ties complete with plastic cones and light grey concrete plugs.
  - .3 Wire ties shall not be permitted.
- .7 Form release agent: Quick drying, sprayable, non-staining, non-toxic coating, compatible with paint and mortar, VOC compliant, containing compounds that react with free lime present in concrete forming water insoluble soaps, preventing concrete from sticking to forms.
  - .1 Eucoslip VOX by The Euclid Chemical Company;
  - .2 Clean Strip Ultra (J-3 VOC) by Dayton Superior Corp.;
  - .3 Sealtight Duogard II by W.R. Meadows of Canada Ltd.;
  - .4 Debond Form Coating by L&M Construction Chemicals Inc. Buffalo., N.Y.
- .8 Chamfer strips: 20 x 20 mm triangular fillets milled from clear, straight grain pine, surfaced each side, or extruded vinyl type, with or without nailing flange.
- .9 Falsework materials: in accordance with CSA S269.1.
- .10 Sealant: in accordance with Division 1 Sections – Joint Sealants.

## 3 Execution

### 3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions are consistent with the Contract Drawings.
- .2 Obtain approval from the Consultant for the use of earth forms framing openings not indicated on the Drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.



- .4 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within the tolerances required by CSA-A23.1/A23.2.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide Site drainage to prevent the washout of soil supporting mud sills and shores.
- .7 Align form joints and make watertight. Keep form joints to minimum.
- .8 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise in the Contract Documents.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated on the Contract Drawings.
- .10 Construct forms for Architectural Concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .11 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .12 Clean formwork in accordance with CSA-A23.1/ A23.2, before placing concrete.

### 3.2 REMOVAL AND RE-SHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 4 Days for walls.
  - .2 7 Days for columns.
  - .3 Until concrete has reached 70% of its compressive strength and not before seven 7 Days for beams, slabs, decks and other structural members. Re-shore concrete with adequate shoring to standards specified for 14 additional Days.
- .2 Provide all necessary re-shoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .3 Space re-shoring in each principal direction at not more than 3,000 mm apart.
- .4 Re-shoring shall remain until concrete has reached its 28-Day designed compressive strength.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

### 3.3 CONSTRUCTION JOINTS

- .1 Obtain approval from the Consultant for location and details of construction joints shown a minimum of two weeks prior to start formwork.

### 3.4 EXPANSION AND CONTROL JOINTS

- .1 Construct expansion and control joints at the locations indicated and in accordance with the details shown on the Contract Drawings.
- .2 Construct clean expansion joints free of foreign material, likely to impair the proper operation of the joint.
- .3 Provide a non-extruding joint filler in expansion joints for the full area between adjacent concrete members. Anchor the filler material to one of the adjacent members or between concrete members and adjacent members of other materials.

**END OF SECTION**



1 General

**1.1 SUMMARY**

- .1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete reinforcing installation.

**1.2 RELATED REQUIREMENTS**

- .1 Section 03 10 00 - Concrete Formwork and Falsework
- .2 Section 03 30 00 - Cast-in-Place Concrete

**1.3 REFERENCES**

- .1 Canadian Standards Association (CSA):
  - .1 CSA A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.
  - .2 CAN/CSA A23.3-04, Design of Concrete Structures.
  - .3 CAN/CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.
  - .4 CSA S413-07, Parking Structures.
  - .5 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures.
  - .6 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction
- .2 ASTM International:
  - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .3 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, For Concrete.
- .3 Reinforcing Steel Institute of Canada (RSIC):
  - .1 RSIC, Reinforcing Steel Manual of Standard Practice (2004).
- .4 International Conference of Building Officials (ICBO):
  - .1 ICBO Research Report.

**1.4 QUALITY ASSURANCE**

- .1 Welder Qualifications: CSA W47.1 and CSA W186 certified.

**1.5 SUBMITTALS**

- .1 Submit in accordance with Division 1 Sections – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit reinforcement drawings prepared in accordance with the RSIC Manual of Standard Practice.
  - .2 Design and detail lap lengths to CAN/CSA A23.3. Supply Class B splices unless shown otherwise on the Contract Drawings. Splices are to be staggered unless otherwise shown on the Contract Drawings.



- .3 Submit placing drawings, bar lists, quantities and bar bending details. Bar bending details shall include details of standard bends. Indicate the name of the bent bar fabricator, name of bulk steel supplier and steel grade.
- .4 On placing drawings, indicate bar sizes, spacing, location and quantities of reinforcement, splices, splice lengths, location of expansion, control and construction joints, with identifying code marks to permit correct placement without reference to structural drawings. Indicate the sequence of placing concrete. Indicate type, sizes, spacings and locations of chairs, spacers and hangers.
- .5 If bar list and bending schedule contain details of bars of more than one reinforcing bar placement drawing, then arrange bar marks in separate groups for each placement drawing. Clearly indicate for each bar mark the corresponding reinforcing bar placement drawing number.
- .6 For slabs, show a separate plan indicating concrete thicknesses, reinforcing bars, and dowels for walls and columns cast in slab.
- .7 For walls, show separate elevations indicating concrete thicknesses, reinforcing bars, and dowels for slabs and adjacent walls cast in wall.
- .8 Show position and size of openings in slabs and walls. Cooperate with trades requiring openings to ascertain necessary information.
- .9 Do not add new information on previously reviewed shop drawings.
- .10 Reinforcing bar placement shop drawings will be reviewed for bar sizes, locations, and spacing, and will be stamped and signed. Bar list and bending schedule will not be reviewed or stamped.
- .11 Submit shop drawings of dowel bar splicers, detailing locations, sizes, and types.
- .12 Substitution of different size bars may be permitted upon written acceptance of the Consultant.
- .13 Reproduction of the Contract Drawings for use as shop drawings is not permitted. Do not use Contract CADD files.
- .3 Product Data Sheets:
  - .1 Submit three copies of the manufacturer's Product data sheets including installation and maintenance instructions for: chairs, bolsters, bar supports, and side form spacers, dowel bar splicers, and mechanical splices.
- .4 Test Reports:
  - .1 Submit certified copies of mill test reports for reinforcing steel and welded wire fabric, showing physical and chemical analysis, a minimum of 30 Days prior to commencing the Work. Determine physical and chemical properties of steel reinforcing in accordance with requirements of CSA-G30.18.
- .5 Certificates:
  - .1 Submit welding certificate in accordance with CSA W47.1 and CSA W186-M.
- .6 Information Submittals:
  - .1 Submit in writing the proposed source of reinforcement material to be supplied.
  - .2 Dowel Bar Splicers:
    - .1 Verification that device threads have been tested and meet the requirements for thread quality, in accordance with the manufacturer's published methods.



## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 1 Sections – Product Requirements and with the manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to Site in original factory packaging, labelled with the manufacturer's name and address.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. Clearly indicate mill run for which bars were fabricated.
- .4 Storage and Handling Requirements:
  - .1 Store reinforcing steel off the ground and kept free of mud, dirt, oil and any contaminants which may adversely affect performance of reinforcing steel. Comply with CSA A23.1/A23.2.
  - .2 Store welded wire fabric sheets flat and off the ground.
  - .3 Deteriorated or contaminated materials will be rejected and shall be removed from site.
  - .4 Replace defective or damaged materials with new materials at no additional cost to the Owner.

## 2 Products

### 2.1 MATERIALS

- .1 Substitution of different size bars may be permitted upon written acceptance of the Consultant.
- .2 Reinforcing Bars:
  - .1 Reinforcing steel: CAN/CSA G30.18-M; Carbon-steel bars, deformed unless indicated otherwise in the Contract Documents, Grade 400R.
  - .2 Weldable reinforcing steel: CAN/CSA-G30.18-M; Weldable low alloy steel bars, where welding of reinforcing bars is indicated in the Contract Documents, deformed, Grade 400W.
  - .3 Plain round reinforcing steel: CAN/CSA G30.18-M; round, Grade 400R, for expansion joints.
  - .4 Do not substitute with epoxy-coated bars.
- .3 Welded steel wire fabric: ASTM A82/A82M; Resistance welded in size and spacing shown for smooth wire fabric and ASTM A497/A497M for deformed wire fabric, in flat sheets only.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M, minimum 1.6 mm diameter, with coating for use with uncoated and coated reinforcing steel.
- .5 Bar Supports and Spacers:
  - .1 Adequate for accurate placing and as required for construction loads.
  - .2 Provide non-conductive bar supports in contact with exposed surfaces that has geometry and bond characteristics that prevents moisture movement from the surface to the reinforcement.
  - .3 In beams, columns, walls, and slabs exposed to view after form removal: Small concrete blocks made up of same color and strength as concrete being placed around them.
  - .4 Do not use plastic or stainless steel bar supports or side form spacers.
  - .5 Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports are not high or strong enough.



- .6 Mechanical Splices:
  - .1 Mechanical Threaded Connections: Furnish metal coupling sleeve with internal threads engaging threaded ends of bars, capable of developing in tension or compression 125 percent of yield strength of bar.
    - .1 Conform to CSA A23.3.
    - .2 Provide a thread-in plastic plug to protect the threads.
    - .3 Wrap exterior with tape.
    - .4 Clip the mounting washer, if provided, to maintain cover without displacing the bar.

## 2.2 FABRICATION

- .1 Fabricate and bend reinforcing steel in accordance with CAN/CSA-A23.1/A23.2, RSIC Manual of Standard Practice and in accordance with the accepted placing drawings.
- .2 Reinforcing Bars:
  - .1 Use longest bar possible.
  - .2 Shear and bending Tolerances:
    - .1 Length:  $\pm 25$  mm.
    - .2 Outside dimensions of stirrups, ties, and spirals:  $\pm 13$  mm.
    - .3 Other bends:  $\pm 25$  mm.
    - .4 Where increases cause interference with waterstop- plus 0 mm.
    - .5 Ensure cutting and bending tolerances are sufficiently accurate to comply with placing tolerances shown.
  - .3 Keep number of splices to a minimum.
  - .4 Do not weld chairs, bolsters, bar supports, or spacers to reinforcing bars.
- .3 Reinforcing Splices:
  - .1 Lap Splices: Splice by lapping reinforcing bars, unless specified otherwise in the Contract Documents.
  - .2 Welded Splices: Full penetration direct butt splice welds in accordance with CSA W186 and as specified in the Contract Documents.
  - .3 Splices in Wire Fabric: Comply with CSA A23.3.
  - .4 Obtain prior written approval from the Consultant for locations of reinforcement splices other than those shown on the placing drawings.
- .4 Bend bars cold, heating of bars will not be permitted.
- .5 Verify elevations before cutting and bending reinforcing bars.
- .6 Obtain written approval from the Consultant prior to welding reinforcement. Weld reinforcement in accordance with CSA W186-M.

## 3 Execution

### 3.1 PREPARATION

- .1 Notify Consultant a minimum one week in advance of when reinforcing is ready for inspection.



- .2 Clean reinforcing bars of loose rust, mill scale, dried cement paste, mud, oil, or other coatings that will affect adhesion in accordance with CSA A23.1/A23.2, Clause 6.1.5 – Surface Condition of Reinforcement, prior to placing concrete.
- .3 Coat wire projecting from bar supports with dielectric material or plastic.

### 3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement without prior written approval by the Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure. Required radius of bend shall be provided in accordance with CSA A23.4.
- .3 Replace bars which develop cracks or splits.

### 3.3 REINFORCEMENT BAR INSTALLATION

- .1 Prior to installation of reinforcing steel, inspect installed Work of other trades and verify that Work is complete for installation of reinforcement.
- .2 Place reinforcing steel as shown on reviewed placing drawings and in accordance with CSA A23.1/A23.2.
- .3 Use plain round bars as slip dowels in concrete.
  - .1 Paint the portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 When paint is dry, apply a thick even film of mineral lubricating grease.
- .4 Tie bars at least at every fourth intersection minimum. Make maximum untied length 1000 mm.
- .5 Do not eliminate or displace reinforcement to accommodate hardware to be embedded in concrete.
- .6 Do not field bend bars partially embedded in concrete except as shown on the Contract Drawings or as accepted by the Consultant.
- .7 Prior to placing concrete or closing wall and column forms, obtain acceptance of reinforcing steel and position from Consultant.
- .8 Ensure cover to reinforcement is maintained during concrete pour.
- .9 Splicing:
  - .1 Use lap splices, unless otherwise shown on the Contract Drawings or permitted in writing by the Owner's Representative.
  - .2 Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar in tension and compression.
  - .3 Stagger splices in adjacent bars.
- .10 Dowel Bar Splicers:
  - .1 Use only in areas specifically approved in writing by the Owner's Representative.
  - .2 Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICBO Research Report.
  - .3 Install dowel bar splicers with plastic setting plugs.
  - .4 Lightly grease internal threads in accordance with manufacturers printed instructions.
  - .5 Maintain minimum edge distance and concrete cover as noted in the Contract Drawings.
- .11 Mechanical Splices:



- .1 Install mechanical splices in accordance with the manufacturer's written instructions. Request the presence of the manufacturer's representative to verify proper installation.
- .12 Tying Reinforcing Bars:
  - .1 Bend tie wire away from concrete surface. Ensure that the cover for tie wires, form tie bolts, etc. are the same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.
- .13 Reinforcement Around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut or disrupted for opening. Extend steel reinforcing a standard lap length beyond opening at each end.
- .14 Welding Reinforcement:
  - .1 Only Type W bars may be welded.
  - .2 Do not perform welding until welder qualifications are approved.
- .15 Do not field cut reinforcement except where indicated or authorized in writing by the Consultant.

### **3.4 PROGRESS CLEANING**

- .1 Leave the Work areas clean at end of each Working Day.
- .2 Final Cleaning: Upon completion of reinforcing steel installation, remove surplus materials, rubbish, tools and equipment and verify that the area ready for placing concrete.

### **END OF SECTION**



1 General

1.1 SUMMARY

- .1 Supply all labour, materials, equipment, services and perform all operations required to complete cast in place concrete installation.

1.2 RELATED REQUIREMENTS

- .1 Section 03 10 00 - Concrete Formwork and Falsework
- .2 Section 03 20 00 – Concrete Reinforcing.

1.3 REFERENCES

- .1 CSA International:
  - .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000-13, Cementitious materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .4 CAN/CSA-G30.18-09: Carbon Steel Bars for Concrete Reinforcement.
  - .5 CSA S413-07, Parking Structures
- .2 ASTM International:
  - .1 ASTM C260-06, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM C494/C494M-11, Standard Specification for Chemical Admixtures for Concrete.
  - .4 .ASTM C1017/C1017M-07, Standard specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5 ASTM D1751-04 (2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .6 ASTM C1059/C1059M-99 (2008), Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
  - .7 ASTM D6690-07, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
  - .8 ASTM D1752-04a (2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
  - .9 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.
  - .10 ASTM D412-06, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.
  - .11 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars using 50-mm Cube Specimens
  - .12 ASTM C1315, Standard Specification for Liquid Membrane-Forming Compound having Special Properties for Curing and Sealing Concrete



- .3 American Concrete Institute (ACI):
  - .1 304.2R Placing Concrete by Pumping Methods
- .4 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB 37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB 51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
  - .1 Type GU or GUb - General use cement.
  - .2 Type MS or MSb – Moderate sulphate-resistant cement.
  - .3 Type MH or MHb - Moderate heat of hydration cement.
  - .4 Type HE or Heb - High early-strength cement.
  - .5 Type LH or LHb - Low heat of hydration cement.
  - .6 Type HS or HSb – High sulphate-resistant cement.
- .2 GGBFS - Ground, granulated blast-furnace slag.

#### 1.5 DEFINITIONS

- .1 Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures including surfaces above water.
- .2 Surface Defects: Surface areas that include honeycomb, rock pockets, indentations greater than 5 mm, cracks 0.25 mm wide and larger, spalls, chips, air bubbles greater than 20 mm in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form pop outs, texture irregularities, and stains and other colour variations that cannot be removed by cleaning.
- .3 Defective concrete: As defined in subsection 1.5.6 – Defective concrete, below.
- .4 New Concrete: Less than 60 Days old.

#### 1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 1 Sections – Quality Requirements.
- .2 Ready Mixed Concrete Producer: Certified member in good standing of the Ready Mixed Concrete Association of the respective province.
- .3 Inspection and tests:
  - .1 Materials: CSA A23.1/A23.2.
  - .2 Tests will be performed in accordance with CSA A23.1/A23.2.
  - .3 Cooperate with and assist the independent testing agency and the Consultant during inspections and tests.
  - .4 Remove defective materials and completed work which fails tests and replace as directed by the Consultant.
  - .5 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control nor relieve the Contractor of its contractual responsibility.
- .4 Test Panels



- .1 Provide test panels 1.8 m x 1.2 m in size for the Consultant's approval before starting the work of the following schedule:
  - .1 Plain concrete:
  - .2 Number 2 finish for slabs.
- .2 Show on panels the specified finish including formwork tie holes and plugs.
- .3 Erect panels individually or build-in on site in areas selected by the Consultant.
- .4 Form as many panels as necessary until written approval has been issued by the Consultant.
- .5 Upon approval, maintain sample panels in place throughout the duration of the Contract as the standard of workmanship to be adhered to.
- .6 Upon completion of the concrete work, remove and dispose of the test panels off Site.
- .5 Defective concrete:
  - .1 Concrete strength:
    - .1 Strength acceptance criteria from cylinder tests will be in accordance with CSA A23.1/A23.2.
    - .2 Concrete shall be considered defective when a cylinder test fails to meet the performance requirements for the corresponding concrete type, as defined in subsection 2.2 – Concrete Mixes, below.
    - .3 In such cases, the Consultant may require further action or testing in accordance with CSA A23.1, Clause 4.4.6.7 – Failure of Standard-Cured Cylinder Test Results to Meet Requirements.
  - .2 Concrete may be considered defective if it is structurally unsound, lacks moisture resistance, has surface defects, the measured air content fails to meet performance requirements or is improperly finished, as determined by the Consultant.
  - .3 The Consultant has the right to require replacement, strengthening or correction of impacted portions of defective concrete structure, in accordance with Clause 4.4.6.7.2 of CSA A23.1.
  - .4 The Contractor shall bear all costs of rectifying defective concrete including inspections, design, coring, testing, strengthening, demolishing, and replacement. The Contractor shall also bear investigation and evaluation costs even if further evaluation of the design allows the unit to be classified as acceptable concrete.
- .6 Concrete delivery:
  - .1 There shall be a maximum time limit of 120 minutes from the time of initial mixing to complete discharge, in accordance with CSA A23.1 Clause 5.2.4.3.1 – Time of Delivery.
- .7 Records:
  - .1 Before unloading at Site, have the concrete producer submit to the Consultant a delivery ticket (with each batch of concrete) on which is printed, stamped or written the following information:
    - .1 Name and location of batch plant.
    - .2 Date and serial number of ticket.
    - .3 Name of Contractor.
    - .4 Contract Name and Contract number.



- .5 Concrete Mix Design Submission Form number, specified strength, target slump and air content at end of chute.
- .6 Amount of concrete in cubic metres.
- .7 Truck number, cumulative total, and/or load number.
- .8 Time loaded or time of first mixing of cement and water/aggregate.
- .2 Include the following information, which is to be registered by the producer's representative on at least two copies of the delivery ticket, after discharge has been completed:
  - .1 Time that load arrived on Site.
  - .2 Time that discharge of load was started.
  - .3 Time that discharge of load was completed.
  - .4 Type and amount of admixtures. If added at Site, initialed by the Consultant.
- .3 Maintain accurate records of cast-in-place concrete elements. Include in the records the following information:
  - .1 Date of placing concrete element.
  - .2 Location of concrete element.
  - .3 Specified strength of concrete.
  - .4 Air and form temperature when concrete was placed
  - .5 Temperature of concrete when placed in the form
  - .6 Test samples taken and results of test samples.
- .8 The Owner, in consultation with the Consultant, will appoint an independent inspection and testing company to verify compliance with this Specification in accordance with Division 1 Sections – Testing and Inspection Services. Cooperate and coordinate with the inspector to facilitate inspection.

## 1.7 SUBMITTALS

- .1 Provide submittals in accordance with Division 1 Sections – Submittal Procedures.
- .2 Certificates:
  - .1 Submit a current, valid "Certificate of Ready Mixed Concrete Production Facilities" as issued by the RMCAO for plants supplying concrete to the Contract.
  - .2 Submit certification from the concrete producer that a Professional Engineer licensed in the each respective province has designed the mixes based on the requirements of the Specifications and that the concrete mixes will produce concrete meeting the performance requirements of the Specification Sections.
  - .3 Submit certification demonstrating that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete. Ensure these tests are current and represent the aggregates being supplied
  - .4 Submit certifications with the concrete mix design, that all concrete constituents are compatible.
- .3 Quality Control Plan:
  - .1 Submit for review by the Consultant the Quality Control Plan which describes the material, equipment and procedures to be used for the following activities:



- .1 Uniform and consistent concrete finishing.
- .2 Cold weather protection when the air temperature is at or below 5 degrees Celsius.
- .3 Hot weather protection when the ambient air temperature is at above 27 degrees Celsius.
- .4 Concrete curing.
- .5 Concrete placing.
- .6 Temperature Management Plan including temperature monitoring and corrective measures.
- .2 Submit concrete delivery records.
- .4 Records
  - .1 Concrete pours: Maintain and submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken, as described in subsection 3.8 - Field Quality Control, below.
  - .2 Concrete hauling times: Maintain and submit records of deviations from the maximum allowable time of 120 minutes for concrete delivery.
- .5 Shop Drawings:
  - .1 Master Plan(s) of Concrete Placements:
    - .1 Before submitting shop drawings of formwork, falsework and reinforcing bars, submit master plan(s) showing separate concrete placements and the locations of all expansion, isolation, control and construction joints, including any proposed construction joints that are in addition to those indicated on the Contract Drawings.
    - .2 Show layout and location for each type of joint, including expansion and construction joints.
    - .3 Show elevation or section taken through the plane of the joint showing the walls and slabs at the joint.
    - .4 Show details of joint fillers, sealant, adhesives, and other appurtenances.
    - .5 Show details of concrete inserts, including location, size, type and surface treatments.
  - .2 Concrete Placing Schedule:
    - .1 Submit concrete placing schedule.
- .6 Concrete Mix Designs:
  - .1 Submit proposed performance mix design data, and the Supplier's applicable standard deviations.
  - .2 Tabulate concrete mixes. Indicate the types of cement, size of coarse aggregate, water/cementing material ratio, admixtures used, air content, slump, and the locations of use for each mix.
  - .3 For high slump flowing concrete submit a mix that will not result in segregation.
- .7 Test Panels
  - .1 Provide test panels as specified in subsection 1.5 – Quality Assurance.
- .8 Trial Mix Design Prequalification Test Results:



- .1 Submit specified trial mix test results with the mix design as performed by an independent laboratory in accordance with CSA A23.1/A23.2.
- .2 Identify the course of action to be taken if the testing program indicates that the requirements of the Contract Documents have not been met.
- .3 Submit test data three weeks prior to concrete placement showing that the concrete supplied meets the performance criteria stated for each concrete types listed in subsection 2.2 – Concrete Mixes, below:
  - .1 At a minimum, the prequalification mix design test data shall prove that the minimum compressive strength, chloride ion content penetrability (for C-1 class of exposure), density, shrinkage and air content of hardened concrete to be supplied meets or exceeds the performance criteria.
  - .2 Trial batching shall replicate the actual batching practices and placing procedures at the Site and the tests shall be based on the concrete samples taken from the point of discharge into the formwork.
  - .3 All prequalification testing of concrete and concrete constituents by the Contractor shall be done by a laboratory certified in accordance with CSA A283 for the appropriate category of testing.
  - .4 For standard mix (concrete mix that has been used before and is proposed to be used without any alterations of the mix design), historical test data that statistically demonstrates conformance to the Specification requirements may be submitted in lieu of mix design prequalification (trial batch testing), subject to review by the Consultant.
- .9 Field Quality Control Test Results:
  - .1 Submit reports of results for each of the following field tests, and as described in subsection 3.8 – Field Quality Control, below:
    - .1 Concrete pours.
    - .2 Slump.
    - .3 Air content.
    - .4 Compressive strength at 7 and 28 Days.
    - .5 Air and concrete temperature.
- .10 Product Data and Samples:
  - .1 Submit technical data and samples, where noted with quantities, of proposed materials including installation, application, and maintenance instructions for:
    - .1 Joint filler (100 mm length of each type).
    - .2 Curing compound.
    - .3 Evaporation retardant.
    - .4 Surface sealer.
    - .5 Floor hardener.
    - .6 Chemical hardener.
    - .7 Polyethylene sheet.
- .11 Submit a Construction Waste Management plan as described in subsection 3.16 – Cleaning, below.



## 1.8 TRIAL MIXES

- .1 Prior to the start of on-Site concrete construction, undertake trial mixes of each structural concrete mix design.
- .2 Submit test results from trial mixes confirming workability and concrete strength.
- .3 Undertake linear shrinkage testing of the trial mixes and submit test results.
- .4 Adjust mixes that do not provide adequate performance, and re-test.

## 1.9 PRE-PLACEMENT MEETING

- .1 Hold a meeting a minimum of 28 Days prior to the initial placement of concrete to review the detailed requirements for preparing the concrete design mixes, finishes, and procedures for concrete placement for the structures.
- .2 Ensure key personnel, Site supervisor, Consultant, concrete formwork and finishing Subcontractors, concrete pumping and conveying equipment supplier, concrete producer and testing laboratories attend.
- .3 Notify the Consultant a minimum of 10 Working Days prior to the scheduled date of the meeting.
- .4 Provide an agenda for the meeting a minimum of 5 Working Days prior to the scheduled date of the meeting,
- .5 Provide minutes of the meeting within 5 Working Days after the meeting. Circulate to all parties.

## 1.10 DELIVERY, STORAGE AND HANDLING

- .1 Comply with the manufacturers' recommendations for delivery, storage, and handling.
- .2 Store materials in a manner that will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from the Site.
- .3 Concrete:
  - .1 Deliver and store materials on Site in accordance with CSA A23.1/A23.2.
  - .2 Site-mixed concrete shall not be permitted.
  - .3 Concrete, mixed off-Site:
    - .1 When the truck mixer or agitator is accepted for mixing or delivery of concrete, do not add admixtures or water to batch after the initial introduction of mixing.
    - .2 If measured slump or entrained-air content falls outside specified limits, ensure another portion of the same sample is tested immediately. If second failure occurs, concrete will be considered to have failed the requirements of the Specification and will be rejected.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials.

## 1.11 SITE CONDITIONS

- .1 Do not place concrete during or prior to rain.
- .2 Prevent rain from reaching newly placed concrete in accordance with CSA A23.1/A23.2
- .3 Cold weather protection:
  - .1 Maintain protection equipment, in a state of readiness, on Site. Use such equipment when the ambient temperature is at or below 5 degrees Celsius, or when, in the opinion of the Consultant the temperature may fall below 5 degrees Celsius before concrete has cured.



- .2 Do not place concrete upon or against a surface that is at temperature lower than 5 degrees Celsius.
- .3 Provide temperature-controlled enclosures for areas where concrete is placed whenever ambient air temperature is 5 degrees Celsius or lower.
- .4 Protect concrete from the adverse effects of space-heated enclosures including local overheating and combustion products.
- .5 Heat mix water and, if necessary, aggregates when air temperature is at or below, or predicted to go below, 5 degrees Celsius at any time during the next 24 hours.
- .6 Maintain temperature of reinforcing bars and forms above 10 degrees Celsius prior to placing concrete.
- .7 Maintain temperature of concrete when deposited in forms not less than 15 degrees Celsius but not higher than 25 degrees Celsius.
- .8 Maintain temperature of concrete at surfaces at least 10 degrees Celsius for a minimum period of seven Days after placing and achieving minimum 75 percent of specified strength. Concrete temperature may then be lowered to ambient air temperature at a rate of 0.5 degrees Celsius per hour or 10 degrees Celsius per day.
- .9 Use additional protection if full 28 Day compressive strength is required at an early age.
- .10 Keep concrete continuously moist during the curing period.
- .11 Obtain the Consultant's acceptance of the method of maintaining minimum temperatures.
- .4 Hot weather protection:
  - .1 Maintain protection equipment in a state of readiness on Site. Use such equipment when the ambient temperature is at or above 27 degrees Celsius, or when, in the opinion of the Consultant the temperature may exceed 27 degrees Celsius before concrete has cured.
  - .2 When ambient temperature is at or above 27 degrees Celsius, protect concrete from direct sunlight and keep forms moist by sprinkling with cool water, applying wet burlap, or other accepted methods of cooling that will not adversely affect the concrete.
  - .3 Do not place concrete when the concrete temperature exceeds 27 degrees Celsius in the mixer.
  - .4 Concrete, which has a temperature in the mixer between 20 degrees Celsius and 27 degrees Celsius shall:
    - .1 Contain a retarder which reduces mixing water requirements and increases strength.
    - .2 Not contain high early strength cement.
  - .5 Protect forms and equipment, including both mixing and placing equipment, from the rays of the sun and cool by wetting as necessary to maintain a temperature of not more than 5 degrees Celsius in excess of the ambient temperature nor more than 30 degrees Celsius.
  - .6 Prior to placing concrete, wet down forms and reinforcement and the area surrounding the work. Ensure that excess water is swept and drained away immediately before casting the concrete.
  - .7 Keep mixing time to the minimum, consistent with the production of the quality of concrete specified and place mixed concrete immediately.
  - .8 Use sufficient qualified personnel for rapid placing and finishing of concrete.
  - .9 Commence continuous wet curing as soon as the concrete has hardened sufficiently to prevent surface damage.



- .5 Protection from drying:
  - .1 When the rate of surface moisture evaporation exceeds 0.50 kg/m<sup>2</sup>/h, take additional measures to prevent rapid loss of moisture from surface of concrete as accepted by the Consultant and in accordance with CSA A23.1 Clause 7.4.1.2 – Severe Drying Conditions.
- .6 Frost Protection for Footings and Slabs on Grade:
  - .1 Protect subgrades below proposed concrete work. Ensure that subgrade temperatures are a minimum of 10 degrees Celsius when the concrete is placed.
  - .2 Provide continuous protection for footings and slabs on grade to prevent the sub-grade below from freezing during cold weather. Provide heated enclosures and insulation as required.
- .7 Influence of Ambient Concrete Temperature on Concrete Crack Control:
  - .1 To minimize the formation of thermal cracks during placement and curing, maintain previously cured concrete and concrete that will be placed against it at the same temperature.
  - .2 Failure to minimize temperature differential between adjacent pours may result in temperature induced cracking. Repair such cracks as specified in this Section.
- .8 Backfilling and Service Loads Restrictions:
  - .1 Obtain approval from the Consultant prior to backfilling around structures.
  - .2 Verify that the backfill is not higher than the finished grades indicated in the Contract Documents.
  - .3 Verify that equipment for backfilling and compaction on top of slabs will not impose loads greater than those indicated in the Contract Documents.
  - .4 Verify that concrete in walls, and slabs, struts, and cross walls, which frame into the walls providing lateral stability, has been placed and has attained the specified compressive strength before backfilling against walls or subjecting walls to service loads.
  - .5 Verify that concrete in slabs, including slabs on grade supported by piles or caissons, and support components, have reached the specified compressive strengths before backfilling or subjecting slabs to service loads.

## 2 Products

### 2.1 MATERIALS

- .1 General:
  - .1 Use admixtures for concrete conforming to CSA A23.1/A23.2, unless otherwise acceptable to the Consultant.
  - .2 Have the concrete producer certify that admixtures are compatible.
  - .3 Use Products in accordance with the manufacturer's printed instructions unless otherwise acceptable to the Consultant.
  - .4 Fresh concrete to be normal density concrete (2350 kg/m<sup>3</sup> ± 100 kg/m<sup>3</sup>), unless otherwise noted in Part 2.2 – Concrete Mixes.
- .2 Cement and supplementary cementing materials: in accordance with CSA A3001:



- .1 For use in general concrete construction, when the special properties of other cement types are not required, Portland cement Type GU or blended hydraulic cement type GUb shall be used.
- .2 Should the Contractor choose to include silica fume cement in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of Portland cement.
- .3 Should the Contractor choose to include fly ash in the concrete mix design, the substitution of fly ash shall not exceed 25% by mass of Portland cement.
- .4 Should the Contractor choose to include a Ground Granulated Blast Furnace Slag (GGBFS) in the concrete mix design, the substitution of GGBFS shall not exceed 50% by mass of Portland cement, unless specifically accepted by the Consultant.
- .3 Aggregates:
  - .1 Course aggregates: In accordance with CSA A23.1/A23.2. All aggregate sources as listed on the MTO's designated Source Materials (DSM) list.
  - .2 Fine aggregates: In accordance with CSA A23.1/A23.2.
- .4 Water: in accordance with CSA A23.1/A23.2.
- .5 Admixtures:
  - .1 Air entraining admixture: in accordance with CSA A23.1/A23.2 and ASTM C260/C260M.
  - .2 Chemical admixture: in accordance with CSA A23.1/A23.2, ASTM C260 and ASTM C494. The Consultant is to approve accelerating or set retarding admixtures during cold and hot weather placing.
    - .1 Water-reducing admixture: ASTM C494/C494M, Type A.
    - .2 Retarding admixture: ASTM C494/C494M, Type B.
    - .3 Accelerating admixture: ASTM C494/C494M, Type C.
    - .4 Water-reducing and retarding admixtures: Type D.
    - .5 Water-reducing and accelerating admixture: Type E.
    - .6 Water-reducing high range admixture (super plasticizers): Type F.
    - .7 Water-reducing, high range and retarding admixtures (super plasticizers): Type G.
    - .8 Specific performance admixtures: Type S.
- .6 Curing compound: to CSA A23.1/A23.2 white.
- .7 Non-shrink grout: Shrinkage compensating grout, pre-mixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1 Compressive strength: 40 MPa at 28 Days.
- .8 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 40 MPa at 28 Days.
- .9 Dry Pack Material: One part cement and three parts sand (fine aggregate) by volume. Add water to obtain a consistency that when a sample is squeezed, only enough water will come to the surface to moisten hand. Maximum water content shall be 4.5 L to 23 kg of cement.
- .10 Dovetail anchors and slots: Minimum 0.64 mm thickness, Z275 zinc coated galvanized steel with fillers to prevent entry of concrete during pouring and minimum 2 mm overall thickness.
- .11 Rigid insulation: In accordance with CAN/ULC S701 Type 4, extruded polystyrene:



- .1 Low Density Insulation:
  - .1 Styrofoam brand, SM Extruded Polystyrene Foam Insulation by Dow Chemical Canada ULC.
  - .2 Foamular C-300 Extruded Polystyrene Rigid Insulation by Owens Corning Canada.
- .2 High Density Insulation:
  - .1 Styrofoam brand, Highload 40 (Hi-40) Extruded Polystyrene Insulation by Dow Chemical Canada ULC.
  - .2 Foamular 600 High Density Extruded Polystyrene Rigid Insulation by Owens Corning Canada.
- .12 Drilled Anchors:
  - .1 HIT-HY 200 System by Hilti (Canada) Corporation.
  - .2 HSL-3 Heavy Duty Expansion Anchor by Hilti (Canada) Corporation.
- .13 Bond breakers: 810-07 Non-Fibered Asphalt Roof and Foundation Coating by Henry Company Canada Inc.
- .14 Premoulded joint fillers:
  - .1 Bituminous impregnated fibre board: in accordance with ASTM D1751.
  - .2 Sponge rubber: in accordance with ASTM D1752, Type I, flexible firm grade.
  - .3 Self-expanding Standard cork: in accordance with ASTM D1752, Type III.
- .15 Surface hardener:
  - .1 Factory premixed natural emery aggregates with Type GU normal Portland cement, superplasticizers and wetting agents:
    - .1 EmeriCrete SH by Sika Canada Inc.
    - .2 CPD Floor Hardener Pre-mix (Premium) by CPD Construction Products.
    - .3 MBT brand, Mastercron Ff by BASF – Building Systems.
- .16 Sump Pit Waterproofing:
  - .1 Primer and Moisture Control: Penetrating two-component primer and moisture control system, standard colour, 3 mm to 4 mm dry film overall system thickness.
  - .2 Coating: Chemical resistant, semi-gloss finish, standard colour, 2.5 mm dry film overall system thickness; single application.
  - .3 Filler and Grout: Compatible with coating and as recommended by the coating manufacturer.
  - .4 Joint Backing: Preformed, compressible strips of closed cell polyethylene or urethane foam, rubber tubing or non-migrating plasticized vinyl, oversized 25%, compatible with sealant, primer, epoxy surfacing and substrate.
  - .5 Joint Sealant: CAN/CGSB-19.24-M, Type 1, Class B, multi-component modified urethane base chemical curing; material compatible with the coating and as recommended by the coating manufacture.

## 2.2 CONCRETE MIXES

- .1 Performance Requirements:



- .1 Proportion concrete for structures to create high performance concrete with improved durability, reduced shrinkage and reduced cracking.
- .2 Density: Normal density.
- .3 Linear Shrinkage:
  - .1 Limit linear shrinkage to 0.040% after 28 Days drying for 40 mm aggregate concrete and 0.045% after 28 Days drying for 20 mm aggregate concrete.
- .4 Durability Design Life
  - .1 Provide concrete produced under this Section with an expected design life of at least 70 years for the service conditions defined by the usage, and the exposures specified in the Contract Documents.
- .2 General:
  - .1 Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete with strength and other properties specified, in accordance with CSA A23.1/A23.2.
  - .2 Design concrete so that material will not segregate and excessive bleeding will not occur.
  - .3 Use same types and brand of cement throughout.
  - .4 Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1/A23.2, Clause 4.4.6.7 Compressive Strength Requirements.
  - .5 Admixtures plant added with the mix water.
- .3 Mixes for Normal Density concrete:
  - .1 High performance concrete for foundations, footings and foundation walls:
    - .1 Class F-1 exposure.
    - .2 30 MPa at 28 Days.
    - .3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm unless the slab is less than or equal to 400 mm thickness.
  - .2 Concrete grout for starting structural walls below-grade at construction joint:
    - .1 Class F-1 exposure.
    - .2 30 MPa at 28 Days.
    - .3 Utilize mix 1 above without the coarse aggregate.
  - .3 High performance concrete for interior slabs, including slabs-on-grade and slabs-on-deck:
    - .1 Class N exposure.
    - .2 32 MPa at 28 Days.
  - .4 Exterior reinforced concrete slabs:
    - .1 Class C-1 exposure.
    - .2 35 MPa at 28 Days.
    - .3 Air content category 1.
    - .4 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.
  - .5 Exterior unreinforced concrete slabs, pavements, sidewalks and curbs:



- .1 Class C-2 exposure.
- .2 32 MPa at 28 Days.
- .3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.
- .6 Lean fill, pipe bedding, duct banks, encasements, underpinning and skim slabs:
  - .1 Class N exposure.
  - .2 15 MPa at 28 Days.
  - .3 Maximum aggregate size 20mm.
- .4 Mix for Pumped Concrete:
  - .1 Comply with the requirements of ACI 304.2R and this Section.
  - .2 Use coarse and fine aggregate with a uniform grading curve.
  - .3 Superplasticizing admixture may be used for pumped concrete.
  - .4 Do not use admixtures which promote bleeding.

### 3 Execution

#### 3.1 RELEASES

- .1 Obtain the Consultant's release:
  - .1 For reinforcement, formwork, falsework, and inserts as placed.
  - .2 To commence placing concrete.
- .2 Provide the Consultant with written notice of the Contractor's intent to pour between 24 hours and 7 Days prior to the pour.
- .3 Provide a completed Concrete Pour Release Form (attached as a supplement to this Section) prior to each pour and allow the Consultant 2 hours for their review.
- .4 Do not order concrete until the Concrete Pour Release Form has been signed by the Consultant.

#### 3.2 PREPARATION

- .1 Obtain written approval from the Consultant before placing concrete. Provide 24 hours minimum notice prior to the placing of concrete.
- .2 Place concrete reinforcing in accordance with Division 1 Sections – Concrete Reinforcing.
- .3 Remove water, snow, ice, loose soil, laitance, curing compound, wood, and other debris from surfaces on or against which new concrete will be placed.
- .4 Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.
- .5 During concreting operations:
  - .1 The development of cold joints shall not be allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum re-handling, and without damage to the existing structure or Work.
- .6 Pumping of concrete is permitted only after the approval of equipment and mix.
- .7 Ensure reinforcement and inserts are not disturbed during concrete placement.



- .8 Prior to placing of concrete, obtain the Consultant's approval of the proposed method for protection of concrete during placing and curing.
- .9 Protect the previous Work from staining.
- .10 Clean and remove stains prior to application for concrete finishes.
- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
  - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with non-shrink grout to anchor and hold dowels in positions as indicated in the design drawings.
- .13 Do not place load upon new concrete until authorized by the Consultant.

### 3.3 MAXIMUM SIZE OF CONCRETE PLACEMENTS

- .1 Limit the size of each placement to allow for strength gain and volume change due to shrinkage.
- .2 Add construction joints as necessary to suit pour sizes. Confirm the joint location with the Consultant and adjust as necessary.
- .3 Consider beams, girders, brackets, column capitals, and haunches as part of the floor or roof system above and place monolithically with the floor or roof system.
- .4 Construction Joints in Unrestrained Slabs on Ground:
  - .1 Base Slabs placed on the ground may be placed continuously from outside edge to outside edge, outside edge to expansion joint, or from expansion joint to expansion joint, unless shown otherwise on the Drawings.
- .5 Construction Joints in Suspended Slabs Restrained by Connecting Walls:
  - .1 Place slab in alternate strips with the larger dimension of any single placement no greater than 15,000 mm for slabs.
  - .2 Locate construction joints in suspended slabs near the middle quarter of the spans of slabs and beams, unless indicated otherwise on the Contract Drawings. If a beam intersects a girder at this location, offset the construction joint in the slab and girder by a distance equal to two times the depth of the beam.
- .6 Construction Joints in Girders and Beams:
  - .1 Construct concrete beams and suspended slabs monolithically, unless indicated otherwise on the Contract Drawings.
  - .2 If vertical construction joints are required, provide shear key, and additional inclined shear reinforcing steel. The Consultant's review and acceptance is required for any joints added into girders and beams.
- .7 Construction Joints in Walls:
  - .1 Limit pours to a maximum of 6.5 m vertically.
  - .2 Allow 3 Days between adjacent pours.
  - .3 Locate construction joints a minimum of 2,000 mm away from any junction of two or more walls, a column or beam supported on a wall, the nearest edge of an opening wider than 600 mm, and a construction joint in a slab on which the wall rests.
  - .4 Place wall in alternate portions with a distance between vertical construction joints not exceeding 15,000 mm for walls

### 3.4 INSTALLATION/APPLICATION



- .1 Prevent damage to waterproofing where concrete is poured against waterproofing.
- .2 Sleeves and inserts:
  - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, slab drop panels, column capitals or columns, except where indicated or approved by Consultant.
  - .2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere in the Contract Documents.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated in design drawings must be reviewed by the Consultant.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from the Consultant before the placing of concrete.
  - .5 Confirm locations and sizes of sleeves and openings shown on the Drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor rods:
  - .1 Prior to placing concrete, place anchor bolts in locations indicated on the reviewed shop drawings under the supervision of the trade supplying anchor bolts and templates in accordance with the manufacturer's printed instructions and in accordance with CSA A23.1/A23.2.
- .4 Grout under base plates:
  - .1 Grout under base plates using procedures in accordance with the manufacturer's recommendations that result in 100% contact over grouted area. Thoroughly compact leaving no voids.
- .5 Joint fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.
  - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
  - .3 Locate and form isolation, construction and expansion joints as indicated on the Drawings and as described in this Section.
- .6 Horizontal Construction Joints in Reinforced Concrete Walls and Columns:
  - .1 Thoroughly clean and saturate the surface of the joint with water.
  - .2 For walls and columns, place grout onto the existing concrete before starting regular concrete placement. Limit wall and column grout placement to a maximum thickness of 50 mm and a minimum thickness of 30 mm.
- .7 Dovetail anchor slots:
  - .1 Install continuous vertical anchor slots to forms where masonry abuts concrete wall or columns.
  - .2 Install continuous vertical anchor slots at 800 mm o.c. where concrete walls are masonry faced. Anchors shall project to within 20 mm minimum of masonry face.
  - .3 Do not install anchor slots in underground concrete walls cast against excavation support systems



### 3.5 PROTECTION AND CURING

- .1 Protect and cure concrete in accordance with CSA A23.1, Clause 7.4 and Table 20.
- .2 Protect freshly placed and finished concrete from adverse conditions such as premature drying, moisture loss, defacement due to building operations, and from excessive hot and cold temperatures, for the period of time corresponding to the required curing type of concrete.
- .3 Commence protection immediately after placing to achieve the temperature and moisture conditions for the period of time necessary for the concrete to develop its required properties.
- .4 Concrete elements shall be protected to limit the temperature differential between the concrete core and the concrete surface within 20°C.
- .5 Protection shall not be removed until the concrete has cooled to the temperature differential given in the CSA A23.1, Table 21, in order to avoid cracking of the concrete due to the sudden temperature change near the end of the curing period.
- .6 Removal of forms prior to the minimum curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum time periods specified for curing and protection. Refer to CSA A23.1, Clause 7.4.1.5.3.4.
- .7 Curing types based on CSA A23.1, Table 20, as modified in this Section:
  - .1 Type 1 – Basic curing: Three days at  $\geq 10^{\circ}\text{C}$  or for the time necessary to attain 40% of the specified strength.
  - .2 Type 2 - Additional curing: Seven days total at  $\geq 10^{\circ}\text{C}$  and for the time necessary to attain 70% of the specified strength.
  - .3 Type 3 - Wet curing: Seven days at  $\geq 10^{\circ}\text{C}$  and for the time necessary to attain 70% of the specified strength.
  - .4 Note: Silica fume concrete must be wet cured.
- .8 Wet Curing of Concrete:
  - .1 When wet curing is required, start fog misting immediately after placing operations are completed, in order to prevent plastic shrinkage and cracking from taking place.
    - .1 Fog misting must be applied continuously from the time of screeding until concrete is covered with burlap or other moisture-retaining covering, in such a way as to maintain high relative humidity above the concrete and prevent drying of the concrete surface.
  - .2 When concrete has set, cover horizontal surfaces with at least one layer of wet burlap or other moisture-retaining covering.
    - .1 Strips must overlap 150 mm and must be held in place without marring the surface of the concrete.
    - .2 Provide suitable weights to prevent blow-off or displacement of protective cover.
    - .3 Burlap must be pre-soaked by immersing it in water for a minimum period of 24 hours prior to placing and must be maintained in a continuously wet condition throughout the curing period by means of a soaker hose.
    - .4 Do not permit intermittent drying.
    - .5 Remove burlap after a minimum of 7 consecutive Days and allow to air dry until the concrete has developed the specified design strengths.
  - .3 Water must not be allowed to drip, flow or puddle on the concrete surface during fog misting, when placing the burlap or at any time before the concrete has achieved final set.



- .9 Use of Curing Compounds and Evaporation Reducers:
- .1 Except where concrete wet curing is required, the use of pigmented curing compounds and evaporation reducers may be authorized by the Consultant.
  - .2 Apply curing compound/evaporation reducer after placing or finishing operations have been completed, in accordance with the compound manufacturer's printed instructions.
  - .3 Ensure the compound application is uniform and continuous over entire area being cured.
  - .4 Where surfaces are to be exposed to sunlight, use compound with white pigment.
  - .5 Do not use curing compounds on surfaces where a bond is required for additional concrete or where a bonded surface coating such as paint, tile, resilient flooring, and similar materials are to be applied.
- .10 Curing Plan:
- .1 Detailed curing plan containing (at minimum) the duration of curing, the manner in which the surface will be kept moist, type of curing material, and provisions to address potential problems (for example, high winds or extreme weather conditions) shall be prepared by the Contractor and submitted for review by the Consultant as part of the Work plan requested in subsection 1.6, above.

### 3.6 FINISHING

- .1 Treat and finish exposed formed surfaces in accordance with CSA A23.1.
- .2 Grout tie holes in concrete flush to the concrete surface. Grout with finishing cement mortar using the same sand and cement as used in the concrete.
- .3 Pack grout into place to fill the tie hole and finish to match the adjacent concrete surface.
- .4 After the removal of forms, strike off projections, and fill honeycombing and defects in accordance with CSA A23.1/A23.2.
- .5 Refer to honeycombed areas for inspection and designation as structural or non-structural and repair as directed by the Consultant.
- .6 Floor finish classification: Class A in accordance with Table 22 of CSA A23.1.
- .7 Except where indicated otherwise in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents or Architectural Drawings, follow the follow finishing schedule:

AREA	Type of Finish
Wall Surfaces – Exterior:	
1. Above grade/exposed (above a point 150 mm below finish grade)	Number 6 Finish
2. Above grade/covered with brick veneer or other finish material	Number 5 Finish
3. Backfilled (below a point 150 mm below finish grade)	Number 4 Finish
Slabs – Upper Surface:	
4. Firing Range floor slab and Shipping & Receiving floor slab	Number 2 Finish
5. Exterior roof slab/covered with roofing or waterproofing material	Number 1 Finish
6. Other exterior slabs	Number 2 Finish
7. Stairs and landings	Number 3 Finish
8. Top of interior buildings slabs	Number 2 Finish
9. Top of interior slabs to receive mortar setting bed for tile	Number 7 Finish
10. Top of interior slabs to receive resilient flooring or carpet, chemical resistant coating, special flooring, tiles on thin set mortar	Number 2 Finish
11. Equipment bases	Number 2 Finish
12. Where shake on hardener is applied	Number 2 Finish



- .8 Finish type other than those indicated in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents shall be as follows:
- .1 Number 1 Finish (Wood Float):
    - .1 After screeding by accepted method to obtain required floor tolerances, work the surface by means of a wood float in such a manner that after concrete has hardened, no portion of surface shows a variation of more than that specified.
  - .2 Number 2 Finish (Trowelled):
    - .1 After screeding and compaction with a wooden float, bring the surface to a smooth level and dense finish free from trowel marks, ridges and depressions by means of steel trowels operated either by hand or by mechanical means.
    - .2 Do not sprinkle dry cement or sand on the surface during the trowelling process.
    - .3 Maintain ambient temperature at a minimum of 10°C, when steel trowelling is in progress.
  - .3 Number 3 Finish (Broomed):
    - .1 Before the floated surface has fully hardened, brush the surface with a stiff broom in one direction to leave a rough surface.
  - .4 Number 4 Finish (Formed):
    - .1 As soon as forms have been removed and directions given by the Consultant, remove projections and fill honeycombing and defects.
  - .5 Number 5 Finish (Smooth Formed):
    - .1 As soon as forms have been removed and directions given by the Consultant, patch formwork tie holes, grind off projections, irregularities and rough spots, patch surface defective areas and repair rough spots. Provide a smooth uniform appearance
  - .6 Number 6 Finish (Rubbed):
    - .1 As soon as forms have been removed and holes pointed, rub surface with an abrasive rubbing brick until form marks and blemishes are removed and the surface is smooth and of uniform texture and colour.
    - .2 Do not remove from a larger surface than can be rubbed to fine finish within 6 hours.
  - .7 Number 7 Finish (Floor to Receive Bonded Topping, Screed, Grout, or Porcelain Tile):
    - .1 Strike off and screed the concrete base slab to a level below the final floor surface equal to the specified thickness of the finish course as shown on the Drawings.
    - .2 Float the surface.
    - .3 Wire broom the surface to make 6 mm deep grooves at approximately 20 mm centres, running in one direction.
  - .9 Where the schedule of finishes requires painting, prepare surfaces for painting as specified in Division 1 Sections - Painting.
  - .10 Surface Hardener:
    - .1 In area(s) indicated to receive surface hardener, power screed the floor slab and float.
    - .2 Over freshly floated concrete apply surface hardener in accordance with the manufacturer's printed instructions.



- .3 Distribute evenly, do not throw hardener.
- .4 Float between applications of hardener and after second hardener application with power floats.
- .5 Machine trowel to smooth, level, and dense surface of uniform colour, free from trowel marks, ridges, pinholes, and other defects.
- .6 Have the manufacturer's representative on Site within 24 hours when requested by the Consultant.
- .11 Ensure that the concrete finish is compatible with specified traffic topping or other applied finish.
- .12 Production of smooth surfaces by means of cement plaster is not permitted

### **3.7 CONSTRUCTION TOLERANCE**

- .1 Concrete tolerances shall be in accordance with CSA A23.1/A23.2 clause 6.4 - Construction Tolerances for Cast-in-Place Concrete, and subsection 1.5 – Quality Assurance, above.

### **3.8 FIELD QUALITY CONTROL**

- .1 Site tests: Conduct tests as follows in accordance with CSA A23.1/A23 and submit results as described in subsection 1.6 – Submittals, above.
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7 and 28 Days.
  - .5 Chloride ion content penetrability (for exposure class C-1 concrete).
  - .6 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Consultant for review in accordance with CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed for discussion at the pre-pouring concrete meeting between the testing laboratory and Consultant.
- .4 The Consultant will take additional test cylinders during cold weather concreting. Cure cylinders on Site under the same conditions as concrete which they represent.
- .5 Non-Destructive Methods for Testing Concrete: in accordance with CSA A23.1/A23.2.
- .6 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control requirements nor relieve Contractor of any of its responsibilities under the Contract.

### **3.9 LOADING OF STRUCTURE**

- .1 Do not load any portion of structure prior to achieving 70% of specified strength and only with the acceptance of the Consultant.
- .2 Removal of forms prior to the minimum required curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum required time periods specified. Refer to subsection 3.5 of this Section above.

### **3.10 REPAIRING SURFACE CRACKS IN CONCRETE**

- .1 After concrete has set for a minimum of 28 Days, and before a maximum of 125 Days, examine surfaces carefully for cracks.
- .2 Rout cracks larger than 0.3 mm at the discretion of the Consultant.



- .3 Fill cracks with non-shrink grout.
- .4 Match the surface to existing surfaces in quality, texture, colour, and elevation.

### **3.11 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS**

- .1 Repair cracks in the completed structures employing a suitable polyurethane injection technique to make such cracks completely watertight after repair.
- .2 Remove surface injection materials following the completion of the Work and finish the affected areas to match the surrounding concrete.

### **3.12 INJECTION OF CRACKS – POLYURETHANE GROUT**

- .1 Use materials in accordance with the manufacturer's printed instructions.
- .2 Clean and prepare cracked areas in accordance with the manufacturer's recommendations.
- .3 Inject polyurethane grout into cracks in accordance with the manufacturer's written instructions.
- .4 Commence injection at the lowest injector on a vertical face and at one end on a horizontal surface. Continue injection until pure uncontaminated material flows out from adjacent injectors. Cap the injectors and proceed to adjacent injectors until all injectors have been filled.
- .5 Upon completion, remove injectors and surface sealer. Thoroughly clean the concrete surfaces of excess grout material. Finish the surface to match the surrounding concrete.
- .6 Patch injection holes.

### **3.13 PATCHING**

- .1 Carry out patching as specified in CSA A23.1/A23.2.
- .2 Make good temporary openings left in concrete for pipes, conduits, ducts, shoring, and other Work during construction.
- .3 Reinforce with welded wire fabric, as required, and finish to match the surrounding work.

### **3.14 SEALANT APPLICATION**

- .1 Do not fill joints sooner than 30 Days after concrete pours.
- .2 Comply with the manufacturer's printed instructions and curing and sawcutting requirements.
- .3 Execute joint sealing during cool, dry ambient conditions when the slab is in a contracted state to minimize future joint separation at sealant filled joints.
- .4 Fill sawn joints in concrete slabs full depth with sawcut joint sealant.
- .5 Seal over pre-moulded joint filler with joint sealant.
- .6 Comply with the sealant manufacturer's primer, application, and temperature requirements. Mask floor to edge of joints and fill joint with sealant.
- .7 After initial set, prime sealant surface and refill joints with sealant as required to produce a slightly convex joint surface.

### **3.15 CLEANING**

- .1 Cleaning:
  - .1 Promptly as the Work proceeds and upon completion, clean-up and remove from the site, the rubbish and surplus material resulting from the Work of this Section.
  - .2 Leave the Work area clean at the end of each Day.
  - .3 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment.



- .2 Waste Management:
  - .1 Prepare a Construction Waste Management plan in accordance with Division 1 Sections - Construction Demolition & Waste Management Plan.
  - .2 Separate waste materials for reuse and recycling.
  - .3 Divert unused concrete materials from landfill to local quarry or facility after receipt of written approval from Consultant.
  - .4 Provide an appropriate area on Site where concrete trucks can be safely washed.
  - .5 Divert unused admixtures and additive materials (pigments, fibres) from landfill to an official hazardous material collections site as approved by Consultant.
  - .6 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
  - .7 Prevent admixtures and additive materials from entering drinking water supplies or streams.
  - .8 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.
  - .9 Dispose of waste in accordance with applicable local, provincial and national regulations.

**END OF SECTION**



1 General

1.1 GENERAL REQUIREMENTS

- .1 Sections of Division 01 apply to this Section.

1.2 SUMMARY

- .1 This Section includes supply and installation of unit masonry assemblies consisting, but not limited to the following:

- .1 Concrete Masonry Units (CMU).
- .2 Masonry accessories.
- .3 Site quality control.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
- .1 Coordinate with other work having a direct bearing on work of this Section.
  - .2 Coordinate the masonry work with anchor requirements at framed openings.
  - .3 Coordinate the masonry work with air barrier installation to achieve continuous monolithic air barrier.

1.4 SUBMITTALS

- .1 Samples: Submit samples of concrete block, mortar, masonry reinforcement, ties and anchors, damp course/thru-wall flashing and adhesive, metal drip flashing, mortar dropping control device and weepholes for Consultant's approval before commencing work of this section.
- .2 Shop Drawings: Submit shop drawings indicating the following:
- .1 Indicate sizes, profiles, coursing, and locations of special shapes for concrete masonry units and stone masonry cladding.
  - .2 Indicate sizes, profiles, and locations of each stone trim unit required.
  - .3 Detail corner units, end dam units, and other special applications for fabricated flashings.
- .3 Informational Submittals: Provide the following submittals when requested by the Consultant:
- .1 Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:
    - .1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of Supplementary Standard SB-3 of Ontario Building Code
    - .2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed.
    - .3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.
  - .4 Certificates: Submit statements of material properties indicating compliance with specified requirements for each type and size of the following:
    - .1 Masonry Units:



- .1 Include material test reports substantiating compliance with requirements.
- .2 Include ULC Listings for fire resistance rated materials and construction equivalent to assemblies with indicated on drawings indicating fire resistance ratings.
- .2 Cementitious Materials:
  - .1 Include brand, type, and name of manufacturer for site mixed mortar materials.
  - .2 Include description of type and proportions of ingredients for pre-blended, dry mortar mixes.
  - .3 Include description of type and proportions of ingredients for grout mixes.
- .3 Accessories:
  - .1 Reinforcing bars
  - .2 Joint reinforcement
  - .3 Anchors, ties, and metal accessories
- .4 Site Quality Control Submissions: Submit detailed description of methods, materials, and equipment used in accordance with cold or hot weather requirements; and proposed unit masonry cleaning techniques.

## 1.5 SITE CONDITIONS

- .1 Protection of Masonry: Protect masonry and other work from marking and other damage and as follows:
  - .1 Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work during construction until permanent flashings and membranes are completed.
  - .2 Cover partially completed masonry when construction is not in progress to prevent wetting of inside wythes of construction and contribution to efflorescence.
  - .3 Extend cover a minimum of 610 mm (24") down both sides and hold cover securely in place.
  - .4 Secure cover a minimum of 610 mm (24") down face next to un-constructed wythe and hold cover in place where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes.
  - .5 Provide adequate bracing for masonry during construction and until permanent lateral supports are in place.
  - .6 Do not apply uniform floor or roof loads for a minimum of 12 hours and concentrated loads for a minimum of 3 days after building masonry walls or columns.
- .2 Cold Weather Protection:
  - .1 Keep masonry materials completely free from ice and frost. Use approved smokeless heaters. Do not use scorched sand. Do not use salts, admixtures or antifreezes.
- .3 Conform to the following construction requirements:

AIR TEMPERATURE	HEATING OF MATERIALS	PROTECTION
Above 5 deg C	Normal masonry procedures	Cover walls and materials



Below 5 deg C	Heating mixing water. Maintain mortar temperatures between 5 deg C and 50 deg C until placed	Cover walls and materials to prevent wetting and freezing.
Below 0 deg C	In addition to above heat sand. Thaw frozen sand and frozen wet masonry units before use.	With wind velocities over 35 km/h provide windbreaks during the workday and cover walls and materials at the end of each workday to prevent wetting and freezing. Maintain masonry above 0 deg C by using auxiliary heat or insulated blankets for 16 hours after laying masonry units.
Below -6 deg C	In addition to above heat dry masonry units to -6 deg C	Provide enclosure and supply sufficient heat to maintain masonry enclosure above 0 deg C for 24 hours after laying masonry units.

.4 Hot Weather Requirements

- .1 Comply with hot weather construction requirements contained in reviewed submittals.
- .2 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
- .3 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

**1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- .1 Delivery and Acceptance Requirements: Deliver pre-blended, dry mortar mix in moisture resistant containers designed for lifting and emptying into dispensing silo; store dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- .2 Storage and Handling Requirements: Store masonry units on elevated platforms in a dry location and as follows:
  - .1 Stack materials on floors of building so that structural design loads are not exceeded; coordinate with Consultant.
  - .2 Cover tops and sides of stacks with waterproof sheeting securely tied to pallets if units are not stored in an enclosed location; do not install masonry units that become wet until they are dry.
  - .3 Store cementitious materials on elevated platforms, under cover, and in a dry location; do not use cementitious materials that have become wet or damp.
  - .4 Store aggregates where grading and other required characteristics can be maintained; store to prevent contamination by substances deleterious to performance and appearance.
  - .5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

2 Products



## 2.1 CONCRETE MASONRY UNITS

- .1 Standard concrete blocks shall be autoclave or bubble cure process, high pressure steam cured, modular, conforming to CSA A165, with lineal shrinkage and moisture movement not to exceed 0.035% and shall be as follows:
  - .1 Classification: S/15/A/M, 75% solid for all locations where structural members bear on concrete block.
  - .2 H/15/A/M, for all other block work.
  - .3 Size: Modular imperial to sizes indicated on Drawings.
  - .4 Special shapes:
    - .1 Provide square units for exposed corners.
    - .2 Provide purpose made shapes for lintels and bond beams.
    - .3 Provide additional special shapes required for project.
    - .4 Manufacture special shapes at same time and with the same batch as standard concrete block to be used.
- .2 Precast Concrete Shapes: Precast suitably reinforced concrete units with uniform colour, accurate definition at corners and at angle changes and faces true, plane and well-defined. Minimum 15 MPa compressive strength. Exposed to view surfaces in dense and even finish, free of defects such as honeycombing, voids, loss of fines. Concealed surfaces in float finish.
  - .1 Sills and Lintels: Colour and texture to match adjacent masonry units.
  - .2 .
- .3 Fire Resistant Concrete Masonry Units:
  - .1 CAN/CSA-A165 Series, same classification as non-rated block units except aggregate used in units and equivalent thickness of units to comply with applicable Code for fire-resistance ratings indicated. For fire rated walls requiring a fire-resistance rating of 3 hours or greater, use ULC certified units.
- .4 Size: Modular to sizes indicated on Drawings.
  - .1 Where concrete block walls are required as fire separations or barriers, they shall conform to the National Building Code. With respect to equivalent thickness and type of concrete. Consult with Consultant for locations and special conditions.
- .5 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.

## 2.2 MORTAR MATERIALS

- .1 Mortar materials shall conform to CSA A179.
- .2 Water: Potable (clean, exempt of ice, oils, acid, alkalis, organic matter, sediments or any other harmful matter). CSA A179.
- .3 Aggregate:
  - .1 CSA A179.
  - .2 Use same brands of materials and source of aggregate for entire project.
  - .3 Use washed aggregate consisting of natural sand or crushed stone for mortar that is exposed to view.
- .4 Cement: Normal portland, in accordance with CSA A3000, Type GU.



- .5 Grout: In accordance with CSA A179, Table 3.
- .6 Hydrated Lime: ASTM C207, Type S.
- .7 Cold Weather Admixture:
  - .1 Non-chloride, non-corrosive, accelerating admixture as recommended by manufacturer for use in masonry mortar of composition indicated.

## 2.3 MORTAR MIXES

- .1 Mixing:
  - .1 Prepare and mix mortar materials under strict supervision and in small batches for immediate use only. Mix proprietary mortars in strict accordance with CSA A179. Do not use re-tempered mortars for coloured mortars.
- .2 For Masonry Below Grade and In Contact With Earth:
  - .1 Use premixed silo or bagged Type 'S' masonry cement mortar having minimum compressive strength of 8.5 MPa at 28 days, jobsite tested.
- .3 Interior Reinforced or Non-Reinforced Block Walls:
  - .1 Use Type 'S', premixed Bloc Mix by Daubios Inc., or approved equal by Maxi-Mix.
- .4 For All Other Masonry:
  - .1 Use Type 'N', premixed silo or bagged masonry mortar having a minimum compressive strength of 3.5 MPa at 28 days, jobsite tested as per property specification, Table 6, CSA A179.

## 2.4 MASONRY REINFORCEMENT, TIES AND ANCHORS

- .1 Masonry Joint Reinforcement: In accordance with to CSA A371 and ASTM A496/A496M, with corrosion protection in accordance with CSA S304.1 and CSA A370, and as follows:
  - .1 Interior Walls: Hot dip galvanized, carbon steel.
  - .2 Exterior Walls: Stainless steel.
  - .3 Lengths: A minimum of 3050 mm (10') with prefabricated corner and tee units.
- .2 Connectors: In accordance with to CSA A370 and CSA S304.1 with hot dip galvanized finish.
- .3 Single Wythe Masonry Joint Reinforcement: Either ladder or truss type with single pair of side rods.
- .4 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:
  - .1 Deflection: Maximum 1.6 mm (1/16") including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.
  - .2 Positive restraint at position of maximum adjustment.
  - .3 Free play of multi-component ties maximum 0.8 mm (1/32") when assembled in all possible configurations.
  - .4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.
- .5 Lateral Partition Supports (Top of Wall Anchors):
  - .1 Angle Support: Fabricated from 3 mm (1/8") core metal thickness angled steel plate having 75 mm (3") long legs fastened to deck structure to allow vertical movement of



- masonry assembly; hot dip galvanized; coordinate with Section 07 84 00 – Firestopping and Smoke-seals for firestopping insulation and smoke seals.
- .2 Plate Support: Fabricated from 3 mm (1/8") core metal thickness stainless steel plate with 9.5 mm (3/8") diameter metal 150 mm (6") long welded to plate having closed end plastic tube fitted over rod that allows rod to move in and out of tube.
  - .3 Anchor Bolts: Where required provide Headed or L-shaped steel bolts in accordance with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized in accordance with ASTM A153/A153M, Class C.
  - .4 Post Installed Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete when tested in accordance with ASTM E488/E488M conducted by a qualified independent testing agency, and as follows:
    - .1 Indoor Locations: Carbon-steel components zinc-plated in accordance with ASTM B633, Class Fe/Zn 5.
    - .2 Outdoor and High Humidity Locations: Alloy Group 1 or 2 stainless steel bolts complying with ASTM F593 and nuts complying with ASTM F594.
    - .3 Fastening into Solid Concrete or Solidly Grouted Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts into new or existing concrete or grout. Basis-of-Design Materials: Hilti Inc., HIT HY150 System, no Substitutions Accepted.
    - .4 Fastening Trough Hollow Wall Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts, with cylindrical mesh screen tube into new or existing masonry cavity wall. Basis-of-Design Materials: Hilti Inc., HIT HY20 System, no Substitutions Accepted.
  - .6 Galvanizing for Masonry Reinforcement, Ties and Anchors:
    - .1 Hot Dip Hardware and Bolts: In accordance with ASTM A153/A153M, Class B-2 regardless of location.
    - .2 Hot Dip Sheet Steel: In accordance with ASTM A653/A653M, Coating Designation Z600, regardless of location.
    - .3 Structural Shapes and Pipes: In accordance with ASTM A123/A123, Grade 85, regardless of location.

## 2.5 MISCELLANEOUS MASONRY ACCESSORIES

- .1 Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation 2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
  - .1 Products: Subject to compliance with the requirements of this Section, provide:
    - .1 RS Series – Rubber Control Joints by Hohmann & Barnard, Inc.
- .2 Firestopping: As specified under Section 07 84 00 – Firestopping and Smoke-seals.
- .3 Sealants: As specified under Section 07 92 00 – Sealants.
- .4 Support Angle:
  - .1 Hot dip galvanized 458 g/m<sup>2</sup>/side in accordance with CSA A370 and ASTM A153/A153M.



- .5 Fasteners: Galvanized fasteners meeting the requirements of ASTM A325, and as recommended by manufacturer.
- .6 Joint Filler:
  - .1 Compressible Filler: Pre-moulded filler strips in accordance with ASTM D1056, Grade 2A1; compressible up to 35%; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- .7 Bond Breaker Strips: #15 asphalt saturated, organic roofing felt in accordance with CSA A123.3.

### 3 Execution

#### 3.1 EXAMINATION

- .1 Verify that field conditions are acceptable and are ready to receive work.
- .2 Verify items provided by other sections of work are properly sized and located.
- .3 Verify that built-in items are in proper location, and ready for roughing into masonry work.
- .4 Verify walls including steel connections in walls to be grouted have been inspected by structural engineer, before grouting.

#### 3.2 PREPARATION

- .1 Direct and coordinate placement of metal anchors supplied to other Sections.
- .2 Provide temporary bracing and shoring during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- .3 Protect materials and adjacent construction from mortar droppings and damage during construction.
- .4 Plug grouting clean-out holes with block masonry units. Brace masonry for wet grout pressure.

#### 3.3 COURSING

- .1 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .2 Establish lines, levels, and coursing indicated. Protect from displacement.
- .3 Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- .4 Concrete Masonry Units:
  - .1 Bond: Running; stack bond for walls indicated with vertical bar reinforcing.
  - .2 Coursing: One unit and one mortar joint to equal 200 mm (8").
  - .3 Mortar Joints: Concave where exposed or where paint or other finish coating is indicated; flush for concealed joints. Cut mortar joints flush where resilient base, wall tile, parging, air barrier or insulation is scheduled.

#### 3.4 PLACING AND BONDING

- .1 Lay hollow masonry units with face shell bedding on head and bed joints.
- .2 Reinforced Masonry: Lay masonry units with core cells vertically aligned clear of mortar and unobstructed. Place mortar in masonry unit bed joints back 6 mm (1/4") from edge of unit grout spaces, bevel back and upward.
- .3 Where indicated, provide special shape units.
- .4 Exposed Faces: Lay face work from face side with exposed face flush.
- .5 Buttering corners of joints or excessive furrowing of mortar joints are not permitted.



- .6 Remove excess mortar as work progresses.
- .7 Interlock intersections and external corners of walls with running bond.
- .8 Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- .9 Perform job site cutting of masonry units with power-driven abrasive discs to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Allow 3 mm (1/8") clearance around items penetrating or built into walls.
- .10 Isolate masonry from vertical structural framing members with a control joint.
- .11 Isolate top joint of masonry from horizontal structural framing members and slabs or decks with compressible joint filler. Finish resulting joint with Sealant.
- .12 Fill masonry cores with grout at:
  - .1 Ends of walls, both free and abutting other work.
  - .2 Jambs of openings, minimum 300 mm (12") from jamb face.
  - .3 Courses under plates and lintel requiring bearing.
  - .4 Attachment devices for fixtures and built-in items.
  - .5 Courses at tops of fire rated walls.
  - .6 Blocks of parapet walls, and in accordance with CSA-A371, Appendix G1.
  - .7 Anchors set in block cells.
  - .8 Install building paper below voids to be filled with grout; keep paper 25 mm (1") back from face of units.

### 3.5 CONTROL AND EXPANSION JOINTS

- .1 General: Install control and expansion joint materials in unit masonry where indicated and not to exceed 6 metres (20') on center and 3 metres (10') from corners. Build-in related items as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- .2 Form control joints in concrete masonry as follows:
  - .1 Install preformed control-joint gaskets designed to fit standard sash block.
  - .2 Keep head joints free and clear of mortar for application of sealant.

### 3.6 PROVISION FOR MOVEMENT

- .1 Leave space of dimension indicated between top of non-loadbearing wall and structural elements. Do not use wedges.

### 3.7 REINFORCEMENT AND ANCHORAGE

- .1 Install reinforcement and anchorage to CSA-A370, CSA-A371 and CSA-S304.1 and as indicated.
- .2 Install masonry joint reinforcement as indicated. Where not indicated provide as follows:
  - .1 Install horizontal joint reinforcement 400 mm (16") on centre. For stack bond, place joint reinforcement at every course.
  - .2 Place reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm (16") each side of opening.
  - .3 Place reinforcement continuous in first and second joint below top of walls.
  - .4 Lap joint reinforcement ends minimum 150 mm (6").



- .3 Bar Reinforcing Steel:
  - .1 Secure reinforcing steel in place. Provide bar sizes, laps and spacings as indicated. Maintain position within 13 mm (1/2") of dimensioned position.
  - .2 Unless otherwise indicated locate vertical reinforcing on centreline of units.
  - .3 Unless otherwise indicated, reinforce stack-bonded unit joint corners and intersections with strap anchors 400 mm (16") on centre.
  - .4 Secure reinforcing steel in place. Inspect steel connections before grouting.
  - .5 Provide cleanout openings at bottom of cores containing reinforcement.
  - .6 Fill cells containing reinforcement and anchor bolts solidly with grout.
- .4 Anchorage:
  - .1 Provide lateral supports for masonry walls and partitions as required by applicable codes, perpendicular to wall faces and either horizontally or vertically to wall panel edges.
  - .2 Where lateral support at tops of walls is required, provide anchors or clip angles installed at spacings not exceeding 10 times the wall thickness, unless otherwise indicated.
  - .3 Where lateral support at sides of walls is required, provide anchors or clip angles installed at spacings not exceeding 4 times the wall thickness, unless otherwise indicated.

### 3.8 LINTELS

- .1 Install steel lintels where indicated.
- .2 Provide masonry lintels where shown and where openings of more than 610 mm (24") are shown without structural steel or other supporting lintels.
- .3 Provide minimum bearing of 200 mm (8") at each jamb unless otherwise indicated.

### 3.9 LATERAL SUPPORT AND ANCHORAGE

- .1 Unless otherwise indicated, attach strap anchors to building structural members abutting ends of walls. Embed in every second block joint.
- .2 Provide other lateral support and anchorage as indicated.

### 3.10 GROUTING REINFORCED MASONRY

- .1 Permit mortar to cure 7 days before placing grout.
- .2 Unless otherwise indicated, reinforce masonry unit cores with reinforcing bars and grout as follows:
  - .1 Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement as indicated.
  - .2 Wet masonry unit surfaces, in contact with grout just prior to grout placement, when required, to reduce moisture suction from grout.
  - .3 Grout spaces less than 50 mm (2") in width with Fine grout using low lift grouting techniques. Grout spaces 50 mm (2") or greater in width with Coarse grout using high or low lift grouting techniques. Completely fill spaces of stack bonded masonry; attain minimum 50 percent grout filling of spaces in running bond masonry.
  - .4 When grouting is stopped for more than one hour, terminate grout 38 mm below top of upper masonry unit to form a positive key for subsequent grout placement.



- .3 Low Lift Grouting: Place first lift of grout to a height of 400 mm (16") to three masonry unit courses and rod for grout consolidation. Place subsequent lifts in 200 mm (8") increments and rod for grout consolidation.
- .4 High Lift Grouting:
  - .1 Provide cleanout opening no less than 100 mm (4") high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
  - .2 Clean out masonry cells with high pressure water spray. Permit complete water drainage.
  - .3 Request inspection of cells. Allow 3 days advance notice of inspection.
  - .4 After cleaning and cell inspection, seal openings with masonry units.
  - .5 Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
  - .6 Limit grout lift to 1500 mm (5') and mechanically vibrate. Wait 45 minutes before placing next lift.

### 3.11 CONTROL JOINTS

- .1 Provide continuous control joints as indicated.
- .2 Do not continue horizontal joint reinforcement through control joints, unless otherwise indicated.
- .3 Break vertical mortar bond with control joint filler, full depth of unit. Fill adjacent core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- .4 Size control joint as specified in Division 07 Section Sealants, for sealant performance.
- .5 Where joint locations are not indicated, space joints 6 m (20') on centre, and one adjacent to corner at each change of direction.

### 3.12 BUILT-IN WORK

- .1 As work progresses, install built-in items to be built into the work and furnished by other sections.
- .2 Install built-in items plumb and level.
- .3 Build chases; cutting not permitted. When openings require cutting after walls are in place, saw cut only; breaking of block not permitted.
- .4 Where masonry encloses conduit or piping, place to required level to permit inspection and testing. Cover items when directed.
- .5 Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill hollow metal door frame voids solid with grout or insulation as indicated.
- .6 Do not build in organic materials subject to deterioration.

### 3.13 ERECTION TOLERANCES

- .1 Maximum Variation from Plane of Wall: 6 mm/3 m (1/4" per 10') and 13 mm/6 m (1/2" per 20') or more; 3 mm/3m (1/8" per 10') for walls to receive thin-set tile.
- .2 Maximum Variation from Plumb: 6 mm (1/4") per story non-cumulative; 13 mm (1/2") in two stories or more.
- .3 Maximum Variation from Level Coursing: 3 mm/m (1/8" per 36") and 6 mm/3 m (1/4" per 120").

### 3.14 CUTTING AND FITTING

- .1 Cut and fit neatly for conduit, sleeves, recessed or built-in objects. Coordinate with other sections of work to provide correct size, shape, and location.
- .2 Make cuts straight, clean and free of uneven edges.



- .3 Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### 3.15 SITE QUALITY CONTROL

- .1 Inspections:
  - .1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located, to perform inspections.
  - .2 Perform timely and regular inspections.
  - .3 Verify installation conforms to applicable building Code.
  - .4 Prepare and submit inspection forms required by applicable building code.
- .2 Testing:
  - .1 Owner will engage qualified independent testing agency to inspect and test engineered masonry work and prepare reports.
  - .2 Allow testing agency access to scaffolding and work areas as needed to perform tests and inspections. Retest materials that fail to meet specified requirements.
  - .3 Tests Prior to Construction: One set of tests.
  - .4 Tests During Construction: One set of tests for each 300 sq. m (3300 sq.ft.) of wall area or portion thereof.
  - .5 Mortar and Grout Compressive Strength and Air Content Tests: For each mix provided, according to ASTM C780 for mortar; ASTM C1019 for grout.

### 3.16 CLEANING

- .1 Clean installed work.
- .2 Remove excess mortar and mortar smears as work progresses.
- .3 Replace defective mortar. Match adjacent work.
- .4 Clean soiled surfaces with cleaning solution.
- .5 Use non-metallic tools in cleaning operations.

### 3.17 PROTECTION OF FINISHED WORK

- .1 Protect installed work.
- .2 Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.
- .3 Cover unfinished walls to prevent moisture infiltration.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.
- .2 Conform to the National Building Code of Canada, the Construction Safety Act, CSA Standard S16.1-M (latest edition) and applicable Provincial building code. All codes and standards shall be current editions with all revisions to date.
- .3 Co-operate with other trades for satisfactory completion of the Work.
- .4 Where structural steel members specified on the drawings are not available to the Contractor, the Structural Steel Contractor shall provide members having all section properties equal to or better than the specified members at no additional cost. Contact Engineer for acceptance of any and all substitutions.

**1.2 RELATED WORK SPECIFIED ELSEWHERE**

- .1 Contractor shall be responsible for co-ordinating this section with all related sections.

**1.3 QUALITY ASSURANCE**

- .1 Execute work of this Section only by a structural steel fabricator who is fully accredited and a current member of the Canadian Institute of Steel Construction, or who has received approval, in writing, from the Consultant no less than one (1) week before Tender closing.
- .2 Any organization undertaking to weld under this contract shall be fully approved by the Canadian Welding Bureau under the requirements of CSA W47.1 (latest edition), W55.3 (latest edition) and CSA W59 (latest edition).

**1.4 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Prepare and submit shop and erection drawings which conform to the requirement of the General Conditions and Division 1 Sections – Submittal Procedures, CAN/CSA S16.1-M (latest edition), and as specified herein.
  - .2 Show the size, spacing and location of structural steel connections, attachments, reinforcing and anchorage. Include necessary plans, elevations and details. Indicate size and type of fastening. For welded connections, use welding symbols in compliance with AWS and indicate clearly net weld lengths.
  - .3 Submit typical details of connections and any special connections for review by the Consultant before preparation of shop drawings.
  - .4 Review of shop drawings by the Architect and Engineer will not absolve the Contractor from his responsibility of providing materials and equipment to complete and finish his work in accordance with the Contract Documents. Departures or differences from the reference drawings shall be approved, in writing, by the Architect/Consultant.
  - .5 The Subcontractor shall include in his delivery schedule a minimum of two (2) weeks for Consultant review of shop drawings.
  - .6 All connections to be designed by a qualified Engineer registered to practice in the Province of construction.
  - .7 All shop drawings are to be signed and sealed by a qualified Engineer registered to practice in the Province of construction, who shall take responsibility for the design of all connections.



- .8 Do not use Contract Documents as shop drawings or erection drawings. Contract Documents used for this purpose will not be reviewed. Delays resulting from this procedure will be the responsibility of the Contractor.

## 1.5 INSPECTION AND TESTING

- .1 Qualified inspectors will be employed by the Owner for this Work. Inspection organization undertaking to inspect welding shall be qualified in accordance with the requirements of CSA W178.1 (latest edition) 'Qualification Code for Welding Inspection Organizations' and approved by the Canadian Welding Bureau.
- .2 Provide free access for inspectors to all places where Work is being done.
- .3 Inspectors are to ensure that materials conform with the requirements of this Specification.
- .4 Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests.
- .5 Inspection shall include:
  - .1 Shop inspection of fabrication in the plant.
  - .2 Identification of material grades.
  - .3 Check of overall dimensions.
  - .4 Check of cambers.
  - .5 Check of workmanship regarding layout, punching and reaming of holes.
  - .6 Shop and field inspection of bolted connections.
  - .7 Shop and field inspection of welded joints.
  - .8 General inspection of field cutting and alterations.
  - .9 General inspection of shop priming and field touch-up. spandrel
- .6 The installation and testing of bolts shall conform to the requirements CAN/CSA S16.1-M (latest edition). Inspector shall check one (1) representative connection in ten (10) by torque testing each bolt, and shall check each bolt in every connection with a tap of a hammer for soundness. Inspectors shall enforce the requirements of the connection type.
- .7 Inspector shall examine visually all welded joints for inclusions, porosity, lack of fusion, penetration, contour, under-cuts and cracks. Root passes shall be checked for penetration and cracks from the back of the joint. When directed by the Consultant, have one (1) representative weld in ten (10) and every weld in direct tension tested ultrasonically.
- .8 Inspector shall make full prompt written report to the Architect of all inspections and tests. Circulate reports to the Architect (two (2) copies), Engineers (one (1) copy), General Contractor (two (2) copies), Owner (one (1) copy) and Authorities having jurisdiction.
- .9 Steel materials and workmanship not conforming to this Specification will be rejected. Remove and replace defective materials without unnecessary delay and without extra cost.

## 1.6 DESIGN

- .1 Design connections in accordance with the Handbook of Steel Construction by the Canadian Institute of Steel Construction for loads shown or required.
- .2 Conform to the National Building Code of Canada (latest edition) and applicable Provincial Building Codes and subsequent updates, CAN/CSA S16.1 (latest edition), local by-laws and regulations.
- .3 Top of beam elevations given in relation to the underside of steel deck levels shall be:
  - .1 Beams support joists: Underside of joist shoe



- .2 Beams not Supporting joist: 0
- .3 Other: As noted on plans/sections

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Co-ordinate deliveries to comply with Construction Progress Schedule and arrange ahead for off-the-ground storage location. Do not load any area beyond the design limits.
- .2 Adequately protect steel against rust and damage during manufacturing, delivery and storage.
- .3 Store material on planks on a dry area and protect from damage. Make good immediately any damage done, clean scratches and the like, touch-up with specified primer.

## 2 Products

### 2.1 MATERIALS

- .1 Structural Steel: New stock (not weathered or rusted); to conform to CAN/CSA-G40.20/G40.21 (latest edition), Grade 350W.
- .2 Hollow Structural Sections: (HSS); New stock; to conform to CAN/CSA-G40.20/G40.21 (latest edition), Grade 350W, Class H, stress relieved.
- .3 Provide high strength bolts in compliance with ASTM Standard A325 (latest edition) - High Strength Bolts for Structural Steel Joints, including suitable nuts and plain hardened washers.
- .4 Provide welding electrodes in compliance with CSA W48-Series - Mild Steel Covered Arch Welding Electrodes. Welding materials shall conform to CSA W59 (latest edition).
- .5 Structural Steel Primer: CAN/CGSB-1.40-M (latest edition), Structural Steel, Oil Alkyd Type or CAN/CGSB-140-M (latest edition): Red Lead, Iron Oxide, Oil Alkyd type and zinc rich paint to approved manufacturer's specifications containing 85% zinc in dry film for exterior exposed members. Shop coat and on-site touch-up shall be no less than 0.5 mils thickness.
- .6 Touch-Up Primer: CAN/CGSB-1.181 (latest edition), zinc rich organic primer, 'Gild Zinc 100' by ICI Paints Canada Inc., or other approved manufacturer.
- .7 Commercial galvanizing to conform to CSA Standard G164-M (latest edition).
- .8 Welded studs shall be by an approved manufacturer such as TRW Nelson and shall conform to CSA Standard W59 (latest edition).

## 3 Execution

### 3.1 PREPARATION RELATED TO OTHER TRADES

- .1 As the work of other trades progresses, supply anchor bolts, adjustable lintel inserts, bearing plates, lintels and other members required to be built-in with the work of other trades.
- .2 Give necessary instructions to other trades for setting bearing plates, anchor bolts and other members to be built-in with the work of other trades.
- .3 Verify the locations and elevations of concrete foundations and anchor bolts for column bases before standing columns, or commencement of erection will be deemed to represent acceptance of the previous work and conditions.

### 3.2 FABRICATION



- .1 Fabrication of structural members shall comply with CSA S16.1-M (latest edition) and as specified below.
- .2 Use only clean and straight material. If straightening or flattening is necessary, do it only by a process and in a manner that will not injure the material. Material having kinks or bends not called for on the drawings will be rejected.
- .3 Shop or field connections shall be bolted with high strength bolts or welded. Connections shall be made with due regard for Architectural drawings and appearance. **DO NOT** interfere with clearance lines or architectural finishes.
- .4 Minimum size of welds to be 5mm.
- .5 Beam connections shall be adequate to resist the reactions produced by the framing or load conditions.
- .6 Provide double angle header connections where practical. Otherwise use seat connections with top clip angles for lateral support.
- .7 Header connections shall be used at all expansion joints for structural steel.
- .8 Minimum length of double angle header connections shall not be less than half of the depth of the beams.
- .9 Do not use one-sided or fish plate type connections.
- .10 Provide top and bottom flange angle clips for all spandrel beams.
- .11 Provide punched holes 11mm to 27mm in diameter for convenience of other trades in attaching wood or other materials to steel work, when so directed by the Architect. Holes shall be so placed as not to cause any appreciable reduction in the strength of the member.
- .12 Provide holes for pipes and ducts and the reinforcing for same as indicated on drawings. Cutting of holes in steel beams in the field will not be permitted, without the written approval of the Consultant.
- .13 Provide separators at approximately 1200mm O.C. for double beams and channels as follows:
  - .1 Beams and channels 200mm or less in depth: One (1) or two (2) rows of pipe separators.
  - .2 Beams and channels over 200mm in depth: Channel separators unless otherwise detailed on the drawings.
- .14 Mill column bearing plates under column bearing.
- .15 Structural steel members shall not be spliced unless approved by the Structural Engineer in writing.
- .16 Provide 50mm clear space between structural steel at expansion joints.
- .17 Provide adjustable galvanized steel anchors 40mm x 6mm on columns that abut masonry for anchoring every 400mm in height.
- .18 Provide adjustable galvanized steel anchors 40mm x 6mm on beams that abut masonry at 400mm O.C. vertically and 2000mm O.C. horizontally.
- .19 Welding shall comply with CSA W59 (latest edition).
- .20 Fabricator shall be approved by the Canadian Welding Bureau under the requirements of CSA W47.1 (latest edition).

### 3.3 SHOP PAINTING AND PROTECTION

- .1 Clean steel by shot-blasting or power wire brushing to remove rust, mill scale, oil, dirt and other foreign matter before commencing shop painting. The quality of cleanliness shall be of standard



- stated in SSPC-SP6 Commercial Blast Cleaning, or SSPC-SP3 Power Tool Cleaning, as may be required to satisfy final paint finish requirements.
- .2 Clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.
  - .3 All steel work shall receive one (1) shop coat of exterior grade primer.
  - .4 Steel work shall be painted and shall remain under cover until the paint protection has dried.
  - .5 Give the parts which are inaccessible after assembly two (2) coats of primer coat paint, of different colours, when members are noted to be painted.
  - .6 Provide sandblasting before finish painting for steel members at edge of openings, as shown on drawings.
  - .7 Steel work shall be left installed in a clean state ready to receive applicable finishes.
  - .8 Where steel is to be covered with sprayed fireproofing, ensure that paint primer used is compatible with sprayed fireproofing.
  - .9 The following surfaces shall not be painted:
    - .1 Surfaces and edges to be field welded, except joist surfaces to receive steel decking. IF painted, remove paint for field welding for a distance of at least 50mm on all sides of the joint.
    - .2 The contact surfaces of friction-type connections assembled by high strength bolts.
    - .3 Portions of steel members which are to be encased in, or in contact with, concrete slabs cast-in-place.
    - .4 All exterior exposed steel shall be galvanized or painted with approved rust inhibitive paint.

### 3.4 ERECTION

- .1 Make adequate provision for horizontal and vertical erection loads and for sufficient temporary bracing to keep structural steel plumb and in true alignment until the completion of erection and installation of concrete work and roof decks which provide the necessary permanent bracing. Any failure to make proper and adequate provisions for erection stresses shall be entirely at the risk and responsibility of the Contractor.
- .2 When temporary steel members are required for erection purposes, such members shall be provided and removed when no longer required.
- .3 Handle and store structural steel on the job site in such a manner that no damage shall be caused to the material, or the structure.
- .4 Erect individual members of the structural steel to the following tolerances:
  - .1 Exterior columns, spandrel beams and angles: 1 to 1000.
  - .2 All other pieces: 1 to 500.
  - .3 Adjustable Shelf Angles attached to steel frame: 3mm plus or minus, with abutting ends of members at the same level. These elements shall be welded in place after final adjustment and galvanizing shall be touched-up with zinc rich paint.
  - .4 A variation of 1.5mm is permissible in the overall length of members with both ends milled. Members without milled ends which are to be framed to other steel parts of the structure may have a variation from the detail length not greater than 2.5mm for members 9000mm or less in length, and not greater than 3mm for members over 9000mm in length.



- .5 Execute all field assembly and welding in accordance with the requirements for shop fabrication excepting such as manifestly apply to shop conditions only.
- .6 Provide bearing plates and standard government wall anchors for beams bearing on masonry or concrete.
- .7 Provide 150mm bearing for angle lintels and bolt or weld together upstanding legs. Maximum spacing of bolts or welds shall be 600mm.
- .8 Paint field bolts, field welds and any abrasions or damage to the shop coat or primer, after erection.
- .9 Provide C100 x 8 structural members for framing at perimeter of holes through metal decking where openings between 450mm and 1200mm in roof deck and between 300mm and 1200mm in floor deck measured across flutes. Connect to main framing members.

### 3.5 ARCHITECTURALLY EXPOSED STEEL

- .1 Where finished surfaces of steel are to be left exposed to view, fabricate as specified in AISC Specification for Architecturally Exposed Steel, including specified straightness.
- .2 Continuously weld connection joints where exposed to view, and grind them smooth and flush with adjacent surfaces.
- .3 Remove mill marks, identification and surface imperfections by grinding smooth and flush with adjacent surfaces.
- .4 Clean, prime and protect all steel as specified in this Section. Apply one (1) coat of primer compatible with finish specified in Division 1 Sections – Painting.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Supply and install all miscellaneous metal work indicated on drawings and not included in the work of other Sections in addition to items listed in this Section.

**1.3 QUALITY ASSURANCE**

- .1 All Codes and Standards referred to in this Specification shall be current editions including all latest revisions and addenda.
- .2 Conform to requirements of CSA-S16, Design of Steel Structures and CAN/CSA-S136, Cold Formed Steel Structural Members.
- .3 Architectural metals work shall be of the highest architectural quality, free of scratches, pitting, roughness, marring, discolouration, staining and other imperfections.
- .4 Work of this Section to be executed by firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturer's specializing in this work.
- .5 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the site to direct the work of this Section.
- .6 Where required by authorities having jurisdiction, have work of this Section designed by a professional engineer licensed to design structures and registered in the Province of the Work.

**1.4 SUBMITTALS**

- .1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.
- .2 Shop Drawings:
  - .1 Make thorough examination of drawings and details, determine the intent, extent, and materials, and be fully cognizant of requirements when preparing shop drawings.
  - .2 Submit shop drawings showing and describing in detail all work of this Section including large scale detail of members and materials, of connection and interfacing with work of other Sections, jointing details, and of anchorage devices, dimension, gauges, thicknesses, description of materials, metal finishing, as well as other pertinent data and information.
  - .3 Digital files of design drawings shall not be used in the preparation of shop drawings.

**1.5 STORAGE, DELIVERY, HANDLING AND PROTECTION**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any area beyond the design limits.
- .2 Adequately protect and crate all components against damage, dirt, disfigurement and weather during delivery and storage. Damaged materials shall not be used and shall be replaced by approved material.
- .3 Cover and protect the work of other Sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.



- .4 Protect the installed work of this Section and on completion the work shall be examined and damage shall be remedied to the complete satisfaction of the Consultant.

## 2 Products

### 2.1 MATERIALS

- .1 Structural Steel Sections and Steel Plate: New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.
- .2 Hollow Structural Sections (HSS): New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.
- .3 Sheet Steel (Structural Quality): Conforms to ASTM A1011/A1011M.
- .4 Sheet Steel (Commercial Quality): Conforms to ASTM A653/A653M, stretcher levelled or temper rolled.
- .5 Tube: Conforms to ASTM A53.
- .6 Galvanized Sheet Steel (Commercial Quality): Galvanized coating G90 (Z275) in accordance with ASTM A653/A653M, minimized spangle, stretch levelled or temper rolled. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.
- .7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M.
- .8 Non-Shrink Grout: Premixed, high strength, maximum bearing, impact resistant, non-shrink non-metallic aggregate grout having minimum 55 MPa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, MasterFlow 816 by Master Builders Solutions, or Sika Grout 212 HP by Sika Canada Inc.
- .9 Galvanizing: All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot dip process according to CAN/CSA-G164, with minimum coating of 600 g/m<sup>2</sup> (2 oz./sq.ft.) Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.
- .10 Primer Paint: CISC/CPMA 2-75.
- .11 Bolts, Nuts, Washers: Conforms to ASTM A325.
- .12 Welding Materials: Conforms to CSA W59.
- .13 Metal Filler: Polyester based type.
- .14 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.
- .15 Touch-up Primer (On Site): Procryl Universal Acrylic Primer by Sherwin Williams Company of Canada Ltd, or approved equal. Touch-up primer shall be no less than 3 mil dft.
- .16 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.
- .17 Refer to Section 09 90 00 – Painting for site finish paint requirement.
- .18 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.
- .19 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.



- .20 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

## **2.2 FABRICATION**

- .1 Fit and assemble work in shop where possible. Execute work according to details and reviewed shop drawings.
- .2 Take measurements at the building for work which is to fit or be connected to steel or concrete before commencing fabrication.
- .3 Where shop fabrication is not possible, make trial assembly in shop.
- .4 Do all welding in accordance with requirements of CSA W59, CSA W55.3 and CSA W47.1 including all supplements. Weld stainless steel electric arc process. Grind welds smooth and flush with surface of parent metal, where exposed to view and where specifically indicated on drawings. Welds shall be continuous seam welds unless specified otherwise. Maintain sharp arises.
- .5 Fit joints and intersecting members accurately in true planes, square, plumb, straight with tight joints and intersections.
- .6 Provide adequate reinforcing, fastenings, anchors, accessories required for fabrication and erection of work of this Section. Such items occurring on or in an exterior wall or slab shall be hot-dip galvanized. Make thread dimensions such that nuts and bolts will fit without rethreading or chasing threads.
- .7 Fabricate, drill and tap members to accommodate attachments, anchorage and work of other Sections where located and directed by them.
- .8 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, weld marks, burrs, rust and scale.
- .9 Gauges and sizes of metal shall be adequate for various conditions.
- .10 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

## **2.3 SHOP PAINTING AND PROTECTION**

- .1 As per SSPC2 Hand Tool Clean and SSPC1 Solvent Clean, clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.
- .2 Prepare steel as per SSPC-3 Power Tool Cleaning for Interior or SSPC-6 Commercial Blast Cleaning for exterior members. Remove rust, mill scale, oil, dirt, and other foreign matter before commencing shop painting.
- .3 Apply shop coat of primer to all surfaces except areas requiring field welding. Apply by brush, working paint well into surfaces, interstices and cavities.
- .4 Primer is to be free of runs, sags, or other collections of primer due to dipping of members into primer.
- .5 Steel work shall be painted under cover, and shall remain under cover, until the paint protection is dry.
- .6 Prime field welded areas after erection and touch up shop coat where damaged and barred by erection and handling.
- .7 Prime steel with two full coats of paint in strict accordance with paint manufacturer's directions.



- .8 Give the parts which are inaccessible after assembly two coats of primer coat paint, of different colours, when members are noted to be painted.

## 2.4 HOT DIP GALVANIZING

- .1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.
  - .1 Members exposed to elements when in final location.
  - .2 Members embedded on exterior side of exterior walls.
  - .3 Members imbedded in concrete.
  - .4 Members specified in this Section or indicated on Drawings.
- .2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows:
  - .1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface
    - .1 4.8 mm (3/16") and less member thickness: 600 g/sq.m (2 oz./sq.ft.).
    - .2 6 mm (1/4") and heavier members: 640 g/sq.m (2.1 oz./sq.ft.).
  - .2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

## 3 Execution

### 3.1 GENERAL

- .1 Verify at site that the Work to receive the work of this Section is free of irregularities detrimental to the installation and performance of the work and that it is located correctly and at proper levels before delivery and installation.
- .2 Erection: To meet specified requirements of CAN/CSA-S16.
- .3 Bearing Plates and Anchors: Standard.
- .4 Anchors: Anchors to structural concrete shall be approved inserts set into concrete or approved self-drilling expansion insets drilled and placed afterwards.

### 3.2 INSTALLATION

- .1 Assemble and erect work plumb, true, square, straight, level and accurate to sizes detailed, to reviewed shop drawings, free from distortion and defects detrimental to appearance and performance.
- .2 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.
- .3 Supply adequate instructions, templates, and if necessary, supervise installation of the fastenings or accessories requiring to be built-in by other Sections of the Work.

### 3.3 SCHEDULES

- .1 Where items are required to be built into masonry, concrete or other work, supply such items to respective Sections with all anchors and accessories for building in.



- .2 Itemized List: Supply and install metal work listed below unless specifically designated to be supplied only. Each item shall be as shown on drawings and as detailed on reviewed shop drawings.
- .3 Miscellaneous Steel Framing, Channels, Angles, Plates and Brackets: As required and indicated on drawings.
- .4 Loose Lintels:
  - .1 Provide and install loose lintels if not by structural steel.
  - .2 Finish: Hot-dip galvanized after fabrication.
- .5 Bollards:
  - .1 Concrete fill steel pipe of diameters as indicated on drawings, having minimum 6 mm (1/4") wall thickness. Dome cap. Height above grade/floor shall be as indicated on drawings.
    - .1 In Grade Installation: Extend bollards 1500 mm (5'-0") below grade.
    - .2 Co-ordinate with Section 03 30 00 – Cast-in-Place Concrete for concrete fill. Ensure that top of concrete shall be smooth and rounded.
  - .2 Finish:
    - .1 Bollard Sleeves: Extruded, high density polyethylene plastic bollard cover,
      - .1 Sureguard Shields, colour yellow by Sureguard Security Products.
      - .2 Bollard Covers, colour yellow by Ontario Bollards.
- .6 Masonry Lateral Supports:
  - .1 Install deflection space and lateral support for non-load-bearing masonry walls and partitions in accordance with specified requirements of CAN3-S304-M, where not provided by Section 05 12 00 – Structural Steel.
  - .2 At walls with concealed tops:
    - .1 75 mm x 50 mm x 6 mm (3" x 2" x 1/4") angles 203 mm (8") long on both sides of walls. Anchor to structure above wall.
  - .3 At walls with tops exposed to view:
    - .1 75 mm x 50 mm x 6 mm (3" x 2" x 1/4") angles, continuous on both sides of wall. Anchor to structure above wall.
  - .4 Finish: Prime paint.
- .7 Frames for Overhead Doors:
  - .1 Supply and install 6 mm (1/4") thick bent steel plate around openings at heads and jambs to suit wall thickness and return 75 mm (3") on either side of wall face. Provide extensions on interior side at head to accommodate track and operators to suit doors specified.
  - .2 Co-ordinate installation with Sections 04 20 00 – Masonry. Provide proper anchors for solid installation.
  - .3 Finish: Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.
- .8 Overhead Doors Track Protection Guards:
  - .1 Provide 6 mm (1/4") thick x 1525 mm (60") high "Z" shaped bent steel plate track protection guards at overhead door tracks.



- .2 Co-ordinate installation with work of other Sections. Provide proper anchors for solid installation.
- .3 Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.
- .9 Support Framing for Suspended Toilet Partitions:
  - .1 Structural channel and angle framing continuously welded and securely anchored to structure above. Design framing and anchorage to support assembly dead loads and live loads, and lateral loads attributable to misuse and vandalism. Finish: Prime painted.
- .10 Under-Counter Steel Supports:
  - .1 Framing: Continuous channel / angle welded construction.
  - .2 Drill 6 mm diameter holes at each cross support for fastening of counter.
  - .3 Provide concealed steel section posts to support channels at front of counter, for building into wall.
  - .4 Provide posts with anchor plates and 9 mm diameter bolts for attachment to structure.
  - .5 Unless otherwise indicated, provide intermediate posts to support long counter spans.
  - .6 Conceal framing from view to greatest extent possible.
  - .7 Prime paint finish. Finish paint by Section 09 91 00.
- .11 Other Miscellaneous Metal Components:
  - .1 Provide steel framing and supports not specified in other Sections as needed to complete the Work.
  - .2 Concealed metal angles and support not included in Division 5 sections.
  - .3 Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - .4 Support brackets and welded plates
  - .5 As required and indicated on drawings.
  - .6 Finish:
    - .1 Prime paint for interior components, ready for finishing by Section 09 90 00 – Painting and hot-dip galvanized after fabrication for exterior components.

**END OF SECTION**



**1 General**

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for supply, fabrication and installation of the following:
  - .1 Structural Steel Stairs: Steel stair stringers will be considered as structural steel components and shall be coordinated with Division 05 Structural Steel sections; requirements for certification and record keeping for steel stairs shall be the same as for structural steel framing with galvanized steel grating treads.
  - .2 Steel Railings, as follows:
    - .1 Handrails and railings attached to stairs.
    - .2 Handrails attached to walls adjacent to stairs.

**1.3 DEFINITIONS**

- .1 Field Dimensions: Actual dimensions measured on site and used by fabricator to construct required assemblies.
- .2 Established Dimensions: Dimensions derived from drawings or that can be reasonably determined from adjacent construction where actual dimensions required by components fabricated in this section are not available; dimensions shall have suitable tolerances so that assemblies can be adjusted on site to fit actual field dimensions.

**1.4 DESIGN REQUIREMENTS**

- .1 Retain a Professional Engineer, registered in the province of the Work, to design details and connections of steel stairs, and ascertain that the following will comply with the requirements of the Building Code and the Contract Documents:
  - .1 Selection and design of connections not detailed on the Contract Documents;
  - .2 Fabrication of components;
  - .3 Erection of the work of this section.
- .2 Design details and connections in accordance with requirements of CAN/CSA S16.1, and applicable codes and authorities having jurisdiction.
- .3 Design gratings for 4.8 kN/m<sup>2</sup> or a concentrated load of 4.8 kN at any point on the standard grating width.
- .4 Design stair and landing sections, attachments and connections, except where members are specifically sized on the drawings, to support a minimum live load of 4.8 kN/m<sup>2</sup> or a concentrated load of 2.0 kN at any point on indicated tread widths in accordance with Building Code.
- .5 Design railing assemblies to withstand a minimum uniform load of 0.75 kN/m or a concentrated load of 1.0 kN at any point applied horizontally to top rail and a minimum of 1.5 kN/m applied vertically to top rail, with individual elements within the assembly designed for a concentrated load of 0.5 kN at any point in the element in accordance with the Building Code.

**1.5 SUBMITTALS**

Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.



- .2 Shop Drawings: Provide shop drawings including, but not be limited to, the following:
  - .1 Sections and plans of stairs, railings and ladders indicating dimensions and assembly of components.
  - .2 Indicate fasteners, welds and connection details between stringers; treads; risers; headers; newels; platforms; struts, columns and hangers; railings; handrails; brackets; reinforcements; anchors; and welded and bolted connections.
  - .3 Methods and locations of all exposed fastenings.
  - .4 Methods and locations of specified finishes.
  - .5 Shop drawings requiring to be sealed by the professional engineer registered in province of work, responsible for the design.

#### **1.6 QUALITY ASSURANCE**

- .1 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 510, 521, and 555; prepare fabrication and erection documents and materials lists in accordance with CSA S16-09.
- .2 Fabricator shall have a minimum five (5) years documented experience fabricating metal stairs and railings and shall perform work of this Section to the highest standard of modern shop and field practice, by personnel experienced in architectural quality metalwork.
- .3 Retain a Professional Engineer, registered in the Province of the work, to design fabrication and erection of the work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:
  - .1 Seal and signature to shop drawings and design submittals.
  - .2 Field review of installed components.

#### **1.7 SITE CONDITIONS**

- .1 Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where metal fabrications are indicated to fit walls and other construction.
- .2 Establish dimensions and proceed with fabricating metal fabrications where field measurements cannot be made without delaying the work; allow for trimming and fitting.

#### **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Store materials in a location and manner to avoid damage; stack materials to prevent bending or applying stress to components; keep handling of materials on-site to a minimum.
- .2 Store components and materials in clean, dry location, away from uncured concrete or masonry; cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation inside of covering.
- .3 Correct damaged material and where damage is deemed irreparable by the Owner, replace the affected item at no additional expense to the Owner.
- .4 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed and ready for final finishing.
- .5 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

#### **1.9 COORDINATION**

- .1 Coordinate fabrication schedule with construction progress to avoid delaying the work.
- .2 Coordinate with Contractor so that field dimensions correspond to established dimensions.
- .3 Coordinate shop priming and finishing requirements.



- .4 Coordinate installation of anchorages for metal stairs.
- .5 Supply items required to be built-in by other Sections, with instructions for installation for work not installed by this Section; install finish hardware and items supplied under other Sections required for completion of components of this Section.
- .6 Coordinate nosing with specified stair finishes and set top of nosing level with top of floor finish; set materials flush with concrete surfaces where no floor finish is indicated.

## 2 Products

### 2.1 MATERIALS

- .1 Use only materials that are new, free from defects that would impair the strength, durability or appearance, and of the best commercial quality for the purposes specified.
- .2 Structural Steel Sections, Steel Plates and Checker Plate:
  - .1 New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.
- .3 Hollow Structural Sections (HSS):
  - .1 New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.
- .4 Sheet Steel (Structural Quality):
  - .1 Conforms to ASTM A1011/A1011M
- .5 Sheet Steel (Commercial Quality):
  - .1 Conforms to ASTM A1011/A1011M, stretcher levelled or temper rolled.
- .6 Steel Grating:
  - .1 Pressure locked type steel grating with serrated upper edges where grating is exposed to exterior conditions, thicknesses as required to support loading and conforming to Metal Bar Grating Manuals, MBG 531-93 and MBG 532-93, type as approved by Consultant, by Borden Metal Products (Canada) Limited, or by Dominion Bridge Company Limited, or by Robertson Building Systems, or by Armtec Inc., or by Fisher & Ludlow, Division of Harris Steel Ltd.
  - .2 Provide steel grating stair treads and landings with non-slip steel checker plate nosings.
  - .3 Provide manufacturer's standard and saddle clip type fasteners for grating.
  - .4 Hot-dip galvanize steel gratings and steel grating stair treads for exterior locations.
- .7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M-12.
- .8 Welding Materials: Conforms to CSA W59.
- .9 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.
- .10 Touch-up Primer (On Site): Procryl Universal Acrylic Primer by Sherwin Williams Company of Canada Ltd, or approved equal. Touch-up primer shall be no less than 3 mil dft.
- .11 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.



- .12 Refer to Division 09 Painting sections for site finish paint requirement.
- .13 Non-Shrink Grout:
  - .1 Premixed, high strength, maximum bearing, impact resistant, non-shrink metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, SikaGrout 212 by Sika Canada Inc., or approved equal.
- .14 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.
- .15 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.
- .16 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.
- .17 Galvanizing:
  - .1 All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot-dip process according to CAN/CSA-G164-M92 (R2003), with minimum coating of 2 oz./sq.ft. Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

## 2.2 FABRICATION AND MANUFACTURE

- .1 General:
  - .1 Fabricate steel stairs and railings to details indicated on Drawings and to Metal Stairs Manual, AMP 510.
  - .2 Fabricate to reviewed shop drawings and in general to details indicated on drawings and specified herein. Where possible, fit and shop assemble and deliver to site in largest practicable sections.
  - .3 Fabricated work shall be complete with components required for anchoring.
  - .4 Fit joints and intersecting members accurately with hairline joints in least conspicuous locations and manner. Make work in true plane with adequate fastenings.
- .2 Welding:
  - .1 Except where bolted connections are indicated, make stairs of welded construction conforming to requirements of CSA W59.
  - .2 Grind exposed welds smooth. Machine materials and straighten in such a way that no disfigurement will show in finished work.
- .3 Fastenings and Connections:
  - .1 Weld connections where possible. Where not possible bolt or otherwise secure in approved manner. Where approved, install exposed fastenings of same materials, colour and finish as base metal on which they occur.
  - .2 Countersink screws unless noted otherwise and reinforce where necessary.
  - .3 Use shop and field connections detailed. Where not detailed, connections shall comply with CSA S16.

## 2.3 COMPONENTS

- .1 Steel Grating Stairs:
  - .1 Treads and Landings: Provide steel grating landings and stair treads where indicated on drawings, reinforced as required. Form open riser grating stair treads and landings from



- steel grating with checker plate nosings. Fasten open riser stair treads to stringers with concealed brackets
- .2 Grating: Galvanized steel stair landing and treads, slip resistant surface. Minimum 32 mm (1 1/4") depth, with bearing bar spacing of 11 mm (7/16") and cross bar spacing of 102 mm (4"); with FRP preinstalled nosing, colour safety yellow. Live load capacity 4.8 kPa (100 psi).
  - .1 Stair Treads by Interstate Gratings.
  - .2 Grating Stair Treads by grating Pacific.
- .3 Stringers: Steel stringer channel unless otherwise noted, with 14 gauge formed fascia where indicated.
- .4 Balusters and Handrails: Provide balustrades, railings and handrails as indicated on drawings, complete with brackets and anchoring devices.
- .5 Framing: Structural steel framing, angles, channels, trimmers, posts and columns, channel bearings, support angles and clip angle connections to floor slabs and walls.
- .6 Finish: Hot-dip galvanize after fabrication.
- .2 Railings and Handrails:
  - .1 Provide floor and wall mounted railings and handrails as indicated on drawings, complete with brackets, anchoring devices and removable sections.
  - .2 Handrails and Wall Brackets: Tubular steel, 38mm (1-1/2") dia. pipe rail with rod and mounting flange as indicated.

## 2.4 HOT DIP GALVANIZING

- .1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.
  - .1 Members exposed to elements when in final location.
  - .2 Members embedded on exterior side of exterior walls.
  - .3 Members imbedded in concrete.
  - .4 Members specified in this Section or indicated on Drawings.
- .2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows:
  - .1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface
    - .1 4.8 mm (3/16") and less member thickness: 600 g/sq.m.
    - .2 6 mm (1/4") and heavier members: 640 g/sq.m.
  - .2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

## 3 Execution

### 3.1 EXAMINATION



- .1 Examine the work of other Sections upon which the work of this Section depends and report any defects to the Consultant. Do not commence installation until such time as all wet trades have been completed. Commencement of work implies acceptance of surface and conditions.

### 3.2 PREPARATION

- .1 Provide anchorage devices and fasteners to other Sections where necessary for securing metal stairs to in place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- .2 Perform cutting, drilling, and fitting required for installing metal stairs.
- .3 Field check and verify that structural framing, enclosures, weld plates, blocking, and that size and location of pockets are placed in accordance with reviewed shop drawings.
- .4 Report discrepancies to Contractor and Consultant, and recommend corrective action by responsible parties.
- .5 Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- .6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates and instructions for installation.

### 3.3 INSTALLATION

- .1 Furnish, set and secure framing brackets, hangers, anchors, inserts or similar supports for proper erection of stairs before masonry and concrete is placed. Provide temporary supports and bracing required to position stairs and railings.
- .2 Do all coring, drilling and fitting necessary to attach work of this Section to adjoining work.
- .3 Continuous weld connections between handrails and balusters and in lengths of handrails.
- .4 Secure wall brackets to wall at 1220 (4') O.C. maximum with through-bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.
- .5 Grout bases of posts, balusters or newels occurring in concrete using non-shrink grout in accordance with manufacturer's instructions. Finish smooth, level and flush with surrounding finished surface.
- .6 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.
- .7 Grind off surplus welding materials and provide sharp profiles and arrises.
- .8 Build and erect work plumb, true, square, straight, level and accurate, to sizes detailed, to reviewed shop drawings, free from distortion or defects detrimental to appearance and performance.
- .9 Touch up with matching primer, or zinc rich paint for galvanized components, field welds, damaged and abraded surfaces, and surfaces not previously primed. Leave ready for finish painting by Division 09 Painting section.

### 3.4 PROTECTION

- .1 Protect completed work from damage during and after installation.
- .2 Field repair or refinishing of damaged, marred or discoloured finishes will not be accepted.

### 3.5 CLEANING

- .1 Clean installations and assemblies progressively as work proceeds, and at completion of work.



- .2 Remove protective coverings and clean metal work using cleaning solutions and methods to suit the metal and its finish at completion of work.
- .3 Protect adjacent materials and finishes from damage or discolouring during cleaning.
- .4 At completion, remove all equipment, tools, surplus materials and debris from job site.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standards.

**1.2 SUMMARY**

- .1 Supply all labour, materials, equipment, services and perform all operations required to complete all rough carpentry work to the full intent of the drawings and as herein specified.

**1.3 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- .1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Do not store seasoned materials under conditions that will cause their moisture content to increase.
- .4 Protect edges and corners of sheet materials from damage during handling and storage.
- .5 Store preservative treated materials under cover, off the ground and protected from moisture.

2 Products

**2.1 MATERIALS**

- .1 Framing Lumber:
  - .1 Lumber for structural components shall be of species and grade specified, well seasoned, processed and stamped at same mill with appropriate grade markings. Conform to requirements of Standard Grading Rules for Canadian Lumber of National Lumber Grades Authority the (NLGA) with latest supplements, approved by the Canadian Lumber Standards Administrative Board.
- .2 Framing, Furring, Strapping, Blocking:
  - .1 Spruce, 122c, "Standard" light framing, except as otherwise specified.
- .3 Plywood Sheathing:
  - .1 Shall be 19 mm (3/4") thick and/or thickness as indicated on drawings, exterior grade at exterior locations, Douglas Fir plywood, veneer core, Select Sheathing - Tight Face, unsanded, "B" faces and conforming to CSA O121.
- .4 Rough Hardware:
  - .1 Provide rough hardware such as nails, spikes, staples, H-clips, bolts, nuts, washers, screws, clips, strap iron and including hardware for temporary enclosures. Nails for plywood shall be annular or spiral type, all other nails shall be spiral type. All nails, spikes and staples shall conform to CSA B111. All rough hardware shall be galvanized unless otherwise noted. Galvanizing shall conform to CAN/CSA-G164.
- .5 All Other Materials and Hardware:
  - .1 Shall be as noted on drawings.

**2.2 PRESSURE PRESERVATIVE TREATED MATERIALS**



- .1 Pressure Preservative Treated Lumber: Lumber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Accreditation Board in accordance with CAN/CSA O80.
  - .1 Species: Pine or Spruce Pine
  - .2 Grade: No.2 or better structural posts and lumber, pieces may be grade stamped or shipment certified by letter of compliance.
  - .3 Grading authority: NLGA, paragraph 131CC
  - .4 Material having twisted grain or structural defects affecting integrity of lumber will not be acceptable for this project.
  - .5 Use only material with radius edges, minimum 6 mm.
  - .6 Kiln dry lumber materials to 8% moisture content or less.
- .2 Pressure Preservative Treated Plywood: Treated in accordance with CAN/CSA O80 using water borne preservative to obtain minimum net retention of 4 kg/m<sup>3</sup> (0.25 lb/ft<sup>3</sup>) of wood. Plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.

### 2.3 PRESSURE FIRE RETARDANT TREATED MATERIALS

- .1 Treat by pressure impregnation with fire retardant chemicals in accordance with CAN/CSA O80 to provide classification for flame spread of not more than 25, smoke developed of not more than 75 in accordance with CAN4 S102.
- .2 All fire retardant wood must comply with the requirements in AWPA Standard C20 for lumber and C27 for plywood.
  - .1 AWPA C20: Structural Lumber, Fire Retardant Pressure Treatment, lumber materials shall only be of species listed. After treatment, lumber 50 mm (2") or less in thickness shall be kiln dried to moisture content of 8% or less.
  - .2 AWPA C27: Plywood, Fire Retardant Pressure Treatment, plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.
  - .3 All species to comply with CAN4 S102 for surface burning characteristics and shall bear identification showing classification and type of fire retardant.
- .3 Each piece or bundle of fire retardant treated material or panel to bear ULC inspection label or stamp attesting to FRS rating indicating flame spread, smoke developed, and fuel contributed classification meeting AWPA standard C20 and C27 for Type A Use.
- .4 Fire retardant chemicals used to treat lumber must comply with FR 1 of AWPA Standard P17 and shall be free of halogens, sulphates and ammonium phosphate.
- .5 Acceptable materials: Plywood and lumber materials treated by licensed applicators with fire retardant materials from the following:
  - .1 Dricon FRTW by Hickson Corporation.
  - .2 Pyro Guard by Hoover Treated Wood Products Inc.
  - .3 D Blaze by Chemical Specialties Inc.

## 3 Execution

### 3.1 INSTALLATION-GENERAL



- .1 Consult with and co-operate with other Sections in advance and build-in or make provisions for installation of other work.
- .2 Provide and fit in place all furring, strapping, battens, nailers, sleepers, grounds and blocking required to provide adequate properly placed fixing for all wood finishes, fitments and as required for the work of others trades.
- .3 Blocking, strapping and other rough carpentry indicated shall not be regarded as complete or exact. Provide all rough carpentry work required, whether specifically shown or not. Grounds shall be of a thickness to provide for application of finishes. Room side surfaces of grounds shall be plumb and in true plane throughout.
- .4 All nails shall be long enough so that at least half their length penetrate in to the second member. Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping nails well in from edges.
- .5 Blocking shall be through-bolted to structure.
- .6 Anchor rough bucks to concrete or masonry with 9.5 mm (3/8") diameter expansion bolts and shields or Drummond and Reeves security buck anchors, minimum three per jamb.

### **3.2 WOOD BLOCKING, CANTS AND NAILERS**

- .1 Provide wood blocking, cants and nailers, where shown to be required as detailed. Bolt securely in place. Block under cants same thickness as installed roof insulation.
- .2 Check mechanical, electrical, architectural drawings and provide all blocking, cants, nailers etc. required. Leave work ready for built-up bituminous roofing and prefinished sheet metal flashings.

### **3.3 PLYWOOD PANELS**

- .1 Provide plywood panels required for electrical/telephone mounting of equipment and in other locations as indicated on drawings.

### **3.4 PRESSURE PRESERVATIVE TREATED WOOD INSTALLATION**

- .1 Comply with AWPA M4.
- .2 Re treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation. Allow first coating to fully soak into grain before applying second coating in accordance with manufacturer's instructions.
- .3 Remove with fine sandpaper, chemical deposits on treated wood to receive applied finish.
- .4 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of preservative treated materials.
- .5 Use water borne preservative treated wood for:
  - .1 Wood in contact with masonry or concrete,
  - .2 Wood within 450 mm (18") of grade,
  - .3 Wood decking and fence boards,
  - .4 Wood in contact with flashings,
  - .5 Wood in contact with waterproofing membranes, confirm compatibility with membrane manufacturer prior to application.

### **3.5 PRESSURE FIRE RETARDANT TREATED WOOD INSTALLATION**

- .1 Field Cuts:
  - .1 Do not rip, mill or conduct extensive surfacing of fire retardant treated lumber, label will be voided.



- .2 Only end cuts, drilling holes and joining cuts are permitted.
- .3 All cuts on plywood will be considered end cuts.
- .4 Fire retardant lumber and plywood can be given a light sanding for cosmetic cleaning after treatment.
- .5 Pre cut to the greatest extent possible before treating.
- .2 Fire retardant treated plywood used in structural applications shall be graded or span rated material.
- .3 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of fire resistant treated materials.
- .4 Where humidity conditions are such that moisture may condense between hardware and treated wood, hardware shall be back primed with a corrosive inhibitive paint.
- .5 Back prime at contact points and fasteners to prevent electrolysis when fire retardant framing members are used in metal buildings.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.

**1.2 SECTION INCLUDES**

- .1 Polymer based solid surface (PSS)

**1.3 SUBMITTALS FOR REVIEW**

- .1 Shop Drawings: Indicate all dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- .2 Samples: Submit two 50 x 50 mm samples of each colour and finish.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: Submit manufacturer's instructions for care and maintenance of solid surface materials including repair instructions.

**1.5 QUALITY ASSURANCE**

- .1 Fabricator/Installer Qualifications: Company specializing in performing the work of this Section with minimum five (5) years' experience and certified by the Manufacturer.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Do not deliver components to site until cabinetry or substrates are ready for installation. Store materials indoors prior to installation.

**1.7 WARRANTY**

- .1 Provide ten (10) year manufacturer warranty against defects in materials and workmanship under normal usage. Warranty shall provide for all material and labour to repair or replace defective materials.

2 Products

**2.1 MANUFACTURERS**

- .1 Subject to conformance with the requirements of this Section provide product by manufacturer named as the basis-of-design or approved equivalent product by an acceptable manufacturer.
- .2 Basis of Design: Refer to Schedule of Finishes.

**2.2 MATERIAL**

- .1 Acrylic (PSS): Homogeneous acrylic; not coated or laminated; meeting ANSI Z124.3 & Z124.6, Type 6. Superficial damage to a depth of 0.25mm shall be repairable by sanding and polishing.
- .1 Colours: Colour to be selected from manufacturer's standard colour selection.
- .2 Countertops: 12mm thick countertop; edge details as indicated on the Drawings. Provide counters complete with backsplash of size shown on the Drawings.
- .1 Colours: Refer to Schedule of Finishes.

**2.3 ACCESSORIES**

- .1 Joint adhesive: Manufacturer's recommended adhesive designed to create chemically bonded, inconspicuous, non-porous joints.



- .2 Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A136.1-1967, UL listed.
- .3 Sealant: Mildew-resistant, FDA/UL recognized silicone sealant in colour matching or clear formulations as specified.

## 2.4 FABRICATION

- .1 Fabrications to be performed by a Manufacturer Certified fabricator/installer.
- .2 Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and Manufacturer's requirements.
- .3 Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 50mm wide reinforcing strip of solid surface material under each joint.
- .4 Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.
- .5 Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- .6 Finish: All surfaces shall have uniform finish.
  - .1 Satin.
- .7 Thermoforming: Comply with forming data from manufacturer.
  - .1 Construct matching molds of plywood to form component shape.
  - .2 Form pieces to shape prior to seaming and joining.
  - .3 Cut pieces larger than finished dimensions. Sand edges. Remove all nicks and scratches.
  - .4 Heat entire component uniformly between 135-163°C during forming.
  - .5 Prevent blistering, whitening and cracking during forming.
- .8 Cove backsplashes: Where indicated, fabricate 13mm radius cove at intersection of counters and backsplashes. Form backsplashes using 13mm material. Fabricate in shop or field.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install components plumb and level, in accordance with approved shop drawings and product installation details.
- .2 Form field joints using Manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- .3 Provide backsplashes where indicated on the drawings. Adhere to countertops using Manufacturer's standard colour-matched silicone sealant.
- .4 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.
- .5 Make plumbing connections to sinks in accordance with Mechanical.
- .6 Rigidly anchor to substrate to prevent misalignment.

### 3.2 TOLERANCES

- .1 Variation in component size:  $\pm 3\text{mm}$ .



- .2 Location of openings:  $\pm$  3mm from indicated location.

### **3.3 PROTECTION**

- .1 Protect completed installation from damage with heavy kraft paper cardboard until date of final inspection.

### **3.4 ADJUSTING AND CLEANING**

- .1 Repair damaged and defective countertops to eliminate functional and visual defects; where not possible to repair, replace. Adjust joinery for uniform appearance.
- .2 Remove all excess adhesives, sealants and other contaminants from installation and all adjacent surfaces. Clean countertops on exposed and semi-exposed surfaces.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Section Includes:
  - .1 Labour, Products, equipment and services necessary to complete the work of this Section.
- .2 Maintain the existing building watertight at all times. Provide required temporary protection, and enclosures. Seal off or temporarily dam open roof edges to prevent any incidence of water into existing building or structure.

**1.3 MATERIALS OWNERSHIP**

- .1 Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- .2 Collect and place demolished materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on site.
  - .1 Storage or sale of demolished items or materials on-site will not be permitted.

**1.4 SUBMITTALS**

- .1 Temporary Roofing: Include Product Data and description of temporary roofing system.
- .2 Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

**1.5 QUALITY ASSURANCE**

- .1 Installer Qualifications: Installer of new membrane roofing system specified in Division 7 SBS Modified Bituminous Roofing Sections.
- .2 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, meet with Owner; Consultant; Owner's insurer if applicable; testing and inspecting agency representative; replacement roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.
  - .1 Review temporary protection requirements for existing roofing system that is to remain, during and after installation.
  - .2 Review roof drainage during each stage of reroofing and review roof drain plugging and plug removal procedures.
  - .3 Review existing deck removal procedures and Owner notifications.
  - .4 Review procedures to determine condition and acceptance of existing deck for reuse.
  - .5 Review structural loading limitations of deck during reroofing.
  - .6 Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.



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- .7 Review HVAC shutdown and sealing of air intakes.
- .8 Review shutdown of fire suppression, fire protection, and fire alarm and detection systems.
- .9 Review governing regulations and requirements for insurance and certificates if applicable.
- .10 Review existing conditions that may require notification of Consultant before proceeding.

## 1.6 PROJECT CONDITIONS

- .1 Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
  - .1 Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area if desired.
  - .2 Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated prior to proceeding with work over the impaired deck area.
- .2 Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- .3 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- .4 Owner assumes no responsibility for condition of areas to be reroofed.
  - .1 Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
- .5 Limit construction loads on roof to rooftop equipment wheel loads and for uniformly distributed loads so as not to endanger the structure.
- .6 Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

## 1.7 WARRANTY

- .1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
  - .1 Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## 2 Products

### 2.1 MATERIALS

- .1 Roofing Materials: New materials, same as and matching materials used in the existing roof system.

## 3 Execution

### 3.1 PREPARATION



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- .1 Protect existing membrane roofing system that is indicated not to be reroofed.

### 3.2 ROOFING

- .1 Preparation: Prepare existing roof for receipt of new work. Ensure existing system is not damaged by preparation work.
  - .1 Remove only areas of the existing roofing system which can be replaced, complete with membrane flashings, on the same day.
- .2 Roofing and Flashing membrane: Install in accordance with manufacturers' instructions.
- .3 Curbs: Install curbs required for new work.

### 3.3 SLEEVE FLASHING

- .1 Embed deck flange in a layer of mastic sealer. Flash into the roofing membrane in general accordance with CRCA flashing detail.
- .2 Apply sealant at joint between base of sleeve flashing and roof membrane flashing.

### 3.4 INSTALLATION - METAL FLASHINGS AND TRIMS

- .1 Install sheet metal work in accordance with CRCA specifications, using concealed fastenings except where approved before installation.
- .2 Fabricate metal flashings and other sheet metal work to details shown. Form pieces in 2400 mm (8') maximum lengths. Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 13 mm (1/2"). Miter and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .6 Counterflash membrane flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.
- .7 Lock end joints and seal with sealant.

### 3.5 CLEANING

- .1 Remove existing debris from all roof areas.
- .2 Clear out roof drains, scuppers, eaves troughs and down spouts of debris and ensure they are free draining at project completion.
- .3 Remove surplus materials and debris resulting from work daily as the work proceeds and on completion.
- .4 Remove stains, sealants and adhesives from soiled surfaces.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Foamed-in-place polyurethane insulation at exterior envelope construction for thermal insulation and air seal.
- .2 Gap-filling foamed-in-place insulation for filling perimeter of window and door shim spaces, crevices, voids and penetrations in exterior walls for thermal insulation and air seal.
- .3 Site quality control.

**1.3 SUBMITTALS**

- .1 Product Data for each type of insulation product specified.
  - .1 Provide the CCMC Evaluation Report and manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the CAN/ULC S705.1 Material Standard.
- .2 Product test reports performed by a qualified third-party testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, and other properties, based on comprehensive testing of current products.
- .3 Manufacturer's certificate certifying insulation provided meets or exceeds specified requirements.
- .4 Installer's certificate showing manufacturers installation certification for quality assurance.

**1.4 QUALITY ASSURANCE**

- .1 Contractor executing work of this section shall have a minimum of five (5) years continuous Canadian experience in successful installations. Provide proof of experience to Consultant upon request.
- .2 Single Source Responsibility: Single source product from one manufacturer.
- .3 The insulating material must be applied by personnel who are certified by manufacturer. These certified individuals must have their certification cards in their possession and available for presentation upon request.
- .4 A copy of the manufacturer's installation manual or guide for the application of sprayed on polyurethane foam must be kept on site.
- .5 Tests must be conducted daily on both core density and cohesion/adhesion to the substrate, following procedures established by the manufacturer. The results of these tests must be entered in the daily report forms provided by the manufacturer.
- .6 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that foamed-in-place insulation conforms to the requirements of ULC S705.1.
- .7 Submit copy of all completed forms to Consultant prior to making application for payment.
- .8 Toxicity/Hazardous Materials:
  - .1 Provide products that contain no urea-formaldehyde
  - .2 Provide products that contain no PBDEs



- .3 Provide products that are "Low-emitting"

## 1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Apply spray polyurethane foam when chemical, atmospheric and cavity/surface temperatures are within the limitations required by the CAN/ULC S705.2 Installation Standard and as recommended by the manufacturer.
- .2 Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation and accessory materials.
- .3 Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation and accessory materials.

## 1.6 DELIVERY, STORAGE, AND PROTECTION

- .1 Deliver and store materials to site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
- .2 Store materials as recommended by manufacturers in clean, dry, protected location and within required temperature range.
- .3 Empty containers of isocyanates to be decontaminated or removed from site on a daily basis.
- .4 Remove and replace materials that cannot be applied within their stated shelf life.
- .5 Protect stored materials from direct sunlight.
- .6 Protect spray polyurethane foam in place from open flame or welding as required in CAN/ULC S705.2.

## 1.7 WARRANTIES

- .1 Provide three (3) year Manufacturer's Material and Workmanship Warranty against defects in workmanship or material, including removal and replacement of adjacent materials.

## 2 Products

### 2.1 MATERIALS - GENERAL

- .1 Use insulations free of HCFCs, CFCs and CFC compounds during manufacturing and in installed products.

### 2.2 SPRAY FOAM INSULATION

- .1 Foamed-In-Place Insulation: Medium density, two-component closed cell polyurethane; CAN/ULC-S705.1:
  - .1 Aged Thermal Resistance: CAN / ULC-S770; RSI of 1.8 for 50 mm thickness.
  - .2 Compressive Strength: ASTM D1621; 195 kPa minimum.
  - .3 Flame Spread and Smoke Developed Rating:
    - .1 CAN/ULC-S102; maximum 250/500.
    - .2 CAN/ULC-S127; maximum 500/500.
  - .4 Off Gassing – VOC Emissions during Aging: CAN/ULC-S774; below detection limit, 24 h.
- .2 Approvals:
  - .1 Current CCMC Evaluation/Listings for Spray-Applied Rigid Polyurethane Foam Insulation,



- .2 CAN/ULC-S742 Air Barrier System or Current CCMC Evaluation/Listing for Air Barrier System.
- .3 Product and Manufacturers:
  - .1 SealTite One by Carlisle Spray Foam Insulation
  - .2 Walltite CM01 manufactured by BASF Canada Inc.
  - .3 Insulthane Extreme by Elastochem Specialty Chemicals Inc.
  - .4 Heatlok Soy HFO by Huntsman Building Solutions.

### 2.3 GAP-FILLING FOAM INSULATION

- .1 Gap-Filling Foam Insulation: Single or multi-component, low VOC, low expansion spray-in-place polyurethane based liquid foam insulation providing an air-tight flexible seal as recommended by spray foam insulation Manufacturer.

### 2.4 ACCESSORIES

- .1 Primer: As required by insulation manufacturer and as well as CAN/ULC-S705.2.

## 3 Execution

### 3.1 EXAMINATION

- .1 Verify work within construction spaces or spaces to receive insulation are complete prior to insulation application.
- .2 Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

### 3.2 PREPARATION

- .1 Isolate the working area during spraying. Mask and protect adjacent surfaces from over spray or dusting.
- .2 Apply primer in accordance with manufacturer's instructions.

### 3.3 APPLICATION

- .1 Protect workers as recommended by CAN/ULC-S705.2.
- .2 Apply insulation in accordance with manufacturer's instructions and CAN/ULC-S705.2.
- .3 Ventilation for applications inside the Air Vapour Barrier: Provide ventilation at a rate of 0.3 air changes within the working area during the application. Isolate the working area during spraying. Maintain ventilation and isolation after the product has been sprayed for the time period determined in accordance with the CAN/ULC-S705.1.
- .4 Apply insulation by spray method, to a uniform monolithic density without voids. Use only one proportioner to supply each spray gun. Do not exceed 50 mm thickness of each pass of spray gun.
- .5 Apply to a minimum cured thickness as indicated.
- .6 Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets are completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
- .7 Patch damaged areas.
- .8 Finished surface of foam insulation to be free of voids and imbedded foreign objects.
- .9 Trim any excess thickness that would interfere with the application of cladding/covering system by other trades

### 3.4 GAP-FILLING FOAM INSULATION

- .1 Install insulation in accordance with manufacturer's written installation and safety instructions.
- .2 Clean openings and mask adjacent surfaces as required.
- .3 Install insulation to provide insulating air seal in exterior envelope construction as follows:
  - .1 Shim Spaces between Frames and Adjacent Construction: Fill with insulation as indicated or as specified in individual sections.
  - .2 Miscellaneous Crevices, Voids: Install insulation in miscellaneous crevices and voids, under sill plates and where required to prevent gaps in insulation.
  - .3 Wall Penetrations: Install insulation around wall penetrations to attain a thermal or acoustic seal or for air-infiltration reduction.
  - .4 Ensure insulation does not impair or impeded opening operating components.
  - .5 Trim cured foam to permit installation of subsequent materials.

### 3.5 SITE QUALITY CONTROL

- .1 Testing Agency Services: Engage a qualified testing agency to perform tests and related inspections in accordance with the CUFCA manual or Manufacturer's programme and to provide the following:
  - .1 Testing in accordance with CAN/ULC S705.2.
  - .2 Daily visual inspections verifying insulation thickness, density measurements and adhesion/cohesion testing.
  - .3 Prepare test and inspection reports.

### 3.6 CLEANING

- .1 Remove masking materials and overspray from adjacent surfaces immediately after foam surface has hardened.
- .2 Use cleaning methods that will not damage adjacent work.

### 3.7 PROTECTION OF FINISHED WORK

- .1 Do not permit subsequent construction work to disturb applied insulation.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for supply and installation of factory formed, site assembled, non-structural, concealed fastener, metal roofing system; including accessories required for weather tight installation; job site manufactured materials will not be acceptable for this project.
- .2 Drawings indicate size, profiles, and dimensional requirements of metal roofing system and are based on the specific system indicated; do not modify intended aesthetic effects.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Construction Meeting: Arrange a pre-construction meeting at project site with Contractor, Subcontractor and Consultant present before starting roof construction; purpose of meeting is to review methods and procedures related to roof construction and metal roofing system including; but not limited to, the following:
  - .1 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - .2 Review methods and procedures related to metal roofing system installation, including manufacturer's written instructions.
  - .3 Examine substrate and sheathing conditions for compliance with requirements, including flatness and attachment to structural members.
  - .4 Review structural loading limitations of deck during and after roofing.
  - .5 Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roofing system.
  - .6 Review temporary protection requirements for metal roofing system during and after installation.
  - .7 Review roof observation and repair procedures after metal roofing system installation.
  - .8 Inspection agency will document proceedings, including corrective measures and actions required, and furnish copy of record to each meeting participant.
- .2 Coordination:
  - .1 Coordinate metal roofing system with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak proof, secure, and non-corrosive installation.

**1.4 PERFORMANCE REQUIREMENTS**

- .1 Design and construct roof so that completed installation will not leak.
- .2 Structural Design Performance:
  - .1 Design Roof System to Resist:
    - .1 Maximum deflection not to exceed  $l/180$  under system's own weight plus wind load (positive and negative) loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:50 years.

- .2 Design the systems so that there is no air or water infiltration under the positive and negative forces imposed by wind and gravity loads. Provide means of draining space between insulation and exterior skin, in accord with NRC Rain Screen Principles.
- .2 Thermal movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
- .1 Temperature change (range): 20 deg C, ambient; 40 deg C, material surfaces.

## 1.5 SUBMITTALS

- .1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data including; but not limited to, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roofing system and accessory.
  - .2 Shop Drawings: Submit shop drawings indicating fabrication and installation layouts of metal roofing system; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details, identify between factory and site assembled work, include details for the following:
    - .1 Flashing and trim
    - .2 Snow guards
  - .3 Samples: Submit one (1) sample for each type of exposed finish required for Consultant's verification of finishes, prepared in sizes as follows:
- .3 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Coordination Drawings: Coordination drawings indicating locations of penetrations and roof mounted items including; but not limited to, the following:
    - .1 Roof systems and attachments.
    - .2 Snow guards

## 1.6 PROJECT CLOSEOUT SUBMISSIONS

- .1 Operation and Maintenance Data: Submit manufacturers written maintenance data for metal roofing system, include name of original installer and contact information for inclusion in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- .1 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Manufacturer: Obtain each type of metal roofing system through one source from a single manufacturer.
  - .2 Installer: Use only installers that are trained and qualified by factory formed roofing panel manufacturer, and who have experience in projects of similar complexity and scope.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver components, metal roofing system, and other manufactured items to prevent damage or deformation; package metal roofing system for protection during transportation and handling.



- .2 Storage and Handling Requirements: Unload, store, and erect metal roofing system in a manner to prevent bending, warping, twisting, and surface damage, and as follows:
  - .1 Protect metal roofing system to prevent wetting of materials, and as follows:
    - .1 Stack metal roofing system on platforms or pallets, covered with suitable weather tight and ventilated covering.
    - .2 Do not store metal roofing system in contact with other materials that might cause staining, denting, or other surface damage.
  - .2 Protect strippable protective covering on metal roofing system from exposure to sunlight and high humidity, except to extent necessary for period of metal roofing system installation.
  - .3 Protect foam plastic insulation from surface degradation, and as follows:
    - .1 Do not expose to sunlight, except to extent necessary for period of installation and concealment.
    - .2 Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
    - .3 Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

#### 1.9 SITE CONDITIONS

- .1 Site Measurements: Verify locations of roof framing and roof opening dimensions by site measurements before metal roofing system fabrication and indicate measurements on shop drawings.
- .2 Established Dimensions: Establish framing and opening dimensions and proceed with fabricating metal roofing system without site measurements where site measurements cannot be made without delaying the Work, or allow for site trimming of panels; coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.
- .3 Ambient Conditions: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roofing system in accordance with manufacturers' written instructions and warranty requirements.

#### 1.10 WARRANTY

- .1 Provide manufacturer's standard form of warranty stating that manufacturer agrees to repair or replace components of metal roofing system that fail in materials within specified warranty period; failures will be considered to include; but are not limited to, the following:
  - .1 Structural failures, including rupturing, cracking, or puncturing.
  - .2 Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - .3 Deterioration of finishes, peeling or cracking of coating, failure to adhere to bare metal, colour fading and chalking.
- .2 Warranty Period:
  - .1 Finishes: Ten (10) years from date of Substantial Performance.
  - .2 Weather Tightness: Five (5) years from date of Substantial Performance stating that manufacturer agrees to repair or replace metal roofing system failing to remain weather tight; including leaks, within specified warranty period.
  - .3 Installer's Warranty: Written Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years after date of Substantial Performance.

- .1 Warranty includes removing and reinstalling work of this Section.

## 2 Products

### 2.1 MATERIALS

- .1 Insulated Panel: Side joint with vertical sidelap, mechanically seamed, concealed fasteners and attachment clips. Panel formed with 2 layers pre-finished steel sheet, sandwich with polyiso insulation core, minimum overall thickness 150 mm (6"), minimum thermal value R45.
  - .1 Exterior Face Sheet: 0.7 mm (22 Gauge) prefinished steel sheet, in PVDF coating consisting of dry film thickness of not less than 0.005 mm (0.2 mil) primer and 0.02 mm (0.8 mil) top coat, micro rib texture finish.
    - .1 Colour to be selected from manufacturer's standard colour range.
  - .2 Interior Face Sheet: 0.45 mm (26 Gauge), prefinished steel sheet, in siliconized polyester coating consisting of epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.005 mm (0.2 mil) for primer and 0.02 mm (0.8 mil) for topcoat, standard texture finish.
    - .1 Colour to be selected from manufacturer's standard colour range.
  - .3 Products:
    - .1 KingSeam by Kingspan Group.
    - .2 Standing Seam (SR2) Roof Panel by Vicwest Building Products.
    - .3 CFR-IMP Insulated Standing Seam Roof Panels by Nucor Building Systems.
- .2 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.
- .3 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.
- .4 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.
- .5 Flashing: As specified in Section 07 62 00 – Prefinished Metal Flashing and Trim.
- .6 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00 – Sealants.

### 2.2 FABRICATION

- .1 Fabricate and finish metal roofing system and accessories at the factory to greatest extent possible, using manufacturer's standard procedures and processes to obtain the indicated profiles and meeting dimensional and structural requirements for the Project.

### 2.3 FINISHES, GENERAL

- .1 Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- .2 Variations in appearance of abutting or adjacent pieces are acceptable if they are within half the range of reviewed samples:
  - .1 Noticeable variations in the same piece are not acceptable.
  - .2 Variations in appearance of other components are acceptable if they are within the range of reviewed samples and are assembled or installed to minimize contrast.

## 3 Execution

### 3.1 EXAMINATION



- .1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roofing system supports, and other conditions affecting performance of work.
- .2 Examine primary and secondary roof framing to verify that angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roofing system manufacturer.
- .3 Examine roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roofing system manufacturer.
- .4 Examine roughing-in for components and systems penetrating metal roofing system to verify actual locations of penetrations relative to seam locations of metal roofing system before metal roofing system installation.
- .5 Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- .1 Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- .2 Install auxiliary levelling substrate boards over metal deck; attach with mechanical fasteners into top flutes of steel to prevent wind uplift.
- .3 Install flashings and other sheet metal in accordance with requirements specified in Division 07 Metal Flashing and Trim section.
- .4 Install eave angles, furring, and other miscellaneous roof system support members and anchorage in accordance with metal roofing system manufacturer's written recommendations.

### 3.3 INSTALLATION

- .1 Install structural girts and other members required to support work of this Section except as otherwise shown on Drawings.
- .2 Install work in accordance with manufacturer's written instructions, plumb with intersecting parts joined together to provide accurately fitted joints with adjoining surfaces in true planes. Attach components in manner not restricting thermal movement.
- .3 Apply heavy coat of isolation coating to concealed surfaces of dissimilar metals and metals in direct contact with concrete or masonry.
- .4 Metal Roofing System:
  - .1 Install metal Fasten metal roof panels to supports with concealed clips at each standing-seam joint at locations, spacings, and with fasteners recommended by manufacturer.
    - .1 Install clips to supports with self-tapping fasteners.
    - .2 Install pressure plates at locations indicated in manufacturer's written installation instructions.
    - .3 Crimp panel standing seams with manufacturer-approved motorized seamer tool so clip and metal roof panel are completely engaged.

### 3.4 ACCESSORY INSTALLATION

- .1 Install accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
- .2 Install components required for a complete metal roofing system assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

- .3 Install flashing and trim in accordance with performance requirements, manufacturer's written installation instructions, and SMACNA recommendations; provide concealed fasteners where possible, and set units true to line and level; install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- .4 Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
- .5 Provide for thermal expansion of exposed flashing and trim:
  - .1 Space movement joints at equally spaced intervals to a maximum of 3050mm (10') feet on centre with no joints allowed within 610mm (24") of corner or intersection.
  - .2 Form expansion joints of intermeshing hooked flanges, not less than 25mm (1") deep, filled with mastic sealant concealed within joints where lapped or bayonet type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof.
- .6 Attach snow guards to metal roofing system with adhesive, sealant, or adhesive tape, as recommended by snow guard manufacturer; do not use fasteners that will penetrate metal roofing system.
- .7 Form flashing around pipe penetration and metal roofing system; fasten and seal to metal roofing system as recommended by manufacturer.

### 3.5 ERECTION TOLERANCES

- .1 Shim and align metal roofing system units within installed tolerance of 6mm (1/4") in 6m (20') on slope and location lines as indicated and within 3mm (1/8") offset of adjoining faces and of alignment of matching profiles.

### 3.6 SITE QUALITY CONTROL

- .1 Engage a factory authorized service representative to inspect completed metal roofing system installation, including accessories and to report results in writing to Owner and Consultant.
- .2 Remove and replace applications of metal roofing system where inspections indicate that they do not comply with specified requirements.
- .3 Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 CLEANING AND PROTECTION

- .1 Remove temporary protective coverings and strippable films, if any, as metal roofing system are installed, unless otherwise indicated in manufacturer's written installation instructions.
- .2 Clean finished surfaces as recommended by metal roofing system manufacturer upon completion of metal roofing system installation; maintain in a clean condition during remainder of construction.
  - .1 Replace metal roofing system components that become damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for prefinished metal siding, complete with a system of girts, flashings and trims, using sheet metals and exposed fasteners, on the following installation applications:
  - .1 As an exterior wall cladding
- .2 Provide specified system with labour, materials, and equipment required to fabricate and erect siding including cutting and penetrations, accessories, flashings, trims and closures necessary for a complete installation.

**1.3 SUBMITTALS**

- .1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.
- .2 Submit manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.
- .3 Shop Drawings:
  - .1 Submit fully dimensioned shop drawings to Consultant showing construction, assembly, elevations, sections and interfacing with work of other Sections.
  - .2 No work of this Section shall be fabricated until shop drawings and all other related submittals, documentation, certifications and samples as required by this Section, have been reviewed by the Consultant.
  - .3 Details shall indicate metal thicknesses, areas to be sealed and sealant materials, gaskets, type of joints, flashings, trim, finishes, fasteners and welds, all anchorage assemblies and components and erection details.
  - .4 Shop drawings shall bear the seal of an engineer registered to practice in the place of Work, employed by the preformed metal siding manufacturer, and shall include complete design calculations for the system and documentation in regard to the reactions of the metal siding due to thermal expansion and contraction, positive and negative wind pressure and assurance that the thermal movement and wind forces have sufficient attachments, supports, bracing and anchorage.
- .4 Samples:
  - .1 Submit to the Consultant for approval, samples of materials and components to be used in the system, prior to fabrication of work together with name of manufacturer and technical literature. Submit 305 mm x 305 mm (12" x 12") samples of metal, peel and stick membrane and Z-girts. Submit two (2) full size panels of metal siding.
- .5 Safety Data Sheets:
  - .1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

**1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Manufacturer and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
  - .2 Erection of preformed metal siding systems shall be by workers especially trained and experienced in this type of work. Have a qualified representative at the job site to direct the work of this Section at all times.
  - .3 Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Document requirements including, but not limited to, the following:
    - .1 Seal and signature to shop drawings and design submittals requiring structural engineering.
    - .2 Field review of installed components.
  - .4 Conform to the requirements of the local Building Code, local by-laws and Authorities having jurisdiction.

#### **1.5 PRE-INSTALLATION CONFERENCE**

- .1 Convene one (1) week before commencing Work of this Section to discuss expectations for fit and finish of wall system, quality of workmanship for installation of air/vapour retarders and insulation and relationship of wall system to adjacent components.
- .2 Meeting shall be attended by the installer, manufacturer's representative, Contractor and the Consultant.
- .3 Manufacturer's representative shall also provide frequent inspection visits during the course of work of this Section to assure quality and competence of membrane installation and panel alignment

#### **1.6 DESIGN REQUIREMENTS**

- .1 Maximum deflection not to exceed  $L/180$  under system's own weight plus wind load (positive and negative) loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:50 years.
- .2 Design sheet cladding to span continuously over at least four structural supports (three spans) and design fastening to structural supports to sustain factored loads in accordance with CAN/CSA S136.
- .3 Calculate live load deflections in accordance with CSSBI 20M, as modified by the requirements of this Section.
- .4 Provide for movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasonal temperature range from -40 deg C to +50 deg C, and wind loads noted above.
- .5 Design the systems so that there is no air or water infiltration under the positive and negative forces imposed by wind and gravity loads. Provide means of draining space between insulation and exterior skin, in accord with NRC Rain Screen Principles.
- .6 Final review and acceptance of work completed by this Section shall be carried out by the manufacturer's representative, the Consultant, Contractor and the Subcontractor.

#### **1.7 STORAGE, DELIVERY, HANDLING AND PROTECTION**

- .1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage locations. Do not load any area beyond the design limits.



- .2 Adequately protect and crate all components against damage, dirt, disfigurement and weather.
- .3 Assembled units and/or their component parts shall be transported, handled and stored in a manner to preclude damage. Accessory materials required for erection at the Site shall be delivered to the Site in manufacturer's labelled containers. Remove all units or components which are cracked, bent, chipped, scratched or otherwise unsuitable for installation and replace with new.
- .4 Provide safe and adequate equipment on the Site to execute the work of this Section, hoisting, scaffolding, staging, safety protection equipment, tools, plant and other equipment required for the completion of the work of this Section.
- .5 Delivered damaged materials or materials which do not comply with this Section shall be rejected by Consultant, removed from the Site and replaced with acceptable materials at Contractor's expense.
- .6 Adequately protect the structure and work of all other trades during delivery, storage, handling and erection of the work of this Section.
- .7 Preformed metal siding components being hoisted to the working level shall be adequately banded and carefully slung employing steel wire rope.
- .8 Bundles shall be tag lined during the ascent of the hoisting operation. Precaution shall be taken to avoid damage to metal siding components and to prevent marring of exposed surfaces.
- .9 Preformed metal siding components, after being positioned, shall be adequately secured in place as quickly as possible and prior to leaving the job site at the end of the working day.
- .10 Loose bundles of preformed metal siding components shall be adequately secured at the completion of each working day.
- .11 Scaffolds, platforms, ladders, and the like, required by the erector for installation of metal siding components shall be properly secured to prevent accidental movement or collapse.

#### 1.8 PROJECT CONDITIONS

- .1 Make thorough examination of drawings and details. Determine the intent, extent, materials, and conditions of interfacing with work of other Sections and be fully cognizant of requirements.
- .2 Inspect substrate surfaces on which the work of this Section is erected for any irregularities detrimental to the application and performance of the work of this Section. Confirm conditions satisfactory before proceeding.
- .3 Co-ordinate and verify, by measurement at the job site, all dimensions affecting work of this Section. Notify Consultant, in writing, of all dimensions and/or conditions at variance with those on the reviewed shop drawings, Contract Documents and/or detrimental to the proper and timely installation of materials. Direction regarding correction measures shall be obtained from Consultant prior to fabrication of the item affected. Insure the compatibility of adjacent items in relationship to the work of this Section.
- .4 Do not perform work of this Section during period of rain, fog, sleet or snow, or upon surfaces covered with dust, water, dew, ice, frost or snow.
- .5 Report to Consultant in writing, defects of work prepared by other trades and unsatisfactory Site conditions. Commencement of application implies acceptance of surfaces and conditions.

#### 1.9 COORDINATION

- .1 Coordinate work of this section with the requirements of Section 07 62 00 – Prefinished Metal Flashing and Trim, for specific requirements for supply of prefinished sheet metal flashing materials to other sections of the work as follows:

- .1 Supply prefinished sheet metal flashings required for the project, regardless of sheet metal thickness and colour.
- .2 Provide prefinished sheet metal flashings to installing trades, tension levelled and guillotine sheared to length ready for brake forming, fabrication and installation by installing trades.
- .3 Coordinate with installing trades during bid period and provide unit prices for materials based on specified thickness and colour of flashing materials required under their respective scopes of work; installing trades will be responsible for carrying cost for flashing materials in their scope of work in their Bid Price.
- .4 Requirements of this portion of the scope of work do not apply to extruded aluminum or other pre-manufactured flashing materials normally supplied by installing trades (i.e.: extruded aluminum curtain wall flashing and sills, preformed roof penetrations, non-prefinished sheet metal products).
- .5 Subcontractor responsible for supply of metal wall and soffit cladding will only be responsible for fabrication and installation of flashings relating to their scope of work.

#### 1.10 WARRANTY

- .1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of five (5) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.
- .2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.
- .3 Promptly make good defects and/or failures in the Work upon written notification by the Owner. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and the Owner's property damaged or disturbed in the course of remedying defects.

#### 2 Products

##### 2.1 MANUFACTURERS

- .1 Basis of Design Products: Products named in this Section were used as the basis of design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section.
- .2 Acceptable Preformed Metal Siding Profile: Subject to compliance with requirements specified in this Section, profiles that may be incorporated into the Work include; but are not limited to, the following:
  - .1 Liner Panel: L-800R Liner by Vicwest Building Products.
  - .2 Exterior Wall Cladding: Profile, size, and colour to match adjacent existing.

##### 2.2 MATERIALS

- .1 Sheet steel conforming to ASTM A653/A653M, structural quality, Grade 'A' with a minimized spangle zinc coating of Z275 conforming to ASTM A653/A653M shall be used for girts, sub-grits, Z-bars, brackets, battens, retention clips, cleats, fascias, preformed metal siding panels, closures and flashings.
  - .1 Girts, Sub-girts, Z bars, Clips and Brackets: Base steel nominal thickness to meet design requirements. Thermal clips shall be slotted to minimize thru-metal conductivity.



- .2 Preformed Cladding and Liner Panel: Base steel nominal thickness to meet design requirements.
- .3 Flashings, Trims and Closures: Factory finish steel of suitable core thickness and finish to match cladding. Inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip, transition/ termination trim and window/ door trim of same material and colour as cladding, with fastener holes pre-punched.
- .2 Finish:
  - .1 Preformed wall cladding, liner panel and related metal flashings shall be prefinished coil coated material in accordance with Technical Bulletin No. 178 mm (7 ") Prefinished and Post Painted Galvanized Sheet Steel for Exterior Building Products" of the Canadian Sheet Steel Building Institute (CSSBI), prefinished to CSSBI 10,000 Series requirements. Colours shall be as indicated on drawings and where not indicated, as selected later by Consultant from manufacturer's full available colours range, including manufacturer's extended colours range. Allow for two (2) different colours to be selected.
- .3 Mineral Fibre Semi-Rigid Insulation: Installation within Roof Equipment Screens for acoustical value:
  - .1 Unfaced, preformed mineral slag batt insulation in accordance with CAN/ULC S702, Type 1; having a nominal R value of 115 mm (4.2/1"); rated non-combustible in accordance with CAN/ULC S114 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; density 32 kg/m<sup>3</sup>; square edges, thickness as required to meet design insulation values indicated on drawings.
    - .1 Basis of Design Materials: CavityRock MD by Rockwool.
- .4 Sealing Tape: Macro-polyisobutylene preformed sealant tape designed for use in metal cladding assemblies.
- .5 Sealants And Gaskets:
  - .1 Sealants and gaskets shall be of types to allow for maximum movements anticipated, maintaining life cycle expectancy, adhesion and flexibility under temperature ranges of - 25 degree C up to +80 degree C, without undue softening or deleterious effects.
  - .2 At sidelaps and end laps of panels, as required, factory applied butyl tape, or polyvinyl chloride "wedge fit" type extrusions.
  - .3 Perimeter Sealant: Multi-component, chemical curing epoxidized polyurethane type sealant conforming to ASTM C920, DYMERIC 240FC by Tremco Inc. (Canada) Ltd., or Sonolastic NP2 by BASF Construction Chemicals, or approved equal. Colour as selected later by Consultant. Provide primers, bond breakers and cleaning agents as recommended by the sealant manufacturer.
- .6 Screws, Bolts, Nuts, Washers, Rivets And Other Fastening Devices:
  - .1 Exposed fasteners used on exterior facing panels, flashing and all trim members shall be Series 400 stainless steel and nylon coloured coated head to match substrate colour, Atlas Colormate or VistaCoat by SFS intec AG.
  - .2 Mechanical fasteners used on underlayment; self tapping metal screws, type and length to suit application and securement plates to the approval of the Consultant.
  - .3 Concealed fasteners located within wall: No.12 teks, self-drilling, self-tapping galvanized screws.
- .7 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

- .8 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.
- .9 Protective Membrane:
  - .1 Minimum 40 mils thick, self-adhesive, glass fibre reinforced 914 mm (36") wide roll form type laminated styrene butadiene styrene (SBS) modified asphalt protective membrane.

## 2.3 FABRICATION

- .1 Co-ordinate and verify, by measurement at the job site, all dimensions affecting the Work. Submit written notifications documenting any and all field dimensions and/or conditions which are at variance with those on the reviewed shop drawings. The Contract documents and/or detrimental to the proper and timely installation of job site materials. The decision regarding corrective measures shall be obtained from the Consultant prior to the fabrication of the item affected. Ensure the suitability of adjacent items in relationship to the work of this Section.
- .2 Report to Consultant in writing, defects in Work prepared by other trades and unsatisfactory Site conditions. Commencement of work shall imply acceptance of conditions.
- .3 Workmanship shall be best trade shop and field practice known to recognized manufacturers specializing in work of this Section. Joints and intersecting members shall be accurately fitted to true planes, adequately and securely fastened and made completely weathertight. Component fastenings shall be concealed of adequate strength.
- .4 Fabricate units to profile and sizes indicated complete with rabbets, interlocks, flashings, trim and filler sections, as required to interface with work of other trades.
- .5 Fabricate all devices required for erection and adequate anchorage and attachment required to be built into or attached to the steel structural or steel deck and main building structure for the support of the Work.
- .6 Anchorage brackets and devices shall be designed and fabricated to compensate for unevenness and dimensional difference in the structure and permit unrestricted expansion and contraction of framing members.
- .7 Steel Welding: Conform with CSA W59 and executed in accordance with CSA W47.1 or CSA W55.3.
- .8 Fabricate preformed metal siding systems where indicated. The systems shall be formed to meet design requirements, and of prefinished steel sheet. The system shall be accurately cut and fitted, all fastenings shall be concealed. Method of attachment shall be to the Consultant's approval and clearly detailed on shop drawings. Panel faces shall be flat and true without waves, buckles or oil canning.
- .9 Supply sufficient prefinished metal of same thickness and colours as the preformed metal siding to Section 07 62 00 – Prefinished Metal Flashing and Trim for his use in installing roof flashings.
- .10 Form starter strips of same material as flashings 38 mm (1-1/2") wide and continuous.
- .11 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, scratches, dents and abrasion.
- .12 Thickness of metal shall be adequate for various conditions.
- .13 Isolate where necessary to prevent electrolysis due to dissimilar metal to metal contact or metal to masonry or concrete. Use bituminous paint or other approved divorcing membrane.

## 3 Execution

### 3.1 INSTALLATION



- .1 Erect preformed metal siding and accessories in strict accordance with reviewed shop and erection drawings and manufacturer's instructions to give a complete and weatherproof system.
- .2 Install underlayment and protective membrane under preformed metal siding and elsewhere as required in strict accordance with manufacturer's written instructions forming a complete waterproof barrier, free of leaks.
- .3 Install girts, 'Z' girts, liner panels, sub-girts, cleats and retention clips and other attachment members necessary to complete the work of this Section.
- .4 Co-operate with other trades to ensure proper installation and anchorage of work of this Section. Install steel bracing and framing and continuous clip angles and secure plumb and in line.
- .5 Damaged, bent or dished sheets will be rejected.
- .6 Place preformed metal siding against supporting substrate and adjust to final position before permanently securing. Bring each unit to bear evenly on framing.
- .7 Align units to provide accurate fit with corresponding sections parallel and straight. Ensure complete nesting of interlocking and sealed side lap joint and fasten sheets to structural supports.
- .8 Fasten exterior sheets of panels to horizontal sub-girts, using colour matching fasteners, where indicated.
- .9 Install necessary closure and trim or neoprene closures at openings and penetrations, fastening at 305 mm (12") O.C. Make cut-outs neatly by saw cutting.
- .10 Where welding has been performed on work of this Section, or field cutting or scratches have been made, field coat such areas with touch-up paint after thoroughly cleaning affected surfaces.
- .11 Seals:
  - .1 Fit flexible seals, tapes, formed gaskets and the like at locations required to provide air/vapour barriers and weathertight junctions. Ensure that end joints, between lengths of material have been properly sealed.
  - .2 Caulk junctions of preformed metal siding system components to themselves and work of other Sections with sealant in accordance with the requirements of Section 07 92 00 – Sealants, to maintain continuity of air/vapour and weather barriers.
- .12 Rigidly connect all prefinished flashing pieces with specified colour matching fasteners at 305 mm (12") O.C. along length. Use preformed corner pieces and erect with ample allowance for thermal movement.
- .13 Furnish adequate quantity of prefinished flat stock flashing sheet to Section 07 62 00 – Prefinished Metal Flashing and Trim for forming and installation. Trim members in this category are cap flashing, base flashing and those specifically shown on drawings as being prefinished and in close proximity to roofing. Flashing pieces entirely remote from roofing flashing and the like are furnished in place under work of this Section.
- .14 Install work of this Section only during period of no rain, fog, sleet or snow, or upon surfaces covered with dust, water, dew, ice, frost or snow.

### 3.2 CLEANING AND CLEAN-UP

- .1 Remove debris and surplus materials from the Site upon completion of work of this Section.
- .2 Clean dirt, soil and misplaced sealants from preformed metal siding systems with recommended cleaners and solvents.

**END OF SECTION**

**1 General**

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Work of this section include the supply and installation of a conventional SBS Modified Bituminous Membrane Roofing system, accessories, and site quality control as indicated in this section.

**1.3 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit copies of membrane manufacturers current technical data sheets describing the physical properties and recommended installation procedures.
  - .2 Shop Drawings:
    - .1 Submit sloped insulation manufacturer's proposed roofing diagrams and layouts for review by the Consultant.
    - .2 Submit membrane manufacturer's standard details that will be used for this project, indicate changes that must be made to make the details project specific for review by the Consultant.

**1.4 SYSTEM PERFORMANCE**

- .1 General Performance: Installed membrane roofing shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- .2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- .3 Minimum Adhesion of Each Material: 1 MPa.
- .4 Fire Hazard and Windstorm Requirements:
  - .1 Provide membrane roofing, base flashings, and component materials equivalent to requirements in as part of a membrane roofing system and as follows:
    - .1 Fire Hazard Classification: CAN/ULC-S107, Class C.
    - .2 Roof Assembly wind uplift requirements: tested in accordance with CSA A123.21-14, Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.
- .5 Expected Service Life: CSA S 478; Provide a fully adhered roofing system whose cap sheet and cap sheet flashings have a predicted service life of a minimum of 20 years in accordance with requirements of Part 7 of CSA S 478.
- .6 Thermal Resistance of Insulation: Minimum effective thermal resistance as indicated in accordance with CAN/ULC-S770-3 - LTTR testing and the following:



- .1 Do not include other system componentry such as air surface films, structural materials, membranes, tapered insulation, roof sheathing component contributions in the calculation.

- .7 Roof slope: Minimum 2% slope to drain.

#### 1.5 QUALITY ASSURANCE

- .1 Obtain roofing membrane materials through one source from a single manufacturer and install using workers who are trained and approved by the roofing membrane manufacturer; maintain a full time experienced journeyman roofer, and at least one apprentice per crew on the Work at all times.
- .2 Roofing and sheet metal work will be performed in conformance with the roofing manufacturer's written recommendations using materials that meet the requirements of CAN/ULC S107 to obtain a Class A fire resistance rating; submit proof that roofing materials meet required performance when requested by the Consultant.
- .3 Conform to Roofing Specifications as published by Canadian Roofing Contractors Association (CRCA) and local Provincial Roofing Contractors Association Roofing Specification Manual.
- .4 Perform the work of this Section by a company which has a minimum of five (5) years of proven satisfactory experience in the Work of this Section.
- .5 Execute work of this section using an applicator approved by the roofing membrane manufacturer.

#### 1.6 FIRE PROTECTION

- .1 Protect roof junctions at parapets, roof curbs and upstands with a fire-resistant tape or barrier to prevent combustible materials within assemblies from ignition arising from the use of torches. Install prior to installation of base sheets.
- .2 Use a heat detector gun to spot any smouldering or concealed fire at the end of each work day. Establish a minimum one (1) hour fire watch after torch application.
- .3 Do not apply torch directly to dry or unprotected wood surfaces.
- .4 Maintain a clean site and have one approved ABC fire extinguisher within 6 meters of each roofing torch. Respect all safety measures described in manufacturer's technical data sheets. Do not place torches near combustible or flammable products.

#### 1.7 STORAGE, DELIVERY, HANDLING AND PROTECTION

- .1 Deliver materials to the job site; handle and store in original packages and containers with manufacturer's seals and labels intact. The manufacturer's name, brand, mass, specification number and lot number must be shown on the labels.
- .2 Store materials in weatherproof shelters having floors that will protect the materials from moisture. Store materials on end. Avoid prolonged exposure of light or heat sensitive materials to sunlight.
- .3 Do not store materials on roof in concentrations that exceed design live load.
- .4 Place plywood runways over the Work to enable the movement of materials and other traffic during construction of roofing.
- .5 Protect surrounding surfaces against damage from roofing work. Where hoisting is necessary, hang tarpaulins to protect walls during delivery of materials from ground to roof.
- .6 In the event of materials damage by the elements, improper handling or other causes, such materials will be rejected and will be replaced at no extra cost to the Owner. Remove rejected materials promptly from the site.

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- .7 During roofing work, exposed surfaces of finished walls must be protected with tarp to prevent damage. Contractor shall assume full responsibility for damage.

## 1.8 PREINSTALLATION MEETING

- .1 Include the roofing manufacturer's representative, roofing contractor's representative, the roofing inspector, the Contractor, the Consultant and Owner.
- .2 The purpose of this meeting is to review installation conditions particular to this project and review materials specified in this section.
- .3 The roofing inspector will complete the minutes and prepare a report for this meeting.

## 1.9 SITE CONDITIONS

- .1 Minimum ambient application temperature shall not be less than -20 deg C. Notify Consultant and roofing inspector where installation is required below stated minimum temperature and submit manufacturer's standard cold weather installation practices prior to proceeding with work of this section.

## 1.10 WARRANTY

- .1 Manufacturer's Warranty: Transferable, Total System/Labour, Material & Workmanship Warranty, No Dollar Limit, Non-Pro-Rated for a period of twenty (20) years from date of Substantial Performance for the project including; but not limited to, the following components:
  - .1 Roofing membrane
  - .2 Base flashings
  - .3 Roofing membrane accessories
  - .4 Roof insulation
  - .5 Other components of membrane roofing system
- .2 Submit for Owner's acceptance, manufacturer's warranty document indicated above, executed by an authorized company official.

## 2 Products

### 2.1 MATERIALS - GENERAL

- .1 Source Limitations:
  - .1 Products of specified roofing system shall be products of one manufacturer, or approved by roofing system manufacturer as part of a system as compatible with their system and listed in and covered by the Manufacturer's Warranty.
- .2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

### 2.2 MANUFACTURERS - MEMBRANE MATERIALS

- .1 Basis of Design: Soprema Inc.,
- .2 Acceptable Manufacturer's: Equivalent systems from the following manufacturers will be considered provided they comply with performance requirements of this Section and the products specified:
  - .1 Holcim Elevate.
  - .2 IKO Industries Ltd.



- .3 Tremco Commercial Sealants & Waterproofing.
- .4 Siplast.

.3 Substitutions: Not permitted.

## 2.3 MEMBRANE MATERIALS

- .1 Base Sheet : CGSB 37-GP-56M Type 2, Class C, Grade 2 asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, reinforced with woven fibre glass 180 g/m<sup>2</sup>; with the following characteristics:
  - .1 Thickness: 2.5 mm.
  - .2 Application: Fully adhered.
  - .3 Top surface: Thermofusible plastic film.
  - .4 Bottom surface: Self-adhesive with silicone release sheet.
  - .5 Product: Sopraflash Flam Stick by Soprema.
- .2 Cap Sheet: CGSB 37-GP-56M Type 1, Class A, Grade 2, asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, heavy duty composite glass and polyester reinforcement; with the following characteristics:
  - .1 Thickness: 4.0 mm.
  - .2 Application: Fully adhered.
  - .3 Top surface: Factory applied granules, colour to match existing.
  - .4 Bottom surface: Thermofusible plastic film.
  - .5 Product: Sopralene Flam 250 GR by Soprema.

## 2.4 BITUMEN MATERIALS

- .1 Asphalt Primer: As approved by manufacturer.
- .2 Asphalt Bitumen: CSA A123.4M Roof Asphalt Type 3.
- .3 Plastic Cement: ASTM D2822 Type I or II, cutback asphalt type as recommended by roofing system manufacturer for application.

## 2.5 VAPOUR RETARDER

- .1 Prefabricated Vapour Retarder Membrane (noted as membrane in roof system): Self-adhesive air/vapour barrier membranes composed of bitumen modified with thermoplastic polymers and high-density polyethylene film, as per roof membrane manufacturer's standard and compliance with extended warranty requirements.
- .2 Prefabricated Vapour Retarder Transition Strip and Flashing Self Adhesive: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, polyester and glass reinforcement; smooth surfaced, as approved by system's manufacturer.

## 2.6 INSULATION

- .1 Bottom Insulation; Faced Polyisocyanurate insulation boards, CAN/ULC-S704, Type 3, Class 3, HCFC and CFC-free, rigid board, inorganic coated-glass facers, and square edges.
  - .1 Board Density: 32 kg/cu m.
  - .2 Thermal Resistance: Min LTTR value of RSI value of 1.8 per 50 mm.

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- .3 Board Size: 1220 x 1220 mm and 1220 x 2440 mm
- .4 Thickness: to match existing.
- .5 Acceptable Manufacturers- Polyisocyanurate Insulation:
  - .1 AC Foam III by Atlas Roofing Corporation.
  - .2 RESISTA ISO by Holcim Elevate.
  - .3 IKO Therm III by IKO Industries Ltd.
  - .4 Sopra ISO Plus by Soprema Inc.
- .6 Tapered Insulation:
  - .1 Board Thickness: As required for fabrication of slopes with a minimum thickness of 13 mm.
  - .2 Fabricate to minimum slope to drain meeting performance criteria specified. Provide custom saddles, sumps, crickets, tapered edge strips and other insulation shapes with increased local slopes to prevent trapping of water behind parapets returns or curbs.
  - .3 Design a custom configured sloping insulation to provide minimum slope to drains with custom sloped accessories.
- .2 Single layer insulating system combining base insulation and tapered insulation will not be accepted as substitute to multi layer insulating system.

**2.7 GYPSUM ROOF SHEATHING AND OVERLAY BOARD**

- .1 Gypsum roof sheathing and overlay board; ASTM C1396; 13 mm thick unless otherwise indicated; primed finish with non-woven glass mats embedded in a water resistant treated gypsum core; minimum compression strength 500 psi.
  - .1 Product:
    - .1 DensDeck Prime Roof Board by Georgia-Pacific Gypsum LLC,
    - .2 Securock Gypsum Fiber Roof Board by CGC Inc.
    - .3 CertainTeed Glasroc Roof Board by CertainTeed

**2.8 ADHESIVES**

- .1 Insulation Adhesive: One or two component, low-rise, chemically cured urethane foam adhesive for the attachment of selected rigid roof insulation to one another and to adhere to vapour barrier membranes; contains no solvents and is compatible with the roofing Manufacturers system.

**2.9 CARPENTRY**

- .1 Wood roof materials shall be as specified in Section 06 10 00 – Rough Carpentry. Do not use pressure treated materials where SBS membrane materials are to be adhered to wood fabrications.

**2.10 ACCESSORIES**

- .1 Sheathing Joint Tape: Paper, heat-resistant type.
- .2 Insulation Joint Tape: Asphalt treated glass fibre reinforced; 150 mm wide; self adhering.
- .3 Flame-Stop Tape: Self-adhesive membrane composed of SBS modified bitumen and a glass mat reinforcement, designed to prevent flames from penetrating into voids, cavities and openings before installing heat-welded membranes; type recommended by membrane Manufacturer.



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- .4 Roofing Nails: Galvanized, hot dipped type, size as required to suit application.
- .5 Jointing Material for Overlay Board: Tape or sealant as recommended by membrane manufacturer.
- .6 Sealants: As recommended by membrane manufacturer.
- .7 Cant Strips: Fabricated from High density mineral wool, asphalt impregnated facer for torch application; 100 mm x 100 mm fabricated to 45 degree angle (with min.140 mm sloped face) dimension.
- .8 Termination Bars: Aluminum, surface mounted, prepunched, maximum possible length per location, with attachment flanges.
- .9 Miscellaneous Accessories: Provide all miscellaneous accessories recommended by roofing system manufacturer.
- .10 Roof drain: Refer to Mechanical Drawings.

**3** Execution

**3.1 GENERAL**

- .1 Perform roofing installation in accordance with membrane manufacturer's written instructions and to CRCA and local Provincial Roofing Contractors Association Roofing Specification Manual requirements.
- .2 Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
  - .1 At end of each day's work, provide water cut-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed. Minimize or eliminate staggered joints to accommodate water cut-offs.
  - .2 Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system. Use membrane flashings consistent with permanent detailing sealed to base layer and vapour retarder with minimum 100 mm laps.
  - .3 Remove and discard temporary seals before beginning work on adjoining roofing.
- .3 Provide water cut-offs to prevent dispersion of moisture at insulation level throughout roof assembly, in the event of future roof leak. Locate cut-offs at 9 m intervals each way.
- .4 Install cap sheets within 48 hrs of installation of base sheets.
- .5 No visible fasteners permitted on underside of exposed decks.

**3.2 EXAMINATION**

- .1 Verify that surfaces and site conditions are ready to receive work.
- .2 Verify deck is supported and secured.
- .3 Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.
- .4 Verify deck surfaces are dry and free of snow or ice.
- .5 Confirm dry deck by moisture meter with 12 percent moisture maximum.

- .6 Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and correctly located.

### 3.3 PREPARATION – GENERAL

- .1 Prepare surfaces in accordance with Standards and manufacturer's written installation instructions of CRCA and and local Provincial Roofing Contractors Association Roofing Specification Manual..

### 3.4 GYPSUM ROOF SHEATHING

- .1 Apply with adhesive in conformance with manufacturer's written recommendations to obtain wind uplift rating specified.

### 3.5 VAPOUR RETARDER APPLICATION

- .1 Primer: Apply primer in accordance with manufacturer's written instructions for system specified. Allow to dry.
- .2 Apply vapour retarder to substrate surface with adhesive overlapping side and end laps in conformance with manufacturer's written recommendations.
- .3 Stagger laps a minimum of 300 mm.
- .4 Begin work at bottom of slopes; unroll and align on substrate, ensuring full contact and support at edges.
- .5 Meet and overlap air/vapour barrier on adjoining walls.
- .6 Seal membrane at insulation perimeters and around penetrations to ensure sealed connections with base sheet at upstands.

### 3.6 INSULATION APPLICATION

- .1 Install insulation to manufacturer written instructions.
- .2 Ensure vapour retarder is clean and dry.
- .3 Bottom Insulation: Install bottom layer of insulation in minimum 2 layers. Apply adhesive to substrate in accordance with adhesive and insulation manufacturer's written instructions. Embed first layer of insulation into adhesive over vapour retarder in accordance with manufacturer's recommendations.
  - .1 For second layer of bottom insulation, apply adhesive to the top surface of first layer of insulation. Embed the second layer of insulation into adhesive, with joints staggered minimum 300 mm from joints of first layer.
- .4 Tapered Insulation: Place constant thickness first layer and tapered thickness insulation second layer to indicated slope pattern in accordance with manufacturer's written instructions.
  - .1 Embed insulation into adhesive as per manufacturer's instructions.
- .5 Minimum Total Insulation Thickness: As required to achieve insulation R or RSI value as indicated. Do not use tapered insulation in the calculation of thickness required.
- .6 Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- .7 Lay tapered boards for a distance of 450 mm back from roof drains for positive drainage.
- .8 Apply no more insulation than can be covered with membrane in same day.

### 3.7 OVERLAY BOARDS



- .1 Install overlay boards with adhesive in accordance with manufacture recommendations over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 150 mm in each direction from joints of insulation below. Loosely butt cover boards together. Tape or seal joints if required by roofing system manufacturer.
- .2 Immediately cover overlay boards with subsequent materials; do not leave exposed.

### 3.8 MEMBRANE APPLICATION

- .1 Apply membrane and primer to manufacturer written instructions.
- .2 Hot mop –fully adhere base sheet with SBS modified asphalt at a rate of 1.25 kg/m<sup>2</sup>.
- .3 Apply membrane; lap and seal edges and ends permanently waterproof.
- .4 Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate. Use rollers
- .5 Extend membrane minimum of 200 mm onto vertical surfaces. Secure base sheets to vertical surfaces of parapets with binder bars.
- .6 Extend membrane over vapour and air barrier of wall construction and seal.
- .7 Mop and seal membrane around roof protrusions and penetrations.
- .8 Torch cap sheet to manufacturer written instructions. On exposed membranes lap cap sheets at seams to limit bitumen bleed-out. Alternatively, apply loose granules of same colour as cap sheet to bitumen bleed-out while material is hot; ensure full coverage and embedment. Visible bleed-out not permitted.

### 3.9 FLASHINGS AND ACCESSORIES

- .1 Apply flexible sheet base flashings to seal membrane to vertical elements.
- .2 Secure to nailing strips at 100 mm on centre.
- .3 Fabricate roofing control and expansion joints to isolate roof into areas as indicated.
- .4 Install prefabricated roof penetration flashings and expansion joint flashings in accordance with manufacturer's instructions.
- .5 Coordinate installation of roof drains, curbs, and related flashings.
- .6 Seal flashings and flanges of items penetrating or protruding through the membrane.
- .7 At locations where standard flashing materials cannot be used apply liquid membrane flashing in accordance with manufacturer's details.

### 3.10 SITE QUALITY CONTROL

- .1 Owner will hire an independent inspection agency for this project to provide inspection services and verify conformance of roofing to specified requirements. Owner to appoint and pay for roof inspections.
- .2 Notify Inspection Company, roofing membrane manufacturer and Consultant 72 hours in advance of commencing roofing. Inspection Company will:
  - .1 Carry out full and complete inspections while the work is in progress, at completion of roofing installation and just prior to the date of Substantial Performance
  - .2 Inspect and review materials and workmanship including storage, handling and protection. Advise the Consultant and the Owner of inspections.
  - .3 Include procedures followed; ambient temperatures, humidity, wind velocity during application.

- .4 Submit a daily report while work is in progress to the Owner, Consultant, Roofing subcontractor and Contractor. This report is to be countersigned by the Roofing Subcontractor's Superintendent acknowledging content.
- .3 Inspection of all roofing to be provided by Owner appointed inspection agency.

### 3.11 MANUFACTURERS SITE SERVICES

- .1 Attend Pre-installation Meetings:
  - .1 Review preparation and installation procedures and coordinating and scheduling required with related work.
- .2 Require site attendance of roofing system manufacturer's technical personnel during installation of the Work to provide field surveillance of the installation of their Products:
  - .1 Schedule of Site Visits: Provide a minimum of three visits beginning with initial start-up of installation, at 25% completion and at 50% completion for each roof assembly.
  - .2 Inspect and review materials and workmanship including storage, handling and protection. Advise Consultant and Owner 48 hours in advance of inspections.
  - .3 Monitor and report installation procedures and unacceptable conditions.
  - .4 Manufacturer's representative to provide a written Site Report for each Site visit.
- .3 Correct identified defects or irregularities.
- .4 Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion of roofing membrane and flashing.
  - .1 Notify Consultant and Owner 48 hours in advance of date and time of final inspection.
  - .2 Manufacturer's representative to provide a written Site Report for Final Inspection.

### 3.12 CLEANING

- .1 In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- .2 Repair or replace defaced or disfigured finishes caused by work of this section.

### 3.13 PROTECTION OF FINISHED WORK

- .1 Protect building surfaces against damage from roofing work.
- .2 Where traffic must continue over finished roof membrane, protect surfaces using 19 mm thick plywood sheets of plywood arranged and installed to prevent tripping and wind uplift.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Furnish labour, materials and other services to complete the fabrication and installation of;
  - .1 Cap and base flashing; curb flashings,
  - .2 Roof edge flashing,
  - .3 Flashing at intersection of roof with vertical surfaces,
  - .4 Break metal flashings where shown,
  - .5 Prefinished flashings where indicated,
  - .6 Any other flashing as indicated on the drawings or as required, including all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.
- .2 Furnish, complete, all materials which shall be installed by other trades as specified and/or shown on the drawings including:
  - .1 Furnish to Section 04 20 00 all metal flashings and counter flashings which are to be built into masonry work.

**1.3 SUBMITTALS**

- .1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the Contract Requirements.
- .2 Submit shop drawings indicating material, thickness and finish.
- .3 Submit duplicate 100mm x 100mm (4" x 4") samples of each type of sheet metal material, colour and finish for review by Consultant prior to fabrication.

**1.4 QUALITY ASSURANCE**

- .1 Fabricator and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of Work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- .2 Erection of metal flashing systems shall be by workmen especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Store materials flat at site under protection to prevent staining from the work of other trades or from collection of water on material and secured against wind damage.
- .2 Carefully store preformed sheet metal work in such a manner as to prevent twisting, bending and rubbing.
- .3 Protect sheet metal work from corrosive materials and dissimilar metals.

**1.6 WARRANTY**

- .1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of two (2) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.
- .2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.
- .3 Promptly make good defects and/or failures in the work of this Section upon written notification by the Owner that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and Owner's property damaged or disturbed in the course of remedying defects.

## 2 Products

### 2.1 MATERIALS

- .1 Zinc Coated Steel Sheet: ASTM A653/A653M, commercial quality, with Z275 designation zinc coating, factory finished, minimum 0.89 mm (0.0336") base metal thickness.
- .2 Nails, bolts screws and rivets: Material - galvanized steel, stainless steel or same metal as material to be fastened. Type - to approved samples.
- .3 Isolation coating: Alkali and acid resistant bituminous paint.
- .4 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.
- .5 Underlay for metal flashing: Asphalt laminated 3.6 to 4.5 kg kraft paper.
- .6 Sealant: Multi-component, chemical curing epoxidized polyurethane type sealant conforming to ASTM C920 Dymeric 240FC by Tremco (Canada) Ltd., or approved equal. Colour as selected later by Consultant. Provide primers, bond breakers and cleaning agents as recommended by the sealant manufacturer.
- .7 All other materials not specifically described but required for a complete and proper installation of the work of this Section shall be new first quality of their respective kinds and subject to the approval of the Consultant.

### 2.2 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work to applicable CRCA 'FL' series specifications and as detailed.
- .2 Form flashings, counter flashings, scuppers and copings as required to suit each condition. Use prefinished sheet steel in all locations. Form pieces in 2438 mm (8'-0") maximum lengths. Make allowance for expansion at joints.
- .3 Fabricate sheet metal components with lines, arises and angles sharp and true and plane surfaces free from objectionable wave, warp or buckle.
- .4 Mitre and seal corners with sealant. Form drip edging at 45 deg angle, secure with a continuous 20 ga. hold-down clip.
- .5 Exposed edges of sheet metal shall be folded back to form a 13 mm (1/2") wide hem on the side concealed from view. Prefabricate corner pieces for flashings and copings. The workmanship and methods employed for forming, anchoring, cleating and the provision for expansion and contraction of sheet metal work shall be to the approval of the Consultant.
- .6 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.



- .7 Fabricate scuppers and overflow scuppers to applicable CRCA 'FL' Series details and as detailed.
- .8 Apply two coats of bituminous paint to metal surfaces to be in contact with masonry, concrete, mortar or dissimilar metals.

### 2.3 FINISHING

- .1 Factory Finished Metal Sheets.
  - .1 Silicone Modified Polyester: Coating thickness: not less than 25micrometres, custom colour.

### 3 Execution

#### 3.1 EXAMINATION

- .1 Inspect substrate surfaces on which the work of this Section is erected for any irregularities detrimental to the application and performance of the Work. Confirm conditions satisfactory before proceeding. Report to Consultant in writing, defects of work prepared by other trades and unsatisfactory site conditions. Commencement of work implies acceptance of surfaces and conditions.

#### 3.2 INSTALLATION

- .1 Metal flashing shall be in compliance with best sheet metal trade practice and shall in no way be contrary to sheet metal practice that will qualify for the Guarantee Certificate specified. Install with "S" lock expansion joints or standing seams incorporated on end of flashing length and all joints sealed with mastic.
- .2 Provide continuous starter strips to present true, non-waving leading edge. Provide clips and anchor to backup in an approved manner to provide rigid, secure installation. Conceal fastenings in completed flashing. Lap, lock and seal all seams.
- .3 Provide underlay under sheet metal. Secure in place and lap joints 100mm (4").
- .4 Install sheet metal flashings, cap flashings and copings as indicated on drawings using flat lock seams. Make joints to permit thermal movement. Make surfaces free from buckling, warp, wave, dents, oil canning or other defects. Make corners square and surfaces straight and in true planes. Equally space joints in cap flashings to suit wall panel module. Space seams not farther apart than 2439mm (8').
- .5 All sheet and strip flashing to be held in place by 14 gauge galvanized iron clips of a size and type to be determined by the construction requirements, except where specifically detailed on the drawings.
- .6 Caulk flashing at cap flashing with sealant.
- .7 Lock end joints and caulk with sealant.
- .8 Use rubber-asphalt sealing compound for joints between sheet metal and bitumen.
- .9 Supply rigid flashing, copings and sheet metal back-up to other trades where required to be built into other work at doors, windows, block openings, curbs and where shown on drawings.
- .10 Take careful note of fans, vents, etc., on mechanical drawings to determine whether flashing and counter flashing is required or whether units are self-counter flashing.
- .11 Caulking shall be installed as per written manufacturer's recommendations.
- .12 Exposed fastenings will be permitted where indicated or where concealed fastening is not possible. Obtain Consultant's approval of exposed fastenings and methods of making same.
- .13 If exposed screws or bolts are used, use cupped neoprene washers.

- .14 Install scupper drains and overflow scupper drains as indicated on drawings, in strict accordance with CRCA manual.

### **3.3 CLEANING**

- .1 Remove, as the work progresses, all excess or foreign material which would set up or become difficult to remove from finished surfaces.
- .2 Do all final cleaning upon completion of the Work of this Section. Leave building and Work in condition to meet the approval of the Consultant.
- .3 Remove excess sealant by the moderate use of mineral spirits or other solvent acceptable by the sealant manufacturer.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Furnish labour, materials and other services to complete the fabrication and installation of:
  - .1 Preformed Penetration Flashings.
- .2 Accessories and flashing material as required and as indicated on the drawings, including all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Bearing professional seal and signature of a professional engineer responsible for the engineering design of work of this Section. Show accessory profile, layout, materials, construction, and securement method to building structure.
  - .2 Furnish complete shop and erection drawings required for the work of this section to the Consultant for review prior to fabrication. Shop drawings shall bear the seal and signature of a Professional Engineer registered to practice at the Place of Work.
  - .3 Co-ordinate shop drawings for work of this section with those for other trades to ensure correct interface details required to provide watertight installation.
  - .4 Shop drawings shall incorporate plans, elevations, sections and details for all work in this Section. The details shall show and specify all metal thicknesses, types and finishes; areas to be sealed and sealant materials; type of construction including joinery, fasteners and welds; all anchorage assemblies and components; connections, fastenings, shapes and finishes; the fabrication and erection tolerances for the work in this section and the adjoining related work of other sections.
- .2 Product Data: Submit product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- .3 Maintenance Manuals: Include complete written and illustrated instruction manuals relative to the care, adjustment and operation of all parts of the equipment, a complete description and listing of components, with recommended frequency of service and maintenance to ensure maximum efficiency, reliability and long life of the equipment.

**1.4 QUALITY ASSURANCE**

- .1 Fabricator and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of Work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- .2 Erection of roofing specialties shall be by workmen especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.
- .3 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper maintenance procedures.
- .4 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation

procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

- .5 Manufacturer's Site Inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. Submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.
- .6 Source Limitations: Obtain each type of product from a single manufacturer.

## **1.5 DELIVERY/STORAGE/HANDLING**

- .1 Inspect material upon delivery and order replacements for any missing or defective items. Keep material dry, covered and off the ground until installed.

## **1.6 WARRANTY**

- .1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of two (2) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.
- .2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.
- .3 Promptly make good defects and/or failures in the work of this Section upon written notification by the Owner that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and Owner's property damaged or disturbed in the course of remedying defects.

## **2 Products**

### **2.1 MANUFACTURERS**

- .1 Specified Products: Work of this Section are based on specified products. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

### **2.2 PREFORMED PENETRATION FLASHINGS**

- .1 Roof Stack Vent Flashing: Properly sized, 483 mm high, 0.8 mm (0.031", 22 ga.) type 304 stainless steel round flashing, EPDM Triple Pressure Grommet Seal and EPDM Base Seal, pre moulded urethane insulation liner, coated deck flange compatible with roofing system, SJ series by Thaler Metal Industries Ltd.
- .2 Double Flexible Conduit Flashing: 1.6 mm (0.064") thick mill finished 1100 aluminium, insulated, moulded-in-place EPDM grommet seals, properly sized holes to suit conduits, galvanized conduit fittings, aluminium base enclosure, coated deck flange compatible with roofing system, MEF-AE2 by Thaler.
- .3 Multiple Flexible Conduit Flashing: Flexible flashing, 1.6 mm (0.064") thick mill finished 1100 aluminium, insulated, moulded-in-place EPDM grommet seals, properly sized holes to suit conduits, galvanized conduit fittings, aluminium base enclosure, coated deck flange compatible with roofing system, MEF-AE4 by Thaler.

### **2.3 FABRICATION**

- .1 Fabricate, assemble and erect manufactured materials in accordance with manufacturer's published specifications for specific types of functions required; manufacturer's specifications are considered to form part of this Section.



- .2 Fabricate assemblies complete in every respect, square, true to size and details, and free from distortion, twist or other defects that could affect strength, operation or appearance.

3 Execution

**3.1 EXAMINATION**

- .1 Report in writing defects in adjacent work and other unsatisfactory site conditions that could affect work of this Section.
- .2 Verify site dimensions. Commencement of work will imply acceptance of prepared work.
- .3 Inspect roof system is properly attached and installed to withstand additional retained loading.

**3.2 INSTALLATION**

- .1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.
- .2 Ensure water-tightness continuity of roofing systems.
- .3 Adjust and seal assembly with provision for expansion and contraction of components.
- .4 Coat metals contact with dissimilar materials, with isolation coating.
- .5 Apply full coverage sealant to fastener penetrations at roof surface and underside of through fasten brackets.

**3.3 ADJUSTING**

- .1 Verify that manufactured units are installed in accordance with specifications and details, and will function as intended.
  - .1 Adjust any items where necessary to ensure proper operation.

**3.4 CLEANING**

- .1 Clean manufactured units using materials and methods approved by manufacturer.
- .2 Do not use cleaners or techniques that could impair performance of the roofing system.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements of design, supply and installation of thin film intumescent fire resistant protective coating systems consisting of surface preparation, basecoat and protective decorative finish coat, having a fire resistance rating of 1 hour.

**1.3 SUBMITTALS**

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data including certified copies of test reports verifying fire resistant material applied to substrate as constructed on project will meet or exceed requirements of specification.
  - .2 Installation Schedule: Submit schedule listing surfaces to which fire resistant material is to be applied indicating minimum thickness required a minimum of one month prior to scheduled application of cementitious fireproofing material.
  - .3 Manufacturer's Data: Submit manufacturer's specifications and installation instructions.
  - .4 Samples: Submit 305 mm x 305 mm (12" x 12") samples of intumescent fireproofing system including final finish, for each colour indicated on the Drawings. Indicate location where material/system shall be utilized.
  - .5 Submit manufacturer's list of approved primers tested for adhesion and compatibility with intumescent fireproofing.
- .3 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Certificates: Submit test results in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.
- .4 Delegated Design Submittals: Provide engineered judgements and certification for work performed by this Section in accordance with requirements of Authority Having Jurisdiction.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Use materials and methods required to achieve fire resistance ratings required for the Project to the satisfaction of the Authority Having Jurisdiction, latest edition of the Ontario Building Code (OBC) and in accordance with referenced standards.
- .2 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Applicator: Use applicators that are licensed or approved by manufacturer of fire resistant material.
    - .1 Certified to National Fireproofing Contractors Association (NFCA) in the Province of Ontario.
    - .1 Accredited to Intumescent Fire-Resistive Materials (IFRM) applications.
  - .2 Materials: Use materials produced under label service of an agency that has tested material, or assemblies containing material, in accordance with specified test standards.



- .3 Air Quality: Provide ventilation in areas receiving fire resistant material during and 24 hours after application to dry material; maintain non-toxic, unpolluted working area; provide temporary enclosure to prevent spray from contaminating air.
- .3 Certifications: Provide the following during the course of the Work:
  - .1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction.
- .4 Field Inspection: An independent testing agency, hired by the Owner, to test random samples, as applied, to verify thickness of intumescent fireproofing.
  - .1 Inspection shall be carried out prior to application of the protective top coat.

#### 1.5 SITE CONDITIONS

- .1 Ambient Conditions: Apply fireproofing materials when temperature of substrate and surrounding air is above manufacturer's minimum temperature, provide sufficient ventilation to aid curing of materials and to maintain air quality requirements.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver in original undamaged sealed containers with manufacturer's labels, application instructions, and labelling agencies labels intact.
- .2 Storage and Handling Requirements: Store materials in dry protected area, raised off ground and away from damp surfaces and conditions that have deleterious effect on materials; keep materials dry until ready for use; discard material that has been exposed to water before actual use; use stock before its expiration date.

#### 1.7 SEQUENCING AND SCHEDULING

- .1 Sequence work in conjunction with structural steel.
- .2 Steel surfaces with less than 1 m (3') clear working access may necessitate applying material to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site.

### 2 Products

#### 2.1 MANUFACTURERS

- .1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests a minimum of five (5) days in advance of Bid Closing.
- .2 Additional Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 A/D FIREFILM III by A/D Fire Protection Systems Ltd.
  - .2 CAFCO SprayFilm WB 5 Intumescent Fire Resistive Material (IFRM) by Cafco/Isolatek International Inc.

#### 2.2 MATERIALS

- .1 Interior Intumescent Coating: Intumescent coating system consisting of primer, base coat and top coat, approved and listed by ULC or cUL for fire ratings required, flame spread of 25 or less and smoke developed of 50 or less, tested in accordance with ULC S102. Fire finish 120+ CFP-

- SP WB by Hilti, AD Firefilm III by Carboline, or Cafco SprayFilm WB 5 by Isolatek International Corp.
- .2 Exterior Intumescent Coating: Intumescent coating system, water resistant, consisting of primer, base coat and top coat, approved and listed by ULC or cUL for fire ratings required, flame spread of 25 or less and smoke developed of 50 or less, tested in accordance with ULC S102. Cafco SprayFilm WB 4 by Isolatek International Corp., complete with epoxy intermediate coat Cafco WM 4 by Isolatek International Corp.
- .3 Primer: Compatible with intumescent coating and substrates.
- .4 Top Coat: Decorative finish coat, compatible with base coat, manufacturer's standard colour offering.

3 Execution

**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that materials having a high moisture load that could cause excessive humidity and affect application and drying of intumescent coatings are installed and cured before applying materials of this Section.
- .2 Pre-Installation Testing: Test surfaces to receive work of this Section and report any defects that may affect the Work of this Section and to confirm compatibility of surfaces to receive fire resistant materials.
- .3 Beginning of installation means acceptance of existing surfaces.

**3.2 INSTALLATION**

- .1 Surfaces to receive fireproofing shall be free of dirt, dust, grease, oil, rust, loose materials, form release agents, frost, moisture or any other matter which would impair the bond of fireproofing material to the substrate. Commercial Blast Cleaning (SSPC-SP6/NACE No. 3) is the recommended minimum requirement for steel surface.
- .2 Prime substrates in accordance with manufacturer's written instructions or recommendations. Confine primers to areas of bond; do not allow spillage or migration onto exposed surfaces.
- .3 Apply intumescent fire resistant in accordance with manufacturer's instructions in sufficient thickness to achieve fire rating indicated; beginning of application means acceptance of substrate.
- .4 Apply intumescent fire resistant and decorative finish using airless spray equipment, brush or roller to achieve smooth, high gloss finish. Orange peel texture and other surface runs or marks arising from painting operations will require remedial action or replacement.
- .5 Apply decorative finish and protective seal coat in accordance with manufacturer's recommendations for finish matching approved samples.
- .6 Mask where necessary to prevent fireproofing material from contracting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so, without disturbing the fireproofing material located at the joint between the fireproofing and adjacent substrates.

**3.3 FIELD QUALITY CONTROL**

- .1 Notify Consultant when completed applications are ready for inspection.
- .2 Arrange for inspections by the Owner's independent inspection and testing company, appointed by Owner. Co-ordinate with requirements of Division 01.
- .3 Following field inspection, provide all repairs as required to ensure compliance with the Contract Documents.



**3.4 CLEANING AND PROTECTION**

- .1 Upon completion of this work, remove all materials, equipment and debris from the site.
- .2 Leave work area and adjacent surfaces in a condition acceptable to the Consultant.
- .3 Leave installed work with sufficient protection to enable it to remain untouched until project turnover.
- .4 Remove excess material, overspray, droppings and debris.

**3.5 PATCHING**

- .1 Patch and repair any fire resistant material that has been damaged by this or any other section; coordinate cost of repairs with Contractor; costs for repairs will be assessed to Sections of work responsible for damage.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for design, supply and installation of cementitious fireproofing, having a fire resistance rating as indicated in the drawings..
- .2 Work of this Section includes, but is not limited to work required to patch, repair and make good after installation of adjacent materials that may cause damage to completed work of this Section.

**1.3 COORDINATION**

- .1 Coordinate installation of hangers, inserts, clips and similar items to surfaces needing protection before applying fireproofing.
- .2 Coordinate installation of ducts, pipes, conduits and similar items that could obstruct spraying operations before applying fireproofing.
- .3 Coordinate patching of fireproofing after installation of materials installed subsequent to installation of fireproofing.

**1.4 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data including certified copies of test reports verifying fire resistant material applied to substrate as constructed on project will meet or exceed requirements of specification.
  - .2 Installation Schedule: Submit schedule listing surfaces to which fire resistant material is to be applied indicating minimum thickness required a minimum of one month prior to scheduled application of cementitious fireproofing material.
- .2 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Certificates: Submit test results in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.

**1.5 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Use materials and methods required to achieve fire resistance ratings required for the Project to the satisfaction of the Authority Having Jurisdiction, latest edition of the Ontario Building Code (OBC) and in accordance with referenced standards.
- .2 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Applicator: Use applicators that are licensed or approved by manufacturer of fire resistant material.
    - .1 Certified to National Fireproofing Contractors Association (NFCA) in the Province of Ontario.
    - .1 Accredited to Sprayed Fire-Resistive Materials (SFRM) applications.
  - .2 Materials: Use materials produced under label service of an agency that has tested material, or assemblies containing material, in accordance with specified test standards.



- .3 Air Quality: Provide ventilation in areas receiving fire resistant material during and 24 hours after application to dry material; maintain non-toxic, unpolluted working area; provide temporary enclosure to prevent spray from contaminating air.
- .3 Certifications: Provide the following during the course of the Work:
  - .1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction.
- .4 Delegated Design: Provide engineered judgements and certification for work performed by this Section in accordance with requirements of Authority Having Jurisdiction.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver in original undamaged sealed containers with manufacturer's labels, application instructions, and labelling agency's labels intact.
- .2 Storage and Handling Requirements: Store materials in dry protected area, raised off ground and away from damp surfaces and conditions that have deleterious effect on materials; keep materials dry until ready for use; discard material that has been exposed to water before actual use; use stock before its expiration date.

## 1.7 SITE CONDITIONS

- .1 Ambient Conditions: Apply fireproofing materials when temperature of substrate and surrounding air is above manufacturer's minimum temperature, provide sufficient ventilation to aid curing of materials and to maintain air quality requirements.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 Isolatek International Inc., Cafco Industries Limited
  - .2 Carboline Company, A/D Fire Protection Systems Inc.
  - .3 GCP Applied Technologies

### 2.2 APPLIED FIREPROOFING

- .1 Design Criteria:
  - .1 Adhesion: Provide materials that meet or exceed adhesion requirements in accordance with ASTM E736.
  - .2 Thickness and Weight: Determine application thickness and weight of fireproofing based on tests of assemblies in accordance with CAN/ULC S101, ASTM E119 or NFPA 251; apply same thickness of fireproofing material to all structural components forming a part of the assembly including; but not limited to, cross bracing, support angles and hangers.
  - .3 **Engineered Judgements:** Provide engineered judgment acceptable to Authority Having Jurisdiction where assembly being protected differs from the tested assembly used to determine thickness.
- .2 Water: Clean, fresh, suitable for domestic consumption, and free from such amounts of mineral or organic substance as would affect set of fire resistant material.
- .3 Primer/Adhesive: Manufacturers recommended primer and adhesive enhancing bonding material forming a part of fire resistant system for coated or hard to bond to substrates.

- .4 Medium Density Fireproofing Material: Spray applied, single component, factory blended cementitious fireproofing, consisting of high quality Portland cement and asbestos-free vermiculite.
  - .1 Acceptable Materials:
    - .1 A/D Type 7 GP by A/D Fire Protection Systems Inc.
    - .2 Cafco 400 by Isolatek.
    - .3 Monokote Z106 by GCP Applied Technologies.
- .5 Sealer: Water based sealer, as recommended by applied fireproofing manufacturer, allowing installation of approved coloured surface coatings or spray foam insulation to applied fireproofing.

### 3 Execution

#### 3.1 EXAMINATION

- .1 Verification of Conditions: Verify that environmental conditions surfaces receiving fireproofing meet manufacturer's requirements before beginning installation products specified in this Section; installation of products will denote acceptance of site conditions.

#### 3.2 PREPARATION

- .1 Protection of Existing Conditions:
  - .1 Provide and maintain temporary enclosures to prevent spray from marring adjacent construction, close off and seal installed duct work to prevent contamination of air supply system.
  - .2 Provide and maintain masking, drop cloths and polyethylene coverings to protect surfaces exposed in final construction from over spray.
- .2 Surface Preparation:
  - .1 Clean surfaces receiving sprayed fireproofing of oil, grease, dirt, loose paint, mill scale or any other material that could impair bond.
  - .2 Prime surfaces as required by manufacturer to achieve bond of fireproofing materials to substrates.

#### 3.3 APPLICATION

- .1 Apply fireproofing in accordance with manufacturers written installation requirements and as required to obtain fire resistance ratings indicated for the Project.
- .2 Apply fireproofing in coats not exceeding recommended by manufacturer for fire resistance ratings indicated for the Project.
- .3 Mix each batch of material separately in accordance with manufacturer's instructions to achieve required density and thickness; do not re-temper material or use frozen, caked, or lumpy material.
- .4 Cut, patch, and repair material that does not meet requirements of this Section or which fails to attain properties stipulated in reports of tests used to determine fire resistance rating of assembly.
- .5 Repair damage to fire resistant material caused by installation of subsequent Work.

#### 3.4 SITE QUALITY CONTROL

- .1 Site Testing and Inspections: Site testing and inspections will be performed in accordance with requirements specified in Section 01 40 00 – Quality Requirements and as follows:



- .1 Owner may appoint third party inspection and testing agency to confirm that installation of fireproofing materials meets requirements of ASTM E605 and ASTM E736-00.
- .2 One series of tests will be performed using both laboratory and site testing for each 1000 m<sup>2</sup> of floor area sprayed; patch and repair inspection locations after completion of cut tests.
- .3 Test results will be distributed to Contractor and installing Subcontractor at completion of each floor by Consultant.
- .2 Non-Conforming Work: Repair deficiencies identified in test results; patch damage to fireproofing caused by other work of the Project before fireproofing is concealed; or if exposed, before substantial performance.

### 3.5 CLOSEOUT ACTIVITIES

- .1 Cleaning: Remove equipment and clean exposed wall and floor areas to remove deposits of sprayed fireproofing materials after completion of fireproofing work.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Systems comprising fireproof firestopping and smoke seal materials and accessories, at joints and penetrations in fire resistance rated wall, floor and roof assemblies, materials and components.

**1.3 RELATED REQUIREMENTS**

- .1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

**1.4 PERFORMANCE REQUIREMENTS**

- .1 Materials, accessories and application procedures listed by ULC, cUL, WHI (Intertek/Warnock Hershey) or OPL (Omega Point Laboratories), or tested in accordance with CAN/ULC-S115 to comply with building code requirements.
- .2 Fire-Resistive Joint Systems:
  - .1 Generally, use listed assemblies types F, FT, FH or FTH, as applicable.
  - .2 Joints at Exterior Curtain-Wall/Floor Intersections: Use joint systems tested at a positive pressure differential of 2.49 per ASTM E2307.
- .3 Firestopping Materials: CAN/ULC-S115 and ASTM E2307, and to achieve fire ratings indicated.
- .4 Surface Burning of Exposed Materials: CAN/ULC-S102 with a minimum flame spread/smoke developed rating of 25/50.
- .5 Engineering Judgment: Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, provide an Engineering Judgment acceptable to the authority having jurisdiction.

**1.5 SUBMITTALS FOR REVIEW**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Provide data on product characteristics, performance and limitation criteria, and indicating construction details accurately illustrating Project conditions. Include descriptions sufficient for identification at Project site.
- .3 System Design Listings: Submit system design listings including design designations, locations and illustrations, from a qualified testing and inspection agency applicable, to each firestop configuration.
  - .1 Where Project conditions require modification to a qualified testing agency's illustration for a particular firestopping system condition, submit illustration, with modifications marked, approved by firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire resistance rated assembly.
- .4 Firestop System Engineering Judgments: When required for acceptance by the authority having jurisdiction, Firestop System Engineering Judgment submissions shall:
  - .1 Clearly indicate that the recommended firestop system is an engineering judgment;
  - .2 Identify the job name, project location and firm which the engineering judgment is issued to.



- .3 Be prepared, stamped and signed by a professional engineer, specializing in fire protection and licensed to practice in the place of the work.
- .4 Be presented in appropriately descriptive written form with or without detail drawings where appropriate;
- .5 Reference tested system(s) which the engineering judgment is based on;
- .6 Include clear directions for the installation of the recommended firestop system;
- .7 Include dates of issue and authorization signature as well as the issuer's name, address and telephone number;
- .5 Samples:
  - .1 Submit samples of each type of firestop and smoke seal material and accessory.

#### 1.6 SUBMITTALS FOR INFORMATION

- .1 Qualifications Data: For manufacturer and installer.
- .2 Installation Data: Manufacturer's special preparation and installation requirements.
- .3 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- .4 Delegated Design Submittals: Design firestopping assemblies required by the Contract Documents to withstand fire ratings indicated and in accordance with the Ontario Building Code.
  - .1 Provide manufacturer's standard listings where site conditions match standard assembly listing.
  - .2 Provide manufacturers engineered judgement with acceptance by authorities having jurisdiction, signed and sealed by the manufacturer's fire protection engineer where assembly does not match standard assembly listing.
- .5 Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:
  - .1 Materials have been tested for bond with substrates.
  - .2 Materials have been verified by manufacturer to be compatible with substrate.
  - .3 Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

#### 1.7 QUALITY ASSURANCE

- .1 Materials and Systems: Asbestos free closures to fire, gas and smoke at openings around penetrations, and at openings and joints within fire separations and assemblies having a fire-resistance rating, including openings and spaces at perimeter edge conditions.
  - .1 Draft tight barriers to retard passage of flame and smoke, and firefighter's hose stream and passage of liquids around outside of mechanical and electrical assemblies where they penetrate fire separations.
  - .2 Maintain fire resistance rating of adjacent floor, wall or other fire separation assembly acceptable to authorities having jurisdiction.
  - .3 Conform to both the temperature and flame ratings of CAN/ULC-S115 and, where applicable, to ASTM E814, and other requirements of authorities having jurisdiction.
  - .4 Comply with ULC XHEZC GuideInfo – Firestop Systems.
- .2 Applicator shall be licensed by the manufacturer of fireproofing materials.

- .1 Accredited Canadian members of the Firestop Contractors International Association (FCIA).
  - .1 Certified installer listed under the ULC's Qualified Firestop Contractor Program.
  - .3 Submit manufacturer's certification that materials meet or exceed specified requirements.
  - .4 Maintain flame and temperature ratings equal to surrounding materials.
  - .5 Single Responsibility: Perform work using single applicator having undivided responsibility for entire Project, including coordination with plumbing, mechanical and electrical installations.
  - .6 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.
  - .7 Regulatory Requirements: Be responsible for securing approval from authority having jurisdiction where project conditions require modification to tested and listed systems.
  - .1 Submit authority having jurisdiction approval for modified systems.
- 1.8 DELIVERY, STORAGE, HANDLING AND PROTECTION**
- .1 Deliver materials in original, unopened packages bearing name of manufacturer and product identification.
  - .2 Store materials off ground, under cover, and away from damp surfaces.
- 1.9 SITE CONDITIONS**
- .1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
  - .2 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.
- 2 Products**
- 2.1 FIRESTOP MANUFACTURERS**
- .1 Subject to compliance with requirements provide products of one of the following manufacturers:
    - .1 3M Fire Protection Products.
    - .2 Hilti Canada Ltd.
    - .3 Specified Technologies Inc.
    - .4 Tremco Inc.
    - .5 Emseal Joint Systems Ltd.
- 2.2 FIRESTOP SYSTEMS**
- .1 Provide firestop systems to follow ULC XHEZC GuideInfo – Firestop Systems:
    - .1 Head of Wall Joint Firestop Systems: XHEZC.HW
    - .2 Joint Firestop Systems: XHEZC.JF
    - .3 Perimeter Joint Firestop Systems: XHEZC.PJ
    - .4 Service Penetration Firestop Systems: XHEZC.SP
    - .5 Service Penetration for Combustible Systems: XHEZC.SPC
- 2.3 FIRESTOP MATERIALS**
- .1 Cementitious Matrixes: Minimum 2758 kPa (400 psi) compressive strength when cured, to retard cable tray warping within the firestop seal.



- .2 Elastomeric Assemblies: Flexible, elastomeric seal suitable to withstand the required movement and capable of returning to original configuration without damage to seal and without adhesive or cohesive failure.
- .3 Primers: Manufacturer's standard for specific material, substrate, and end use.
- .4 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.
- .5 Damming and Backup Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .6 Pipe and Duct Insulation and Wrappings: Compatible with firestopping systems.
- .7 Intumescent Pads: Permanently pliable type.
- .8 Intumescent Composite Sheet: Composite sheet, strip or precut shapes.
- .9 Sealants and Putty For Vertical and Overhead Joints: Non sagging.
- .10 Sealants and Fluid Seals at Floors: Self levelling.
- .11 Identification Labels: Minimum 75 mm x 100 mm (3" x 4") permanent self-adhering or mechanically retained corrosion resistant metal labels, with black text on yellow background.
- .12 Indicate ULC or cUL firestopping system number, rating, products used, and contact information of installers.

## 2.4 ACCESSORIES

- .1 Provide components for each firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components recommended by firestopping manufacturer in accordance with tested assembly being installed, and acceptable to authorities having jurisdiction.
- .2 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- .3 Dam Material: Permanent:
  - .1 Mineral wool board: Minimum 64 kg/m<sup>3</sup> density, non-combustible, flame spread of 0, smoke development of 0 to ULC S102.
  - .2 Mineral wool batt: Minimum 32 kg/m<sup>3</sup> density, non-combustible, flame spread of 0, smoke development of 0 to ULC S102.
  - .3 Alumina silicate fire board.
  - .4 Sealants used in combination with other forming, damming and backing materials to prevent leakage of fill materials in liquid state.
  - .5 Fillers for sealants.
- .4 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- .5 Water: Potable, clean and free from injurious amounts of deleterious substances.

## 2.5 FINISHES

- .1 Colour: Red unless otherwise noted.

## 3 Execution

### 3.1 EXAMINATION

- .1 Verify existing conditions before starting work.

- .2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.
- .3 Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- .1 Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- .2 Remove incompatible materials which may affect bond.
- .3 Install backing and damming materials to arrest liquid material leakage.
- .4 Mask adjacent surfaces to protect from spillage and over coating; immediately remove material from adjacent surfaces.

### **3.3 APPLICATION**

- .1 Apply primer and materials to manufacturer's written instructions, approved tested assemblies and details.
  - .1 Provide materials to maintain the fire separations in the project as indicated on the drawings.
- .2 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- .3 Apply firestopping material in sufficient thickness to achieve rating and to uniform density and texture.
- .4 Tool or trowel exposed surfaces to a uniform finish.
- .5 Compress fibred material to achieve a density of 25-40 percent of its uncompressed density required for listed system.
- .6 Place material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- .7 Place intumescent coating in sufficient coats to achieve rating required.
- .8 Remove dam material after firestopping material has cured. Dam material to remain.
- .9 Provide identification labels as specified.
- .10 In non-fire rated construction indicated to prevent smoke movement, tightly pack voids of service penetrations and around openings with mineral wool insulation and sealant.

### **3.4 IDENTIFICATION**

- .1 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - .1 The words: "Warning: Through-Penetration Firestop System - Do Not Disturb"
  - .2 Contractor's name, address and telephone number.
  - .3 Designation of applicable testing and inspection agency.
  - .4 Date of installation.
  - .5 Manufacturer's name for firestop materials.

### **3.5 MANUFACTURER'S SITE SERVICES**



- .1 Require site attendance of firestopping product manufacturer during installation of the Work. Schedule manufacturer's review of work procedures at stages listed:
  - .1 Pre-installation Meeting: 1 review at Site and meeting with authorized Installers.
  - .2 Installation: 3 reviews at Site: 1 at commencement of Work; 1 at 50% completion of Work; 1 upon completion of Work.
- .2 Submit manufacturer's written reports to Consultant describing:
  - .1 The scope of work requested.
  - .2 Date, time and location.
  - .3 Procedures performed.
  - .4 Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions.
  - .5 Limitations or disclaimers regarding the procedures performed.
  - .6 Obtain reports within three days of review and submit immediately to Consultant.
- .3 Monitor and report installation procedures and unacceptable conditions.
  - .1 Inspect and review materials and workmanship including storage, handling and protection. Advise Consultant and Owner 48 hours in advance of inspections.
  - .2 Correct identified defects or irregularities.
- .4 Remove and replace unacceptable firestopping assemblies.

### 3.6 SITE QUALITY CONTROL

- .1 Owner will engage an independent testing agency to perform the following special inspections and tests, and prepare reports in accordance with ASTM E2174 and ASTM E2393:
  - .1 Correct size of joint.
  - .2 Placement and anchorage of mechanical supports.
  - .3 Thickness of coatings.
  - .4 Correct use and location of backings and bond breaker materials.
  - .5 Adherence testing to verify material bond with substrate.
- .2 Testing and inspecting of completed joints and seals shall take place in successive stages, and at a rate not less than one test per day for each Installer and material type. Where deficiencies are found or firestopping is damaged or removed because of testing, repair or replace firestopping to conform to requirements.
- .3 Do not proceed with installations for the next area until test results for previously completed installations show conformance to requirements.
- .4 Products and materials will be considered defective if they do not pass tests and inspections.
- .5 Proceed with enclosing firestopping with other construction only after inspection reports are issued and installations conform to requirements.
- .6 Submit testing agency's written reports to Consultant.

### 3.7 CLEANING

- .1 Clean installed work.
- .2 Clean adjacent surfaces of firestopping materials.

### 3.8 PROTECTION OF FINISHED WORK

- .1 Protect installed work.
- .2 Protect adjacent surfaces from damage by material installation.

**END OF SECTION**



**1 General**

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 RELATED REQUIREMENTS**

- .1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

**1.3 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.
  - .2 Structural Sealant Joint Design: Provide calculations for structural bite, dead load support, glue line thickness, shear, and other parameters. Include confirmation that design data provided by Consultant have been reviewed and approved by sealant manufacturer.
  - .3 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.
- .2 Submittals for Information:
  - .1 Qualifications Data: For Manufacturer and Installer.
  - .2 Installation Data: Manufacturer's special installation requirements.
    - .1 Indicate special procedures, surface preparation, perimeter conditions requiring special attention, and field quality control testing.
  - .3 Field reports.
    - .1 Site quality control report identifying procedures for site testing and verification.
    - .2 Manufacture site service report identifying materials have been installed in accordance with manufactures recommendations.

**1.4 QUALITY ASSURANCE**

- .1 Applicator qualifications:
  - .1 Execute Work by applicators trained and approved by the manufacturer and having 5 years proven experience.
- .2 Independent inspection and testing agency:
  - .1 Qualification: In accordance with ASTM C1021.
  - .2 Conduct field inspection and testing of sealant with the manufacturer's representative for a minimum of 5% of joints, including mixing of materials, joint preparation, priming, joint profile and thickness, application, adhesion, cohesion, and tooling.
  - .3 Prepare and submit inspection and test report results after each inspection. Include confirmation by the manufacturer that installation has been satisfactorily completed.
- .3 Manufacturer's representative:
  - .1 Review Site conditions, joint design, and installer's qualifications. Report unsatisfactory conditions to Consultant.

- .2 Check container labels, inspect preparation of substrate materials and review installation procedures 48 hours in advance of installation, and randomly test installed Work.
- .4 Pre-installation meetings:
  - .1 Conduct meetings 7 Days in advance of sealant installation.
  - .2 Include Consultant, sealant manufacturer's representative, independent inspection and testing agency engaged by Contractor, and parties who are directly affected by the Work of this Section.
  - .3 Verify Contract requirements, substrate conditions, joint conditions and profile, weather conditions, and the manufacturer's installation instructions.
  - .4 Within 72 hours following the pre-installation meeting, prepare a pre-installation meeting report and issue to all parties in attendance.
    - .1 Clearly indicate the recommendations made during the pre-installation meeting, the required actions, and by whom.

## 1.5 SITE CONDITIONS

- .1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

## 1.6 DELIVERY, STORAGE HANDLING AND PROTECTION

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.
- .3 Maintain containers and labels in undamaged condition.

## 1.7 WARRANTY

- .1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.
  - .1 Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.
- .2 Provide manufacturer's twenty-year material warranty for installed silicone sealant.

## 2 Products

### 2.1 MATERIALS – SEALANTS

- .1 Type A:
  - .1 Single component, non-sag, non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.
  - .2 Colour:
    - .1 To match adjacent substrate.
  - .3 Manufacturer's Products:
    - .1 DOWSIL™ Contractors Weatherproofing Sealant (CWS) by Dow.
    - .2 Tremsil 400 by Tremco Sealants.
    - .3 Sikasil-N plus by Sika Canada Inc.
    - .4 SWS by GE Silicones.
    - .5 Pecora PCS by Pecora Corporation.



- .2 Type B:
  - .1 Silicone joint sealant, in accordance with ASTM D5893/D5893M and non-staining when tested in accordance with ASTM C510 or ASTM C1248.
  - .2 Colour:
    - .1 To match adjacent substrate.
  - .3 Manufacturer's Products:
    - .1 Contractors Concrete Sealant (CCS) by Dow.
    - .2 Spectrem 900 SL by Tremco Sealants.
    - .3 Sikasil 728 SL by Sika Canada Inc.
    - .4 300SL by Pecora Corporation.
- .3 Type C:
  - .1 Anti-microbial (mildew-resistant), non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.
  - .2 Colour:
    - .1 White.
  - .3 Manufacturer's Products:
    - .1 DOWSIL 786 by Dow.
    - .2 Tremsil 200 by Tremco Sealants.
    - .3 Sikasil-GP/GP HT by Sika Canada Inc.
    - .4 SCS1700 Sanitary by GE Silicones.
    - .5 Pecora 898NST by Pecora Corporation.

## 2.2 ACCESSORIES

- .1 Primers:
  - .1 Type recommended by sealant manufacturer for substrate, to promote adhesion and to prevent staining of adjacent surfaces for conditions encountered.
- .2 Joint backing:
  - .1 Extruded, round, solid section, skinned surface, closed cell, soft polyethylene foam gasket stock, compatible with primer and sealant materials.
  - .2 30% to 50% oversized.
  - .3 Shore A hardness of 20, tensile strength 140 kPa to 200 kPa, in accordance with ASTM C1330.
  - .4 Bond breaker type surface.
- .3 Bond breaker tape:
  - .1 Polyethylene tape or other plastic tape recommended by sealant manufacturer to prevent sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.
  - .2 Provide self-adhesive, pressure sensitive tape where applicable.

- .3 Do not use material impregnated with oil, bitumen, non-curing polymer or similar deleterious material.
- .4 Cleaning agents:
  - .1 Recommended by sealant manufacturer.
  - .2 Free of oily residues or other substances capable of staining or harming joint substrates and adjacent surfaces.
- .5 Masking tape:
  - .1 Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

### 3 Execution

#### 3.1 INSPECTION

- .1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.
- .2 Ensure masonry and concrete have cured 28 days minimum.
- .3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.
- .4 Verify that specified recommended environmental conditions are present before commencing work.
- .5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.
- .6 Do not start work of this Section until conditions are satisfactory.

#### 3.2 PREPARATION

- .1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.
- .2 Remove dust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.
- .3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.
- .4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.
- .5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.
- .6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.
- .7 Prepare surfaces as recommended by sealant manufacturer.
- .8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.
  - .1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.
- .9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.



- .10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.
- .11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.
- .12 Before any sealing is commenced, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.
- .13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.
- .14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

### 3.3 INSTALLATION

- .1 Perform Work in accordance with manufacturer's recommendations for Products and applications indicated, unless more stringent requirements apply.
- .2 Use Products without additives or adulteration. Use one manufacturer's Product for each location in accordance with Sealant Location Schedule at end of this section.
- .3 Perform Work in accordance with ASTM C1193, and ASTM C919 for Acoustic Sealant.
- .4 Joint backing:
  - .1 Install joint backing to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    - .1 Depth of recess: Maintain 2:1 joint width to depth ratio.
    - .2 Where recess is less than specified depth, cut back surface of recess to specified depth.
  - .2 Do not leave gaps between ends of joint backings.
  - .3 Do not stretch, twist, puncture, or tear joint backings.
  - .4 Remove absorbent joint backings that have become wet before sealant application and replace with dry materials.
  - .5 Support joint backing on horizontal surfaces against vertical movement which might result from pedestrian or vehicular traffic loads.
- .5 Install bond breaker tape between sealant and back of joints where joint backing is not used.
- .6 Apply sealant immediately after adjoining Work is in condition to receive sealant Work and as follows:
  - .1 Apply sealant in a continuous bead using gun with correctly sized nozzle. Use sufficient pressure to completely fill joint recess.
  - .2 Ensure sealant has full, direct uniform contact with, and adhesion to, side surfaces of recess. Superficial pointing with skin bead is not acceptable.
- .7 Tooling:
  - .1 Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified to form smooth, uniform sealant bead, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains, or other defects.

- .2 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.
- .3 At recesses in flush surfaces, finish sealant with concave face and flush with face of material at each side.
- .8 Immediately remove excess sealant and droppings.
- .9 Ensure sealant bead is uniform in colour.
- .10 Cure in accordance with the sealant manufacturer's recommendations. Do not cover up sealants until proper curing has taken place.
- .11 Remove defective sealant and reapply.

### 3.4 SITE QUALITY CONTROL

- .1 Joint Sealants: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1193, Method A – Field-Applied Sealant Joint Hand Pull Tab.
  - .1 Perform test no later than 21 days after installation at a rate of one test every 300 m of installed sealant.
- .2 Structural Sealant: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1401, Method B – Hand-Pull Tab (Non-destructive).
  - .1 Perform five tests for first 300 meters of applied silicone sealant and one test for each 300 meters seal thereafter or perform one test per floor per building elevation minimum.
  - .2 For sealant applied between dissimilar materials, test both sides of joint.
- .3 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.
- .4 Maintain test log and submit report to Consultant indicating tests, locations, dates, results, and remedial actions.
- .5 Maintain record of conditions and temperatures during application.

### 3.5 MANUFACTURER'S SITE SERVICES

- .1 Require site attendance of each sealant manufacturers, during installation of the Work. Start sealant application in presence of manufacturer's technical representative.
- .2 Monitor and report installation procedures and unacceptable conditions.

### 3.6 CLEANING

- .1 Clean surfaces adjacent to joints. Immediately remove sealant smears or other soiling resulting from application of sealants.
- .2 Remove masking tape and other residue.
- .3 Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

### 3.7 PROTECTION

- .1 Protect joint sealants:
  - .1 During and after curing period from contact with contaminating substrates.
  - .2 From damages by construction operations or other causes.
- .2 If damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated sealants immediately.

### 3.8 SEALANT LOCATIONS SCHEDULE



Type A	Above grade level, vertical applications
	<ul style="list-style-type: none"><li>- General perimeter caulking (window, doors and frames, louver frames, shelf angles, thresholds, bedding of mullions, precast and tilt-up panels).</li><li>- Vertical expansion, control, lap joints application.</li><li>- Painted metals.</li><li>- Mullion joints.</li><li>- Interior partition head to structure above.</li><li>- Interior metal frames joints.</li><li>- Exterior metal flashing.</li><li>- Locations not indicated on Contract Drawings and required sealant for Work.</li></ul>
Type B	Above grade level, horizontal applications
	<ul style="list-style-type: none"><li>- Horizontal expansion joints.</li><li>- Saw cut horizontal joints.</li><li>- Precast slab horizontal joints.</li><li>- Horizontal expansion and control joints in parking garages, plazas, terraces, decks, floors, and sidewalks.</li></ul>
Type C	Above grade level, horizontal and vertical applications
	<ul style="list-style-type: none"><li>- Around sinks, urinals, and bathroom fixtures.</li><li>- Tiled areas' horizontal and vertical control and expansion joints.</li><li>- Between vanity and mechanical fixtures/fittings.</li><li>- Between access panels and tiles.</li><li>- At corners of tiled walls.</li></ul>

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for supply and installation of expansion control systems including; but not limited to, the following:
  - .1 Exterior expansion joint cover system.

**1.3 DESIGN CRITERIA**

- .1 Joint movement capability: Provide expansion control systems with movement capability as specified Structural Consultant's specifications or as indicated, but not less than plus or minus 50 percent of joint width, without detrimental effects to assembly and adjacent construction.
- .2 Design expansion joints to withstanding loads and of accommodating movement, and the other functions for which they are designed including those specified below, without failure.
  - .1 Vertical Exterior Joints: Maintain continuity of weather enclosure.
  - .2 Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.

**1.4 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.
  - .2 Shop Drawings: Indicate joint and splice locations, mitres, layout of the work, line diagrams showing entire route of each expansion control system, affected adjacent construction, anchorage locations, and include a product schedule prepared by or under the supervision of the supplier. Include the following information in tabular form:
    - .1 Manufacturer and model number for each expansion control system.
    - .2 Expansion control system location cross-referenced to Drawings.
    - .3 Nominal joint width.
    - .4 Movement capability.
    - .5 Materials, colours, and finishes.
    - .6 Product options.
  - .3 Samples for Verification: Full size units 150mm (6") long of each type of joint system indicated; in sets for each finish, colour, texture, and pattern specified, showing the full range of variations expected in these characteristics.
- .2 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Certificates: Submit certificate signed by manufacturer indicating that Products supplied for work of this Section are appropriate for expected range of performance including engineered judgements for fire rated products not tested to meet ULC requirements.



- .2 Source Quality Control Submittals: Submit testing data from a qualified testing agency indicating that expansion control systems meet range of movement and exposure requirements for Project, based on comprehensive testing of current products.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate compatibility of products supplied by this Section with adjoining joint systems specified in other Sections.
- .2 Pre-Construction Meeting: Conduct a meeting before starting any concrete or waterproofing work with attendance by Contractor, Subcontractor for work of this Section, Subcontractor's for work affected by this Section to discuss the following:
  - .1 Expansion joint placement and alignment, and installation of block outs
  - .2 Establishing minimum nominal joint width to suit ambient conditions at time of installation of expansion joint materials
  - .3 Protection of expansion joints during construction and after installation of expansion joint materials
  - .4 Include follow-up agenda item for subsequent progress meetings to identify ongoing coordination and responsibilities relating to installation of expansion joints.
- .3 Source Limitation: Obtain expansion joint cover assemblies from one source from a single manufacturer.

## 1.6 WARRANTY

- .1 Provide five year warranty by each manufacturer of expansion joint assemblies covering defects in products and failure to meet specified requirements.
- .2 Warranty: Coverage for separation of seals, distortion, and visible defects in finishes.

## 2 Products

### 2.1 ACCEPTABLE PRODUCTS

- .1 Specified Products: The design for the work of this Section is based on the products specified. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

### 2.2 MATERIALS

- .1 Structural Steel Shapes: ASTM A36.
- .2 Steel Plates: ASTM A283 Grade C.
- .3 Rolled Steel Floor Plates: ASTM A786.
- .4 Aluminium: ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 6061-T6, sheet and plate.
  - .1 Aluminium Surfaces In Contact With Cementitious Materials: Finish with heavy metal free high solids primer or chromate conversion coating.
  - .2 Exposed to View Aluminium Surfaces: Mill finish.
- .5 Stainless Steel: ASTM A167, Type 304 with 2B finish, unless otherwise indicate, for plates, sheets and strips.

- .6 Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible vapour seals and filler materials, drain tubes, adhesive and other accessories compatible with material in contact, as indicated or required for complete installations.

## 2.3 FABRICATION

- .1 Fabricate work in design, basic profile, materials, and operation indicated. Select units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and structural movement.
- .2 Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitred corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee joints, corner, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

## 2.4 ROOF COVERS

- .1 Metal Roof Covers: Continuous extruded aluminium base frame sections fastened to roof curb at 600 mm (24") o.c. with aluminium cover formed from min. 0.078" thick aluminium sheet. Seal frame with continuous extruded PVC gasket and continuous neoprene waterstop. Equip frames with adjustable angle flange folded on site to cover adjacent edge of roof membrane. Factory fabricate transitions and end caps to ensure maximum weather tightness. Seal butt joints with aluminium splice cover bedded on sealant and fasten splice cover on one side only.
  - .1 Roof-to-Roof (EJ-1): Capable of accommodating 50% movement, SRJ Series by Construction Specialties, Inc.

## 2.5 EXTERIOR WALL JOINT COVERS

- .1 Wall Assemblies: Continuous extruded aluminium frame assemblies of a suitable profile to receive free floating cover plate. Equip with polyethylene vapour barrier.
  - .1 Wall-to-Wall (EJ-2): Capable of accommodating 50% movement, ASM-X Series by Construction Specialties, Inc.
  - .2 Wall-to-Corner (EJ-3): Capable of accommodating 50% movement, ASMC-X Series by Construction Specialties, Inc.

## 2.6 INTERIOR WALL JOINT COVERS

- .1 Floor Assemblies: Capable of accommodating movements of plus 50%, minus 50%, continuous extruded aluminium frame assemblies of a suitable profile to receive smooth free floating bottom centre plate and replaceable top preformed extruded seal with rigid edges for positive attachment to frame.
  - .1 Floor-to-Wall (EJ-4): PCW-2G Series by Construction Specialties, Inc.

## 2.7 FIRE BARRIER SYSTEMS

- .1 Maximum lengths to minimize field splicing, prefabricated flame and insulation barrier and to accommodate the specified dynamic movement, labelled and tested in accordance with ULC S101 for fire resistance rating required, Monoflex by Construction Specialties, Inc.

## 2.8 METAL FINISHES

- .1 Factory apply finishes after products are fabricated. Protect finishes on exposed surfaces with protective covering before shipment.
- .2 Aluminium Finishes
  - .1 Clear Anodize Finish – AA-C204R1; medium matte etched finish with 0.4 mil minimum thick anodic coating.



- .3 Concealed Surfaces: Protect concealed metal surfaces that will be in contact with concrete and masonry surfaces when installed by applying a shop coat of manufacturer's standard primer to contact surfaces. Provide minimum dry film thickness of 2.0 mils.

### 3 Execution

#### 3.1 PREPARATION

- .1 Prepare substrates according to expansion control system manufacturers written instructions.
- .2 Examine expansion joints for the presence of voids, honeycombing, spalling and to confirm joint dimensions. Report in writing all errors, discrepancies and deficiencies to the Consultant.
- .3 Clean joints, ensuring that they are clean, dry, free of dust, dirt, loose materials, grease, oil and other foreign materials detrimental to installation of expansion joint assemblies.
- .4 Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

#### 3.2 INSTALLATION

- .1 Comply with manufacturer's written instructions for handling and installing expansion control assemblies and materials, unless more stringent requirements are indicated.
- .2 Coordinate installation of expansion control assembly materials and associated work so complete assemblies comply with assembly performance requirements.
- .3 Terminate exposed ends of exterior expansion control assemblies with factory fabricated termination devices to maintain waterproof system.
- .4 Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
  - .1 Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
  - .2 Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
  - .3 Locate covers in continuous contact with adjacent surfaces.
  - .4 Securely attach in place with required accessories.
  - .5 Locate anchors at interval recommended by manufacturer, but not less than 76 mm (3") from each end and not more than 610 mm (24") o/c.
- .5 Maintain continuity of joint systems with a minimum number of end joints and align metal members.
- .6 Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.
- .7 Adhere flexible filler materials, if any, to frames with adhesive or pressure sensitive tape as recommended by manufacturer.
- .8 Vapour Barriers: Install vapour barriers to provide continuous, uninterrupted water resistance throughout length of joint, including transitions and end joints.

#### 3.3 CLEANING AND PROTECTION

- .1 Do not remove protective covering until finish work in adjacent areas is complete; clean exposed metal surfaces to comply with manufacturer's written instructions when protective covering is removed.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for supply and installation of the following:
  - .1 Exterior and interior steel doors and frames.
  - .2 Fire rated door and frame assemblies.

**1.3 DEFINITIONS**

- .1 Base Metal Thickness: Thickness dimensions are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic coated steel sheets.

**1.4 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data:
    - .1 Submit product data for each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, fire resistance ratings, and finishes.
  - .2 Shop Drawings:
    - .1 Show each type of frame, door, hardware blanking, reinforcing, tapping and drilling arrangements, metal gauges, thicknesses and finishes.
    - .2 Show details of doors including vertical and horizontal edge details.
    - .3 Submit door and frame schedule identifying each unit. Each unit shall bear a legible identifying mark corresponding to that listed in the door and frame schedule.
  - .3 Samples:
    - .1 Supply for Consultant's review, if requested, sample of frame corner showing construction, workmanship and finish.
  - .4 Informational Submittals: Provide the following submittals when requested by the Consultant:
    - .1 Source Quality Control Submittals: Submit information on zinc coating treatment and primer spot treatment, including instructions for surface treatment before site painting and any restrictions or special coating requirements.
  - .5 Certificates: Submit the following certificates or letters of compliance:
    - .1 Oversize Compliance: Submit oversize construction evidence indicating compliance with fire labelling for door and frame assemblies required to be fire protection rated and exceeding size limitations of labelled assemblies.

**1.5 QUALITY ASSURANCE**

- .1 Manufacturer: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer, and as follows:

- .1 Fabricate work of this Section to meet the requirements of the Canadian Steel Door Manufacturer's Association (CSDMA), and as further modified in this section.
- .2 Fabricator shall be a member in good standing of the Canadian Steel Door Manufacturer's Association (CSDMA).
- .2 Supplier: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer.
- .3 Installer: Use installers who are experienced with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.
- .4 Testing Agencies: Provide doors produced under label service program of a testing agency acceptable to Authorities Having Jurisdiction, and as follows:
  - .1 Steel Fire Rated Doors and Frames: Labelled and listed by an organization accredited by Standards Council of Canada for ratings specified or indicated.
  - .2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:
    - .1 List by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
    - .2 Fabricate all rated doors, frames and screens to labelling authority standard.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Adequately protect units against rust and damage during manufacture, delivery and storage.
- .3 Store materials on planks in a dry area and cover to protect from damage. Make good immediately any damage done. Clean scratches and touch-up with rust-inhibitive primer.

#### 1.7 SITE CONDITIONS

- .1 Site Measurements: Verify actual dimensions of openings by site measurements before fabrication and indicate measurements on shop drawings; coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Measurements: Establish dimensions and proceed with fabricating doors and frames without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

### 2 Products

#### 2.1 MATERIALS

- .1 Sheet Steel:
  - .1 Exterior Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF180 (A60) zinc-iron-alloy (galvannealed) coating designation.
  - .2 Interior Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF120 (A40) zinc-iron-alloy (galvannealed) coating designation.
- .2 Gauges:



- .1 Exterior Door and Screen Frames: 2.00 mm (14 msg).
- .2 Interior Door and Screen Frames: 1.60 mm (16 msg).
- .3 Doors and Panels (Stiffened Hollow Steel Construction)
  - .1 Face Sheets: 1.60 mm (16 msg).
  - .2 Vertical Stiffeners: 0.912 mm (19 msg).
- .4 Doors and Panels (Honeycomb or Polystyrene Core):
  - .1 Face Sheets: 1.2 mm (0.047").
- .5 Top and Bottom End Channels: 1.30mm (18 msg).
- .6 Reinforcements:
  - .1 Lock and Strike Reinforcements: 1.60mm (16 msg).
  - .2 Hinge Reinforcements: 3.51mm (10 msg).
  - .3 Flush Bolt Reinforcements: 1.60mm (16 msg)
  - .4 Door Closer or Holder Reinforcements: 2.74mm (12 msg)
- .3 Anchors: As required to suit condition.
- .4 Rubber Bumpers: 3 per door
- .5 Weatherstrip: To requirement in Division 8 hardware sections.
- .6 Door Cores:
  - .1 Honeycomb Core: Structural small cell; 25 mm (1") maximum, kraft paper honeycomb; minimum weight 36 kg/ream; minimum density 16.5 kg/m<sup>3</sup>; sanded to required thickness.
  - .2 Insulation Core: Semi rigid, CAN/ULC S702, Type 1 mineral wool insulation, meeting CAN/ULC S102 flame spread index and Smoke developed index.
  - .3 Core Adhesives: Heat resistant, single component adhesive recommended by manufacturer.
- .7 Touch-Up Primer: Rust inhibitive primer meeting CAN/CGSB 1.132, touch up zinc coatings using shop applied primer; grey or red coloured primer, clear primer not acceptable; provide additional primer for site touch-up to repair damaged zinc and shop applied coatings.
- .8 Accessories:
  - .1 Sealant: To requirement in Division 7 sealant sections.
  - .2 Door Silencers (Bumpers or Mutes): Manufacturer's standard black or grey neoprene silencers; three silencers on strike jambs of single door frames; two silencers on heads of double-door frames; stick on bumpers are not acceptable.
- .9 Materials for fire rated doors shall conform to ULC or ULI requirements.
- .10 Thermal Break: Rigid polyvinylchloride extrusion.

## 2.2 FABRICATION AND MANUFACTURE

- .1 Gauges of metal shall be as specified. No deviations or substitutions will be accepted
- .2 Reinforcing specified is the minimum acceptable. Provide additional reinforcement where required to ensure a permanent, rigid, trouble free installation able to withstand the stresses of heavy commercial usage.
- .3 Cut, shear, straighten and work the steel in manner to prevent disfigurement of the finished work.

- .4 Punch frames for rubber door bumpers.
- .5 Fill seams, joints and weld depressions with epoxy metal filler, disc sand to a smooth, flat, uniform scratch-free surface, with all arrises sharp and true to line. Drilled and punches holes shall be reamed and have all burrs removed.
- .6 Finished work shall be free of warp, open seams, buckles, weld and grind marks and other surface defects detrimental to the production of a good paint finish.
- .7 Fastenings shall be concealed.
- .8 Welding shall conform to CSA W59.
- .9 Hardware Requirements:
  - .1 Blank, mortise, reinforce, drill and tap doors and frames to receive templated hinges and other hardware as required. Check hardware lists for requirements.
- .10 Frames:
  - .1 Fabricate frames to profiles shown. Frames shall be fabricated to suite the header conditions of masonry work. Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame. Fabricate header frame to suit. Where site welding or splicing is required due to size of unit, the location of field joints shall be shown on the shop drawings and strictly adhered to.
  - .2 Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.
  - .3 Cutouts in doors for mortise lock sets shall be fitted with leaf spring clips and back limit stop to facilitate easy positioning and setting of locksets.
  - .4 Weld floor clip angles to inside of each jamb profile, two holes in each for anchorage to floor. Where required provide adjustable type floor clip angles.
  - .5 Fit frames with channel or angle spreaders, two per frame, to ensure proper frame alignment. Install stiffener plates or spreaders between frame trim where required, to prevent bending of trim and to maintain alignment when setting and during construction.
  - .6 Where frames occur in masonry provide and adjustable T-strap type or wire type anchor for every 610mm (2'-0") of jamb length. Special anchors for frames to be set in concrete shall be as detailed.
  - .7 Construct door frames of labelled fire doors as approved by ULC or ULI. Ratings for frames shall match doors. Locate label on the frame jamb midway between the top hinge and the head of door frame so that it is concealed when the door is closed.
  - .8 Provide continuous weatherstripping at head and jambs of exterior door frames. Properly secure in place with screws and adjust as required.
  - .9 Insulate exterior frames to provide continuous thermal barrier in exterior frames.
  - .10 Fabricate thermally broken frames for exterior doors, separating exterior portion of frame from interior portion with polyvinyl chloride thermal breaks.
    - .1 Reinforce strike and hinge jambs with crimped 100 mm x 1.6 mm thick (4" x 0.060" thick) steel reinforcement spot welded to jamb returns at locations corresponding to hinge heights. Weld reinforcement to inside of jambs. Set reinforcement flush with outside of jambs.
- .11 Doors:
  - .1 Fabricate doors to present one continuous face free from joints, tool markings and abrasions.



- .2 Reinforce, stiffen honeycomb doors with small cell honeycomb core laminated to the inside faces of panels. The core shall completely fill the inside hollow of the door.
- .3 Exterior doors shall be completely filled with polystyrene foam core.
- .4 Reinforce door edges with channel reinforcing. Bevel stiles 3 mm (1/8"). Assemble by tack welding and fill.
- .5 Provide flush top edge on exterior doors.
- .6 Fabricate fire rated door assemblies in accordance with ULC or ULI requirements. Provide labels for all fire rated doors. Locate label on the door midway between the top hinge and the head of the door so that it is concealed when the door is closed.
- .12 Finishing
  - .1 Shop apply zinc rich primer to repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site; include compatible primer for site finishing and correction of surface abrasions to zinc coatings and factory applied primer.
  - .2 Remove weld slag and splatter from exposed surfaces.
  - .3 Fill and sand smooth tool marks, abrasions and surface blemishes to present smooth uniform surfaces.

### 3 Execution

#### 3.1 EXAMINATION

- .1 Examine substrates, door swing arcs, areas of installation and conditions affecting installation for compliance with requirements for manufacturer's installation tolerances and other conditions affecting performance of work of this Section.
- .2 Verify roughing-in for embedded and built-in anchor locations before installing frames.
- .3 Verify door and frame size, door swing and ratings with door opening number before installing frames.
- .4 Installation of hollow metal doors and frames will denote acceptance of site conditions.

#### 3.2 INSTALLATION

- .1 Install steel doors, frames, and accessories in accordance with reviewed shop drawings, ANSI A250.11, CSDMA Installation Guide, manufacturer's data, and as specified in this Section.
- .2 Door Frames:
  - .1 Remove temporary spreaders before installing door frames, leaving exposed surfaces smooth and undamaged.
  - .2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm (1/16") out of plumb measured on face of frame, maximum twist corner to corner of 3 mm (1/8"); align horizontal lines in final assembly.
  - .3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 1220mm (4') and wider in accordance with ANSI A250.1; do not use temporary metal spreaders for bracing of frames.
  - .4 For frames over 1220mm (4') in width, provide vertical support at the centre of head.
- .3 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:

- .1 Squareness: Maximum 0.8mm (1/32") measured across opening between hinge jamb and strike jamb.
- .2 Plumbness: Maximum 0.8mm (1/32") measured from bottom of frame to head level.
- .3 Alignment: Maximum 0.8mm (1/32") measured offset between face of hinge jamb and strike jamb relative to wall construction.
- .4 Twist: Maximum 0.8mm (1/32") measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.
- .4 Doors:
  - .1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.
  - .2 Install hardware in accordance with manufacturers' templates and instructions.
  - .3 Adjust operable parts for correct clearances and function.
  - .4 Install door silencers.
  - .5 Install fire rated doors within clearances specified in NFPA 80-2010.
- .5 Adjusting and Cleaning
  - .1 Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of air-drying primer compatible with factory applied primer, and as follows:
    - .1 Clean exposed surfaces with soap and water to remove foreign matter before site touch-up.
    - .2 Finish exposed site welds to a smooth uniform surface and touch-up with site applied rust inhibitive primer.
    - .3 Site apply touch-up primer on exposed surfaces where zinc coating or factory applied primer has been damaged during installation or handling.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for supply and installation of the following types of electric motor operated overhead coiling doors:

- .1 Insulated Service Doors

**1.3 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
- .2 Product Data: Submit product data for each type and size of overhead coiling door and accessories.
  - .1 Shop Drawings:
    - .1 Submit shop and erection drawings in accordance with General Conditions.
    - .2 Show and describe in detail special door assemblies, including elevations, sections and detail of doors, track, hardware and operating components, and of relationship of door to adjacent construction including dimensions, gauges, thickness, description of materials, finishes, as well as all other pertinent data and information.
  - .2 Samples for Initial Selection: Submit manufacturer's colour charts showing full range of colours available for units with factory applied finishes for initial selection.
  - .3 Certificates: Submit certification for oversize door assemblies having fire ratings that exceed size limitations of labelled assemblies.
  - .4 Maintenance Data and Operating Instructions: Upon completion of installation, supply copies of data all as per General Conditions.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Agencies: Provide laboratory tested products acceptable to the Authority Having Jurisdiction for the following criteria:
  - .1 Electrical: Provide electrical components, devices and accessories, motors, controls and wiring conforming to CSA Standards and CSA labelled.
- .2 Qualifications:
  - .1 Work shall be executed by a firm having minimum five (5) years experience in successful manufacture and installation of work of type and quality shown and specified.
- .3 Job Conditions:
  - .1 Protect during installation any adjacent finished surfaces from contamination and damage due to work under this section.

**1.5 SITE CONDITIONS**

- .1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where overhead coiling doors are required to fit within openings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

- .2 Established Dimensions: Establish dimensions and proceed with fabricating overhead coiling doors without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

## 1.6 WARRANTY

- .1 Warrant work of this section against defects in materials and workmanship in accordance with General Conditions but for three (3) years. Agree to make good promptly any defects which occur within this period.

## 2 Products

### 2.1 MATERIALS

- .1 Basis of Design Materials and Manufacturers:
  - .1 Exterior insulated overhead coiling doors:
    - .1 Thermiser Insulated Rolling Service Door, Model ESD20 by Cookson Company
    - .2 RapidSlat Model 626 Stormtite Insulated Doors by Overhead Door Corporation
    - .3 ThermoTite Model 800C by Wayne-Dalton Corporation

### 2.2 PERFORMANCE REQUIREMENTS

- .1 Operation Cycle Requirements:
  - .1 Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day
  - .2 Provide fire rated overhead coiling door components and operators tested to operate for a minimum of 50,000 cycles and 500 closing trip tests.

### 2.3 COMPONENTS AND FABRICATION

- .1 Curtain:
  - .1 Interlocking, galvanized steel slats of 20 GSG .096mm (2") wide, flat surface interlocking slats and free of sharp breaks or curves.
    - .1 Exterior Door: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane foam type thermal insulation; enclose insulation completely within metal slat faces.
  - .2 Slats shall be of uniform width and easily replaced.
  - .3 Bottom bar shall consist of 2 steel angles minimum 3mm (1/8") thick equal weights, installed one each side of bottom slat and securely fastened to slat.
  - .4 The ends of each interlocking slat shall be fitted with malleable steel end locks to prevent lateral movement and act as wearing surface.
- .2 Guides:
  - .1 Guides shall be of standard rolled or fabricated steel angles and channels minimum 5mm (3/16") thick, to form slot of sufficient depth to retain curtain against reasonable impact. Flare upper ends of guides for curtain entry.
  - .2 Guides shall be securely anchored to jambs, (welding will not be permitted). Bolts used for anchoring shall be provided with fibre washers.
- .3 Counterbalance:



- .1 Curtain shall be coiled on a pipe of size sufficient to carry the door load with deflection not to exceed 1mm (0.03") per ft. of opening width and to evenly balanced by oil tempered helical counter-balancing steel springs of sufficient size to balance the width of curtain, including a minimum 25% overload factor.
- .2 Fit one end of barrel with governor sprocket and other end with large gear for hand chain hoist.
- .3 Springs shall all be anchored to the same tension rod and held in position by easily accessible adjusting mechanism.
- .4 Install ball bearings at rotating support points.
- .4 Escapement Gears:
  - .1 Fabricate escapement gears to disengage operating mechanism, allowing the door to close by fusible link and/or electromechanical release units. Escapement gears to be covered by minimum 24 gauge galvanized steel sheet cover.
- .5 End Brackets:
  - .1 Fabricate from heavy steel plate and bar designed to support ends of coils and various mechanisms in accordance with manufacturer's standards and design.
- .6 Hoods:
  - .1 Fabricate from galvanized steel sheet of not less than 24 gauge commercial galvanized steel and formed to fit contour of end brackets. Reinforce top and bottom edges with returned hem and intermediate supports to prevent sagging.
  - .2 Provide continuous internal hinged flame baffle.
- .7 Operation:
  - .1 Door will be operated by means of motor operation. Optional pneumatic sensing edge to be attached to bottom bar to stop and reverse the door when it contacts an object during the closing cycle.
- .8 Electronic Door Operators:
  - .1 Motorized Operator: 2 HP, 110 Volt Single Phase, with automatic reset current sensing overload protection of size and capacity recommended by manufacturer for specified door; factory pre-wired motor controls, starter, gear reduction unit, solenoid operated brake, clutch, control devices, integral gearing for locking door, and accessories required for proper operation, having the following characteristics:
    - .1 Speed: Sized to open door from any position, at minimum 200 mm and maximum 300 mm per second.
    - .2 Limit Switches: Adjustable switches, interlocked with motor controls set for automatic door stop at fully opened and fully closed positions.
  - .2 Disconnect Device: Hand operated disconnect to automatically engage chain and sprocket operator to release brake for emergency manual operation and disconnect from motor, without affecting timing of limit switch; mounted in and accessible location; with interlock device to automatically prevent motor from operating when emergency operator is engaged.
  - .3 Door Operator Type: Wall mounted, jackshaft, gear head type door operator unit consisting of electric motor, enclosed worm gear running in oil primary drive, and chain and sprocket secondary drive; with auxiliary chain hoist and floor level disconnect.
- .9 Locking:

- .1 Electric-motor operation doors will lock through the operator gearing.
- .10 Finish:
  - .1 Steel and Galvanized Steel Finishes: Manufacturer's standard powder coat finish consisting of primer and topcoat; colour selected from manufacturer's complete colour line.
- .11 Accessories:
  - .1 Weather Seals: Combination bottom weather seal and sensor edge for motor operated doors.
  - .2 Provide all anchors, bolts, washers, shims, expansion shields and other miscellaneous items necessary to complete the work.
  - .3 Vision Windows: 6 mm thick, clear polycarbonate meeting CGSB 12.12; set in manufacturer's standard vinyl, rubber, or neoprene glazing channel secured to curtain slats.

### 3 Execution

#### 3.1 EXAMINATION

- .1 Examine areas of work that affect the work of this section. Report in writing all errors, defects and discrepancies immediately to the Consultant.
- .2 Commencement of work implies acceptance of surfaces and conditions.

#### 3.2 INSTALLATION

- .1 Secure guides to frame as recommended by door manufacturer with maximum spacing of 914mm/ 1m (3'-0") on centers.
- .2 Doors shall fit snugly to all edges of jambs and heads of frames and shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward. All necessary appurtenances relating to the door installation, required on the door frames shall be supplied and installed under this section.

#### 3.3 ADJUSTMENT AND CLEANING

- .1 Adjust work to ensure free-running, tightly closing and properly counterbalanced operation. Ensure that installation is free from warp, twist or other distortion. Lubricate operating hardware only as recommended by the manufacturer.
- .2 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at site only if approved by the Consultant.

### END OF SECTION



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Provision of all labour, materials, equipment and incidental services necessary to supply finish hardware, including the following:
  - .1 Supply and delivery to the project all items of architectural finishing hardware specified herein.
  - .2 Supply and installation of low-energy door operators and hardware.
  - .3 Supply and installation of all electrical hardware items including, but not limited to; low voltage wire (FT6 plenum-rated when not in conduit), maglocks, electric strikes, electric exit devices, current transfer devices, wall switches, jamb switches, keypads, controllers, power supplies.
  - .4 Completion of all low voltage terminations by the hardware supplier.

**1.3 RELATED REQUIREMENTS**

- .1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

**1.4 DEFINITIONS**

- .1 Architectural Hardware Consultant (AHC): person or persons skilled in selecting, coordinating and specifying architectural hardware, and certified by the Door and Hardware Institute.
- .2 Hardware Supplier: company or group of companies whose purpose is the manufacture and supply of architectural finish hardware.
- .3 Hardware Distributor: company whose purpose is the distribution of architectural finish hardware.

**1.5 QUALITY ASSURANCE**

- .1 Products
  - .1 Products specified herein are minimum standard. Approved substitutions are listed. Products proposed as substitutions must be accepted by addenda prior to Bid Closing.
- .2 Hardware for doors in fire separations and exit doors must be certified by a Canadian Certification Organization accredited by Standards Council of Canada. Supply only ULC and/or CSA listed electrical components.
- .3 Hardware Suppliers
  - .1 Hardware Suppliers must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.
  - .2 The Hardware Supplier will provide following services to the Contract:
    - .1 preparation of the hardware schedule issued for tender,
    - .2 review of all shop drawings,

- .3 provision of requested samples,
  - .4 review of hardware substitution submittals, and
  - .5 provision of all inspections and reports as specified herein.
- .4 Hardware Distributors
  - .1 The Distributor must have a minimum of five (5) years documented experience in the supply of Finish Hardware for similar projects.
  - .2 Hardware Distributors must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.
  - .3 The Hardware Distributor will assume responsibility that the Products supplied under this section meet or exceed the minimum requirements of the specifications, the hardware schedule, and all authorities having jurisdiction.
- .5 Installers
  - .1 Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. The Contractor shall provide verification of installer's qualification to the Consultant for approval. Installers to attend all review meetings with the Hardware Supplier and Distributor.
- .6 Pre-installation Meeting
  - .1 Convene a pre-installation meeting for the work specified in this section. Attendees must include, as a minimum, representatives of the following:
    - .1 Contractor (Site Superintendent & Project Manager)
    - .2 Installation Subcontractor (Site Foreman & Project Manager)
    - .3 Hardware Supplier (AHC)
    - .4 Hardware Distributor (AHC and Installer)
    - .5 Related Subcontractors (ie. Electrical, Security Systems)
    - .6 Consultant

#### 1.6 SUBMITTALS

- .1 Updated Finish Hardware Schedule
  - .1 Prepare and submit complete detailed hardware schedules prepared in 216mmx279mm DHI format.
- .2 Product Data
  - .1 Provide product data sheets with the finish hardware schedule showing all items of hardware to be used on the project.
- .3 Templates
  - .1 Provide hardware templates for related fabricating and installation.
- .4 Keying Schedule



- .1 Provide keying schedule for review. Include all special keying notes and stamping instructions. Locks and cylinders are not to be ordered until the key schedule has been approved by the Owner.
- .5 Wiring Diagrams
  - .1 Provide a written description of the functional use of all electrical hardware. Include door and frame elevations showing the location of each item of electrical hardware to be installed, including a diagram showing number and size of all conductors. Include drawings showing all terminal connections. Where electrical hardware is to be supplied and installed provide the Contractor with riser diagrams listing the correct wire runs and back box sizes as well as 115V AC requirements.
- .6 Operations and Maintenance Data
  - .1 Prior to Substantial Performance, provide following, but not limited information for inclusion in Operation And Maintenance Manuals:
    - .1 Maintenance instructions for each hardware item.
    - .2 Catalogue cut sheets and Product Specifications or each product.
    - .3 Parts list for each product.
    - .4 Copy of final "as-built" finish hardware schedule.
    - .5 Copy of final keying schedule.
- .7 Maintenance Materials
  - .1 Provide five (5) of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver each hardware item in its original package complete with all fasteners, keys, templates, and installation instructions required for installation.
- .2 Package hardware separately for each door or unit and state clearly on each package the number and description of the door or unit for which the hardware therein is intended. Group items accordingly.
- .3 Clearly mark each container with the door opening number and the hardware schedule item or heading number.
- .4 Store hardware in a locked room or other secure area, accessible by only the Contractor. Storage area must contain adequate storage provision to hold all hardware off the floor (temporary shelving or wood pallets). Ensure area is kept dry and clean.
- .5 When requested, package items of hardware separately for delivery to other fabricators for their installation.
- .6 Deliver and assist in unloading and sorting of hardware. All hardware must be checked in on site by the Contractor's Site Supervisor.

#### **1.8 COORDINATION WITH OTHER TRADES**

- .1 Supply finish hardware to those who are to install it, complete with templates and other complete installation instructions in sufficient time to avoid delaying the progress of the work.

- .2 Supply complete templates and instructions to all door and frame manufacturers for factory machining of products to receive Hardware.

## **1.9 INSPECTION**

- .1 Hardware Distributor must perform the following inspections:
  - .1 Check all hardware when it has been installed and notify the Consultant of improper installation, defective materials, or products installed that were not specified. Replace defective hardware promptly.
  - .2 Check all door closers after they have been installed to make sure that all adjustments such as back-checking degree have been properly made. Notify the Consultant of any closers which have not been properly adjusted.

## **1.10 MAINTENANCE**

- .1 Maintenance Service
  - .1 Following occupancy of the building by the Owner, arrange with the Owner's maintenance staff for instruction of proper use, servicing, adjusting and lubrication of all finish hardware. Submit to the Consultant a list of attendees and meeting date.

## **1.11 EXTENDED WARRANTIES**

- .1 Provide the following manufacturer's warranties beyond the date of expiration of the Contract warranty:
  - .1 Hinges - Lifetime
  - .2 Mortise locksets - Seven (7) years
  - .3 Electrified Locksets – Two (2) years
  - .4 Exit Devices - Five (5) years
  - .5 Door closers - Ten (10) years

## **2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Subject to conformance to requirements provide hardware manufactured by the following:
  - .1 Dorma Group of Companies.
  - .2 ASSA-ABLOY Group of Companies.
  - .3 Allegion Group of companies.

### **2.2 MATERIALS**

- .1 Fabricate all hardware to template. Provide templates and template hardware together with the instructions necessary for door and frame preparation.
- .2 Supply all hardware with necessary screws, bolts or other fastening devices to anchor hardware in position neatly and properly in accordance with best practices.
- .3 Only products listed in the hardware schedule or the approved alternates noted in the following list are to be used on this project.



- .4 Use one manufacturer's products only for all similar items.
- .5 All exterior doors shall be fitted with complete perimeter weatherstripping and threshold where not provided by door or frame manufacturer.
- .6 No substitutions are allowed for the following products, due to integration with existing hardware:
  - .1 Locksets, Latchsets, and Privacy Sets.
  - .2 Exit Devices.
  - .3 Door Closers.

## 2.3 FASTENINGS

- .1 Supply all required bolts, screws, expansion shields, anchors, and other related accessories for satisfactory attaching or installing of all finish hardware.
- .2 Exposed fasteners shall match finish of, and be of compatible material with hardware.
- .3 Where push/pull hardware is scheduled, door pull must be through-fastened and have fasteners concealed by push plate on opposite side.

## 2.4 HINGES

- .1 Butt Hinges: ANSI/BHMA-A156.1, Grade 1.
  - .1 Supply hinges with non-removable pin (NRP) option on all doors where the hinge barrel is exposed on the secured exterior side of the door.
  - .2 Use two hinges on doors up to 1525mm and an additional hinge for each additional 760mm or fraction thereof.
  - .3 Doors 914mm wide and less: 114mm high hinges; doors greater than 914mm to 1220 mm wide: 127mm high hinges; all standard weight.
  - .4 Supply standard weight and heavy weight concealed bearing hinges on all doors equipped with door closers; stainless steel for all doors as listed in the hardware groups.

## 2.5 LOCKSETS, LATCHSETS, DEADLOCKS

- .1 Grade 1 Cylindrical
  - .1 ANSI/BHMA-A156.2, Grade 1 extra heavy duty residential, commercial, institutional and industrial applications. Latch bolts to be steel with minimum 13mm throw deadlocking on keyed and exterior functions. 19mm throw anti-friction latchbolt on pairs of fire doors. Provide manufacturer's standard wrought box strike for each latch or lock, with curved lip extended to protect frame. Lock case to be steel. Locks to incorporate one piece spring cage and spindle. Precision solid brass 6-pin cylinder with nickel silver keys. All levers to be solid with no plastic inserts. Locks and latchsets tested to exceed 3,000,000 cycles.
  - .2 All Grade 1 and Grade 2 cylindrical lever locksets shall have a free wheeling or clutch mechanism so the lever moves when in the locked position without retracting the latch bolt.

## 2.6 EXIT DEVICES

- .1 Heavy Duty: ANSI/BHMA-A156.3, Grade 1 ULC listed for panic hardware and fire exit hardware. Supply exit devices and fire exit devices featuring coil compression springs on all device mechanism subassemblies and dead latching mechanisms for all active latchbolts. Supply exit devices with smooth mechanism case and "the quiet one" fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no

exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Roller strikes to be standard on all rim and surface vertical rod devices. Doors greater than 914mm wide supply long bar exit devices, doors 2134mm high and greater supply extension rods. 1,000,000 cycle testing independently certified by ETL.

- .2 Device Trim
  - .1 Supply device trim featuring recessed cylinder mounting and coil compression spring design with shear pin protection for all lever designs. Similar lever designs for exits as specified for locksets.
- .3 Exit devices installed on exterior doors must have dead latching bolts to ensure tamper proof security.

## 2.7 DOOR CLOSERS

- .1 Door closers to be Grade 1 ANSI/BMHA A156.4, and have the following features (see separate closer sections below for further information):
  - .1 Fully hydraulic, rack and pinion action with high strength cast iron cylinders and one piece forged steel pistons.
  - .2 Hydraulic fluid of a type requires no seasonal adjustments, and has constant temperature control from 49°C to -35°C.
  - .3 Hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.
  - .4 Separate adjustments for backcheck, general speed and latch speed.
  - .5 Include high efficiency, low friction pinion bearings.
  - .6 Size 1 manual door closers to provide less than 22N opening force on a 914mm door leaf.
  - .7 Closers with painted finishes shall exceed a minimum 100-hour salt spray test, as described in ANSI/BHMA-A156 and ASTM B117.
  - .8 Closers detailed with plated finishes shall include plated covers (or finish plates), arms and visible fasteners.
  - .9 Provided with all mounting plates required to mount on any special door and frame conditions.
- .2 Heavy Duty Mechanical (Multiple Applications)
  - .1 ANSI/BHMA-A156.4, non-sized (1-6) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory with power-adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

## 2.8 DOOR OPERATORS

- .1 Heavy Duty Electric Operator (Push Side Mount)



- .1 ANSI/BHMA-A156.19, Grade 1, non-sized (2-5) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft. With forged steel main arm. Power operator to include:
  - .1 Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.
  - .2 Second Chance Function: program within the on-board computer monitoring resistance during opening cycle. If resistance is present operator pauses for a few seconds, then attempts to open door again. If resistance does not exist door will open normally. However if resistance still exists, door will pause and the unit will time out and door will close.
  - .3 Breakaway Drive System: System within the motor/clutch assembly. If the door is forced closed while in the opening cycle, the clutch slips preventing damage to the operator, door and frame.
  - .4 Soft Start Motor Control: required for controlled start once actuator is depressed to extend the service life of all drives components.
  - .5 Built in Power Supply to deliver 12V and 24V outputs up to a maximum of 1.0 amp.
  - .6 Certified by ULC for use on labeled doors.
  - .7 Independent adjustments for all electrically controlled functions within controller module.
- .2 Actuators
  - .1 Wave sensor activator
    - .1 Wall mount type activator to be hard-wired either 12V DC or 24V DC actuator, 114 mm square stainless steel plate with sensor window locate in the centre of the plate. Engrave with hand wave symbol, and letter "WAVE TO OPEN" in black colour. Units to include heavy grade components for vandal resistant mounting and weather resistant.
  - .3 Low energy door operators will be supplied and installed by factory trained installers. Hardware supplier will coordinate the installation of the door operators and include the cost of labour for this work.

## 2.9 PULLS AND PLATES

- .1 Supply door trim as listed in hardware schedule. Supply pulls with back to back (BTB) or through bolt mounting as required. When push plates are listed with door pulls, install the push plate to conceal the through bolt.
- .2 All kickplates, push plates, and bumper plates must have all sides beveled and corners rounded to ensure no sharp edges. Supply plates with counter sunk screw holes. Supply double-sided tape for adhesive-mount.
- .3 Kick plates will be minimum 0.127mm thick unless listed otherwise; size to be door width less 35mm for single door, and less 25mm for pairs of doors. Heights as scheduled.

## 2.10 DOOR STOPS AND HOLDERS

- .1 Overhead stops and mechanical holders shall be surface mounted unless a conflict exists with door closers or other hardware. Provide door stays with friction action in locations that do not have door closers. Install all overhead stops and holders for 90° stop unless otherwise specified.

## 2.11 DOOR SEALS

- .1 Supply perimeter seals to fully cover all gaps between door, frame, and floor condition to seal against weather, sound, or smoke as required and scheduled.
- .2 Frame gaskets shall be closed cell neoprene. Extruded housing must have a rib to prevent distortion during installation. Aluminum frames will be provided with weather stripping inserts by the frame supplier.
- .3 Door bottoms will be heavy-duty and have an adjustment screw to ensure proper contact with flooring. Supply correct drop insert for carpet where required.

## 2.12 THRESHOLDS

- .1 Supply extruded aluminum thresholds to ensure the sweep or door bottom makes full contact. Supply thermally broken thresholds for all exterior door openings.
- .2 Threshold height shall not exceed 13mm for barrier-free path of travel.

## 2.13 ELECTRONIC HARDWARE

- .1 Power Supplies
  - .1 Power supplies to be Underwriter Laboratories (UL) listed for general-purpose use tested to meet UL1012 specifications. Power supplies to have 12/24V DC field selectable output voltage with output current of 3 amps at 12V DC and 2 amps at 24V DC with supply output voltage filtered and regulated. The power supply to be inherently modular by design for ease of installation and to provide flexibility for future system modifications when necessary.
- .2 Access control will be frame-mounted stand-alone keypad complete with adjustable time delay. Units will have all functions keypad programmable, 12 or 24 volt AC/DC with a code length of 3-6 digits.
- .3 Electronic hardware will be supplied and installed by this section, including all low voltage device wiring.
- .4 Coordinate installation Work of electronic hardware with electrical drawing and specification.

## 2.14 FINISHES

- .1 As indicated on Finish hardware schedule.

## 2.15 KEYING

- .1 General
  - .1 Architectural Hardware Consultant (AHC) will meet with the Owner to obtain and finalize all keying requirements, and will subsequently issue copies of the keying schedule for review.
  - .2 Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner prior to occupancy. The Owner or Owner's Agent will void the operation of the construction keys.
  - .3 Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability.
  - .4 Key Quantity: Furnish keys in the following quantities:
    - .1 Temporary construction keys: 10 each.



- .2 Grand Master keys per grand master group: 6 each.
- .3 Master keys per master group: 6 each.
- .4 Change keys per cylinder or keyed alike group: 4 each.
- .5 5 Extractor tools each.
- .5 Deliver all permanent key blanks and security keys direct to Owner from factory by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.
- .6 Furnish one key control system complete with indexed door numbers, key codes, bittings, building numbers, room numbers, lock function, design, and finish. In addition, include model numbers, handing, design, and functions of exit devices and door closers. Transmit to the Owner by secure carrier, return receipt requested.
- .7 Provide complete cross-index system, place keys on markers and hooks in the cabinet as determined by the final key schedule. Provide one each key cabinet and hinged panel type cabinet for wall mounting as noted in detailed hardware schedule.
- .2 Construction Keying
  - .1 Equip lock cylinders in construction system.
  - .2 The construction key system to be inoperative once the Owner's keys are inserted in the cylinders.
  - .3 Provide 12 construction master keys.
- .3 Permanent Keying
  - .1 Interior locks and cylinders shall be furnished in a key system to match existing facility.
  - .2 Exterior locks and cylinders to be high-security removable core cylinders with level-three side-bit milling to allow integration with existing standard key systems.
  - .3 Permanent cylinders to be factory-keyed, combined in sets or subsets, master keyed or great grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the keyset symbol on all keyblanks for identification. Visual key control marks or codes will not include the actual key cuts.
- 3 Execution
  - 3.1 EXAMINATION
    - .1 Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.
    - .2 Ensure that door frames and finished floor are sufficiently plumb and level to permit proper engagement and operation of hardware.
    - .3 Submit to Consultant in writing a list of deficiencies determined as part of inspection required in FILED QUALITY CONTROL as specified herein, prior to installation of finished hardware.
  - 3.2 INSTALLATION
    - .1 Install hardware to ANSI/DHI-A115.1G.

- .2 Install hardware at mounting heights as specified in the manufacturer's templates or specific references in approved hardware schedule or approved elevation drawings. Where mounting height is not otherwise specified herein, install hardware at the following mounting heights:
  - .1 Locksets: 1015mm.
  - .2 Exit device: 1015mm.
  - .3 Push/Pull: 1065mm.
- .3 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.
- .4 Ensure that all locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. Handing is part of installation procedure.
- .5 Ensure that all exit devices are of the correct hand and adjust device cam for proper outside trim function prior to installation. Handing is part of installation procedure.
- .6 Follow all manufactures installation instructions. Adjustment is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.
- .7 Delayed action door closers are to be adjusted to forty (40) second delay for handicapped accessibility and movement of materials. Time period to be approved by Owner.
- .8 Install head seal prior to installation of parallel arm mounted door closers and push side mounted door stops/holders.
- .9 Counter sink through bolt of door pull under push plate during installation.
- .10 Mount all closers, automatic operators and hold-open devices with through bolts, as indicated in the finish hardware schedule.
- .11 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .12 Remove construction locks when directed by Consultant; install permanent cores and check operation of all locks.
- .13 Other trades installing hardware must follow all manufacturer's instructions including door closer adjustment, handing of locksets as required, and degree of door swing.
- .14 Hardware Distributor will include all labour to terminate secondary low voltage wire runs at all door control devices supplied by this section, including but not limited to; door operators, magnetic locks, push button code entry units (keypads), request to exit switches, electric strikes and any associated electrical equipment. Ensure system is tested and complete for Owner's use. Provide staff training for push button code system (keypads) including all programming function and maintenance.
- .15 Hardware Distributor will instruct the installer as to how various newer or unusual items that are required to be installed for proper performance.

### 3.3 FIELD QUALITY CONTROL

- .1 Hardware distributor to perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.
- .2 Upon completion of hardware installation, arrange with the Owner and Consultant demonstration and training in the proper operation, adjustment, and maintenance of all finish hardware supplied under this Contract.



- .3 Before completion of the Work but after finish hardware installation has been completed, submit a certificate to the Consultant stating that final inspection has been made and that all hardware has been checked for installation and operation by representatives of both the Hardware Supplier and the Hardware Distributor, and that operation and maintenance of all hardware has been fully demonstrated to the satisfaction of the Owner, and verified by Consultant.

### 3.4 ADJUSTING AND CLEANING

- .1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.
- .2 All hardware to be left clean and free of disfigurements.
- .3 Check all locked doors against approved keying schedule.

### 3.5 PROTECTION

- .1 Protect hardware from damage during construction period by removing and reinstalling or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturer's warranty.

### 3.6 HARDWARE SCHEDULE

- .1 Hardware group 1
  - .1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630
  - .2 1 Push Plate, 8200 x 4 x 16 x 630
  - .3 1 Pull Handle, 8302 x 8 x 4 x 16 x 630
  - .4 1 Door Operator, 9531 MS x aluminium clear anodized
  - .5 1 Rocker Switch, 8310-806R x 689
  - .6 2 Actuators, 8310-810D x 630
  - .7 1 Kickplate, 8400 x 205 x less door width x 630
- .2 Hardware group 2
  - .1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630
  - .2 1 Cylindrical Lockset, ND80PD x interchangeable less core x SPA x 626
  - .3 1 Door Closer, 4040XP Reg x 689
  - .4 1 Overhead Stop, 100S x 630
  - .5 1 Kickplate, 8400 x 205 x less door width x 630
- .3 Hardware group 3
  - .1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630
  - .2 1 Passage Set, ND10S x SPA x 626
  - .3 1 Door Closer, 4040XP Reg x 689
  - .4 1 Overhead Stop, 100S x 630
  - .5 1 Kickplate, 8400 x 205 x less door width x 630

- .4 Hardware group 4
  - .1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x 630
  - .2 1 Push Plate, 8200 x 4 x 16 x 630
  - .3 1 Pull Handle, 8302 x 8 x 4 x 16 x 630
  - .4 1 Door Closer, 4040XP Reg x 689
  - .5 1 Overhead Stop, 100S x 630
  - .6 1 Kickplate, 8400 x 205 x less door width x 630
- .5 Hardware group 5
  - .1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x NRP x 630
  - .2 1 Exit Device, 9875 x EL x 990TP x 630
  - .3 1 Power Supply, PS902
  - .4 1 Door Operator, 9531 MS x aluminium clear anodized
  - .5 1 Rocker Switch, 8310-806R x 689
  - .6 2 Actuators, 8310-810D x 630
  - .7 1 Weatherstripping, W-13 x aluminium clear anodized x 1 opening width x 2 opening height
  - .8 1 Door Sweep, W-13S x aluminium clear anodized x 1 opening width
  - .9 1 Threshold, CT-66 x aluminium clear anodized x 1 opening width
  - .10 1 Kickplate, 8400 x 205 x less door width x 630
- .6 Hardware group 6
  - .1 3 Butt Hinges, 5BB1 x 4.5 x 4.5 x NRP x 630
  - .2 1 Cylindrical Lockset, ND80PD x interchangeable less core x SPA x 626
  - .3 1 Door Closer, 4040XP SCUSH x 689
  - .4 1 Overhead Stop, 100S x 630
  - .5 1 Weatherstripping, W-13 x aluminium clear anodized x 1 opening width x 2 opening height
  - .6 1 Door Sweep, W-13S x aluminium clear anodized x 1 opening width
  - .7 1 Threshold, CT-66 x aluminium clear anodized x 1 opening width
  - .8 1 Kickplate, 8400 x 205 x less door width x 630

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirement for supply and installation of components required for a complete wall and ceiling assembly with proprietary components as follows:
  - .1 Non-Loadbearing Steel Framing.
  - .2 Gypsum board panels.

**1.3 DESIGN CRITERIA**

- .1 Deflection Criteria: Limit metal framing systems deflection under load to the following:
  - .1 Deflection, Support Framing Gypsum Board Partitions: Deflection of support framing for gypsum board partition systems shall be limited to L/240 of the span in height, except as otherwise shown or specified.
    - .1 In areas where room side finish is veneer plaster or ceramic tile, deflection of partitions shall be limited to L/360 of the span in height.
  - .2 Deflection, Support Framing Gypsum Board Ceilings: Gypsum board interior suspended ceilings, and partitions supporting tile, shall be designed for deflection not to exceed L/360 of the distance between supports
- .2 Design Modifications: Make design modifications only as may be necessary to meet performance requirements and coordinate the Work. Variations in details and materials which do not adversely affect appearance, durability or strength shall be submitted to the Consultant for review.

**1.4 QUALITY ASSURANCE**

- .1 Contractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- .2 Perform Work in accordance with ASTM C840, GA-214, GA-216 and GA-600.
- .3 Handling Gypsum Board: Comply with GA-801.

**1.5 SUBMITTALS**

- .1 Shop Drawings: Submit shop drawings showing the design, construction and relevant details of furring, enclosures and partitions which require a fire rating.
- .2 Product Data: Submit manufacturer's current technical literature for each component.
- .3 Samples: Supply for Consultant's review, if requested, samples of the following:
  - .1 Board: Submit sample of each panel product specified, 150mm (6") square.
  - .2 Trim: Submit sample of each type of trim specified, 305mm (12") long.
  - .3 Texture: Submit sample, 305mm (12") square, of textured coated gypsum board.
- .4 Quality Assurance Submittals:
  - .1 Design Data, Test Reports: Provide manufacturer's test reports indicating product compliance with indicated requirements.

- .2 Manufacturer's Instructions: Provide manufacturer's written installation instructions.

## 1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, enclosed, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact, in accordance with GA-238 and manufacturer's recommendations.
- .4 Protect bagged products from excessive moisture or wetting. Store metal component sections in crates to prevent damage to material. Do not use bent or deformed material.

## 1.7 PROJECT CONDITIONS

- .1 Establish and maintain environmental conditions for application and finishing gypsum wallboard to comply with ASTM C 840 and in accordance with manufacturer's written instructions.
- .2 In cold weather (outdoor temperatures less than 13 °C), controlled heat in the range of 13 °C to 21 °C must be provided. This heat must be maintained both day and night, 24 hours before, during, and after entire gypsum board joint finishing and until the permanent heating system is in operation or the building is occupied. Minimum temperature of 10 °C shall be maintained during gypsum board application.
- .3 Ventilate building spaces to remove excess moisture and humidity during the drying process. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

## 2 Products

### 2.1 MATERIALS - WALLBOARD

- .1 Gypsum Ceiling Board:
  - .1 Sag Resistant Gypsum Board: Meeting requirements of ASTM C1396M, 12.7 mm (1/2") thick ceiling board manufactured to have more sag resistance than regular type gypsum board with long edges tapered, and as follows:
    - .1 Location: Ceiling surfaces.
    - .2 Acceptable Materials:
      - .1 Sheetrock UltraLight Sag-Resistant Interior Ceiling Board by CGC Inc.
      - .2 ToughRock Span 24 Lite-Weight Ceiling Board by Georgia Pacific Canada.
      - .3 Easi-Lite Lightweight Interior Ceiling Gypsum Board by CertainTeed Canada.

### 2.2 MATERIALS - STEEL FRAMING

- .1 Non-Loadbearing Steel Framing:
  - .1 General:
    - .1 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.
    - .2 Steel for non-loadbearing members shall have metallic coats that conform to ASTM A653M or ASTM A792M with minimum metallic coating weighs (mass) of Z120 and AZM150 respectively.



- .3 Framing members shall comply with the CAN/CSA S136 - North American Specification for the Design of Cold Formed Steel Structural Members, for conditions indicated.
- .2 Metal Studs:
  - .1 Minimum 0.45mm (25 gauge), screwable with crimped web and returned flange. Provide knockout openings in web at 150mm (6") O.C. to accommodate (if required) horizontal mechanical and electrical service lines, and bracing. Widths as indicated on drawings. Provide structural studs where indicated.
  - .2 Where metal stud framing forms walls are to be thermally insulated as indicated on drawings, provide metal studs with integrated fastening system for glass fibre/mineral fibre insulation.
  - .3 Provide special shapes indicated on drawings as part of steel stud/drywall assemblies.
- .3 Furring Members:
  - .1 Hat-shaped, rigid furring channels shall comply with the ASTM C645 and shall have a minimum base steel thickness of 0.45mm (25 gauge) and a minimum depth of 22mm (7/8") the minimum width of furring attachment flanges shall be 13mm (1/2").
  - .2 Resilient furring channels designed to reduce sound transmission shall have a minimum base steel thickness of 0.45mm (25 gauge) and have a minimum depth of 13mm (1/2").
  - .3 Furring members shall be used for furring out any surface for application of gypsum wallboard finish and for secondary furring member in suspended ceilings/soffits.
  - .4 All furring members shall be hot-dipped galvanized.
- .4 Drywall Grid Suspension for Ceilings: Conforming to ASTM C645 and ASTM C754, direct hung system composed of main beams and cross furring members that interlock and as follows:
  - .1 Tie Wire: Tie wire shall comply with ASTM A641/A641M zinc-coated, soft annealed.
    - .1 4.1mm (8 gauge) used for hangers in suspended ceiling grid work.
    - .2 2.6mm (12 gauge) for drywall suspension system.
    - .3 1.2mm (18 gauge) for wire-tying channels in wall furring and ceiling construction.
  - .2 Furring Runners: Manufactured from 0.5mm (0.020") thick steel, 35mm (1-3/8") wide with knurled face by 38mm (1-1/2") high by 305mm (12') long, with factory punched cross tee slots, hanger holes and non-directional bayonet end tab couplings.
  - .3 Furring Tees: Manufactured from 0.45mm (25 gauge) thick steel, 35mm (1-3/8") wide with knurled face by 38mm (1-1/2") high by 1220mm (4') long with stab-type end tab couplings, with factory punched cross tee slots, and hanger holes.
  - .4 Furring Cross Channels: Manufactured from 0.45mm (25 gauge) thick steel, 35mm (1-3/8") wide with knurled face by 22mm (7/8") high by 1220mm (4') long with straight locking end tabs.

- .5 Cross Tees: Manufactured from 0.45mm (25 gauge) thick steel, 24mm (15/16") wide by 22mm (7/8") high by 1220mm (4') long with stab-type end tab couplings, with factory punched cross tee slots, and hanger holes.
- .6 Wall Track: Manufactured from 0.45mm (25 gauge) thick steel, 39mm (1-9/16") high by 3048mm (10') long with a 25mm (1") top and bottom flange.
- .7 Basis of Design System:
  - .1 660-C Stab Drywall Grid Suspension System by Rockfon.
  - .2 FrameAll Drywall Grid by Armstrong World Industries Inc.
- .2 Acoustic Hangers for STC Rated Ceilings: Purpose made double deflection neoprene hanger with eyebolts for ceiling isolation.
  - .1 Product: WHD Architectural Ceiling Hanger or similar selected for required load rating by Mason Industries, or approved equivalent.
- .3 Acoustic Isolation Hangers: Purpose made double deflection neoprene hanger with eyebolts for ceiling isolation.
  - .1 The isolation hanger deflection shall be selected from manufacture pre-engineered system to provide a maximum natural frequency of 3.3 Hz.
  - .2 Hangers shall be tested by an independent laboratory
  - .3 Cold Rolled Channel: Provide 38 mm x 13 mm, 16-gage cold-rolled steel channel provided by this section and incorporated into hanger assembly.
  - .4 The hanger assembly bracket shall be designed to accept cold-rolled channel. Provide APB (Air Performance Bracket) Hanger bracket by listed manufacture including a 9.5 mm (3/8") threaded insert for attaching threaded rod below the hanger for optional equipment suspension below drywall ceiling.
  - .5 Basis of design product and manufacture: 'KSCH-Hangers' manufactured by Kinetics Noise Control, Inc.
- .4 Acoustic Isolation Clips for STC Rated Walls and Ceilings: Purpose made isolation clips consisting of a rubber element into which a standard galvanized steel furring channel is captured without any metal-to-metal or other rigid contact; spaced as required for STC rating and load rating manufactured.
  - .1 Product:
    - .1 GenieClip by Pliteq Inc.
    - .2 Iso-Max Sound Isolation Clips by Kinetics Noise Control,
    - .3 or approved equivalent.

## 2.3 ACCESSORIES

- .1 Concrete Anchors:
  - .1 Self-drilling tie wire anchors, Red-Head No. T-32 by Phillips Drill Company, Division of ITT Industries of Canada Ltd., or approved equal.
- .2 Concrete Inserts:
  - .1 Hot-dip galvanized "turtle back" type concrete inserts to suit conditions as approved by Consultant, by Acrow-Richmond National Concrete Accessories, Division of Premetalco Inc., or approved equal.
- .3 Gypsum Wallboard Accessories:



- .1 In general, gypsum wallboard accessories shall conform to ASTM C1047.
  - .2 Corner Beads:
    - .1 Made from galvanized steel sheet conforming to ASTM A653, minimum 0.0179" (25 gauge). Minimum width of flanges 28mm for 13mm (1-1/8" for 1/2") thick wallboard and 32mm for 16mm (1-1/4" for 5/8") thick wallboard.
  - .3 Casing Beads:
    - .1 Made from galvanized steel sheet conforming to ASTM A653, minimum 30 gauge, U-shaped designed for finishing with joint compound.
  - .4 Control Joints:
    - .1 Made from galvanized sheet steel conforming to ASTM A653, minimum 0.0179" (25 gauge), or roll-formed zinc-alloy to resist corrosion, with expansion joint material perforated flanges.
      - .1 Zinc Control Joint No. 093 by CGC Inc.
      - .2 or approved equal.
  - .5 Reveals:
    - .1 Galvanized sheet steel conforming to ASTM A653, minimum 0.0179" (25 gauge), in profiles as indicated on drawings.
  - .4 Wallboard Screws:
    - .1 Corrosion resistant, self-drilling, self-tapping gypsum wallboard screws conforming to ASTM C1002 (Type S) and ASTM C954 (Type S-12), 25mm (1") long No. 6 for single layer application, 41mm (1-5/8") long No. 7 for double layer application.
    - .2 At fire rated construction, type and size of wallboard screw shall be same as used in fire-rating test.
  - .5 Joint Compound for Interior Gypsum Board:
    - .1 Conforming to ASTM C475 and as recommended by gypsum wallboard, fire-rated gypsum wallboard and exterior wallboard manufacturers to suit conditions.
  - .6 Resilient Sponge Tape:
    - .1 Closed cell neoprene sponge type tape with self-sticking adhesive on one side. Permastik 122X by Jacobs and Thompson Ltd., or foamed vinyl type tape, Arnofoam by Arno Adhesive Tape Incorporated.
  - .7 Adhesive:
    - .1 Conforming to CGSB 71-GP-25M, and as recommended by manufacturer and compatible with contacted surfaces.
  - .8 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.
  - .9 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.
  - .10 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.
- 3 Execution
- 3.1 EXAMINATION**
- .1 Examine gypsum wallboard panels for damage and existence of mould. Install only undamaged panels.

- .2 Examine gypsum wallboard in accordance with GA-231 for water damage.
- .3 Examine areas and substrates, with installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- .1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- .2 Coordinate installation of gypsum board suspension systems with installation of acoustical ceiling tiles (ACT) suspension systems. Where gypsum board suspension systems abut ACT systems, ensure that ceiling tiles grid fit into gypsum grid without affecting overall design and appearance.
- .3 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### 3.3 INSTALLATION - GENERAL

- .1 Conform to ASTM C840, except as otherwise specified herein. Co-operate with mechanical, electrical and other trades to accommodate fixtures, fittings and other items in wallboard areas.
- .2 Review extent of temporary heat provided. Carry out the work of this Section only when temperature is maintained and controlled in the range of 13 deg. C to 21 deg. C for at least 24-hours before installing gypsum wallboard and is maintained or can be maintained until joint compound and adhesives are dried or cured.
- .3 Metal studs in partitions and bulkheads are to be continuous to underside of steel deck, except where noted otherwise on drawings. Continue framing around ducts penetrating partitions above ceiling.
- .4 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- .5 Install bracing at terminations in assemblies.
- .6 Do not bridge building control and expansion joints with non-loadbearing steel framing members. Frame both sides of joints independently.
- .7 Bring gypsum board into contact, but do not force into place.

### 3.4 CEILING FURRING

- .1 Install in accordance with ASTM C754, GA-216 and manufacturer's written instructions.
- .2 Install suspension system components in sizes and spacings indicated on drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- .3 Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- .4 Hangers:
  - .1 Hangers for suspended gypsum wallboard ceiling, bulkheads and duct furring shall support the grillage independent of walls, columns, pipes, ducts, conduit and similar components.
  - .2 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.



- .3 Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
- .4 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
  - .1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
- .5 Wire Hangers: Secure by looping and wire tying, either directly to structure or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- .6 Do not attach hanger to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- .7 Powder actuated fasteners are not approved.
- .8 Do not attach hangers to or through steel deck. Attach hangers to steel joists. Where joist spacing is not suitable and where ducts and other equipment interfere, provide adequate cross channels between joists and securely wire tie in position for support of hangers.
- .9 Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- .10 Do not connect or suspend steel framing from ducts, pipes, or conduit.
- .11 Recessed ceiling fixtures which exert a load in excess of 48.824 kg/m<sup>2</sup> (10 lbs/ft<sup>2</sup>) shall be suspended independent of ceiling furring for gypsum wallboard application.
- .12 Prior to installation of suspension system confirm that ceiling heights called for on room finish schedules and drawings can be maintained and that all recess lighting can be accommodated and shall not interfere with piping, ductwork and the like.
- .13 Space hangers at maximum 1220mm (4') O.C. along the runner channels and not more than 150mm (6") from the ends to support weight of ceiling and superimposed loads such as lighting fixtures, diffusers and grilles.
- .14 Where ducts are large or where combination of ducts, or combination of ducts and other items interfere so that hanger spacing exceeds 1220mm (4'), increase size of main runner channels and hangers accordingly to sustain increased loading and span.
- .15 For fire-resistant rated assemblies, wire tie furring channels to supports.
- .16 Install suspension systems that are level to within 3mm (1/8") measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
- .5 Carrying Channels:
  - .1 Space carrying channels at maximum 1220mm (4') O.C. and not more than 150mm (6") from boundary walls, interruptions of continuity and changes in direction.
  - .2 Run channels at right angles to structural framing members where splices are necessary, lap members at least 200mm (8") and wire each end with minimum double strand of tie wire. Avoid clustering or lining up splices.
  - .3 Attach channels to rod hangers by bending hanger sharply under bottom of flange of runner and securely wire in place with a saddle tie.
- .6 Cross Furring:

- .1 Erect furring channels at right angles to carrying channels.
- .2 Space furring channels at 610mm (24") O.C. and not more than 150mm (6") from boundary walls, interruptions in ceiling continuity and change in direction.
- .3 Secure furring channels to each support with a double strand of tie wire or with clip approved by manufacturer of furring components. Splice joints by nesting and tying channels together.
- .4 The wallboard furring channels shall be level to a maximum tolerance of 3mm over 3658mm (1/8" over 12') non-cumulative.

### 3.5 BOARD INSTALLATION – GENERAL

- .1 Install gypsum board in accordance with ASTM C840, GA-216 and GA-600, and manufacturer's instructions.
- .2 Vertically, with edges and ends occurring over firm bearing. Erect single layer gypsum board in non-fire rated partitions in most economical direction, with ends and edges occurring over firm bearing.
- .3 Erect single layer fire rated gypsum board
- .4 Use screws when fastening gypsum board to metal furring or framing.
- .5 Place control joints consistent with lines of building spaces as indicated. Where not indicated install as directed at maximum 3.5 m spacing. Construct joints using back-to-back casing beads filled with a low modulus sealant capable of flexible joint movement. Maintain fire-resistance rating of wall assemblies.
- .6 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and as indicated.

### 3.6 SOUND ISOLATION CLIPS

- .1 Install isolation clips to substrate with approved fastener for a minimum pull out and shear of 120lbs.
- .2 Ceiling Installation:
  - .1 Install sound isolation clips a maximum 2440 mm (48") on center. (horizontal)
  - .2 Spacing between the furring channels (hat channel) shall not exceed 450 mm (16"). Install furring channels perpendicular to the joists.
  - .3 Fasten the sound isolation clips to the substrate with a fastener approved for a minimum pull out and shear of 54 kg (120 lbs).
  - .4 Locate the first row of furring channel within 75 mm to 150 mm (3" to 6") of the wall edge and install in a checker pattern.
  - .5 Furring channel shall not be cantilevered more than 150 mm (6") beyond the last sound control clip.
  - .6 Snap furring channel into sound isolation clip and make joins between clips with a 150 mm (6") overlap. Secure with 1.2 mm (18 ga.) wire or framing screws.
  - .7 Stagger seams of gypsum board in double layer applications.
  - .8 Caulk around entire perimeter of gypsum board, filling the space with non hardening acoustic caulk. Use fire and smoke rated caulking sealant where required. Do not install caulking so that it is 'proud' of the gypsum board surface.

### 3.7 CONTROL JOINTS

- .1 Install control joints using metal control joint strip as specified where:



- .1 A partition, furring or column fireproofing abuts a structural element, dissimilar wall or partition assembly, or other vertical penetration, or ceiling.
  - .2 A ceiling or soffit abuts a structural element, dissimilar wall or partition assembly or other vertical penetrations.
  - .3 Wings of "L", "U" and "T"-shaped ceiling/soffit areas are joined;
  - .4 Construction changes within the plane of the partition or ceiling or soffit.
  - .5 Partition, restrained ceiling or furring run exceeds 9144mm (30').
  - .6 Unrestrained ceiling dimensions exceed 15240mm (50') in either direction.
  - .7 Expansion or control joints occur in the base exterior wall.
  - .8 Wallboard is installed over masonry control joints.
  - .9 And elsewhere as indicated on the drawings.
- .2 Install in accordance with manufacturer's instructions. Where application is on furring members and double furring members at control joints, place one furring member on each side of the control joint.

### 3.8 BULKHEADS

- .1 Fur out bulkheads in areas indicated and as required to conceal mechanical, electrical or other services in rooms where drywall finishes are scheduled, and elsewhere if called for on drawings.
- .2 Ensure hangers are installed as to prevent splaying.

### 3.9 PRESSED STEEL (HOLLOW METAL) FRAMES

- .1 Install pressed steel (hollow metal) frames where they occur in gypsum wallboard partitions.
- .2 Anchor frames securely to studs using a minimum of three (3) anchors per jamb for jambs up to 2134mm (7') high and minimum of four (4) anchors per jamb for jambs over 2134mm (7') high.

### 3.10 FINISHING

- .1 Before proceeding with installation of finishing materials ensure the following:
  - .1 Wallboard is fastened and held close to framing and furring.
  - .2 Fastening heads in wallboard are slightly below surface in dimple formed by driving tool.
- .2 Levels of Gypsum Wallboard Finish:
  - .1 Level 0: Temporary construction only.
  - .2 Level 1: Plenum areas and above ceilings. Where a fire-resistance rating is required finishing should be in accordance with reports of fire tests of assemblies that have met the requirements of the fire rating imposed.
  - .3 Level 2: Areas of water resistant gypsum backing board under tile, exposed areas where appearance is not critical.
  - .4 Level 3: Service corridors and areas to receive heavy or medium textured coatings or heavy-duty wall coverings.
  - .5 Level 4: Areas to receive light textured coatings or lightweight wall coverings.
  - .6 Level 5: Areas to receive gloss, semi-gloss or flat sheen paints and critical lighting conditions. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat over entire surface for corridors,

long hallways, walls and ceilings longer than 7500 mm or walls higher than 3600 mm ,  
and for all curved or angled wall surfaces.

- .3 Finish gypsum wallboard in strict accordance with ASTM C840, GA-214 and GA-216 and as follows:
  - .1 Fill and tape joints and internal corners and fill screw depressions in board face and smooth out along corner beads and metal strip with joint compound.
  - .2 Mix joint compound (powder) in accordance with manufacturer's written instructions.
  - .3 Prefill "V" grooves of rounded edges with special setting type joint compound using a 127mm to 150mm (5" to 6") joint finishing knife. Finish flush with tapered surface ready for tape reinforcing application. Allow prefill material to dry thoroughly before application of embedding compound and tape.
  - .4 Apply joint compound in thin uniform layer. Embed reinforcing tape accurately centred on joint and securely pressed in, leaving sufficient compound under tape to provide proper bond. Immediately apply skim coat over tape application. Allow to dry thoroughly before application of next coat.
  - .5 Apply fill coat finishing the tapered depression flush with board surfaces. Allow to dry thoroughly before application of finish coat.
  - .6 Apply finish coat extending slightly beyond the filler coat and feathered out onto the board surface. Do not apply finish coat to gypsum board scheduled to be sprayed with acoustic surfacing finish.
  - .7 Sand between coats and following the finishing coat, where necessary, and leave surface smooth and ready for painting.
  - .8 Finish screw depressions with filler material and finish coat as specified above.
  - .9 Joint and depression finish shall in no case protrude beyond the plane of the board surface.
  - .10 Furnish corner beads and metal trim flush with board surface using filler and finishing coats feathered out approximately 50mm (2") and 100mm (4") respectively onto the board surface.
  - .11 Provide metal casing beads at exposed edges, at junctions of gypsum/cement board with dissimilar material, at control joints and at junction with columns. Casing beads are required at perimeter of gypsum/cement wallboard ceilings and soffits. Fasten with screws at 305mm (12") O.C. along entire length.
  - .12 Finish gypsum board to receive a Level 4 finish.

### 3.11 REPAIRS

- .1 After taping and finishing has completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.
- .2 Patch holes or openings 13mm (1/2") or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- .3 Repair holes or openings over 13mm (1/2"), or equivalent size, with 16mm (5/8") thick gypsum wallboard secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- .4 Tape and refinish scratched, abraded or damaged finished surfaces including cracks and joints in non-decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

### 3.12 PROTECTION



- .1 Protect installed products from damage during remainder of construction period.
- .2 Remove and replace panels that are damaged.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 The work in this section includes supply and installation for floor and wall tile finishes and the following:
  - .1 Waterproof membrane
  - .2 Tile bonding accessories
- .2 Site quality control

**1.3 PERFORMANCE REQUIREMENTS**

- .1 Tile products manufactured and tested to ISO 10545 Series and ANSI A137.1.
- .2 Slip Resistance: Minimum dynamic coefficient of friction (DCOF) of 0.42 wet to ANSI A137.1.
- .3 Floor Traffic Load Bearing Performance: ASTM C627, meeting minimum moderate duty, and outlined in this section and the TTMAC Guide Specification.
- .4 Surface Flatness Tolerances:
  - .1 Standard Format Floor Tile 100 x 100 mm to 400 x 400 mm: Floor flatness measured to a minimum FF35; equivalent to 5 mm with maximum 2 gaps under a 3 m straightedge measurement.
  - .2 Wall Tiles: Wall levelling similar to floors tiles having similar sizes listed above.

**1.4 PRE-INSTALLATION CONFERENCE**

- .1 Contractor shall hold pre-installation conference 2 weeks prior to commencing work of this Section. Conference shall be attended by the Contractor, Owner, Consultant, concrete finishing subcontractor, tile installers and tile manufacturer's representative, setting bed and grout manufacturer's representative to discuss the following, but not limited to the following;
  - .1 Substrate conditions, non-structural cracks, structural cracks and preparation requirements.
  - .2 Floor and wall surface irregularities and levelness tolerances, including all remedial requirements.
  - .3 Installation of tiles and grouting.
  - .4 Edge details and treatments.
  - .5 Installation of tile and grout sealers.
- .2 Contractor shall ensure that manufacturer's representatives issues written installation instructions at the pre-installation conference, to all parties attending the pre-installation conference and the Consultant, for all tile types, setting beds, grouts and sealers required for the work of this Section.
- .3 Contractor shall within 72 hours of the pre-installation conference, prepare minutes of the conference, and issue minutes to all parties attending the pre-installation conference and the Consultant. Contractor shall clearly indicated required actions and by which party.

**1.5 SUBMITTALS FOR REVIEW**



- .1 Product Data: For each product. Include installation instructions for using setting materials and grouts.
- .2 Samples:
  - .1 Submit sample panel of each type and colour tile, 610 mm x 610 mm (24" x 24"). Adhere to a rigid board with setting compound, grout and a dummy control joint showing sealant as specified. Identify samples by project number, date, name of sub-contractor and tile type. Tile and grout used in the building shall correspond to appearance of approved samples in all respects. Do not install tile until samples are approved.
  - .2 Upon Consultant's request submit samples of base, trim and fittings.

#### **1.6 SUBMITTALS FOR INFORMATION**

- .1 Installation Data: Manufacturer's special installation requirements.
- .2 Tile setting material manufacturer's review report.
- .3 Field test reports.

#### **1.7 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

#### **1.8 QUALITY ASSURANCE**

- .1 Perform work in accordance with TTMAC Specification Guide, Tile Installation Manual.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.
- .4 Tile Setting Material Manufacturer's Review:
  - .1 Prior submitting Submittals obtain tile setting manufacturer's review and approval for conformance of tile installation methods and procedures with warranty requirements.
  - .2 Prepare and submit report signed by the tile setting manufacturer.
  - .3 Review of waterproofing membrane installation, and provide required testing ensuring waterproofing membrane manufactures recommended thickness is achieve.

#### **1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- .1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- .4 Restrict traffic by other trades during installation.
- .5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 100 mm (4") and taped.
- .6 Heavily travelled areas shall have additional 13 mm (1/2") thick fibreboard sheet protection with taped joints over polyethylene sheet protection as specified above.

- .7 Protect exposed edges of floor tile with same thickness as tile x 100 mm (4") wide tapered strip of plywood adhered to floor until adjoining floor finish is to be installed.

#### **1.10 SITE CONDITIONS**

- .1 Ambient Conditions: Apply tile after completion of work by other Sections is complete; to surfaces sufficiently dry, clean, firm, level, plumb and free from oil or wax or any other material deleterious to tile adhesion and as follows:
  - .1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.
  - .2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.

#### **1.11 WARRANTY**

- .1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of five (5) years from date of Substantial Performance, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining, pitting, splitting and deformation of tiles and grout.

#### **2 Products**

##### **2.1 MATERIALS – CERAMIC MOSAIC TILE (CMT)**

- .1 ANSI 137.1, Table 6; cushion edges.
- .2 Ceramic Mosaic Tile:
  - .1 Finish Texture:
  - .2 Factory-Mounted Backing: Dots not to exceed 12 percent area of each tile, and located minimum 2 mm below surface of tile at joint.
- .3 Slip Resistance: Required.
- .4 Wet Area Tiles Abrasive Content: Minimum 7.5 percent. Applies to 100% of all Wet Areas.
- .5 Tile Trim: Provide coved tile bases, nosings, finger grip, toe grip, moulded trimmers for external and internal angles and projections as shown in Drawings.
- .6 Product size, colour and finish textures to be selected by Consultant.

##### **2.2 MATERIALS – PORCELAIN TILE (PCT)**

- .1 ANSI 137.1; cushion edges; colour through rectified porcelain tiles.
- .2 Slip Resistance: Required.
- .3 Tile Trim: Provide coved tile bases, nosings, finger grip, toe grip, moulded trimmers for external and internal angles and projections as shown in Drawings.
- .4 Product size, colour and finish textures to be selected by Consultant.

##### **2.3 MORTAR AND GROUT MATERIALS – GENERAL**



- .1 Acceptable Tile Setting Materials: Subject to conformance to requirements, mortar and grout materials listed below shall be of a uniform quality for each adhesive, and grout component from a single manufacturer and each aggregate from one source or producer as follows:
  - .1 Laticrete International Inc.,
  - .2 Mapei Corporation,
  - .3 TEC Incorporated Building Products Group, an H.B. Fuller Company,
  - .4 Flextile Ltd.
- .2 Setting and Grouting Materials: Conform to material standards in ANSI's Specifications for the Installation of that apply to materials and methods specified.
  - .1 Grout Colours: Unless otherwise indicated, to be selected by Consultant.
  - .2 Grout joints: for stone floor tiles provide grout material capable of maintaining maximum 3 mm grout joints.
- .3 Source limitations: All materials shall be from one manufacturer, forming a complete system.
- .4 Products: Provide like products from same production run. Install products in sequence from sequentially numbered dye lots.

## 2.4 MORTAR AND GROUT SETTING SYSTEMS

- .1 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:
  - .1 Thinset Mortar:
    - .1 4237 latex additive and 211 Crete filler powder by Laticrete.
    - .2 Kerabond with Keralastic by Mapei.
    - .3 TA 382 Ultimate LFT by TEC, HB Fuller.
    - .4 51 Premium Wall & Floor Thin-Set Mortar with 44 Acrylic Additive by Flextile.
  - .2 Trowelable Underlayment and screed Compound:
    - .1 226/3701 mortar mix by Laticrete.
    - .2 Topcem by Mapei.
    - .3 TA 305 Fast Set Deep Patch by TEC, HB Fuller.
    - .4 FAST-SET SCREED BY Flextile.
  - .3 Grout: ANSI A108/A118/A136.1:
    - .1 Standard for dry locations:
      - .1 SPECTRALOCK PRO Premium Grout by Laticrete.
      - .2 Mapei UltracolorPlus.
      - .3 PowerGrout by TEC, HB Fuller.
      - .4 1600 RSG by Flextile.
    - .2 Epoxy Grout: Washrooms locations.
      - .1 SPECTRALOCK PRO Premium Grout by Laticrete.
      - .2 Kerapoxy by Mapei.
      - .3 AccuColour EFX by TEC, HB Fuller.
      - .4 FLEX-EPOXY 100 GROUT by Flextile.

## 2.5 TILE SETTING SYSTEMS FOR WET AREAS

- .1 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:
  - .1 Scratch/Skim/ Bond Coat:
    - .1 211/4237 by Laticrete.
    - .2 Kerabond mixed with Keralastic additive by Mapei.
    - .3 TA392/393 SUPERFLEX ULTRA PREMIUM THIN SET by TEC.
    - .4 #51 FLOOR & WALL PREMIUM MORTAR MIXED #44 ACRYLIC ADDITIVE by Flextile.
  - .2 Mortar Bed/levelling coat: For bed thicknesses over 40 mm, suspend reinforcing mesh within mortar bed.
    - .1 226/3701 mortar mix by Laticrete.
    - .2 Topcem with Planicrete AC by Mapei.
    - .3 TA305 FAST SET DEEP PATCH WITH PATCH ADDITIVE by TEC.
    - .4 FAST-SET SCREED or 4:1 DRY PACK with #44 Acrylic Additive by Flextile.
  - .3 Waterproof Membrane: ANSI A118.10
    - .1 Hydroban by Laticrete.
    - .2 Aquadefense by Mapei.
    - .3 TA 316 Hydraflex by TEC, HB Fuller.
    - .4 WP-900 HYDRO-BLOCK by Flextile.
  - .4 Grout: ANSI A108/A118/A136.1 Epoxy Grout:
    - .1 SPECTRALOCK PRO Premium Grout by Laticrete.
    - .2 Kerapoxy by Mapei.
    - .3 AccuColour EFX by TEC, HB Fuller.
    - .4 FLEX-EPOXY 100 GROUT by Flextile.
  - .5 Fibreglass reinforcing mesh and cleavage membrane, as recommended by manufacture.

## 2.6 ACCESSORIES

- .1 Water: Fresh, clean, potable, free from deleterious matter, acids or alkalis.
- .2 Sealant: movement and joint sealants to requirement of Division 07 Sealants.
- .3 Trims:
  - .1 Transition Edge Strips: Extruded clear satin anodized aluminum edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material and sloped, narrow profile transition
    - .1 Basis-of-Design Materials: Schlüter Reno U.
- .4 Provide fillers, primers, reinforcing fabric and all other materials and accessories as recommended by the crack suppression membrane manufacturer.
- .5 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:



- .1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturer's recommendations and as recommended by tile manufacturer.
- .2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer's recommendations.

## **2.7 MORTAR AND GROUT MIXING**

- .1 Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- .2 Add materials, water, and additives in accurate proportions.
- .3 Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated or specified.

## **3 Execution**

### **3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify that surfaces are ready to receive work.
  - .1 Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated or specified.
  - .2 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - .3 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Consultant.
- .3 Verify sealants and grout are cured for manufacturer recommended periods at required temperatures and relative humidity conditions, before water immersion.
- .4 Crack Suppression Membranes:
  - .1 Prepare all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.
  - .2 Prime and fill all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.
- .5 Commencement of installation shall signify complete acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- .1 Surface Preparation:
  - .1 Make backing surfaces level and true to a tolerance in plane of  $\pm 3$  mm in 2 m (1/8" in 8') for walls and  $\pm 3$  mm in 3 m (1/8" in 10') for floors using levelling bed mortar.
  - .2 Surfaces shall be structurally sound, well fastened, clean and free from dust, oil, grease, paint, tar, wax, curing agents, primers, sealers, form release agents or any deleterious substances that may act as bond barriers.
  - .3 Backing surfaces shall be dry and fully cured. Dampness must not exceed 5% by volume.

- .2 Examine concrete substrate, repair as required to produce level, clean surface for new tile installation. Repair Work shall include levelling, filling, grinding or cutting.
- .3 Ensure work of other trades shall be installed, complete and approved before tile installation.
- .4 Fill cracks, holes, and depressions in concrete substrates for tiling installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- .5 Check as per ASTM F710 for Concrete Preparation for excessive moisture levels & pH of the slab.

### 3.3 INSTALLATION - GENERAL

- .1 Installation of the tile shall be by thin-set method, as indicated on the drawings and as specified herein;
  - .1 Apply floor tile and prepare floor slabs in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.
- .2 Install mortar bed, tile, and grout to referenced TTMAC Manual and TTMAC systems listed.
- .3 Thoroughly clean surfaces to which tile is to be applied.
- .4 Back butter all floor tile.
- .5 Neatly cut tile around fitments, fixtures, access panels, and the like. Splitting of tile is expressly prohibited except where no alternative is possible. Form intersections, corners and returns accurately.
- .6 Finish surfaces flat and level or, sloped and graded as required.
- .7 Joint Widths: Install tile with the following joint widths, unless indicated on drawings:
  - .1 Ceramic Mosaic Tile: 2 mm (1/16")
  - .2 Wall Tile: 2 mm (1/16")
  - .3 Floor Tile: 6 mm (1/4"), unless otherwise indicated on the Drawings.
  - .4 Make joints consistent width and alignment within tile area.
  - .5 Maintain 2/3 of grout joint depth free of setting material.
- .8 Joints in base shall match floor patterns. Joints shall be watertight without voids, cracks or excess grout.
- .9 Lay out tile so that fields or patterns are centred on wall areas or architectural features and so that no tile less than 1/2 size occurs.
- .10 Arrange and set recessed accessories in tile work so that they are evenly spaced, centred with joints and set true with correct projection. Rigidly install accessories.
- .11 Provide manufacturer's standard trim pieces at changes of direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions:
  - .1 Internal horizontal corners: Coved.
  - .2 External vertical and horizontal corners: Bullnosed.
  - .3 Internal vertical corners and unexposed edges: Square.
- .12 Install tiles in patterns and locations as indicated on drawings.
- .13 Install wall tile full wall height unless shown otherwise.
- .14 Coordinate work of this Section with work of other Sections for items requiring to be recessed into work of this Section.



- .15 Sound tiles after setting and remove and replace tiles not fully bedded.
- .16 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.
- .17 Finished tile work shall be clean and free of tiles which are pitted, chipped, cracked or scratched. All damaged tile shall be removed and replaced.
- .18 Where indicated on Drawings or as required, install continuous single piece metal edge trims centred under doors in closed position and other locations where tile meets other floor finishes.
- .19 Allow tile to set for a minimum of 48 hours prior to grouting.

### **3.4 GROUTING**

- .1 Grout tiles in accordance with ANSI A108.10 and as specified herein.
- .2 When grouting a fresh laid floor, make certain that traffic and grouting will not cause movement of floor in setting bed. Protect floor by using kneeling boards or gypsum board to defend floor against traffic while grouting.
- .3 Mix grouts and install in strict accordance with the manufacturer's instructions.
- .4 Excess grout shall be removed from the surface of tiles using the edge of a rubber float held at a 45 deg angle, moving it diagonally to the joints. Fill all gaps and air holes.
- .5 Do not allow grout to harden on face of tile. Refer to manufacturer's instructions for thorough removal.
- .6 Floors which required damp curing shall be cured for the required length of time using heavy kraft paper, not polyethylene sheets. Consult manufacturer for instructions.

### **3.5 WATERPROOFING**

- .1 Install waterproofing in accordance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.
- .2 Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

### **3.6 CLEANING AND FINISHING**

- .1 Clean tiled areas after grouting has cured, using compatible solutions and methods as recommended by the manufacturer.
- .2 Remove grout residue from tile as soon as possible.
- .3 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation.
- .4 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.
- .5 Flush surface with clean water before and after cleaning.
- .6 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

### **3.7 PROTECTION OF FINISHED WORK**

- .1 Protect installed work.
- .2 Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 This Section includes requirements for supply and installation of:
  - .1 Acoustical panel ceiling systems (ACT).
  - .2 Suspended metal grid ceiling system and perimeter trim.
  - .3 Supplementary acoustic insulation over system units.
  - .4 Site quality control.

**1.3 DESIGN AND PERFORMANCE REQUIREMENTS**

- .1 Suspension System:
  - .1 Determine the superimposed loads that will be applied to suspension systems by components of the building other than the ceiling and ensure that adequate hangers are installed to support the additional loads in conjunction with the normal loads of the system.
  - .2 Design supplemental suspension members and hangers where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at required spacing to support standard suspension system members:
  - .3 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - .4 Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of L/360.
  - .5 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.
  - .6 Surface-Burning Characteristics: Conform to CAN/ULC S102 or ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordinate layout and installation of ceilings with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression system.

**1.5 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for combustibility requirements for materials.
- .2 Conform to applicable code for seismic requirements for ceiling system.

**1.6 SUBMITTALS FOR REVIEW**

- .1 Provide submittals bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.



- .2 Product Data: Submit product data for each type of product specified.
- .3 Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items indicating the following:
  - .1 Ceiling suspension system members.
  - .2 Method of attaching suspension system hangers to building structure.
  - .3 Ceiling mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special mouldings at walls, column penetrations, and other junctures of acoustic ceilings with adjoining construction including seismic design.
- .4 Samples:
  - .1 Submit two 300 x 300 mm samples illustrating material and finish of each type of acoustic unit.
  - .2 Submit two 300 mm long samples of suspension system main runner, cross runner, and perimeter moulding.

#### **1.7 SUBMITTALS FOR INFORMATION**

- .1 Qualifications Data: For Installer.
- .2 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.
- .3 Professional Structural Engineer's Letters of Assurance:
  - .1 Provide letters or completed Owner-prescribed forms signed by the professional structural engineer used to prepare the shop drawings, stating that the ceiling system has been designed accordance with the structural performance requirements of the applicable codes, including verification that:
    - .1 Specified products have been used.
    - .2 Designs and installations as tested, have been installed on the Project.
    - .3 Loads and movement requirements have been achieved.

#### **1.8 QUALITY ASSURANCE**

- .1 Conform to Ceilings and Interior Systems Contractors Association (CISCA) Ceiling Systems Handbook requirements.
- .2 Qualifications of Installer: Approved by suspension system manufacturer.

#### **1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

#### **1.10 SITE CONDITIONS**

- .1 Ambient Conditions: Install acoustic unit ceilings only when building is enclosed, has sufficient heat, when overhead mechanical and electrical work is complete, and dust and moisture producing activities are complete; maintain uniform temperatures and relative humidity within range recommended by material manufacturer from the time of installation until Substantial Performance for the project; make adjustments to temperature and humidity gradually within tolerances indicated by manufacturer.

## 1.11 WARRANTIES

- .1 Provide two (2) year warranty by manufacturer of acoustic panels covering defects in products and failure to meet specified requirements.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include the following:
  - .1 Armstrong World Industries Canada Ltd,
  - .2 CertainTeed Gypsum Canada Inc. a Division of Saint-Gobain, or
  - .3 CGC Inc. a USG Company.
  - .4 Rockfon LLC.

### 2.2 METAL SUSPENSION SYSTEMS

- .1 Grid Components: ASTM C635/C635M, intermediate duty; exposed, downward access removable T; components die cut and interlocking; minimum 38 mm high bulb tee design.
  - .1 Recycled Content: minimum 50 %
- .2 Grid Materials: Hot dip galvanized steel with factory paint finishes.
- .3 Grid Finish: White, manufacturer's standard.
- .4 Module: Sized as appropriate to acoustic panel size.
- .5 Mouldings:
  - .1 Perimeter Moulding: Formed to provide shadow reveal profile moulds unless shown otherwise in baked white enamel finish.
- .6 Exposed Suspension System (Type 1): Provide standard exposed 'T' bar system: zinc-coated steel with baked white enamel finish for exposed surfaces in colour to match acoustic panels.
  - .1 Acceptable Products:
    - .1 Prelude XL HRC manufactured by Armstrong World Industries Canada Ltd.
    - .2 15/16" Classic Stab System by CertainTeed Gypsum Canada.
    - .3 DONN Brand Suspension System, 25 mm exposed face; Donn DX/DXL HRC by CGC Inc.
    - .4 Chicago Metallic 1200HRCMax 15/16" Stab System by Rockfon LLC.

### 2.3 ACOUSTIC CEILING PANELS (ACT)



- .1 Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by the nominal values for types, patterns, acoustic ratings, and light reflectance class, unless otherwise indicated.
- .2 Surface burning properties, all types: Flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with CAN/ULC S102, substantiated by ULC labels on materials supplied.
- .3 Acoustic Panel (ACT): ASTM E1264, Type XII, Form II, Pattern G:
  - .1 Performance:
    - .1 NRC: Min. 0.85.
    - .2 Thickness: 19 mm.
    - .3 Surface Texture: Fine.
    - .4 Surface Colour: White.
  - .2 Edge Profile: Square.
  - .3 Sizes: 610mm x 610mm.
  - .4 Approved Products:
    - .1 OPTIMA Open Plan series manufactured by Armstrong World Industries Canada Ltd.
    - .2 Symphony f series by CertainTeed Gypsum Canada.
    - .3 Halcyon ClimaPlus series manufactured by CGC Inc.
    - .4 Sonar by Rockfon LLC.

## 2.4 ACCESSORIES

- .1 Accessories: Stabilizer bars, clips, perimeter mouldings and splices required for suspended grid system.
- .2 Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- .3 Ties Wire: minimum 1.98 mm (14 ga.) Ø steel wire, galvanized.
  - .1 Hanger Attachments to Concrete: 1 #12 galvanized annealed steel wire for support of a maximum weight of 68 kg. per hanger; #9 galvanized annealed steel wire for support of a maximum weight of 140 kg. per hanger; 4.5 mm diameter galvanized annealed steel rod to support a maximum weight of 250 kg. per hanger.
- .4 Anchors: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency; Minimum tensile strength 390 MPa.
- .5 Acoustic Sealant for Perimeter Mouldings: To requirement of Division 07 Sealants.
- .6 Edge Trim: As required and listed by suspension system manufacturers.
  - .1 Height: 50 mm and 102 mm high as indicated.
  - .2 Colour: White.

3 Execution

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify that layout of hangers will not interfere with other work.

**3.2 INSTALLATION – GENERAL**

- .1 Install acoustical ceilings according to Cisca publication Ceiling Systems Handbook.

**3.3 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM**

- .1 Install suspension system to manufacturer instructions and ASTM C636/C636M, and as supplemented in this section.
- .2 Install system in accordance with ASTM E580/E580M.
- .3 Install system capable of supporting imposed loads to a deflection of L/360 maximum.
- .4 Lay out system to a balanced grid design with edge units no less than 50 percent of acoustic unit size, unless otherwise detailed.
- .5 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- .6 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- .7 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- .8 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.
- .9 Do not eccentrically load system, or produce rotation of runners.
- .10 Perimeter Moulding:
  - .1 Install edge moulding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.
  - .2 Use longest practical lengths.
  - .3 Overlap corners.
  - .4 Provide at junctions with other interruptions.

**3.4 INSTALLATION - ACOUSTIC UNITS**

- .1 Install acoustic units to manufacturer's instructions.
- .2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- .3 Install units after above ceiling work is complete.
- .4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
- .5 Cutting Acoustic Units:



- .1 Cut to fit irregular grid and perimeter edge trim.
- .6 Where round obstructions occur, provide preformed closures to match perimeter moulding.
- .7 Where indicated, lay acoustic insulation for a distance of 1 200 mm either side of acoustic partitions.
- .8 Install panel hold-down clips, where specified, to retain panels tight to grid system.

### **3.5 ERECTION TOLERANCES**

- .1 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.
- .2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### **3.6 SITE QUALITY CONTROL**

- .1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located to:
  - .1 Perform timely and regular inspections.
  - .2 Verify installation conforms to applicable code.
  - .3 Prepare and submit inspection reports.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Trowel application of epoxy flooring, including surface preparation, primer, aggregate topping, grout coat, and finish coat.
- .2 All work required to result in a first class installation for the Owner's intended use. No substitution of materials or installation methods will be accepted.

**1.3 RELATED WORK SPECIFIED ELSEWHERE**

- .1 Contractor shall be responsible for co-ordinating this section with all related sections.

**1.4 EXAMINATION**

- .1 Examine all areas and conditions affecting work of this Section and report any discrepancies or defects which would affect finished results.

**1.5 QUALITY ASSURANCE**

- .1 Subcontractor executing work of this Section shall employ installers having a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- .2 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the Site to direct the work of this Section at all times. Representative shall meet Consultant's approval.
- .3 Ensure proper use of proprietary materials in strict accordance with the material manufacturer's directions. It shall be the responsibility of the material manufacturer or supplier to furnish these directions to the Contractor and to check periodically at the site to ensure that they are being carried out.
- .4 Testing of Concrete Floors: Test floors that have been cured for minimum 28 days, and after preparation for Product installation is complete and patching or levelling compound is fully cured. Conduct testing simultaneously on floors free of sealer, curing compounds, oil, grease and other agents detrimental to the test and Product performance. Locate test sites evenly to cover representative installation areas. Do not proceed with work when the test results do not conform to the specified allowable.
  - .1 Cohesive Strength: Minimum 1.45 MPa (210 psi) by tensile load as tested to CSA A23.2-6B. Do one test for every 9 sq.m. (1000 sq.ft.) or fraction thereof.
  - .2 Moisture Vapour Emission: Maximum moisture content of 1.36 kg/93 sq.m. (3 lbs/1000 sq.ft.) per 24 hour as tested to ASTM F1869 using anhydrous calcium chloride method. Provide 3 test sites for floor area up to 93 sq.m. (1000 sq.ft.), add one test site for each additional 93 sq.m. (1000 sq.ft.) or fraction thereof.
  - .3 Surface Temperature: Minimum 3 degree C above the measured dew point.

**1.6 PRE-INSTALLATION CONFERENCE**

- .1 Contractor shall hold pre-installation conference two (2) weeks prior to commencing work of this Section. Conference shall be attended by the Contractor, Owner, Consultant, concrete finishing subcontractor, Epoxy installers and Epoxy manufacturer's representative to discuss the following, but not limited to the following;



- .1 Substrate conditions, non-structural cracks, structural cracks and preparation requirements.
- .2 Floor surface irregularities and levelness tolerances, including all remedial requirements.
- .3 Installation of Epoxy Flooring.
- .4 Edge details and treatments.
- .5 Inspections during the work.
- .6 Protection of Epoxy work.
- .2 Contractor shall ensure that manufacturer's representatives issues written installation instructions at the pre-installation conference, to all parties attending the pre-installation conference and the Consultant, for all Epoxy required for the work of this Section.
- .3 Contractor shall within 72 hours of the pre-installation conference, prepare minutes of the conference, and issue minutes to all parties attending the pre-installation conference and the Consultant. Contractor shall clearly indicated required actions and by which party.

#### **1.7 SUBMITTALS**

- .1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the General Conditions and Division 01 of the Specifications.
- .2 Safety Data Sheets:
  - .1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.
- .3 Maintenance Instructions:
  - .1 Upon completion of the Work, furnish Consultant with copies of maintenance instructions, containing complete detailed and specific instructions for maintaining, preserving and keeping clean the surfaces of this Work and in particular, giving adequate warning of maintenance practices of materials detrimental to the work of this Section for inclusion in the Operation and Maintenance Manual.

#### **1.8 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- .1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- .4 Restrict traffic by other trades during installation.
- .5 Provide adequate protection of completed epoxy surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 100mm (4") and taped.

#### **1.9 WARRANTY**

- .1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of two (2) years, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining.

2 Products

**2.1 GENERAL**

- .1 All components and products of the epoxy flooring system shall be manufactured and supplied by a single manufacturer, to ensure compatibility between components.

**2.2 MATERIALS**

- .1 Epoxy Flooring System: Two-component, 100% solids, fast cure, solvent free, low VOC.
  - .1 Sikafloor Fastflor CR by Sika Canada.
  - .2 Epoxal 100WH by Niagara Protective Coatings.
  - .3 Stonkote GS4 by Stonhard Limited.
- .2 Moisture Barrier, Slab-on-Grade: Coating manufacturer's standard, to reduce moisture transmission to 1.36 kg/93 sq.m. (3 lbs/1000 sq.ft.).
- .3 Primer: As recommended by manufacturer supplying flooring material for types of surface to be primed.
- .4 Subfloor Filler: Compatible to floor coating and as recommended by coating manufacturer.
- .5 Joint Backing: Preformed, compressible strips of closed cell polyethylene or urethane foam, rubber tubing or non-migrating plasticized vinyl, oversized 25%, compatible with sealant, primer, epoxy surfacing and substrate.
- .6 Joint Sealant: ASTM C920, Type M, Grade P, Class 25, Use T, multi component modified urethane base chemical curing; material compatible with floor finish and as recommended by flooring manufacturer.

3 Execution

**3.1 EXAMINATION**

- .1 Examine surfaces and conditions under which flooring is to be applied. Moisture content of surfaces and building air temperatures must be within limits recommended by the flooring manufacturer. Do not start work until unsatisfactory conditions have been corrected. Application of materials indicates acceptance of surfaces.
- .2 Surfaces shall be free of membrane curing compounds, laitance, dust, dirt, grease, oil and other contaminants that may affect proper adhesion of the coating.
- .3 Do not apply coating system if ambient temperature is below 10 deg C (50 deg F) or above 32 deg C (90 deg F) or if relative humidity is above 80%.

**3.2 SURFACE PREPARATION**

- .1 Remove projections and other conditions that may affect the installation of the flooring system.
- .2 Protect adjacent surfaces, fixtures and equipment with drop cloths or masking as necessary to prevent damage from surface preparation.

**3.3 INSTALLATION**

- .1 Mix and apply work in strict accordance manufacturer's printed directions in specified thickness, with integral cove bases, uninterrupted except at sawn joints or other types of joints required, free of laps, pin holes, voids, crawls, skips or other marks or irregularities are visible, and to provide uniform appearance.
- .2 Work coating into corners and other restricted areas, up and over bases, and into recesses in floors to ensure full coverage.

- .3 Make clean true junctions with no visible overlap between adjoining applications of coatings.
- .4 Moisture Barrier: Apply moisture barrier coating on prepared slab-on-grade substrate before primer application, to manufacturer's instruction.
- .5 Primer: Apply primer over prepared substrate, at manufacturer's recommended spreading rate with timing of application co-ordinated with subsequent application of topping mix to ensure optimum adhesion between flooring materials and substrate.
- .6 Finish coats: Apply minimum of two finish coats at spreading rate recommended by manufacturer to achieve minimum total thickness of 0.5 mm (0.020") DFT. Allow minimum recommended drying time between coats.
  - .1 Base Coat: Apply base coat and immediately broadcast aggregates and back roll to obtain slip-resistant texture finish. Let dry.
  - .2 Top Coat: Apply top coat to dry base coat for consistent appearance.
- .7 Cove Base: Provide 150 mm (6") high cove base struck straight to provide line for wall finish.

### **3.4 CLEANING AND FINISHING**

- .1 Clean flooring areas after completion, using compatible solutions and methods as recommended by the manufacturer.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Provide labour, materials, tools and other equipment, services and supervision required to complete painting work for the new and repainting surfaces.
- .2 Surface preparation for this section will be limited to priming and back-priming, and specific pre-treatments noted in this section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.

**1.3 RELATED REQUIREMENTS**

- .1 Other sections of the specification requiring painting refer to this section. Coordinate requirements of referencing sections.

**1.4 DEFINITIONS**

- .1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows:

Gloss Level	Description	Gloss Units @ 60 Degrees	Sheen Units @ 85 Degrees
G1	Matte or Flat Finish	Max. 5	Max. 10
G2	Velvet Finish	Max. 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin Finish	20 to 35	Min. 35
G5	Semi-Gloss Finish	35 to 70	
G6	Gloss Finish	70 to 85	
G7	High-Gloss Finish	More than 85	

**1.5 SUBMITTALS**

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit list of all painting materials used for the Work to the Consultant for review prior to ordering materials for each paint system indicated, including block fillers and primers.
    - .1 Material List: An inclusive list of required coating materials indicating each material and cross reference specific coating, finish system, and application; identify each material by manufacturer's catalogue number and general classification.
    - .2 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
  - .2 Samples: Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application, and as follows:

- .1 Drawdown Samples: Provide three (3) drawdown sample charts (cards) for each type, texture and colour of finish specified for verification purposes before ordering paint materials.
- .3 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Certification: Submit certification reports for paint products indicating that they meet or exceed low VOC and coloured base requirements listed in this Section.

#### 1.6 PROJECT CLOSEOUT SUBMISSIONS

- .1 Operation and Maintenance Data: Submit copies of paint manufacturer's written maintenance information for inclusion in the operations manual in accordance with Section 01 33 00 – Submittal Procedures, including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.
- .2 Maintenance Materials: Deliver maintenance materials to Owner in quantities indicated and in accordance with Section 01 33 00 – Submittal Procedures, that match products installed; packaged with protective covering for storage, and identified with labels describing contents and building location and as follows:
  - .1 Paints and Coatings: Minimum of 4-4L containers of field colours and 4-1 L containers of each accent colour, and all remnants.

#### 1.7 QUALITY ASSURANCE

- .1 Conform to the standards contained in the MPI Manual.
- .2 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in service performance, and as follows:
  - .1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.
  - .2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.
  - .3 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:
  - .1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Conform to MPI Manual and manufacturers requirements.
- .2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.
- .3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.

- .5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.
- .6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.
- .7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

## **1.9 WARRANTY**

- .1 Special Warranty: Provide an MPI two (2) year guaranty, or a 100% two (2) year Maintenance Bond in accordance with MPI Manual requirements; painting subcontractors choosing the Maintenance Bond option must provide a maintenance bond consent from a reputable surety company licensed to do business in Canada as follows:
  - .1 Warrant that painting work has been performed in accordance with MPI Manual requirements.
  - .2 Provide a cash value to repair or replace defective coatings in the event that the original installer is not able to perform warranty work.

## **2 Products**

### **2.1 MANUFACTURERS**

- .1 Subject to compliance with requirements, manufacturers that have attained the prerequisites for ecologically sustainable labelling mark on their products and may be incorporated into the Work include; but are not limited to, the following:
  - .1 Sherwin-Williams LLC
  - .2 Benjamin Moore and Co. Limited
  - .3 ICI Paints (Canada) Inc.
  - .4 Para Paints
  - .5 PPG Canada Inc.- Architectural Finishes
  - .6 SICO Inc.

### **2.2 MATERIALS**

- .1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.
- .3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

### **2.3 FINISH AND COLORS**

- .1 The Consultant will issue a schedule indicating colours, gloss value and sheen. Colour may be selected from the lines of up to 3 manufacturers. A maximum of 6 base colours and 6 bright colours in differing gloss and sheen will be selected.
  - .1 Allow for a maximum of 3 colours on each wall in each room unless otherwise noted.



- .2 Where required by authorities having jurisdiction, finish exit and vestibule doors in contrasting color to walls and a different color than any other door in the same area.
- .3 Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels: To match adjacent surfaces, unless otherwise noted or where pre-finished.

### 3 Execution

#### 3.1 PREPARATION OF SURFACES:

- .1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

#### 3.2 APPLICATION

- .1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.
- .2 Paint surfaces requiring paint or stain finish to Premium MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.
- .3 Continue paint finishes through behind wall mounted items.
- .4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

#### 3.3 EXTERIOR SURFACES

- .1 Paint exterior surfaces in accordance with the MPI Manual painting systems listed in this section.
- .2 Finish exterior new and existing surfaces in accordance with MPI Painting Manual requirements:
- .3 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, gutters, flashing, etcetera):
  - .1 EXT 5.3L: Pigmented polyurethane semi gloss finish (over epoxy primer).

#### 3.4 INTERIOR SURFACES

- .1 Paint interior surfaces in accordance with the MPI Manual painting systems listed in this section.
- .2 Finish interior new and existing surfaces in accordance with MPI Painting Manual requirements:
- .3 Concrete Masonry Units (smooth and split face block and brick):
  - .1 INT 4.2D: High Performance Architectural Latex semi gloss coating.
- .4 Structural Steel and Metal Fabrications:
  - .1 INT 5.1G: Pigmented polyurethane semi gloss finish (over high-build epoxy).
- .5 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etcetera):
  - .1 INT 5.3D: Epoxy semi gloss finish (over epoxy primer).
- .6 Plaster and Gypsum Board (gypsum board, drywall, and other sheet gypsum materials):
  - .1 INT 9.2B: High performance architectural latex semi gloss finish.
- .7 Site Painting for Structural Steel: Interior acrylic polyurethane paint system:
  - .1 Structural Steel Members (Shop Primed).

- .1 Shop Priming: Surface preparation to SSPC SP6. One coat of organic zinc-rich epoxy primer Zinc Clad III HS B69A100 Series by Sherwin-Williams at 125 um (5 mils) DFT.
- .2 Site clean surface to SSPC SP2 or SP3. Touch up with shop primer.
- .3 One coat of semi-gloss acrylic polyurethane Acrolon 218 HS B65-650 Series by Sherwin-Williams at 152 um (6 mils) DFT.
- .2 Metal Deck.
  - .1 Surface preparation to SSPC SP1.
  - .2 One coat of water based wash primer DTM Wash Primer B71Y1 by Sherwin-Williams at (25 um (1 mil) DFT.
  - .3 One coat of semi-gloss acrylic polyurethane Acrolon 218 HS B65-650 Series by Sherwin-Williams at 152 um (6 mils) DFT.

### 3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

- .1 Paint "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
  - .1 In exposed-to-view exterior and interior areas.
  - .2 In interior high humidity interior areas.
  - .3 In boiler room, mechanical and electrical rooms.
- .2 Leave conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks in unfinished areas.
- .3 Paint inside of ductwork where visible behind louvers, grilles and diffusers beyond sight line with primer and one coat of matt black (non-reflecting) paint.
- .4 Paint the inside of light valances gloss white.
- .5 Refer to Mechanical and Electrical specifications for painting, banding, stencilling of other surfaces/equipment, and generally as follows:
  - .1 Paint gas piping gas standard yellow where visible in service spaces.
  - .2 Paint both sides and all edges of plywood backboards for equipment before installation.
  - .3 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
  - .4 Do not paint over nameplates.

### 3.6 SITE QUALITY CONTROL

- .1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 4' from the painted surface:
  - .1 Runs, sags, hiding or shadowing by inefficient application methods
  - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles
- .2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.
  - .1 Damage due to touching before paint is sufficiently dry or any other contributory cause.

- .2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
- .3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)
- .3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Owner or Consultant:
  - .1 Small affected areas may be touched up
  - .2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.
  - .3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

### 3.7 PROTECTION

- .1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.
- .2 Curing periods shall exceed the manufacturers recommended minimum time requirements.
- .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

### 3.8 CLEANUP

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Furnish all labour and materials necessary for the completion of work in this Section as shown on the Contract Drawings and specified herein.
- .2 Work in this Section includes but is not limited to:
  - .1 Solid Phenolic Toilet Partitions
  - .2 Hardware

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Submit shop drawings showing and describing in detail materials, finishes, dimensions, details of connections and fastenings elevations, plans, sections, thicknesses, hardware and any other pertinent information.
- .2 Samples:
  - .1 Submit necessary templates and instructions where supports or anchors have to be built-in by others.
  - .2 Submit one sample of each of the following:
    - .1 Hinge, latch, panel fitting.
    - .2 Corner section, 300mm x 300mm (12" x 12") showing colour, corner, edge and core construction.

**1.4 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.
- .2 Do not permit delivery of work to job site until building is sufficiently dry, wet trades are completed and the moisture readings of surfaces in proposed storage area is less than 18%.
- .3 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Store materials flat on level surface. Protect materials with suitable non-staining waterproof coverings, but allow for air circulation at sides.

**1.5 WARRANTY**

- .1 Warrant that the solid phenolic partitions and screens shall be free from defects in materials or workmanship in accordance with General Conditions for a period of ten (10) years and agree to promptly make good defects by replacing defective solid phenolic partitions and screens in finish to match original finish and in a manner satisfactory to Owner. Defects shall include, but not be limited to, bubbling, delamination of faces, or edges, warp, twist, bow exceeding 1/4" and telegraphing of core. "Replace" as used herein includes installing panels, pilasters, hardware, shoes including hanging and fitting doors.

2 Products

**2.1 MANUFACTURERS**

- .1 Basis-of-Design products are named in this Section; additional manufacturers offering similar solid phenolic toilet partition systems may be incorporated into the work provided they meet the performance requirements established by the named products.
- .2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 Floor Anchored Toilet Partitions:
    - .1 Solid Phenolic Core Partitions by Bradley Corp.
    - .2 Black Core Phenolic by ASI Global Partitions.
  - .2 Floor Anchored Privacy Partitions:
    - .1 Solid Phenolic Core 72" high door by Bradley Corp
    - .2 Phenolic Ultimate Privacy 72 by ASI Global Partitions.

## 2.2 MATERIALS

- .1 Solid Phenolic, Melamine Surfaced, Panels, Pilasters and Doors:
  - .1 Plastic Laminate Face Sheets: High pressure, paper based, melamine surfaced, laminated plastic sheets, conforming to CAN3-A172-M, with thickness tolerances in accordance with Table 1 of CAN3-A172-M and plastic laminate grades as follows:
    - .1 Cores: Solid phenolic type core material. Thicknesses as specified herein.
- .2 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.
- .3 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.
- .4 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.
- .5 Hardware and Fittings (Institutional):
  - .1 Hinges: 1.6 mm thick (16 gauge) x 2" wide continuous stainless steel piano hinge with 1/8" diameter stainless steel pin and extends full height of doors.
  - .2 Door Latches: 2 mm thick (14 gauge) stainless steel type slide type on nylon track. Provide "C" type pulls at compartments for handicapped.
  - .3 Door Keepers: 2.9 mm thick (11 gauge) stainless steel type.
  - .4 Coat Hooks: Stainless steel type with rubber bumper on end.
  - .5 Door Stops: 2.9 mm thick (11 gauge) stainless steel type designed to prevent the door from being kicked out of compartment.
  - .6 'U' Channels: 1.2 mm thick (18 gauge) continuous 'U' shaped stainless steel channel extending full height of panels and screens.
  - .7 Hardware Material and Finish: Stainless steel shall be AISI 18-8 type 304 alloy conforming to ASTM A167.
  - .8 Hardware Fasteners: Vandal resistant, torqs stainless steel machine screws installed from inside compartments. Door hardware shall also have factory installed threaded metal inserts in doors and pilasters.
  - .9 Provide reinforcement for washroom accessories as required to preserve integrity of partition panels and as required to ensure secure attachment of accessories.
  - .10 Top connection of pilaster for ceiling hung partitions shall consist of 19 mm (3/4") diameter threaded rods complete with spacer and nuts and a 3" die-formed stainless

steel pilaster shoe. Stainless steel shall be 0.6 mm (0.024") thick, AISI type 304 stainless steel alloy conforming to ASTM A167.

- .11 Install matching 19 mm (3/4") thick x 100 mm (4") wide overhead bracing between pilasters for reinforcing. Fasten with stainless steel plates and screws on the inside of each stall.

## 2.3 FINISHES

- .1 Toilet Partition Panel Colours:
  - .1 Colours, textures and manufacturers as indicated on drawings and schedules.
- .2 Stainless Steel:
  - .1 AISI No.4 brushed finish.

## 2.4 FABRICATION AND MANUFACTURE

- .1 Shop fabricate toilet partitions. Take site measurements for areas where partitions are to be located and fabricate to suit site dimensions.
- .2 Fabricate doors, panels and pilasters from solid phenolic core material with high pressure matte plastic laminate surfaces fused to core. Edges shall be "black". Stiles and doors shall have a finished thickness of 19 mm (3/4") thick. Panels shall be 13mm (1/2") thick.
- .3 Check sizes and locations for washroom accessories and if necessary, reinforce panels.
- .4 Prepare panels to accept tissue dispensers and grab bars where indicated on drawings.
- .5 Design supports to withstand, within acceptable deflection limitations, their own weight, the weight of the toilet partitions, loads imposed by the motion of partition doors and all live loads, which might be applied to the toilet partitions in the course of their normal function. Design supports as required to accommodate structural deflection. Build in reinforcing to support the grab bars and withstand a downward pull of 227 kg (500 lbs). at any point on the grab bar. Provide additional stainless steel brackets as required to stabilize pilasters to consultant's approval.

## 3 Execution

### 3.1 INSPECTION

- .1 Check areas scheduled to receive partitions and urinal screens for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of holding brackets.
- .2 Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.
- .3 Do not begin installation of partitions until conditions are satisfactory and agreement on details with the owners or contractors were well understood.

### 3.2 INSTALLATION

- .1 Install partitions and urinal screens in strict accordance with manufacturer's installation recommendations.
- .2 Install partitions and urinal screens plumb, level and securely fastened in the locations shown on the drawings.
- .3 Perform drilling of steel, masonry and concrete necessary to install the work of this Section.
- .4 Co-ordinate installation with the work of trades providing wall and floor finishes, washroom accessories and other adjacent partitions and constructions.



- .5 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.
- .6 Install hardware supplied under this Section and ensure that it is visually aligned.
- .7 Securely install panels to walls and pilasters with fittings to make a strong and rigid installation.
- .8 Locate wall channels so that holes for mounting occur in ceramic tile joints.
- .9 Install urinal screens to locations on walls as indicated on drawings, plumb, level and rigidly secured in place.
- .10 Install partitions allowing the following clearances and tolerances:
  - .1 Between panel edges and wall: 25 mm +3 mm (1" +1/8").
  - .2 Between partition panel edge and pilaster panel: 13 mm +3 mm (1/2" +1/8").
  - .3 Between pilaster panel edge and door edge: 5 mm +1.5 mm (3/16" +1/16"). Ensure that partitions are visually aligned from all view points.

### 3.3 ADJUSTMENT

- .1 Upon completion of the work or when directed, remove all traces of protective coating or paper, and polish compartments.
- .2 Test hinges, locks and latches and where necessary, adjust and lubricate. Set hinges so that doors stand open 30 deg when compartment is not in use. Ensure that compartments are in working order.

### 3.4 CLEANING

- .1 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replacing finishes or materials that cannot be satisfactorily cleaned.
- .2 Upon completion of the work, remove all debris, equipment and excess material resulting from the work of this Section from the site.

### END OF SECTION

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

**1.2 SUMMARY**

- .1 Furnish labour, materials and other services to complete the fabrication and installation of washroom accessories and framed mirrors, including attachment hardware.
- .2 Include all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

**1.3 SUBMITTALS**

- .1 Product Data: For each product, indicate manufacturers and product name, including installation requirements and instructions.
- .2 Shop Drawings: Show and describe in detail, materials, finishes, dimensions, details of connections and fastenings, elevations, plans, sections, metal gauges, hardware and any other pertinent information.
- .3 Coordinate the work of this Section with the placement of internal wall reinforcement.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store materials in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- .4 Unsatisfactory materials shall be removed from the site.
- .5 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of the Section.
- .6 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

2 Products

**2.1 MANUFACTURERS**

- .1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests for substitution.
- .2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 ASI Watrous - Global Partitions
  - .2 Bobrick
  - .3 Frost

- .4 Koala Kare
- .5 Dyson

## 2.2 MATERIALS

- .1 Provide one of the products indicated for each designation in the Washroom and Custodial Accessory Schedule below, subject to compliance with specified requirements.
- .2 Stainless Steel: In accordance with ASTM A666, Type 304, with No. 4 finish (satin); minimum nominal thickness as established by product type.
- .3 Sheet Steel: Steel: In accordance with ASTM A1008/A1008M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pretreatment as required for applied finish.
- .4 Galvanized Steel Sheet: In accordance with ASTM A653/A653M, minimum Z180 coating designation.
- .5 Galvanized Steel Mounting Devices: In accordance with ASTM A153/A153M, hot dip galvanized after fabrication.
- .6 Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

## 2.3 FABRICATION

- .1 Washroom and Custodial Accessories:
  - .1 Surface Mounted:
    - .1 Fabricate units with tight seams and joints, and exposed edges rolled.
    - .2 Hang doors and access panels with continuous stainless steel hinge.
    - .3 Provide concealed anchorage where possible.
  - .2 Recessed Mounted:
    - .1 Fabricate units of all welded construction, without mitred corners.
    - .2 Hang doors and access panels with full length, stainless steel hinge.
    - .3 Provide anchorage that is fully concealed when unit is closed.
- .2 Workmanship shall be best grade of modern shop practice known to recognized manufacturers specializing in this work. Joints and intersecting members shall be accurately fitted, made in true planes with adequate fastening. Wherever possible fastenings shall be concealed.
- .3 Isolate where necessary to prevent electrolysis between dissimilar metal to metal or metal to masonry or concrete contact.
- .4 Fabricate and erect work square, plumb, straight, true and accurately fitted. Provide adequate reinforcing and anchorage.
- .5 Drilling shall be reamed and exposed edges left clean and smooth.
- .6 Include anchors and fastenings necessary to anchor work of this Section.
- .7 Coordinate with Section 06 10 00 – Rough Carpentry, for wood blocking for attachment of washroom accessories.
- .8 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.



3 Execution

**3.1 EXAMINATION**

- .1 Inspect surfaces over which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this Section. The decision regarding corrective measures shall be obtained from the Consultant prior to proceeding with the affected work.
- .2 Commencement of work of this Section implies acceptance of surfaces and conditions.

**3.2 INSTALLATION**

- .1 Make thorough examination of drawings and details, determine the intent, extent, materials, conditions of interfacing with other work and be fully cognizant of requirements.
- .2 Work of this Section shall include complete installation of items specified herein. Installation shall be in strict accordance with manufacturer's printed instructions.
- .3 Securely fasten accessories, level and plumb in the locations shown on the drawings and specified herein. All fastenings shall be concealed.
- .4 Co-ordinate the work of this Section with the work of other Sections to provide the necessary recesses, edge conditions wood blocking for the accessories as required.
- .5 Do all drilling of steel, masonry and concrete necessary for the anchorage of the work.
- .6 Installed grab bars shall be capable of supporting a downward pull of 500 lbs. per lineal foot.

**3.3 ADJUSTING**

- .1 Check mechanisms, hinges, locks and latches, adjust and lubricate to ensure that accessories are in perfect working order.

**3.4 CLEANING**

- .1 Upon completion of the work of this Section or when directed by Consultant, remove all protective coatings, and coverings. Clean and polish exposed surfaces.

**3.5 WASHROOM AND CUSTODIAL ACCESSORY SCHEDULE**

No.	Description	Model
CH	Coat Hooks: Satin finished stainless steel, double hooks profiled with concealed mounting, provide 1 for each toilet stall and 2 for shower and locker area, located as directed by Consultant.	7345-S by ASI B-672 by Bobrick
CR	Coat Rack: Satin finished stainless steel, 610 mm (24") wide back plate with three hooks, hook project 75 mm (3") from wall and 163 mm (6.5") high, locate as indicated in the Drawing.	Interion 695714 by Global Industrial
FND	Feminine Napkin Disposal: Surface mounted, concealed fastening, self closing disposal opening with leak proof plastic receptacle and 10 disposable liners for initial stocking purposes for each unit.	0852 by ASI B-270 by Bobrick 622 by Frost
GB1	Grab Bar: Horizontal 1.2mm (0.048") thickness; 610mm (24") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-24P by ASI B-6806.99x24 by Bobrick
GB2	Grab Bar: Vertical 1.2mm (0.048") thickness; 765mm (30") long x 38mm (1-1/4") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-30P by ASI B-6806.99x30 by Bobrick

No.	Description	Model
GB3	Grab Bar: Horizontal 1.2mm (0.048") thickness; 1067mm (42") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-42P by ASI B-6806.99x42 by Bobrick
GB4	Grab Bar: Side "L"-shape grab bar, 760mm (30") long x 760mm (30") high 38mm (1-1/2") dia., stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3804P-Type04 by ASI B-6898.99 by Bobrick
RPTD	Paper Towel Dispenser and Disposal: Surface mounted, handicap accessible, capable of holding 600 C-fold or 800 multi-fold or 1100 single-fold paper towels, with leak proof waste container.	64676-9 by ASI B-380349 by Bobrick 400C by Frost
MR	Mirror (Flat): Framed, 910mm (36") high x 460mm (18") wide, fixed installation, mounted 1000mm (40") to bottom of frame.	0600-1836 by ASI B-290x1836 by Bobrick
TPD	Toilet Tissue Dispenser: Double roll, surface mounted, tissue dispenser with concealed mounting, stainless steel construction, bright polished finish with theft resistant spindles.	7305-2B by ASI B-6867 by Bobrick
SD2	Wall-Mounted Soap Dispenser: Heavy-duty all-purpose valve, wall-mounted stainless steel soap dispenser, 1.2L capacity with visible viewing window.	0347 by ASI B-2111 by Bobrick
JS	Janitor's Shelf complete with Mop and Broom Holders and Hooks: 864mm (34") long x 330mm (13") high x 200mm (8") deep. Shelf constructed of minimum 18-8 stainless steel, type 304, 18 gauge. Utility hooks fabricated of 2.9 mm (11 gauge) stainless steel, and mop holders fabricated of cadmium plated steel. Pivoting, spring-loaded serrated rubber cam shall hold round handles of 22mm to 32mm (7/8" to 1-1/4") dia.	1308-3 by ASI B-239 x 34 by Bobrick
SHC	Shower Curtain: Opaque, matte white vinyl, 0.2mm (.008") thick, containing antibacterial and flame retardant agents. Complete with grommets every 150mm (6"), and hemmed top, bottom and sides.	1200-V by ASI B-204-2 by Bobrick
SHCH	Shower Curtain Hook: Fabricated of type 304 stainless steel alloy 18-8, solid formed wire 2.5mm (0.98") in diameter. Hook shall accommodate 25mm to 32mm (1" to 1-1/4") diameter curtain rods.	1200-SHU by ASI B-204-1 by Bobrick
SHCR	Shower Curtain Rod: Extra-heavy duty rod, 32mm (1-1/4") diameter fabricated of alloy 18-8 stainless steel, type 304, 1.2mm (18 gauge). Flanges fabricated from 0.9mm (20 gauge) stainless steel. Satin Finish. Length: As determined on the Drawings.	1204 by ASI B-6047 by Bobrick
SHSD	Shower Soap Dish: Type 304 stainless steel, matte polished finish. Surface mount. Unit 108mm W x 102mm D (4.25" W x 4" D).	7320-S by ASI B-6807 by Bobrick
SHS	Shower Seat: Constructed of durable, water-resistant, ivory colored, 8mm (5/16") thick solid phenolic. Frame and mounting bracket are Type 304 stainless steel and self-locking mechanism. Supports up to 227 kg (500 lbs) when properly installed. Seat 560mm (22") wide, projects 400mm (15 13/16") from wall.	8203 Series by ASI B-5192 by Bobrick

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

- .1 Sections of Division 01 apply to this Section.
- .2 All references standards specified herein imply the latest edition of the standard.

1.2 SUMMARY

- .1 Supply and install facility fall protection system for maintenance work in roof areas and as indicated on Drawings.

1.3 QUALITY ASSURANCE

- .1 Installation and Design Responsibility: Work of this Section to be executed by a firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best modern shop and field practice known to recognized manufacturers specializing in this work.
- .2 Have work of this Section engineered by a professional engineer registered in the Province of the Work. Engineer work to Ministry of Labour requirements for facility fall protection systems. Be responsible for:
  - .1 Layouts and quantities, to requirements of the authorities having jurisdiction, and CSA-Z91.
  - .2 Co-ordination and ensure compatibility with building structure.
- .3 Obtain all necessary permits and approvals from the authorities having jurisdiction.
- .4 Installer Qualifications: Trained and approved by the manufacturer and having a minimum three years' experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.
- .5 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper procedures and schedules for adjusting, operating, troubleshooting, servicing, and maintaining the work.
- .6 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.
- .7 Manufacturer's Site Inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. Submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.
- .8 Source Limitations: Obtain each type of product from a single manufacturer.

1.4 SUBMITTALS

- .1 Shop Drawings: Bearing professional seal and signature of a professional engineer responsible for the engineering design of work of this Section. Show track profile, layout, materials, construction, and securement method to building structure.
- .2 Maintenance Manuals: Include complete written and illustrated instruction manuals relative to the care, adjustment and operation of all parts of the equipment, a complete description and listing of components, with recommended frequency of service and maintenance to ensure maximum efficiency, reliability and long life of the equipment.



- .3 Facility Fall Protection Reports: Include approved ceiling joist layout plan, anchor details, test reports, special liability insurance certificate, warranty certificate, and authorized Letter of Acceptance from the Ministry of Labour.
- .1 Special Liability Insurance: Currently dated and duly authorized certificate, indicating that the subcontractor has valid, special liability insurance policy in place to warranty the fabrication and installation of the work of this Section.

## 1.5 PROTECTION

- .1 Protect the structure and its finishes from damage due to installation, testing and operation of work of this Section.
- .2 Make good components or surfaces soiled or otherwise damaged in connection with the work of this section.

## 1.6 MAINTENANCE INSPECTIONS

- .1 Provide three (3) years of facility fall protection system maintenance inspections as part of the Contract, from the date of the Substantial Performance, at no additional cost to the Owner. Maintenance inspections shall include but not limited to load tests, structural inspection and weld inspections.

## 1.7 WARRANTY

- .1 Provide a written and signed warranty in the name of the Owner, that work of this Section shall be free of defects in materials, workmanship and installation for a period of three (3) years from the date of Substantial Performance of the Work.
- .2 Defects shall include but not be limited to:
  - .1 Weld failure.
  - .2 Excessive deformation of parts and components while under imposed loading.
  - .3 Metal fatigue.

## 2 Products

### 2.1 MATERIALS

- .1 Stainless Steel Plates, Round Bars and Flat Bars: Structural quality with  $F_y = 50,000$  psi.
- .2 Stainless Steel Sheet: 18 gauge, AISI type 304 stainless steel with No.4 finish.
- .3 Stainless Steel Plates: New stock (not weathered or rusted), to CAN/CSA-G40.21, Grade 300W. Hot-dip galvanize steel plates after fabrication to CAN/CSA-G164.
- .4 Galvanized Steel Sheet: Commercial quality, stretcher levelled, 6 mm (0.24") thick to ASTM A446 with minimized spangle zinc coating Z275 to ASTM A526.
- .5 Stainless Steel Welding Materials: CAN/CSA-W59. Use electrodes compatible with and of the same properties as the stainless steel.
- .6 Isolation Coating: Alkaline and acid resistant bituminous paint.
- .7 Stainless Steel Lock Washers and Hex Nuts: High strength AISI 300 or 400 Series austenitic grade stainless steel types.
- .8 Provide at each interior entry area leading to the roof, a reduced laminated as-build drawing showing anchor location, in accordance with requirements of Authorities having jurisdiction.
  - .1 Drawing shall be metal framed with clear polycarbonate scratch resistant cover and securely fasten to the wall.

## **2.2 ACCEPTABLE PRODUCTS**

- .1 Roof Guardrail System: Comply with building code, CSA Z259. Prefinished aluminium tubing guardrail assembly with counterweight base.
- .1 VSS Compact Roof Guardrail System by Delta Prevention.

## **3 Execution**

### **3.1 PREPARATION**

- .1 Examine work of other sections where such work influences the work of this Section and report unsuitable conditions to the Consultant.
- .2 Ensure surface where counterweights will be located must be free of all debris and allow sufficient adhesion to avoid sliding of the systems.
- .3 Have a qualified manufacturer's representative on site to direct and supervise the installation of materials which are installed by other trades.
- .4 Apply isolation coating of approximately 0.76 mm (30 mils) dry film thickness, or other suitable permanent separator on concealed contact surfaces of dissimilar materials, before assembly or installation where there is possibility of corrosive or electrolytic action with concrete, masonry, mortar, or steel.

### **3.2 INSTALLATION - EQUIPMENT**

- .1 Install work by the manufacturer or its authorized representative.
- .2 Install railing system in accordance to the manufacturer's installation guide and inspection criteria.
- .3 Install railings minimum 300 mm (12") offset from the edge of the roof.
- .4 Place railings at locations as indicated in the contract drawings.
- .5 Replace defective materials and components at no cost to the Owner.

**END OF SECTION**

**1** General

**1.1 GENERAL**

- .1 Design, manufacture, supply, installation, testing, and commissioning of fully operational 3 axis personnel pneumatic lifts, festooning system, and compressed air supply hose, for use in an abrasive blasting room , equipped with recirculating dust collection.
- .2 Coordination with all other trades as required.
- .3 The blasting operations include:
  - .1 Wet/vapour blasting (primarily)
    - .1 Compressed air driven equipment
      - .1 GRACO Ecoquip, or similar,
      - .2 Skid mounted unit, located at either end of the room.
      - .3 Blast hose on floor
    - .2 Using various media in water.
  - .2 Dry blasting (intermittently, but not at same time as wet blasting):
    - .1 Compressed air pressure pot, mounted on lift.
      - .1 Blast hose on floor.
    - .2 Using various media

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedure
- .2 Section 01 74 11 - Cleaning
- .3 Section 01 74 21 – Construction Demolition Waste Management and Disposal
- .4 Section 01 77 00 – Closeout Procedure
- .5 Section 01 78 00 – Closeout Submittals
- .6 Section 01 79 00 – Demonstration and Training
- .7 Section 05 12 23 – Structural Steel for Buildings

**1.3 REFERENCES**

- .1 Refer to the current versions of:
- .2 American Institute of Steel Construction (AISC):
  - .1 AISC 325 Steel Construction Manual, Thirteenth Edition.
- .3 American Society for Testing and Materials (ASTM):
  - .1 ASTM A325M, Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
  - .2 ASTM A563M, Specification for Carbon and Alloy Steel Nuts (Metric).
  - .3 ASTM-A668 – Specification for Steel Forging, Carbon & Alloy for General Industrial Use.
- .4 American Welding Society
- .5 Canadian Standards Association (CSA):



- .1 CSA Standard C22.1, Canadian Electrical Code.
- .2 CAN/CSA G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 CAN/CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members.
- .4 CSA-S136.1 Commentary on CSA Standard S136.
- .5 CSA W47.1, Certification of Companies for Fusion Welding
- .6 Steel Structures.
- .7 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
- .8 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.
- .6 Occupational Safety and Health Administration (USA)
  - .1 OSHA guideline 1910.212 – General requirements for Machine Guarding.
  - .2 OSHA guideline 1910.219 – General requirements for guarding safe use of mechanical power transmission apparatus.

#### 1.4 DESIGN RESPONSIBILITY

- .1 The lift and runway shall be designed by a Professional Engineer, registered in the State or Province of fabrication, with a minimum of 10 years of experience in the design of this type of equipment.
- .2 The Professional Engineer shall be responsible for establishing design requirements, compliance to applicable codes, standards and regulations, testing and commissioning of system and providing final certification of system.

#### 1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings shall include all the major systems including and not limited to the following information:
  - .1 General arrangement drawing showing:
    - .1 Overall layout in relation to the building
    - .2 Overall dimensions and clearances.
    - .3 Lift capacity.
    - .4 Lift reach coverage, including dimensions relative to the nearest building gridline(s).
    - .5 Runway and festooning arrangement.
  - .2 Total weights, wheel loads, reaction loads at structural connections.
  - .3 Compressed air schematic, and supply requirements.
  - .4 Bill of materials.
- .3 All structure related shop drawings shall be prepared and stamped by Professional Engineers of respective disciplines registered in the Province of Ontario.

#### 1.6 QUALIFICATIONS

- .1 Supplier, and Installing Contractor, and its personnel shall have a minimum five years of demonstrated experience in the related field of design, fabrication, installation, testing and certification of this type of equipment.

#### **1.7 QUALITY ASSURANCE**

- .1 Manufacturer's technical representatives shall supervise the installation, testing and commissioning of the respective equipment and components.

#### **1.8 DESIGN REQUIREMENTS**

- .1 Design lifts in accordance with the applicable standards and codes.
- .2 Design lifts to be capable of supporting and lifting the specified loads at any location along the runway.
- .3 Lift systems shall be designed to fit within the space allocated on the drawings.
- .4

#### **1.9 PRE-START HEALTH AND SAFETY:**

- .1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

#### **1.10 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.

### **2 Products**

#### **2.1 THREE AXIS PERSONNEL LIFTS**

- .1 Provide one (1) travelling 3 axis personnel lift system on each side of the room.
- .2 Approved for use in:
  - .1 Class 2 hazardous locations during dry blasting, and
  - .2 Locations subject to water spray and mist as may occur from the wet/vapour blasting process.
  - .3 Provide suitable protection for all components, including but not limited to mast, filter-regulator, controls,
- .3 Compressed air driven for all axes of motion.
- .4 Design to include means to minimize accumulation of dust on structures and especially on any moving/wearing parts.
- .5 Overall Dimensions:
  - .1 Retracted lateral dimension: maximum 48 inches (1200 mm) from wall
  - .2 Extended lateral extension: minimum 9 ft (2700 mm) from wall
  - .3 Vertical: minimum lifted platform floor height: 10 ft. (3000 mm)
  - .4 X-axis travel length travel to within 1 ft (300 mm) of end of room, or of pedestrian doors.
- .6 Lift Performance:
  - .1 X-Axis (along wall):
    - .1 Variable speed to approximately 40 ft./min. (11.5 metres per minute (mpm),
    - .2 Position holding brake.
  - .2 Y-Axis (perpendicular to wall):

- .1 Variable speed to 15 ft/min. (4.5 mpm) (approx.),
  - .2 Position holding brake to counteract blast hose forces.
- .3 Z-Axis (up/down):
  - .1 Variable speed to 15 ft/min. (4.5 mpm) (approx.),
  - .2 Air/hydraulic cabled lift system.
  - .3 Position holding brake
- .4 Shall perform as specified at 90 psig (620 kPa) minimum compressed air pressure.
- .7 Lift Assembly Guides and Support System:
  - .1 Refer to drawings.
  - .2 Floor based bottom support
  - .3 Wall/column mounted top rail support
    - .1 Include connection plates for connection to structural standoffs (by Structural discipline)
  - .4 Guide rails shall be within 12 in. (300 mm) of wall unless approved by ONTC.
- .8 Base and frame:
  - .1 Non sparking rail wheels with wheel sweeps for uncovered rails.
  - .2 Rubber or shock absorbing travel end stops.
  - .3 Sealed mast system, with service access covers
  - .4 Abrasive Blast Pressure pot support:
    - .1 Frame mounted (x-axis travel only on lift structure)
    - .2 Open bottom design.
    - .3 Pot retention system
      - .1 To allow direct top access for pot filling or removal.
    - .4 Suitable for pot with:
      - .1 Minimum diameter 20 in. (500 mm)
      - .2 Maximum weight: 600 lbs.(270 kg)
- .9 Platform:
  - .1 Capacity: minimum 500 lbs (225 kg).
  - .2 Access ladder/steps.
  - .3 Minimum 30 in. x 48 in. (450 mm x 1200 mm) floor size, with 4 in (100 mm) kick plate.
  - .4 Grating type floor
  - .5 Minimum 36 in. (900 mm) high guard rails with self closing self latching gates
  - .6 Factory fall protection tie-off location.
  - .7 Permanently mounted female quick disconnect outlets for:
    - .1 Compressed air, and
    - .2 Breathing air.
      - .1 Quick disconnect to match breathing air system specified products.



- .8 Hook system for blast hose support.
- .10 Lift Control System
  - .1 On board in-line Filter/Regulator/Lubricator, in closed cabinet, with access door.
  - .2 Forward facing operator controls on platform.
    - .1 X-axis foot control
    - .2 Y and Z-Axis hand control
    - .3 All with suitable means to prevent inadvertent control operation.
  - .3 Hand actuated Emergency stop
  - .4 Safety edge / bump strip on the 3 accessible sides of the platform to stop all travel in the event of contact with vertical or horizontal obstructions.
  - .5 Elimination of pinch points, by design or suitable protective means, including but not limited to guards, bellows, etc.
  - .6 Safety interlock to prevent operation if platform door is not closed and latched.
  - .7 Safety brake/hold mechanism for vertical travel with Emergency lowering.
  - .8 Auxiliary base mounted control to raise/lower platform.
  - .9 Release for manual Y axis retraction in case of air failure.
  - .10 X-axis holding brake to prevent creep when not travelling.
- .11 Air Festooning system:
  - .1 Overhead rigid track and wheeled dollies with hose saddles.
  - .2 Suitable for a minimum of 3 hoses with following inside diameters:
    - .1 One 1 in. (25mm)
    - .2 Two ¾ in (19mm).
  - .3 Designed for minimal festoon stackage/storage length.
  - .4 Complete with 1" (25mm) diameter rubber compressed air hose, approved for rated pressure and application.
- .12 Lift Compressed air supply:
  - .1 On-board distribution and connections from festoon supply hose to all air powered components and controls.
  - .2 Outlet on operator platform.
    - .1 Minimum 1/2 inch (13mm) supply
    - .2 Threaded end for suitable quick disconnect (by others)
- .13 Lift Breathing air supply:
  - .1 On-board breathing air distribution line on from top of lift to rear panel on operators platform.
  - .2 Threaded ends for connection to festooned Breathing air hose (top) and quick disconnect (bottom)
    - .1 Minimum 3/8 in. (9mm) interior diameter
- .14 Factory applied paint in manufacturer's standard colour for all exposed and non-wearing components.

- .15 Acceptable product suppliers:
  - .1 LPI
  - .2 Approved Equivalents.

## **2.2 MAINTENANCE AND SERVICING DESIGN**

- .1 Make all parts subject to servicing, adjustment or replacement by operating or maintenance personnel readily accessible. Design which renders servicing, adjustment or replacement unduly difficult under field conditions will not be acceptable.
- .2 Provide any special tools required for servicing or adjustment..
- .3 Plan manufacturing, delivery, installation, testing, commissioning and certification of crane systems to meet the approved construction schedule.
- .4 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

## **3 Execution**

### **3.1 INSTALLATION**

- .1 Install lift systems and festooning systems in accordance with manufacturer's recommendations, and in conformance with the requirements of all applicable codes, standards, specifications and regulations.
- .2 Provide all necessary material, labour, tools and equipment for the installation.
- .3 Ensure that installation is carried out within the tolerances specified in this Section, and applicable codes and standards.
- .4 Complete all necessary compressed air, and breathing air supply connections to building connection point.
- .5 Upon completion of installation, touch up and restore to new condition, damaged or defaced factory finished surfaces.
- .6 Remove protective coverings and clean exposed surfaces after completion.

### **3.2 TESTING, COMMISSIONING, CERTIFICATION AND TRAINING**

- .1 All equipment shall be operated through a complete travel and lift/lowering cycles:
  - .1 The equipment shall perform smoothly and safely.
- .2 All tests shall be carried out with the systems loaded at 125 percent of capacity.
- .3 Provide all necessary material, labour, tools and equipment required for all testing and commissioning.
- .4 Supplier shall provide the test weight loads.
  - .1 Test weights shall be of minimal size and clearly labelled.
- .5 Any defects shall be corrected by the Supplier without any expense to the Consultant.

### **3.3 TRAINING AND DEMONSTRATION**

- .1 Upon successful completion of testing and commissioning of lifts, after the delivery of all documentation (manuals, drawings, certificates, etc) and prior to issuance of Certificate of Completion, carry out equipment and system demonstration and training.
- .2 Demonstrate operations and maintenance of equipment and systems and provide training to Owner's operations and maintenance personnel.

- .3 Provide certified personnel to demonstrate operation of crane.
- .4 Provide Engineer a minimum of 7 days advance notice in writing of demonstration.
- .5 Prior to demonstration, submit project record documents and operating and maintenance manuals to the Engineer.
- .6 Instruct personnel (2 hours minimum allowance) in basic maintenance and use of the lifts

**END OF SECTION**



1 General

1.1 REFERENCES

- .1 Conform to Division 1, General Requirements

1.2 CODES, STANDARDS AND LAWS

- .1 All work shall be carried out in accordance with the applicable regulations of the following authoritative bodies, codes in effect at the time of Tender, and any other Authority having jurisdiction:
  - .1 Ontario Building Code
  - .2 Ontario Plumbing Code
  - .3 Fire Marshall
  - .4 Worker's Compensation Board
  - .5 Local Building By-Laws
  - .6 Canadian Standards Association
  - .7 CSA Gas Code B149.1
  - .8 CSA Mechanical Refrigeration Code B52
  - .9 Canadian Safety Standard (CSA):
    - .1 CAN/CSA C22.2.CAN/CSA C747, Energy Efficiency Test Methods for Small Motors.
    - .2 CAN/CSA C390, Test methods, marking requirements and energy efficiency levels for three-phase induction motors.
  - .10 Electrical Equipment Manufacturers' Association Council (EEMAC).
  - .11 Institute of Electrical and Electronic Engineers (IEEE).
    - .1 IEEE 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
  - .12 National Electrical Manufacturers Association (NEMA).

1.3 WORK STANDARDS

- .1 All Codes and Standards referred to in this Section are the latest edition of the Codes and Standards in effect at the time of tendering this Contract.
- .2 All mechanical piping system Work, including equipment, must comply in all respects with requirements of the Ontario Technical Standards and Safety Authority, and CSA Standards B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, fittings, valves, equipment, etc., must bear a CRN number.
- .3 All electrical items associated with mechanical equipment shall be CSA (or equivalent agency certified electrically), or bear a stamp to indicate special Electrical Safety Authority approval.

1.4 DEFINITIONS

- .1 The following are definitions of words found in Sections of Divisions 20, 22, and 23 and on associated Drawings:
  - .1 "Concealed" – means Work hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
  - .2 "Exposed" – means Work normally visible, including Work in equipment rooms and similar spaces.

- .3 "Provide" (and tenses of "provide") – means supply and install complete.
- .4 "Install" (and tenses of "install") – means install and connect complete.
- .5 "Supply" – means supply only.
- .6 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished.
- .2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the Specification Sections they are understood, unless otherwise defined in the Contract Documents, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the Drawings.
- .3 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the Specification Sections they are understood, unless otherwise defined in the Contract Documents, to mean that Work or product referred to is "approved by", "inspected by", etc., the Consultant.

## **1.5 WORKPLACE SAFETY**

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials.
- .2 Comply with all requirements of O.Reg 213/91, Construction Projects, enacted under the Occupational Health and Safety Act.

## **1.6 APPLICATION**

- .1 This Section specifies requirements, products, common criteria and characteristics, and methods and execution that are common to one or more Sections of Divisions 20, 22, and 23, and it is intended as a supplement to each Section and shall be read accordingly

## **1.7 PLANNING AND LAYOUT OF WORK**

- .1 The exact locations and routing of mechanical and electrical services shall be properly planned, coordinated and established with all affected trades prior to installation such that the services will clear each other as well as any obstructions. Generally, give the right-of-way to piping requiring uniform pitch and locate and arrange other services to suit.
- .2 All shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings, must be located for easy access for servicing and/or removal. Products which do not meet the location's requirements shall be relocated at no cost to the Owner.

## **1.8 DOCUMENTS**

- .1 The Contract Drawings are performance Drawings, diagrammatic, and show approximate locations for equipment and materials. The Drawings are intended to convey the scope of work and do not necessarily show architectural and structural details. The locations of materials and equipment shown may be altered (when revised layouts have been submitted and approved), to meet requirements of the material and/or equipment, other equipment and systems being installed, and of the building. Provide all fittings, offsets, transformations, and similar items required as a result of obstructions and other architectural or structural details but not shown on the Mechanical Drawings.

## **1.9 ACCEPTABLE PRODUCT MANUFACTURERS**

- .1 Products scheduled and/or specified on the Drawings and in the Sections of Divisions 22 and 23 have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, acceptable manufacturers are stated for any product specified by manufacturer's name and model number. The Contract price may be based on products supplied by any of the manufacturers named as acceptable for the particular product. If acceptable manufacturers are not stated for a particular product, base the Contract price on the products supplied by the specified manufacturers.

- .2 If products supplied by a manufacturer named as acceptable in any Section of Divisions 22 and 23 are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted product is equivalent in performance and operating characteristics (including energy consumption if applicable) to the specified product, and, it is to be understood that any additional costs, and changes to associated or adjacent Work resulting from provision of products supplied by a manufacturer other than the specified manufacturer is included in the Contract price. In addition, in equipment spaces where products named as acceptable are used in lieu of specified products and the dimensions of such products differ from the specified products, prepare and submit for review, accurately dimensioned layouts of rooms affected.

#### **1.10 SUBMITTALS**

- .1 Submit the following for review:
  - .1 Shop drawings for all products specified in this Section.
  - .2 Location drawings for all required sleeves and formed openings in new masonry walls.
  - .3 Samples of materials and any other items as specified in other Sections of this Division.
  - .4 WHMIS MSDS – Material Safety Data Sheets for all products where required, and maintain one copy at the site in a visible and accessible location and available to all personnel.
  - .5 A list of equipment identification nameplates indicating proposed wording and sizes.
  - .6 A list of pipe and duct identification colour coding and wording.
  - .7 A proposed valve tag chart and a list of proposed valve tag numbering and identification wording.
  - .8 A clean “reviewed” copy of each shop drawing for insertion into the O&M instruction manual.

#### **1.11 SHOP DRAWINGS**

- .1 The following shall be read in conjunction with the wording on the Consultant's shop drawing review stamp applied to each and every mechanical work shop drawing submitted:
  - .1 “This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of its responsibility for errors or omissions in the shop drawings or of its responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades/subcontractors.”

#### **1.12 OPERATING AND MAINTENANCE INSTRUCTION MANUALS**

- .1 The Contractor will prepare and submit for review to the Consultant one (1) copy of:
  - .1 Permits, inspection certificates, and the like,
  - .2 Shop drawings for all mechanical equipment,
  - .3 Pipe leakage test sheets, manufacturer's startup check sheets, and similar data,
  - .4 All required operating and maintenance instruction data,
  - .5 Valve tag charts,
  - .6 All other data specified in applicable Sections of Divisions 20, 22, and 23 of the Specification.
- .2 Each manual is to be organized into the following categories:



- .1 A - Project Directory
- .2 B - Warranty Letter
- .3 C - All applicable certifications letters
- .4 D - Plumbing and Drainage
- .5 F - Heating
- .6 G - Ventilation and Noise Attenuation
- .7 H – Process Equipment and Systems
- .8 I - Building Management System
- .3 The project directory is to contain the names, addresses, telephone and fax numbers of the Project Team, including:
  - .1 Owner,
  - .2 Architect,
  - .3 Mechanical Consultant,
  - .4 General Contractor,
  - .5 Mechanical Sub-contractors,
  - .6 Manufacturers and manufacturer's representatives.
- .4 Sections D to H are to be divided into the following subsections:
  - .1 Shop Drawings
  - .2 Operation Procedures
  - .3 Maintenance Procedures
  - .4 Spare Parts List
  - .5 Trouble Shooting Guide
  - .6 Valve Chart (where applicable)
  - .7 Equipment Lists
  - .8 Testing and Verification Forms
  - .9 Certification Forms
- .5 Section I is to be divided into subsections as follows:
  - .1 Shop Drawings
  - .2 As-Built Control Sequences
  - .3 As-Built Panel Layout and Points List
  - .4 All Point Log Per System
  - .5 Operating Procedures for all Equipment and Systems
  - .6 Maintenance Procedures for all Equipment
  - .7 Spare Parts List
  - .8 Software Licensing Agreements
  - .9 Software Manuals
  - .10 Software Disks
  - .11 Point Data and Program Disks

- .12 Testing and Verification Forms
- .6 The operating procedures are to be the manufacturer's recommended operating procedures for the equipment.
- .7 The maintenance procedures are to include Scope of Work, frequency of activity, parts required, and necessary documentation.
- .8 The spare parts list is to be the manufacturer's recommended list for maintenance purposes.
- .9 The trouble shooting guide is to be the manufacturer's recommendations for the equipment.
- .10 The equipment list is to include make, model, serial number, electrical characteristics, RPM, pump impeller sizes, fan belt and sheave sizes, as applicable.

#### 1.13 RECORD DRAWINGS

- .1 Submit record model and drawings identifying location of fire dampers, access doors and actual room names or numbers.
- .2 Piping Elevations:
  - .1 Water Lines: All water lines. Invert elevations to be given at each junction, changes of direction horizontally and vertically and at every 30m run as well as type of material used.
  - .2 Sanitary sewers and Storm sewers.
  - .3 Heating, and Plumbing Lines: All piping of any size. Invert elevations to be given at each junction, at change of direction, at high and low points.
- .3 All valve stations, trap stations, coils, dampers and ductwork not easily accessible.
- .4 All changes which affect the operation of the mechanical system.
- .5 At end of construction, the final set of PDFs shall be made available to the Owner and Consultant for review.
- .6 Location, tagging and numbering of all valves except individual plumbing fixtures or equipment isolation valves.
- .7 The as-built daily marked-up prints shall conform to the standards of the contract drawings and shall include all details from revision drawings, supplementary drawings, change orders, addenda and site revisions, etc. Provide controls as built drawings from controls contractor. Each white print drawing sheet shall be marked: "We hereby certify that these drawings represent the building, as built." with signatures immediately below of authorized personnel of the Contractor

#### 1.14 EQUIPMENT AND SYSTEM STARTUP AND COMMISSIONING

- .1 An independent Commissioning Agent ("Commissioning Agent") shall be retained by the Contractor to supervise the system and equipment startup and performance testing, to test and balance air and water flows, to make final adjustments to equipment and systems, to prepare operating and maintenance instruction manuals, to update CADD discs for record drawings, and to provide other associated services.
- .2 The work for the independent Commissioning Agent is specified in Section 20 08 00 - Commissioning. Carefully read Section 20 08 00 and provide for all labour to physically perform start-ups and performance testing, supply of equipment manufacturer's representatives and technicians on-site, services, etc., which are indicated as being supplied by the Contractor, including:
  - .1 Data and shop drawings for operation and maintenance manuals.
  - .2 Marked-up white print "record drawings" prepared on site during construction.
  - .3 All test data and certificates.

- .3 The majority of the Commissioning Work specified in Section 20 08 00 must be complete prior to application for Substantial Performance of the Work.

## 2 Products

### 2.1 PIPE SLEEVES

- .1 Minimum 1.6mm thick (16 ga) galvanized steel with an integral flange at one end to secure the sleeve to formwork construction.
- .2 Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.
- .3 Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at the sleeve midpoint.

### 2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than the fire resistance rating of surrounding construction.
- .2 Pipe insulation forming part of a ULC fire and smoke seal assembly is specified in Section 20 07 00.

### 2.3 WATERPROOFING SEAL MATERIALS

- .1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so that when the bolts are tightened the links expand to seal the opening watertight. The seal assemblies shall be selected to suit the pipe size and the sleeve size or wall opening size. Acceptable products are:
  - .1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S.
  - .2 The Metraflex Co. "MetraSeal" type ES.

### 2.4 PIPE ESCUTCHEON PLATES

- .1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with screws, each sized to cover the pipe sleeve or wall or slab opening, and to fit tightly around the pipe or pipe insulation.

### 2.5 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

- .1 For exposed fan blades, unless otherwise specified in the Contract Documents - removable 12 mm (0.5") galvanized steel wire mesh with galvanized steel frames.

### 2.6 COMMON ELECTRICAL REQUIREMENTS

- .1 Division 26 – Electrical, shall provide all line side power wiring for equipment provided by Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – HVAC and Division 25 – Integrated Automation, up to the respective motor control center and starters, also provided under Divisions 26.
- .2 Load side power wiring shall be under Divisions 21, 22 and 23. Divisions 21, 22 and 23 shall provide all local disconnect switches, control panels and VFD's for mechanical equipment as required.
- .3 Control wiring of local safeties and interlocks for packaged equipment shall be provided under the respective Sections unless otherwise specified in the Contract Documents.
- .4 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.



- .5 Check all wiring diagrams and control diagrams submitted in shop drawing form. Before submitting these shop drawings to the Consultant, submit these drawings to Division 26 - Electrical Contractor for approval. Have these drawings stamped by Division 26 - Electrical Contractor as verification of their approval before forwarding to the Consultant. Co-operate in the commissioning of all electrically driven equipment with Division 26 - Electrical.

## 2.7 COMMON MOTORS REQUIREMENTS

- .1 General:
  - .1 The efficiency of single phase motors to 0.746 kW (1 HP) is to be in accordance with CAN/CSA – C747. The efficiency of all three phase motors 0.746 kW (1 HP) and larger shall be equal to or exceed the NEMA Premium Efficiency designation as tested in accordance with CSA C390 or IEEE 112.
- .2 Motors:
  - .1 Unless otherwise specified in the Contract Documents, motors shall conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards.
  - .2 Vertically mounted and submersible motors shall be purposely designed for mounting in this attitude.
  - .3 Single Phase Motors: Unless otherwise specified in the Contract Documents, motors smaller than 0.373 kW (0.5 HP) shall be 115 volt, continuous duty capacitor start type with an EEMAC 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class “B” insulation, and a 1.15 service factor at 40°C (104°F) ambient temperature.
  - .4 Thermistor Protection: Motors 22.37 kW (30 HP) and larger, as scheduled in the Contract Drawings, shall be complete with a heat sensing Siemens PTC thermistor (or an approved equivalent) in the end turn of the stator winding for each phase and connected in series inside the motor with two marked leads brought out to the main motor conduit box.
- .3 Drive Guards and Accessories:
  - .1 For V-belt drives - removable, four sided, fully enclosed, galvanized sheet steel guards in accordance with OSHA standards, complete with 115 mm (4.5”) diameter tachometer openings covered with removable perforated galvanized plates at each shaft location.
  - .2 For flexible couplings - removable "U" shaped galvanized steel guards with a 2.3 mm (0.093”) thick frame and expanded mesh face.
  - .3 For exposed fan blades, unless otherwise specified in the Contract Documents, removable 12 mm (0.5”) galvanized steel wire mesh with galvanized steel frames.

## 3 Execution

### 3.1 INSTALLATION OF PIPE SLEEVES

- .1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:
- .2 In poured concrete slabs, unless otherwise specified in the Contract Documents: minimum 1.6 mm thick (16 ga) flanged galvanized steel or, where permitted by governing authorities, factory fabricated, plastic sleeves
- .3 In concrete or masonry walls: Schedule 40 galvanized steel pipe.
- .4 Sleeves in waterproofed slabs shall be lengths of Schedule 40 mild galvanized steel pipe in accordance with the Drawing detail. Provide waterproof sleeves in the following locations:
- .5 In mechanical room floor slabs, except where on grade.

- .6 In slabs over mechanical, fan, electrical and telephone equipment rooms or closets.
- .7 In all floors equipped with waterproof membranes.
- .8 In the roof.
- .9 Size sleeves, unless otherwise specified in the Contract Documents, to leave 12 mm ( $\frac{1}{2}$ ") clearance around the pipes, or where pipe is insulated, a 12 mm ( $\frac{1}{2}$ ") clearance around the pipe insulation.
- .10 Pack and seal the void between the pipe sleeves and the pipe or pipe insulation for the length of the sleeves as follows:
- .11 Pack sleeves in fire rated construction as specified in the article entitled "INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS".
- .12 Pack sleeves in non-fire rated interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound.
- .13 Pack sleeves in exterior walls above grade with mineral wool and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified in the Contract Documents.
- .14 Seal sleeves in exterior walls (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.
- .15 Sleeves in fire rated construction will be packed and sealed as part of the work of Division 7.
- .16 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.
- .17 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 100 mm (4") above the finished surface.
- .18 "Gang" type sleeving will not be permitted.
- .19 Where sleeves are provided for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of the sleeved opening.

### **3.2 INSTALLATION OF WATERPROOFING SEAL MATERIALS**

- .1 Provide watertight link type mechanical seals in exterior wall openings where shown and/or specified on the Drawings.
- .2 Assemble and install each mechanical seal in accordance with the manufacturer's instructions.
- .3 Periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until the seal is completely watertight.

### **3.3 DUCT OPENINGS**

- .1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.
- .2 Ensure that openings for fire dampers to 600 mm (24") high are sized to suit the damper arrangement with the folding blade out of the air stream.

### **3.4 SLEEVE AND FORMED OPENING LOCATION DRAWINGS**

- .1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.

- .2 Begin to prepare such drawings immediately upon notification of acceptance of Tender and award of Contract.

### 3.5 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIAL

- .1 Where mechanical Work penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal material installed in accordance with the ULC Firestop System requirements to seal holes and voids in the walls or slabs, as follows:
  - .1 Bare pipe or conduit through a floor with a circular sleeved or core drilled opening - ULC System SP115.
  - .2 Bare pipe or conduit through a floor with a rectangular cast or cut opening - ULC System SP116.
  - .3 Bare pipe or conduit through a wall with a circular sleeved or core drilled opening - ULC System SP114.
  - .4 Bare pipe or conduit through a wall with a rectangular cast or cut opening - ULC System SP107.
  - .5 Insulated pipe through a wall with a sleeved or core drilled circular opening - ULC System SP108.
  - .6 Insulated pipe through a wall with a rectangular cast or cut opening - ULC System SP107.
  - .7 Insulated pipe through a floor with a circular sleeved or core drilled opening - ULC System SP109.
  - .8 Insulated pipe through a floor with a rectangular cast or cut opening - ULC System SP116.
- .2 Note that the insulation for insulated piping penetrating fire rated construction is specified in Section 23 07 00 and is fire rated insulation with a vapour barrier jacket, ULC listed as a firestop component for use with ULC Systems SP107, SP108, SP109, and SP116.
- .3 At all fusible link damper locations in ductwork penetrating fire rated construction, seal the perimeter of the angle iron framing on both sides of the wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.

### 3.6 INSTALLATION OF PIPE ESCUTCHEON PLATES

- .1 Provide escutcheon plates suitable secured over all exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.
- .2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

### 3.7 INSTALLATION OF FASTENING AND SECURING HARDWARE

- .1 Provide all fastening and securing hardware required for mechanical Work to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.
- .2 Use fasteners compatible with the structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.
- .3 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure that is to support the



products. Provide reinforcing or connecting supports where required to distribute the loading to the structural components.

- .4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with the requirements of CSA Standards CAN3-Z166.1 and 2-M85.

### **3.8 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES**

- .1 Protect all exposed accessible rotating parts on all mechanical equipment with a guard.
- .2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

### **3.9 INTERRUPTIONS TO AND SHUT-DOWNS OF MECHANICAL SERVICES AND SYSTEMS**

- .1 Co-ordinate all shut-downs and interruptions to the existing mechanical systems. Generally, shut-downs may be performed only between the hours of 12:00 midnight Sunday until 6:00 a.m. Monday morning.
- .2 Upon award of the contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform the Owner in writing 72 hours in advance of the proposed shut-down or interruption and obtain written approval from the Owner to proceed. Do not shut-down or interrupt any system or service without such written approval.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible. Prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

### **3.10 EQUIPMENT BASES AND SUPPORT**

- .1 Unless otherwise specified in the Contract Documents, set all floor mounted equipment on 100 mm (4") high concrete housekeeping pads 100 mm (4") wider and longer than the equipment base dimensions.
- .2 Supply dimensioned drawings, equipment base templates and anchor bolts for proper setting and securing of equipment on pads, and be responsible for all required leveling, alignment, and grouting of the equipment.
- .3 For equipment not designed for base mounting, where required, provide prime coat painted structural steel stands flange bolted to housekeeping pads.
- .4 Provide prime coat painted structural black steel angle or channel frames and brackets for all surface wall mounted equipment not specifically designed for surface wall mounting, unless otherwise specified in the Contract Documents.

### **3.11 EXCAVATION AND BACKFILL WORK**

- .1 Excavation, backfill and related Work such as dewatering required for the mechanical Work will be performed as part of the Work of Division 2, except for final hand grading Work which is to be performed as part of the Work of Division 23.
- .2 Inverts and locations of existing site services have been shown on the Drawings. The inverts and locations shown are approximate, and it is your responsibility to confirm and satisfy yourself that the inverts and locations as shown are correct, prior to commencing site service Work.
- .3 Accurately mark-out the location and routing of excavation required for the work of this Section, as well as the required depth.
- .4 Ensure that all underground piping subject to freezing and located outside the building has a minimum of 1.5 m of cover.
- .5 Ensure that all underground piping subject to freezing and located inside the building in unheated areas has a minimum of 450 mm of cover.

- .6 Ensure that pipe bedding is proper prior to laying pipes. Hand excavate under pipe hubs, couplings, flanges and similar items to ensure even bearing along the entire barrel of each length of pipe.
- .7 Ensure that piping is inspected, leakage tested and approved prior to backfilling. Supervise the initial backfilling operation to ensure that the buried Work is not disturbed.

### **3.12 PACKING AND SEALING CORE DRILLED PIPE OPENINGS**

- .1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:
  - .1 Pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal.
  - .2 Pack and seal openings in fire rated walls and slabs as specified in this Section.
  - .3 Pack and seal openings in exterior walls with mechanical link type waterproofing seal materials specified in PART 2 of this Section.

### **3.13 HOISTS AND SCAFFOLDS**

- .1 Provide interior movable or roller scaffolds for the installation of the mechanical work.

### **3.14 ACCESS OF EQUIPMENT**

- .1 Make all arrangements to ensure that access into the building is available for all mechanical equipment. Do all hoisting and rigging into place of all specified equipment and be responsible for any damages incurred.

### **3.15 EQUIPMENT PROTECTION AND CLEAN-UP**

- .1 Protect equipment and material in storage on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.
- .5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

### **3.16 TEMPORARY OR TRIAL USAGE**

- .1 Temporary or trial usage by the Owner of mechanical equipment supplied under contract shall not represent acceptance.
- .2 Repair or replace permanent equipment used temporarily.
- .3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

### **3.17 SEMI-FINAL AND FINAL INSPECTIONS**

- .1 Perform the following items prior to semi-final inspection:
  - .1 Make heating and air conditioning systems capable of operation with automatic controls in operation generally, but not necessarily finally calibrated.
  - .2 Make necessary tests on equipment including those required by authorities having jurisdiction. Obtain certificates of approval.

- .3 Rough balance air systems.
- .4 Completely identify equipment so as to be clearly visible.
- .5 Lubricate equipment as per manufacturer's data.
- .6 Mail warranty forms to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.
- .7 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.
- .8 Review and ensure access doors are suitably located and of correct type and equipment is easily accessible including plumbing cleanouts.
- .9 Clean fan plenums, remove temporary filters and install permanent filters.
- .10 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.
- .2 Prior to semi-final inspection, provide complete list of items which are deficient at the time of the semi-final inspection.
- .3 Provide declaration in writing that deficiencies noted at time of semi-final inspection have been corrected and the following items completed prior to the final inspection:
  - .1 Clean equipment both inside and out and lubricate.
  - .2 Clean plumbing fixtures and brass.
  - .3 Complete final balancing.
  - .4 Submit rough data of balance reports.
  - .5 Complete final calibration.

### **3.18 SUBSTANTIAL COMPLETION INSPECTION**

- .1 Prior to the Contractor requesting an inspection for substantial completion all the following items must be provided to permit beneficial use by the Owner.
  - .1 Maintenance and Operating Manuals to be submitted and approved.
  - .2 Record drawings.
  - .3 Air balancing reports.
  - .4 All motor name plate ratings and actual operating amps and voltages.
  - .5 All systems shall be certified in writing by the Contractor as complete and fully operational.
  - .6 Instructions to the Owner's operating personnel shall be provided in accordance with the specifications. A signed statement to this effect, countersigned by the Owner, shall be submitted to the Architect.
  - .7 A complete list of items which the Contractor has not finished, or are deficient shall be provided. If, in the opinion of the Engineer, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.
  - .8 The Contractor shall be fully responsible to accumulate all necessary data from this Sub-trades and suppliers and present same in the specified format for the approval by the Engineer.

### **3.19 INSTRUCTIONS TO OWNER**

- .1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment specified in this Division.



- .2 Arrange and pay for the services at the site of qualified technicians and other manufacturer's representatives to instruct on specialized portions of the installation.
- .3 Submit, prior to issue of a Certificate of Substantial Performance, a complete list of systems for which instructions were given to the Owner, stating for each system:
  - .1 Date instructions were given to the Owner's staff;
  - .2 Duration of instruction;
  - .3 Names of persons instructed;
  - .4 Other parties present (manufacturer's representatives, etc.).
- .4 Obtain the signatures of the Owner's staff to verify that they properly understood the system installation, operation and maintenance requirements and have received operating and maintenance manuals and record Drawings.

### **3.20 COMMON MOTOR REQUIREMENTS**

- .1 Manufacturer's Instructions:
  - .1 Compliance: comply with Manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Installation of Equipment Drive Guards and Accessories:
  - .1 Protect all exposed accessible rotating parts on all mechanical equipment with a guard.
  - .2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 This Section covers the work of designing, fabrication and installation of pipe support systems for process and building mechanical piping systems unless the pipe support has been detailed elsewhere in the Contract Documents.

**1.2 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 20 05 48 – Vibration & Noise Control.
- .3 Section 22 11 19 – Domestic Water Piping.
- .4 Section 22 11 20 – Drainage, Waste and Venting Piping.
- .5 Section 23 31 00 – HVAC Ducts, Plenums.
- .6 Section 23 57 19 – Hydronic Piping.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
- .2 Manufacturers Standardization Society
  - .1 ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Applications and Installation.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 ANSI/SMACNA 006, HVAC Duct Construction Standards - Metal and Flexible
- .4 National Building Code of Canada (NBC)
- .5 Ontario Building Code 2012 (OBC)

**1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.
- .2 Shop Drawings:
  - .1 The Contractor shall submit shop drawings and design calculations showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall be sealed and signed by a professional engineer licensed to practice in the Province of Ontario.
  - .2 The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the project Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
  - .3 The drawings shall identify each support, hanger, guide, and anchor type by catalogue number and Shop Drawing detail number. No anchor points shall be permitted without reviewed shop drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

- .4 Metal Framing Support Systems: Detailed installation drawings, catalogue information, and complete component specifications.
- .3 Information Submittals: Maintenance information on the piping support system.

## 1.5 DESIGN REQUIREMENTS

- .1 General:
  - .1 Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.
  - .2 Hangers, supports, anchors, guides, and restraints shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment.
  - .3 The piping support design shall meet the requirements of ANSI/MSS SP-58, "Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Applications and Installation" or as modified by this Section.
  - .4 Revisions to support systems resulting from changes in the related piping system layout or by the addition other piping accessories (eg. flexible joints) as may occur during the execution of the Work, and shall be included in the Contractor's design.
- .2 Pipe Support Systems:
  - .1 The Contractor shall select and design within the spans and component requirements specified in the Contract Documents.
  - .2 Generally, the piping supports specified to be designed, supplied and installed by the Contractor are not shown on the Contract Drawings. The absence of pipe supports and details on the Contract Drawings shall not relieve the Contractor of its responsibility for sizing and providing supports.
  - .3 Criteria for Structural Design and Selection of Pipe Support System Components:
    - .1 Dead loads imposed by the weight of the pipes filled with water, except air and gas pipes within the specified spans and component requirements, plus any insulation.
    - .2 Safety Factor for drilled-in Concrete Anchors (for example, Hilti type anchors): Minimum of 5.
  - .4 The Contractor shall design, size, and space support anchoring devices, including lateral supports, anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
  - .5 Any modification to the piping, including the addition of flexible joints where not shown on the Contract Drawings, shall require the review and approval of the support system by the Consultant.
  - .6 Steel Framing Support System:
    - .1 Bending Members: Size such that beam stress does not exceed allowable stresses in accordance with the requirements of the OBC and maximum deflection does not exceed 1/240 of span.
    - .2 Compression Members: Size in accordance with the manufacturer's recommended method.
    - .3 Support Loads: Calculate using weight of pipes filled with water.
- .3 Pipe Support Spacing:



- .1 Vertical Supports: Stainless steel, mild steel, ductile iron, cast iron and copper piping (Note that this spacing may require the use of higher load pipe clamps and more than a single point anchor point in concrete).
- .1 Unless otherwise specified or shown maximum pipe support spacing shall be in accordance with Table 4 in MSS SP-58 or the table below:

Table 1: Maximum Horizontal Pipe Hanger Spacing

Pipe Diameter		Max. Spacing Stainless Steel, Mild Steel & Ductile Iron		Max. Spacing Cast Iron		Max. Spacing Copper	
mm	in.	meters	feet	meters	feet	meters	feet
to 25	to 1	2.1	7	2.1	7	1.5	5
32 to 40	1¼ to 1½	2.1	7	2.1	7	1.8	6
50 to 100	2 to 4	3.0	10	3.0	10	2.4	8
150 to 250	6 to 10	4.2	14	3.0	10	3.6	12
250 & up	10 & up	Spaced as required by the Contractor's design calculations					

- .2 Support pipe at changes in direction or elevation and adjacent to flexible joints, couplings, fittings, and valves within 610mm (24 in.) on each side on pipes over 40mm (1½ in.) diameter.
- .2 Lateral Supports: Tie-rods in two directions or combined tension/compression members.
- .3 Plastic and Fibreglass Piping:
  - .1 Maximum support spacing: As recommended by the manufacturer for the flow temperature in pipe.
  - .2 Minimum Hanger Rod Sizing: Same as listed for copper pipe.
- .4 Pipe Support Hanger Rods: Galvanized steel (unless otherwise specified in the Contract Documents), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58 or the table below. When supporting multiple pipe runs rod size to be in accordance with the Contractor's design:

Table 2: Minimum Rod Diameters for Single Rigid Rod Hangers

Pipe Diameter		Hanger Rod Diameter	
mm	in.	mm	in.
to 50	to 2	9mm	3/8
65 to 75	2½ to 3	12mm	1/2
100	4	16mm	5/8
150	6	19mm	3/4
200 to 300	8 to 12	22mm	7/8

- .5 Thrust Restraint:
  - .1 Thrust Blocks and Ties: For specified piping systems, thrust blocks, and ties at pipe joints, which are unable to transmit thrust forces, may be shown on the Contract Drawings.
  - .2 Piping systems shall be analyzed and designed by a professional engineer licensed to practice in the Province of Ontario, engaged by and paid by the Contractor. Such piping systems shall be provided with thrust blocks, ties and/or other restraint systems as required to resist all internal and external forces on the piping system. The Contractor-provided design shall provide as part of the shop drawing submittal process information on lateral deflection, axial strain and any resulting unbalanced forces on equipment or connecting piping systems.

.6 Duct Support Spacing:

- .1 Unless otherwise specified or shown maximum duct support spacing and hanger construction shall be in accordance with Chapter 5 of SMACNA or the table below:

Table 3: Maximum Horizontal Duct Hanger Spacing

Duct Dimension	Hanger Construction
<b>Horizontal rectangular duct</b>	
Up to 1500 mm (60 in.) for Low Pressure Ductwork Only	Two 25 mm (1 in.) x 16 US gauge straps with two screws on side of duct one screw on bottom. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
For all sizes of Medium and High Pressure Ductwork up to 3000 mm (120 in.) and Low Pressure Ductwork from 1525 mm to 3000 mm (61 in. to 120 in.)	50 mm x 50 mm x 6 mm (2 in. x 2 in. x 1/4 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
3000 mm to 6000 mm (120 in. to 240 in.)	65 mm x 65 mm x 5 mm (2-1/2 in. x 2-1/2 in. x 3/16 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 1200 mm (48 in.) on centres.
<b>Horizontal round duct</b>	
Up to 450 mm (18 in.)	One 25 mm (1 in.) x 16 US gauge hanger ring supported from one 25 mm (1 in.) x 16 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
475 mm to 900 mm (19 in. to 36 in.)	One 25 mm (1 in.) x 12 US gauge hanger ring supported from 25 mm (1 in.) x 12 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
925 mm to 1250 mm (37 in. to 50 in.)	One 25 mm (1 in.) x 12 US gauge hanger ring supported from 25 mm (1 in.) x 12 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
1275 mm to 2100 mm (51 in. to 84 in.)	Two 40 mm (1-1/2 in.) x 12 US gauge hanger connected to the 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) angle girth reinforcing of duct hanger. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.

- .2 Support all vertical ducts at each floor, on all sides, with angle riveted to the ducts.
- .3 Support all horizontal ducts within 610mm (24 in.) of each elbow and within 1200mm (48in.) of each branch intersection.
- .4 Flexible duct lengths greater than 2,400 mm (84 in.) shall be supported at the midpoint with strap hangers.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

## 2 Products

### 2.1 GENERAL

- .1 Pipe hanger and support materials, including accessories, shall be, unless otherwise specified in the Contract Documents, constructed in accordance with the MSS Standard Practice Manual SP-58, "Pipe Hangers and Supports – Materials, Design and Manufacture", and, where possible, MSS designations are indicated with each product.
- .2 Ductwork hanger and support materials, including accessories, shall be, unless otherwise specified in the Contract Documents, constructed in accordance with the SMACNA, "HVAC Duct Construction Standards".
- .3 All pipe hangers and exposed ductwork hangers shall be zinc plated unless otherwise noted in the Contract Documents.
- .4 Hangers and supports for insulated piping and ductwork shall be sized to fit around the insulation and covering.
- .5 All pipe hangers and supports shall be manufactured to the latest requirements of MSS-SP-58. Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME Code for Pressure Piping B31.1
- .6 When specified proprietary pipe support items are not available, fabricate pipe supports of the specified material and to the general configuration indicated by the Contract Drawings.
- .7 Special support and hanger details as designed by the Contractor may be used for cases where standard catalogue supports are inapplicable or impractical.

### 2.2 HORIZONTAL SUSPENDED PIPING

- .1 Adjustable Clevis Type: MSS SP 58, Type 1.
  - .1 Anvil International Inc.; Fig. 260
  - .2 Cooper B Line Inc.; Fig. B3102
- .2 Adjustable Split Ring Pipe Clamp: MSS SP 58, Type 6 or 12.
  - .1 Anvil International Inc.; Fig. 104
  - .2 Cooper B Line Inc.; Fig. B3198H
- .3 Adjustable Swivel Ring Band: MSS SP 58, Type 10
  - .1 Anvil International Inc.; Fig. 69
  - .2 Cooper B Line Inc.; Fig. B3170
- .4 Adjustable Roller Hanger c/w Steel Protection Saddle: MSS SP 58, Type 41, 43 or 45 c/w Type 39
  - .1 Anvil International Inc.; Fig. 171, 177 or 181 c/w Figure 160 to 166A
- .5 Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.
- .6 See section 2.3 "Trapeze Support System"

### 2.3 TRAPEZE TYPE SUPPORT SYSTEMS



- .1 Trapeze Hanger/Support: MSS SP 58, Type 59
- .2 Channel Size: As designed by contractor. Minimum 12 gauge, 1 5/8 inch wide steel. Minimum 1 1/2 inch wide FRP.
- .3 Members and Connections: Design for all loads with safety factor of 5.
- .4 Pipe Anchors Type: Galvanized steel anchor chair with U bolt strap.
- .5 Manufacturers:
  - .1 Anvil International Inc.; Power Strut.
  - .2 Cooper B Line Inc.; Strut System.
  - .3 Unistrut Corporation.
  - .4 TYCO Inc. - Aickenstrut (FRP).
  - .5 Gripple Inc.

#### **2.4 HORIZONTAL PIPE ON VERTICAL SURFACES:**

- .1 Steel offset pipe clamp:
  - .1 Anvil International Inc.; Fig. 103
  - .2 E. Myatt & Co. Inc. Fig. 170
- .2 J-Hanger, MSS SP 58, Type 5:
  - .1 Anvil International Inc.; Fig. 262
  - .2 Cooper B Line Inc.; Fig. B3690
- .3 See section 2.5 "Wall Brackets"

#### **2.5 WALL BRACKETS**

- .1 Welded Steel Bracket: MSS SP 58 and SP 69, Type 33 (heavy-duty).
  - .1 Anvil International Inc.; Fig. 199
  - .2 Cooper B Line Inc.; Fig. B3067
- .2 Pipe Anchors Type: Galvanized steel anchor chair with U bolt strap.
- .3 One Hole Clamp: Anvil International Inc.; Figure 126.
- .4 Channel Type:
  - .1 Unistrut Corporation.
  - .2 Anvil International Inc.; Power Strut.
  - .3 Cooper B Line Inc.; Strut System.
  - .4 TYCO Inc. - Aickenstrut (FRP).
  - .5 Gripple Inc.

#### **2.6 VERTICAL RISERS THROUGH FLOORS:**

- .1 Riser clamp, MSS SP 58, Type 8:
  - .1 Anvil International Inc.; Fig 121,
  - .2 E. Myatt & Co. Inc. Fig. 151
- .2 Heavy-duty steel riser clamp MSS SP 58, Type 8:
  - .1 Anvil International Inc.; Fig. 261
  - .2 E. Myatt & Co. Inc.; Fig's. 182,183, 190 and 191

- .3 Base of Vertical Risers: Support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment shall consist of a base elbow support with flange Empire Tool & Mfg. Co. Fig. 830 or approved equivalent.

## 2.7 VERTICAL PIPING ON VERTICAL SURFACES:

- .1 Adjustable Split Ring Pipe Clamp: MSS SP 58, Type 6 or 12.
  - .1 Anvil International Inc.; Fig. 104
  - .2 Cooper B Line Inc.; Fig. B3198H
- .2 Steel offset pipe clamp:
  - .1 Anvil International Inc.; Fig. 103
  - .2 E. Myatt & Co. Inc. Fig. 170
- .3 Heavy-duty steel pipe strap: MSS Type 26
  - .1 Anvil International Inc.; Fig. 262
  - .2 E. Myatt & Co.; Fig. 161

## 2.8 PIPE GUIDES

- .1 Intermediate Guides:
  - .1 Piping 150 mm and Smaller: Specify the use of pipe clamp with oversize pipe sleeve to provide a minimum of 3 mm of clearance.
    - .1 Manufacturers:
      - .1 Kin Line, Inc., Figure 417.
      - .2 Grinnell (division of Tyco Fire Products LP): Power Strut, Figure P5932.
  - .2 Piping 200 mm and Larger: Specially formed U bolts with double nuts to provide a minimum clearance of 6 mm around pipe.
    - .1 U Bolt Stock Size:
      - .1 200 mm Pipe: 16 mm U bolt.
      - .2 250 mm Pipe: 400 mm U bolt.
      - .3 300 through 400 mm Pipe: 22 mm U bolt.
      - .4 450 through 760 mm Pipe: 25 mm U bolt.
- .2 Alignment Guides:
  - .1 Piping 200 mm and Smaller: Galvanized steel spider or sleeve type.
  - .2 Piping 250 mm and Larger: Galvanized roller type guides.
  - .3 Manufacturers:
    - .1 Vibrant Power Inc.
    - .2 Senior Flexonics Canada Ltd.
    - .3 Kin-Line Inc.

## 2.9 THERMAL BREAKS

- .1 All insulated piping shall be provided with a continuous thermal break between the outer pipe diameter and the pipe hanger/support.
- .2 Calcium silicate (or approved equivalent high density insulation) pre-insulated support shield c/w galvanized steel jacket.

- .3 Manufacturers:
  - .1 Cooper B Line Inc.; B3380 thru B3387
  - .2 National Pipe Hanger Corp.; Pro-Shield

## 2.10 ACCESSORIES

- .1 I-Beam Clamp: Concentric loading type, MSS SP 58, Type 21, 28, 29, or 30, which engage both sides of flange.
- .2 Concrete Insert: MSS SP 58, Type 18, continuous channel insert with load rating not less than that of the hanger rod it supports.
- .3 Concrete Anchors: Hilti (Canada) Co. type HIT or HSL anchors of size and numbers to resist the design loads based on a Factor of Safety (FOS) of 5.
- .4 All fasteners to be sized by the equipment manufacturer.
- .5 Insulation Saddle:
  - .1 Type: Galvanized steel or stainless steel, MSS SP 58 and SP 69, Type 40.
  - .2 Manufacturers and Products:
    - .1 Anvil International Inc.; Figure 167.
    - .2 Cooper B Line Inc.; Figure B3151.

## 2.11 SPECIAL HANGERS AND SUPPORTS:

- .1 **Vibration isolated supports** – Black steel riser clamps as specified above, complete with vibration isolation pads Vibro-Acoustics Ltd. type “NSN” between the clamp and the floor or approved equivalent.
- .2 **For groups of pipes having the same slope** – Welded steel brackets Anvil Fig. 195 or approved equivalent, universal trapeze assemblies Anvil Fig. 46, or Unistrut Corporation or approved equivalent assemblies, all with U-bolts, clamps, etc., to secure pipes in place. For pipes 150 mm (6”) and greater Anvil Fig. AS 911 pipe roller with Anvil Fig. 160 to 166A – MSS SP 58, Type 39 steel protection saddle or approved equivalent.
- .3 **For sections of piping connected to vibration isolated equipment** – hangers and supports as specified above but complete with MSS SP 58, Type 48 spring cushions.
- .4 **For plastic piping** – generally as specified above but in accordance with the pipe manufacturer's printed recommendations.
- .5 **For bare copper piping** – generally as specified above but factory vinyl coated to prevent contact between the pipe and hanger.

## 3 Execution

### 3.1 INSTALLATION OF PIPING SUPPORTS

- .1 General:
  - .1 Install pipe support systems in accordance with MSS SP 58, unless shown otherwise on the Contract Drawings.
  - .2 Support piping connections to equipment by pipe support and not by the equipment.
  - .3 Support large or heavy valves, fittings, and appurtenances independently of connected piping.
  - .4 No pipe shall be supported by any other pipe located above, below or beside it.
  - .5 Do not install pipe supports and hangers in equipment access areas or bridge crane runs.



- .6 Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.
- .7 Install sway prevention bracing for all suspended piping in accordance with the requirements of OBC.
- .8 All drilling for hangers, rod inserts and work of similar nature shall be done by Mechanical Division.
- .9 Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
- .10 Repair mounting surfaces to their original condition after attachments are made.
- .11 Install concrete anchors in accordance with the Manufacturer's printed instructions.
- .12 Install resilient hangers in accordance with Section 20 05 48 – Vibration & Noise Control.
- .2 Standard Pipe Supports:
  - .1 Horizontal Suspended Piping:
    - .1 Single Pipes: Adjustable swivel ring, split ring, or clevis hangers.
    - .2 Grouped Pipes: Trapeze hanger systems.
    - .3 Furnish galvanized steel protection shield and oversized hangers for insulated pipe.
    - .4 Furnish precut sections of rigid insulation with vapor barrier at hangers for insulated pipe.
  - .2 Horizontal Piping Supported From Vertical Surface:
    - .1 Single Pipes: Wall brackets or J-Hangers attached to wall with anchors. Clamps attached to wall mounted framing are also acceptable.
    - .2 Stacked Piping:
      - .1 Wall mounted framing system and clamps acceptable for piping smaller than 75 mm minimal diameter.
      - .2 Piping clamps that resist axial movement of pipe through support are not acceptable.
    - .3 Wall mounted piping clamps are not acceptable for insulated piping.
    - .4 Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.
    - .5 Standard Attachments:
      - .1 To Concrete Ceilings: Concrete anchors.
      - .2 To Steel Beams: I beam clamp or welded attachments.
      - .3 To Wooden Beams: Lag screws and angle clips to members a minimum of 62.5 mm thick.
      - .4 To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
- .3 Intermediate and Pipe Alignment Guides:
  - .1 Provide pipe alignment guides (or pipe supports that provide same function) at expansion joints and loops.
  - .2 Guide piping on each side of expansion joint or loop at 4 and 14 pipe diameters from each joint or loop.

- .3 Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.
- .4 Accessories:
  - .1 Insulation Shield: Install on insulated piping. Oversize rollers and supports.
  - .2 Welding Insulation Saddle: Install on insulated steel pipe. Oversize rollers and supports.
  - .3 Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.
    - .1 Dielectric Barrier: 6.4 mm by 75 mm neoprene rubber wrap, oversize clamps
    - .2 Where factory applied electrical isolation between carbon steel members and copper is not possible wrap pipe with neoprene strip at hanger
    - .3 Install neoprene between stainless steel supports and non-stainless steel ferrous metal piping.

### 3.2 INSTALLATION OF DUCT SUPPORTS

- .1 All drilling for hangers, rod inserts and work of similar nature shall be done by Mechanical Division.
- .2 Hang all ductwork securely and in a rigid manner. Provide hangers as described in Section 1.5 "Design Requirements"
- .3 **Rectangular Duct Support Inside Building:** Support horizontal rectangular ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with galvanized steel channels and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20 in.).
- .4 **Round and Flat Oval Duct Support Inside Building:** Support round and flat oval ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Unless otherwise specified in the Contract Documents, for both uninsulated and insulated ducts exposed in finished areas use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.
- .5 **Flexible Duct Support Inside Building:** Unless otherwise specified in the Contract Documents support in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

### 3.3 FIELD FINISHING

- .1 Paint: As specified in Section 09 91 00 – Painting.

END OF SECTION

1 General

1.1 SCOPE

- .1 Furnish and Install a complete cUL Listed, CSA Certified, or FM approved system of heating cables, components, and controls to provide freeze protection of piping, similar to Raychem.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
- .1 Section 20 05 00 – General Mechanical Provisions
  - .2 Section 20 05 53 – Labeling and Identification
  - .3 Section 20 05 93 – Testing, Adjusting and Balancing
  - .4 Division 25 – Controls
  - .5 Division 26 – Electrical

1.3 QUALITY ASSURANCE

- .1 The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured and tested in accordance with the requirements stated in the applicable CSA, FM, IEEE and UL standards and Canadian Electrical Codes

2 Products

2.1 MATERIALS

- .1 Accepted vendors: Raychem, Pyrotenax, Serge Baril, Thermon
- .2 Freeze-Protection Systems (Domestic water, chiller water, condenser water, sanitary and storm drain lines, sprinkler system)
- .1 The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.
  - .2 A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.
  - .3 The heating cable shall have a tinned copper braid wire with a cross-sectional area being equal to or greater than conductor cross-sectional area. The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket. In order to conserve energy and to prevent overheating, the heating cable shall have a self-regulating factor of at least 90 %. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 4.4°C (40°F) pipe temperature operation to 65.6°C (150°F) pipe temperature operation.
  - .4 In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self-ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350°F (177°C) for 30 minutes. After this test, if the cable is reenergized, it must not have an increasing power output leading to thermal runaway. F. The heating cable shall be self-regulating heater, with continuous exposure (maintain) capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C).



Pipe size mm (inches)	Minimum Ambient Temperature	
	-17.8°C (0°F)	-28.9°C (-20°F)
100 (4") or less	16.4 (5) Watts	16.4 (5) Watts
150 (6")	16.4 (5) Watts	26.2 (8) Watts
200 (8")	16.4 (5) Watts	26.2 (8) Watts
250 (10") or more	16.4 (5) Watts	2 strips of 16.4 (5) Watts

- .3 Freeze Protection and Process Temperature Maintenance (Heating water and steam lines)
  - .1 The heating cable shall consist of two 14 AWG nickel-plated copper bus wires, separated by a fluoropolymer spacer and helically wrapped with a selfregulating fluoropolymer fiber that controls power output so that the cable has an unconditional temperature identification number (T-rating) of T2C (446°F or 230°C) or lower without use of thermostats.
  - .2 A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.
  - .3 The heating cable shall have a tinned copper braid wire with a cross-sectional area being equal to or greater than conductor cross-sectional area. The braid shall be protected from chemical attack and mechanical abuse by a fluoropolymer outer jacket.
  - .4 The heating cable shall be self-regulating heater, for continuous exposure (maintain) capability up to 300°F (150°C) and intermittent exposure capability up to 482°F (250°C or 250 psi steam).

## 2.2 COMPONENTS

- .1 All heating-cable components shall be cUL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the Installing Contractor to cut into the heating-cable core to expose the bus wires. All components that make an electrical connection shall be re-enterable for servicing.
- .2 No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

## 2.3 SYSTEM CONTROL

- .1 Thermostatic Control–Line Sensing
  - .1 The system shall be controlled by a line sensing thermostat (AMC-F5) set at 4.4°C (40°F) either directly or through an appropriate contactor.
- .2 No heat tracing circuit shall extend more than 600mm (24") beyond a point where such junctions permit optional flow paths. In such cases, separately controlled tracers shall be used.
- .3 Separately controlled heating circuits shall be provided on dead end legs and closed bypasses.
- .4 Where the rating of the thermostat would be exceeded, it shall be used in conjunction with a relay or contactor.

## 2.4 OTHER

- .1 Provide an electrical pipe tracing system as indicated on the drawings and specified herein.

- .2 Connect heat trace power supply from disconnect switches provided by Division 26 - Electrical. Refer to Division 26 – Electrical drawings for exact locations. Co-ordinate power requirements with Division 26 – Electrical.
- .3 Provide electric tracing for the following services:
  - .1 All domestic water piping (cold, hot, hot recirculation), including humidification make-up, cooling tower make-up, and irrigation supply in unheated areas or outside the building.
  - .2 All sanitary and storm drain lines in unheated areas except parking drain sanitary system.
  - .3 Humidifier drain lines, cooling tower overflow and bleed-off lines, spray water pumps and piping, exposed on roof.
  - .4 All heating water lines in unheated areas, except glycol heating system.
  - .5 All fire standpipe and wet sprinkler lines in parking garage.
  - .6 Drum drips on the dry sprinkler system.

## **2.5 SHOP DRAWINGS**

- .1 Provide shop drawings for:
  - .1 heat trace cables
  - .2 temperature controls and ancillaries
  - .3 accessories including banding.

## **2.6 ELECTRICAL EQUIPMENT AND WORK**

- .1 Read together with Division 26 – Electrical and adhere to its requirements. Supply and install all electrical apparatus, which is required and is not covered by Division 26 – Electrical.
- .2 The entire design and installation shall comply with the Electrical Code and all applicable regulations.

## **3 Execution**

### **3.1 GENERAL**

- .1 The cable shall be fastened to each end of the pipe with pipe straps. Fasten middle of cable to middle of pipe leaving equal slack on either side. Fasten at the middle of the remaining lengths, repeating depending on length of pipe. The loops shall be formed around pipe and fastened at intervals not exceeding 450mm (18").
- .2 Extra cable shall be used at points such as valves and flanges to compensate for increased heat loss.
- .3 Use Cupron tie wire, 16 AWG or larger on irregularly shaped objects such as valves. Tie wire and strapping shall be snug but not cut or indent the sheath.
- .4 Provide thermostatic control. Locate bulb and capillary of thermostat as far from heating cable as possible, ensure that bulb does not contact heating cable.
- .5 After installation, before and after installing the thermal insulation, subject heating cable to testing using a 2500-VDC Megger. Minimum insulation resistance shall be 20 megohms or greater.
- .6 All terminations shall be protected from the weather and from physical damage.
- .7 Any field alternations or deviations shall proceed only after authority via signed change order has been issued by Consultant. All changes shall be accurately recorded by the Contractor and shall be turned over to the Consultant upon completion of the work.

- .8 Junction boxes, thermostats, and the like shall not be attached to the insulation, but shall be mounted on brackets fabricated of galvanized angle, channel or other material of sufficient strength to support equipment mounted on them.
- .9 Hydrostatically test all piping prior to installation of tracing cables.
- .10 Apply "Electric Traced" labels to the outside of the thermal insulation.

**END OF SECTION**



1 General

**1.1 SUMMARY**

- .1 This section covers the supply and installation of the complete vibration isolation system for all equipment, ductwork, and piping covered by the Mechanical Contractor.
- .2 Vibration isolation system shall be fully integrated into and compatible with noise and vibration controls in accordance with 20 05 50 - Seismic Restraint Systems.
- .3 This specification should be read in conjunction with Section 23 21 16 - Hydronic Piping Specialties and Section 22 11 19 - Domestic Water Piping Specialties for flexible pipe connections and Section 23 33 00 - Air Duct Accessories for the acoustical treatment of ductwork.

**1.2 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 20 05 29 – Hangers and Supports.
- .3 Section 20 05 50 – Seismic Restraint System.

**1.3 REFERENCES**

- .1 American Society of Heating, Refrigerating, and Air Condition Engineers (ASHRAE)
  - .1 ASHRAE Handbook: HVAC Applications “Chapter 43 Sound and Vibration Control”
- .2 Ontario Building Code 2012 (OBC)

**1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.
- .2 Shop Drawings:
  - .1 Provide the manufacturer's product literature and datasheets for all components listed in this specification.
  - .2 Include full details of design criteria, schematics, specifications, installation procedures and instructions.
- .3 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into O&M manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

**2.1 GENERAL**

- .1 All equipment provided for vibration isolation shall be new and manufactured specifically for the purpose intended.

- .2 All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control or Mason Industries and shall be one manufacturer throughout the project.
- .3 Provide vibration isolation with integral seismic restraint for equipment intended to provide restraint from seismic and wind forces. Housings shall be capable of withstanding the applicable design forces for the specific installation. Installation shall be in accordance with Section 20 05 50 - Seismic Restraint Systems.

## 2.2 VIBRATION ISOLATION

### .1 Type DDNH (Double Deflection Neoprene Hangers)

- .1 Type DDNH shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel. The diameter of the clear hole in the hanger box shall be at least 19mm larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30 degree arc. When installed the hanger box shall be allowed to rotate through a full 360 degrees without encountering an obstructions.
- .2 Unless otherwise specified the static deflection of DDNH hangers shall be 8mm.
- .3 Acceptable Manufacturers:
  - .1 Vibro-Acoustics; Model RHD.
  - .2 Kinetics; Model RH.
  - .3 Mason Industries; Model HD.

### .2 Type SPH (Spring Hangers)

- .1 Type SPH shall consist of a steel spring and welded steel housing. Spring diameter and hanger box hole shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19 mm (3/4 in.) larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.
- .2 Unless otherwise specified, the static deflection of SPH hangers under actual load conditions shall be 50 mm (2 in.).
- .3 Acceptable Manufacturers:
  - .1 Vibro-Acoustics; Model SH.
  - .2 Kinetics; Model SH.
  - .3 Mason Industries; Model 30.

### .3 Type SPNH (Spring and Neoprene Hangers)

- .1 Type SPNH shall be as above with the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9mm with a strain not exceeding 15%. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).
- .2 Acceptable Manufacturers:
  - .1 Vibro-Acoustics; Model SHR.
  - .2 Kinetics; Model SRH.
  - .3 Mason Industries; Model 30N.

- .4 All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.
- .5 Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 80% of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after spring installation.
- .6 All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.
- .7 All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.

### 3 Execution

#### 3.1 GENERAL

- .1 Obtain one copy of all Shop Drawings of equipment to be isolated showing weights, shaft centres and all dimensions.
- .2 On system start-up, inspect the complete installation and provide a report in writing.
- .3 Furnish concrete bases, including concrete fill, on springs or other vibration isolation materials for mechanical isolation.
- .4 All floor mounted equipment shall be erected on concrete housekeeping pads, with thickness as identified, over the complete floor area of the equipment, unless shown or specified otherwise. Wherever vibration eliminating devices and/or concrete inertia pads are specified, these items shall be mounted on concrete housekeeping pads.
- .5 Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.
- .6 All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 6mm maximum, under all operating conditions. Lateral restraining isolators shall have the same static deflection as equipment being isolated.
- .7 Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.
- .8 Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping, and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.
- .9 All mechanical equipment not specifically identified in this Section that contains rotating or vibrating elements, and any associated electrical apparatus installed by this Division that contains transformers or inductors shall be installed on Type DDNM, MEP, or EP isolators as appropriate.
- .10 All wiring connections to mechanical equipment on isolators shall be made with a minimum long flexible conduit installed in a slack "U" shape.
- .11 Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.
- .12 Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

#### 3.2 INSTALLATION OF VIBRATION ISOLATION



- .1 Unit Heaters suspended from overhead structure shall be hung on Type SPNH spring isolators. The static deflection of the isolators shall be 50 mm (2 in.).
- .2 Suspend all piping in Mechanical Rooms on Type SPH or SPNH isolators as required. Where piping is supported from the floor, weld brackets to the piping and support on Type SPNM isolators. Isolators do not replace constant support hangers or mounts.
- .3 The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.
- .4 Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.

**1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB)  
.1 CAN/CGSB-1.60-M, Interior Alkyd Gloss Enamel.  
.2 CAN/CGSB-24.3, Identification of Piping Systems.  
.2 Ontario Building Code 2012 (OBC)

**1.3 DEFINITIONS**

- .1 For purposes of this Section:  
.1 "CONCEALED" means mechanical services and equipment in suspended ceilings, non-accessible chases, and furred-in spaces.  
.2 "EXPOSED" means "not concealed" as defined in this Section.

**1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.  
.2 Shop Drawings:  
.1 Provide manufacturer product literature identifying size, type, material and colour of labels.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.  
.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.  
.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

**2.1 PIPE IDENTIFICATION**

- .1 Mechanical Contractor shall identify piping and equipment throughout with labels and direction of flow arrows regardless of whether or not specified elsewhere. Labelling shall be as per Painting Schedule or as requested by Consultant if not covered in Schedule.  
.2 **Pipe Markers and Direction Arrows:** This piping identification system lends itself to commercially available pipe markers having standard sizes of lettering and colours. Standard Colours designate classes of materials as follows, and are consistent with those specified by CAN/CGSB-24.

Colour	Material
Yellow	Dangerous Materials
Green	Safe Materials
Red	Fire Protection Equipment
Blue	Protective Materials

- .3 Standard Pipe Identification:

- .1 For pipe up to and including 150 mm (6") diameter markers shall consist of coloured, coiled, semi-rigid vinyl plastic of a length to wrap completely around the pipe, and indoor/outdoor type vinyl ink lettering and directional arrows.
- .2 Stencilled lettering (black Franklin Gothic) identification and directional arrows for normal flow shall be applied by each colour band.
- .3 The lettering and arrow size shall be as indicated below:

Pipe Size (mm)	Letter Height (mm)	Arrow Height x Arrow Length (mm x mm)
Greater than 65	50	50 x 150
30 to 65	25	25 x 100
Smaller than 30	12	12 x 50

- .4 Pipe markers and direction arrows shall be suitable for continuous operating temperatures between -40°and 122°C.
- .4 **Standard Pipe Identification Wording and Colours:** Identification wording and colours for pipe identification materials shall be as follows:

<u>Legend</u>	<u>Colour</u>	<u>Symbol</u>
Potable Cold Water	White/Green	DCW
Potable Hot Water	White/Green	DHW
Potable Hot Water Return	White/Green	DHWR
Tempered Potable Water	White/Green	TW
Storm Drainage	White/Green	ST
Sanitary Drainage	White/Green	SAN
Plumbing Vent	White/Green	VENT
Glycol Heating Water Supply	Black/Yellow	GHWS
Glycol Heating Water Return	Black/Yellow	GHWR

- .5 **Identification Material Manufacturers:** Acceptable manufacturers of identification materials shall be equivalent SMS "Coil-Mark" pipe markers:
  - .1 Smillie McAdams Summerlin Ltd.
  - .2 W.M. Brady of Canada Ltd.
  - .3 Revere-Seton Inc.
  - .4 Embree Industries Ltd.Execution

## 2.2 EQUIPMENT IDENTIFICATION

- .1 **Equipment Nameplates:** Minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, white background – black lettering, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2 ½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Each nameplate shall be complete with bevelled edges and engraved wording to completely identify the equipment with no abbreviations. Wording shall generally be in accordance with the Drawings but must be reviewed by the Consultant prior to engraving. Supply stainless steel screws for securing nameplates in place.
- .2 **Valve Tags:** Coloured, 40 mm (1½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match the piping classification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording. For example:



VALVE V12  
200 mm  
DCW  
NORMALLY OPEN

### 2.3 DUCT IDENTIFICATION:

- .1 Custom made Mylar stencils with 50 mm (2") high lettering to accurately describe the duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured inks with ink pads and roller applicators. Ink colours shall contrast with the lettering background.
- .2 Paint: CAN/CGSB-1.60-M in colours specified in the Contract Documents. Non-specified colours to conform to CAN/CGSB-24.3.
- .3 Letters shall be 50 mm high and directional flow arrows shall be 150 mm long stenciled with specified paint with the following wording:
  - .1 SUPPLY AIR
  - .2 RETURN AIR
  - .3 EXHAUST AIR
  - .4 TRANSFER AIR

## 3 Execution

### 3.1 INSTALLATION OF MECHANICAL IDENTIFICATION

- .1 **Exposed Piping and Ductwork:** Identify exposed piping and ductwork in accordance with Part 2 of this Section in the following locations:
  - .1 At every end of every piping or duct run.
  - .2 Adjacent to each valve, strainer, damper and similar accessory.
  - .3 At each piece of connecting equipment.
  - .4 At every change of direction.
  - .5 On both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified in the Contract Documents.
  - .6 At 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length.
  - .7 On each side of special valves, special fittings and branch connections.
  - .8 At least once in each room and at least once on pipe and duct runs less than 6 m (20') in length.
- .2 **Concealed Piping and Ductwork:** Identify concealed piping and ductwork in accordance with Part 2 of this Section in the following locations:
  - .1 At points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas.
  - .2 At maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room.
  - .3 At each access door location.
  - .4 At each piece of connected equipment, automatic valve, etc.
- .3 **Equipment:** Provide an identification nameplate for each piece of equipment, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place with stainless steel screws unless such a practice is prohibitive, in which

case use epoxy cement applied to cleaned surfaces. Locate all nameplates in the most conspicuous and readable location.

- .4 **Electrical Tracing:** For all electrically traced mechanical Work, identification wording shall include the phrase "ELECTRICALLY TRACED".
- .5 **Valve Tagging and Chart:** Tag valves and prepare a valve tag chart in accordance with the following requirements:
  - .1 Attach a valve tag to each new valve, except for valves located immediately at the equipment they control.
  - .2 Prepare a typed or computer printed valve tag chart to list all tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed).
  - .3 Frame and glaze one copy of the chart and affix the same to a wall where later directed at the site.
  - .4 Include a copy of the valve tag chart in each copy of the O&M instructions.
- .6 **Ceiling Tacks or Stickers:** Where shut-off valves, control dampers, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in the ceiling panel material, or stickers on the ceiling grid material to indicate locations of the items. Confirm colours prior to installation.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 TAB means testing, adjusting and balancing equipment to ensure performance in accordance with requirements of Contract Documents and to perform all other work as specified in this section.
- .2 Standard: TAB shall be performed in accordance with the most stringent of TAB standards of AABC, NEBB, SMACNA and ASHRAE.
- .3 Perform TAB of all systems, equipment, components, controls specified in the Mechanical Division.
- .4 TAB is to be split into two sections of work, the Mechanical Contractors testing and balancing, and the and the TAB Contractor's (see Article 1.3) testing and balancing:
  - .1 Mechanical Contractor's Obligations: Leakage testing of piping, and ductwork.
  - .2 TAB Contractor's Obligations: Testing, adjusting and balancing of all equipment and system components (pumps, valves, fans, dampers, etc).

**1.2 THE TAB CONTRACTOR**

- .1 The Mechanical Contractor in consultation with the Consultant shall appoint a TAB Contractor to measure and report TAB results to the Consultant. The Mechanical Contractor shall submit a proposal to the Consultant for assessment before any selection of the TAB Contractor is made. The proposal shall include:
  - .1 Experience in projects of this size.
  - .2 Labour costs per hour plus a maximum upset limit.
  - .3 Personnel to be used.
  - .4 Equipment to be used for the testing and balancing of the systems.
  - .5 Test procedures and methods.
  - .6 Any other items requested.
- .2 Names of all personnel proposed to perform TAB shall be submitted to and approved by the Owner within 90 days of the award of the contract.
- .3 Qualifications: Personnel performing TAB shall be current member in good standing of AABC, NEBB, or NBCTA.
- .4 Suggested Testing and Balancing Agents: Design Test & Balancing Co. (905-886-6513), John Price Enterprises (416-755-4676), Airwaso (519-652-4040), Technical Aire Balancing Inc (416-492-9408), Air Adjustments & Balancing Inc. (416-254-3004) and Flowset Balancing Ltd. (416-410-9793).

**1.3 SUBMITTALS**

**.1 Pre-mobilization**

- .1 Submit to the Consultant, prior to the commencement of TAB, the following:
  - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.
  - .2 Proposed check lists and report forms.



**.2 Preliminary TAB Report**

- .1 Submit for checking and approval of the Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include the following:
  - .1 Details of instruments used.
  - .2 Details of TAB procedures employed.
  - .3 Calculations procedures.
  - .4 Summaries.

**.3 Tab Report**

- .1 TAB report shall show all results in SI units and shall include:
  - .1 Tabulated data from air and piping system measurements; see Article 3.5 and 3.6.
  - .2 Project record drawings used to show testing locations.
  - .3 System schematics.
- .2 Submit electronic copy of the initial TAB Report to the Consultant for verification and approval, if requested submit one paper copy complete with index tabs.
- .3 Provide three copies of the final TAB report. Reports shall be complete with index pages and index tabs, and certified by the TAB Contractor. Any diagram as single line representation of a Mechanical System specifically prepared for this project shall be prepared using a CAD system and shall be acceptable to the consultant.

**1.4 QUALITY ASSURANCE**

- .1 The work specified in this section shall be performed by an Independent Agency specializing in this type of work.
- .2 Balancing (of both air and piping systems) and sound level readings shall be performed by the same agency.
- .3 Balancing procedures shall be in accordance with the latest, current requirements of "National Environmental Balancing Bureau" (NEBB) or "Associated Air Balance Council" (AABC), including the following:
  - .1 NEBB Procedural Standards For Whole Building Systems Commissioning Of New Construction;
  - .2 NEBB Procedural Standards For Testing Adjusting And Balancing Of Environmental Systems;
  - .3 NEBB Procedural Standards For Retro- Commissioning Of Existing Buildings;
  - .4 AABC National Standards for Total System Balance;
  - .5 AABC Test and Balance Procedures;
- .4 TAB of systems and equipment regulated by codes, standards shall be to the satisfaction of the Ontario Building Code.

**1.5 SCOPE OF TAB**

- .1 The following systems shall be tested, adjusted, and balanced:
  - .1 Air conditioning, ventilation and heating systems
  - .2 Air distribution (supply, return and exhaust)
  - .3 Miscellaneous ventilation or exhaust systems including Process dust collection.
  - .4 Boilers and hydronic distribution

- .5 Plumbing systems
- .6 All process piping including natural gas, oil, compressed air, etc.

2 Products [NOT USED]

3 Execution

**3.1 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
- .4 Report all values back to Consultant.

**3.2 COORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into the Work construction and completion schedule so as to ensure completion prior to the acceptance of project.
- .2 Perform TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
- .3 The TAB Contractor shall co-ordinate with the Mechanical Contractor to ensure that all necessary control and balancing valves (water-side) as well as manual and splitter dampers (air-side) for balancing are installed in all locations required. Notify the Consultant in writing that this co-ordination has taken place. Include in this letter any recommendations made regarding valves, dampers, locations, installation, etc. If this TAB Contractor fails to co-ordinate with the Contractor and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the TAB Contractor at no cost to the Owners.
- .4 The TAB Contractor shall not disconnect any control device. Command control devices and enter adjusted set points into the building automation system with tools and training that are furnished under Section 25 00 00 – Building Automation System (BAS). If the TAB Contractor fails to co-ordinate with Section 25 00 00 – Building Automation System (BAS) and if failure to co-ordinate results in any cost, the cost of any change required shall be paid by the TAB Contractor at no cost to the Owner.
- .5 The Mechanical Contractor will provide new filters, etc. required for the measurements taken by the TAB Contractor.
- .6 The Mechanical Contractor shall provide copies of all Shop Drawings requested by the TAB Contractor.
- .7 The Mechanical Contractor shall make staff available, as required by the TAB Contractor, to operate the equipment to take measurements and to correct any deficiencies in the mechanical systems which prevent the TAB Contractor from balancing the system.

**3.3 THE MECHANICAL CONTRACTOR'S TESTING**

- .1 Pipework and ductwork leakage tests shall be carried out on sections of the work during construction and these sections shall be identified by reference number of the test sheet and by description of the piping or duct system. The reference identification number shall be indicated on the As-Built Drawings.

- .2 All tests for systems shall be performed in the presence of, and test reports signed by the TAB Contractor. Notify the TAB Contractor in writing a minimum of one week in advance of testing.
- .3 Repair any leaks or defects and repeat the tests to the satisfaction of the Consultant.
- .4 Ensure access is provided to all valves, dampers, fire dampers, and other equipment that requires servicing.
- .5 **Start-Up and Operation of Equipment:**
  - .1 Follow start-up procedures as recommended by the equipment manufacturer unless specified otherwise in the Contract Documents.
  - .2 Follow special start-up procedures specified in the Mechanical Division
  - .3 Operate systems for length of time required for TAB and as required by the Consultant for verification of TAB reports.
  - .4 Coordinate with Commissioning Agent as required.
- .6 **Piping System Tests:**
  - .1 Test all piping systems for leakage in accordance with all applicable plumbing codes.
  - .2 All other systems not covered by codes noted above shall be tested and proven tight over a period of 24 hours by a hydrostatic test. Remove vents and gauges and temporarily plug connections.
  - .3 Test pressure for domestic water, and hydronic systems shall be:
    - .1 1-1/2 times the system working pressure but not less than 1035 kPa (150 psig), or
    - .2 The maximum working pressure of expansion joints and vibration isolators.
  - .4 Test pressure for drainage and venting systems:
    - .1 Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of two hours.
    - .2 After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship.
    - .3 Make a smoke test, ball test, or video inspection if required by the local Municipality.
- .7 **Air System Tests:**
  - .1 Test all ductwork for leakage in accordance with all SMACNA Manuals and Standards.
  - .2 Seal ducts at all equipment connections and pressurize with a small blower.
  - .3 Refer to Section 23 00 00 – HVAC Ducts and Plenums, Article 3.2.16 for leakage testing requirements and pressure ratings of ductwork.
  - .4 The entire system shall be tested for noise, tightness of joints and proper functioning of the system. Noise tests shall be made under minimum system pressure drop conditions (highest air velocities and clean filter conditions). This Section shall make all necessary alterations and repeat the tests until satisfactory operation is achieved.

### 3.4 THE TAB CONTRACTOR'S TESTING AND BALANCING

- .1 The TAB Contractor is responsible for balancing the systems to obtain the design conditions and shall repeat the balancing until the required conditions have been met.



- .2 The TAB Contractor shall balance all air systems to ensure all fans, VAVs, FCUs, and AHUs are operating to design conditions. Adjust air volumes and control settings under maximum system pressure drop conditions by means of balancing dampers and record balance position.
- .3 The TAB Contractor shall balance all piping systems to ensure all boilers, chillers, pumps, heat exchangers, AHUs, FCUs, cabinet/unit/other heaters, domestic hot water balancing valves, etc, are operating to design conditions. Adjust the circuits by means of the balancing valves and record balance position.
- .4 **Pre-Tab Review:**
  - .1 Review contract documents prior to the commencement of the Work and confirm in writing to the Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.
  - .2 If testing procedures are to deviate from the specified standards provide the Consultant with all proposed procedures for acceptance.
  - .3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.
- .5 **Instruments:**
  - .1 Prior to TAB work, submit to the Consultant a list of instruments to be used for TAB together with serial numbers.
  - .2 Calibrate the instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
  - .3 Calibrate the instruments within 3 months of the performance of TAB work. Provide certification of calibration to the Consultant.
- .6 **Tolerances:**
  - .1 Perform TAB in accordance with the following application tolerances of design information:
    - .1 Piping systems: Plus or minus 10%.
    - .2 Air systems: Plus or minus 5%.
  - .2 Accuracy of measured values shall be accurate to within plus or minus 2% of actual values.
- .7 **Start-up of TAB:**
  - .1 Notify the Commissioning Agent and the Consultant seven (7) days prior to start of TAB.
  - .2 Start TAB only when the building is essentially completed, including the following components:
    - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
    - .2 Application of weather stripping, sealing, caulking.
    - .3 All pressure, leakage, other tests specified elsewhere; Division 22, 23, 25.
    - .4 All provisions and components for TAB installed and operational.
    - .5 Start-up and verification of proper, normal and safe operation of all mechanical systems and associated electrical/control systems affecting TAB including but not limited to:
      - .1 Proper thermal overload protection in place for electrical equipment.
      - .2 Air systems:
        - .1 Filters.

- .2 Duct systems clean.
    - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
    - .4 Correct fan rotation.
    - .5 Fire, smoke, volume control dampers installed and open.
    - .6 Coil fins combed, clean.
    - .7 Duct access doors installed, closed.
    - .8 All outlets installed, volume control dampers open.
  - .3 Piping systems:
    - .1 Flushed, filled and vented.
    - .2 Correct pump rotation.
    - .3 Strainers in place, baskets clean.
    - .4 Isolation, check, and control valves installed, open.
    - .5 Calibrated balancing valves installed, at factory settings.
    - .6 Chemical treatment systems complete, operational.
  - .3 The TAB Contractor shall balance the air and piping systems as described in Articles 3.5 and 3.6 of this Section. TAB Contractor shall submit an initial TAB Report for Verification.
- .8 Verification:**
- .1 After initial balancing all reported results are subject to verification by the Consultant.
  - .2 In all cases where measurements by the TAB Contractor show failure to comply with the Drawings and Specifications, the Contractor shall change fan sheaves, etc., as required, and new balancing measurements shall be made by the TAB Contractor.
  - .3 At the time of final review, recheck in the presence of the Consultant random selections of air quantities and fan data recorded in the certified report. Points or areas for recheck shall be selected by the Consultant and be approximately 10% of the report data.
  - .4 At the time of verification measure space temperature and humidity in a representative number of rooms to verify performance. Tabulate these results and bind into certified report as an appendix.
  - .5 Number and location of verified results shall be at the discretion of the Consultant. A measured flow deviation of more than 10% between the verification reading and the reported data shall be considered as failing the verification procedure.
  - .6 Bear costs to repeat TAB and submit new certified reports as required to the satisfaction of the Consultant.
- .9 Completion of TAB:**
- .1 TAB shall be considered complete when the final TAB Report is received and approved by the Consultant.
  - .2 After TAB is completed to satisfaction of the Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.
  - .3 Following final acceptance of the certified reports by the Consultant, permanently mark the settings of all valves, dampers, splitters and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.

- .4 Ensure all thermostats and controls are set to give specified conditions and include settings is report.

### 3.5 AIR SYSTEMS TESTING BY TAB CONTRACTOR

- .1 Measurements: shall include, but not be limited to the following as appropriate for systems, equipment, components, controls:
  - .1 Air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .2 Locations of equipment measurements shall include, but not be limited to the following as appropriate:
  - .1 Inlet and outlet of each damper, filter, coil, fan, other equipment causing changes in conditions, at each controller, controlled devices.
- .3 Locations of systems measurements shall include, but not be limited to following as appropriate:
  - .1 Each main duct, main branch, sub-branch, or run-out (or grille, register or diffuser).
- .4 Duct traverse readings shall be taken through the access ports provided. Where no access ports have been provided new holes shall be made as required. These holes shall be resealed after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable. Where insulation is damaged it shall be repaired including the vapour barrier in an approved manner. Duct tape is not acceptable.
- .5 Fans on all systems shall be set up to give the minimum discharge pressure required to overcome the resistance of the box, discharge ductwork and diffusers.

### 3.6 PIPING SYSTEMS TESTING BY TAB CONTRACTOR

- .1 Measurements: shall include, but not be limited to the following as appropriate for systems, equipment, components, controls:
  - .1 Liquid velocity, pressure, flow rate, pressure drop (or loss), temperatures, RPM, electrical power, voltage, noise, vibration.
- .2 Locations of equipment measurements shall include, but not be limited to following as appropriate:
  - .1 Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device, or fixture. (Includes both hydronic and plumbing systems)
- .3 Locations of systems measurements shall include, but not be limited to following as appropriate:
  - .1 Each main, main branch, branch, or sub-branch.
- .4 Flow through all coils, heat exchangers, boilers and other such equipment shall be balanced to ensure that the pressure drop through the equipment is within 10% of the manufacturer's design conditions.
- .5 If the design conditions cannot be met by adjusting the balancing valves throughout the system, or by the adjusted the VFD settings, then pump impellers shall be either changed or trimmed as required.

**END OF SECTION**



1 General

**1.1 SUMMARY**

- .1 This Section covers the selection and installation of plumbing, process, and building mechanical piping insulation as well as the selection and installation of ductwork insulation unless additional requirements have been detailed elsewhere in the Contract Documents.

**1.2 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 20 05 29 – Hangers and Supports.
- .3 Section 22 11 19 – Domestic Water Piping.
- .4 Section 22 11 20 – Drainage, Waste and Venting Piping.
- .5 Section 23 31 00 – HVAC Ducts and Plenums.
- .6 Section 23 57 19 – Hydronic Piping.

**1.3 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
  - .2 C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulations
  - .3 ASTM C 177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - .4 ASTM C 240, Standard Test Methods of Testing Cellular Glass Insulation Block.
  - .5 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .6 ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .7 ASTM C 449, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .8 ASTM C 547, Specification for Mineral Fiber Pipe Insulation.
  - .9 ASTM C 553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .10 ASTM C 612, Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .11 ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
  - .12 ASTM C 921, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .13 ASTM E 96 / E 96M, Standard Test Methods for Water Vapor Transmission of Materials.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 International Organization for Standardization (ISO)

- .1 ISO-6944, Duct 'A' Standard with 1 or 2-Hour External Duct Fire Rating.
- .5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .6 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .7 Ontario Building Code 2012 (OBC)

#### 1.4 DEFINITIONS

- .1 For purposes of this Section:
  - .1 "CONCEALED" means insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" means "not concealed" as defined in this Section.
  - .3 Insulation systems shall mean insulation material, fasteners, jackets, and other accessories.

#### 1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.
- .2 Shop Drawings:
  - .1 Submit a set of shop drawings identifying each product with the manufacturer's name and insulation type, and the proposed use of the insulation. Include a product data sheet for each insulation type.
  - .2 Include shop drawings of all insulation jacket materials, each identified as to its intended use, and product data sheets for the protective coatings.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

#### 2 Products

##### 2.1 FIRE HAZARD RATINGS

- .1 All insulation materials shall meet the requirements of CAN/ULC-S700 Series Standards.
- .2 Unless otherwise specified in the Contract Documents, all insulation system materials inside the building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102.

##### 2.2 PIPE INSULATION MATERIALS

- .1 **Flexible Elastomeric Foam:** Closed cell, tubular foamed plastic pipe insulation with a "k" factor of 0.039 W/m°C (0.27 BTU/hr\*ft\*°F) when tested in accordance with ASTM C177 or ASTM C518 at mean temperature 24°C (75°F), 25/50 flame spread/smoke developed rated, with a water vapour transmission rating of 0.08 in accordance with ASTM E 96, Procedure A, and all required installation accessories. Acceptable products are:
  - .1 Armacell LLC "AP Armaflex 25/50" with "Armafix" insulation pipe hangers (IPH)
- .2 **Closed Cell Foamed Glass:** Pittsburgh-Corning "FOAMGLASS", expanded, sectional, rigid sleeve type insulation with a liquid or vapour permeability rating (in accordance with ASTM C240) of 0.00, and a factory applied "PITTWRAP SSII" self-sealing jacket secured with, when required. "PITTWRAP SS" primer and PC88 adhesive.

- .3 **Fire Rated Preformed Fibreglass:** Non-Combustible, fire rated, hollow cylindrical heavy density (min 7 pcf or 112 kg/m<sup>3</sup>) fibreglass units with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. Pipe covering material as listed as a firestop component in cUL/ULC listed firestop systems, C-AJ-1366, C-AJ-1066, W-J-1127, C-AJ-5125, and C-AJ-8075.
- .4 **Preformed Fibreglass:** Rigid, sectional, sleeve type insulation with a "k" factor of 0.033W/m°C (0.23 @ 75°F) when tested in accordance with ASTM C335 (Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation), and a factory applied vapour retarding jacket (.02 perm). Acceptable products are:
  - .1 Johns Manville Inc. "Micro-Lok H" with "ASJ-SSL jacket
  - .2 Knauf Insulation Ltd. Earthwool 1000° with ASJ/SSL Pipe Insulation
  - .3 Manson Insulation Products Ltd. "ALLEY K" with "ASJ-SSL" jacket
- .5 **Blanket Fibreglass:** Blanket type roll insulation, 24 kg/m<sup>3</sup> (1.5 lb/ft<sup>3</sup>) density, with installed "R" value of 0.83 m<sup>2</sup> °C/W (4.7 BTU/hr\*ft\*°F, and a factory applied vapour barrier facing. Acceptable products are:
  - .1 Johns Manville Inc. Type 150 "Microlite"
  - .2 Knauf Insulation Ltd. Fiber Glass Blanket Insulation with multi-purpose "FSK" facing
  - .3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"
- .6 **Pipe Insulation at Hangers and Supports:** Coordinate with discipline responsible for Section 20 05 29 Hangers and Supports to provide thermal breaks as listed here and in section 2.9 of that specification. Insulation shall be a 300 mm (12 in.) long piece of sectional pipe insulation with a thickness equal to the adjacent insulation, a foil and glass reinforced kraft paper vapour barrier jacket, and a minimum 0.80 mm thick (22 ga) G60 galvanized steel shield the same length as the insulation. The insulation shall be:
  - .1 Johns Manville Inc. "Thermo-12 Gold" or Calsilite Group Ruston "GOLD" rigid calcium silicate
  - .2 Belform Insulation Ltd. 60 kg/m<sup>3</sup> (3.75 lb./ft<sup>3</sup>) density "Insulphen" closed cell phenolic foam

## 2.3 EQUIPMENT INSULATION MATERIALS

- .1 **Blanket Fibreglass:** Blanket type roll form insulation, 24 kg/m<sup>3</sup> (1.5 lb/ft<sup>3</sup>) density, with a "k" factor (compressed thickness) of 0.035 W/m°C (0.24 BTU/hr\*ft\*°F), with a factory applied vapour barrier facing. Acceptable products are:
  - .1 Johns Manville Inc. Type 150 "Microlite"
  - .2 Knauf Insulation Ltd. Friendly Feel Duct Wrap with KwikStretch Markings with multi-purpose "FSK" facing
  - .3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"
- .2 **Semi-Rigid Fibreglass Board:** Roll form, moulded insulation, 48.1 kg/m<sup>3</sup> (3.0 lb/ft<sup>3</sup>) density, with a "k" factor of 0.033 W/m°C (0.23 BTU/hr\*ft\*°F), with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper. Acceptable products are:
  - .1 Johns Manville Inc. "Pipe and Equipment Insulation"
  - .2 Knauf Insulation Ltd. Fiber Glass Pipe and Tank Insulation or KwikFlex Pipe & Tank Insulation
  - .3 Manson Insulation Inc. "AK FLEX"



- .3 **Closed Cell Foamed Glass:** Pittsburgh Corning "FOAMGLAS" expanded, rigid board and block type insulation with a liquid or vapour permeability rating (in accordance with ASTM C240) of 0.00.

## 2.4 DUCTWORK SYSTEM INSULATION MATERIALS

- .1 **Rigid Fibreglass Board:** Preformed board type insulation, 48.1 kg/m<sup>3</sup> (3.0 lb/ft<sup>3</sup>) density, with a "k" factor of 0.033 W/m°C (0.23 BTU/hr\*ft\*°F @ 75°F mean), with a factory applied reinforced aluminum foil and kraft paper facing. Acceptable products are:
  - .1 Johns Manville Inc. Type 814 "Spin-Glas"
  - .2 Knauf Insulation Ltd. Fiber Glass Insulation Board with FSK facing
  - .3 Manson Insulation Products Ltd. "AK BOARD FSK"
- .2 **Blanket Fibreglass:** Blanket type roll form insulation, 24 kg/m<sup>3</sup> (1.5 lb/ft<sup>3</sup>) density, 40mm (1.5 in.) thick, with a factory applied vapour barrier facing. Acceptable products are:
  - .1 Johns Manville Inc. Duct Wrap Type 150 "Microlite"
  - .2 Knauf Insulation Ltd. Friendly Feel Duct Wrap with KwikStretch Markings with multi-purpose "FSK" facing
  - .3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"
- .3 **Flexible Elastomeric Foam Sheet:** Sheet form, closed cell foamed plastic insulation with a "k" factor of 0.039 W/m°C (0.27 BTU/hr\*ft\*°F) at mean temp 24°C (75°F) per ASTM C177, 25/50 flame spread/smoke developed rated, with a water vapour transmission rating of 0.08 in accordance with ASTM E 96, Procedure A, and all required installation accessories. Acceptable products are:
  - .1 Armacell LLC "AP Armaflex 25/50" Sheet & Roll

## 2.5 INSULATION FASTENINGS

- .1 **Wire:** Minimum 1.8 mm diameter (15 ga) galvanized annealed wire.
- .2 **Stainless Steel Banding:** Childers Products Co. "FABSTAPS" 0.6 mm (24 ga) Type 304 minimum 12 mm (0.5 in.) wide stainless steel strapping or approved equivalent.
- .3 **Duct Insulation Fasteners:** Weld-on 2 mm (12 ga) zinc coated steel spindles of suitable length, complete with minimum 40 mm (1.5 in.) square plastic or zinc plated steel self-locking washers.
- .4 **Tape Sealant:** Venture Tape Corp. 1525CW, 3M FSK Silver (foil) Facing Tape UL 723 classified (5/10 flame/smoke rating), 3M™ FSK Facing Tape or approved equivalent self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match the surface being sealed.
- .5 **Adhesive - Fibreglass Insulation:** Clear, pressure sensitive, quick setting brush consistency adhesive, non-flammable when wet, fire resistive when dry, suitable for a temperature range of -20°C (-4°F) to 82°C (180°F) and compatible with the type of material to be secured, and WHMIS classified as non-hazardous.
- .6 **Adhesive – Flexible Elastomeric Insulation:** Armstrong World Industries Inc. # 520 air-drying contact adhesive.
- .7 **Adhesive – Closed Cell Foamed Glass Insulation:** Pittsburgh-Corning PC88 multi-purpose two-component adhesive.
- .8 **Sheet Metal Screws:** No. 10 stainless steel sheet metal screws.

## 2.6 INSULATION JACKETS AND FINISHES

- .1 **White PVC Fitting Covers:** Factory preformed, one-piece, minimum 15 mil thick white PVC covers, 25/50 rated with a semi-luster finish. Acceptable products are:
  - .1 Proto Corp. "LoSMOKE"

- .2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"
- .3 Speedline Corporation The Sure-Fit System "SMOKE-LESS 25/50"
- .4 Johns Manville Inc. "Zeston"
- .5 Belform Insulation Ltd.
- .2 **White Sheet PVC:** Roll form (and fitting covers), minimum 15 mil thick white PVC, 25/50 rated, complete with installation and sealing accessories. Acceptable products are:
  - .1 Proto Corp. "LoSMOKE"
  - .2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"
  - .3 Speedline Corporation The Sure-Fit System "SMOKE-LESS 25/50"
  - .4 Johns Manville Inc. "Zeston"
  - .5 Belform Insulation Ltd.
- .3 **Aluminum:** Smooth aluminum jacket material with a 13 mm (0.5 in.) safety edge in accordance with ASTM B209, 0.6 mm (0.025 in.) thick, factory cut to size and complete with moisture barrier and 50 mm overlap and with stainless steel bands on 300 mm (12 in.) centres. Fittings shall be two piece epoxy coated with silicone joints as required.
- .4 **Stainless Steel:** Smooth type 304 stainless steel jacket material to ASTM A240, 0.4mm (0.016 in.) thick, factory cut to size, complete with moisture barrier and 50 mm overlap and with stainless steel bands on 300 mm (12 in.) centers. Fittings are to be two piece pressed stainless steel with silicone joints as required.
- .5 **Factory Applied Insulation Weather Barrier:** Knauf Insulation Ltd. Redi-Klad™ 1,000° pipe insulation, factory applied, five-ply, weather and abuse resistant, 0.0 permeability, embossed aluminum, self-sealing lap pipe insulation jacket. Insulation and jacketing system shall be designed for piping systems operating from -18°C to 538°C (0°F to 1,000°F).
- .6 **Insulation Cement:** Heat resistant, trowel consistency thermal insulating and finishing cement to ASTM C-449/C-449M, and suitable in all respects for the application.
- .7 **Protective Coating - Foamed Glass Insulation:** Pittsburgh Corning Co. "PITTCOTE 404" flexible acrylic latex weather barrier coating, white unless otherwise specified in the Contract.
- .8 **Protective Coating - Flexible Elastomeric Foam Insulation:** Armacell LLC "WB Armaflex" white, water based latex enamel, semi-gloss or approved equivalent.

3 Execution

3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

- .1 Unless otherwise specified in the Contract Documents, do not insulate the following:
  - .1 Factory insulated equipment and piping;
  - .2 Heating piping within radiation unit enclosures, including blank filler sections of enclosures;
  - .3 Heating piping in soffits and/or overhang spaces and connected to bare element radiation in the spaces;
  - .4 Heated liquid system pump casings, valves, strainers and similar accessories;
  - .5 Manufactured expansion joints and flexible connections;
  - .6 Acoustically lined ductwork and/or equipment; and
  - .7 Flexible ductwork.

- .2 Unless otherwise specified or shown in the Contract Documents the installation of piping and ductwork insulation shall be in accordance with the TIAC Mechanical Insulation Best Practices Guide.
- .3 Install insulation directly over pipes and ducts and not over hangers and supports. Insulation and covering shall pass unbroken through the hangers and supports.
- .4 Do not apply insulation unless leakage tests have been satisfactorily completed.
- .5 Ensure that all surfaces to be insulated are clean and dry.
- .6 Ensure that the ambient temperature is minimum 13°C (55°F) for a minimum of one day prior to the application of insulation, and for the duration of insulation work, and that relative humidity is and will be at a level such that mildew will not form on insulation materials.
- .7 Install piping insulation and covering continuous through pipe openings and sleeves.
- .8 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .9 Pipe insulation at hangers and supports shall consist of a minimum of 300 mm (12 in.) long sections of calcium silicate or phenolic foam sectional insulation with vapour barrier jacket. Coordinate with discipline responsible for Section 20 05 29 Hangers and Supports to provide thermal breaks as listed here and in section 2.9 of that specification. Galvanized steel shields shall be provided between the insulation and the hanger or support for all pipe 50 mm (2 in.) diameter and above and not requiring a roller hanger or support. Provide "Armafix" insulation pipe hangers (IPH) for flexible elastomeric foam insulation.
- .10 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal. Insulation on cold piping must not be broken. Saddles that touch the cold piping directly are not acceptable on cold piping.
- .11 Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.
- .12 The final appearance and finish of exposed mechanical Work depends to a large degree on the quality of the insulation application, therefore, a neat and properly finished insulation job will be insisted upon.
- .13 When insulating vertical piping risers 75 mm (3 in.) diameter and larger, use insulation support rings welded directly above the lowest pipe fitting, and thereafter at 4.5 m (15 ft.) centres and at each valve and flange. Insulate in accordance with Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.
- .14 Where piping and/or equipment is traced with electric heating cable, ensure that the cable has been tested and accepted prior to the application of insulation, and ensure that the cable is not damaged or displaced during the application of insulation.
- .15 Where existing insulation work is damaged as a result of a new mechanical work, repair the damaged insulation work to new work standards.
- .16 Where fibreglass rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover the exposed end of the insulation with a purpose made PVC cover on "cold" piping.
- .17 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.



- .18 Where thermometers, gauges, etc., occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in the insulation and provide a suitable grommet in the opening.

### 3.2 PIPE INSULATION REQUIREMENTS – FIBREGLASS

- .1 **Domestic Water:** Insulate the following pipe with fibreglass insulation of the thickness noted below:
- .1 Potable cold water piping inside building and above ground – 25 mm (1 in.) thick.
  - .2 Potable hot water piping within. operating water temperatures up to and including 60°C (140°F), size of up to and including 32 mm (1.25 in.) – 25 mm (1 in.) thick.
  - .3 Tempered potable water piping, up to and including 32 mm (1.5 in.) - 25 mm (1 in.) thick.
  - .4 Tempered potable water piping, 40 mm (1.5 in.) and larger - 40 mm (1.5 in.) thick.
  - .5 Potable hot water recirculation piping with operating water temperatures up to and including 60°C (140°F), size of up to and including 32 mm (1.25 in.) - 25 mm (1 in.) thick.
  - .6 Non-potable cold water inside building and above ground – 25 mm (1 in.) thick.
- .2 **Drainage, Waste, and Venting:** Insulate the following pipe with fibreglass insulation of the thickness noted below:
- .1 Storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal mains. Where the roof drain is less than 3000 mm (10 ft.) from the vertical leader, insulate the first 3000 mm (10 ft.) of pipe closest to the roof drain including the vertical riser - 25 mm (1 in.) thick.
  - .2 Drainage piping from refrigerated drinking fountains to nearest 75 mm (3 in.) dia. or larger drain pipe – 25 mm (1 in.) thick.
  - .3 Drainage piping carrying chilled condensate to closest branch or main – 25
- .3 **Heating Water Piping:** Insulate the following pipe with fibreglass insulation of the thickness noted below:
- .4 Glycol solution heating or heat reclaim piping, supply and return, up to and including 32 mm (1.25 in.) dia. - 40 mm (1.5 in.) thick.
  - .5 Glycol solution heating or heat reclaim piping, supply and return, 40 mm (1.5 in.) dia. and larger - 50 mm (2 in.) thick.
  - .6 Piping: Ensure that the overlap flap of the sectional insulation jacket is secured tightly in place. Cover section to section butt joints with tape sealant.
  - .7 Fittings: Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket fibreglass insulation to a thickness and insulating value equal to the sectional insulation and secured in place with adhesive and/or wire and covered with PVC fitting covers. Provide sufficient material to prevent the PVC cover from being pushed in or crushed.
  - .8 "Cold" Piping Valves, Strainers, Etc.: Insulate valves, strainers, and similar piping system accessories in "cold" piping such as potable water piping with cut and tightly fitted segments of sectional pipe insulation with all joints covered with tape sealant, or, alternatively, wrap the piping valve, strainer, etc., with blanket fibreglass and cover with PVC covers as for "Fittings" above.
  - .9 Flanges and Mechanical Couplings: Terminate sectional insulation approximately 50 mm from the flange or coupling on each side of the flange or coupling. Cover the flange or coupling with a minimum 50 mm (2 in.) thickness of blanket fibreglass insulation wide enough to butt tightly to the ends of the adjacent sectional insulation. Secure the blanket insulation in place and cover with a PVC cover. Provide sufficient material to prevent the PVC cover from being pushed in or crushed.

### 3.3 DUCTWORK INSULATION REQUIREMENTS – FIBREGLASS

- .1 Insulate the following ductwork systems with fibreglass insulation of the thickness noted below:
  - .1 All fresh air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to the first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and the fresh air is not tempered, then the fresh air ductwork system complete – 50 mm (2 in.) thick
  - .2 Mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket
  - .3 Supply air ductwork outward from fans, except for supply ductwork exposed in the area it serves – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket
  - .4 Exhaust discharge ductwork for a distance of 3 m (10 ft.) downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10 ft.) distance or up until the motor operated damper – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket
  - .5 Any other ductwork, casings, plenums or sections specified or detailed on the Drawings to be insulated – thickness shall be as specified on the Drawings.
- .2 Insulation for casings, plenums, exposed rectangular ductwork shall be rigid board type. Insulation for round ductwork and concealed rectangular ductwork shall be blanket type.
- .3 Liberally apply adhesive to all surfaces of the ductwork and/or casing. Provide weld-on pins at 450 mm (18 in.) centres on the bottom duct surface only where blanket insulation is to be applied, and at 450 mm (18 in.) centres on bottom and side surfaces of ducts and/or casings where board insulation is to be applied. Secure the insulation in place with tight circumferential and longitudinal joints. Secure and seal all joints with 75 mm (3 in.) wide tape sealant. Install self-locking washers over pins and cut-off any excess pin length. Ensure that the insulation does not sag or bulge.
- .4 Provide drywall type metal corner beads on edges of exposed rectangular ductwork, casings and plenums in equipment rooms, service corridors, and any other area where the insulation is subject to accidental damage. Secure in place with tape sealant.
- .5 At each trapeze type duct hanger under rectangular or oval ductwork to be insulated with blanket type insulation, provide a 100 mm (4 in.) wide full length piece of rigid fibreglass board insulation between the duct and the hanger and cover joints with strips of tape sealant.
- .6 At each band type duct hanger around round ductwork to be insulated, provide a 100 mm (4 in.) wide section of sleeve or scored board type fibreglass insulation and cover joints with tape sealant.

### 3.4 INSULATION FINISH REQUIREMENTS

- .1 White Sheet PVC: Unless otherwise shown and/or specified in the Contract Documents, jacket all exposed fibreglass insulation work inside the building with white sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal all joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by the manufacturer's instructions.
- .2 Protective Coating – Flexible Elastomeric Insulation: Apply two heavy coats of the coating specified in the Contract Documents to all flexible elastomeric insulation exposed above grade.

**END OF SECTION**

1 General

**1.1 REFERENCE STANDARDS**

- .1 National Fire Prevention Association (NFPA)
  - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN4 S543, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittals.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
  - .2 Indicate:
    - .1 Materials.
    - .2 Finishes.
    - .3 Method of anchorage
    - .4 Number of anchors.
    - .5 Supports.
    - .6 Reinforcement.
    - .7 Assembly details.
    - .8 Accessories.
- .4 Samples:
  - .1 Submit samples of following:
    - .1 Each type of sprinkler head.
    - .2 Signs.
- .5 Test reports:
  - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Certificates:



- .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.

### 1.3 CLOSEOUT SUBMITTALS

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
- .2 Manufacturer's catalogue Data, including specific model, type, and size for:
  - .1 Pipe and fittings.
  - .2 Alarm valves.
  - .3 Valves, including gate, check, and globe.
  - .4 Sprinkler heads.
  - .5 Pipe hangers and supports.
  - .6 Pressure or flow switch.
  - .7 Mechanical couplings.
- .3 Drawings:
  - .1 Sprinkler heads and piping system layout.
    - .1 Prepare 707 mm by 1000 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
    - .2 Show data essential for proper installation of each system.
    - .3 Show details, plan view, elevations, and sections of systems supply and piping.
    - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
  - .2 Electrical wiring diagrams.
- .4 Design Data:
  - .1 Calculations of sprinkler system design.
  - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Field Test Reports:
  - .1 Preliminary tests on piping system.
- .6 Records:
  - .1 As-built drawings of each system.
    - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
    - .2 Submit 707 mm by 1000 mm drawings with title block similar to full size contract drawings.

- .7 Operation and Maintenance Manuals:
  - .1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for underground and aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

#### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: company or person specializing in wet sprinkler systems with documented experience and approved by manufacturer.
- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Protection:
  - .1 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

### 2 Products

#### 2.1 DESIGN REQUIREMENTS

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .6 Design systems for earthquake protection.
- .7 Location of Sprinkler Heads:

- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for ordinary hazard occupancy or as indicated.
- .2 Uniformly space sprinklers on branch.
- .8 Water Distribution:
  - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
  - .2 Discharge from individual heads in hydraulically most remote area to be 100 % of specified density.
- .9 Density of Application of Water:
  - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
- .10 Sprinkler Discharge Area:
  - .1 Area: hydraulically most remote areas as defined in NFPA 13.
- .11 Outside Hose Allowances:
  - .1 Include allowance in hydraulic calculations of 1892 lpm for outside hose streams.
- .12 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.
- .13 Water Supply:
  - .1 Perform water supply test to form the basis of hydraulic calculations. Coordinate with Owner.

## 2.2 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
  - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will only be permitted following written approval from Owner.
- .3 Conceal piping in areas with suspended ceiling.

## 2.3 PIPE, FITTINGS AND VALVES

- .1 Pipe:
  - .1 Ferrous: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
    - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
  - .2 Provide threaded fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.



- .3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
- .4 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
- .5 Fittings: ULC approved for use in wet pipe sprinkler systems.
- .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
- .7 Side outlet tees using rubber gasketed fittings are not permitted.
- .8 Sprinkler pipe and fittings: metal.
- .3 Valves:
  - .1 ULC listed for fire protection service.
  - .2 Gate valves: open by counterclockwise rotation.
  - .3 Provide wall indicator valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
  - .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.
  - .5 Provide gate valve in piping protecting machine rooms, machinery spaces, and elevator hoistways.
- .4 Pipe hangers:
  - .1 ULC listed for fire protection services in accordance with NFPA.

## 2.4 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
  - .1 Type A: upright bronze.
  - .2 Type B: pendant chrome link and lever type.
  - .3 Type C: pendant chrome glass bulb type.
  - .4 Type D: recessed chrome glass bulb type with ring and cup.
  - .5 Type E: flush satin link and lever type.
  - .6 Type F: side wall chrome link and lever type.
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
  - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
  - .2 Provide polished chromium-plated pendent sprinklers below suspended ceilings.
  - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
  - .4 Provide sprinkler heads as indicated.
  - .5 Deflector: not more than 75 mm below suspended ceilings.

- .6 Ceiling plates: not more than 25 mm deep.
- .7 Ceiling cups: not permitted.

## 2.5 SUPERVISORY SWITCHES

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
  - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Pressure or flow switch type:
  - .1 With normally open and normally closed contacts and supervisory capability.
  - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
  - .3 Connect into building fire alarm system.
  - .4 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
- .4 Pressure alarm switch:
  - .1 With normally open and normally closed contacts and supervisory capability.

## 2.6 PRESSURE GAUGES

- .1 ULC listed. and to Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems
- .2 Maximum limit of not less than twice normal working pressure at point where installed.

## 2.7 PIPE SLEEVES

- .1 Provide pipe sleeves where piping passes through walls, floors, and roofs.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
  - .1 Firmly pack space with mineral wool insulation.
  - .2 Seal space at both ends of sleeve or core-drilled hole with mechanically adjustable segmented elastomeric seal.
  - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
  - .1 Provide hot-dip galvanized steel.
  - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other than Masonry and Concrete Walls, Floors, and Roofs:
  - .1 Provide 0.61 mm thick galvanized steel sheet.

## **2.8 ESCUTCHEON PLATES**

- .1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
- .2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

## **2.9 INSPECTOR'S TEST CONNECTION**

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

## **2.10 SIGNS**

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

## **2.11 SPARE PARTS CABINET**

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Construct to sprinkler head manufacturers standard.
- .3 Number and types of extra sprinkler heads as specified in NFPA 13.

## **3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### **3.2 INSTALLATION**

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.
- .2 Testing to be witnessed by authority having jurisdiction.

### **3.3 PIPE INSTALLATION**

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.



### 3.4 ELECTRICAL CONNECTIONS

- .1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.
- .3 Provide wiring in rigid metal conduit or intermediate metal conduit.

### 3.5 DISINFECTION

- .1 Disinfect new piping.
- .2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.
- .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.
- .4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

### 3.6 FIELD PAINTING

- .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 mil, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 mil.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
  - .1 Piping in Finished Areas:
    - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
    - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
    - .3 Provide piping with 50 mm wide red enamel bands spaced at maximum of 6 m intervals throughout piping systems.
  - .2 Piping in Unfinished Areas:
    - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in spaces where walls or ceiling are not painted or not constructed of a prefinished material, pipe chases, spaces above suspended ceilings, crawl spaces, mechanical equipment room.
    - .2 Provide piping with 50 mm wide red enamel bands spaced at maximum of 6 m intervals.

### 3.7 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
  - .1 Perform test to determine compliance with specified requirements in presence of Owner.
  - .2 Test, inspect, and approve piping before covering or concealing.
  - .3 Preliminary Tests:
    - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
    - .2 Flush piping with potable water in accordance with NFPA 13.
    - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
    - .4 Test alarms and other devices.
    - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
  - .4 Formal Tests and Inspections:
    - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
    - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
    - .3 Repeat required tests as directed.
    - .4 Correct defects and make additional tests until systems comply with contract requirements.
    - .5 Furnish personnel, equipment, instruments, appliances, connecting devices, for tests.
    - .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

### 3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

1 General

**1.1 DESCRIPTION**

- .1 For additional information, refer to Section 21 05 01 - Common Work Results for Mechanical and Division 1 - General Conditions of the Construction Contract.
- .2 The Construction Contractor shall be responsible for coordinating all aspects of this work.
- .3 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Construction Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

**1.2 SCOPE OF WORK**

- .1 The scope of work for this Section includes, but is not limited to, the following:
  - .1 Provision and installation of pumping equipment for transfer of used process water to an existing oil-water separator.

**1.3 RELATED WORK**

- .1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.
- .2 Division 1 forms an integral part of Divisions 21, 22 and 23.

**1.4 REFERENCES**

- .1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.
- .2 In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Material Safety Data Sheets (MSDS).
- .4 National Research Council (NRC)/Institute for Research in Construction:
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC).

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Refer to Section 21 05 01 - Common Work Results for Mechanical and Section 01 33 00 - Submittal Procedures for submission requirements.
- .2 Product Data: Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

**1.6 CLOSEOUT SUBMITTALS**

- .1 Refer to Section 21 05 01 - Common Work Results for Mechanical, Section 01 33 00 - Submittal Procedures, and Section 01 78 00 - Closeout Submittals for submission requirements.

**1.7 DELIVERY, STORAGE AND HANDLING**



- .1 Shipping:
  - .1 All equipment, material and spare parts shall be shipped, stored, handled, and installed in such a manner as not to degrade quality, serviceability, or appearance. Equipment and material warranties shall not be voided by actions of the Construction Contractor.
  - .2 Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  - .3 Pack spare parts in containers bearing labels clearly designated contents and pieces of equipment for which intended.
  - .4 Deliver spare parts at same time as pertaining equipment. Deliver to City after completion of work.
- .2 Receiving:
  - .1 All equipment, material and spare parts shall be delivered to the site in original packages or containers bearing the manufacturer's labels and product identification.
  - .2 Inspect for damage and correctness, and inventory items, upon delivery to site.
  - .3 Store equipment, material and spare parts protected for the weather, humidity and temperature variations, dirt and dust or other contaminants. Store and safeguard in accordance with Manufacturer's recommendations.

## 1.8 QUALITY ASSURANCE

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

## 2 Products

### 2.1 CENTRIFUGAL TRANSFER PUMP

- .1 Type: base mounted, horizontal shaft, end suction
- .2 Fully self-priming
- .3 Discharge: 1-1/2" NPT
- .4 Liquid temperature rating: to 160°F (71°C); continuous at 70°F (21°C)
- .5 Maximum solids passing: less than 1/8 inch (3mm)
- .6 Volute: Cast Iron ASTM A-48, Class 30.
- .7 Motor Housing: Cast Iron ASTM A-48, Class 30.
- .8 Seal plate: Cast Iron ASTM A-48, Class 30.
- .9 Impeller:
  - .1 Design: Single Vane, Enclosed.
  - .2 Material: Cast Iron ASTM A-48, Class 30.
- .10 Shaft: Stainless Steel.
- .11 Square rings: Buna-N.
- .12 Hardware: 300 Series Stainless Steel.
- .13 Paint: Air Dry Enamel.
- .14 Seal:

- .1 Design: Single Mechanical, self-lubricating
    - .2 Material: Carbon/Ceramic/Buna-N.
  - .15 Hardware: 300 Series Stainless
  - .16 Motor:
    - .1 TEFC
    - .2 Insulation: Class B.
  - .17 Controller
    - .1 Dual Pump, float operated, duty / standby.
    - .2 Nema 4 (Cat.1 Wet location) controller with floats for on/off/high level alarm.
      - .1 Hand/Off/Auto for each pump.
      - .2 Power on/off indication.
      - .3 Pump on indication.
      - .4 Visual / Audible Alarm – manual reset for:
        - .1 Pump failure indication.
        - .2 High level alarm indication.
  - .18 Performance: as indicated in the schedules.
- 3 Execution
- 3.1 **MANUFACTURER'S INSTRUCTIONS**
  - .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2 **INSTALLATION**
  - .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
  - .2 Ensure pump and motor assembly do not support piping.
- 3.3 **CLEANING**
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1 American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
  - .5 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .6 ASME B31.9, Building Services Piping.
  - .7 ASME B36.19M, Stainless Steel Pipe.
- .2 ASTM International
  - .1 ASTM A182/A 182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
  - .2 ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .4 ASTM A312/A312M, Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .5 ASTM A351/A351M, Castings, Austenitic, for Pressure Containing Parts.
  - .6 ASTM A403/A403M, Wrought Austenitic Stainless Steel Piping Fittings.
  - .7 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .8 ASTM B32, Standard Specification for Solder Metal.
  - .9 ASTM B42, Seamless Copper Tube, Standard Sizes.
  - .10 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
  - .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .2 ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast, for Water.
- .4 CSA Group
  - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S101, Fire Endurance Tests of Buildings Construction and Materials.
  - .2 CAN/ULC S102.2, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
  - .3 CAN/ULC S115, Standard Method of Fire Tests of Firestop.
- .6 Department of Justice Canada (Jus)



- .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Grey Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .9 National Research Council (NRC)
  - .1 National Plumbing Code of Canada (NPC).
- .10 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

## **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data
  - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

## **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect all new equipment, devices, and piping from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground:
    - .1 Copper tube, hard drawn, type L: to ASTM B88M.
  - .2 Buried or embedded:

- .1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

## 2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

## 2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: tin copper alloy 95/5.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

## 2.4 GATE VALVES

- .1 NPS 2 and under, soldered:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 1/2 and over, flanged:
  - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

## 2.5 GLOBE VALVES

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.

## 2.6 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 1/2 and over, flanged:
  - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

**2.7 BALL VALVES**

- .1 NPS 2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.
  - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

**2.8 BUTTERFLY VALVES**

- .1 NPS 2-1/2 and over, lug :
  - .1 To MSS-SP-67, Class 200.
  - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
  - .3 Lever operated.
- .2 NPS 2-1/2 and over, grooved ends:
  - .1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
  - .2 Operator:
    - .1 NPS 4 and under: lever handle.

**Part 3 Execution**

**3.1 APPLICATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

**3.2 INSTALLATION**

- .1 Install in accordance with National Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 15 - Common Installation Requirements for Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.
- .4 Install CWS piping below and away from HWS and HWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .7 Valves
  - .1 Isolate equipment, fixtures and branches with ball valves or butterfly valves.
  - .2 Balance recirculation system using circuit balancing valves. Mark settings and record on as-built drawings on completion.



**3.3 PRESSURE TESTS**

- .1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

**3.4 FLUSHING AND CLEANING**

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal/Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

**3.5 PRE-START-UP INSPECTIONS**

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

**3.6 DISINFECTION**

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of DCC Representative.
- .2 Upon completion, provide laboratory test reports on water quality for DCC Representative approval.

**3.7 START-UP**

- .1 Timing: start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Bring HWS storage tank up to design temperature slowly.
  - .4 Monitor piping HWS and HWR piping systems for freedom of movement, pipe expansion as designed.
  - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

**3.8 PERFORMANCE VERIFICATION**

- .1 Scheduling:
  - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:

- .1 Verify that flow rate and pressure meet Design Criteria.
- .2 Verify compliance with safety and health requirements.
- .3 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .4 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

### 3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 22 42 00 – Plumbing Fixtures and Fittings.

**1.2 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA B70, Cast iron soil pipe, fittings, and means of joining.
  - .2 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.
  - .3 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Ontario Building Code 2012 (OBC)

**1.3 SUBMITTALS**

- .1 **Shop Drawings:** Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.
- .2 **Test Data:** Submit the following test data prior to application for Substantial Performance of the Work.
  - .1 Pipe leakage test sheets in accordance with Section 23 05 00 – Common Work Results for HVAC.
  - .2 A copy of the plumbing inspection certificate.
  - .3 Any other start-up or test data specified in this Section.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

**2.1 PIPE, FITTINGS AND JOINTS**

- .1 Adhesives and Sealants: Use sealants as recommended by the Manufacturer and in accordance with Section 01 35 22 – VOC requirements, and Section 01 60 00 – LEED product requirements as well as relevant ASTM standards.



## 2.2 PIPING AND FITTINGS

- .1 **Solvent Weld PVC Sewer Pipe:** SDR 35, 150 mm (6") and below, rigid PVC hub and spigot pattern sewer pipe and fittings in accordance with CAN/CSA B182.2. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. Provide green coloured pipe for sanitary lines and white coloured pipe for storm lines.
  - .1 Acceptable Manufacturers
    - .1 Ipex Solvent Weld Sewer Pipe
    - .2 Royal Building Products Solvent Weld Sewer Pipe
- .2 **Gasketed PVC Sewer Pipe:** SDR 35, 200 mm (8") and above, rigid PVC hub and spigot pattern sewer pipe and fittings in accordance with CAN/CSA B182.2, with gasket joints assembled with pipe lubricant from same manufacture as pipe. Provide green coloured pipe for sanitary lines and white coloured pipe for storm lines.
  - .1 Acceptable Manufacturers
    - .1 Ipex "Ring-Tite" Sewer Pipe
    - .2 Royal Building Products "DSL1" Sewer Pipe
    - .3 Next Polymers "Duraloc" Sewer Pipe
- .3 **PVC DWV Pipe:** Ipex Inc. System 15 rigid PVC drain, waste, and vent pipe and fittings manufactured to CAN/CSA B181.2, complete with solvent weld joints. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. When used in buildings of non-combustible construction all PVC pipes shall be certified to CAN/ULC S102.2 and achieve a Flame Spread Rating not exceeding 25. System 15 shall not be used in high buildings or air plenums. For dry fire barrier penetration, an approved donut type firestop conforming to the requirements of ULC/CAN4-S115 M95 shall be installed at all fire rated walls.
  - .1 Acceptable Manufacturers
    - .1 Ipex "System 15" DWV Pipe
    - .2 Royal Building Products "LRS-25" DWV Pipe
- .4 **Plenum Rated PVC DWV Pipe:** Ipex Inc. System XFR rigid PVC drain, waste, and vent pipe and fittings to CAN/CSA B181.2, complete with solvent weld joints. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. When used in buildings of non-combustible construction, high buildings, and air plenums all PVC pipes shall be certified to CAN/ULC S102.2, achieve a Flame Spread Rating not exceeding 25 and achieve Smoke Developed Classification not exceeding 50. For dry fire barrier penetration, an approved donut type firestop conforming to the requirements of ULC/CAN4-S115 M95 shall be installed at all fire rated walls.
  - .1 Acceptable Manufacturers
    - .1 Ipex "XFR" DWV Pipe
    - .2 Royal Building Products "HRS-2550" DWV Pipe
- .5 **DWV Copper- Solder Joint:** Type DWV hard temper in accordance with ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.
- .6 **Cast Iron:** Cast iron pipe, fittings and joints in accordance with CAN/CSA B70, couplings to CAN/CSA B602 (Class 4000).
- .7 **DWV Copper-Grooved Coupling Joint:** Type DWV hard temper in accordance with ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic Co. "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings or Grinnell (Tyco Mechanical Products) Style 672.

3 Execution

3.1 PIPING INSTALLATION REQUIREMENTS

- .1 Provide all required drainage, waste, and vent piping. Pipe, unless otherwise specified in the Contract Documents, shall be as follows:
  - .1 For underground sanitary and storm pipe inside the building footprint use rigid **PVC Sewer Pipe**, minimum 100 mm (4") diameter. For pipe sizes 150 mm (6") diameter and smaller use **Solvent Weld PVC Sewer Pipe**, for all larger pipe diameters use **Gasketed PVC Sewer Pipe**.
  - .2 For sanitary and storm pipe inside the building and above ground in sizes up to and including 65 mm (2½") diameter type **DWV Copper** shall be used. Where permitted by the OBC, **PVC DWV Pipe** may be used in lieu of **DWV Copper**.
  - .3 For sanitary and storm pipe inside the building and above ground in sizes 75 mm (3") diameter and larger - **Cast Iron** shall be used except for drainage pump discharge pipe. Where permitted by the OBC, **PVC DWV Pipe** may be used in lieu of **Cast Iron**.
  - .4 In air plenums **Plenum Rated PVC DWV Pipe** shall be used in lieu of **PVC DWV Pipe**.
- .2 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, the pipe has a smooth and uniform invert. Keep pipe thoroughly clean so that jointed compound will adhere. Inspect the pipe for defects before lowering the pipe into the trench. Do not use defective pipe.
- .3 Unless otherwise specified in the Contract Documents, slope horizontal drainage piping above ground in sizes to and including 75 mm (3") diameter 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") diameter and larger 25 mm (1") in 2.4 m (8').
- .4 Install and slope underground drainage piping to inverts or slopes indicated on the Drawings to facilitate straight and true gradients between the points shown. Verify available slopes before installing the pipes.
- .5 Unless otherwise specified in the Contract Documents, slope horizontal branches of vent piping down to the fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 (4').
- .6 Extend vent stacks up through the roof generally where shown but with exact locations to suit site conditions. Terminate vent stacks 457 mm (18") above the roof in vent stack covers.
- .7 Provide proper dielectric unions at connections between copper pipe and ferrous pipe or equipment.

END OF SECTION

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 22 13 16 – Drainage, Waste, and Vent Piping.
- .3 Section 22 13 20 – Floor Drains.
- .4 Section 22 13 23 – Sump Pumps and Pits

**1.2 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
  - .2 ASTM A48, Standard Specification for Gray Iron Castings.
  - .3 ASTM A563, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B584, ASTM Specification for Copper Alloy Sand Castings.
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ASME B1.20.1, Pipe Threads, General Purpose, Inch
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.
  - .2 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.
  - .3 CSA B272-93, Prefabricated Self-Sealing Roof Vent Flashings.

**1.3 SUBMITTALS**

- .1 **Shop Drawings:** Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

**2.1 CLEANOUTS**

- .1 Horizontal Piping: TY pipe fitting with an extra heavy brass plug screwed into the fitting.
- .2 Vertical Piping:
  - .1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, epoxy coated cast iron cleanout tees, each gas and water-tight, complete with an ABS tapered thread plug. Acceptable cast iron cleanout tees are:
    - .1 Zurn #Z-1445



Project No. 60678205

- .2 Jay R. Smith #4510
- .3 Mifab #C1460
- .4 Watts Water Technologies (Canada) Inc. #CO-460
- .3 Urinal(s): Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandalproof stainless steel securing screw. Acceptable products are:
  - .1 Zurn #Z-1666-1-VP
  - .2 Jay R. Smith #SQ4-1819
  - .3 Mifab #C1440-RD-6
  - .4 Watts Water Technologies (Canada) Inc. #CO-440-RD-6

## 2.2 FLOOR CLEANOUT TERMINATIONS

- .1 Baked epoxy coated cast iron terminations, each complete with a solid stainless steel gasketed access cover to suit the floor finish, a cleanout plug, and captive stainless steel securing hardware. Acceptable products are:
  - .1 Zurn #ZS-1602-SP Series
  - .2 Jay R. Smith #4020-SS-F-C Series
  - .3 Mifab #C1000-R-3-34
  - .4 Watts Water Technologies (Canada) Inc. #CO-1200-R-3-34
- .2 All cleanout terminations in areas with a tile or sheet vinyl finish are to be as above but with a square top in lieu of a round top. Refer to the Room Finish Schedule.

## 3 Execution

### 3.1 INSTALLATION OF CLEANOUTS:

- .1 Provide cleanouts in drainage piping in locations as follows:
  - .1 In the building drain or drains as close as possible to the inner face of the outside wall, and, if a building trap is installed, locate the cleanout on the downstream side of the building trap.
  - .2 At or as close as practicable to the foot of each drainage stack.
  - .3 At maximum 15 m (50 foot) intervals in horizontal pipe 100 mm (4 inch) diameter and smaller.
  - .4 At maximum 30 m (100 foot) intervals in horizontal pipe larger than 100 mm (4 inch) diameter.
  - .5 In the wall at each new urinal or bank of urinals in a washroom.
  - .6 Wherever else shown on the Drawings.
- .2 Cleanouts are to be the same diameter as the pipe in piping to 100 mm (4 inch) diameter, and not less than 100 mm (4 inch) diameter in piping larger than 100 mm (4 inch) diameter.
- .3 Cleanouts in vertical piping are to be cleanout tees, cast iron in piping 75 mm (3 inch) diameter and larger, copper or bronze in piping smaller than 75 mm (3 inch) dia.
- .4 Cleanouts in horizontal piping are to be TY fittings with removable plugs.

- .5 Where cleanouts are concealed behind walls or partitions, install the cleanouts near the floor and so that the cover is within 25 mm (1 inch) of the finished face of the wall or partition.

**3.2 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS:**

- .1 Where cleanouts occur in horizontal inaccessible underground piping, extend the cleanout TY fitting up to the floor and provide a cleanout termination set flush with the finished floor.
- .2 In waterproof floors, ensure that each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit the floor finish. Refer to Room Finish Schedules.
- .3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 22 13 16 – Drainage, Waste, and Vent Piping.
- .3 Section 22 13 19 – Drainage, Waste, and Vent Piping Specialties.

**1.2 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
  - .2 ASTM A48, Standard Specification for Gray Iron Castings.
  - .3 ASTM A563, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B584, ASTM Specification for Copper Alloy Sand Castings.
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ASME B1.20.1, Pipe Threads, General Purpose, Inch
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA B70, Cast iron soil pipe, fittings, and means of joining.
  - .2 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.
  - .3 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

**1.3 SUBMITTALS**

- .1 **Shop Drawings:** Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

**2.1 FLOOR DRAINS**

- .1 Compliance: ASME A112.6.3.
- .2 Body: 8-inch (200-mm) diameter body.
- .3 Lacquered, ASTM A 48, Class 25 cast iron body with anchor flange and weepholes.
- .4 4-inch (100-mm) throat. 4-inch (100-mm) NPS machined integral body threads.
- .5 Ductile iron grate.
- .6 Strainer Diameter: 5 inches (125 mm).
- .7 Pipe Size: minimum 3 inches (75 mm)



- .8 Sediment bucket.
- .9 Socket Connection Body: [PVC] [ABS].

3 Execution

**3.1 INSTALLATION OF FLOOR DRAINS**

- .1 Provide floor drains where shown on the Drawings.
- .2 Equip each drain with a trap and trap primer line.
- .3 In equipment rooms and similar areas, exactly locate floor drains to suit the location of mechanical equipment and equipment indirect drainage piping.
- .4 Confirm the exact location of drains prior to roughing in.
- .5 Temporarily plug floor drains during construction procedures. Remove plugs during final cleanup work and demonstrate free and clear operation of each drain. Replace any damaged grates.

**END OF SECTION**

1 General

**1.1 SUMMARY**

.1 Section Includes:

.1 Supply and installation of all piping, fittings, receiver, and related equipment used to supply compressed air to:

- .1 Festooning system for two traveling person lifts.
- .2 Compressed air festooning hose supplied by lift supplier.
- .3 Existing distribution piping system for abrasive blasting units.
- .4 Purified Breathing Air filtration system
- .5 Including festooning hose to two person lifts.
- .6 Receiver/storage tank.
- .7 Dust collector system.
- .8 As also indicated on the drawings.

.2 Quick disconnect connectors for room outlets and two outlets for person-lifts

.3 Related Requirements

.1 Not used

**1.2 REFERENCE STANDARDS**

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.

- .1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.
- .2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.
- .3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.

.2 ASME B16.5, Pipe Flanges and Flanged Fittings.

.3 ASME B16.11, Forged Fittings, Socket-Welding and Threaded.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A53/A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A181/A181, Standard Specification for Carbon Steel Forgings for General Purpose Piping.

.3 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

.1 Submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
- .2 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01- Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
  - .1 Submit shop drawings:
  - .2 Shop Drawings shall include all the major systems including and not limited to the following information:
    - .3 Filters
    - .4 Receiver
    - .5 Automatic drain and condensate pumping
    - .6 Piping Systems.
      - .1 Piping, fittings, valves.
      - .2 System purging and cleaning procedures and products.
      - .3 Quick connectors
    - .7 Electrical.
      - .1 Single line wiring diagram showing all devices and electrical components.
    - .8 Controls.
      - .1 Control Panel features and alarms.

#### 1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.

#### 1.5 TSSA PACKAGE:

- .1 Submit all required forms to CSA B51 and TSSA requirements.
- .2 Submit copies to both TTC and the TSSA.
- .3 Items to include:
  - .1 List of all welders working upon piping systems.
  - .2 Each welder's certification and welding procedure registration number(s).
  - .3 Welders' credentials prior to beginning installation of any system governed by the Boilers and Pressure Vessels Act.
  - .4 TSSA form, "Piping Systems Installation and Test Data Report."
- .4 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

#### 1.6 APPROVALS



- .1 TTC will register Contract Drawings and Specifications, where required under Boilers and Pressure Vessels Act, with Technical Standards and Safety Authority (TSSA).

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal and for recycling in accordance with Waste Management Plan (WMP).
  - .4 Separate for recycling and reuse and place in designated containers in accordance with Waste Management Plan (WMP).
  - .5 Handle and dispose of hazardous materials in accordance with CEPA and Regional and Municipal regulations.
  - .6 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

#### **1.8 PRE-START HEALTH AND SAFETY:**

- .1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

#### **1.9 APPROVALS**

- .1 ONTC will register Contract Drawings and Specifications, where required under Boilers and Pressure Vessels Act, with Technical Standards and Safety Authority (TSSA).

#### **1.10 CLOSEOUT SUBMITTAL(S):**

- .1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - .1 Identification: Manufacturing name, type, year, serial number, number of units, capacity and identification of related systems.
  - .2 Functional description detailing operation and control of components.
  - .3 Performance criteria and maintenance data.
  - .4 Operating instructions and precautions.
  - .5 Safety precautions.
  - .6 Spare parts list in accordance with Section 20 05 00.
  - .7 All TSSA test and inspection reports.
  - .8 Maximum allowable operating pressure of each system.
  - .9 Pressure rating of every device in each system, including pipes, fittings, hoses, flexible connectors, and valves.
  - .10 Actual working operating pressure of each system.
  - .11 Setting of each pressure regulator, PRV, etc.
  - .12 Maintain records and include documentation provided to TSSA of all certified fittings and assemblies (CRN).
  - .13 Copy of test certificate TSSA form "Piping Systems Installation and Test Data Report" completed and signed by the Contractor and TSSA inspector.
  - .14 Copy of piping system registration documents (Supplied by TTC).

- .15 Manufacturer's instructions for piping delivery and storage.
- .16 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.
- .17 Warranty information.

## 2 Products

### 2.1 MATERIALS

#### 2.2 AIR RECEIVER

- .1 Steel tank: to CSA B51, ASME Section VIII and provincial regulations, for working gauge pressure of 1035 kPa.
- .2 Inlet and outlet connections: NPS 3.
- .3 Accessories: adjustable pressure regulator, safety valve, 125 mm diameter gauge with pressure range of 0 to 1500 kPa, drain cock, and automatic condensate trap.
- .4 CRN.
- .5 Provincial inspector's certificate and label.
- .6 Finish: shop primed, ready for field painting.

#### 2.3 STEEL PIPING

- .1 Piping: to ASTM A53/A53M, schedule 40 seamless black steel.
- .2 Fittings:
  - .1 NPS1 and smaller: to ASME B16.11, schedule 40 steel, threaded.
  - .2 NPS1 to 2: to ASME B16.11, schedule 40 steel, threaded.
  - .3 NPS2 1/2 and larger: to ASME B16.11, schedule 40 steel, butt or socket welded.
- .3 Couplings: to ASME B16.11, socket welded or threaded half coupling type.
- .4 Unions: 1035 kPa malleable iron with brass-to-iron ground seat.
- .5 Dissimilar metal junctions: use dielectric unions.
- .6 Flanges:
  - .1 NPS2 and smaller: to ASME B16.5, forged steel, raised face and socket welded.
  - .2 NPS2 1/2 and larger: to ASME B16.5, forged steel, raised face and slip-on or weld neck.
- .7 Joints:
  - .1 NPS2 and smaller: NPT.
  - .2 NPS2 1/2 and larger: butt welded.

#### 2.4 BALL VALVES

- .1 Three piece design or top entry for ease of in-line maintenance.
  - .1 To ASTM A181/A181M, Class 70, carbon steel body screwed ends, carbon steel ball and associated trim suitable for compressed air application.
  - .2 To withstand 1035 kPa maximum pressure.
- .2 Proprietary for approved proprietary piping systems.

#### 2.5 COUPLERS/CONNECTORS

- .1 Industrial interchange series, full-bore, to match existing.

- .2 Maximum inlet pressure: 1700 kPa.
- .3 Valve seat: moulded nylon.
- .4 Body: zinc plated steel.
- .5 Threads: NPT.

3 Execution

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**3.2 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION**

- .1 Install flexible connection in accordance with Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
- .2 Install shut-off valves at outlets, major branch lines and in locations as indicated.
- .3 Install quick-coupler chucks and pressure gauges on drop pipes.
- .4 Install unions to permit removal or replacement of equipment.
- .5 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.
- .6 Grade piping at 1% slope minimum.
- .7 Install compressed air trap and pressure equalizing pipe at moisture collecting points. Drain pipe to nearest floor drain.
- .8 Make branch connections from top of main.
- .9 Install compressed air trap at bottom of risers and at low points in mains, piped to nearest drain. Distance between drain points to be 30 m maximum.
- .10 Weld steel piping in accordance with Section 23 05 17- Pipe Welding and;
  - .1 To ASME code and requirements of authority having jurisdiction.
  - .2 Weld concealed and inaccessible piping regardless of size.

**3.3 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Testing: pressure test in accordance with requirements of Section 21 05 01 - Common Work Results for Mechanical, for 4 hours minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.

**3.4 CLEANING**

- .1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems and Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping System.
- .2 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.
- .3 Check entire installation is approved by authority having jurisdiction.
- .4 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**



1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 01 00 – General Requirements
- .2 Section 22 11 16 – Domestic Water Piping

**1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International):
  - .1 CAN/CSA-B45 Series, Plumbing Fixtures.
  - .2 CAN/CSA-B125.3, Plumbing Fittings.
  - .3 CAN/CSA-B651, Accessible Design for the Built Environment.

**1.3 ACTIONS AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .3 Provide manufacturer's printed product literature and datasheets for fixtures and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Closeout Submittals:
- .5 Provide maintenance data in accordance with Section 01 78 00.
- .6 Include:
  - .1 Description of fixture and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.
- .7 Include diagrams for power, signal, and control wiring of automatic faucets.

**1.4 DELIVERY STORAGE AND DISPOSAL**

- .1 Waste Management and Disposal:
- .2 Separate waste materials for reuse and recycling.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material, in appropriate on-site bins.
- .4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

2 Products

**2.1 PLUMBING FIXTURE AND FITTING SCHEDULE**

- .1 For plumbing fixture and fitting manufacturers, catalogue numbers, and specific requirements, refer to the Drawing schedule of plumbing fixtures and fittings.
- .2 Unless otherwise specified in the Contract Documents, requirements specified below apply to the plumbing fixtures and fittings scheduled on the Drawings.

**2.2 GENERAL: PLUMBING FIXTURES AND FITTINGS**

- .1 Fixtures and fittings, where applicable, shall be in accordance with the requirements of CSA B45 Series, Plumbing Fixtures.
- .2 All fixtures and fittings for use by the handicapped are to be in accordance with Ontario Building Code requirements.

- .3 Unless otherwise specified in the Contract Documents, all vitreous china and porcelain enamelled fixtures shall be white.
- .4 Unless otherwise specified in the Contract Documents, all fittings exposed to view shall be chrome plated and polished.
- .5 All fittings located in areas other than private washrooms shall be vandal-proof.
- .6 All fixtures carriers shall be suitable in all respects for the fixture they support and the construction in which they are located.
- .7 Provide a master thermostatic mixing valve in basement mechanical room near hot water heaters and refer to Section 22 11 19.

## 2.3 WATER CLOSETS

- .1 WC-1 - Barrier Free, Wall Hung, Solar Flush Valve Water Closet
  - .1 Fixture: American Standard Afwall Millennium FloWise Elongated bowl no. 3351101.020 High Efficiency Toilet, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, white finish, siphon jet flush action, toilet operates in the range of 4.2L to 6.0L (1.1USG to 1.6USG) per flush, condensate channel, 305mm x 254mm (12" x 10") water surface, 54mm (2-1/8") fully glazed internal trapway, 38mm (1-1/2") diameter top spud.
  - .2 Seat: Centoco no. AMFR1500STSCSS-001 toilet seat, extra heavy duty, for elongated bowl, open front, solid plastic, less cover, stainless steel self-sustaining check hinges, metal flat washers stainless steel posts and nuts, white, antimicrobial and fire retardant surface.
  - .3 Valve: Delta Commercial model 81T201SP-48-MMO, electronic exposed solar flush valve for top spud toilet, polished chrome finish, 4.8L (1.28USG) factory set flow non-adjustable, vandal proof metal cover with top mounted electronic sensor and solar module, true mechanical manual override button (MMO), sensor designed for indoor lighting and operates in high or low brightness levels and compatible with occupancy lighting, scratch resistant lens window, four 'AA' batteries (factory installed) with battery strength indicator and low battery warning light, infrared sensor with multiple detection distances along with a bowl length setting to react appropriately to usage patterns, 24 hour automatic flush option, quiet action 'TECK' exposed chloramine resistant diaphragm flush valve, angle check stop with protecting cap, cover tube, wall flange, spud flange, concealed spud nut, outlet tube for 292mm (11-1/2") rough-in, vacuum breaker. Valve handing (Left or Right) shall be selected to suit each barrier free toilet stall location with **valve override button located farthest away from side wall**.
  - .4 Carrier: Watts no. ISCA-101-M11 single horizontal adjustable toilet carrier, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102mm (4") no hub waste, 51mm (2") no hub vent, 158.8kg (350 lbs) static load. Minimum space: 305mm (12") finished metal stud wall to back of pipe space.
  - .5 Coupling: Champion model MI-XHUB, no hub, 304 type stainless steel band and eyelet, elastomeric compound gasket comply to ASTM C-564, 304 type SS shield painted red to ease identification

## 2.4 LAVATORIES

- .1 LAV-1 - Barrier free Wall Hung Lavatory with Solar Faucet
  - .1 Fixture: American Standard Decorum #9024.001EC.020 Basin, Center hole only, 508 mm x 464 mm x 127 mm (20" x 18-1/4" x 5") high, Vitreous china, White Finish, for carrier with concealed arms, for carrier with concealed arms, Rear overflow, self-draining faucet ledge.
  - .2 Faucet: Delta model DEMD-320LF solar powered Electronic Faucet, Chrome plated finish, Center hole only, solid brass, above deck serviceable components, sensor

designed for indoor lighting and operates in high or low brightness levels and compatible with occupancy lighting, four 'AA' batteries (factory installed) with low battery warning light, auto shut-off after 30 seconds, vandal resistant concealed aerator at 0.5 GPM (1.9 LPM), single temperature, built-in check valve and inline filter.

- .3 McGuire #155A Open Grid Drain, cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece.
- .4 McGuire #LFH170BV Faucet Supplies, Chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, Escutcheon and flexible copper risers.
- .5 McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, Shallow wall flange and Seamless tubular wall bend.
- .6 McGuire PROWRAP #PW2000 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.
- .7 Watts #WCA-411 Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space

## 2.5 SINKS

- .1 S-1 – Barrier Free Two Compartment Stainless Steel Sink
  - .1 Fixture: Franke Commercial no. ALBD6406P-1/1 double bowl countertop mount sink, 1 hole, 794mm (31-1/4") wide x 521mm (20-1/2") long x 152mm (6") deep, spillway, counter mounted, back ledge, grade 18-10 18ga. (1.2mm) type 304 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89mm) crumb cup waste assembly with 1-1/2" (38mm) tailpiece.
  - .2 Faucet: Delta Signature model 470-DST single handle faucet, polished chrome finish, center hole only, Diamond coated ceramic cartridge, 6.8LPM (1.8GPM) regulator, swing spout rotates 120 degrees, 229mm (9") reach, lever handle with red/blue indicator markings, pull-out spray wand with aerated stream or spray, retractable hose 1346mm (53") long which extends to 864mm (34") usable length, standard 10mm (3/8") compression gasket fittings, integral double check valves in spout, 3/8" OD straight staggered PEX supply lines.
  - .3 Supplies: McGuire no. LFBV170 faucet supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13mm (1/2") I.D., inlet x 127mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers.
  - .4 Trap: McGuire no. 8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38mm (1-1/2") size, box flange and seamless tubular wall bend.
  - .5 McGuire PROWRAP #PW2000 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes
- .2 MS - Floor Mounted Service Sink
  - .1 Fixture: Stern Williams no. CRS-2200 Crescent quarter round service / mop sink, 711mm (28") wide x 711mm (28") long x 305mm (12") deep with 152mm (6") front lip with one piece 20 go. 302 stainless steel cap cast integral on from drop, floor mounted, Terrazzo receptor composed of pearl grey marble chips and white Portland cement



ground smooth, grouted and sealed to resist stains, integral cast brass drain with stainless steel strainer, 3" (76mm) outlet.

- .2 Faucet: Delta no. 28C8173 wall mounted two handles faucet, chrome plated finish, wall mount 8" (203mm) center set, cast brass body, 3.8LPM (1.0GPM) unrestricted hose end outlet, 203mm (8") projection spout with vacuum breaker and bucket hook, vandal resistant hooded lever handle, top brace, integral check stops, CER-TECK cartridges.
- .3 Splash Panel: Stern Williams BP 610mm (24") 20 ga. 304 stainless steel.
- .4 Hose & Wall Hook: Stern Williams T-34 hose and wall hook 36" (915mm) long flexible heavy duty 5/8" rubber hose, cloth reinforced with 3/4" chrome coupling. Wall bracket is 5"(127mm) long by 3" (76.2mm) stainless steel rubber grip.
- .5 Hanger: Stern Williams T-40 mop hanger, stainless steel with #4 finish, 24 inch long with 3 rubber spring loaded grips.

## 2.6 SHOWERS

- .1 SH-1 – Barrier Free Shower
  - .1 Fixture: Delta #T13H152-25 Universal Pressure balancing Shower kit, Chrome plated finish, R10000-UNWS MultiChoice valve heavy duty forged brass body, integral screwdriver stops, wall trim faceplate with on/off and temperature control single lever handle, integral service stops and adjustable hot limit safety stop. Hand shower with two check valves, 5.7 LPM (1.5 GPM) flow rate, 1753mm (69") long chrome plated stainless steel hose, wall supply, 914mm (36") stainless steel slide bar with adjustable slide.
  - .2 Drain: Watts #FD-100-C-A Floor Drain, epoxy coated cast iron, 5" (127 mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. Provide P-Trap, Same material as the connecting pipe drain.

## 2.7 EMERGENCY FIXTURES

- .1 ES – Eye Wash and Emergency Shower
  - .1 Fixture: Guardian #G1902 -FC20-SSH, pedestal mounted, combination shower and eye wash, 11 1/2" (292 mm) diameter, stainless steel bowl, two (2) GS-Plus spray heads with fliptop dust cover and filter, powder coated cast aluminum flag handle activation, 10" (254 mm) diameter stainless steel shower head, 1/2" (13 mm) IPS chrome plated brass stay-open ball valve with Teflon seal, 1" (25 mm) IPS chrome plated brass stay-open ball valve with Teflon seals, stainless steel actuating arm and 29" (737 mm) stainless steel pull rod, schedule 40 galvanized steel furnished with orange polyethylene covers on vertical piping, shower flow rate at 20 GPM (76 LPM), 1-1/4" (32 mm) NPT female outlet - Unit is third party certified by IAPMO to meet ANSI Z358.1-2014, the Uniform Plumbing Code cUPC and the National Plumbing Code of Canada. Eyewash/Facewash fixture should be installed 4 to 10 feet from the mixing valve.
  - .2 Thermostatic Mixing Valve: Lawler no. 911E/F, emergency thermostatic mixing valve for Eyewash or Eye/Face Wash, lead-free brass and stainless steel design, vandal resistant temperature adjustment, stainless steel sliding piston control device allow cold flow through both the fixed and variable bypass, 13mm (1/2") N.P.T., outlet, positive hot water shut-off, liquid-filled thermostatic motor control mechanism, 29°C (84.2°F) factory set temperature, standard 69.8°F (21°C) - 89.6°F (32°C) temperature range, 26LPM (6.9GPM) flow capacity at 30psi (207kPa) pressure drop across the valve, 7.57LPM (2.0GPM) min. Flow rate, 18LPM (4.8GPM) bypass flowrate at 30psig. Provide shut-offs at emergency mixing valve

## 2.8 ACCEPTABLE MANUFACTURERS

- .1 Vitreous china and enameled cast iron or steel fixtures: Basis of Design = American Standard, Alternate: Zurn, Sloan, Toto, and Kohler.
- .2 Stainless steel sinks: Franke, AERO, Novanni Stainless Inc., Kindred Industries "Aristaline".
- .3 Precast terrazzo fixtures: Acorn, Fiat Products Ltd. and Stern-Williams.

- .4 Water closet seats: Basis of Design = Centoco, Alternate: Zurn, Bemis, Olsonite and Beneke.
- .5 Flush valves: Basis of Design = Delta Commercial, Alternates: Zurn, Sloan, American Standard, Toto.
- .6 Fixture carriers: Zurn, Mifab, Jay R. Smith and Watts Industries .
- .7 Faucets: unless otherwise specified, Delta Commercial, Zurn, American Standard, Kohler and Chicago Faucet.
- .8 Fixture trim: unless otherwise specified, McGuire, Zurn, American Standard, Kohler.

### 3 Execution

#### 3.1 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

- .1 Provide all required plumbing fixtures and fittings.
- .2 Provide isolation valves (ball valves) for all fixtures.
- .3 Connect plumbing fixtures and fittings with piping sized in accordance with the Drawing schedule.
- .4 Confirm the exact location of all plumbing fixtures and trim prior to roughing-in.
- .5 When installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.
- .6 Counter Mounted Fixtures and Trim: Supply templates for all counter mounted fixtures and trim and hand to the trade who will cut the counter. Ensure openings in the counter are properly located.
- .7 Electronic Lavatory Faucets: Locate control panels for electronic faucets under the lavatories and recessed into the wall. It is the intent to locate the transformer(s) (power converter(s)) in the wall cavity or concealed under counters. Provide access doors accordingly for servicing of transformer(s). Coordinate locations with the work of Division 26 that will provide 120 vac line supply to the transformers(s). Provide low voltage wiring from the transformer(s) to each terminal point in control panel(s) under lavatories. All water and electronic supply from control panel to faucet shall be through the flexible conduit supplied with the control panel. Connect hot and cold water piping to the mixing valve in each box, and tempered water piping from each mixing valve to the faucet. Set mixing valve maximum temperature limit stops to 43°C. (109°F) after potable water systems (hot and cold) are complete. Ensure that each programmable controller is properly programmed, and that water off after deactivation is set for three seconds. **Note:** All electrical line supply and low voltage wiring, including any wall receptacles as well as low voltage wiring to boxes shall be concealed.
- .8 Electronic Flush Valves: Locate the transformer(s) (power converter(s)) in the wall cavity next to fixtures to be served. Provide access doors accordingly for servicing of transformer(s). Coordinate locations with Division 26 who will provide 120 vac line supply to the transformers(s). Provide low voltage wiring from the transformers(s) to each electronic flush valve terminal point. **Note:** All electrical line supply and low voltage wiring, including any wall receptacles as well as low voltage wiring to boxes shall be concealed.
- .9 Thermostatic Mixing Valves: The device shall be designed to be installed at a single outlet. It may be used to supply individual outlets when there is sufficient supply pressure. Ball valves shall be installed on the hot and cold inlet supplies. Temperature shall be field set. Maximum pressure differential shall be 103 kPa (15 psi) between hot and cold inlets. Integral check valves and strainer screen shall be installed on hot and cold supply.

#### 3.2 ADJUSTING

- .1 Adjust the water flow rate to design flow rates.
- .2 Adjust the pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
  - .1 Aerators: Verify operation, cleanliness.

- .2 Vacuum breakers, backflow preventers: Verify operation under all conditions.
- .3 Thermostatic controls:
- .4 Verify temperature settings, operation of control, limit and safety controls.

### **3.3 CLEANING AND PROTECTION**

- .1 After completing the installation of fixtures, inspect and repair damaged finishes.
- .2 Clean fixtures, faucets, valves and other fittings with the manufacturers' recommended cleaning methods and materials.
- .3 Provide protective covering for installed fixtures and fittings.
- .4 Do not allow the use of fixtures for temporary facilities unless approved in writing by the Owner.

**END OF SECTION**

**END OF SECTION**



**1 General**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
  - .1 ANSI/AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2 ANSI/AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.
  - .3 ANSI/AWWA C702, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
  - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
  - .2 CSA B79, Commercial and Residential Drains and Cleanouts.
  - .3 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 National Research Council Canada (NRC)
  - .1 National Plumbing Code of Canada (NPC).
- .5 Plumbing and Drainage Institute (PDI)
  - .1 PDI-WH201, Water Hammer Arresters Standard.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation Meetings:
  - .1 Convene pre-installation meeting 1 week prior to beginning on-site installation, with DCC Representative to:
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building construction subtrades.
    - .4 Review manufacturer's written installation instructions and warranty requirements.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:

- .1 Drawings to indicate accessories, dimensions, construction and assembly details, number of anchors, finishes, materials, method of anchorage.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **2 Products**

#### **2.1 FLOOR DRAINS**

- .1 Floor Drains: to CSA B79.
- .2 Type 2: heavy duty ; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.
- .3 Type 3: combination funnel floor drain ; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel, and trap seal primer connection.

#### **2.2 TRENCH DRAINS**

- .1 Trench Drains: to CSA B79.
- .2 Description: 14" (352mm) wide x 3.28' (1000mm) long drain system with integral ductile iron edge rail, precast polyester concrete channel of interlocking design with a built-in slope of 0.5%. Channel has an integral ductile iron edge rail, radiused bottom and 12" (305mm) internal width. Supplied with secured ductile iron slotted grate, Catch basin or integral 8" (203mm) No Hub bottom outlets. System shall be frame-anchored, with ductile iron, ADA compliant grating to suit DIN Class F load rating. System to include frame connectors, grate lockdowns, and construction covers.

- .3 Provide accessories to install and service the trench drains including minimum of four (4) grate removal tools. Turn accessories over to DCC Representative.

## **2.3 ROOF DRAINS**

- .1 Type 2: standard roof drain with cast iron body with aluminum dome, under-deck clamp to suit roof construction, flashing clamp ring with integral gravel stop.

## **2.4 CLEANOUTS**

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
  - .1 Wall Access: face or wall type, stainless steel square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
    - .1 Plugs: bolted bronze with neoprene gasket.
    - .2 Cover for Unfinished Concrete Floors: round nickel bronze gasket, vandal-proof screws.

## **2.5 NON-FREEZE WALL HYDRANTS**

- .1 Recessed type with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Chrome plated finish.

## **2.6 WATER HAMMER ARRESTORS**

- .1 Copper construction, piston type: to PDI-WH201.

## **2.7 BACK FLOW PREVENTERS**

- .1 Preventers: to CSA-B64 Series, application as indicated, including reduced pressure principle type and double check valve assembly.

## **2.8 VACUUM BREAKERS**

- .1 Breakers: to CSA-B64 Series, vacuum breaker, hose connection.

## **2.9 PRESSURE REGULATORS**

- .1 Capacity: as indicated.
  - .1 Inlet pressure: 1034 kPa.
  - .2 Outlet pressure: 413 kPa.
- .2 Up to NPS 1-1/2 bronze bodies, screwed: to ASTM B62.
- .3 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.
- .4 Semi-steel spring chambers with bronze trim.

## **2.10 BACKWATER VALVES**

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
- .2 Access:
  - .1 Surface access.
  - .2 Access pipe with cover: maximum 300 mm depth.



- .3 Steel housing with gasketted steel cover.
- .4 Concrete access pit with cover, as indicated.

#### 2.11 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

#### 2.12 WATER MAKE-UP ASSEMBLY

- .1 Complete with backflow preventer, pressure gauge on inlet and outlet, pressure reducing valve to CAN/CSA-B356, pressure relief valve on low pressure side and ball valves on inlet and outlet.

#### 2.13 TRAP SEAL PRIMERS

- .1 Pre-fabricated distribution manifold for trap seal priming. Quantity of connections to be determined by contractor on site.
- .2 Backflow Prevention: anti-siphon atmospheric vacuum breaker. NPS 3/4 inlet and outlet. Type "L" copper tubing.
- .3 Electrical Components: circuit breaker, manual override switch/test button, timer, solenoid valve marked as ULC listed, 120V.
- .4 Cabinet: 305 x 305 x 102 mm NEMA 1 surface mount, galvanized finish.

#### 2.14 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

#### 2.15 EMERGENCY FIXTURES

- .1 Designation: EW – Eye Wash and Emergency Shower
  - .1 Fixture: Pedestal mounted, combination shower and eye wash, 11 1/2" (292 mm) diameter, stainless steel bowl, two (2) spray heads with fliptop dust cover and filter, powder coated cast aluminum flag handle activation, 10" (254 mm) diameter stainless steel shower head, 1/2" (13 mm) IPS chrome plated brass stay-open ball valve with Teflon seal, 1" (25 mm) IPS chrome plated brass stay-open ball valve with Teflon seals, stainless steel actuating arm and 29" (737 mm) stainless steel pull rod, schedule 40 galvanized steel furnished with orange polyethylene covers on vertical piping, shower flow rate at 20 GPM (76 LPM), 1-1/4" (32 mm) NPT female outlet. Unit shall be third party certified by IAPMO to meet ANSI Z358.1-2014, the Uniform Plumbing Code cUPC and the National Plumbing Code of Canada. Eyewash/Facewash fixture shall not be installed further than 3000mm from the mixing valve.
  - .2 Thermostatic Mixing Valve: Emergency mixing valve, Thermostatic High-low master water mixing valve, Rough bronze finish, 7" X 6-1/2" X 3" (178 mm X165 mm X75 mm) , Temperature adjustment shall be vandal-resistant, 34 LPM (9 GPM) tempered flowrate @ 5 PSI pressure drop, 49 LPM (13 GPM) tempered flowrate @10 PSI pressure drop, 64 LPM (17 GPM) tempered flowrate @ 20 PSI pressure drop, 94 LPM (25 GPM) tempered flowrate @ 20 PSI pressure drop, In the event that the liquid motor fails, the control mechanism closes off the hot water port with the reverse seat and fully opens the internal variable bypass to allow cold water flow, The control mechanism shall employ a liquid-filled thermostatic motor to drive the valve without additional power requirements. The

control mechanism shall employ a stainless steel sliding piston control device with reverse seat closure and both fixed and variable cold water bypass, Listed to ASSE 1071, 32 mm (1-1/4") NPT inlet, 32 mm (1-1/4") NPT outlet, In the event of interruption of the hot water supply, the control mechanism shall allow cold flow through both the fixed and variable bypass., In-built thermometer to measure the temperature of the stream, In the event of interruption of the cold water supply, the control mechanism closes off the hot water port, stopping all flow. Positive hot water shut-off, For a single shower or for a single or multiple Eye wash station, 85 F, 125 PSI max inlet pressure, 70-90 F, 35 PSI Minimum supply pressure, 120 F Recommended inlet temperature, 65 PSI recommended operating pressure, 102 LPM (27 GPM) tempered flowrate @ 40 PSI pressure drop, The mixing valve must be installed with inlet check valves and the shower or the Eyewash/Facewash fixture should be installed 4 to 10 feet from the mixing valve. Hot and cold water inlet pressures must be equal. Provisions shall be made to thermally isolate the valve. Provide shut-offs at emergency mixing valve.

### **2.16 MASTER THERMOSTATIC MIXING VALVE**

- .1 Master water mixing valve shall be of the thermostatic type with liquid-filled thermal motor. It shall have lead free brass body construction with replaceable corrosion-resistant components. Valve construction shall employ a sliding piston control mechanism. Sliding piston and liner shall be of stainless steel material. Valve shall come equipped with union end stop and check inlets with removable stainless steel strainers. Valve shall control temperature from a low flow of 19 LPM (5 GPM) up to a maximum flow rate for a given pressure differential. For a flow rate of 624 LPM (200 GPM) the nominal pressure drop shall be 310 kPa (45 PSI). For a flow rate of 363 LPM (96 GPM) the nominal pressure drop shall be 70 kPa (10 PSI). Valve shall provide protection against hot or cold supply line failure and thermostat failure. Valve shall have safety limit feature set at 45 degrees C maximum and be adjustable on site.
- .2 Unit shall include a dial thermometer and shut-off valve on tempered water outlet. Unit shall be assembled and tested with necessary fittings and nipples.

## **3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: Examine all existing site conditions prior to commencing any work. Inform DCC Representative of any and all unacceptable conditions or deviations from the contract documents immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied or deviations have been addressed following receipt of written approval to proceed from DCC Representative.

### **3.2 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

### **3.3 INSTALLATION**

- .1 Install in accordance with National Plumbing Code and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

### **3.4 CLEANOUTS**

- .1 Install cleanouts at base of soil and waste stacks, and at locations required code, and as indicated.

- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

### **3.5 NON-FREEZE WALL HYDRANTS**

- .1 Install 600 mm above finished grade and as indicated.

### **3.6 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to fixtures or group of fixtures.

### **3.7 BACK FLOW PREVENTERS**

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
  - .1 Drains.
  - .2 Backwater Valves.
  - .3 Water Make-up Assembly.
- .2 Pipe discharge to terminate over nearest drain or service sink.

### **3.8 BACKWATER VALVES**

- .1 Install in main sewer lines and where indicated.
- .2 Install in access pit as indicated.

### **3.9 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

### **3.10 TRAP SEAL PRIMERS**

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply, in concealed space, to approval of DCC Representative.
- .3 Install soft copper tubing to floor drain.

### **3.11 STRAINERS**

- .1 Install with sufficient room to remove basket for maintenance.

### **3.12 WATER METERS**

- .1 Install water metre provided by local water authority.
- .2 Install water metre as indicated.

### **3.13 WATER MAKE-UP ASSEMBLY**

- .1 Install on valved bypass.
- .2 Pipe discharge from relief valve to nearest floor drain.

### **3.14 EMERGENCY FIXTURES**

- .1 Wall mount eye/face/shower water tempering valve assembly where indicated. Set maximum temperature limit stop to deliver 30°C water. Set mixing valve to deliver 25°C and confirm proper operation.
- .2 Secure eye/face/shower assembly to floor in accordance with manufacturer's installation instructions.

### **3.15 START-UP**

- .1 General:



- .1 In accordance with General Requirements, supplemented as specified herein.
- .2 Timing: start-up only after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

### 3.16 TESTING AND ADJUSTING

- .1 General:
  - .1 Test and adjust plumbing specialties and accessories in accordance with General Requirements, supplemented as specified.
- .2 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
  - .1 Pressure at fixtures: +/- 70 kPa.
  - .2 Flow rate at fixtures: +/- 20%.
- .4 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.
  - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .5 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.
  - .4 Check security, accessibility, removability of strainer.
  - .5 Clean out baskets.
- .6 Trench Drains
  - .1 Verify operation of trap seal primer and/or trench fume extraction fan.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check for proper slope and drainage throughout.
  - .4 Check security, accessibility, removability of grating.
- .7 Vacuum breakers, backflow preventers, backwater valves:
  - .1 Test tightness, accessibility for O&M of cover and of valve.
  - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
  - .3 Verify visibility of discharge from open ports.

- .8 Roof drains:
  - .1 Check location at low points in roof.
  - .2 Check security, removability of dome.
  - .3 Adjust weirs to suit actual roof slopes, meet requirements of design.
  - .4 Clean out sumps.
  - .5 Verify provisions for movement of roof systems.
- .9 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .10 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .11 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .12 Wall hydrants:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
- .13 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .14 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.
- .15 Hose bibbs, sediment faucets:
  - .1 Verify that flow and pressure meet design criteria.
  - .2 Check for leaks, replace compression washer if required.
- .16 Hydronic system water Make-up Assembly:
  - .1 Verify flow, pressure, and connection.
- .17 Water meters:
  - .1 Verify location and accessibility.
  - .2 Test metre reading accuracy.
- .18 Emergency fixtures:
  - .1 Adjust the water flow rate to design flow rates.
  - .2 Check Thermostatic controls:
  - .3 Verify temperature settings, operation of control, limit and safety controls.
  - .4 Verify system is capable of delivering emergency water flow for specified time frames of 75.7 lpm for 15 minutes for the shower and 11.4 lpm for 15 minutes for the eye wash.
- .19 Thermostatic Mixing Valves

- .1 Adjust the water flow rate to design flow rates.
- .2 Check Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

### **3.17 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.18 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

**END OF SECTION**



1 General

1.1 RELATED REQUIREMENTS

- .1 Section 20 05 00 – General Requirements.
- .2 Section 23 21 16 – Hydronic Piping Specialties.
- .3 Section 23 21 23 – Hydronic Pumps.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
  - .5 ANSI/ASME B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.
  - .6 ANSI/ASNE B31.9, Building Services Piping.
- .2 ASTM International Inc.
  - .1 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .2 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications.
  - .3 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - .4 ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .5 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
  - .6 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .7 ASTM B88, Standard Specification for Seamless Copper Water Tube.
  - .8 ASTM B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).
  - .9 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.
  - .10 ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - .11 ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.
  - .12 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

.3 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems

.4 Ontario Building Code 2012 (OBC)

### 1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Product Data:

.1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHIMS MSDS – Materials Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

.2 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

### 1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

## 2 Products

### 2.1 HYDRONIC PIPING, FITTINGS AND JOINTS

.1 **Black Steel – Grooved Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with:

.1 Cast ductile iron grooved end fittings conforming to ASTM A536.

.2 Victaulic Style 07 "Zero-Flex", Victaulic Corporation Style 107 "QuickVic", Tyco Grinnell (Tyco Mechanical Products) Style 772, Anvil International, Gruvlok Fig. 7401 "Rigidlok" or Shurjoint Model Z07 rigid couplings for piping in the Mechanical Rooms and for piping risers, Victaulic Corporation Style 77, Tyco Grinnell (Tyco Mechanical Products) Style 707, Anvil International, Gruvlok Fig. 700 or Shurjoint (Tyco Mechanical Products) Model 7707 standard flexible couplings for all other piping.

.3 Gaskets shall be EPDM compound, rated -34° C to +110° C (-30° F to +230° F).

.2 **Black Steel – Screwed Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.3 **Black Steel – Welded Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, mill or site beveled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible, and welded joints.

.4 **Black Steel – Press Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, complete with carbon steel fittings conforming to the performance criteria of IAPMO PS 117 and ASME B31.9. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed

connection. System to be rated to a minimum pressure of 1379 kPa (200 psi) and a temperature range of -18°C to 120°C (0F to 250°F).

- .1 Acceptable Manufacturers
  - .1 Viega LLC. "MegaPress"
  - .2 Apollo Valves "PowerPress"
- .5 **Copper – Solder Joint:** Type "L" hard drawn seamless copper to ASTM B88, plain ends. All joints made with 95-5 tin-antimony or tin-silver solder.
- .6 **Copper – Press Joint:** Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper press fittings (ANSI/ASME B16.22) or cast copper alloy press fittings (ANSI/ASME B16.18) conforming to the performance criteria of IAPMO PS 117. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. System to be rated to a minimum pressure of 1379 kPa (200 psi) and a temperature range of -18°C to 120°C (0F to 250°F).
  - .1 Acceptable Manufacturers
    - .1 Viega LLC. "ProPress"
    - .2 Apollo Valves "Press"
    - .3 Nibco Inc. "Press Fittings"

## 2.2 PIPING UNIONS

- .1 Screwed Steel Piping: Dart Union Co. of Canada Ltd. or approved equivalent malleable iron, ground joint, brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 Press Steel Piping: Viega MegaPress union or approved equivalent carbon steel press connection with a minimum pressure rating of 1379 kPa (200 psi) at a temperature range -18°C to 120°C (0F to 250°F).
- .3 Welded Steel Piping: Forged carbon steel slip-on type raised face welding flange unions in accordance with ASTM A105, 150 lb. Class.

## 3 Execution

### 3.1 HYDRONIC PIPING MATERIAL AND JOINT TYPES:

- .1 Heating water piping, Chilled water piping and Glycol water piping; unless otherwise specified, is to be as follows:
  - .1 For pipe up to 50 mm (2 in.) diameter, Schedule 40 **Black Steel – Screwed Joint**. As an alternative Schedule 40 **Black Steel – Press Joint**, Type "L" **Copper - Press Joint**, and Type "L" **Copper – Solder Joint** may be used.
  - .2 For short, individual branch connections to heating/cooling equipment, when pipe diameters are less than 25 mm (1 in.) and when working pressures are below 1034 kPa (150 psi) **Hydronic PEX** piping may be used as an acceptable alternative.

### 3.2 GENERAL PIPING INSTALLATION REQUIREMENTS

- .1 Slope all piping so that it can be completely drained. Horizontal piping mains to be sloped to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Branch supply

- and return piping connections to be sloped towards equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation of air vents.
- .2 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the work specified in Section 25 05 00 – Building Automation System.
  - .3 Connect equipment provided as part of the Work of other Sections with piping as indicated in and/or required by the Contract Drawings. Refer to pipe connection details on Drawings.
  - .4 Unless otherwise specified in the Contract Documents, locate and arrange horizontal pipes above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.
  - .5 Unless otherwise specified in the Contract Documents, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.
  - .6 Install all pipes and ducts parallel to building lines (all piping shall run parallel with closest wall).
  - .7 Piping in walk-in pipe spaces shall be installed as close to one wall as possible.
  - .8 Neatly group and arrange all exposed work.
  - .9 Locate all valves and any other equipment which will or may need maintenance or repaired in accessible spaces, equipment shall be easily accessible from access doors. Where valves and similar piping accessories occur in vertical service spaces (ie. in shafts, pipe spaces or partitions) locate the accessories at the floor level.
  - .10 Make all connections between pipes of different materials using proper approved adapters. Provide proper dielectric unions in all connections between copper pipe and ferrous pipe or equipment. Dielectric fitting to conform to ASTM F492 complete with thermoplastic liner.
  - .11 Ensure that the equipment and material manufacturers' installation instructions are followed unless otherwise specified in this Section or on the Drawings, and unless such instructions contradict governing codes and regulations.
  - .12 Carefully clean all pipes and fittings prior to installation. Temporarily cap or plug ends of pipes and equipment which are open and exposed during construction.
  - .13 Install piping which is to be insulated so that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the pipe, except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.
  - .14 Inspect surfaces and structure prepared by other trades before performing the work of this Section. Verify that surfaces or the structure to receive the work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of the work shall constitute the Contractor's acceptance of such surfaces as being satisfactory.

### 3.3 PIPE JOINT REQUIREMENTS

- .1 Do not make pipe joints in walls or slabs.
- .2 Ream all piping ends prior to making joints.
- .3 Properly cut threads in screwed steel piping and coat male threads, unless otherwise specified in the Contract Documents, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two pipe threads are to remain exposed.



- .4 Unless otherwise specified in the Contract Documents, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.
- .5 Install mechanical joint fittings and couplings in accordance with the manufacturer's instructions.
- .6 If grooved fittings and couplings are used, ensure that all valves and piping accessories are suitable. Grooves shall be rolled. Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to the manufacturer's instructions with respect to pipe grooving, support, anchoring and guiding the grooved piping system. Note that all grooved end piping system products shall be supplied by a single manufacturer who is operating to an ISO 9001 program.

#### **3.4 PRESSURE TESTS**

- .1 Conform to requirements of Section 20 30 01 – Pressure Testing, Cleaning and Filling.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 23 21 13 – Hydronic Piping.
- .3 Section 23 21 23 – Hydronic Pumps.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
  - .5 ANSI/ASME B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.
  - .6 ANSI/ASNE B31.9, Building Services Piping.
- .2 ASTM International Inc.
  - .1 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications.
  - .2 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - .3 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
  - .4 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .5 ASTM B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).
  - .6 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies
  - .3 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems
- .4 Ontario Building Code 2012 (OBC)

**1.3 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.
- .2 Product Data:
  - .1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHIMS MSDS – Materials Safety Data Sheets.

- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.
  - .2 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Store at temperatures and conditions recommended by the Manufacturer.

### 2 Products

#### 2.1 SHUT-OFF VALVES

- .1 Ball Type for nominal pipe sizes from 12 to 50 mm ( $\frac{1}{2}$ " to 2"): Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded or press joint ends, and removable lever handle. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:
  - .1 Kitz Corp. Code 58
  - .2 Toyo Valve Co. Fig. 5044A
  - .3 Nibco T-585-70
  - .4 Watts Water Technologies (Canada) Inc. #FBV-3C
  - .5 Equivalent manufacturers: Apollo Valves, Viega, Victaulic, Tyco Grinnell, M.A Stewart & Sons, NCI.
- .2 Butterfly Type for nominal pipe sizes 65 mm (2-1/2") and larger: Ductile iron, lug body style or grooved, 1200 kPa (175 psi) rated, butterfly valve, each complete with a neck to permit 50 mm (2 inches) of insulation above the flange, an EPDM seat, aluminum bronze or stainless steel disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 100 mm (4 inch) diameter, and a handwheel and gear type operator for valves larger than 100 mm (4 inch) diameter and each suitable for bubble-tight dead end service with the valve in position and either side of the connecting piping removed. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:
  - .1 Kitz Corp. Code 6122EL or 6122EG
  - .2 Toyo Valve Co. #918 BESL-2 or 918 BESG-2
  - .3 Nibco # LD-2000
  - .4 Equivalent manufacturers: Apollo Valves, Viega, Victaulic, Tyco Grinnell, M.A. Stewart & Sons, DeZurik of Canada Ltd.

#### 2.2 SWING CHECK VALVES

- .1 Bronze – Screwed: Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends. Acceptable products are:
  - .1 Kitz Corp. Code No. 22

- .2 Toyo Valve Co. Fig. 236
- .3 Nibco #T-413
- .4 Equivalent manufacturers: Apollo Valves, Watts Water Technologies (Canada) Inc.
- .2 Steel – Grooved Ends: Victaulic Co. of Canada Ltd. Series 716 "Vic-Check", Tyco Grinnell Model 590, Gruvlok Series 7811 or Shurjoint #SJ-900 grooved end carbon steel check valves suitable for mounting horizontally or vertically.
- .3 Cast Iron –Flanged: Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover and flanged ends as required. Acceptable products are:
  - .1 Kitz Corp. Code No. 78
  - .2 Toyo Valve Co. Fig. 435A
  - .3 Nibco #F-918-B
  - .4 Equivalent manufacturers: Apollo Valves, Watts Water Technologies (Canada) Inc.

### 2.3 VERTICAL LIFT CHECK VALVES

- .1 Class 125, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc. Acceptable products are:
  - .1 Kitz Corp. Code No. 36
  - .2 Toyo Valve Co. Fig. 231
  - .3 Nibco #T-480
  - .4 Watts Water Technologies (Canada) Inc. #LF600
  - .5 Equivalent manufacturers: Apollo Valves, Viega, M.A. Steward & Sons.

### 2.4 WAFER CHECK VALVES

- .1 Threaded lug body type, full bore, Class 125, 1380 kPa (200 psi) rated at 38 degrees C (100 degrees F), non-slam dual wafer check valves, each complete with a carbon steel or cast iron body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe. Acceptable products are:
  - .1 Nibco #W-920
  - .2 The Metraflex Co. Style CVXX
  - .3 Watts Water Technologies (Canada) Inc. Series #ICV-125
  - .4 Equivalent manufacturers: Crane Valve Co, Mueller Steam Specialty, Gulf Valve Co.

### 2.5 DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (3/4-inch) diameter straight pattern full port bronze or brass ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (3/4-inch) diameter garden hose, and a cap and chain. Acceptable products are:
  - .1 Kitz Corp. Code No. 68AC
  - .2 Toyo Valve Co. Ltd. Fig. 5046
  - .3 Nibco # T-585-70-HC
  - .4 Watts Regulator #B-6000-CC
  - .5 Equivalent manufacturers: Apollo Valves.



## 2.6 CIRCUIT BALANCING VALVES

- .1 Valves 12 to 50 mm (1/2 to 2 in.) 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off. Valves shall provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360 degree handwheel turns. 90 degree 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, 6.35 mm (1/4 in.) threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin.
- .2 Valves 65 to 300 mm (2-1/2 to 12 in.) 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off. Valves shall provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360 degree handwheel turns. 90 degree 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body shall be either cast iron with integrated cast iron flanges or ductile iron with industrial standard grooved ends. Valve stem and plug disc shall be bronze with ergonomically designed handwheel that permits multi-turn adjustments. Sizes 65 and 75 mm (2-1/2 and 3 in.) – 5 turns; sizes 100 mm to 150 mm (4 to 6 in.) – 6 turns; sizes 200 and 250 mm (8 and 10 in.) – 12 turns and size 300 mm (12 in.) – 14 turns. Flange adapters shall be supplied, to prevent rotation.
- .3 Acceptable products are:
  - .1 Armstrong Fluid Technology. Series "CBV" screwed, flanged or grooved
  - .2 Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end
  - .3 Tyco Grinnell Series CB800 screwed, flanged, or grooved end
  - .4 Gruvlok series "GBV" screwed or grooved
  - .5 RWV #9517 screwed or 9474P flanged

## 2.7 AUTOMATIC FLOW LIMITING VALVES

- .1 Valves 12 to 50 mm (1/2 to 2 in.) 'Y' pattern, pressure independent, cartridges shall be stainless steel with a spring loaded cup designed to dynamically absorb pressure fluctuations resulting from changes in system conditions due to varying heating/cooling loads. Flow shall be controlled within +/- 5% of the design flow, with a WOG rating of no less than 300 psi. Valves shall arrive fully assembled and include:
  - .1 **Cartridge:** AISI Type 304 stainless steel cartridge complete with an AISI Type 17-7 PH stainless steel spring.
  - .2 **Strainer:** 20 mesh stainless steel.
  - .3 **Body Material:** 12 to 40 mm (1/2 to 1-1/2 in.) to be constructed of forged brass (ASTM B283), 40 to 50 mm (1/2 to 1-1/2 in.) to be constructed of cast brass.
  - .4 **End Connections:** Brass – NPT, Sweat or Press joint.
  - .5 **Ball Valve Seals:** Teflon
  - .6 **Union Seal:** EPDM O-Ring

- .7 **Body Tappings:** Port 1 and 2 shall be combination P/T test valves and manual air vent; Port 4 shall be a drain.
- .8 **Ball Valve:** Nickel-plated brass ball.
- .2 Acceptable manufacturers:
  - .1 Griswold Controls LLC.
  - .2 Hays Fluid Controls.
  - .3 Bell & Gossett (Xylem Inc.)

## 2.8 PRESSURE RELIEF VALVES:

- .1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1035 kPa (150 psi) rated pressure relief valves, each capable of relieving the full output of the equipment it is associated with, and each factory set at the pressure as noted in Part 3 of this specification. Acceptable products are:
  - .1 Bell & Gossett (Xylem Inc.), 3301/4100, or 790/1170
  - .2 Spirax Sarco Ltd. SVI Series
  - .3 Watts Water Technologies (Canada) Inc. 174A or 740
  - .4 Equivalent manufacturers: Dresser Industries, McDonnell & Miller, Conbraco, Kunkel.

## 2.9 AIR VENTS

- .1 Manual Air Vents: Apollo Valves (Johnson Paterson) 27-Series or approved equivalent, 3.2 mm (1/8-inch) dia. manual valve with key.
- .2 Automatic Air Vents: Float actuated air vents, each complete with a cast iron body and a cap, a stainless steel float assembly and seat, and an EPDM valve head. Acceptable products are:
  - .1 Spirax Sarco Ltd., Type 13 WS for system working pressures to 1035 kPa (150 psi), 13WH for system working pressures greater than 1035 kPa (150 psi)
  - .2 Armstrong International, No. 1-AV

## 2.10 STRAINERS

- .1 Cast iron or bronze wye shaped strainers, minimum 860 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2 inch) diameter and larger, a blowdown pipe connection tapping. Acceptable products are:
  - .1 Kitz Fig. 15 screwed or Fig. 80 flanged
  - .2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged
  - .3 Watts Water Technologies (Canada) Inc. #77SCI
  - .4 Victaulic Co. of Canada Style 732 "Vic-Strainer"
  - .5 Equivalent manufacturers: Spirax Sarco Ltd., Muller Steam Specialties, Tyco Grinnell, Gruvlok, Shurjoint.

## 2.11 PIPING ALIGNMENT GUIDES

- .1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit the pipe size and the pipe insulation thickness. Acceptable products are:
  - .1 Mason Industries Inc. Series SPG.
  - .2 Hyspan Precision Products, Series 9500.
  - .3 The Metraflex Co. Style IV.

- .4 Equivalent manufacturers: Senior Flextronics Inc., E. Myatt & Co, Anvil Inc., Empire Tool & Mfg. Inc.

## **2.12 PIPE ANCHORS**

- .1 Welded structural black steel anchors of a size and type to securely anchor the pipe at the point shown. Each anchor is to be designed and detailed by a professional structural engineer registered in the Province of Ontario. Submit anchor shop drawings, stamped by the design engineer, for review.

## **3 Execution**

### **3.1 INSTALLATION OF SHUT-OFF VALVES**

- .1 Provide shut-off valves in piping connections to equipment, on branch line connections to mains, on each piping riser, at 30 m (100 foot) intervals on main lines, and wherever else indicated on the Drawings.
- .2 Valves in piping to and including 50 mm (2 inch) diameter are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified.
- .3 Locate all valves so that they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

### **3.2 INSTALLATION OF CHECK VALVES**

- .1 Provide a check valve in the discharge piping of every pump, and elsewhere in piping where shown on the Drawings.
- .2 In horizontal piping swing or vertical lift check valves shall be used. Where check valves are required in vertical piping, ensure that they are suitable in all respects for the application; vertical lift check valves shall be used wherever possible.
- .3 Wafer check valves may be used as an alternative to swing check valves when necessary.
- .4 Note that check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory supplied with the pump.

### **3.3 INSTALLATION OF DRAIN VALVES**

- .1 Provide a drain valve at the base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

### **3.4 INSTALLATION OF CIRCUIT BALANCING VALVES**

- .1 Provide circuit balancing valves in piping connections to all equipment (including but not limited to coils, heat exchangers (both circuits), boilers, unit heaters, radiation, radiant ceiling panels, pumps, 3-way control valves (2 ports), by-pass around control valves, etc.).
- .2 Confirm locations with the consultant prior to installation.

### **3.5 INSTALLATION OF AUTOMATIC FLOW LIMITING VALVES**

- .1 Provide automatic flow limiting valves, as an alternative to circuit balancing valves and where required by these specifications and the drawings.
- .2 Confirm locations with the consultant prior to installation.

### **3.6 INSTALLATION OF PRESSURE RELIEF VALVES**

- .1 Provide factory set pressure relief valves in all closed loop HVAC systems wherever else shown on the drawings.

- .1 For glycol-filled systems, pipe the discharge of each relief valve to the glycol make-up package storage tank unless otherwise shown or specified.
- .2 Pressure relief valve settings shall be selected based on the following order of priority:
  - .1 As noted on the drawings.
  - .2 The relief pressure specified for the loop's expansion tank.
  - .3 10% lower than the component in the system with the lowest pressure rating.
- .3 Confirm all pressure relief valve settings with the consultant prior to purchase and installation.

### **3.7 INSTALLATION OF AIR VENTS**

- .1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Install vents in accordance with the Drawing detail(s).

### **3.8 INSTALLATION OF STRAINERS**

- .1 Provide strainers in piping where shown.
- .2 Locate strainers so that baskets are easily accessible and removable.
- .3 Clean strainer baskets after piping system flushing and cleaning is complete, and before water quantity balancing commences.

### **3.9 INSTALLATION OF PIPING ANCHORS**

- .1 Provide anchors to secure pipework to the structure where shown and/or specified.
- .2 Anchors are to be in accordance with reviewed shop drawings.

**END OF SECTION**



1 General

**1.1 SCOPE OF WORK**

- .1 The scope of work for this Section includes, but is not limited to, the following:
  - .1 Materials and procedures for the provision and installation of hydronic pumps and related accessories.

**1.2 RELATED WORK**

- .1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the relevant Sections of Division 21, 22, 23, and 26 and all related works.
- .2 Division 1 forms an integral part of Division 21, 22 and 23 related requirements.

**1.3 REFERENCES**

- .1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE):
  - .1 Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for pump, circulator, and equipment, and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.
- .3 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and operation data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.6 MAINTENANCE**

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

**1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

**2.1 EQUIPMENT**

- .1 Size and select components to CSA-B214.

**2.2 VERTICAL IN-LINE CIRCULATORS**

- .1 Close-coupled, inline for vertical or horizontal installation.
- .2 Cast iron construction.
- .3 Suitable for standard operations at up to 212F (100°C) and 150 psig (1040 kPag) working pressure.
- .4 Pump internals capable of being serviced without disturbing piping connections.

- .5 Solid alloy steel shaft integral to motor. Non-ferrous shaft sleeve employed to completely cover the wetted area under the seal.
- .6 Motor bearings support shaft via heavy-duty, grease lubricated ball bearings.
- .7 Mechanical seal assembly internally flushed and installed in an enlarged tapered seal chamber complete with stainless steel housing, Buna bellows and seat gasket, stainless steel spring, and be carbon ceramic design with carbon face rotating against stationary ceramic face.
- .8 Stainless steel impeller keyed to shaft and secured by stainless steel locking capscrew or nut.
- .9 Impeller hydraulically and dynamically balanced to Hydraulic Institute Standards.
- .10 Pump volute Class 30 cast iron design with integral cast iron flanges drilled for 125# ANSI companion flanges. Include gauge ports at nozzles, vent and drain ports. Volute designed with base ring matching ANSI 125# flange to simplify pump support.
- .11 Motor:
  - .1 Power, speed, and voltage as scheduled.
  - .2 Heavy-duty grease lubricated ball bearings.
  - .3 Non-overloading at any point on the pump curve and meet NEMA specifications.
- .12 Controls:
  - .1 Integrated VFD with sensorless pump control.
  - .2 Factory mounted, wired, with a disconnect switch and menu-driven graphical interface.
  - .3 Provide near unity displacement power factor ( $\cos \phi$ ) without need for external power factor correction capacitors at all loads and speeds using VVC-PWM type integrated controls.
  - .4 Includes dual DC link reactors equivalent to 5% impedance line reactors, for reduction of mains borne harmonic currents and DC link ripple current to increase DC link capacitor lifetime.
  - .5 EMI/RFI filters conforming to DIN EN61800-3 to ensure integrated controls meets low emission and immunity requirements.
  - .6 System pressure to be maintained at 33 feet (10 m) (adj.) head minimum.
  - .7 Supports direct communication with the building management system (BMS) with builtin support for BACnet™ MS/TP protocol.
  - .8 Enclosure rated to ULc Type 12 suitable for indoor operation.
  - .9 Supports programmable skip frequencies and adjustable switching frequency for noise and vibration control.
  - .10 Provide a temperature controlled fan for cooling of the heat sink in the back panel.
  - .11 Rated to operate in ambient working conditions of minus 10°C to 45°C.
  - .12 Inputs and Outputs:
    - .1 Two (2) analog inputs (current or voltage).
    - .2 One (1) current output.
    - .3 Six (6) programmable digital inputs with 2 configurable as outputs.
    - .4 Supports two (2) programmable pulse inputs and two (2) programmable relay outputs.
    - .5 One (1) RS485 communication port.

- .13 Software capable of sensorless control in variable volume systems without need for pump mounted (internal/external) or remotely mounted differential pressure sensor.
- .14 Operates under quadratic pressure control (QPC) to ensure head reduction with reducing flow conforms to quadratic control curve.
- .15 Supports a minimum head of 40% of design duty head.
- .16 Provide user adjustable control mode settings and minimum/maximum head set points using built-in programming interface.
- .17 Software capable of controlling pump performance for non-overloading power at every point of operation.
- .18 Software capable of maintaining flow rate data.
- .13 Factory tested and name-plated before shipment.

### 3 Execution

#### 3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### 3.2 INSTALLATION

- .1 Install pumps to CSA-B214.
- .2 In line circulators: install as indicated by flow arrows.
  - .1 Support at inlet and outlet flanges or unions.
  - .2 Install with bearing lubrication points accessible.
- .3 Base mounted type: supply templates for anchor bolt placement.
  - .1 Include anchor bolts with sleeves. Place level, shim unit and grout.
  - .2 Align coupling in accordance with manufacturer's recommended tolerance.
  - .3 Check oil level and lubricate.
- .4 Ensure that pump body does not support piping or equipment.
  - .1 Provide stanchions or hangers for this purpose.
  - .2 Refer to manufacturer's installation instructions for details.
- .5 Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.
- .6 Pipe drain tapping to floor drain.
- .7 Install volute venting pet cock in accessible location.
- .8 Check rotation prior to start-up.
- .9 Install pressure gauge test cocks.

#### 3.3 START-UP

- .1 General:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements; supplemented as specified herein.
  - .2 In accordance with manufacturer's recommendations.

#### 3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**



1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 23 33 00 – Air Duct Accessories.
- .3 Section 23 36 00 – Diffusers, Registers, and Grilles.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers International (ASME)
  - .1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
  - .2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .2 A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
  - .3 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - .5 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 HVAC Duct Construction Standards - Metal and Flexible.
  - .2 HVAC Air Duct Leakage Test Manual.
- .4 Canadian Standards Association (CSA):
  - .1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.
  - .2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.
- .5 Underwriters' Laboratories, Inc. (UL)
  - .1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.
- .6 Ontario Building Code 2012 (OBC)

**1.3 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.
- .2 Shop Drawings:
  - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Duct Construction: Provide the manufacturer's product literature of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.

- .3 Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.

.3 Test Data:

- .1 Submit duct leakage test data prior to ductwork being covered from view.

.4 Closeout Submittals:

- .1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic.
- .4 Store at temperatures and conditions recommended by the Manufacturer.

## 2 Products

### 2.1 DUCTWORK

.1 General:

- .1 All ductwork shall be designed, constructed, supported and sealed in accordance with SMACNA HVAC Duct Construction Standards and pressure classifications, unless otherwise noted in the Contract Documents.

.2 Material:

- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
- .2 Thickness: to SMACNA.

### 2.2 CASING AND PLENUM MATERIAL

- .1 Unless otherwise specified in the Contract Documents, casing and plenum material shall be the same as the connecting duct material. If connecting duct is galvanized steel the galvanizing shall be G90.
- .2 Unless otherwise specified in the Contract Documents, each plenum shall have a hinged access door and each intake plenum shall have a watertight drainage pan and 25mm drainage port.

### 2.3 DUCT SYSTEM JOINT SEALANT

- .1 High Velocity Duct Sealant
- .2 ULC listed and labelled.
- .3 Premium grade, grey colour, water base, non-flammable duct sealer, brush or gun applied, with a maximum flame spread rating of 0 and smoke developed rating of 0.

### 2.4 ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 G90 galvanized steel, flared notched and beaded round duct take-off collar complete with damper and associated hardware (including spring loaded damper clip, threaded damper clip, locking wing-nut and aluminum handle) to be installed in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible
  - .1 Acceptable manufacturers are:
    - .1 Peppertree Air Solutions Inc.

- .2 Westaflex Inc.
- .3 Approved equivalent.

### 3 Execution

#### 3.1 FABRICATION OF DUCTWORK

- .1 Unless otherwise specified in the Contract Documents, construct, install and seal ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designations positive and negative as listed below. Construct ductwork so the manufacturer's gauge markings are external. Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting ductwork. Unless otherwise shown or specified, hang or support ductwork from the structure only. Where the ductwork is insulated, supports and hangers shall be of sufficient length to allow the insulation and covering to pass between the hangers unbroken.
- .2 The following low pressure and medium pressure construction is based on the SMACNA method of construction, and gives a minimum standard of construction. Proposed alternatives are acceptable provided they follow the SMACNA HVAC Duct Construction Standards. Submit alternatives for review prior to fabrication.
- .3 **Low Pressure Rectangular Ducts:** For systems less than 0.5 kPa (2" w.g.) static pressure and under 10.2 m/s (2000 fpm) velocity. Construct low pressure rectangular ducts as follows in Table 2:
  - .1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.
  - .2 Locate bracings mid-way between joints.
  - .3 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.

Table 1: Low Pressure Rectangular Duct Construction

Max. Duct Dimension	Sheet Metal (ga)	Transverse Joint Connection and Bracing
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing

- .4 **Low and medium pressure round ducts:** For systems below 6 inch Water Column (1.5 kPa) static pressure. Use products specified in Part 2 - Products wherever possible, otherwise construct low and medium pressure ducts as follows:
  - .1 Round ducts up to 750 mm (30 in.) dia. shall be factory fabricated, helically wound galvanized iron strips with spiral lock seam as follows. Join with galvanized iron coupling sleeves or conduit fittings of welded construction:

Table 2: Low and Medium Pressure Round Duct Construction (Up to 750mm)

Diameter	Strip Metal (ga)	Strip Joint	Girth Joint
Up to 200 mm (8 in.)	26	100 mm (4 in.)	50 mm (2 in.) long slip

225 mm to 550 mm (9 in. to 22 in.)	24	100 mm (4 in.)	50 mm (2 in.) long slip
575 mm to 750 mm (23 in. to 30 in.)	22	150 mm (6 in.)	100 mm (4 in.) long slip

- .5 All ductwork shall be sealed in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings.

### 3.2 GENERAL INSTALLATION OF DUCTWORK

- .1 Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.
- .2 Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.
- .3 Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.
- .4 Where the reinforcing of ductwork is required use of tie rods is the preferable method.
- .5 For insulated ductwork, size the hanger support to suit the insulated duct and install the hanger or support on the outside of the insulation and covering.
- .6 **Rectangular Duct Support Inside Building:** Coordinate with discipline responsible for Section 20 05 29 - Hangers and Supports to support horizontal rectangular ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with galvanized steel channels and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20").
- .7 **Round and Flat Oval Duct Support Inside Building:** Coordinate with discipline responsible for Section 20 05 29 - Hangers and Supports to support round and flat oval ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Unless otherwise specified in the Contract Documents, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.
- .8 **Watertight Ductwork:** Where watertight horizontal ductwork is required inside the building, construct the ducts without bottom longitudinal seams. Solder or weld the joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide the drain points. Provide watertight ductwork for:
- .1 Lockers shower/ washroom exhaust air ductwork (ERV)
- .2 Wherever else shown on the Drawings.
- .9 **Leakage Testing:** Leakage testing shall be performed in accordance with the ANSI/SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012 and shall be witnessed by the Consultant.
- .1 Acceptable Leakage shall be calculated based on the following criteria:
- .1 Rectangular metal ductwork - Leakage Class 6 (cfm/100ft<sup>2</sup> @ 1" w.g.)
- .2 Round metal ductwork - Leakage Class 3 (cfm/100ft<sup>2</sup> @ 1" w.g.)
- .3 No less than 25% of all ductwork shall be tested at the rated static pressure of the supply or exhaust duct. If the test result is "pass" then no additional testing shall be required. If the test result is "fail" then additional leak testing shall be



performed on 50% of all ductwork. If the test result is "pass" then no additional testing shall be required. If the second test result is "fail" then all 100% of ductwork shall be tested.

- .4 All ductwork shall be tested prior to the installation of dampers, grilles, registers, coils, openings, etc that could cause a failure in the pressure test. Sections of ductwork shall be completely replaced where this occurs prior to the passing of the leakage testing.
- .5 Positive pressure leakage testing is acceptable for negative pressure ductwork.
- .6 Leakage factor to be calculated based on surface area of metal contained within the section and the specified test pressure using ANSI/SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012 Fig's 5-1 & 5-1L.
- .7 To be certified by the same testing, adjusting, and balancing agency approved by the Consultant to undertake testing, adjusting, and balancing on this project.
- .10 **Application of Sealants:** Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed, apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of the sealant. For Seal Class A apply the sealant on the interior of the duct.

### 3.3 INSTALLATION OF FLEXIBLE DUCTWORK

- .1 Provide maximum 1.5 m (5') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers.
- .2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.
- .3 Install flexible ducts as straight as possible and support in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.
- .4 Do not penetrate fire barriers with flexible duct.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers International (ASME)
- .1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- .2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 American Society for Testing and Materials International (ASTM)
- .1 A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .2 A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .3 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- .5 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- .1 HVAC Duct Construction Standards - Metal and Flexible.
- .2 HVAC Air Duct Leakage Test Manual.
- .4 Canadian Standards Association (CSA):
- .1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.
- .2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.
- .5 Underwriters' Laboratories, Inc. (UL)
- .1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.
- .6 Ontario Building Code 2012 (OBC)

**1.3 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.
- .2 Shop Drawings:
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Duct Construction: Provide the manufacturer's product literature of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.
- .3 Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.
- .3 Test Data:

- .1 Submit duct leakage test data prior to ductwork being covered from view.
- .4 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).
- .4 Store at temperatures and conditions recommended by the Manufacturer.

### 2 Products

#### 2.1 DUCTWORK

- .1 Material:
  - .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
  - .2 Thickness: to SMACNA.
- .2 Construction: round.
  - .1 Ducts: factory fabricated, welded seam or spiral wound, with matching fittings and specials.
  - .2 SMACNA standard.
    - .1 Dust carrying ducts to be two gauges thicker than SMACNA standard recommendations.
  - .3 Transverse joints up to 36 in. (900 mm): slip type with tape and sealants.
  - .4 Transverse joints over 36 in. (900 mm): Vanstone.
  - .5 Fittings:
    - .1 Elbows: 5 piece (for 90 degrees), 3 piece (for 45 degrees)]. Centreline radius: 1.5 x diameter.
    - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.
- .3 Construction: rectangular:
  - .1 Clean air only.
  - .2 Ducts: to SMACNA.
  - .3 Transverse joints: welded.
  - .4 Fittings:
    - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
    - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow.
- .4 Fire stopping:
  - .1 Retaining angles around duct, on both sides of fire separation in accordance with Section .

- .2 Coordinate with Section 07 84 00 - Fire Stopping to ensure fire stopping materials and installation does not distort duct.

## 2.2 SEAL CLASSIFICATION

- .1 Clean air duct classification as follows:

Maximum Pressure "WC (Pa)	SMACNA Seal Class
10 (2500)	[A]
6 (1500)	[A]
4 (1000)	[A]
3 750)	[B]

- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant tape, or combination thereof.

## 2.3 SEALANT

- .1 Sustainability Characteristics:
- .1 Adhesives and sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .2 Oil resistant, water-borne polymer type flame resistant high velocity duct sealing compound.
- .1 Temperature range of minus 30 degrees C to plus 93 degrees C.

## 2.4 TAPE

- .1 Tape: polyvinyl treated, open weave fibre glass, [50] mm wide.

## 2.5 HANGERS AND SUPPORTS

- .1 Hangers and supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.
- .1 Band hangers: use on round and oval ducts up to 20 inch (500 mm) diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 20 inch (500 mm) diameter or longest side, to SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to most restrictive of SMACNA and following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:



- .1 For concrete: manufactured concrete inserts.
- .2 For steel joist: manufactured joist clamp or steel plate washer.
- .3 For steel beams: manufactured beam clamps:

### 3 Execution

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of ONTC Representative.
  - .2 Inform ONTC Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from ONTC Representative.

#### 3.2 GENERAL

- .1 Do work in accordance with ASHRAE and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate band hangers 4 inches (100) mm beyond insulated duct.
  - .2 Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

#### 3.3 HANGERS

- .1 Band hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: [in accordance with most restrictive of SMACNA and following:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

#### 3.4 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

#### 3.5 LEAKAGE TESTS

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Perform leakage tests in sections.
- .3 Perform trial leakage tests, as instructed to demonstrate quality of work.
- .4 Do not install additional ductwork until trial tests have been achieved.
- .5 Test section minimum of 100 ft. (30) m long with not less than 3 branch takeoffs and two 90 degrees elbows.
- .6 Complete tests before performing insulation or concealment Work.

### 3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Requirements.
- .2 Section 23 30 00 – HVAC Ducts and Plenums.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
  - .2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - .3 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 HVAC Duct Construction Standards - Metal and Flexible.
  - .2 HVAC Air Duct Leakage Test Manual.
- .4 Canadian Standards Association (CSA):
  - .1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.
  - .2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.
- .5 Underwriters' Laboratories, Inc. (UL)
  - .1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.
- .6 Ontario Building Code 2012 (OBC)

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit shop drawings for all equipment in this Section.
- .2 Test Data:
  - .1 Submit duct leakage test data prior to ductwork being covered from view.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

- .4 Store at temperatures and conditions recommended by the Manufacturer.

## 2 Products

### 2.1 GENERAL

- .1 The following shall not apply to dust transporting duct work.

### 2.2 SPLITTER DAMPERS

- .1 Minimum 0.95 mm thick (20 ga) damper blade constructed of the same material as the duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware DynAir Inc. #Q-50 "DYN-A-QUAP Single Shear" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin or approved equivalent.

### 2.3 AIR TURNING VANES

- .1 For square elbows – Ductmate "PROrail" multiple-radius turning vanes, interconnected with bars, adequately reinforced to suit the pressure and velocity of the system, constructed of the same material as the duct they are associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 For short branch ducts at grille and diffuser connections - air extractor type, each equipped with a matching bottom operated 90 degree opposed blade volume control damper, constructed of the same material as the duct it is associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

### 2.4 MANUAL BALANCING (VOLUME) DAMPERS

- .1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of the same material as the connecting ductwork unless otherwise specified in the Contract Documents (where aluminum is not available use stainless steel), each designed to maintain the internal free area of the connecting duct, and each complete with:
  - .1 A round shaft extension through the frame;
  - .2 Non-stick, non-corrosive bronze bearings for rectangular dampers, flange, non-stick, non-corrosive oilite bronze bearings for round dampers;
  - .3 No blade stops;
  - .4 Linkage for multiple blade dampers;
  - .5 Nailor # HL2 locking hand quadrant damper operator with 50 mm (2") standoff mounting.
- .2 Rectangular Dampers: Nailor Model #1810FDB-(GLV or SS)-DSB-BO-HLF, Spinnaker Industries Inc Model SK-1810-FF-16-CL-CB or Ruskin Model CD80VG1 (GLV or SS), maximum size 1.2m x 1.2m (4' x 4') for a single damper, and equipped with a 1.613 mm thick (16 ga) flanged type frame with 40 mm (1½") bolt hole centres, non-stick, non-corrosive bronze bearings, no sill and linkage out of air stream.
- .3 Round Dampers: Nailor Model #1090 BO FMS, galvanized or stainless steel, non-stick, non-corrosive oilite bronze bearings, full perimeter blade stop, maximum 1.2 m (4') diameter equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.
- .4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of the same material as the damper and designed for tight and secure mounting of the individual dampers.
- .5 Acceptable manufacturers are:
  - .1 Nailor Industries Inc.
  - .2 Greenheck Fan Corporation



- .3 E.H. Price Ltd.
- .4 Ruskin Company

## 2.5 CONTROL DAMPERS:

- .1 Motorized dampers shall be sized as indicated. Maximum damper section shall be 1200 mm x 1500 mm (48 in. x 60 in.). For dampers larger than the section maximum, use an assembly of multiple, equally sized sections.
- .2 Two-Position motorized dampers shall be parallel blade. Modulating motorized dampers shall be opposed blade. Exception: Parallel blade dampers may be used for return air and bypass application.
- .3 Frames shall be constructed of extruded aluminum.
- .4 Provide in duct mounting dampers.
- .5 Blades shall be extruded aluminum airfoil type.
- .6 Blade seals shall be extruded EPDM. Frame seals shall be extruded silicone. Seals shall be secured in an integral slot within the aluminum extrusions. Blade and frame seals shall be mechanically fastened to eliminate shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals shall not be acceptable.
- .7 Maintenance free bearings shall be composed of a Celcon inner bearing fixed to an aluminum blade pivot pin, rotating within a polycarbonate outer bearing inserted into the frame. No metal to metal or metal to plastic contact.
- .8 Drive rods, U bolt fasteners and retaining nuts shall be corrosion resistant zinc plated steel.
- .9 All linkage hardware shall be installed on the frame side. All linkage crank arm and rod hardware parts shall be constructed of aluminum.
- .10 Dampers shall be designed for operating in temperatures between -40°C to 100°C (-40°F to 212°F).
- .11 Leakage shall not exceed 15 l/s/m<sup>2</sup> (2.95 cfm/ft<sup>2</sup>) against 250 Pa (0.036 psi) of differential pressure across fully closed damper when tested to AMCA Standard 511.
- .12 Acceptable manufacturers are:
  - .1 T.A. Morrison & Co. Inc
  - .2 Nailor Industries Inc.
  - .3 Greenheck Fan Corporation
  - .4 E.H. Price Ltd.
  - .5 Ruskin Company.
  - .6 Ventex Inc.

## 2.6 FUSIBLE LINK (FIRE) DAMPERS

- .1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified in the Contract Documents) fusible link dampers, ULC classified to Standard CAN/ULC-S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1.5 hour or 3 hour rated as required by the Contract Documents, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, an integral steel sleeve c/w retaining angles, and, unless otherwise specified in the Contract Documents, a 74°C (165°F) rated standard fusible link.
- .2 Fusible link dampers shall be type "B" or type "C" (as required) with the folded curtain blade out of the air stream except where damper size or location requires the use of type "A" dampers with the curtain blade in the air stream.
- .3 Fusible link dynamic types shall consist of the following:

- .1 Dynamic curtain type shall not exceed a single section as follows:
  - .1 Horizontal mount Type "A": 610 mm wide x 610 mm high (24" wide x 24" high) Nailor Model D0114 c/w factory sleeve.
  - .2 Vertical mount Type "A": 914 mm wide x 914 mm high (36" wide x 36" high) Nailor Model D0114 c/w factory sleeve.
  - .3 Horizontal Type "B": 533 mm wide x 610 mm high (24" wide x 21" high) Nailor Model D0124 c/w factory sleeve
  - .4 Horizontal Type "B": 914 mm wide x 813 mm high (36" wide x 32" high) Nailor Model D0124 c/w factory sleeve.
  - .5 Type "A" dampers with folded blades in the airstream are only acceptable with the prior approval of the consultant
- .2 Dynamic airfoil multi-blade for sizes above 600 mm wide x 533 mm high (24" wide x 21" high):
  - .1 Vertical mount Type "A" shall not exceed 1829 mm wide x 1219 mm high (72" wide x 48" high) or 914 mm high x 2438 mm wide (36" wide x 96" high) maximum consisting of two sections. Nailor Industries Inc. Model D1201 c/w factory sleeve
  - .2 Horizontal mount Type "A" not to exceed 1626 mm wide x 1219 mm high (64" wide x 48" high) or 813 mm wide x 2438 mm high (32" wide x 96" high) maximum consisting of two sections. Nailor Industries Inc. Model D1201 c/w factory sleeve.
  - .3 Dampers with duct heights less than 203 mm (8") require Type B Nailor Industries Inc. Model D1202 c/w factory sleeve or Type "C".
  - .4 Type "A" dampers with folded blades in the airstream are only acceptable with the prior approval of the consultant
- .4 Fusible link dampers in ductwork other than galvanized steel shall be as specified above but constructed of type 316 stainless steel. Nailor Model D1201SS c/w factory sleeve:
  - .1 Type "A" single section minimum 203 mm wide x 203 mm high (8" wide x 8" high) or 914 mm high x 1219 mm wide (36" x 48") maximum single section. Vertical mount only. Nailor Model D1201SS c/w factory sleeve.
  - .2 Type "A" multi section assembly 203 mm wide x 203 mm high (72" wide x 96" high) or 914 mm wide x 1219 mm high (144" wide x 48" high) vertical mount only. Nailor Model D1201SS c/w factory sleeve.
- .5 Acceptable manufacturers are:
  - .1 Nailor Industries Inc.
  - .2 Greenheck Fan Corporation
  - .3 E.H. Price Ltd.
  - .4 Ruskin Company

## 2.7 FLEXIBLE CONNECTION MATERIAL

- .1 Waterproof indoor-outdoor woven fibreglass fabric coated on both sides with a specially compounded synthetic rubber, off-white in colour, flexible material between the fan discharge and the casing opening, with spring thrust restraints secured to welded brackets on the fan housing and by steel rods through the fan casing with a steel back-up plate. Acceptable products are:
  - .1 Duro Dyne Canada Inc. "DUROLON"
  - .2 DynAir Inc. "HYPALON"

- .2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber to produce a material with an operating temperature range of from -50°C to 260°C (-60°F to 500°F). Acceptable products are:

- .1 Duro Dyne Canada Inc. "Thermofab"
- .2 DynAir Inc. "SILICON HI-T"

## 2.8 DUCT ACCESS DOORS

- .1 Nailor Model Series 0800 flat oval access doors or approved equivalent complete with safety chain. Frame shall be of flat oval design, double flange frame mounting type M-1, die-formed of minimum 0.85 mm (22 ga) galvanized steel. Door shall be die-formed of minimum 0.85 mm (22 ga) galvanized steel and be of double skin construction with 25 mm (1") of insulation fully enclosed within and an integral bulb type seal fastened to the door with sizes suitable in all respects for the purpose for which they are provided, and, unless otherwise specified in the Contract Documents, constructed of the same material as the duct they are associated with. Manufacturer shall submit leakage data tested to a minimum of 2 kPa (8" w.g.).
- .2 Acceptable manufacturers are:
  - .1 Nailor Industries Inc.
  - .2 Ductmate Industries Inc.
  - .3 Ruskin Company

## 2.9 DUCTWORK DRAIN POINT

- .1 Ductmate Canada Ltd. "Moisture Drain", or approved equivalent 20 mm (3/4") in diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

## 2.10 INSTRUMENT TEST PORTS

- .1 Duro Dyne of Canada Ltd. #TH1 or #IP2 (to suit insulation thickness where applicable) or approved equivalent gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

## 2.11 FILTERS FOR COMMISSIONING

- .1 Supplied with each air handling unit as follows:
  - .1 Construction filter - Camfil Farr "CG-3000" 25 mm (1") thick, high-loft fibreglass (white/yellow), MERV 8, synthetic roll media secured in place in the filter section prior to shipping.

## 3 Execution

### 3.1 INSTALLATION OF SPLITTER DAMPERS

- .1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on the Drawings. Install splitter dampers so they cannot vibrate and rattle and so that the damper operation mechanisms are in an easily accessible and operable location.

### 3.2 INSTALLATION OF TURNING VANES

- .1 Provide turning vanes in all ductwork elbows (supply, exhaust, return) where due to site installation routing and duct elbow radius of less than one and a half (1½) times width (smooth radius elbows with a R/W of 1.5) is not possible, turning vanes and splitter vanes shall be in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

- .2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified in the Contract Documents.

### **3.3 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS**

- .1 Provide manual balancing dampers in all open end ductwork, in all supply and return air duct mains, in all branch ducts, at each individual grille, register, diffuser and wherever else shown and/or specified in the Contract Documents.
- .2 Install the dampers so that the operating mechanism is accessible and positioned for easy operation, and so that the dampers cannot move or rattle.
- .3 Where a duct for which a balancing damper is required has dimensions larger than the dimensions of the maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.
- .4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit.

### **3.4 INSTALLATION OF BACKDRAFT DAMPERS**

- .1 Provide backdraft dampers where shown on the Drawings.
- .2 Install and secure the dampers so that they cannot move or rattle.

### **3.5 INSTALLATION OF CONTROL DAMPERS**

- .1 Provide control dampers for all exhaust fans, exhaust air louvres, air intake louvres, and wherever else shown on the Drawings.
- .2 Install dampers in accordance with manufacturer's Installation Instructions.
- .3 Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access. The general contractor shall furnish any access doors required in walls, ceilings, or other general building construction.
- .4 Install dampers square and free from racking.
- .5 The installing contractor shall provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.
- .6 Do not compress or stretch the damper frame into the duct or opening.
- .7 Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.
- .8 Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft
- .9 Install connections to actuators as specified in Section 25 00 00.

### **3.6 INSTALLATION OF FUSIBLE LINK (FIRE) DAMPERS**

- .1 Provide fusible link dampers where shown and/or specified on the Drawings. Ensure that the damper rating (1.5 or 3 hr.) is suitable for the fire barrier it is associated with.
- .2 Install dampers with retaining angles on all four sides of the sleeve on both sides of the damper and connect with ductwork in accordance with the damper manufacturer's instructions and details to meet OBC requirements.



- .3 Provide expansion clearance between the damper or damper sleeve and the opening in which the damper is required. Ensure that the openings are properly sized and located, and that all voids between the damper sleeve and the opening are properly sealed to maintain the rating of the fire barrier.
- .4 Where the size of the fire barrier opening requires the use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC - S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.
- .5 Operational Testing: All fusible link dampers shall be tested in accordance with NFPA 80 and NFPA 105 as follows:
  - .1 An operational test shall be conducted after the building's HVAC system has been balanced.
  - .2 The operational test shall be conducted under normal HVAC airflow conditions as well as static flow conditions. The damper shall fully close/seal under both test conditions.
  - .3 After the installation of a damper is completed, an operational test shall be conducted to verify that:
    - .1 The dampers shall fully close from the open position.
    - .2 It shall be verified that the system airflow where the damper is installed is within the design velocity.
  - .4 All inspections and testing shall be documented, indicating the location of the fire damper, date(s) of inspection, name of inspector, and deficiencies discovered. The documentation shall have a space to indicate when and how the deficiencies were corrected rating of the damper listing.
  - .5 Demonstrate re-setting of all fire dampers to the Owner's representative after fan start/air handling unit startup and air balancing.
- .6 After testing, all fusible links shall be reset into the "closed" position, holding the damper blades in the in the open position, allowing airflow to pass through.

### **3.7 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL**

- .1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or casings connect to fans, where ducts cross building expansion joints, and wherever else shown or specified in the Contract Documents.
- .2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum 24 ga) to each edge of the flexible fabric and to the fan, duct, plenum, etc., in accordance with Figures 7-8 and 7-9 in SMACNA HVAC Duct Construction Standards Metal and Flexible Third Edition.
- .3 Ensure that connections to the flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

### **3.8 INSTALLATION OF DUCT ACCESS DOORS**

- .1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils (upstream and downstream), fire dampers, smoke dampers, duct mounted smoke detectors, control and operating dampers, equipment requiring maintenance, duct mounted instrumentation or control devices.
- .2 Install in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .3 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure that the doors are properly located for damper maintenance.
- .4 When requested, submit a sample of proposed duct access doors for review.

- .5 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce the ductwork to suit the access door installed.

### **3.9 INSTALLATION OF INSTRUMENTS TEST PORTS**

- .1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.
- .2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

**END OF SECTION**

1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 00 – General Mechanical Requirements.
- .2 Section 23 30 00 – HVAC Ducts and Plenums.
- .3 Section 23 33 00 – Air Duct Accessories.

**1.2 REFERENCES**

- .1 Air Movement and Control Association (AMCA)
  - .1 AMCA Publication 511, Product Rating Manual for Air Control Devices.
- .2 Air Conditioning, Heating, and Refrigeration Institute (AHRI)
  - .1 ANSI/AHRI 885, Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.
- .3 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE 36B-63, Method of Testing for Rating the Acoustic Performance of Air Control and Terminal Devices.
  - .2 ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA, HVAC Duct Construction Standards - Metal and Flexible.
- .5 Ontario Building Code 2012 (OBC)

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit product literature for all equipment in this Section.
- .2 Colour Chart(s): Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).
- .4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

**2.1 GENERAL**

- .1 Grilles, registers, and diffusers for inlets to exhaust and return air system and as outlet for supply air systems shall be sized shown on the Contract Drawings.
- .2 Refer to the Grilles and Diffusers Schedule at the end of the Section for additional details.

- .3 Where special colour finish or material is noted submit samples for the Consultant selection. Refer to the Contract Drawings for model and capacity.
- .4 Diffusers shall meet test requirements of ASHRAE Standard 36B-63, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63.
- .5 Acceptable manufacturers are:
  - .1 E.H. Price Ltd.
  - .2 Nailor Industries Inc.
  - .3 Titus HVAC.
  - .4 Krueger.
  - .5 Enviro-Tec.

## **2.2 SQUARE SUPPLY DUFFUSERS**

- .1 All diffusers shall be steel plaque diffusers constructed of square, coned metal with a powder coat finish.
- .2 Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown.
- .3 An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck.

## **2.3 RETURN, EXHAUST AND TRANSFER GRILLES**

- .1 Return, exhaust and transfer registers shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return.
- .2 The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated or galvanized steel.
- .3 General appearance, type of material and finish shall match supply grilles within item 2.4.

## **2.4 EGGCRATE RETURN GRILLE**

- .1 Return grilles shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick.
- .2 Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system.
- .3 Colour shall match adjacent surfaces.

## **3 Execution**

### **3.1 INSTALLATION OF DIFFUSERS, REGISTERS, AND GRILLES**

- .1 Provide grilles and diffusers where shown on the Drawings. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit. The mechanical drawings show intent and number of diffusers, grilles and registers required.



- .2 Wherever possible, diffusers, registers, and grilles shall be the product of one manufacturer. Unless otherwise specified connect diffusers, registers, and grilles in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .3 Install in accordance with manufacturer's instructions.
- .4 Confirm diffuser, register, and grille finishes prior to ordering.

**GRILLE AND DIFFUSER SCHEDULE**

Tag	Service	Model	Description	Finish	Mounting

\*Models selected based on EH Price

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

**1.2 SUMMARY**

- .1 This Section includes requirements for the supply, installation, testing and commissioning of a Purified Breathing Air (PBA) system, supplied from existing shop compressed air, including:
- .1 PBS Filtering system
  - .2 Remote Carbon Monoxide (CO) alarming system.
  - .3 Piping, fittings and valves.
  - .4 Quick disconnect couplings.
  - .5 BA festooning hose
  - .6 Final air sampling, and testing by 3<sup>rd</sup> party accredited laboratory
- .2 Use:
- .1 The systems will be used by up to 3 end users performing abrasive blasting within a designated blasting room. End users are assumed to be wearing full hood type respiratory protection with anticipated maximum airflow rates of 15 CFM (7 litres/second) each.
- .3 Distribution System to include
- .1 Two drops, and festooning system hose for connection to two travelling person lifts.
    - .1 Festooning system lift supplier.
  - .2 Four drops with quick disconnect couplings in blast room.

**1.3 RELATED REQUIREMENTS**

- .1 Not used

**1.4 DEFINITIONS**

- .1 Not used

**1.5 REFERENCE STANDARDS**

- .1 All references and standards specified herein imply the latest edition of the standards.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
- .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ASTM International
- .1 American Society for Testing and Materials International, (ASTM)
    - .1 ASTM B16/B16M-Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
    - .2 ASTM B62- Standard Specification for Composition Bronze or Ounce Metal Castings
    - .3 ASTM B88 Standard Specification for Seamless Copper Water Tube

- .4 ASTM B283, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
- .5 ASTM B505/B505M, Standard Specification for Copper-Base Alloy Continuous Castings.
- .6 ASTM A653/A653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian Standards Association
  - .1 CSA Standard C22.1, Canadian Electrical Code.
  - .2 CSA Standard Z180.1 Compressed Breathing Air and Systems
- .3 European Union
  - .1 EU REGULATION (EU) 2016/425 - Personal protective equipment' which include the following standards:
    - .1 SS-EN 14594: Respiratory protective devices - Continuous flow compressed air line breathing devices - Requirements, testing and marking.
    - .2 SS-EN 14593-1: Respiratory protective devices - Compressed air line breathing devices with demand valve - Part 1: Devices with a full face mask - Requirements, testing and marking.
  - .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
    - .1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
    - .2 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.
    - .3 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
  - .5 Province of Ontario
    - .1 Ontario Occupational Health and Safety Act
    - .2 R.R.O. 1990, Regulation 833 – Control of Exposure to Biological or Chemical Agents
  - .6 Underwriters Laboratories of Canada (ULC)
    - .1 CAN/ULC-S102-1988 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.
- .4 In addition, comply with all Local and Regional Statutory Regulations, Codes and Standards.
- .5 In the event of conflict between the drawings, specifications, data sheets and/or the purchase order, obtain clarification before proceeding with the work.

#### 1.6 SUBMITTALS

- .1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:
  - .1 Shop Drawings shall include all the major systems including and not limited to the following information:
  - .2 PBA unit
    - .1 Overall system information
    - .2 Purification system details
  - .3 Piping Systems.

- .1 Piping, fittings, valves, flux, solders.
- .2 System purging and cleaning procedures and products.
- .3 Quick connectors
- .4 Electrical.
  - .1 Single line wiring diagram showing all devices and electrical components.
  - .2 Remote alarm annunciator circuit diagram/schematic.
- .5 Controls.
  - .1 Control Panel features and alarms.

**1.7 QUALITY ASSURANCE SUBMITTAL(S):**

- .1 Submit design data and test reports related to PBA system performance.
- .2 Submit final air purity testing by an independent recognized agency.

**1.8 COMMISSIONING SUBMITTAL(S):**

- .1 In accordance with Section 01 91 00:
- .2 Submit Test Procedures.
- .3 Submit Certificate of Readiness.
- .4 Submit Test Reports.
- .5 Submit Closeout Report.

**1.9 CLOSEOUT SUBMITTAL(S):**

- .1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
- .2 Identification: Manufacturing name, type, year, serial number, number of units, capacity and identification of related systems.
- .3 Functional description detailing operation and control of components.
- .4 Performance criteria and maintenance data.
- .5 Operating instructions and precautions.
- .6 Safety precautions.
- .7 Spare parts list in accordance with Section 20 05 00.
- .8 Maintenance and troubleshooting guidelines/protocol and recommended equipment for analysis and repair.
- .9 Manufacturer's installation instructions for replaceable components and consumables.

**1.10 PRE-START HEALTH AND SAFETY:**

- .1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

**1.11 MANUFACTURER QUALIFICATIONS:**

- .1 The Manufacturer(s) of the filtration system shall:
- .2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.
- .3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.



#### 1.12 MANUFACTURER'S REPRESENTATIVE:

- .1 A qualified manufacturer's representative shall be available to:
  - .1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.
  - .2 On site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):
    - .1 Initial start-up and ongoing testing. Include for 1 site day.
    - .2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 – Training.

#### 1.13 DELIVERY, STORAGE, AND HANDLING

- .1 Reject equipment delivered to site in damaged condition.
- .2 Store in manufacturer's unopened packaging in clean, dry area prior to installation.
- .3 Unpack and handle in accordance with manufacturer's instructions.

### 2 Products

#### 2.1 PURIFIED BREATHING AIR (PBA) FILTERING SYSTEM.

- .1 Compressed air based system.
  - .1 Wall mounted panel type system.
  - .2 Cartridge type filtration.
  - .3 Minimum rated capacity: 45 CFM (21 L/sec)
  - .4 Treatment to the requirements of CSA Z180, including but not limited to the acceptable levels of:
    - .1 Solid particles
    - .2 Oil mists, vapours, and fumes
    - .3 Water mists
- .2 Minimum 3 stage purification including:
  - .1 Coalescing filtering
  - .2 Activated carbon filtering
- .3 Onboard Monitoring and Diagnostic system
  - .1 Filter change indicator
  - .2 Integrated CO Monitor with visual and audible alarming on unit.
  - .3 CSA components.
  - .4 Activation at 5ppm, or as per local Authority Having Jurisdiction, whichever is most stringent.
  - .5 120vac
  - .6 Integrated pressure indicator gauge
  - .7 Integrate remote alarming output

- .8 Dry contact relay.
- .9 Refer also to section 2.3
- .4 Acceptable products:
  - .1 Air Systems International – BB50 series
  - .2 Nano BAP 050
  - .3 Parker-Domnick-Hunter BAFP-064P
  - .4 Approved equivalent.

## 2.2 PURIFIED BREATHING AIR SYSTEM DISTRIBUTION

- .1 Distribution to 4 room air outlets, and to 2 festooning system connections for travelling person lifts.
- .2 To the requirements of CSA Z180.1
- .3 Pipe:
  - .1 Copper: ASTM B88 type L
- .4 Valves:
  - .1 Bronze full port ball valves to MSS SP-110
- .5 Connections and Fittings:
  - .1 Bronze union at filter pack discharge.
  - .2 Threaded bronze fittings at all outlets
  - .3 Lead free silver soldered pipe to pipe only
- .6 Breathing Air Outlets with quick disconnects:
  - .1 Locations:
    - .1 Room: four quick disconnect couplers at 1200mm above floor, as indicated on the drawings, and
    - .2 Person-lifts – one quick disconnect coupler on each lift, applied to lift threaded pipe end.
    - .3 Oriented outlet vertically downwards to minimize obstruction into space or with any equipment in space.
    - .4 Installed in a recess in the room's metal liner to avoid interference with travelling person-lifts.
  - .2 Quick disconnect coupling shall be approved for Breathing Air.
    - .1 Configuration to be distinct from regular shop compressed air outlet.
    - .2 Brass body, with nickel plated surface.
    - .3 Single hand operation for coupling.
    - .4 Safety lock to prevent inadvertent disconnection.
    - .5 CEJN 344 interchangeability
    - .6 Dust cap with retainer chain to close off coupler when not being used.
    - .7 Acceptable product:
      - .1 ONTC preferred PBA quick disconnect, or in absence of same:

- .2 Parker- Rectus 95KS series, or approved equivalent
- .3 Make, model, type to be confirmed with ONTC
- .3 Provide permanent labelling at each outlet
  - .1 Indicating "Breathing Air Only".
  - .2 Aluminum or stainless steel , with stamped characters. (Lamacoid system or approved equivalent)
  - .1 Characters: minimum 13mm (nominal)
  - .2 Size: minimum 50 x 100 mm
  - .3 Colour to be determined with ONTC.
  - .4 Mechanically fastened to wall.
- .7 PBA Festooning Hose
  - .1 For supply to travelling person-lifts
  - .2 Refer to drawings for festoon system length.
  - .3 All hose and components approved for breathing air use.
    - .1 Meeting requirements for NIOSH Type C respirator use
    - .2 Provide manufacturer certification of suitability
  - .4 Working pressure: minimum 150 psig (10 bar)
  - .5 Burst pressure: minimum 600 psig (40 bar)
  - .6 Threaded end connections.
  - .7 Suitable for festooning with hose saddles.
  - .8 Minimum nominal inside diameter: 3/8 inch
  - .9 Approved product:
    - .1 Kuri Tec Corporation A1243
    - .2 Approved equivalent

## 2.3 PURIFIED BREATHING AIR REMOTE ALARMING SYSTEM

- .1 Contractor shall provide remote visual/audible annunciator system
- .2 Design by controls system integrator.
  - .1 Submit shop drawings and electrical schematic for review.
- .3 CSA/ULc components.
- .4 Rated for the electrical classification of the area of installation (Refer to Electrical drawings).
- .5 Locations as indicated on the drawings.
- .6 System Power: 120 vac. Refer to electrical drawings.
- .7 Designed to operate with the breathing air filtration system's remote alarming function.
  - .1 Audible:
    - .1 Minimum sound pressure level: 80 dBA at 1 meter from device (adjustable).
    - .2 Tone to be distinct from any fire alarm notification tone.
  - .2 Visual:

- .1 Aluminum housing
- .2 Polycarbonate lens
- .3 Omnidirectional.
- .4 Programmable flashing LED.
- .5 Flash frequency: adjustable
- .6 Minimum peak intensity: 750 candelas unless otherwise approved.
- .7 Colour to be confirmed with ONTC.
- .8 Keyed electrical alarm reset/silence switch at breathing air filtration unit location.
  - .1 Provide minimum of 4 keys.
- .9 Alarm signage:
- .10 Provide permanently installed warning sign at all breathing air alarm annunciator locations, and at key switch location.
  - .1 UV resistant vinyl on aluminum background.
  - .2 Minimum size: 150mm x 150mm
  - .3 Submit shop drawings for review
  - .4 Annunciator (remote alarm) location text:
    - .1 "BREATHING AIR FILTRATION SYSTEM CO ALARM – DO NOT USE SYSTEM WHEN IN ALARM MODE".
  - .5 Main Alarm/key switch location text:
    - .1 "BREATHING AIR FILTRATION SYSTEM CO ALARM SILENCE – DO NOT USE SYSTEM WHEN IN ALARM MODE. SHUT OFF SYSTEM AIR SUPPLY (LOCKOUT/TAGOUT) UNTIL DEFECT CORRECTED. ADVISE SUPERVISORY PERSONNEL AND ALL END USE PERSONNEL OF SYSTEM SHUTOFF"
- .11 Refer also to Electrical for details.
- .12 Acceptable alarm component manufacturers:
  - .1 Edwards General-Signal
  - .2 Federal Signal
  - .3 Approved Equivalent
- 3 Execution
- 3.1 **PRE-START HEALTH AND SAFETY REPORT**
  - .1 Prepare and submit documentation required to support Pre-Start Health and Safety Review Report.
  - .2
- 3.2 **TESTING AND COMMISSIONING**
  - .1 Perform filtration system testing in accordance with the requirements of CSA Z180.1
  - .2 Perform remote alarm system testing.
  - .3 Perform Commissioning in accordance with Sections 01 91 00 and 20 05 00.



- .4 Verify operational performance in general conformance with following outlines:
  - .1 Measurements: Maximum available outlet airflow.
  - .2 Air quality sampling and testing be accredited laboratory to confirm conformance to CSA Z180 requirements.

### **3.3 MAINTENANCE**

- .1 Maintain all equipment and systems installed until Substantial Performance.
- .2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Condensing Natural Gas Boilers.
  - .2 Venting.
- .2 Related Requirements
  - .1 Section 21 05 01 - Common Work Results for Mechanical.

**1.2 REFERENCES**

- .1 American Boiler Manufacturer's Association (ABMA):
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):
  - .1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.
- .3 Canadian Standards Association (CSA):
  - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2 CSA B149.1, Natural Gas and Propane Installation Code.
- .4 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
  - .1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate the following:
    - .1 General arrangement showing connection points.
    - .2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
    - .3 Foundations with loadings, anchor bolt arrangements.
    - .4 Piping hook-ups.
    - .5 Equipment electrical drawings.
    - .6 Burners and controls.
    - .7 All miscellaneous equipment.
    - .8 Flame safety control system.
    - .9 Breeching and stack configuration.
    - .10 Stack emission continuous monitoring system to measure CO, O<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, stack temperature and smoke density of flue gases.

- .3 Engineering data to include:
  - .1 Boiler efficiency at 25%, 50%, 75%, and 100% of design capacity.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Closeout Submittals:
  - .1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial codes and regulations and the Authority Having Jurisdiction.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling, and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

#### 1.6 MAINTENANCE

- .1 Extra materials:
  - .1 Special tools for burners, manholes, handholes and Operation and Maintenance.
  - .2 Spare parts for one (1) year of operation.
  - .3 Spare gaskets.
  - .4 Probes and sealants for electronic indication.

### 2 Products

#### 2.1 CONDENSING BOILER

- .1 General:
  - .1 Natural gas fired, fully condensing, fire tube design.
  - .2 Fully modulating power burner, 20:1 turndown.
  - .3 Positive pressure vent.
  - .4 Boiler efficiency increases with decreasing load (output) while maintaining setpoint.
  - .5 Factory-fabricated, factory-assembled and factory-tested, condensing boiler with heat exchanger sealed pressure-tight, built on a steel frame, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections, and controls.
  - .6 Ready for attachment to piping, electrical power, controls, flue gases exhaust.
  - .7 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code and bear label.
  - .8 CRN (Canadian Registration Number), to CSA B51.

- .9 Boiler/burner package and controls to bear ULc label.
- .2 Heat Exchanger:
  - .1 Welded stainless steel.
  - .2 ASME stamped for a working pressure not less than 1,100 kPa.
  - .3 Access to heat exchanger available by burner and exhaust manifold removal. Minimum access opening shall be no less than 200 mm diameter.
- .3 Modulating Air/Fuel Valve and Burner:
  - .1 Capable of a 20-to-1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves.
  - .2 Burner produces less than 20 ppm of NOx corrected to 3% excess oxygen.
  - .3 Burner constructed of metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone stainless steel construction.
  - .4 No moving parts within the burner itself.
  - .5 Modulating air/fuel valve meters the air and fuel input.
  - .6 Modulating motor must be linked to both the gas valve body and air valve body with a single linkage. Linkage requires no field adjustment.
  - .7 Variable speed, cast aluminum, pre-mix blower ensures optimum mixing of air and fuel between the air/fuel valve and the burner.
- .4 Controls:
  - .1 The control panel shall consist of circuit boards using state-of-the-art surface-mount technology in a single enclosure. These circuit boards shall include:
    - .1 A display board incorporating LED display to indicate temperature and a vacuum fluorescent display module for all message enunciation.
    - .2 A CPU board housing all control functions.
    - .3 A power supply board.
    - .4 An ignition /stepper board incorporating flame safeguard control.
    - .5 A connector board.
    - .6 Each board shall be individually field replaceable.
  - .2 The combustion safeguard/flame monitoring system shall use spark ignition and a rectification-type flame sensor.
  - .3 The control panel hardware supports RS-485 remote communications.
  - .4 The controls shall annunciate boiler and sensor status and include extensive self-diagnostic capabilities that incorporate a minimum of eight separate status messages and 34 separate fault messages.
  - .5 The control panel shall incorporate three self-governing features designed to enhance operation in modes where it receives an external control signal by eliminating nuisance faults due to over-temperature, improper external signal, or loss of external signal. These features include:
    - .1 Setpoint High Limit: Setpoint high limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. Setpoint limit is based on a PID function that automatically limits firing rate to maintain outlet



- temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature.
- .2 Setpoint Low Limit: Allow for a selectable minimum operating temperature.
  - .3 Failsafe Mode: Failsafe mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can shut off the unit upon loss of external signal, if so desired.
  - .4 The boiler control system shall incorporate the following additional features for enhanced external system interface:
    - .1 System start temperature feature.
    - .2 Pump delay timer.
    - .3 Auxiliary start delay timer.
    - .4 Auxiliary temperature sensor.
    - .5 Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate.
    - .6 Remote interlock circuit.
    - .7 Delayed interlock circuit.
    - .8 Fault relay for remote fault alarm.
  - .5 Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME BPVC Section IV and CSD-1.
  - .6 Each boiler shall have an oxygen monitoring system that will measure the oxygen content of the exhaust gasses in real-time. Output of O2 information shall be displayed on the C-More control panel.
  - .7 Each boiler shall have integrated Boiler Sequencing Technology (BST), capable of multi-unit sequencing with lead-lag functionality and parallel operation. The system will incorporate the following capabilities:
    - .1 Efficiently sequence 2 units on the same system to meet load requirement.
    - .2 Integrated control and wiring for seamless installation of optional isolation valve. When valves are utilized, the system shall operate one motorized valve per unit as an element of load sequencing. Valves shall close with decreased load as units turn off, minimum of one must always stay open for recirculation.
    - .3 Automatically rotate lead/lag amongst the units on the chain and monitor run hours per unit and balance load in an effort to equalize unit run hours.
    - .4 Designated master control used to display and adjust key system parameters.
    - .5 Automatic bump-less transfer of master function to next unit on the chain in case of designated master unit failure; master/slave status should be shown on the individual unit displays.
    - .6 Designated master control used to display and adjust key system parameters.

- .8 When set on Internal Setpoint Mode, temperature control setpoint on the ACS shall be fully field adjustable from 10°C to 88°C in operation. When set on Indoor/Outdoor Reset Mode, the ACS will operate on an adjustable inverse ratio in response to outdoor temperature to control the main header temperature. Reset ratio shall be fully field adjustable from 0.3 to 3.0 in operation. When set on 4-20 ma Temperature Control Mode, the ACS will operate the plant to vary header temperature setpoint linearly as an externally applied 4-20 ma signal is supplied.
- .9 When set on MODBUS Temperature Control Mode, the ACS will operate the plant to vary header temperature setpoint as an external communication utilizing the MODBUS protocol is supplied via the RS-485 port. The ACS controller shall have a vacuum fluorescent display for monitoring of all sensors and interlocks. Non-volatile memory backup of all control parameters shall be internally provided as standard. The controller will automatically balance the sequence of operating time on each boiler by a first-on first-off mode and provide for setback and remote alarm contacts. Connection between central ACS system and individual boilers shall be twisted pair low voltage wiring, with the boilers 'daisy-chained' for ease of installation.
- .6 Venting:
  - .1 The exhaust vent must be UL Listed for use with Category II, III and IV appliances and compatible with operating temperatures up to 110°C, condensing flue gas service. UL-listed vents of Polypropylene and Al 29-4C stainless steel must be used with boilers.
  - .2 The minimum exhaust vent duct size for each boiler is 150 mm diameter.
  - .3 Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors.
  - .4 The minimum ducted combustion air duct size for each boiler is 150 mm diameter.
  - .5 Common vent and common combustion air must be an available option for boiler installation. Consult manufacturer for common vent and combustion air sizing.
  - .6 Follow guidelines specified in manufacturer's venting guide.
- .7 Electrical Power:
  - .1 Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.
  - .2 Voltage: 120V, 60 Hz, single phase.
  - .3 Full-Load Current: 18 Amps.

### 3 Execution

#### 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

#### 3.2 INSTALLATION

- .1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing, and maintenance without disruption of operation of any other equipment/system.
- .4 Install boilers level on concrete bases.
- .5 Connect gas piping to boiler gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- .6 Install piping from safety relief valves to nearest floor drain.

### **3.3 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials, components, and installation for heat recovery equipment.
  - .2 Unit to be installed on rooftop to provide general ventilation of abrasive blast room area when wet abrasive blasting is performed.
  - .3 Unit to include hydronic preheat coil as required to minimize probability of core freezing due to moisture laden exhausted air stream.

**1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):
  - .1 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers (ANSI approved).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
  - .1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Certificates:
  - .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling, and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

**1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:



- .1 Bearings and seals.
- .2 Addresses of suppliers.
- .3 List of specialized tools necessary for adjusting, repairing, or replacing.

## 2 Products

### 2.1 DUAL CORE REVERSE FLOW HEAT RECOVERY VENTILATOR

- .1 General:
  - .1 All components in airstream suitable for Category 1 moist operation.
- .2 Construction
  - .1 Housing:
    - .1 Aluminum channel posts and 0.6 mm panels with painted mechanical fasteners.
  - .2 Panels and Access Doors:
    - .1 50-mm nominal thickness injected polyurethane foam insulation.
    - .2 RSI: 1.14 m<sup>2</sup> °C/W per 25 mm of wall thickness.
    - .3 Inner and outer sections of panel constructed of 0.6 mm, galvanized steel.
    - .4 Module to module assembly shall be accomplished with self-adhering, Viton (FPM) gaskets.
    - .5 Provide test data demonstrating less than 5 mm deflection for an unsupported 1220 mm x 1220 mm panel under 7.5 kPa pressure.
    - .6 Access Doors flush mounted to cabinetry, minimum of two (2) hinges, full size handle assembly.
    - .7 Access doors to allow full access to motor, drive, and bearings.
    - .8 Access doors to include locking latches on control section.
- .3 Heat Recovery Cores:
  - .1 Efficiency and Performance:
    - .1 Winter: 90% plus or minus 5% sensible and 70% plus or minus 5% latent at equal airflow.
    - .2 Summer: 80% plus or minus 5% sensible and 70% plus or minus 5% latent at equal airflow.
    - .3 No defrost. Unit requires no frost protection in applications down to -40 °C.
    - .4 Maximum allowable face velocity across heat exchangers: 2.3 m/s.
  - .2 Materials:
    - .1 Corrugated high grade aluminum.
    - .2 Stainless steel heat exchanger frames.
    - .3 Stainless steel drain pans c/w 25 mm NPT connections.
  - .3 Damper Section:
    - .1 Multi section, low leakage dampers operated by fast acting pneumatic actuators.
    - .2 Damper switching times: maximum 1.5 seconds. Dampers with higher switching times not acceptable.
    - .3 Single blade dampers not acceptable.

- .4 Each damper control one (1) of four (4) airways; upper-horizontal, lower-horizontal, forward-vertical, and rear-vertical.
- .5 Dampers capable of orienting to close off outside air to the building without needing external shut off dampers.
- .6 Dampers capable of orienting to allow 100% recirculation of air without using heat recovery device for off peak or unoccupied heating modes.
- .7 Recovery cycles controlled by internal programmed thermostats measuring both supply and exhaust air, optimizing performance of both heat recovery and free cooling modes.
- .8 Dampers blades galvanized steel.
- .9 Damper manufacturer must provide the following:
  - .1 Written documentation that the dampers are capable of a minimum duty cycle of 500,000 cycles annually.
  - .2 Written warranty on damper manufactures letterhead confirming the warranty.
- .4 Fans:
  - .1 Supply and return fans direct-drive airfoil plenum fans.
  - .2 Fan assemblies including fan and motor dynamically balanced by the manufacturer on all three planes and at all bearing supports.
  - .3 Size fans to ensure maximum fan RPM is below first critical speed.
  - .4 Bearings and Shafts:
    - .1 Self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit.
    - .2 Heavy duty, greaseable, pillow block flange bearings. Bronze or plastic bearings are not acceptable.
    - .3 Bearing minimum diameter: 20 mm ( $\frac{3}{4}$ ").
    - .4 20 mm ( $\frac{3}{4}$ " ) chromium shafts, maximum of 4 shafts per unit.
    - .5 Grease fittings attached to the fan base assembly near access door: either factory or field installed.
    - .6 Extended copper lubrication lines to access side of unit.
  - .5 Fan and motor mounted internally on galvanized, steel base. Fan and motor assembly shall be mounted on rubber-in-shear vibration type isolators inside cabinetry.
- .5 Controls:
  - .1 Provide all sensors for standalone operation.
  - .2 Unit Control Panel:
    - .1 NEMA 1 panel located remotely (in Mechanical - Electrical Room).
    - .2 Contains unit PLC, electrical contacts, and all accessories to operate ERV in the following modes:
      - .1 Heat Recovery.
      - .2 Free Cooling.
      - .3 Recirculation.
  - .3 Variable Frequency Drives (VFD's):

- .1 Located in Mechanical Room.
- .2 Electronically commutated motors may be used instead of VFDs.
- .6 Electrical:
  - .1 Bears CSA or ULc listing label for entire assembly. Units with only components bearing third party safety listing are unacceptable.
  - .2 Control panels supplied loose and to be remotely field mounted in unclassified area.
  - .3 Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. All wires shall be number tagged and cross-referenced to the wiring diagram for ease of troubleshooting.
- .7 Filters:
  - .1 Filter section with stainless steel filter racks and guides with hinged and latching access doors on both sides for side loading and removal.
  - .2 Filter media shall be UL 900 listed, Class I or Class II.
  - .3 Angle arrangement with 50mm deep, pleated, disposable panel filters.
- .8 Heating Coils:
  - .1 General:
    - .1 Access to coils from both sides of unit for service and cleaning.
    - .2 Enclose coil headers and return bends fully within unit casing.
    - .3 Coil connections to extend a minimum of 125 mm beyond unit casing for ease of installation.
    - .4 Drain and vent connections provided exterior to unit casing.
    - .5 Coil connections factory sealed with grommets on interior and exterior and gasket sleeve between outer wall and liner where each pipe extends through the unit casing to minimize air leakage and condensation inside panel assembly.
    - .6 Coils removable through side and top panels of unit without the need to remove and disassemble the entire section from the unit.
  - .2 Certification:
    - .1 In accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.
  - .3 Headers:
    - .1 Seamless copper tubing.
    - .2 Intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility.
    - .3 Diameter varies with fluid flow requirements.
  - .4 Fins:
    - .1 0.2 mm aluminum plate.
    - .2 Full drawn collars to provide a continuous surface cover over the entire tube.
  - .3 Tubes:

- .1 Mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length.
  - .2 16 mm OD seamless copper, 0.6 mm nominal tube wall thickness, expanded into fins, brazed at joints.
  - .3 Soldered U-bends, 0.6 mm.
  - .4 Coil connections:
    - .1 RFWN Class 150# flanged carbon steel.
    - .2 Vent and drain fittings furnished on connections, exterior to air handler.
    - .3 Vent connections provided at the highest point to assure proper venting.
    - .4 Drain connections provided at the lowest point to insure complete drainage.
    - .5 Coil casings shall be a formed channel frame of galvanized steel.
  - .9 Capacity and Performance: as scheduled.
- 3 Execution
- 3.1 MANUFACTURER'S INSTRUCTIONS**
- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2 INSTALLATION**
- .1 Install in accordance with manufacturers recommendations.
  - .2 Support independently of adjacent ductwork with flexible connections.
  - .3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers, and filters.
- 3.3 FIELD QUALITY CONTROL**
- .1 Tests:
    - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- 3.4 CLEANING**
- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
  - .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**



1 General

**1.1 GENERAL REQUIREMENTS**

- .1 Comply with Division One as applicable. Comply with Division One as applicable

**1.2 SECTION INCLUDES**

**1.3 REFERENCES**

- .1 ARI 210/240 - Unitary Air Conditioning Equipment and Air-Source Heat Pump Equipment.  
.2 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.  
.3 UL 465 - Central Cooling Air Conditioners.

**1.4 SUBMITTALS**

- .1 Product Data: Provide catalogue data indicating rated capacity, dimensions, duct and service connections, electric nameplate data and wiring diagrams.  
.2 Shop Drawings: Indicate layout of system and components.  
.3 Manufacturer's Instructions: Indicate installation instructions and recommendations.  
.4 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.  
.5 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer.

**1.5 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

**1.6 REGULATORY REQUIREMENTS**

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.7 WARRANTY**

- .1 Provide five year manufacturer warranty for compressors.

2 Products

**2.1 MANUFACTURERS**

- .1 Products shall be manufactured by Carrier or other approved manufacturer.  
.2 Other Acceptable Manufacturers:  
.1 Daikin  
.2 Johnson Controls/York.

**2.2 PACKAGED HEAT PUMPS, AIR SOURCE**

- .1 General

- .1 Outdoor, electrically controlled, heating and cooling unit utilizing hermetic scroll compressor(s) for cooling duty and heat pump for heating duty
- .2 Factory assembled, single piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
- .3 Unit shall use R410a or similar 'green' refrigerant.
- .4 Unit shall be installed in accordance with the manufacturer's instructions.
- .5 Unit must be installed in compliance with all applicable codes and standards.
- .2 Quality Assurance
  - .1 Unit meets ASHRAE 90.1 minimum efficiency requirements.
  - .2 Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
  - .3 Unit shall be designed to conform to ASHRAE 15, 2001.
  - .4 Unit shall be UL--tested and certified in accordance with ANSI Z21.47 Standards and UL- or ETL--listed and certified under Canadian standards as a total package for safety requirements.
  - .5 Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
  - .6 Unit casing shall be capable of withstanding 500--hour salt spray exposure per ASTM B117 (scribed specimen).
  - .7 Unit shall be designed in accordance with ISO 9001, and shall be manufactured in a facility registered by ISO 9001.
  - .8 Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
  - .9 Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
- .3 Operating Characteristics
  - .1 Unit shall be capable of starting and running at 125F (52C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at 10% voltage
  - .2 Compressor with standard controls shall be capable of operation down to 30F (--1C), ambient outdoor temperatures.
  - .3 Unit shall be capable of simultaneous heating duty and defrost cycle operation when using electric heaters.
  - .4 Unit shall discharge supply air horizontally as shown on contract drawings.
- .4 Unit Cabinet
  - .1 Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces.
  - .2 Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60\_F): 60, Hardness: H--2H Pencil hardness.
  - .3 Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2--in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated

- on the air side. Aluminum foil--faced fiberglass insulation shall be used in the heat compartment.
- .4 Base Rail a. Unit shall have base rails on a minimum of 2 sides. b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging. c. Holes shall be provided in the base rail for moving the unit by fork truck. d. Base rail shall be a minimum of 16 gauge thickness.
- .5 Condensate pan and connections:
- .1 Shall be a sloped condensate drain pan made of a non--corrosive material.
- .2 Shall comply with ASHRAE Standard 62.
- .3 Shall use a 3/4-in. 14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.
- .6 Top panel:
- .1 Shall be a single piece on all 04 to 09 models. Two piece on size 12 models.
- .7 Electrical Connections
- .1 All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.
- .2 Thru--the--base capability
- .1 Standard unit shall have a thru--the--base electrical location(s) using a raised, embossed portion of the unit base pan.
- .2 Optional, factory approved, watertight connection method must be used for thru--the--base electrical connections.
- .3 No base pan penetration, other than those authorized by the manufacturer, is permitted.
- .8 Component access panels (standard)
- .1 Cabinet panels shall be easily removable for servicing.
- .2 Unit shall have one factory--installed, tool--less, removable, filter access panel.
- .3 Panels covering control box, indoor fan, indoor fan motor, and compressors shall have molded composite handles.
- .4 Handles shall be UV modified, composite. permanently attached, and recessed into the panel.
- .5 Screws on the vertical portion of all removable access panels shall engage into heat resistant, molded composite collars.
- .6 Collars shall be removable and easily replaceable using manufacturer recommended parts.
- .5 Coils
- .1 Standard Aluminum/Copper Coils: on all models.
- .1 Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

- .2 Evaporator coils shall be leak tested to 150 psig. Pressure tested to 450 psig and qualified to UL 1995 burst test at 1775 psig.
- .3 Condenser coils shall be leak tested to 150 psig. Pressure tested to 650 psig and qualified to UL 1995 burst test at 1980 psig.
- .6 Refrigerant Components
  - .1 Refrigerant circuit shall include the following control, safety, and maintenance features:
    - .1 Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
    - .2 Refrigerant filter drier on each refrigerant circuit.
    - .3 Service gauge connections on suction and discharge lines.
    - .4 Pressure gauge access through a specially designed access port in the top panel of the unit.
    - .5 Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching. Standard on each refrigerant circuit.
  - .2 There shall be gauge line access port in the top of the unit, covered by a black, removable plug.
    - .1 The plug shall be easy to remove and replace.
    - .2 When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.
    - .3 This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
    - .4 The plug shall be made of a leak proof, UV--resistant, composite material.
  - .3 Compressors
  - .4 Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
  - .5 Models shall be available with single compressor designs on 04--07 models, plus additional 2 compressor (stage) models from 08--12 sizes.
  - .6 Compressor motors shall be cooled by refrigerant gas passing through motor windings.
  - .7 Compressors shall be internally protected from high discharge temperature conditions.
  - .8 Compressors shall be protected from an over temperature and over--amperage conditions by an internal, motor overload device.
  - .9 Compressor shall be factory mounted on rubber grommets.
  - .10 Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
  - .11 Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.
- .7 Filter Section
  - .1 Filters access is specified in the unit cabinet section of this specification.



- .2 Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
- .3 Shall consist of factory--installed, low velocity, throw--away 2--in. thick fiberglass filters.
- .4 Filters shall be standard, commercially available sizes.
- .5 Only one size filter per unit is allowed.
- .8 Evaporator Fan and Motor
  - .1 Evaporator fan motor:
    - .1 Shall have permanently lubricated bearings.
    - .2 Shall have inherent automatic--reset thermal overload protection or circuit breaker.
    - .3 Shall have a maximum continuous BHP rating for continuous duty operation; no safety factors above that rating shall be required.
  - .2 Electric Drive (Direct Drive) X13 – 5 Speed/Torque Evaporator Fan:
    - .1 Multi speed motor with easy quick adjustment settings.
    - .2 Blower fan shall be double inlet type with forward curved blades.
    - .3 Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
    - .4 Standard on all 04--06 models.
  - .3 Belt--driven Evaporator Fan:
    - .1 Belt drive shall include an adjustable pitch motor pulley.
    - .2 Shall use sealed, permanently lubricated ball--bearing type.
    - .3 Blower fan shall be double inlet type with forward curved blades.
    - .4 Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
    - .5 Standard on all 07--12 size models. Optional on all 04--06 3--phase models.
- .9 Condenser Fans and Motors
  - .1 Condenser fan motors:
    - .1 Shall be a totally enclosed motor.
    - .2 Shall use permanently lubricated bearings.
    - .3 Shall have inherent thermal overload protection with an automatic reset feature.
    - .4 Shall use a shaft down design on all sizes.
  - .2 Condenser Fans:
    - .1 Shall be a direct driven propeller type fan.
    - .2 Shall have aluminum blades riveted to corrosion resistant steel spiders and shall be dynamically balanced.
- .10 Accessories

- .1 Standard Integrated economiser, with standard leak rating for single speed indoor fan motor models.
  - .1 Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
  - .2 Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory installed option.
  - .3 Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
  - .4 Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
  - .5 Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
  - .6 Standard leak rate models shall be equipped with low--leakage dampers, not to exceed 2% leakage at 1 in.wg pressure differential. Economizer controller on electromechanical units shall be Honeywell W7212 that provides:
    - .1 Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.
    - .2 Functions with solid state analog enthalpy or dry bulb changeover control sensing.
    - .3 Contain LED indicates for: when free cooling is available, when module is in DCV mode, when exhaust fan contact is closed.
- .2 Condenser Coil Hail Guard Assembly
  - .1 Shall protect against damage from hail.
  - .2 Shall be louvered design.
- .3 Unit Mounted, Non--Fused Disconnect Switch:
  - .1 Switch shall be factory--installed, internally mounted.
  - .2 National Electric Code (NEC) and UL approved non--fused switch shall provide unit power shutoff.
  - .3 Shall be accessible from outside the unit
  - .4 Shall provide local shutdown and lockout capability.
- .4 Convenience Outlet
  - .1 Outlet shall be powered from a separate 115--120v power source.
  - .2 A transformer shall not be included.
  - .3 Outlet shall be factory--installed and internally mounted with easily accessible 115V female receptacle.
  - .4 Outlet shall include 15 amp GFI receptacles.
  - .5 Outlet shall be accessible from outside the unit.
- .5 Roof Curb

- .1 Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
- .2 Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
- .3 Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
- .6 Electric Heat
  - .1 Heater element open coil resistance wire, nickel--chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
  - .2 Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermo limit controls, magnetic heater contactors (24V coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
- .7 Hinged Access Panels
  - .1 Shall provide easy access through integrated quarter turn latches.
  - .2 Shall be on major panels of filter, control box, fan motor and compressor.
- .8 Control / Controller
  - .1 Shall be ASHRAE 62--2001 compliant.
  - .2 Shall accept 18--32VAC input power.
  - .3 Shall have an operating temperature range from --40F (-40C) to 158F (70C), 10% -- 95% RH (non--condensing).
  - .4 Shall include an integrated economizer controller to support an economizer with 4 to 20 mA actuator input and no microprocessor controller.
  - .5 Controller shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock--out, fire shutdown, enthalpy, fan status, remote time clock/door switch.
  - .6 Shall provide the following outputs: Economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve/ dehumidify/ occupied.
  - .7 Unit shall provide surge protection for the controller through a circuit breaker.
  - .8 Shall be Internet capable, and communicate at a Baud rate of 38.4K or faster.
  - .9 Shall have an LED display independently showing the status of activity on the communication bus, and processor operation.
  - .10 Shall include an EIA--485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an EIA--485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks plug--in communications card.
  - .11 Shall have built--in Carrier Comfort Network (CCN) protocol, and be compatible with other CCN devices, including ComfortLink and ComfortVIEW controllers.

- .12 Shall have built-in support for Carrier technician tool.
- .13 Software upgrades will be accomplished by local download. Software upgrades through chip replacements are not allowed.
- .14 Shall be shock resistant in all planes to 5G peak, 11ms during operation, and 100G peak, 11ms during storage.
- .15 Shall be vibration resistant in all planes to 1.5G @ 20--300Hz.
- .16 Shall support a bus length of 4000ft max, 60 devices per 1000ft section, and 1 RS--485 repeater per 1000ft sections.

3 Execution

3.1 **INSTALLATION**

- .1 Install horizontal heat pumps using hanger kit and rubber isolators provided by heat pump supplier.
- .2 Install vertical heat pumps on neoprene vibration isolation pads.
- .3 Install all units neat and level following manufacturer's instructions.
- .4 Install flexible pipe ball valves and duct connections between heat pump units and piping/ductwork.
- .5 Install loop water controller where shown on drawings and according to manufacturer's instructions.
- .6 Install all control wiring required to provide a complete and operating system between loop water controller and water cooled air conditioning units and to all accessories as per manufacturer's wiring diagrams.
- .7 Coordinate with Electrical Division all power wiring to heat pumps, loop water controller and accessories.
- .8 Furnish the services of a trained representative of the equipment manufacturer to supervise the installation, wiring, set up and testing of the loop water controller.

**END OF SECTION**



1 General

**1.1 DESCRIPTION**

- .1 For additional information, refer to Section 21 05 01 - Common Work Results for Mechanical and Division 1 - General Conditions of the Construction Contract.
- .2 For a list of applicable codes and standards, refer to Section 21 05 01 - Common Work Results for Mechanical.
- .3 The Construction Contractor shall be responsible for coordinating all aspects of this work.
- .4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Construction Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

**1.2 SCOPE OF WORK**

- .1 The scope of work for this Section includes, but is not limited to, the following:
  - .1 Materials and procedures for the provision and installation of explosion proof and non-explosion proof hydronic unit heaters, hydronic cabinet unit heaters, hydronic baseboard heaters, and hydronic radiant ceiling panels.

**1.3 RELATED WORK**

- .1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 and all related works.
- .2 Division 1 forms an integral part of Division 21, 22 and 23.

**1.4 REFERENCES**

- .1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.
- .2 In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.
- .3 Canadian Standards Association (CSA International):
  - .1 CSA C22.1, General Requirements, Canadian Electrical Code, Part I.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .5 National Fire Protection Association (NFPA):
  - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
  - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
- .6 Underwriters' Laboratories (UL) Inc.:
  - .1 UL 2021, Fixed and Location-Dedicated Electric Room Heaters.

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Refer to Section 21 05 01 - Common Work Results for Mechanical and Section 01 33 00 - Submittal Procedures for submission requirements.

- .2 Product Data: Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Submit copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

## 1.6 CLOSEOUT SUBMITTALS

- .1 Refer to Section 21 05 01 - Common Work Results for Mechanical, Section 01 33 00 - Submittal Procedures, and Section 01 78 00 - Closeout Submittals" for submission requirements.

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Shipping:
  - .1 All equipment, material and spare parts shall be shipped, stored, handled, and installed in such a manner as not to degrade quality, serviceability, or appearance. Equipment and material warranties shall not be voided by actions of the Construction Contractor.
  - .2 Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  - .3 Pack spare parts in containers bearing labels clearly designated contents and pieces of equipment for which intended.
  - .4 Deliver spare parts at same time as pertaining equipment. Deliver to the City after completion of work.
- .2 Receiving:
  - .1 All equipment, material and spare parts shall be delivered to the site in original packages or containers bearing the manufacturer's labels and product identification.
  - .2 Inspect for damage and correctness, and inventory items, upon delivery to site.
  - .3 Store equipment, material and spare parts protected for the weather, humidity and temperature variations, dirt and dust or other contaminants. Store and safeguard in accordance with Manufacturer's recommendations.

## 1.8 QUALITY ASSURANCE

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

## 2 Products

### 2.1 GENERAL

- .1 Provide CSA approved, packaged factory assembled components.

### 2.2 UNIT HEATERS

- .1 Casing: 1.31 mm thick galvanized steel, epoxy coated finish with lugs for unit suspension and hinged door accessed control panel.
- .2 Heating Coil:
  - .1 13 mm nominal diameter seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and integral collar of the aluminum fin.
  - .2 Minimum copper tube thickness shall be 0.7 mm.

- .3 Fins shall be die-formed and have a high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.
- .4 Minimum fin thickness shall be 0.25 mm.
- .5 Lanced fins shall not be acceptable.
- .6 Fins are continuous across width and depth of coil and are vertically oriented to resist collection of dirt and foreign particles.
- .7 Coils are of non-ferrous construction and serpentine design or will incorporate brazed steel header tubes.
- .8 All coils shall be tested at 1896 kPa air pressure under water, and rated for a maximum 1517 kPa water and 190°C.
- .3 Coils have CRN pressure vessel certification.
- .4 Fan: Direct drive propeller type, factory balanced, with aluminum alloy blades, steel hub and Occupational Safety & Health Administration approved fan guard.
- .5 Motor: Totally enclosed, permanently lubricated ball bearings with thermal overload protection.
- .6 Air outlet: Individually adjustable extruded aluminum directional vanes.
- .7 Temperature hi-limit: Automatic reset.
- .8 Fan-only switch: Built in factory installed.
- .9 Contactor: Built in factory installed.
- .10 Thermostat: Remote, shipped loose, located as per Drawings.

## 2.3 HYDRONIC HEATING COILS

- .1 General:
  - .1 Extended surface, staggered tube, plate fin design.
  - .2 Suitable for 50% propylene glycol.
  - .3 Capacity and size as scheduled.
- .2 Headers:
  - .1 Made of seamless copper tubing to assure compatibility with primary surface.
  - .2 Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
  - .3 Vent and drain plugs shall be provided on the coil header. For certain replacement air handler (Vision/Skyline & some LSL models) coils the plugs will be provided on the coil connections.
- .3 Connections:
  - .1 Coil connection should be compatible with the piping to the coil to minimize chance of "galvanic action/electrolysis."
  - .2 Connections shall be a diameter adequate for specified gpm flow.
  - .3 The connections are located to permit right or left hand mounting of the coil and assure equal pressure through all the circuits. Contractor to confirm connection location on site prior to ordering coils.
  - .4 Connection material to be carbon steel pipe. Connection type to be threaded.
  - .5 Coils are circuited to provide maximum mean effective temperature difference for heat transfer rates.

- .6 Coils, greater than 2 rows, must be arranged for counter flow.
- .4 Testing and Pressure Ratings:
  - .1 Completed coils are tested at a minimum of 2170 kPa (315 psig) air pressure while submerged in warm water. Hydronic tests alone are not acceptable.
  - .2 Standard coil construction is rated for 1725 kPa (250 psig) working pressure at 149°C (300°F).
- .5 Primary Surface:
  - .1 Tubes 16 mm (5/8") O.D., staggered in direction of airflow on 40 mm (1½") tube centers.
  - .2 Wall thickness: 0.5 mm (0.02") nominal copper.
  - .3 Tubes mechanically expanded into fin collars to provide a continuous primary to secondary compression bond over entire coil length.
  - .4 Coil Tube Type. Standard smooth bore.
- .6 Secondary Surface:
  - .1 Corrugated plate style fins.
  - .2 Fin thickness: 0.2 mm (0.0075") aluminum.
  - .3 Fins to have collars to determine fin spacing per unit length and support the heat transfer bond to primary surface.
  - .4 Tubing should not be visible between the fins.
  - .5 Fin Style: New Ripple fin type.

3 Execution

3.1 **MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 **CLEANING**

- .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

- .1 Design, labour, Products, equipment and services necessary for electric heater Work in accordance with the Contract Documents.

**1.2 RELATED REQUIREMENTS**

- .1 Section 20 01 00 – Mechanical General Requirements
- .2 Section 20 05 00 – Common Work Results

**1.3 REFERENCES**

- .1 CSA, Canadian Standards Association.
- .2 ULC, Underwriters' Laboratories of Canada.

**1.4 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data and Shop Drawings Package:
  - .1 Product Data:
    - .1 Submit manufacturer's Product data for all Products listed in this Section indicating:
      - .1 Product characteristics.
      - .2 Performance criteria, minimum operating air flow.
      - .3 Mounting methods, unit support.
      - .4 Physical size.
      - .5 KW rating, voltage, phase.
      - .6 Cabinet material thicknesses.
      - .7 Limitations, clearance to combustibles.
      - .8 Colour and finish.
  - .2 Shop Drawings:
    - .1 Submit Shop Drawings in accordance with Section 01 33 00 indicating:
      - .1 Equipment, capacity and piping connections.
      - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
- .3 Commissioning Package:
  - .1 Submit the following:
    - .1 Commissioning Plan.
    - .2 Commissioning Procedures.
    - .3 Certificate of Readiness.
  - .2 Submit design data and test reports.
  - .3 Submit inspection and test reports.
- .4 Commissioning Closeout Package:

- .1 Submit the following:
  - .1 Deficiency Report.
  - .2 Commissioning Closeout Report.
- .5 Closeout Submittals:
  - .1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 00:
    - .1 Identification: Manufacturer name, type, year, serial number, number of units, and capacity.
    - .2 Functional description detailing operation and control.
    - .3 Performance criteria and maintenance data.
    - .4 Operating instructions and precautions.
    - .5 Component parts availability including names and addresses of spare part suppliers.
    - .6 Lubrication schedule, maintenance and troubleshooting guidelines.
    - .7 Manufacturer's installation instructions for the following items:
      - .1 Force flow heater.
  - .2 Submit As-Built Drawings in accordance with Section 01 78 00.

## 1.5 TRAINING

- .1 Operation Training:
  - .1 Allow for minimum of 1 hour of total on-site time to train in all aspects of equipment and system(s) operation(s), per group to be trained.
  - .2 Operation training of related systems may be combined, at discretion of the City of Toronto, provided all Contract requirements satisfied.

## 1.6 SPARE PARTS

- .1 Provide manufacturer's recommended spare parts list in accordance with Section 20 05 00.

## 2 Products

### 2.1 FORCED FLOW WALL HEATERS

- .1 Manufacturers:
  - .1 Ouellet.
  - .2 Stelpro.
- .2 Construction: Wall cabinet mounted, 1 mm thick steel (20 ga) removable and tamperproof panel, glass fibre insulation and integral air outlet and inlet.
- .3 Finish: Polyester epoxy powder coat, white.
- .4 Electric coils: Nickel-chrome resistance coils embedded in refractory material and enclosed in steel sheathing with brazed spiral steel extended fan.
- .5 Fans: Five blade propeller fan, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted, black anodized mixed flow aluminum fins.
- .6 Motor: Totally enclosed type with permanently lubricated bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .7 Capacity: As indicated in schedules.

- .8 Controls:
  - .1 On-off switch with integral overloads in cabinet.
  - .2 Double pole built-in thermostat.
  - .3 High temperature limit switch.
- .9 Units must be ULC and CSA approved.

## 2.2 BASEBOARD HEATERS

- .1 Low profile wall mount baseboard heaters, each approximately 150 mm (6") high, 65 mm (2-½") deep, complete with:
  - .1 #22 gauge steel body with #20 gauge steel connection box at both ends of heater, 2 rows of mounting holes, single screw built-in wire holder, and #20 gauge steel removable front panel with rounded upper corners;
  - .2 standard watt density (900 W/m) tubular steel heating element with aluminium fins, noise free and floating on high temperature nylon bushings;
  - .3 factory installed, tamperproof, adjustable bi-metal thermostat;
  - .4 factory supplied enclosure accessories as indicated on drawings and/or heater schedule;

## 3 Execution

### 3.1 EXAMINATION

- .1 Review proposed locations on-site and co-ordinate installation requirements with general trades, architectural finishes and power requirements.

### 3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Check final location with City of Toronto if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow City of Toronto's direction.
- .3 Clean finned tubes and comb straight.
- .4 Provide supplementary suspension steel as required.
- .5 Install thermostats in locations indicated.
- .6 Before acceptance, set discharge patterns and fan speeds to suit requirements.

### 3.3 COMMISSIONING

- .1 Perform Commissioning in accordance with 20 05 00.
- .2 Verify operational performance in general conformance with the following outline:
  - .1 Operational performance outline:
    - .1 Thermostat operation.
    - .2 Element response.
    - .3 Fan operation.
    - .4 Disconnect.
    - .5 Other unit control features/devices.

**3.4 PROTECTION**

- .1 Protect from damage during construction. Do not operate during construction or until unit and area thoroughly cleaned and inspected.

**END OF SECTION**



1 General

**1.1 SUMMARY**

- .1 This section provides general requirements for complete, interfaced, reliable, continuous operating electrical systems shown, implied, described or required, including but not limited to all labour, equipment, confirmations, co-ordination of equipment, interim set-up and operation, spare parts, fees, service layouts, permits, inspections, investigations, studies, acceptance tests, including 3rd party, demonstrations, reports, bonds, notices, declarations, administration, liaison, reviews, meetings, correspondence and travel. Provide training, warranties and insurance.
- .2 The electrical drawings are schematic and indicate major equipment and intended overall arrangement. Exact sizes, dimensions, locations, devices and arrangements shall suit equipment, site conditions and requirements. Review shop drawings for sizes and requirements under Division 26 and ensure compatibility of all systems specified and installed; report problems, concerns and variations. The Engineer shall review shop drawings of equipment prior to installation.
- .3 Make, at no additional cost, any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).
- .4 Provide all equipment after co-ordinating and reviewing all Division 26 work required by other Sections, service companies and jurisdictional authorities. The omission of work and materials that are required to complete the project is not to be interpreted as relieving this Section of the necessity of providing such work and materials. Ensure all equipment is installed correctly and sequentially.
- .5 In case of conflict among authorities, trades, drawings, specifications and other documents, the most stringent requirements shall apply, as directed by the Consultant.
- .6 All work and material shall be installed to the manufacturer's and the Consultant's recommendations and satisfaction, as applicable. Construction shall be performed by relevant, competent, qualified and certified trade persons.
- .7 Protect materials and equipment after delivery to minimize the probability of condensation or other damage prior to the application of final heating systems.

**1.2 RELATED REQUIREMENTS**

- .1 Coordinate with Division 26 as follows:
  - .1 Provide line voltage power wiring and terminations to equipment of all Divisions.
  - .2 Provide low voltage (31 to 750 volts) wiring to equipment of all other Divisions. Unless otherwise indicated on the electrical drawings Division 22/23/25 control and interlock wiring, extra-low (up to & including 30 volts) and/or low voltage shall be by Division 22/23/25.
  - .3 Provide starters and/or disconnects as noted on drawings.
- .2 Coordinate with Division 22, 23 and/or 25 as follows:
  - .1 Where applicable provide all air handling units, gas fired unit heaters, fans, pumps, motors & domestic water heaters where indicated complete with control panels, starters and/or disconnect switches.
  - .2 Provide, mount and wire all damper motors.
  - .3 Provide variable frequency drives as required.

**1.3 EXAMINATIONS**

- .1 Examine the proposed locations of equipment and fixtures of other trades and report any defects or interference with the work of this Division in writing to the Consultant. Affected work shall not commence until any discrepancies adversely affecting the work of this Division are remedied.
- .2 Fully understand the function of the systems described in this Division. Have no doubt as to the extent of the systems and/or materials and labour required. Contact the Consultant for clarification. No extras will be allowed to complete systems inadequately installed or not fully operational.

#### **1.4 REGULATIONS**

- .1 Comply with the latest Ontario Building Code, including amendments, and the requirements of the Municipal Building Department.
- .2 Comply with the latest regulations of the Electrical Safety Code and the requirements of the local Electric Safety Authority inspection department, the requirements of the local hydro commission, the recommended standards of the Canadian Standards Association, the Ontario Ministry of Labour, the Occupational Health and Safety Act, Provincial and Federal governments or any other authority having jurisdiction.
- .3 The Contract Drawings show the minimum standard acceptable regardless of any lesser standards set by any Codes, Regulations or Authorities Having Jurisdiction.
- .4 Refer to Division 01 General Requirements section.

#### **1.5 SUBMITTALS**

- .1 Refer to Division 01 General Requirements section.

#### **1.6 SHOP DRAWINGS**

- .1 Refer to Division 01 General Requirements section.

#### **1.7 CERTIFICATES**

- .1 Refer to Division 01 General Requirements section.
- .2 Provide copies of all required certificates of approval, test results and verifications. Insert in Operating and Maintenance Manuals

#### **1.8 RECORD DRAWINGS**

- .1 Refer to Division 01 General Requirements section.

#### **1.9 WARRANTY**

- .1 Provide warranty of material and workmanship in accordance with the requirements of Division 01 General Requirements section.
- .2 Provide manufacturers' standard warranty if greater than one year.
- .3 The Contractor is to submit extended warranties for specific materials and/or work where specified. Extended warranties are to be issued on the Contractor's letterhead, under seal, and issued in the name of the Owner.

#### **1.10 OPERATING AND MAINTENANCE MANUALS**

- .1 Refer to Division 01 General Requirements section.

### **2 Products**

#### **2.1 MATERIAL**

- .1 All material shall be specification grade, where applicable, new and carry CSA approval or special approval in accordance with ESA requirements.

- .2 Similar devices and items shall be from one manufacturer throughout the project.
- .3 Material or equipment specified by technical description shall be provided with the best commercial qualities obtainable for the purposes described.
- .4 Requests for extra money, time or equipment substitution due to late ordering of equipment will not receive any consideration.

## **2.2 ALTERNATE MATERIALS**

- .1 Whenever a substitute or alternate product is proposed for use, the Contractor shall guarantee that such proposed substitutes or alternates will not adversely affect the requirements allocated on the drawings for the material or item or plant or equipment specified. He shall agree to bear any additional expense incurred due to the use of proposed substitutes or alternates, particularly in connection with any required changes in the work of any other division.
- .2 Requests for approval shall be accompanied by complete specifications for the equipment, showing dimensions, ratings, photometrics, cost reductions, etc.
- .3 Substitutions or alternates will be allowed after tender close.
- .4 Any equipment installed, without the Consultant's written approval, shall be removed and the correct equipment installed at no extra cost.
- .5 In the event the approved alternate equipment is not available for any reason, the specified equipment shall be installed.
- .6 When proposing an alternative product make all affected parties aware of any structural, architectural, mechanical, or electrical design changes necessary to accommodate the alternative product. The contractor is responsible for paying all costs incurred, which may result, from the acceptance of the alternative. Any cost savings anticipated must include all additional costs incurred for any changes to the original design.
- .7 For proposed alternate lighting fixtures, the contractor shall demonstrate that the alternate fixtures meet desired lighting performance targets.

## **2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring, conduit and connections: provided by Division 26 where voltage exceeds 30V, provided by Division 22/23/25 where voltage is 30V or less.

## **2.4 EQUIPMENT IDENTIFICATION**

- .1 Identify all panel(s), starter(s), disconnect switch(es), etc. with approved, mechanically fastened lamacoid nameplates. Indicate equipment being controlled, voltage and the supply panel/device and its location.
- .2 Labels on fused disconnect switches to include size and type of fusing. Also indicate "Equipment to be off before Isolation".
- .3 Terminal cabinets, junction boxes and pull boxes: indicate system and voltage and/or circuits.
- .4 Use 3mm (1/8") thick lamacoid plates. White colour background with 6mm (1/4") high black letters. Use client equipment numbers as required.
- .5 Within panel boards, provide a typewritten directory of all circuits identifying the loads connected.
- .6 Provide warning signs, as specified or to meet requirements of Inspection Department and Consultant. Use porcelain enamel for outdoor and decal for indoor signs, minimum 175 x 250 mm size.

## **2.5 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, metal sheathed cables and junction boxes. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling or floor and at 3050mm (120") intervals. Colours to be 25mm (1") wide as follows:

- .1 Fire Alarm, Red
- .2 Telephone, Green
- .3 Emergency Power, Blue

## 2.6 WIRING IDENTIFICATION

- .1 All wiring shall be colour coded and shall be identified at each end with Brady self-sticking wire markers or equivalent. Update and or indicate numbers on "as-built drawings".
- .2 Maintain phase sequence and colour coding throughout. Colour coding to CSA C22.1.
- .3 Use colour coded wires in communication cables, matched throughout system.

## 2.7 FINISHES

- .1 Prepare and clean surfaces of electrical products requiring painting to SSPC SP3 for rust and SSPC SP1 for oil, grease, dirt and other contaminants.
- .2 Apply One coat of primer.
- .3 Apply Two coats of finish paint. Colour of manufacturer's standard ASA grey except specified otherwise. Paint all electrical equipment to EEMAC standard.
- .4 Apply paint in accordance with manufacturer's instructions regarding application methods, coating thicknesses, equipment, temperature and humidity conditions.
- .5 Clean and touch up surfaces scratched or marred during shipment and installation, to match original paint finish.
- .6 Clean, prime and paint exposed hangers, racks and fasteners to prevent rust.
- .7 Provide touch-up paint.

## 3 Execution

### 3.1 EXISTING CONDITIONS AND DEMOLITION

- .1 Examine drawings of all other trades and allow for all work such as the removal and re-installation of electrical luminaires, equipment, devices, wiring, raceways, etc. where such work is required due to alterations in or about the existing building. Remove all surplus conduits, wiring, luminaires and devices in renovated areas. Blank off or remove all unused outlet boxes.
- .2 Assume that all existing conduits in Work area contain live circuits.
- .3 Protect, support and maintain existing active services as required for execution of work without disturbing these services.
- .4 Circuit designation on the existing panelboards may not agree with field installation. Trace and verify such circuits, as required.
- .5 Do not disrupt existing lighting, power or communication systems.
- .6 If temporary connections are required to maintain services during construction period, supply and install necessary material, equipment and labour to electrical safety codes and standards.
- .7 Protect personnel during construction from physical danger from exposed energized equipment such as panelboard mains and outlet wiring. Shield and mark live parts LIVE – 600/230 VOLTS AC or 600 VOLTS DC.



- .8 Arrange for installation of temporary doors, barriers and similar items, for rooms containing electrical equipment. Keep door closed except when under direct supervision.
- .9 Use minimum 1½ hours fire rated temporary door and barriers for rooms containing electrical equipment.
- .10 Electrical equipment requiring temporary or permanent relocation or power due to construction is the Contractor's responsibility.
- .11 Include and provide additional items and accessories or connections obviously required to provide complete working system for relocated equipment but omitted from Specifications or not shown on the Contract Drawings.
- .12 Trace conduits and circuits feeding existing equipment in Work area obstructing and interfering with agreement of work. Maintain circuits live, and if required in use.
- .13 Unless "only" suffixes "supply, install and connect" or variation of those words, it means "supply install and connect".
- .14 Ensure that all existing equipment/devices which are to be reused and/or relocated and/or are to remain are thoroughly inspected and refurbished to ensure correct operation when put back into service and to meet ESA approval.

### 3.2 EQUIPMENT INSTALLATION

- .1 Do complete installation in accordance with OESC except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 and CSA C22.3 No.7 respectively, except where specified otherwise.
- .3 The location of any panels, equipment, outlet, raceway and wiring may be changed by the Consultant if the new location is within a limit of 3000mm (120") radius of the original location. Provide changes without extra cost if requested before installation.
- .4 Do not install wall-mounted equipment at locations where built-in furniture or other equipment is to be installed. In cases of conflict, install equipment above the built-in furniture and clear the trim by approximately 150mm (6") unless otherwise instructed by the Consultant.
- .5 In electrical rooms, no equipment to be mounted directly to the walls. The panels and equipment are to be mounted on U channel standoffs or on fire rated plywood complete with 2 coats of fire-retardant paint.
- .6 Arrange for openings in the walls and floors for transportation and installation equipment. Extra charges for cutting and making good of walls or floors for the work will not be accepted.
- .7 Notify other trades concerned of openings, anchors, hangers or other provisions necessary for installation of electrical work for installation in structure, walls, floors and similar locations or may affect other work. Coordinate electrical installation with other trades. Install electrical items in time to avoid cutting or patching of Work.
- .8 Prior to installation and start up, co-ordinate and confirm that all electrical equipment and systems are compatible, are sized correctly and shall work safely as intended.
- .9 Provide an acceptable documented procedure for the commissioning of all systems. Contact the Consultant to arrange for a viewing of the system demonstration. All systems shall be fully operational and verification documents available at least 24 hours before requesting a review by the Consultant. Provide hard copies of all programs for review before and after commissioning of equipment. At the discretion of the Owner, back charges for costs incurred may be levied if systems are not commissioned and operational at the time of the Consultants visit and return visit(s) are required.
- .10 Install, program, set-up and adjust all equipment as indicated and or required and complete all commissioning.

- .11 Electrical work is indicated generally on the Contract Drawings by standard symbols as per the legend. The letters in the symbol indicate the type of device as per the schedules. The letters and numbers outside and adjacent to the symbols indicate the panel and circuit number. If no circuit identification is indicated utilize available circuit(s) and load to acceptable practices.
- .12 All row mounted fixtures shall be accurately installed in line with all mounting hardware.
- .13 Support every outlet box, junction box, panel tub, etc. independent of conduits running to it.
- .14 Surface mounted distribution and control equipment shall be mounted square and level on flame retardant backboard.
- .15 Transformers, MCC and panels (as required) shall be mounted on housekeeping pads. Provide 100mm housekeeping pads for this equipment, unless noted otherwise.
- .16 Mount exit lights at a level so that they are clearly visible and to the satisfaction of authorities having jurisdiction.
- .17 Loading Dock equipment is provided with switches for dock light and dock fan to be hardwired by electrical contractor. Each dock leveler shall be provided with a fused disconnect switch.

### **3.3 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### **3.4 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
- .2 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm (2"). All holes through concrete or steel structural members shall be approved by the Structural Consultant.
- .3 Install cables, conduits and fittings close to building structure so furring can be kept to minimum.
- .4 Relocate temporary or permanent electrical equipment and conduits as required.

### **3.5 NEUTRAL CONDUCTOR AND PHASING**

- .1 Install individual grounded neutral conductor for one-pole, two-pole or three-pole branch breakers of balanced, 3 phase, 4 wire circuits unless noted otherwise. Current carrying capacity of neutral conductors shall be equal or greater than the phase conductor to suit load conditions.
- .2 Balance single phase loads to minimize unbalance of 3 phase supply.

### **3.6 NOISE AND VIBRATION**

- .1 If equipment operates with excessive noise or vibration due to incorrect installation or support, eliminate noise or vibration to acceptance by Owner.
- .2 Make connections to noise producing and vibrating equipment with flexible conduit.
- .3 Install vibration isolators where indicated. isolate transformers from structure with spring or rubber isolators when suspended and appropriate sandwich pads when floor mounted. .

### **3.7 EQUIPMENT MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless indicated otherwise. Verify unspecified heights and dimensioned locations before installation. Ensure indicated heights are per current Barrier Free access requirements before installation. Stagger back to back devices (such that they are not located in a common stud wall cavity) to reduce sound transfer and maintain fire separations.

- .2 Install switches, receptacles, devices, etc. on one common centre line when shown on the drawings in a grouping.
- .3 The top of recessed boxes to be mounted even with the nearest top of block. Alternatively, the bottom of recessed boxes may be mounted even with the nearest bottom of block.
- .4 Generally, install electrical equipment at following heights unless indicated otherwise on drawings:
  - .1 Light switches and thermostats in public spaces: 1200mm (47").
  - .2 Pit light switches: 305 mm (12") below hatch, right side (preferred).
  - .3 Wall receptacles:
    - .1 General: 405mm (16").
    - .2 Height above top of counters or counter splash backs: 175mm (7").
    - .3 Mounted high (refrigerator, etc.): 1120mm, (44").
    - .4 In mechanical rooms: 1120mm (44").
  - .4 Panelboards: as required by Code or as indicated (Maximum circuit breaker height 1700mm (67")).
  - .5 Exit lights at ceiling height, to a maximum of 2290mm (90"). Confirm visibility before installation.
  - .6 Wall mounted emergency lights: 2440mm (96").
  - .7 Barrier Free door release/opener button & washroom lights: 1,100mm (43").
  - .8 Motor starters, generally: 1400mm (55").
  - .9 Telephone outlets: 400mm (16").
  - .10 Wall mounted telephone outlets: 1372mm (54").
  - .11 Television outlets: as noted on drawings.
  - .12 Hand dryers: 1200mm (47").
  - .13 Fire Alarm Pull Stations: 1,100mm (43")
  - .14 Fire Alarm Signal Devices: 2,400mm (94.5")

### **3.8 LOAD BALANCING**

- .1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record current readings.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment. Measure phase voltages to reflect utility voltage fluctuations and set accordingly.

### **3.9 CLEAN-UP**

- .1 Continuously remove surplus and waste material generated by the electrical work.
- .2 Clean all supplied equipment and material of dirt, dust and stray paint, immediately prior to final acceptance of the work.
- .3 Remove tools, surplus material, scrap and debris (resulting from the work of this Division) on completion of the Contract.
- .4 Clean and touch-up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

- .5 Clean, prime and paint exposed non-galvanized hangers, racks and fastenings to prevent corrosion.

### 3.10 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Verify prior to energizing of circuits.

### 3.11 TESTING

- .1 Furnish labour, materials, and instruments and bear other costs in connection with all tests, including third party and factory tests, obtain required certificates of approval, acceptance, and compliance with regulations of agencies having jurisdiction and as specified.
- .2 Confirm proper operation of each piece of equipment and system for correct function.
- .3 Measure amperage readings of each phase at service entrance switchboard and on each panel/equipment feeder. Ensure phase imbalance does not exceed 10% at operating load conditions. Adjust loads as required.
- .4 Megger test all feeders prior to energizing; submit test results in Operating & Maintenance Manuals. Provide insulation resistance testing on service entrance cables, panel feeders and feeders to major equipment. Testing to be completed as follows:
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
- .5 Note: Check resistance to ground and conductor to conductor resistance for conductors in the same conduit before energizing.
- .6 Measure voltage at service entrance switchboard, at feeder supply connections and at load connections. Measurements to be taken under normal operating conditions. Submit test results in Operating & Maintenance Manuals.
- .7 Confirm continuity of metal raceways where raceway is used in lieu of a bonding conductor.
- .8 Demonstrate that the settings described in the co-ordination study have been incorporated.

### 3.12 INSPECTIONS

- .1 Inform the Consultant in writing a minimum of 3 working days prior to any test of any system.
- .2 All work and materials covered by these Specifications shall be subject to inspection at any time by the Consultant.
- .3 If the Consultant finds that any material or workmanship does not conform to these specifications undertake to correct such workmanship within 5 days of notification by the Consultant.
- .4 Work shall not be deemed complete and Certificate of Substantial Performance will not be issued, until all indicated certificates of approval, test results and/or verifications have been delivered to the Consultant.
- .5 Notify the Consultant when the final inspection of the work shall be performed. Defects or deficiencies found during this inspection shall be corrected to the satisfaction of the Consultant before final payment is made.

### END OF SECTION



1 General

1.1 SUMMARY

- .1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED REQUIREMENTS

- .1 Section 26 05 00 – General Electrical Requirements  
.2 Section 26 05 73 – Electrical Systems Analysis

1.3 REFERENCE STANDARDS

- |     |                     |   |
|-----|---------------------|---|
| .1  | CSA C22.2 No. 41    | Grounding and Bonding Equipment   |
| .2  | CSA C22.2 No. 38    | Thermoset Insulated Wires and Cables  |
| .3  | CSA C22.2 No. 51    | Armoured Cables   |
| .4  | CSA C22.2 No. 52    | Underground Secondary and Service - Entrance Cables                               |
| .5  | CSA C22.2 No. 75    | Thermoplastic-Insulated Wires and Cables  |
| .6  | CSA C22.2 No. 83.1  | Electrical Metallic Tubing - Steel  |
| .7  | CSA C22.2 No. 211.1 | Rigid Types EB1 and DB2/ES2 PVC Conduit   |
| .8  | CSA C22.2 No. 211.2 | Rigid PVC Conduit   |
| .9  | CSA C22.2 No. 45.1  | Electrical Rigid Metal Conduit – Steel  |
| .10 | CSA C22.2 No. 45.2  | Electrical Rigid Metal Conduit – Aluminum, Red Brass & Stainless Steel            |
| .11 | CSA C22.2 No. 56    | Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit                    |
| .12 | CSA C68.3           | Power Cables with Thermoset Insulation  |
| .13 | CSA C22.2 No. 85    | Rigid PVC Boxes and Fittings  |
| .14 | CSA C22.2 No. 18.1  | Metallic Outlet Boxes   |
| .15 | CSA C22.2 No. 18.2  | Non-Metallic Outlet Boxes   |
| .16 | CSA C22.2 No. 18.3  | Conduit, Tubing and Cable Fittings  |
| .17 | CSA C22.2 No. 18.4  | Hardware for the Support of Conduit, Tubing and Cable                             |
| .18 | CSA C22.2 No. 40    | Cutout, Junction and Pull Boxes   |
| .19 | CSA C22.2 No. 65    | Wire Connectors   |
| .20 | CSA C22.2 No. 14    | Industrial Control Equipment  |
| .21 | CSA C22.2 No. 177   | Clock-Operated Switches   |
| .22 | CSA C22.2 No. 42    | General Use Receptacles, Attachment Plugs, and Similar Wiring Devices             |
| .23 | CSA C22.2 No. 42.1  | Cover Plates for Flush Mounted Wiring Devices                                     |
| .24 | C22.2 NO. 182.1     | Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type               |
| .25 | C22.2 NO. 182.2     | Industrial Locking Type, Special Use Attachment Plugs, Receptacles and Connectors |
| .26 | C22.2 NO. 182.3     | Special Use Attachment Plugs, Receptacles and Connectors                          |
| .27 | CSA C22.2 No. 4     | Enclosed and Dead-Front Switches  |
| .28 | CSA C22.2 No. 111   | General Use Snap Switches   |

- .29 CSA C22.2 No. 55 Special Use Switches
- .30 CSA C22.2 No. 106 HRC Miscellaneous Fuses
- .31 CSA C22.2 No. 248 Low-Voltage Fuses
- .32 CSA C22.2 No. 39-13 Fuseholder Assemblies
- .33 CAN/ULC-S115 Standard Method of Fire Tests of Firestop Systems

#### 1.4 SCOPE

- .1 Provide wiring and equipment as detailed on the Contract drawings and specified herein.

#### 1.5 SHOP DRAWINGS

- .1 Submit shop drawings for the equipment detailed within this specification section. Shop drawings shall be submitted in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 01.

### 2 Products

#### 2.1 MATERIAL

- .1 All material shall be specification grade, where applicable, new and carry C.S.A. approval or special approval in accordance with the requirements of the Electrical Safety Authority.
- .2 Similar devices and items shall be from one manufacturer throughout the project.

#### 2.2 WIRING

- .1 All conductors, unless specifically noted otherwise, shall be copper with 600 volt, x-link insulation. Temperature rating to be 90°C or as required by Code.
- .2 All wiring shall be copper conductors in overhead conduit.
- .3 All feeders 125A and smaller or feeding motors or vibrating equipment shall be copper.
- .4 All conductors shall be colour coded consistent with the Ontario Electrical Safety Code.
- .5 Conductors up to and including # 10 may be solid copper. Larger conductors shall be stranded.
- .6 Branch circuit wiring shall be #12 AWG minimum. For circuit (15Amp, 120VAC) lengths exceeding 30m (100') minimum size shall be #10 AWG and for circuit lengths exceeding 45m (150') minimum size shall be #8AWG. For circuit (20A, 120VAC) Lengths exceeding 20m(70') minimum size shall be #10AWG and for the circuit lengths exceeding 30m (100') minimum size shall be #8AWG. Size wiring to maintain a maximum of 3% voltage drop.
- .7 Control wiring to be #16 AWG minimum. Size wiring to maintain a maximum of 2% voltage drop.
- .8 Wiring in dry locations shall be: R90 or RW90 installed in EMT conduit (unless noted otherwise).
- .9 Wiring in damp locations shall be: RW90 in conduit (conduit type as noted on drawings).
- .10 Underground service entrance wiring shall be RWU90 in PVC duct or conduit.
- .11 Armoured cable (AC90) shall be permitted in ceiling spaces for interconnection of lighting fixtures. Maximum length per location shall not exceed 3m (10'); utilize EMT conduit for longer lengths.
- .12 All feeders shall be run in continuous length between power supply point and the load with no splices.
- .13 Provide separate neutrals for electronic ballast lighting circuits (do not share neutrals between lighting circuits).
- .14 Sleeve and seal wiring through fire rated walls and floors, per Ontario Building Code requirements.

- .15 Wiring in fire rated partitions shall be armoured cable.

## 2.3 CONDUIT

- .1 EMT conduit shall be utilized for typical wiring. Conduit to be concealed wherever possible.
- .2 Where conduit is surface mounted and subject to mechanical damage, use rigid galvanized steel threaded conduit to a minimum of 3m (10') above finished floor level. Use electrical metallic tubing (EMT) above 3m (10').
- .3 Direct buried conduit shall be rigid PVC conduit with bond, as permitted by Code.
- .4 Seal tight (flexible, PVC jacketed, metallic) conduit shall be used to connect motors and vibrating equipment; minimize length of runs where possible.
- .5 Concrete encased conduit shall be PVC type DB2 duct with bond wire, as permitted by Code. The minimum cover to concrete surface shall be as per OESC.
- .6 Minimum conduit size for lighting and power circuits shall be 21 mm (3/4") unless otherwise stated. All buried conduit or conduit embedded in concrete shall be minimum 27 mm (1") diameter.
- .7 Provide all pull boxes, junction boxes, terminal boxes, fittings, drains, plugs, cover plates, bushings, clips, rods and accessories as required and appropriate.
- .1 In-grade pull boxes shall be Quazite PG Type polymer concrete with bolt down cover.
- .2 Boxes shall have T rating do suit installed location as per manufacturer's recommendations.
- .8 Pull boxes installed in heavy vehicular areas such as launchpad and truck docks shall be submitted to the Consultant for approval. EMT conduit connectors to be c/w steel set screw.
- .9 Where the potential for box submergence exists, the box is to have a submersible rating with all fittings designed and installed to prevent the entry of water.
- .10 Supports for conduit, cable or equipment shall be corrosion resistant (galvanized steel or equivalent).
- .11 Raceways on roof shall be EMT with weather-tight compression fittings.
- .1 All raceway supports on roof shall be Dura-blok db10 or equal.
- .12 Exterior conduits buried in ground or slab shall be PVC.
- .13 Exterior above ground conduits shall be rigid galvanized steel.
- .14 Power required for dock equipment may be run under-slab in the pour-back area and concealed conduits run in the preformed walls slabs.
- .15 Feeders to MDP panels may be run underground. Conduit to be run overhead just under the joist top chord, located to avoid interference with ESFR sprinkler heads.
- .16 Conduits serving items along dock wall may be run under slab.
- .17 Acceptable manufacturers:
- .1 PVC conduit: IPEX or Royal Pipe Systems.
- .2 Metallic conduit: Columbia MBF/Allied Tubing or Wheatland Tube.
- .3 PVC Coated RGS conduit: Ocal by Thomas & Bets or Perma-Code by Robroy Industries.

## 2.4 WIRING DEVICES AND COVERPLATES

- .1 General
- .1 Colour of devices and cover plates (other than stainless) to be confirmed by Consultant.

- .2 Receptacles in office areas that are identified to be switched by occupancy sensing devices shall be gray in colour to differentiate from non-switched receptacles.
- .3 Acceptable Manufacturers: Hubbell, Bryant, Pass & Seymour, Leviton.
- .4 All devices to be of the same manufacturer throughout.
- .2 Switches
  - .1 Refer to 26 09 24 – Lighting Control Devices for low voltage switch requirements.
- .3 Receptacles
  - .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
    - .1 Urea moulded housing.
    - .2 Suitable for No. 10 AWG for back and side wiring.
    - .3 Break-off links for use as split receptacles.
    - .4 Eight back wired entrances, four side wiring screws.
    - .5 Triple wipe contacts and riveted grounding contacts.
  - .2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, with features detailed above for 15A device.
  - .3 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
    - .1 Urea moulded housing.
    - .2 Suitable for No. 10 AWG for back and side wiring.
    - .3 Four back wired entrances, 2 side wiring screws.
    - .4 Other receptacles with ampacity and voltage as indicated.
  - .4 Duplex Ground Fault Interrupter Receptacle
    - .1 Rated 15A or 20A (as per drawings), 125VAC, U-grounded type.
    - .2 Class A requirement, trip level 4-6 mA, parallel blade, with test and reset switches, CSA 5-15R/20R configuration.
  - .5 Note: Except as specifically indicated, provision of either GFI receptacle or GFI circuit breaker will be acceptable to ensure ground fault protection of circuits as shown.
- .4 Coverplates
  - .1 Cover plates shall be from one manufacturer throughout project.
  - .2 Stainless steel (302/302), smooth cover plates, for wiring devices mounted in flush-mounted outlet box.
  - .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
  - .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
  - .5 Weatherproof locations: Provide cast aluminum cover ("while-in-use cover) complete with adapter plate and gaskets. Cover shall have "wet location" rating with or without a plug inserted into the receptacle.
- .5 Receptacle and switches installed in the warehouse below 7' shall be provided with a protective metal cage. The cage shall be prevented typical use when installed. The product shall be a standard manufactured product, not a custom-made guard. Basis of design: American Wire Guards Open Face Rectangle Guards.



## 2.5 OUTLET & CONDUIT BOXES

- .1 General
  - .1 Gang boxes where wiring devices are grouped.
  - .2 Provide blank cover plates for boxes which are roughed in only. Cover plate style as detailed above.
  - .3 Provide 347V outlet boxes for 347V switching devices.
  - .4 Provide combination boxes with barriers where outlets for more than one system are grouped.
- .2 Galvanized Steel Outlet Boxes
  - .1 One-piece electro-galvanized construction.
  - .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm (3" x 2" x 1½") or as indicated. 102mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
  - .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48mm (4" x 2" x 2").
  - .4 102mm (4") square or octagonal outlet boxes for lighting fixture outlets.
  - .5 Extension and plaster rings for flush mounting devices in finished tile walls.
- .3 Floor Boxes
  - .1 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep. Barrired interior compartments to accommodate communication/data and power/receptacle circuits.
  - .2 Where penetrating fire rated floor assembly, fire rated poke through (flush series) shall be utilized for power and data.
- .4 Masonry Boxes
  - .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.
- .5 Concrete Boxes
  - .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.
- .6 Conduit Boxes
  - .1 Where subject to mechanical damage (or as noted on drawings) provide cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

## 2.6 GROUND & BONDING

- .1 Provide all grounding to the authorities' approval. Use approved connection methods (thermal weld or compression). Provide appropriate mechanical protection for all ground wire.
- .2 Provide means for permanent and effective electrical grounding of exposed non-current carrying metal parts, assemblies housing electrical current carrying components (switchgear, transformer, etc.) as required by OESC (Ontario Electrical Safety Code).
- .3 Provide appropriately sized ground or bond wire in all conduit systems; including EMT, steel and PVC types.
- .4 Provide safety grounding studs, ball type complete with covers on 480V MCC.

- .5 All electrical distribution and control equipment doors to have flexible ground braid to extended ground from equipment ground busbar and not rely on hinge.
- .6 Provide #6 AWG insulated bond wire main service ground to:
  - .1 service entrance telecommunication backboard, and
  - .2 main telecommunication server room.
- .7 Install 20 X 3000mm long copper clad steel rod electrodes and make grounding connections at electrical service entrance.
- .8 Engage the services of an independent contractor to undertake a ground resistance measurement on the grounding system prior to termination and backfill. A log of measurements shall be provided. Notify the Engineer if the resistance of any rod is greater than 5 ohms.
- .9 Acceptable manufacturers: Thomas & Betts, Burndy & Dossert.

## **2.7 JUNCTION & PULL BOXES**

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25mm (1") minimum extension all around
- .3 Covers Surface Mounted: screw-on flat steel covers.
- .4 Junction boxes, pull boxes and fittings are to be match the finish of the raceway used.

## **2.8 CABINETS**

- .1 Construction: welded sheet steel, hinged door, handle, lock (2 keys) and catch.
  - .1 NEMA Type 1 for Dry Indoor locations, NEMA Type 3R for indoor wet/damp locations (reclaim room, M/E room), and NEMA Type 4X for outdoor locations unless indicated otherwise.
- .2 Cabinet to be supplied complete with back panel and bonding conductor from panel to door.

## **2.9 DISCONNECT SWITCHES**

- .1 Fusible, Non-fusible, Horsepower rated disconnect switches in CSDA enclosure to CSA-C22.2 No.4, size to suit circuit ampacity. Contractor to selected suitable type to suit environment.
  - .1 CSA Type 1: Dry and non-sprinkler.
  - .2 CSA Type 3R: Sprinkler areas, wet/damp indoor locations (reclaim room, M/E room).
  - .3 CSA Type 4X: Wet or Outdoor areas.
- .2 Provision for padlocking in Off switch position by 3 locks.
- .3 Mechanically interlocked door to prevent opening when handle in 'ON' position.
- .4 Fuses: Size as indicated or as recommended in the Short Circuit and Protection Co-ordination studies.
- .5 Fuseholders: To CSDA C22.2 No.39, relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 'ON-OFF' switch position indication on switch enclosure cover.

## **2.10 SUPPORTING DEVICES**

- .1 Every conduit or cable shall have at least one support. Only approved conduit supports will be accepted. Perforated pipe straps, tie wrap or wood support for conduits or outlet boxes etc., will not be accepted.

- .2 Single conduit runs: Galvanized conduit straps, ring bolt type hangers or P.V.C. saddles.
- .3 Horizontal multiple raceways runs: Conduit rack with minimum 25 percent spare capacity. Trapeze style hanger on threaded rod.
- .4 Vertical multiple raceway runs: Electrical strut fastened to structure.
- .5 Strut Channels and Components
  - .1 General: Strut shall be 1-5/8 inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.
  - .2 Materials and Finish: Hot-dip Galvanized Steel.
    - .1 Strut shall be manufactured from steel and hot-dip galvanized after fabrication.
    - .2 Fittings shall be manufactured from steel and hot-dip galvanized after fabrication.
    - .3 All hardware shall be stainless steel Type 304 or chromium zinc ASTM F1136 Gr. 3.
  - .3 Acceptable Manufacturers: Cooper B-Line, Thomas & Betts

## 2.11 ACCESS DOORS

- .1 Provide access doors in walls and ceilings to service electrical equipment and concealed devices requiring access. Positive latch system. Minimum 18 gauge steel.
- .2 Group devices to minimize doors. Access doors in fire separations are to be ULC labelled. Doors shall match finish and be flush with surface.
- .3 All sizes and locations of doors shall be approved in writing by the Owner and or Engineer before installation.
- .4 Provide hinged doors for all access panels with a size of 450 x 450 (18" x 18") or larger.

## 2.12 CUTTING & PATCHING

- .1 At all penetrations of the roof, walls and floors and/or as indicated on the Contract Drawings provide Portals Plus Alumi-Flash, Pipe Portal, Pipe Boots and Quadraseals or Portals Plus Retrofit as manufactured by Portals Plus, Inc. and distributed by D.E.L. Roofing Equipment, 905 856 0333. Seals shall be installed to the manufacturer's recommendations, instructions and to the satisfaction of the Engineer.
- .2 Cut and patch holes located incorrectly.
- .3 Pneumatic hammers, drills, or explosive fasteners shall not be used without prior written approval from the Owner and/or Consultant.
- .4 Openings on all electrical metal boxes shall be punched or cut.

## 2.13 FIRE STOPPING

- .1 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases.
- .2 Comply with the requirements of CAN/ULC-S115, and do not exceed opening sized for which they have been tested.
- .3 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.
- .4 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.
- .5 Fire stopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

- .6 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes.
- .7 Acceptable Manufacturers:
  - .1 Fyresleeve Industries Inc.
  - .2 General Electric Pensil Firestop Systems
  - .3 International Protective Coatings Corp.
  - .4 Rectorseal Corporation (Metacaulk)
  - .5 Proset Systems
  - .6 Minnesota Mining and Manufacturing (3M)
  - .7 Tremco.
  - .8 Hilti
- .8 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements, for the following items:
  - .1 Fire stopping materials.
  - .2 Manufacturers literature and installation instructions.
  - .3 Manufacturers Letter of Certification that project meets or exceeds specified requirements.

### 3 Execution

#### 3.1 GENERAL

- .1 Verify all wall and partition locations, door swings, light switch and other device locations.
- .2 Install all equipment according to manufacturer's recommendations with adequate access and clearances.
- .3 Provide acceptable painted metal shroud over cables and conduits around exterior or public areas to prevent climbing, as required.
- .4 Install all equipment according to manufacturer's recommendations with adequate access and clearances.
- .5 All wiring, receptacles, light switches to be added to finished existing walls shall be concealed if possible. If surface mounted equipment and Wiremold raceway is proposed its location and type must be approved by the Owner before installation. At tender specify where surface equipment and conduits are proposed to be installed.
- .6 Correct improperly installed work as directed by the Consultant or authorized inspector.

#### 3.2 SHORT CIRCUIT AND COORDINATION STUDY

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Verify prior to energizing of circuits.
- .2 Equipment short circuit ratings shall meet specified values as a minimum and be confirmed by the short circuit calculation before purchasing equipment. Short circuit current ratings are the responsibility of the power system provider. Refer to Spec 26 05 73.

#### 3.3 WIRING

- .1 Maximum armoured cable (BX) length of 3 m (10ft) is acceptable in the ceiling space, use EMT conduit otherwise. Minimum lengths of armoured cable may be used in furred ceilings, hollow



partitions and hollow walls. EMT only in masonry walls unless otherwise approved. No BX may lay on or clip to ceiling tiles or terminate in panels.

- .2 Conductor length for parallel feeders to be identical.
- .3 Wire or cable used for feeders shall be free of splices.
- .4 Systems of different voltages shall be installed in separate raceways.

### 3.4 CONDUITS

- .1 Provide and locate all sleeves required to pass wiring through building walls and floors and ceilings. Fill voids between conduits and sleeves with material and caulking sealant to suit application and fire rating.
- .2 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .3 Elevator requirements:
  - .1 Provide a 16 mm (1/2"), empty conduit through the hoist way wall for elevator cab on each floor, for lanterns and push buttons.
  - .2 Provide a 63 mm, (2 1/2"), empty conduit from the elevator hoist way on the ground floor and extend to elevator control panel.
  - .3 Provide a 16 mm. (1/2"), empty conduit from the telephone backboard to the elevator control panel.
- .4 Provide complete metal conduit system for door entry wiring.
- .5 Provide empty conduit systems for phone, computer, cable TV outlets or as designated. Conduit as indicated or as a minimum: 21 mm (3/4") EMT conduit from the outlet to 150 mm (6") above the ceiling panel. Provide outlet boxes, cover plates, junction and pull boxes and fireproof backboards as required.
- .6 Telephone, Computers and Cable TV shall be wired by the Owner authorized company. Provide the authorized installers for these systems with estimated installation dates at the start of construction and two weeks prior to estimated pre-wiring dates. Provide raceways from outlets to accessible ceiling space. Co-ordinate with the end user authority and follow applicable installation guidelines.
- .7 Co-ordinate with all trades to locate conduits in slabs, as required, before concrete pouring, record routing on prints.
- .8 Co-ordinate and record exact routing of underground ducts and conduits. Establish elevation of ducts, schedule of work before installation.
- .9 Supply and install expansion couplings where conduits cross construction joints.
- .10 Install conduits on surface at lower trough of roof decking.
- .11 All conduit and wiring within the building shall be run neatly and parallel to the building structure, above finished ceilings, within finished walls or below the floor. Conceal conduits as much as practical. It shall be supported from the building structure. Minimize horizontal runs along walls. Nails or tie wires are not acceptable. Do not caddy clip to ceiling hangers.
- .12 Provide fish wire in all empty conduits.

### 3.5 WIRING DEVICES

- .1 Switches:
  - .1 Switches shall operate vertically, with handle in "UP" position when switch closed. Devices on three way switches shall be off when all toggles are down.

- .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .3 Mount toggle switches at height in accordance with Section 26 05 00 – General Electrical Requirements unless noted otherwise.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Generally, mount receptacles with U-ground oriented down.
  - .3 Mount receptacles at height in accordance with Section 26 05 00 – General Electrical Requirements unless noted otherwise.
  - .4 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .5 All receptacles and data outlets mounted on the warehouse columns shall be a minimum of 42" AFF.
  - .6 Provide module power drops with 120V quad receptacles in warehouse areas (maximum of 1 quad per 20A circuit).
  - .7 Provide MHE equipment power drops with 120V L5-30 receptacles in warehouse areas (maximum of 1 twist-lock per 30A circuit).
- .3 Cover plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
  - .4 All electrical outlets shall include a permanent label affixed to cover plate indicating panel and circuit designation serving the outlet.

### 3.6 OUTLET AND CONDUIT BOXES

- .1 Gang power, voice and data outlets using gang boxes with barriers. Coordinate with voice and data wiring provider and provide combination cover plates to suit.
- .2 Mount all boxes, plumbed-true on vertical installations. Mount level on horizontal installations.
- .3 In finished areas, all boxes to be installed flush mounted.
- .4 All boxes to be supported independent of conduits or cables.
- .5 Openings in all boxes shall be punched or cut, no burning of holes allowed.
- .6 Fill all K.O. openings not used with proper filler plates.
- .7 Door swings are to be determined from the Architectural drawings for switch locations.
- .8 All final locations to be determined in field with Owner.

### 3.7 GROUNDING AND BONDING

- .1 Install complete permanent, continuous grounding and bonding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run bond wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.

- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermite process, permanent mechanical connectors or inspectable wrought copper compression connectors.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate bond conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make bonding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .13 Equipment Grounding
  - .1 Install grounding connection to service entrance equipment. Provide bonding connections to typical equipment included in, but not necessarily limited to following list:
    - .1 Transformers, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators, distribution panels, and outdoor lighting.

### 3.8 JUNCTION AND PULL BOXES

- .1 Install junction and pull junction boxes so they are supported independent of raceways.
- .2 Install pull boxes after every 30 m (100') of continuous raceway.
- .3 Locate pull boxes above accessible ceiling spaces in inconspicuous locations wherever possible.
- .4 Colour code pull boxes to indicate system involved.
- .5 Provide 305mm (12") crushed gravel beneath the box for drainage.
- .6 Conduit shall enter on sides with minimum burial depths of 24" below finished grade.
- .7 Conduit knockouts shall be drilled or punched on site.

### 3.9 CABINETS

- .1 Mount all surface mounted equipment enclosures on an approved fire rated backing, or Unistrut channels.
- .2 All recessed enclosures shall have trim for recessed mounting.
- .3 Enclosures mounted in finished areas shall be finished to match.
- .4 Terminate wiring in screw type terminal blocks or strips.

### 3.10 SUPPORTING DEVICES

- .1 Install supporting devices to maintain headroom and clearances as described for conduits and conductors.
- .2 Maintain a neat appearance and follow building lines where possible.

### 3.11 ACCESS DOORS

- .1 Provide access panels where required for electrical equipment concealed in walls, partitions or floors. Location and type of access panels shall be to the Consultant's approval.
- .2 Paint access panels to match surrounding decor or as directed by the Consultant on site.
- .3 Keep access doors to a minimum by locating equipment in easily accessible locations.

### **3.12 FIRE STOPPING**

- .1 Confirm location and extent of fire separations from architectural drawings.
- .2 Inspect surface to be fire stopped. Report unsatisfactory conditions to Consultant in writing prior to commencement of work. Initiation of work to be deemed as acceptance of conditions and surfaces.
- .3 Store all materials in accordance with manufacturers recommendations as to acceptable ambient temperatures. Damaged or deteriorated materials are not to be used and are to be removed from the site.
- .4 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in all conduit, cable, duct etc. penetrations in new or existing fire separation to provide temperature, flame and smoke rated seals not less than the fire resistance rating of the assembly, or separation.
- .5 Seal all holes made by through-penetrations and un-penetrated openings to ensure continuity and integrating of fire separation, including where existing component or device has been removed.
- .6 Notify Consultant and/or Authority having jurisdiction for inspection prior to concealing or enclosing fire stopping materials and service penetrations.
- .7 Remove excess material and debris and clean adjacent surfaces immediately after application. Leave in a tidy condition.

### **3.13 TIME SWITCHES**

- .1 Label each time switch to indicate the device it controls.
- .2 Confirm programming of time switches with Consultant/Owner and provide setup of switches.

### **3.14 CONTACTORS**

- .1 Install contactors and connect auxiliary control devices.
- .2 Locate contactors in a convenient location for accessibility and service. Wherever possible, locate in service spaces such as electrical rooms, mechanical rooms, janitors closets, etc. Provide a self-supporting mounting surface where required.
- .3 Label each contactor to indicate the device it controls.

### **3.15 MOTOR STARTERS**

- .1 Install starters and control devices in accordance with manufacturer's instructions.
- .2 Install and wire starters and controls as indicated.
- .3 Ensure correct fuses are installed in starters.
- .4 Confirm motor nameplate and adjust overload devices to suit.
- .5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

### **3.16 DISCONNECT SWITCHES**

- .1 Label each disconnect switch to indicate the device it controls.



- .2 Provide a separate self-supporting structure to support the disconnect device where the equipment or adjacent walls are not capable of supporting the device.
- .3 Install disconnect switches complete with fuses if applicable.

### **3.17 FUSES**

- .1 Ship fuses in original containers
- .2 Do not ship equipment with fuses installed.
- .3 Store spare fuses in original containers in fuse storage cabinet. Install fuse storage cabinet in electrical room.
- .4 Install fuses in mounting devices immediately before energizing circuit.
- .5 Prior to energization of any circuit, verify that the correct fuse is installed:
  - .1 for the calculated or assumed circuit capacity, and
  - .2 for the proper equipment and conductor protection requirements.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 This Section includes requirements for supply and installation of all wiring and equipment detailed on the contract drawings and specified herein.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – General Electrical Requirements

**1.3 REFERENCE STANDARDS**

- .1 CSA Group:
- .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables
  - .2 CSA C22.2 No. 38-M, Thermoset Insulated Wires and Cables
  - .3 CSA C22.2 No. 51-M, Armoured Cables
  - .4 CSA C22.2 No. 52, Underground Secondary and Service - Entrance Cables
  - .5 CSA C22.2 No. 75-M, Thermoplastic-Insulated Wires and Cables
  - .6 CSA C22.2 No. 131-M, TECK 90 Cables
  - .7 CSA C22.2 No. 123, Metal Sheathed Cables (Applies for Drive RX Cable)
  - .8 CSA C22.2 No. 174, Cables and Cable Glands in Hazardous Locations
  - .9 All cables installed in areas requiring fire rating shall conform to test FT-4.
  - .10 All cables installed in spaces designated as a return air plenum shall conform to test FT 6 or be installed in continuous conduit system.
- .2 No "Aluminium" Wiring, Buswork or "Nual" Wiring shall be used on this Contract.

**1.4 ACTION SUBMITTALS**

Provide submittals in accordance with Division 01 General Requirements section.

- .1 Shop Drawings: Submit shop drawings for the equipment detailed within this specification section. Shop drawings shall be submitted in accordance with Section 26 05 00 – General Electrical Requirements.

**1.5 STORAGE, DELIVERY, HANDLING AND PROTECTION**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

2 Products

2.1 BUILDING WIRES

.1 Conductors

- .1 Copper conductors, of the size as indicated in the Contract Documents, having a minimum conductivity of 98 percent.
- .2 Conductors up to and including #10 may be solid copper. Larger conductors shall be stranded.
- .3 Branch circuit conductors shall be minimum No. 12 AWG, size conductor for maximum 3% voltage drop to the furthest outlet on a fully loaded branch circuit.
- .4 Control wiring to be No. 16 AWG minimum. Size wiring to maintain a maximum of 2% voltage drop.
- .5 Voltage shall be rated at a minimum of 600 V for 120/208 V wiring and 1000 V for 347/600 V wiring.
- .6 All feeders shall run in continuous length between power supply point and the load with no splices.

.2 The following shall be used with respect to branch circuit (15 Amp, 120 VAC) wire sizing for voltage drop from the circuits associated panel board.

- .1 #12 AWG to be used from 0 to 100 ft, maximum length of branch circuit run from panel board.
- .2 #10 AWG to be used from 100 to 150 ft, maximum length of branch circuit run from panel board.
- .3 #8 AWG to be used circuits longer than 50 ft, maximum length of branch circuit run from panel board.

.3 The following shall be used with respect to branch circuit (20 Amp, 120 VAC) wire sizing for voltage drop from the circuits associated panel board.

- .1 #12 AWG to be used from 0 to 70 ft, maximum length of branch circuit run from panel board.
- .2 #10 AWG to be used from 70 to 100 ft, maximum length of branch circuit run from panel board.
- .3 #8 AWG to be used circuits longer than 100 ft, maximum length of branch circuit run from panel board.

.4 The Electrical Contractor shall up-size feeder and branch circuit wiring and associated conduit as required to meet the requirements of the code with respect to acceptable voltage drop.

.5 Insulation:

- .1 Wiring in dry locations shall be: R90 or RW90 installed in EMT conduit (unless noted otherwise).
- .2 Wiring in damp locations shall be: RW90 in conduit (conduit type as noted on drawings).
- .3 Underground service entrance wiring shall be RWU90 in PVC duct or conduit.

.6 Colour Coding:

- .1 All conductors shall be colour coded consistent with the Ontario Electric Safety Code.

.7 Manufacturers: Acceptable manufacturers approved as a basis of design:

- .1 Canada Wire and Cable Limited
- .2 Prysmian Group
- .3 Phillips Cables Limited
- .4 Pirelli
- .5 Nexans

## 2.2 TECK 90 CABLE

- .1 Conductors
  - .1 Copper conductors shall be of the sizes indicated in the Contract Documents, having a minimum conductivity of 98 percent.
  - .2 Each cable shall have a grounding conductor.
- .2 Insulation:
  - .1 Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 1000V, type RW 90.
- .3 Inner jacket: polyvinyl chloride material
- .4 Armour: aluminum interlocked armour
- .5 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project. Conform to FT4.
- .6 Fastenings
  - .1 One hole malleable iron straps to secure surface mounted cables.
  - .2 12-gauge galvanized steel channel type supports for two or more cables at 1500 mm centres.
  - .3 1/4" diameter threaded rods to support the suspended channels.
- .7 Connectors
  - .1 Watertight TECK connectors, T & B series 10464 and 10470.
- .8 Manufacturers: Acceptable manufacturers approved as a basis of design
  - .1 Canada Wire and Cable Limited
  - .2 Prysmian Group
  - .3 Phillips Cables Limited
  - .4 Pirelli
  - .5 Nexans

## 2.3 ARMoured CABLES

- .1 AC90 Cable
  - .1 Shall be permitted in ceiling spaces for interconnection of lighting fixtures. Maximum length per location shall not exceed 3m; utilize EMT conduit for longer lengths.
  - .2 Conductors: Copper conductors, of the sizes as indicated in the Contract Documents, having a minimum conductivity of 98%.
  - .3 Insulation: Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 600 V.
  - .4 Armour: Interlocking armour fabricated from aluminum strip.



- .5 Connectors: anti short connectors
- .6 Shall be provided with an integral insulated ground wire.

## **2.4 MINERAL-INSULATED CABLE**

- .1 Conductors: Solid bare soft-annealed copper conductors, of the sizes as indicated in the Contract Documents.
- .2 Insulation Compressed powered magnesium oxide insulation to form a compact homogeneous mass throughout the entire length of the cable.
- .3 Sheath:
  - .1 An annealed seamless copper sheath, Type MI, rated 600 V, 250 C.
  - .2 Termination Kits: Provide copper termination kits at each end of each cable.
- .4 Manufacturers: Acceptable manufacturers approved as a basis of design for MI cable are:
  - .1 Pyrotenax of Canada Limited.

## **3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify existing conditions are acceptable for installation of work of this section, in accordance with manufacturer's written instructions and reviewed shop drawings.
  - .1 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PREPARATION**

- .1 Prepare surface to receive work in this section in accordance with manufactures recommendations.

### **3.3 INSTALLATION**

- .1 Install grounding, grounded and neutral conductors without any fuses, switches or breakers of any kind unless otherwise indicated in the Contract Documents.
- .2 Ground the grounded or neutral conductor at the source of supply as indicated in the Contract Documents and isolate the grounded or neutral conductor at all other locations.
- .3 Do not use any grounded or neutral conductors as a grounding conductor.
- .4 Do not use any grounding conductor as a grounded or neutral conductor.
- .5 Do not splice any wiring in any raceway. Make splices only at junction boxes.
- .6 Provide sufficient slack at the connection points of conductors to permit proper connections to be made.
- .7 Do not install any conductors in any raceway until the raceway is complete and cleared of all obstructions.
- .8 Install all conductors in any one conduit at the same time taking care not to twist the conductors.
- .9 Use wire pulling lubricants that will not shorten the life of the insulation.
- .10 Do not install any wires or cables at temperatures above or below those which will cause damage to the wires or cables.
- .11 Systems of different voltages shall be installed in separate raceways.

### **3.4 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 05 – Basic Materials and Methods.
  - .2 In wireways and auxiliary gutters in accordance with Section 26 05 05 – Basic Materials and Methods.

### **3.5 INSTALLATION OF TECK 90 1000 V**

- .1 Install cables as indicated.
- .2 Group cables wherever possible on channels.
- .3 Terminate cables in accordance with Section 26 05 05 – Basic Materials and Methods.

### **3.6 INSTALLATION OF ARMoured CABLE**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 05 – Basic Materials and Methods.
- .3 Shall only be permitted for the final connection to light fixtures and the length of the drop shall not exceed 3 meters. Armoured Cable commonly known as BX shall not be permitted for any other use on this Contract.

### **3.7 INSTALLATION OF MINERAL INSULATED CABLE**

- .1 Install cable exposed, as indicated in the Contract Documents and securely supported by stainless steel straps. Strap cable every 4 feet along the length of the cable with stainless steel straps.
- .2 Make cable terminations by using factory-made kits.
- .3 At cable terminations use thermoplastic sleeving over bare conductors.
- .4 Where cables are embedded in cast concrete or masonry, provide a sleeve for the entry or exit of cables.
- .5 Do not splice the cables.

### **3.8 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 01 General Requirements section.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 General Requirements section.

### **3.9 PROTECTION**

- .1 Protect installed products and components from damage during construction.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 This section specifies the requirements for electrical grounding for the project.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 05 – Basic Materials and Methods
- .2 Division 26 – Electrical
- .3 Division 27 – Communications
- .4 Division 28 – Electronic Safety and Security

**1.3 REFERENCE STANDARDS**

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

**1.4 ACTION SUBMITTALS**

- .1 Submit in accordance with Division 01 General Requirements section.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 01 General Requirements section.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

**1.6 STORAGE, DELIVERY, HANDLING AND PROTECTION**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

2 Products

**2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: Size as required to electrically conductive underground water pipe.

- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.
- .3 Rod electrodes: Copper clad steel 19 mm diameter by minimum 3 m long.
- .4 Grounding conductors: Bare stranded copper, tinned, soft annealed, size as indicated.
- .5 Insulated grounding conductors: Green, copper conductors, size as indicated.
- .6 Ground bus: Copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Compression type conductor connectors.
  - .5 Thermit welded type conductor connectors.
  - .6 Bonding jumpers, straps.
  - .7 Pressure wire connectors.

3 Execution

**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Owner.
  - .2 Inform Owner of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner.

**3.2 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process. Alternate compression type connection by Burndy is acceptable.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.



- .10 Connect building structural steel and metal siding to ground by welding copper to steel or approved mechanical connector.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .13 Ground secondary service pedestals.

### **3.3 ELECTRODES**

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water metre shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections as indicated.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 4/0 AWG copper conductors for connections to electrodes.

### **3.4 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of secondary Three (3) phase, Four (4) wire system].

### **3.5 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, , distribution panels, outdoor lighting, cable trays.

### **3.6 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.7 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
  - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
  - .2 Sound, fire alarm, security systems, intercommunication systems as indicated.

### **3.8 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – General Electrical Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**3.9 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 01 General Requirements section.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 General Requirements section.

**END OF SECTION**

1 General

1.1 GENERAL

- .1 All conditions of the Contract apply to the work of this Section.

1.2 REFERENCES

- .1 The following standards are applicable to the collection of data, modeling, calculation, and evaluation methodology required for the analysis. The Engineering Contractor is expected to know and utilize the best practices and methods outlined in these standards.
- .1 OESC, Ontario Electrical Safety Code
  - .2 CSA Z462 – 18 and NFPA 70E – Standard for Electrical Safety in Workplace.
  - .3 CAN/CSA-Z460 - Control of Hazardous Energy - Lockout and Other Methods
  - .4 IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations.
  - .5 NETA International Electrical Testing Association Standards for Power System Studies for requirement specified under the specification.
- .2 Where references to Codes and Standards are made, the latest version shall be applicable for the purposes of this specification.

1.3 SCOPE

- .1 This specification defines the minimum technical requirements governing the performance of a complete Electrical Systems Analysis for the existing building and new construction.
- .2 Construct a comprehensive and up-to-date electrical distribution system Single Line Diagram (SLD) using AutoCAD for area of work within facility. The SLD shall include all major electrical equipment.
- .3 A Short Circuit and Protective Device Coordination study for the electrical distribution system shall be performed before performing the Arc Flash Risk Assessment. The intent of the Short Circuit Study is to identify underrated equipment and to increase facility reliability, equipment protection and personnel safety. The intent of the Protective Device Coordination Study is to increase facility reliability by limiting the effects of a fault to the smallest portion of the distribution system.
- .4 Device Short Circuit ratings identified on the drawings and specifications shall be the minimum acceptable ratings and it is the responsibility of the power system provider to indicate required Short Circuit ratings for all distribution equipment.
- .5 Perform an Arc Flash Risk Assessment for the area of work within facility electrical distribution system based on the up-to-date Single Line Diagram. The intent of the Arc Flash Risk Assessment is to determine the level of hazard that exists at each major piece of electrical equipment shown on the Single Line Diagram and/or information collected on site. This includes distribution panels, panelboards, disconnects, cables and transformers. It is the responsibility of the contractor to collect data, model, and recommend components of the power system not included in the area of work deemed significant to the results of the power study.
- .6 The Arc Flash Risk Assessment shall consider all expected operating scenarios during normal conditions, alternate operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard. The Arc Flash warning labels shall list the maximum incidental energy calculated and the scenario from which it is derived shall be documented in the final report. The following is a sample list of common operating scenarios:
- .1 Maximum and Minimum Utility Fault Conditions

- .7 Coordinate with the Local Power Utility Company and obtain required information such as available short circuit current, design fault level, etc. (from supply authority) and equipment (service transformer, cabling and protective devices) installed by the utility for completing study.
- .8 Any available documented information pertaining to existing equipment shall be provided by the Owner. Any outstanding data shall be collected on site by the Electrical Contractor (or his representative who is undertaking the analysis).
- .9 It is the Contractor's responsibility to obtain qualified and competent personnel to safely perform on-site data collection without hindering the Owner's normal operations.
- .10 A detailed report shall be provided to the Owner at the completion of the study. The report shall contain and list all electrical equipment modeled in the study and the results of the Short Circuit study, Protective Device Coordination, and Arc Flash study.
- .11 Recommendations shall be included in the report to mitigate any hazard above an incident energy of 12 cal/cm<sup>2</sup> at the specified working distance. Solutions shall be cost-effective, and mindful of the operating and maintenance requirements. For new construction projects, these recommendations shall be documented in sufficient time for changes to be made in the power system design to avoid creating a location of high hazard.
- .12 The study will include the creation of Arc Flash Hazard and Shock Warning Labels. These labels serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working on and around exposed and energized conductors and equipment.
- .13 The Labels will be produced and installed by the Contractor as required by applicable regulatory standards and specifications identified herein.

#### 1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 01.
- .2 Reports shall be submitted as Shop Drawing submissions and shall include:
  - .1 Short Circuit Study.
  - .2 Protective Device Coordination Study.
  - .3 Arc Flash Hazard Study (including Arc Flash Hazard Labels)
- .3 Final reports shall be submitted with close out documents as hard copies and pdf file.

#### 1.5 QUALITY ASSURANCE

- .1 The electrical system analysis shall be performed using SKM Power Tools, ETAP, Paladin, or an equivalent commercially available Arc Flash Software package. The use of single point software or CSA Z462 Task Tables to determine Arc Flash Hazard Classification is not acceptable.
- .2 The analysis shall be completed by one of the following Companies:
  - .1 G.T.Wood Company Limited
  - .2 Spark Power Corp.
  - .3 Brosz Technical Services Inc.
  - .4 K-Tek Electro Services
  - .5 Alternates: not allowed
- .3 The Study shall be prepared and/or reviewed by a Professional Electrical Engineer (licensed in the province of Ontario) who has relevant work experience and academic background in the power systems industry. Relevant work experience shall be at least five years of experience in power system analysis.



2 Products

**2.1 SHORT CIRCUIT STUDY**

- .1 A Short Circuit Study shall be performed on the equipment as per the up-to-date Single Line Diagram.
- .2 The short circuit current available at each bus in the system shall be calculated per the applicable standards. The results shall be compared with the equipment short circuit ratings as per IEEE Standard 1015 and IEEE Standard 242 to ensure that all equipment is compliant with rule 14-012 of the Ontario Electrical Safety Code. Verify that the equipment is properly rated for the available bolted three phase short circuit current.
- .3 The short circuit study shall consider all potential fault current sources. Motors less than 50HP will not be considered a significant source.
- .4 The study will be continued downward into the system until a 100A bus is reached at the 208 volt level. Only the largest or slowest protective device on each bus needs to be represented in the study.
- .5 Short circuit calculations shall be based on transient and sub-transient impedances of fault sources. X/R ratio analysis shall be used where asymmetric fault current may be an issue.
- .6 Where actual equipment data is not available, the IEEE Gray Book shall be used as an alternate source. This shall be documented in the report.
- .7 Recommendations from the Short Circuit Study shall be provided.

**2.2 PROTECTIVE DEVICE STUDY**

- .1 A Protective Device Coordination Study shall be performed for the equipment as per the up-to-date Single Line Diagram.
- .2 The study shall include the main service and secondary switchgear for the facility. Utility protective devices and short circuit levels shall be included in the study. The results of this analysis will be documented in a log-log TCC (time current curve) representation including all cables, transformation, cables, circuit breakers and fuses. Where grounding protection is applicable, it shall also be included. This information shall be included in the final report.
- .3 For each TCC graph, a complete title and single line diagram with legend identifying the specific portion of the system covered.
- .4 Identify the device associated with each curve by type, function, and if applicable, tap, time delay, and instantaneous settings recommended.
- .5 The study will be continued downward into the system until a 100A bus is reached at the 208 volt level. Only the largest or slowest protective device on each bus needs to be represented in the study.
- .6 All protective devices settings and ratings shall be documented in the report.
- .7 Any miss-coordination uncovered shall be depicted in a log-log TCC plot showing the details of the miss-coordination and description of the situation along with a recommended solution and anticipated improvement.
- .8 Recommended settings for the protective devices shall be provided to improve the situation.

**2.3 ARC FLASH HAZARD STUDY**

- .1 The Arc Flash Hazard Study shall be performed once the Short Circuit Study and the Protective Device Coordination Study have been completed.
- .2 Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the final report.

- .3 The analysis shall be in accordance with latest applicable IEEE 1584 and CSA-Z462 Standards.
- .4 Best practices and guidelines identified in IEEE 1584 shall be utilized to provide accurate and usable results.
- .5 The Engineering Contractor shall analyze and make practical and cost-effective recommendations to reduce the hazard potential for any location above an incident energy of 12 cal/cm<sup>2</sup>.
- .6 Design and print Arc Flash Warning Labels.

## 2.4 STUDY ANALYSIS


- .1 Submit preliminary report of short circuit analysis to verify short circuit withstand ratings specified for electrical equipment provided under this Contract. Submit report before starting manufacturing or placing purchase orders with suppliers.
- .2 Final report to include written summary of:
  - .1 Scope of studies performed.
  - .2 Explanation of bus and branch numbering system.
  - .3 Prevailing conditions.
  - .4 Selected equipment deficiencies.
  - .5 Results of short circuit and co-ordination studies.
  - .6 Comments or suggestions.
- .3 Suggest changes and additions to equipment rating and/or characteristics.
- .4 Notify the Consultant in writing of circuit protective devices improperly rated for new fault conditions.

## 2.5 ARC FLASH HAZARD LABELS

- .1 Labels are required on:
  - .1 Power distribution equipment
  - .2 Control cabinets
  - .3 Distribution and lighting panels
  - .4 Equipment disconnects
  - .5 Equipment where access to energized electrics is required
- .2 Labels are not required on:
  - .1 Enclosed equipment not required to be serviced while energized
  - .2 Motor terminal boxes
  - .3 120 volt receptacles
  - .4 Conduit fittings or pull boxes
  - .5 Lighting fixtures
- .3 Where equipment is composed of multiple sections, cubicles or doors, warning labels shall be installed such that the hazard is readily observed upon opening of any enclosure door or panel.
- .4 All equipment shall have a label containing information from the worst case scenario analysis.

- .5 Units on label will be in millimeters and calories per centimeters squared. Distances shall be rounded to the nearest whole number. Incident energy level shall have decimals rounded to the nearest tenth.
- .6 Arc Flash and Shock Hazard Labels shall be printed in a format to that shown in Figure 1. Labels will contain information including:
  - .1 The heading "ARC FLASH and SHOCK HAZARD"
  - .2 Incident Energy
  - .3 Working Distance
  - .4 Arc Flash Boundary
  - .5 Shock Hazard Potential
  - .6 Shock Insulation Class
  - .7 Limited Approach Boundary
  - .8 Restricted Approach Boundary
  - .9 Method of Arc Flash calculation
  - .10 Date of Study
  - .11 Firm Preparing the Study
  - .12 Name of Panel/Bus/Equipment
  - .13 Name of Upstream Protective Device

FIGURE 1: Arc Flash and Shock Hazard Label Standard

 <h1 style="margin: 0; display: inline;">WARNING</h1>			
<h2 style="margin: 0;">ARC FLASH &amp; SHOCK HAZARD</h2> <p style="margin: 0;">APPROPRIATE PPE REQUIRED</p>			
<b>ARC FLASH PROTECTION</b>  <b>Incident Energy:</b> <b>6.1 cal/cm<sup>2</sup></b> <b>Working Distance:</b> 460 mm <b>Arc Flash Boundary:</b> 1210 mm  For PPE Requirements refer to: CSA Z462-15 Table H.2		<b>SHOCK PROTECTION</b>  <b>Nominal System Voltage:</b> 600VAC <b>Limited Approach Boundary:</b> 1070 mm <b>Restricted Approach Boundary:</b> 310 mm <b>Glove Class:</b> 0  <div style="text-align: right;">           ABC Engineering Ltd.            January 11, 2015            IEEE 1584/SKM v7.0         </div>	
Equipment Name:		Upstream PD:	

### 3 Execution

#### 3.1 SITE ACCESS

- .1 All site access will be coordinated through a designated representative of Owner and confirmed in advance. The Contractor shall take reasonable care to minimize disruption to the building occupants and operation. All inquiries, direct communication for all approvals, concerns and general management issues of the projects will also be directed to the Board's representative. Contact information will be given to the successful contractor upon award of the Contract.
- .2 Program all protective relays according to values established by the co-ordination study. Provide list of parameter settings to the Engineer for review.
- .3 Make modifications to equipment as required to accomplish conformance with the short circuit and protective device co-ordination studies.
- .4 Notify the Consultant in writing of any required major equipment modifications.
- .5 post arc flash labels on the electrical equipment.

### **3.2 ARC FLASH HAZARD LABEL INSTALLATION**

- .1 After the report, including a copy of the Arc Flash Hazard and Shock Warning Labels, is approved by the Consultant, the labels shall be installed.
- .2 The Contractor shall arrange with the Owner for access and install labels as indicated in the Arc Flash Risk Hazard report. They shall be installed prominently where personnel has to access the energized equipment. Bus or panel names on the label shall be the same as on the bus or panel enclosure and consistent with the bus or panel name on the Single Line Diagram.
- .3 The label installer shall clean and otherwise prepare the surface for effective and permanent installation. The label installer shall be issued with a concise Arc Flash summary sheet outlining the panel names and the calculated incident energy level.

### **3.3 FIELD QUALITY CONTROL**

- .1 The Analysis Engineer (or his designate) will inspect the work when complete to ensure that;
  - .1 All equipment modeled in the analysis has a correct label as indicated in the report.
  - .2 Warning Labels have been installed as per applicable standards.
  - .3 All required equipment has been included in the analysis.

**END OF SECTION**



1 General

1.1 SCOPE

- .1 Provide commissioning of electrical systems provided under Division 26 and 28.
- .2 The Contractor shall perform electrical system installation, start-up, testing, preparation of O&M manuals and operator training, and the coordination of the commissioning process the responsibility of the General contractor
- .3 Include all labor and material as required to participate in the commissioning process, as outlined in this section, for equipment installed under Division 26 and responsibilities prescribed for the electrical contractor in Division 01 General Requirements section.

1.2 RELATED WORK

- .1 Commission electrical equipment and systems in conjunction with: Specification Section of Division 1 - General Commissioning Requirements and Commissioning for LEED requirements.
- .2 This Section of the specification shall be read in conjunction with all other Sections of the Division 26, and 28 - Electrical Specifications, which include details of specific tests / inspections to be performed on various equipment /systems in addition to those specified in this Section.

1.3 COORDINATION

- .1 Coordinate the work of this Section with all other Divisions to ensure complete and operational electrical systems at completion of this work.
- .2 Review the design intent of the project and the intended operation of systems with Police Training Facility representative and the Consultant before proceeding with commissioning.

1.4 COMMISSIONING PROCESS

- .1 Commissioning Mandate for Electrical Systems: to ensure that all project systems perform interactively and in strict accordance with the design intent and latest OESC requirements for life safety equipment and owner's operational needs as set forth in the Contract Documents.
- .2 Commissioning procedures are in accordance with this Section.
- .3 The Commissioning process develops, coordinates, and documents the following:
  - .1 Shop drawings and record drawings
  - .2 Start up, installation inspection and equipment verification and/or system and calibration
  - .3 Check sheets and testing forms
  - .4 Testing of equipment and systems
  - .5 Functional and Performance Testing
  - .6 Commissioning meetings and reporting
  - .7 Operation documentation
  - .8 Operator training
  - .9 Warranties
- .4 The Commissioning Program is divided into the following parts:
  - .1 Part 1: Shop drawings and record drawings
  - .2 Part 2: Factory Testing

- .3 Part 3: Pre-Start and Start-Up testing
- .4 Part 4: Installation Verification testing
- .5 Part 5: Functional testing
- .6 Part 6: Systems Operating Manuals
- .7 Part 7: Operator Training
- .8 Part 8: Warranties

## 1.5 WORK INCLUDED

- .1 Commissioning work of Division 26 includes, but is not limited to:
  - .1 Shop drawing review for Mechanical and Electrical coordination.
  - .2 Participation in regular construction meetings as well as separate Commissioning Meetings during the construction period associated with the scheduling, coordination, and implementation of the various commissioning activities within the overall construction program.
  - .3 Factory Testing of equipment as described under various equipment specifications.
  - .4 Site Testing and start-up of equipment.
  - .5 Detailed acceptance testing as described under various equipment specifications including supplementary testing required by Commissioning Authority
  - .6 Cooperation with the Commissioning Authority in developing and implementation of the commissioning plan.
  - .7 Providing qualified personnel for participation in implementing commissioning test procedures.
  - .8 Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
  - .9 Providing operation and maintenance manuals and as-built drawings to the Commissioning Authority for verification in a timely manner.
  - .10 Providing training and demonstrations for the systems specified in this Division prior to turnover to Owner.
- .2 Conduct complete and thorough evaluation and documentation of the operation and performance of all components, systems, and sub-systems, including the following equipment and systems:
  - .1 Low Voltage Switchboards
  - .2 Dry Type Transformers primary up to 600V
  - .3 Fire Alarm System
  - .4 Power and lighting panels
  - .5 Lighting System
  - .6 Emergency Lighting System
  - .7 Lighting Control System
  - .8 Power Monitoring System

- .3 Commission all equipment supplied under the Contract by the Contractor, as well as any equipment, pre-purchased, or pre-ordered by the Owner. Provide skilled trades people to operate various related electrical equipment in support of the commissioning program.
- .4 Commission services to equipment, but not the equipment itself, where the supply of the equipment does not form part of the electrical Work. Provide skilled trades people to operate various related electrical equipment in support of the commissioning activities of other trades.
- .5 Provide the following commissioning documentation:
  - .1 recording completed Pre-start and Start-up procedures test results,
  - .2 record completed Installation Verification and Performance Validation, as well as Functional test results, and Certificates
  - .3 As-built records.
  - .4 Operation and maintenance manuals
- .6 The final commissioning report will be prepared by the Commissioning Consultant.

#### **1.6 EXCLUDED WORK**

- .1 Unless otherwise specified, equipment which is not supplied by the electrical contractor or their sub-trades, where the value for the supply of equipment is not included as part of the Work, such as:
  - .1 Supplied by Owner (SBO) equipment,
  - .2 Equipment marked Not in Contract (NIC) or Not in Electrical Contract (NIEC).

#### **1.7 REQUIRED INFORMATION AND COMMISSIONING PREREQUISITES INFORMATION**

- .1 A complete shop drawing submission schedule shall be submitted to the Commissioning Authority.
- .2 Approved construction administration shop drawing shall be submitted to the Commissioning Authority two weeks before the production release of each item.
- .3 A complete set of accurate "as built" drawings must be transmitted to commissioning consultant/authority a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.
- .4 A copy of all equipment specifications must be transmitted to commissioning consultant a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.
- .5 All "sequence of operation" narratives must be submitted to the commissioning consultant a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.
- .6 A copy of all Factory Acceptance Test (FAT) reports must be completed, reviewed by the Consultant, and transmitted to commissioning consultant a minimum of 31 Days prior to the anticipated date of Substantial Performance of the Work.
- .7 A copy of all site startup reports must be transmitted to the commissioning consultant a minimum of 5 Working Days prior to the anticipated date of Substantial Performance of the Work.

#### **1.8 DEFINITIONS**

- .1 Major deficiency – an item which if not corrected renders the equipment or system unsuitable or un-safe for use by the Owner. Major deficiencies must be corrected as a condition for achieving Substantial Performance of the Work.

- .2 Minor deficiency – an item which does not impact on the operation of the equipment or system and will allow the Owner to use the system safely. Minor deficiencies may be corrected before or after Substantial Performance but will not prevent certification of Substantial Performance of the Work.

#### **1.9 COMMISSIONING SCHEDULE**

- .1 Provide a detailed commissioning schedule for consolidation into the main construction schedule.
- .2 Include:
  - .1 equipment and systems start-up predecessors
  - .2 Time periods for pre-start and start up testing, verification and validation testing for each equipment and system.

#### **1.10 DOCUMENTATION DELIVERABLES**

- .1 Identify documents including test documents, binder covers, etc. using equipment ID numbers provided on equipment schedules.
- .2 Scan original signed test reports, including verification and performance and / or functional test reports, manufacturers service reports, etc. in Adobe Acrobat \*.pdf version 8 format. For original document chapters, provide Adobe chapter referencing.
- .3 Submit three (3) copies of each completed and accepted Verification and Functional Performance Test reports, both preliminary and final issues.
- .4 Collate final, accepted and signed test results in separate binders as follows:
  - .1 Electrical Systems
  - .2 Fire Alarm Systems
- .5 Provide PDF copies of commissioning documentation.

#### **1.11 SUBSTANTIAL PERFORMANCE**

- .1 Refer to project commissioning requirements specified in the Contract Documents.
- .2 Application for Substantial Performance of the Work is contingent on the Work being ready for Owner's use which includes completion of the following commissioning elements:
  - .1 Start-Up and testing
    - .1 Commissioning Verification testing including submission of completed records,
    - .2 Commissioning Performance Validation testing including submission of completed records, except for alternate season tests,
    - .3 Commissioning Controls Validation testing,
    - .4 Training of Owner's operations personnel,
    - .5 As-built documentation issued for Consultant's review,
    - .6 Operations and Maintenance manuals which have been reviewed by the Consultant and accepted by the Owner.

#### **1.12 TEST EQUIPMENT**

- .1 The Contractor shall provide all labour and materials, tools and equipment required during the various stages of pretesting, startup, and commissioning processes.



- .2 Provide any test equipment and software required for pretesting and start-up, whether specified or not.
- .3 Ensure that the manufacturer provides test equipment and personnel as required for the startup and testing of their equipment and assists in the commissioning process as needed.
- .4 Ensure that Manufacturer provides test equipment, demonstrates its use, and assists in the commissioning process as needed.

## 2 Organization

### 2.1 GENERAL

- .1 Complete all phases of work so that the systems can be started, tested, and verified for alarm or status monitoring by the Building Automation System (BAS) and fire alarm systems as applicable, and the Commissioning procedures can be undertaken in a timely manner such that only one acceptance test is conducted at any one time. Provide supplementary testing as required to ensure all BAS and fire alarm system monitoring of electrical equipment status points are verified to demonstrate all operating status and alarm conditions.
- .2 Participate and assist in the development of the Commissioning Schedule by the Construction Manager, by providing necessary information pertaining to the equipment and installation. Provide commissioning schedule information to be incorporated into the overall Construction Plan Schedule.
- .3 Acceptance procedures may begin prior to completion of a system and/or sub-system. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems in accordance with the commissioning and construction schedule.

### 2.2 PARTICIPANTS

- .1 Commissioning Team consists of multiple parties with separate responsibilities.
- .2 Owner:
  - .1 establishes acceptance criteria,
  - .2 provides operations staff to receive training, and to witness any or all tests at their discretion,
  - .3 Final acceptance of commissioning results.
- .3 Consultant:
  - .1 Responsible for the construction review activities in accordance with local building code requirements,
  - .2 May participate in development and / or review of commissioning procedures,
  - .3 reviews pre-startup, testing, and commissioning test results,
- .4 General Contractor and the Consultant
  - .1 Develops and/or approves the commissioning plan and procedures,
  - .2 Coordinates Owner's commissioning team members who witnesses tests,
  - .3 Witnesses commissioning tests to confirm compliance by the Contractor to the Commissioning Plan,
  - .4 Reviews commissioning test results and makes recommendations to the Owner and/or Acceptance Authority for acceptance,

- .5 Monitors the progress of the commissioning work and reports to the Owner.
- .6 Accepts the commissioning test results on behalf of the Owner.
- .5 General Contractor:
  - .1 Coordinates and manages commissioning activities,
  - .2 Develops and integrates commissioning activities into the construction schedule,
  - .3 Ensures commissioning procedures are completed and documented, and commissioning records including any required attachments are submitted.
- .6 Contractor:
  - .1 Provides the services of qualified technician(s) who are familiar with the construction and operation of the system, to start-up and debug equipment and systems within the Division 26 scope of Work. Include work of Independent testing contractors, ITC. Include for labour, materials, and subsistence costs for these same technicians to assist the Commissioning Authority in completing the commissioning program.
  - .2 Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.
  - .3 Ensures the qualified technician(s) are available and present during commissioning testing to complete the tests, make adjustments and to assist in problem resolutions.
  - .4 Should any equipment or system experience performance problems and/or reconstruction or replacement is required, include for additional technician time for subsequent retesting of systems until required system performance is achieved.
  - .5 The Commissioning Authority reserves the right to approve proposed technicians with regard to the technical skill level required for each type of equipment and/or system, and willingness by the individual(s) to work within the Commissioning Group.
  - .6 Provides a foreman electrician familiar with the electrical interlocks, interfaces with emergency power supply, and interfaces with BAS, alarm, and life-safety systems. Provide access to the contract plans, and all as-built schematics of sub-systems, interfaces and interlocks.
- .7 Independent Testing Contractor
  - .1 The Independent Testing Contractor (ITC) shall be hired by the Electrical Contractor to provide the coordination study, the Arc Flash study, testing, verification and calibration of the electrical system, and to issue reports to the Design Consultant and Commissioning Authority.
  - .2 The ITC shall conduct, as detailed in the specification 26 05 10, the Arc Flash study, and a coordination study and issue a report as a shop drawing submission and also provide testing, verification and calibration of the electrical system and issue reports to the Design Consultant and Commissioning Authority.
- .8 Equipment suppliers:
  - .1 Provide the services of manufacturers' service personnel to provide assistance with pre-start and initial start-up of the equipment, and to undertake operation of equipment as part of the acceptance and commissioning testing program as required.

3 Execution

3.1 COMMISSIONING MEETINGS

- .1 Participate in periodic commissioning team meetings, and trade commissioning meetings.
- .2 Construction and Post-Construction:
  - .1 Participate in commissioning meetings as scheduled by the Construction Manager.
  - .2 participate in trade commissioning meetings as required, in addition to the regular commissioning team meetings,
  - .3 Identify to the commissioning group problems relating to the commissioning schedule, identification of start-up issues, etc, and participate in the resolution of these problems.

3.2 COMMISSIONING PROCEDURES

- .1 The commissioning process shall meet the requirements of ANSI/NETA ATS – 2009 Standards for Acceptance Testing of Electrical Systems except as specifically modified by this specification.
- .2 The Contractor shall prepare a detailed Commissioning Schedule for commissioning of all electrical systems and equipment in coordination with the Construction Manager's schedule and to the approval of Commissioning Authority. Update the schedule as appropriate through the construction period.
- .3 Shop Drawings and Record Drawings
  - .1 Prepare record documentation for each equipment installation covering:
    - .1 Equipment identification and supplier.
    - .2 Shop Drawing submittal, review, production release coordination, and delivery dates.
    - .3 Dates for completion of all work required preparing for equipment installation.
    - .4 Dates for equipment installation, supplier prestart checkout, and system availability for start-up.
    - .5 Dates for equipment start-up, performance testing, proposal for temporary use, acceptance testing, demonstration, turnover and warranty start / finish.
  - .2 Submit proposed record sheets and procedures to Commissioning Authority for review and approval.
  - .3 List all specialist personnel and equipment required for the tests, and ensure that these are available by the test dates.
  - .4 Provide documentation of the commissioning process and include in maintenance manuals. These are to include check sheets, equipment data sheets, start-up certificates from suppliers involved in start-up, and documentation concerning demonstration to the Owner's O&M Personnel. Include all record and result sheets from commissioning tests.
  - .5 Maintain a log of key operating parameters, problems encountered, solutions employed and verification of effectiveness of solutions. Include log in maintenance manuals.
  - .6 Submit templates for all documentation including record sheets, check sheets, commissioning reports etc. to Commissioning Authority for approval. Meet Commissioning Authority's requirements for level of reporting.
- .4 Check sheets and Testing Forms

- .1 The Contractor and manufacturers shall fill out the check sheets and test forms listed in this section or provide other forms. The Consultant and the Region must approve the forms before they are used.
- .2 The Commissioning Authority will randomly confirm that check sheets are complete and accurate. In the event that false or incomplete check sheets are submitted, ALL check sheets will be rejected. The contractor will be required to resubmit new check sheets for all similar systems. All cost incurred by the contractor with processing and rechecking false or incomplete check sheets will be to the contractors account.
- .5 The Owner's designated Commissioning Authority provides the approved commissioning procedures (checklists, etc) for use by the contractor.
- .6 Each commissioning procedure tests the equipment and systems, and consists of the following elements:
  - .1 Document sign-off
  - .2 Pre-start and Initial test
  - .3 Installation Verification - Equipment
  - .4 Installation Verification - Systems
  - .5 Performance Validation
  - .6 Appendices
- .7 Document Sign-Off:
  - .1 each completed procedure is signed off by the following parties:
    - .1 Contractor, for testing,
    - .2 Independent testing organization for review of factory test report, witness the factory testing and testing.
    - .3 Commissioning Authority/Consultant, for review and witnessing,
    - .4 Owner, for test acceptance.
- .8 Pre-Start and Initial Test:
  - .1 Checklists included: confirmation of authorities inspections, pre-start safety checks (where applicable), system cleaning and pressure testing, and confirmation of availability of supporting systems.
- .9 Installation Verification - Equipment
  - .1 Checklists to verify the installation of equipment, including: design specification requirements, drawing requirements, manufacturer installation requirements, and other experience-related items.
  - .2 Use of pre-printed manufacturer installation and start-up checklists are permitted and encouraged; however, the commissioning procedure checklists may contain supplemental items.
- .10 Installation Verification - System:
  - .1 Checklists to verify the installation of the system associated with the equipment.
- .11 Functional Test Plans:



- .1 Specific test procedures and record documentation requirements for performance measurements of the various systems.
- .12 Appendices:
  - .1 Collate test reports from authorities having jurisdiction, manufacturer start-up and test reports, balancing reports, etc.

### 3.3 COMMISSIONING TEST METHODOLOGY

- .1 Step 1: Notify the required attendees in accordance with an agreed schedule and notification period when testing will begin on each procedure type. The Commissioning Consultant will witness the testing on an audit basis, including the first instance, the last instance, and at random during other times.
- .2 Step 2: complete the commissioning procedures including recording results, and sign-off and date separately the completion of Part "A" Verification, and Part "B" Validation. Any deficiencies discovered during this testing are to be corrected prior to sign-off of the test.
- .3 Step 3: on completion of systems which do not require witness demonstration, finalize the report and submit to the General Contractor for review.
- .4 Step 4: on completion of systems which have been witnessed by the required reviewers the General Contractor is to sign-off the completed procedure document as being witnessed.

### 3.4 COMMISSIONING IMPLEMENTATION

- .1 Conduct operating tests and checks to verify that all components, equipment, systems, and interfaces between systems, operate in accordance with contract documents.
- .2 Demonstrate and verify operating modes, interlocks, specified control sequences, specific responses to abnormal or emergency conditions, and verification of the proper response to the Building Automation System, security system, and fire alarm system as applicable.
- .3 Roles and Responsibilities:

<b>Organized by:</b>	<b>Construction Manager</b>
Approved Test sheets provided by:	Commissioning Authority
Testing Conducted by:	Contractor Equipment Suppliers Technical Personnel as appropriate Independent Testing Organization as specified
Testing recorded by:	Contractor Equipment Suppliers Technical Personnel as appropriate Independent Testing Organization as specified Commissioning Authority
Tests witnessed by:	Commissioning Consultant/Authority Owner (selected tests)
Reports reviewed by:	Construction Manager Commissioning Consultant/Authority

Organized by:	Construction Manager Design Consultant
Reports Accepted by:	Owner

### 3.5 OPERATING CHECKS

- .1 The Commissioning Consultant witnesses equipment and system tests.
- .2 Set the system equipment into operating mode to be tested including but not limited to:
  - .1 Normal start up, operation, and shut-down
  - .2 Normal auto position
  - .3 Normal manual position
  - .4 Unoccupied cycle
  - .5 Emergency power operation, including transition states.
  - .6 Status and Alarm conditions
- .3 Inspect and verify the position of each device and interlock identified on the checklist.
- .4 Repeat the above tests for each operating mode that applies to the system being tested.
- .5 For failed test items, provide appropriate comments to the checklist data sheet and classify whether it is a "Major" or "Minor" deficiency.
  - .1 The Consultant retains the right to make the final decision regarding classifications of deficiencies.
- .6 Test failure is defined as:
  - .1 Refer to relevant specification sections.
- .7 Acceptance
  - .1 The final reports will be reviewed by the Commissioning Consultant and the Consultant, to determine if verification is complete and the operating systems are functioning in accordance with the contract documents.
  - .2 The Commissioning Consultant, in conjunction with the Consultant, reviews and makes final classification of all noted deficiencies. Correct deficiencies classified as "Major" before acceptance of the Verification stage.
  - .3 The Owner will make the final acceptance of test results.

### 3.6 FUNCTIONAL VALIDATION TESTING

- .1 Conduct performance / functional tests and checks to validate that equipment and system components are providing the required functionality (capacity) for each equipment and system.

### 3.7 PROBLEM RESOLUTION

- .1 In the event that additional work is required to correct either systems, misapplied or improperly installed equipment, and/or deficient performance under varying load conditions, assist the Owner and Commissioning Consultant in developing an acceptable resolution to the problem, including the resources of equipment suppliers.
- .2 The Owner has final approval over any additional work required to achieve the required level of performance.

- .3 Complete corrective work in a timely fashion to permit the completion of the commissioning process.

### 3.8 ACCEPTANCE

- .1 Any identified deficiencies will be reviewed by the Consultant in conjunction with the Construction Manager to determine if correction of the deficiency is as a result of a defect in the equipment or installation.
- .2 If it is determined the performance deficiency is as a result of a defect in the equipment or its installation, rectify the deficiency and repeat the functional test until the required performance levels are functionality is achieved.
- .3 If it is determined the equipment or system has been constructed in accordance with the contract documents, the Owner will decide whether to accept the functionality as is, or, direct the installation contractor to make changes to the system as required to obtain performance levels which meet the design intent, and retest the system.

### 3.9 POST-SUBSTANTIAL COMMISSIONING

- .1 Provide commissioning after Substantial Performance of the Work:
  - .1 Functional testing which is weather or live-load dependent;
  - .2 For out-of-season system functional testing, conduct initial functional tests to demonstrate off-peak load performance. Schedule peak load performance testing over the succeeding nine (9) months to ensure all equipment is tested at peak load prior to the expiry of the warranty period.
  - .3 Infra-red thermal imaging of equipment under peak building live-load conditions,
  - .4 Alternatively, provide temporary equipment (load banks, etc) to simulate full load conditions. Submit proposed methodology for review by the Commissioning Authority and Consultant.

### 3.10 ADDITIONAL COMMISSIONING

- .1 Additional commissioning activities may be required after completion of system functional testing. Include in the tender cost a reasonable reserve to complete this work, including assistance from manufacturers' service technicians.

### 3.11 SYSTEMS OPERATING MANUALS

- .1 Provide Operating and Maintenance Manuals in accordance with the requirements of Division 1.
- .2 The Systems Operating Manuals (SOM) are in addition to the Operating and Maintenance Manuals (OMM) required under Section 26 05 00.
- .3 Conform to the specification Section 26 05 00 for the requirements of the O&M manuals. Documents such as system description, sequence of operation (including start-up and shut-down procedures) shall be compiled by the Contractor from the specification, drawings and approved shop drawings and included in the manuals after Consultant's approval.
- .4 Included a list of spare parts, special tools, lubricants, etc. for each item of equipment, which has been purchased as part of the Contract.
- .5 Provide a list of recommended spare parts for all equipment installed under Divisions 26, 27 and 28 to cover a period from Substantial Performance of the Work to Warranty end.
- .6 Provide at minimum, the following information for recommended spare parts:
  - .1 Manufacturer's name, address, phone and fax numbers.

- .2 Manufacturer's part name, part number, unit price, lead time, shelf life.
- .3 Quantity recommended for one (1) year.
- .4 Alternative suppliers of compatible parts, including local supplier name, address, phone and fax numbers.
- .7 Submit preliminary list of spare parts and tools to Owner to a minimum of 30 Days prior to intended system handover to Owner. The Owner reserves the right to add to, reduce, or omit entirely, the recommendations contained on these lists.

**END OF SECTION**



1 General

**1.1 SUMMARY**

- .1 All conditions of the Contract apply to the work of this Section.

**1.2 RELATED WORK**

- .1 Section 26 05 00 – General Electrical Requirements
- .2 Section 26 05 05 – Basic Materials and Methods
- .3 Section 26 50 00 – Lighting
- .4 Contractor shall be responsible for co-ordinating this section with all related sections.

**1.3 REFERENCE STANDARDS**

- .1 American National Standards / Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
- .2 Underwriter Laboratories of Canada (ULC)
- .3 International Electro-technical Commission
- .4 International Organization for Standardization (ISO)
- .5 National Electrical Manufacturers Association (NEMA)
- .6 WD1 (R2005) - General Color Requirements for Wiring Devices.
- .7 Underwriters Laboratories, Inc. (UL):
  - .1 916 – Energy Management Equipment.
  - .2 924 – Emergency Lighting

**1.4 SYSTEM DESCRIPTION**

- .1 The Lighting Control and Automation system as defined under this section covers the following equipment:
  - .1 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relays controllers with 0-10 volt control for ballasts (if applicable) and single relay application-specific plug load controllers.
  - .2 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
  - .3 Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
  - .4 Digital Photosensors – Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.
  - .5 Digital Plug Load Controllers – Self-Configuring, digitally addressable one relay controllers, specifically designed and cUL listed for use as a plug load control device.
  - .6 Isolated Relay Interface- A component of the Digital Lighting Management system that allows for seamless integration with third party devices such as HVAC systems of exhaust fans.
  - .7 Configuration Tools – Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED

display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.

- .8 Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.
- .9 Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

## 1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.
- .2 Shop drawing submission shall include:
  - .1 Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
  - .2 Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.
  - .3 Product Data: Catalog sheets, specifications, and installation instructions.
  - .4 Include data for each device which:
    - .1 Indicates where sensor is proposed to be installed.
    - .2 Prove that the sensor is suitable for the proposed application.

## 1.6 WARRANTY

- .1 Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.

## 2 Products

### 2.1 MANUFACTURERS

- .1 The basis of design for the lighting controls is as indicated on drawings.
- .2 Alternate Manufacturers
  - .1 Lutron
  - .2 Acuity Brands nLight
  - .3 Leviton
  - .4 Cooper iLumin Plus
  - .5 Or approved equivalent
- .1 Any proposed substitutions shall be submitted in writing a minimum of 5 working days prior to the tender closing date for review by the consultant. Proposed alternate products must be accompanied by a review of the specification noting compliance on a line-by-line basis. Alternate systems shall not be supplied and/or installed without written acceptance by the Consultant.
- .2 The Contractor shall accept responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The Contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted in an alternate color to the Consultant for review and approval prior to rough-in.

## 2.2 SINGLE/DUAL RELAY WALL SWITCH OCCUPANCY SENSORS

- .1 Type DW: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor. Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled.

## 2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- .1 Wall or ceiling mounted (to suit installation) dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.
- .2 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
  - .1 Digital calibration and pushbutton programming for the following variables:
    - .1 Sensitivity – 0-100% in 10% increments
    - .2 Time delay – 1-30 minutes in 1 minute increments
    - .3 Test mode – Five second time delay
    - .4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - .5 Walk-through mode
    - .6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
  - .2 One or two RJ-45 port(s) for connection to DLM local network.
  - .3 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
  - .4 Device Status LEDs including:
    - .1 PIR Detection
    - .2 Ultrasonic detection
    - .3 Configuration mode
    - .4 Load binding
  - .5 Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
  - .6 Manual override of controlled loads.
- .3 Units shall not have any dip switches or potentiometers for field settings.
- .4 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

## 2.4 DIGITAL WALL SWITCHES

- .1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:
  - .1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

- .2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
- .3 Red configuration LED on each switch that blinks to indicate data transmission.
- .4 Blue Load/Scene Status LED on each switch button with the following characteristics:
  - .1 Bi-level LED
  - .2 Dim locator level indicates power to switch
  - .3 Bright status level indicates that load or scene is active
- .5 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
- .2 Two RJ-45 ports for connection to DLM local network.
- .3 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
- .4 The following switch attributes may be changed or selected using a wireless configuration tool:
  - .1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
  - .2 Individual button function may be configured to Toggle, On only or Off only.
  - .3 Individual scenes may be locked to prevent unauthorized change.
  - .4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
  - .5 Ramp rate may be adjusted for each dimmer switch.
  - .6 Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

## 2.5 ROOM CONTROLLERS

- .1 Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:
  - .1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
  - .2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
  - .3 Device Status LEDs to indicate:
    - .1 Data transmission
    - .2 Device has power
    - .3 Status for each load
    - .4 Configuration status
  - .4 Quick installation features including:



- .1 Standard junction box mounting
  - .2 Quick low voltage connections using standard RJ-45 patch cable
- .5 Plenum rated
- .6 Manual override and LED indication for each load
- .7 Dual voltage (120/277 VAC, 60 Hz) capable or 347VAC, 60 Hz
- .8 Zero cross circuitry for each load.
- .2 On/Off Room Controllers shall include:
  - .1 One or two relay configuration
  - .2 Efficient 150 mA switching power supply
  - .3 Three RJ-45 DLM local network ports
  - .4 Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
    - .1 One relay configuration only
    - .2 Automatic-ON/OFF configuration
- .3 On/Off/Dimming enhanced Room Controllers shall include:
  - .1 Real time current monitoring
  - .2 One, two or three relay configuration
  - .3 Efficient 250 mA switching power supply
  - .4 Four RJ-45 DLM local network ports.
  - .5 One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
  - .6 Optional Network Bridge for BACnet MS/TP communications (LMRC-3xx).
  - .7 The following dimming attributes may be changed or selected using a wireless configuration tool:
    - .1 Establish pre-set level for each load from 0-100%
    - .2 Set high and low trim for each load
    - .3 Set lamp burn in time for each load up to 100 hours
  - .8 Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
    - .1 One relay configuration only
    - .2 Automatic-ON/OFF configuration

## 2.6 DIGITAL PHOTOSENSORS

- .1 Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.
- .2 Digital photosensors include the following features:
  - .1 An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not

- measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
- .2 Sensor light level range shall be from 1-10,000 footcandles (fc).
  - .3 The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
  - .4 For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling after they turn off.
  - .5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
  - .6 Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.
  - .7 Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
  - .8 Red configuration LED that blinks to indicate data transmission.
  - .9 Blue status LED indicates test mode, override mode and load binding.
  - .10 Recessed switch to turn controlled load(s) ON and OFF.
  - .11 One RJ-45 port for connection to DLM local network.
  - .12 An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.
- .3 Closed loop digital photosensors include the following additional features:
- .1 An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
  - .2 Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
  - .3 Automatically establishes setpoints following self-calibration.
  - .4 A sliding setpoint control algorithm for dimming daylight harvesting with a "Day Setpoint" and the "Night Setpoint" to prevent the lights from cycling.
- .4 Open loop digital photosensors include the following additional features:
- .1 An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
  - .2 Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
  - .3 A proportional control algorithm for dimming daylight harvesting with a "Setpoint" to be maintained during operation.

## 2.7 DIGITAL PLUG LOAD CONTROLLERS

- .1 Single Relay Digital Plug Load Controllers shall include the following features:

- .1 One 20 Amp relay for on/off control of connected plug loads.
- .2 High efficiency 150mA power supply.
- .3 cUL Listing for use with plug loads.
- .4 Three RJ-45 DLM local network ports.
  - .1 Single relay configuration only
  - .2 Automatic ON/OFF configuration.

## 2.8 ISOLATED RELAY INTERFACE

- .1 Isolated relay interface module shall include the following features:
  - .1 One single pole, double throw isolated relay with normally open, normally closed, and common outputs.
  - .2 Two RJ-45 DLM local network ports.
  - .3 Ability to control HVAC systems or exhaust fans using the occupancy signal of any digital occupancy sensor in the local DLM network.

## 2.9 ROOM NETWORK (DLM LOCAL NETWORK)

- .1 The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:
  - .1 Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
  - .2 Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
  - .3 Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
  - .4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

## 2.10 CONFIGURATION TOOLS

- .1 A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.
- .2 Features and functionality of the wireless configuration tool shall include:
  - .1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
  - .2 High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
  - .3 Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
  - .4 Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

- .5 Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting.
- .6 Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

### 3 Execution

#### 3.1 INSTALLATION

- .1 Do not install equipment until the following conditions can be maintained in spaces to receive equipment:
  - .1 Ambient temperature: 0° to 40° C (32° to 104° F).
  - .2 Relative humidity: Maximum 90 percent, non-condensing.
- .2 When using wire for connections other than the DLM local network (Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements.
- .3 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- .4 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
  - .1 Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.
- .5 Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
  - .1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - .2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - .3 Load Parameters (e.g. blink warning, etc.)
- .6 Re-commissioning – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Consultant / Owner of re-commissioning activity.

#### 3.2 FACTORY COMMISSIONING

- .1 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
- .2 The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.
- .3 Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

**END OF SECTION**



1 General

1.1 GENERAL

- .1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

- .1 Section 26 05 00 – General Electrical Requirements

1.3 REFERENCES

- .1 CAN/CSA-C22.2 No.47 - Air-Cooled Transformers (Dry Type).  
.2 CSA C9 - Dry-Type Transformers.

1.4 SCOPE

- .1 Provide dry type distribution transformers as detailed herein and on drawings.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.

2 Products

2.1 MATERIAL

- .1 All transformers shall meet Natural Resources Canada (NRCAN) 2019 energy efficiency regulation requirements.  
.2 All transformers shall be of one manufacturer. Acceptable Manufacturers: Schneider Electric, Eaton, Hammond, Rex, Delta, Bemag.  
.3 All material shall be specification grade, new and carry CSA approval or special inspection approval in accordance with Electrical Safety Authority requirements.

2.2 TRANSFORMERS

- .1 Type: ANN.  
.2 Three (3) phase, 480 V input, 120/208 V output, 60 Hz. kVA rating as detailed on drawings.  
.3 Voltage taps: standard, 2 x  $\pm 2.5\%$  (2 FCAN, 2 FCBN).  
.4 Coil Windings: Copper  
.5 Insulation: Class H (220°C),  
.6 Basic impulse level: Standard.  
.7 Winding temperature rise 150°C .  
.8 Maximum sound level: 55dB or less  
.9 Enclosure: CSA Type 2 (drip proof), removable metal front panel.  
.10 Mounting: wall or floor, as indicated on drawings. Transformer shall be supplied with c/w all required mounting accessories.  
.11 Finish: ASA 61 baked grey powder coating.

3 Execution

3.1 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA floor or wall mounted as indicated on drawings. Coordinate installation with Consultant and structural trades with regards to proper load bearing.
- .2 Mount dry type transformers above 75 kVA on floor. Provide 100mm (4") high concrete housekeeping pads under all floor mounted transformers
- .3 Ensure adequate clearance (150mm (6") minimum to adjacent walls) is provided around transformers for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.

**END OF SECTION**

1 General

1.1 REFERENCES AND RELATED WORK

- .1 Section 26 05 00 – Common Work Results – Electrical
- .2 Section 26 05 27 – Substation Grounding
- .3 Section 26 05 28 – Building Grounding
- .4 Section 26 24 13 – Secondary Switchboard
- .5 Section 26 24 16 – Distribution Panel
- .6 Section 26 24 17 – Panelboards Breaker Type
- .7 Section 26 24 18 – Panelboards Switch and Fuse Type
- .8 Section 26 24 19 – Motor Control Centres
- .9 Section 26 27 19 – Multi-Outlet Assemblies
- .10 Conform to relevant sections of specifications for Division 26 and other Divisions.

1.2 SYSTEM

- .1 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors.
- .2 The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category B environment (as tested by ANSI/IEEE C62).
- .3 The Surge Protective Device (SPD) shall consist of a high performance filter designed to provide transient voltage surge suppression and high-frequency electrical noise filtering.
- .4 The specified unit shall be compatible with non-linear loads and provide high energy transient voltage suppression, surge current diversion and high-frequency electrical line noise attenuation.
- .5 The unit shall be connected in parallel with the electrical distribution system.
- .6 The operation of the unit shall not be affected by or interact with any other filter or harmonic reduction device installed on the electrical distribution system.
- .7 The SPD unit shall be remote of panelboards and shall be manufactured by the same manufacturer. The SPD unit shall be connected to the equipment via a circuit breaker from within the equipment in order that the SPD unit can be serviced. The SPD shall be of modular design.

1.3 STANDARDS

- .1 The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:
  - .1 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)
  - .2 American National Standards Institute.
  - .3 Federal Information Processing Standards Publication 94 (FIPS PUB 94).
  - .4 National Electrical Manufacturer Association (NEMA LS-1 1992 All Tests).
  - .5 MIL Standard 220A Method of Insertion Loss Measurement.
  - .6 Underwriters Laboratories UL 1283 and UL 1449 (most recent edition).
  - .7 Canadian Standards (CUL).

- .8 Canadian Standards Association (CSA) CSAC22.2-Latest Edition.
- .9 Ontario Hydro Electrical Safety Code Latest Edition.

#### 1.4 PRODUCT SHOP DRAWING DATA

- .1 Product data shall be submitted in accordance with Section 26 05 00 – Common Work Results - Electrical. This shall include schematic diagram and all options including indicating lights and dry contacts.
- .2 Evidence of compliance to the certifications as per CSA and UL 1449 must be submitted. Manufacturer shall submit the NEMA LS-11992 test results. This will show actual test data as certified by UL and ANSI standard. Documentation must include copy of UL Listing Report. Manufacturer shall certify stating that tested product (UL tests) and delivered product both had same suppliers for raw materials and same processes to manufacture.

#### 1.5 SUBMITTALS

- .1 Product Data: Provide catalogue sheets showing voltage, physical size, Measured Limited Voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length.
- .2 Submit product data for all components and accessories.
- .3 Manufacturer's Installation Instructions: use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.
- .4 List and detail all protection systems such as fuses, disconnecting means and protective features.
- .5 Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA approvals.
- .6 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41 Category C3 & C1 (combination wave) and A1 (ringwave) tested in accordance with ANSI/IEEE C62.45.
- .7 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 10 khz and 100 khz verifying the devices noise attenuation equals or exceeds 50 db at 100 khz.
- .8 Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both per mode and per phase basis using the IEEE C 62.41, 8x20 microsecond current wave. Test data must be on a complete SPD with internal fusing in place. Test data on an individual module is not acceptable.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- .1 The operating temperature range shall be -40° to 70° C (-40° to 160° F).
- .2 The unit shall be capable of operation up to 13,000 feet above sea level.
- .3 No appreciable magnetic fields shall be generated. Unit shall be capable of use in computer rooms without danger to data storage systems or devices.
- .4 Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
- .5 The unit shall not generate any audible noise during normal operation.



## 1.7 QUALITY ASSURANCE

- .1 The manufacturer shall provide a full 10-year parts and labour warranty from date of shipment against failure when installed in compliance with manufacturer's written instructions, ULC listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available for consultation, (local, national) engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or the nearest dispatch centre shall be stated in the Bid form.
- .2 An SPD that shows evidence of failure or incorrect operation during the warranty period shall be replaced free of charge. Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPD's shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. That is, the warranty must specifically provide for unlimited free replacements in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.
- .3 The installation of SPD's in or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.

## 1.8 MANUFACTURERS

- .1 Acceptable manufacturers:
  - .1 Schneider Electric
  - .2 Eaton
  - .3 International Innovative Systems-Total Protection Solutions

## 1.9 QUALIFICATIONS

- .1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- .2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- .3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

## 1.10 DELIVERY, STORAGE AND HANDLING

- .1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

## 1.11 OPERATION AND MAINTENANCE MANUALS

- .1 Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

## 2 Products

### 2.1 PERFORMANCE

- .1 General
  - .1 Electrical Requirements

- .2 The SPD device shall be suited for operation in the following configurations; 480V VAC, 3 pole, wye, 3 wire, electrical configuration. The operating environment is classified by IEEE C62.41 as follows:
    - .1 Panelboards, 480V: Category B.
    - .2 Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be 125% of the nominal system operating voltage.
    - .3 The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor at the distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
    - .4 Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), lineground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
    - .4
  - .3 The unit shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (latest edition, latest revision, and not merely the components or modules).
  - .4 The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.
  - .5 Obtain all surge suppression devices through one source from a single manufacturer.
  - .6 No unit will be accepted unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, independent NEMA LS-1 per mode surge testing, and all other requirements of this specification.
  - .7 In compliance with NEMA LS-1-1992, each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing at an independent, nationally recognized test laboratory. To be considered for approval, the manufacturer must submit a test report on a unit which was tested with internal over current fusing in place. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 µsec 6000V open circuit voltage waveform and an 8 X 20 µsec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 µsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Compliance is achieved if the suppression voltage found from the two UL1449 surges does not vary by more than +10%. Test data on an individual module is not acceptable.
- .2 SPD Design
- .1 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating SPD modules shall not be acceptable.

- .2 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.
- .3 Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

<u>Attenuation</u> <u>Frequencies</u>	<u>50 kHz</u>	<u>100</u> <u>kHz</u>	<u>500</u> <u>kHz</u>	<u>1 MHz</u>	<u>10 MHz</u>	<u>100</u> <u>MHz</u>
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

- .4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.
- .5 Monitoring Diagnostics – Each SPD shall provide integral monitoring options:
- .6 Each unit shall provide a green / red solid-state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.
- .7 Remote Status Monitor – The SPD device must include Form C dry contacts (one normally opened and one normally closed for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.
- .8 Audible Alarm – The SPD shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.
- .9 Push to Test – The SPD shall be equipped with push-to-test feature designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. A test button shall be provided to initiate a self test procedure. If the system is fully operational, the self test will activate all indicator lights.
- .10 Event Counter – The SPD shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The events counter triggers each time under each respective category after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.
- .11 Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:
- .12 Individual Fusing: MOVs shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.
- .13 Thermal Protection: MOVs shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100 mA to 30 Amp, or if the occurrence is over a longer period of time, the TFS will

disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100 mA to 30 A.

- .14 All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.
- .15 Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992.
- .16 The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20 kV open circuit voltage. 8 x 20µsec, 10 kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:
  - .1 Branch Location Panelboard: 9000 impulse per mode.

## 2.2 SYSTEM APPLICATION

- .1 The branch panel located SPD shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C1 environments.
- .2 Surge Current Capacity - The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand capability with compliance to ANSI/IEEE C62.41 & NEMA LS1

<u>Application</u>	<u>Per Phase</u>	<u>Per Mode</u>	<u>Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)</u>
Branch Locations (Panelboards)	120 kA	60 kA	9000

- .3 The SPD shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options.
- .4 The SPD shall be immediately installed on the load side of the main breaker.
- .5 The panelboard shall be capable of re-energizing upon removal of the SPD.
- .6 A direct bus bar connection shall be used to mount the SPD component to the panelboard bus bar to reduce the impedance of the shunt path.
- .7 The SPD panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and SPD device is not acceptable). SPD units that use a cable connection do not meet the intent of this specification.
- .8 The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
- .9 The SPD shall be of the same manufacturer as the panelboard.
- .10 The complete panelboard including the SPD shall be UL67 listed.
- .11 Retrofit Installation (externally mounted suppressor). Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches. Comply with the manufacturer's recommended installation and wiring practices.



3 Execution

**3.1 EXAMINATION**

.1 Factory Testing

- .1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

**3.2 INSTALLATION**

- .1 The SPD shall be remote mounted to the Panelboard and shall be installed by the Contractor. Connect SPD units to circuit breaker within the equipment noted on drawings. Conductors are to be as short and straight as possible as, no greater than 18" in length. Input conductors to the SPD/filter shall be twisted to reduce impedance during high frequency filtering. Cable size shall be minimum #6 AWG.
- .2 The SPD should be installed following the manufacturer's recommended practices and in compliance with all applicable codes.

**3.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification nameplate in accordance with Section 26 05 00 – Nameplates.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 All conditions of the Contract apply to the work of this Section.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – General Electrical Requirements

**1.3 SUBMITTALS**

- .1 Shop Drawings
- .1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.
  - .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**1.4 QUALITY ASSURANCE**

- .1 Panelboards and circuit breakers shall comply with the following standards:
- .1 CSA-C22.2 No. 5 - Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
  - .2 CSA C22.2 No. 29 - Panelboards and Enclosed Panelboards.

**1.5 SCOPE**

- .1 Provide circuit breaker type panelboards at locations detailed on drawings.

2 Products

**2.1 GENERAL**

- .1 All panelboards, distribution panels and moulded case circuit breakers shall be of one manufacturer. Acceptable Manufacturers: Eaton, Schneider Electric, Siemens.

**2.2 PANELBOARDS**

- .1 Refer to drawings for specific details pertaining to panelboards: mains rating, voltage, main lug or main breaker, flush or surface mounting, number of circuits, and number and size of branch circuit breakers. Panelboard cabinet assemble to comply with NEMA enclosure type 2 with drip shield for indoor areas, unless otherwise indicated on the Contract Drawings.
- .2 All power panelboards to contain six spare circuit breakers.
- .3 Install circuit breakers in panelboards and distribution panels before shipment.
- .4 277/480V or 347/600V Panelboards with tin plated copper buses and bus bracing rated for a minimum 22kA (rms symmetrical) interrupting capacity. Final kA rating shall be as per short circuit and co-ordination analysis.
- .5 120/208VAC panelboards: bus and circuit breakers rated for a minimum 10kA (rms symmetrical) interrupting capacity. Final kA rating shall be as per short circuit and co-ordination analysis.
- .6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .7 Provide two keys for each panelboard and key panelboards alike.
- .8 Copper bus with neutral of same ampere rating as mains.

- .9 Mains: suitable for bolt-on circuit breakers.
- .10 Trim with concealed front bolts and hinges.
- .11 Trim and door finish: baked grey enamel.
- .12 All new panel boards that supply exterior and roof equipment are to come complete with surge protection devices.
- .13 All panelboard should be equipped with main circuit breaker unless noted otherwise.

### 2.3 MOULDED CASE CIRCUIT BREAKERS

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Circuit breakers for 277/480V or 347/600V panelboards to have minimum 22kA symmetrical rms interrupting capacity rating. Final kA rating shall be as per short circuit and co-ordination analysis.
- .4 Circuit breakers for 120/208V panelboards to have minimum 10kA symmetrical rms interrupting capacity rating. Final kA rating shall be as per short circuit and co-ordination analysis.
- .5 Circuit breakers shall have thermal and magnetic tripping unless indicated otherwise.
- .6 Main circuit breaker:
  - .1 Separately mounted on top or bottom of panel to suit cable entry.
  - .2 When mounted vertically, down position should open breaker.
  - .3 Provide shunt trip on main circuit breaker for panelboards serving laboratory equipment.
- .7 Provide ground fault circuit breaker with 30 mA sensitivity as shown on Contract Documents. Ground fault circuit-breaker with minimum 10 kAIC at 208 V, 480 V or 600 V or in accordance with short circuit and co-ordination study.

## 3 Execution

### 3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Mount panelboards to height specified in Section 26 05 00 – General Electrical Requirements or as indicated.
- .3 Provide a spare 32mm (1¼") EMT raceway into accessible ceiling space from each recessed panel. Provide nylon pull string in raceway and cap open end.
- .4 Connect loads to circuit breakers.
- .5 Connect neutral conductors to common neutral bus.
- .6 Panelboards shall not be located on interior building columns within the warehouse area.
- .7 All panelboards are to be located in designated electrical rooms or along dock wall (coordinated with fire sprinkler risers).

### 3.2 CIRCUIT BREAKERS

- .1 Ensure all circuit breakers mounted in panelboard have the specified interrupting capacity required for that piece of equipment.

### 3.3 IDENTIFICATION

- .1 Provide Iamacoid nameplate on all panelboards.
- .2 Provide circuit directory cards for all panelboards with typewritten directories indicating loads controlled by each circuit. Install circuit directory under plastic protective cover on front of panel.

**END OF SECTION**



1 General

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results - Electrical
- .2 Section 26 05 00 – Nameplates
- .3 Section 26 05 24 – Wiring Methods
- .4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
- .5 Section 26 05 39 – Under Floor Duct
- .6 Conform to relevant sections of specifications for Division 26 and other Divisions.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Division 01 General Requirements section.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Indicate type of multi-outlet assemblies with similar terminology to these documents.

**1.3 1.3 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Division 01 General Requirements section.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures or any other specialty instruction.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle in accordance with Division 01 General Requirements section.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

**2.1 SURFACE RACEWAY FOR WIRING DEVICES**

- .1 Two-piece assembly manufactured for mounting wiring devices and associated wiring.
- .2 Raceway with base channel and snap on cover plate. Cross-section dimensions: as indicated.
- .3 Finish: Standard to be selected by architect.
- .4 Internal barrier for raceway having power and communication.

**2.2 WIRING DEVICES**

- .1 Wiring devices: as indicated.
- .2 Communication devices: as indicated.
- .3 Cover plate: to match raceway manufacturer's standard snap-on cover.

**2.3 PREWIRED RECEPTACLE HARNESS**

- .1 Receptacle harness factory assembled with single receptacles at 1525 mm centres on 2 circuits.

## 2.4 VINYL PLASTIC STRIP

- .1 Extruded rigid vinyl plastic with 2- [No. 12 AWG] [3] mm<sup>2</sup> copper wires and continuous ground strip.
- .2 Unfused "U" ground lock-in receptacle [for each 1.5 m of strip] [as indicated].

## 2.5 FITTINGS

- .1 Elbows, tees, supports, connectors, couplings and fittings to make a complete installation.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install multi-outlet assemblies and raceway system in accordance with manufacturer's instructions.
- .2 Install supports, elbows, tees, connectors, fittings.
- .3 Keep number of elbows, offsets and connections to minimum.
- .4 Install barriers where required.
- .5 Install surface raceway continuous around corners. Provide corner and vertical sections as required.

### 3.2 WIRING

- .1 Install wiring after installation of raceway system is complete.
- .2 Install receptacle harness as indicated.
- .3 Fasten wiring with wire clips inside raceway.
- .4 Install ground wire as required.

### 3.3 WIRING DEVICES

- .1 Install wiring devices and cover plates as indicated
- .2 Install vinyl strip receptacles as indicated.
- .3 Install identification labels for all electrical outlets.

### 3.4 CLEANING

- .1 Clean in accordance with Division 01 General Requirements section.
- .2 Clean installed products in accordance to manufacturer's recommendation.
- .3 Waste Management: separate waste materials for [reuse] [and] [recycling] in accordance with Division 01 General Requirements sections.

**END OF SECTION**

1 General

**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results - Electrical
- .2 Section 26 05 10 – Short Circuit, System Coordination and ARC Flash Study
- .3 Section 26 24 16 – Distribution Panel
- .4 Section 26 24 18 – Panelboards Switch and Fuse Type
- .5 Section 26 28 23 – Disconnect Switches Fused and Non-Fused
- .6 Conform to relevant sections of specifications for Division 26 and all other Divisions.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Division 01 General Requirements section.
- .2 Submit fuse performance data characteristics for each fuse type and size above 60A. Performance data to include: average melting time-current characteristics, (for fuse coordination), and peak let-through current.

**1.3 MAINTENANCE MANUALS**

- .1 Six spare fuses of each type and size installed up to and including 600 A.

**1.4 DELIVERY AND STORAGE**

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet and moisture free location.

2 Products

**2.1 FUSES GENERAL**

- .1 Fuse type references L1, L2, J1, R1 etc. Have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

**2.2 FUSE TYPES**

- .1 HRC-L fuses (formerly Class L).
  - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 second minimum.
  - .2 Type L2, fast acting.
- .2 HRCI-J fuses (formerly Class J).
  - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10second minimum.
  - .2 Type J2, fast acting.
- .3 HRCI-R fuses (formerly Class R). For UL Class RK1 fuses, peak let-through current and values not to exceed limits of UL 198E-1982, table 10.2.

- .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
- .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 HRCII-C fuses (formerly Class C).

3 Execution

3.1 **INSTALLATION**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
  - .1 Install Class R rejection clips for HRCI-R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
- .5 Fuses protecting motor loads, and transformers to be type J1 for up to and including 600 A and L1 for ratings above 600 A.
- .6 Fuses protecting service entrance and feeder circuits to be type J2 for up to and including 600 A, and type L2 for ratings above 600 A.
- .7 Fuses protecting other services or equipment shall be of the type required for that purpose.

**END OF SECTION**

1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results - Electrical
- .2 Section 26 05 03 – Nameplates
- .3 Section 26 05 10 – Short Circuit, System Coordination and Arc Flash Study
- .4 Section 26 24 13 – Secondary Switchboard
- .5 Section 26 24 16.01 – Panelboards and Circuit Breakers
- .6 Section 26 24 17 – Panelboards Breaker Type
- .7 Conform to relevant sections of the specifications for Division 26 and all other Divisions.

1.2 STANDARDS

- .1 CAN/CSA-C22.2 No. 144-M91 (R2001): Ground Fault Circuit Interrupters.
- .2 CSA C22.2 No. 5-02: Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- .3 CSA C22.1-02-Canadian Electrical Code.
- .4 UL 489 (2002) Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
- .5 ANSI C37.17 (latest) American National Standard for trip devices for AC and general purpose DC low voltage power circuit breakers.
- .6 NEMA-AB1-1993 Molded case circuit breakers and molded case switches.
- .7 ANSI C37.50 American National Standard for Switchgear – test procedures for low voltage AC power circuit breakers used in enclosures.
- .8 IEEE Standard 1015, specifically acceptance practice.
- .9 NETA –ATS Section 7.
- .10 Ontario Electrical Safety Code.
- .11 Section 26 05 73 – Short Circuit, System Coordination & Arc Flash Study.

1.3 PRODUCT DOCUMENTATION

- .1 Submit shop drawings in accordance with Section 26 05 00. There will be details such as dimensions, clearances required, cable entries, tabulation of all devices including tags, wiring diagrams (power ,signals, control wiring). The notes will identify field wiring and factory installed wiring).
- .2 Include time-current characteristic curves for breakers with ampacity of 150A and over. In some cases due to critical nature of the equipment smaller size breaker may have to be verified for Time Current coordination as well.

2 Products

2.1 BREAKERS GENERAL

- .1 Provide bolt-on molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient as indicated in the Contract Documents.



- .2 Circuit breakers that are 400 amps and higher that are part of the emergency distribution system shall be 100% rated.
- .3 The purpose of selecting right type of circuit breaker is to comply with Section 26 05 10. The contractor shall ensure that a necessary study is carried out or professional judgment is sought before offering the breakers. The coordination study must be submitted at the same time as all panelboards, switchboards and any other equipment that is being supplied with molded case circuit breakers. No equipment shall be released for manufacturing prior to the coordination study being approved by the consulting engineer.
- .4 Provide multi-pole breakers with a common-trip device and a single handle.
- .5 Provide magnetic instantaneous trip elements in circuit breakers, to operate only when the value of the current reaches the setting, as indicated. For breakers with adjustable trips, provide a trip range of 3 to 10 times the rated current or as indicated in the Contract Documents.
- .6 Provide circuit breakers with interchangeable trips as indicated in the Contract Documents.
- .7 Provide pad locking devices on all breakers to lock the handle of a breaker in the "on" or "off" position with the trip units to remain free to function and protect the circuit from both overload and short circuit conditions.

## **2.2 THERMAL MAGNETIC BREAKERS (TMB)**

- .1 Provide molded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping characteristic.

## **2.3 FUSED THERMAL MAGNETIC BREAKERS (FTMB)**

- .1 Provide fused thermal magnetic breakers with current limiting fuses internally mounted. Coordinate the time vs current characteristics and the time current limiting characteristics of the fuses with the time vs current tripping characteristics of the circuit breakers resulting in the circuit interruption by the breaker of currents up to the interrupting capacity of the breaker and the circuit interruption by the fuses above the interrupting capacity of the breaker. Provide individually removable fuses interlocked with the breaker such that the removal of the fuse cover, the blowing of a fuse or the removal of a fuse will trip the breaker.

## **2.4 SOLID STATE TRIP BREAKERS DESIGN (LSI, LSIG AS INDICATED IN THE CONTRACT DOCUMENTS)**

- .1 Provide molded case circuit breakers to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip devices to provide an inverse time vs current trip characteristic under overload conditions, and long time short time instantaneous tripping for phase ground fault short circuit protection. The trip unit shall be fully adjustable current and time characteristics. All breakers 400 A and above shall be solid state type (LSIG) unless otherwise shown on Drawings.

## **2.5 MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

## **2.6 OPTIONAL FEATURES**

- .1 Provide shunt trip devices, with 120 V AC coils unless otherwise indicated in the Contract Documents, to provide remote tripping where indicated.
- .2 Provide closing coils, with 120 V AC coils unless otherwise indicated, to provide remote/automatic closing where indicated in the Contract Documents.
- .3 Provide auxiliary switches, rated at 5 A and 120 V unless otherwise indicated in the Contract Documents, to operate remote devices where indicated. Circuit breakers rated 800A or larger shall have contacts rated 10A at 240V where indicated.

- .4 Provide motor operated mechanisms, with 120 V motors unless otherwise indicated, to provide remote operation where indicated. This will be provided with electrical closing mechanism where indicated.
- .5 Provide NEMA and UL rated enclosures for individual breakers as required.

## **2.7 MANUFACTURERS**

- .1 Provide circuit breakers of one manufacturer. Acceptable manufacturers are:
  - .1 Schneider Electric
  - .2 Eaton Electric.
  - .3 Siemens

## **3 Execution**

### **3.1 EXAMINATION**

- .1 Examine the circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after satisfactory compliance has been confirmed.

### **3.2 INSTALLATION**

- .1 Circuit breakers in panelboards shall be factory installed.
- .2 Install other individual breakers where indicated in the Contract Documents.

### **3.3 IDENTIFICATION**

- .1 Identify all field installed conductors, wiring and components; provide warning signs as required by manufacturer and also CEC and Ontario Electrical Safety Code. Install engraved nameplates and lamacoid nameplates on enclosures.

### **3.4 CONNECTION**

- .1 Install grounding connections, power wiring and indication devices. Verify the torque recommended by manufacturer.

### **3.5 TESTS**

- .1 Test for continuity of phase and ground connections and insulation resistance (Megger) for each phase to phase and phase to ground.
- .2 Verify all acceptance tests as per NETA test procedure.
- .3 Any malfunctioning of the units shall be corrected and retested to demonstrate compliance.

### **3.6 SUBMITTALS**

- .1 Field test reports: Include the test procedures and instruments used. Record test results for formal submission to Consultant and Owner.
- .2 Final maintenance manual shall include all the routine maintenance requirements and complete information about each circuit breaker settings.

**END OF SECTION**

1 General

**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results - Electrical
- .2 Section 26 05 00 – Nameplates
- .3 Section 26 05 10 – Short Circuit, System Coordination and Arc Flash Study
- .4 Section 26 24 16 – Distribution Panel
- .5 Section 26 24 18 – Panelboards Switch and Fuse Type
- .6 Conform to relevant sections of the specifications for Division 26 and all other Divisions.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Standards: Design, manufacture and test all disconnect switches in accordance with good industry practice and in accordance with the following Standards and Codes:
- .3 CSA Standard C22.2 No. 4 Enclosed switches;
- .4 CSA Standard C22.2 No. 39 Fuseholder assemblies.

2 Products

**2.1 DISCONNECT SWITCHES**

- .1 Provide fusible and non-fusible disconnect switches in CSA Enclosure to suit the environment where the switch is located.
- .2 Provide the provision for padlocking the switch in the ON and OFF switch position by using one lock via a multi-lock hasp.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, to Section 26 28 14 – Fuses - Low Voltage.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.
- .6 Provide a type A quick-make, quick-break switching action with arc chutes or arc snuffers.
- .7 Provide a vertically moving handle with an ON-OFF switch position indication on the switch enclosure cover with the ON position being the upper handle position.
- .8 Provide solderless neutral terminals where indicated.
- .9 Disconnect switches integrated rating must be rated to handle the design interrupting capacity for this project.
- .10 Ensure system coordination per Section 26 05 73 prior to ordering of the equipment.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Indicate name of load controlled on nameplate.
- .3 If part of the emergency distribution system, it shall be finished in Sherwin Williams #F65E37.

### 2.3 ACCEPTABLE MANUFACTURERS

- .1 Provide disconnect switches which are the product of one manufacturer. Acceptable manufacturers are:
  - .1 Schneider Electric
  - .2 Eaton Canada.
  - .3 Siemens Canada.

### 2.4 ENCLOSURE

- .1 Individually mounted disconnect switch shall be installed in Sprinkler proof enclosure c/w drip shield.

### 3 Execution

#### 3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

1 General

1.1 REFERENCES & RELATED WORK

- .1 Section 26 05 00 – Common Work Results - Electrical
- .2 Section 26 05 03 – Nameplates
- .3 Section 26 05 00 – Short Circuit, System Coordination and Arc Flash Study
- .4 Section 26 05 28 – Building Grounding
- .5 Section 26 22 18 – Surge Protection Device (SPD)
- .6 Section 26 24 19 – Motor Control Centres
- .7 Section 26 28 14 – Fuses – Low Voltage
- .8 Section 26 29 12 – Control Devices
- .9 Conform to relevant sections of specification for this and other Divisions.

1.2 SHOP DRAWINGS & PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Indicate:
  - .1 Mounting method and dimensions.
  - .2 Starter size and type.
  - .3 Layout of identified internal and front panel components.
  - .4 Enclosure types.
  - .5 Wiring diagram for each type of starter.
  - .6 Interconnection diagrams.
- .3 Upon approval of the shop drawings, CAD files are to be submitted to the Consultant such that diagrams for each motor load can be developed. The Consultant will develop motor wiring diagrams for submission to Sanofi Pasteur Ltd. – C&Q Team.
- .4 The CAD files shall be submitted to the Consultant in the same format as Record Drawings in Section 26 05 00 – Common Work Results - Electrical. The CAD files are to be provided for:
- .5 Interconnection diagrams.
- .6 Wiring Diagram for each type of starter. The following information shall be included on the diagrams:
  - .1 Starter size and over-current protection.
  - .2 All components of the starter.
  - .3 Terminal numbers for all connections within starter. Terminals shall be labeled for the following interfaces:
    - .1 Fire Alarm start-up and shutdown.
    - .2 Safeties and permissive signals from field devices.
    - .3 Start/Stop signal



- .4 Motor and overload connections.
- .5 All spare terminals shall be labeled in diagrams.

## 2 Products

### 2.1 MATERIALS

- .1 Starters in accordance with CSA Standard C22.2 No. 14: Industrial Control Equipment for Use in Ordinary (Non- Hazardous) Locations.
  - .1 Half size starters are not acceptable.
  - .2 Minimum starter size: Size 1
  - .3 All starters shall be provided with the following indicating LED Pilot Lights:
    - .1 Red LED Pilot Light Denotes – Running.
    - .2 Green LED Pilot Light Denotes – Stopped.
    - .3 Amber LED Pilot Denotes – Tripped.
  - .4 All starters shall be EEMAC / NEMA rated. IEC rated starters are not acceptable.
  - .5 All starters shall be complete with indicating lights for run and off indication and 'Push To Test' lamp test push button.

### 2.2 MANUAL MOTOR STARTERS

- .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1 Switching mechanism, quick make and break.
  - .2 Solid state overloads.
  - .3 Manual resets with a trip indicating handle.
- .2 Accessories:
  - .1 Toggle switch, standard duty labelled as indicated.
  - .2 Indicating light: standard duty and colour as indicated.
  - .3 Locking tab to permit padlocking in ON or OFF position.

### 2.3 COMBINATION MAGNETIC STARTERS (CMS)

- .1 All magnetic starters to be the combination, fusible, magnetic type unless otherwise indicated.
- .2 Combination type starters to include disconnect switch with a vertically moving operating lever on the outside of enclosure to control disconnect switch and provision for:
  - .1 Locking in OFF position with up to 3 padlocks.
  - .2 Locking in ON position.
  - .3 Independent locking of enclosure door.
  - .4 A voidable interlock to prevent the starter door from being open when the disconnect switch is in the ON position and to prevent switching the disconnect switch to the ON position when the starter door is open.
  - .5 Provide as part of CMS type starter all items as specified in 2.4 Full Voltage Magnetic Starter. (FVNR).

- .6 Provide control transformer.

## **2.4 FULL VOLTAGE MAGNETIC STARTERS (FVMS)**

- .1 Full voltage magnetic starters of the size, type, rating and enclosure type as indicated with the following components:
  - .1 Rapid action solenoid operated contactor.
  - .2 Motor overload solid state protective device in each phase, manually reset from outside enclosure.
  - .3 Power and control terminals.
  - .4 Wiring and schematic diagram inside starter enclosure in visible location.
  - .5 Identify each wire and terminal for the internal and external connections within starter, with permanent number markings identical to the wiring and schematic diagram.
- .2 Accessories:
  - .1 Hand-off-auto selector switches: heavy duty, labelled as indicated.
  - .2 Indicating lights: heavy duty and colour as indicated.
  - .3 2 normally open and 2 normally closed spare auxiliary contacts unless otherwise indicated.

## **2.5 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer installed in with starter enclosure as indicated in accordance with Section 26 29 12: Control Devices.

## **2.6 THERMISTOR RELAY**

- .1 Thermistor overload protection relay for starters Size 2 and larger, supplied under Division 26, shall be Siemens Electric Limited Cat. #3UN21 or equivalent, complete with door mounted reset button and amber pilot light on door to indicate thermistor trip unit trip condition.

## **2.7 FINISHES**

- .1 For all painted surfaces, acid etch, prime coat and apply two finish coats of the manufacturer's standard finish.

## **2.8 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 03 – Nameplates.

## **2.9 MANUFACTURERS**

- .1 Provide starters of one manufacturer. Acceptable manufacturers are:
  - .1 Schneider Electric SquareD
  - .2 Eaton Canada
  - .3 Siemens Canada
  - .4 Allen-Bradley

## **3 Execution**

### **3.1 INSTALLATION**

- .1 Install the starters and connect the power and control wiring as indicated.
- .2 Ensure that the correct fuses and overload devices and elements are installed.

### 3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate all switches and contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of the contactors and relays.
- .4 Check that the sequence controls, interlocking with other separate related starters, equipment and control devices operate as indicated.

**END OF SECTION**

1 General

**1.1 REFERENCES & RELATED WORK**

- .1 Section 26 05 00 – Common Work Results - Electrical
- .2 Section 26 29 11 – Motor Starters Up To 600 V
- .3 Section 26 24 19 – Motor Control Centres

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical, and Division 01 General Requirements section.
- .2 Include schematic, wiring, and interconnection diagrams.

2 Products

**2.1 STANDARDS**

- .1 Provide control relays designed, manufactured and tested in accordance with CSA Standard C22.2 No. 14: Industrial Control Equipment for Use in Ordinary (Non- Hazardous) Locations.

**2.2 MANUFACTURERS**

- .1 Provide control devices of one manufacturer (except thermostats). Allen-Bradley catalogue numbers are indicated to indicate the quality of the control devices required. Equivalent products of other acceptable vendors may be used. Acceptable manufacturers are:
  - .1 Allen-Bradley
  - .2 Schneider Electric
  - .3 Eaton Electric
  - .4 Siemens Canada

**2.3 AC CONTROL RELAYS**

- .1 Electrically held with field convertible contact cartridges and the following characteristics:
  - .1 Coil rating: 120 V
  - .2 Contact rating: EEMAC A600 & P300.
  - .3 4 contacts
  - .4 Allen-Bradley 700-P Series or equivalent.
- .2 Double voltage, electrically held with a sliding barrier to permit access to the only the contact compartment or the coil compartment at any one time, field convertible contact cartridges and the following characteristics:
  - .1 Coil rating: 120 V
  - .2 Contact rating: EEMAC A600 & P300
  - .3 4 contacts in the contact compartment and 2 contacts in the coil compartment.
  - .4 Allen-Bradley 700-BRD Series or equivalent.

## 2.4 DC CONTROL RELAYS

- .1 Electronically held with field convertible contact cartridges, economizing coil and the following characteristics:
  - .1 Coil Rating: 24 V DC
  - .2 Contact Rating: EEMAC A300 & P300
  - .3 4 Contacts
  - .4 Allen-Bradley 700DC-N Series or equivalent.
- .2 Selector switches:
  - .1 Type A:
    - .1 Duty: Standard
    - .2 Operator type: Standard
    - .3 Operator colour: black as indicated
    - .4 Nameplate type: metal, engraved with contrasting letters as indicated.
    - .5 Two position, maintained
    - .6 Three position, maintained
    - .7 One normally open and one normally closed contact rating: EEMAC A600.
    - .8 Enclosure: CSA enclosure 1
    - .9 Allen-Bradley 800S Series or equivalent.
- .3 Pilot Lights:
  - .1 Type A:
    - .1 Heavy duty
    - .2 Push to test full voltage type for operation in a 120 V circuit.
    - .3 Lens colours: Red, green, amber, as indicated.
    - .4 Nameplate: Metal, engraved with contrasting letters, as indicated.
    - .5 Enclosure: CSA enclosure
    - .6 Allen-Bradley 800 Series or equivalent.

## 2.5 RELAY ACCESSORIES

- .1 Standard contact cartridges field convertible between normally-open and normally closed.
- .2 Sealed contact cartridges, normally open and normally closed as indicated.
- .3 Overlap contact cartridges supplied in pairs having a normally open contact that closes before the normally closed contact opens and vice versa (Make before Break).
- .4 Indexed mounting strips easily cut to the required length and bolted or rivetted in place. The relays are installed in rows on the strips with captive mounting screws.
- .5 Adder contact decks to add contacts in multiples of 4 contacts to the maximum of 12 contacts.
- .6 Mechanical latch attachment to convert an electrically held relay to a mechanically held relay.



## 2.6 CONTROL & RELAY PANELS

- .1 Sheet steel CSA enclosure 1 with hinged pad-lockable access door to accommodate all relays timers, terminals labels, wiring and all other components as indicated to the factory installed and wired to identified terminals.
- .2 Provide sprinkler protection complete with rain tight fittings.

## 2.7 SOLID STATE TIMING RELAYS

- .1 Construction: AC operated electronic timing relay with a solid-state timing circuit to operate output contact. The timing circuit and output contact to be completely encapsulated for protection against vibration, humidity and atmospheric contaminants.
- .2 Operation: On-delay or off-delay.
- .3 Potentiometer: Self contained to provide time interval adjustment.
- .4 Supply voltage: 120 V, 60 Hz.
- .5 Operating temperature range: -20°C to 60°C.
- .6 Contact rating: EEMAC B300 and P300.
- .7 Timing ranges: Continuously adjustable over the range 0.1 s. to 30 s. or as required.
- .8 Components shall be DIM railed mounted.

## 2.8 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary voltage: to match the equipment line voltage.
- .3 Secondary voltage: 120 V unless otherwise indicated.
- .4 Rating: 50 VA or the actual load plus 20%, whichever is the greater unless otherwise indicated.
- .5 Secondary fuse: size for the actual load x 2.5 or the next largest standard size unless otherwise indicated. Provide an integrally mounted fuse holder.
- .6 Close voltage regulations as required by magnet coils and solenoid valves.
- .7 Components shall be DIM railed mounted.

## 2.9 OPERATOR CONTROL STATIONS

- .1 Pushbuttons:
  - .1 Type A
    - .1 Duty: Standard
    - .2 Operator type: recessed
    - .3 Operator colour: red and green as indicated
    - .4 Nameplate type: metal, engraved with contrasting letters as indicated
    - .5 Provision for padlocking in the depressed position
    - .6 1 normally open and 1 normally closed contacts
    - .7 Contact rating: EEMAC A600
    - .8 Enclosure: CSA enclosure 1
    - .9 Allen-Bradley 800S Series or equivalent.
    - .10 Provide Red Mushroom Head for E-Stop.

3 Execution

3.1 **INSTALLATION**

- .1 Install the pushbutton stations and control devices as indicated and interconnect them as indicated.

3.2 **TESTS**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Depending upon the magnitude and complexity, divide the control system into convenient sections, energize one section at a time and check out the operation of the section.
- .3 Undertake the group testing upon completion of the sectional tests.
- .4 Check out the complete system for operational sequencing.
- .5 Submit one copy of the test results to the Consultant and the Owner.

**END OF SECTION**

1 General

**1.1 SUMMARY**

- .1 All conditions of the Contract apply to the work of this Section.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – General Electrical Requirements  
.2 Section 26 09 24 – Lighting Control Devices  
.3 Section 26 53 00 – Emergency Lighting and Exit Signs  
.4 Contractor shall be responsible for co-ordinating this section with all related sections

**1.3 REFERENCE STANDARDS**

- .1 CAN/CSA C22.2 No. 250.0 – Luminaires.  
.2 CAN/CSA C22.2 No. 9.0 - General Requirements for Luminaires.  
.3 ASHRAE/IESNA 90.1 – Energy Standard for Building except Low-Rise Residential Buildings.  
.4 CAN/CSA-C22.2 No.250.13-14 – Lighting Emitting Diode (LED) Equipment for Lighting Applications.  
.5 CAN/CSA-C239.02 – Performance Standard for Dusk to Down Luminaires.  
.6 CSDA C22.2 No.206 – Lighting Poles.

**1.4 SCOPE**

- .1 Provide lighting fixtures (luminaires) complete with LEDs, drivers and accessories as detailed herein and in the lighting fixture schedule (on drawings).  
.2 Operation and Maintenance Data: Provide operations and maintenance information in accordance with Division 01 General Requirements section.  
.3 Spare Parts and Tools: Submit unique parts and tools for maintaining system in accordance with Division 01 General Requirements section.

**1.5 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 01.

**1.6 WARRANTY**

- .1 All LED lighting fixtures shall be supplied with a minimum of ten (10) years' warranty.

2 Products

**2.1 MATERIAL**

- .1 All material shall be specification grade, where applicable, new and carry CSA approval or special certification as per Electrical Safety Authority requirements.  
.2 Similar devices and items shall be from one manufacturer throughout the project.  
.3 LED light sources and integrated electronic drivers detailed in this specification are based on manufacturers listed in the fixture schedule. Alternate products will also be acceptable subject to equivalent performance and conformance with the specifications.

- .4 Refer to Lighting Fixture Schedule on drawings for details of fixtures to be supplied. Where alternate fixtures are proposed, provide submission prior to tender close in accordance with Section 26 05 00 – General Electrical Requirements.

## 2.2 LED LAMPS

- .1 Long-life rated: Based on IESNA LM-80-20.
- .2 Warehouse fixtures L70 of  $\geq 50,000$  hours and Office fixtures L85 of  $\geq 60,000$  hours.
- .3 LED drivers shall provide 0-10V dimming where required; refer to fixture schedule on drawings for fixtures to be dimmed.
- .4 Warranty: 10 years

## 2.3 FIXTURE CONSTRUCTION

- .1 All interior fixtures shall comply with CSA Standard C22.2 No.9, latest edition, complete with accessories and components, complying with relevant CSA standards applicable to accessory or component.
- .2 Fixture lens, where specified, shall be flat and in hinged metal frame unless otherwise specified, made from clear acrylic lenses and shall be 100% virgin acrylic minimum 3.2mm (.125") thick.
- .3 Standard fixture colour shall be baked white enamel unless noted otherwise, which shall resist chipping, corrosion and discolouration. Before finishing all metal shall be chemically degreased and neutralized. Where custom fixture colours are required, colour shall be confirmed via shop drawing submission.
- .4 All fixtures shall be CSA approved and/or carry certification by a certifying organization recognized by the Electrical Safety Authority.

## 3 Execution

### 3.1 INSTALLATION

- .1 Co-ordinate fixture locations with other trades on site prior to rough in.
- .2 Install fixtures complete with all mounting hardware and trims for a neat, finished appearance.
- .3 Ensure that all fixtures installed in built-in enclosures can be serviced.

### 3.2 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines (unless indicated otherwise on drawings).

### 3.3 LUMINAIRE SUPPORTS

- .1 General:
  - .1 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment, and in a horizontal or vertical position as intended.
  - .2 Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
  - .3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.
- .2 Supports:

- .1 Self-alignment ball joint hangers shall be used for rod suspended fixtures, and ceiling canopies shall be fitted tightly to the ceiling without restricting the alignment of the hanger.
- .2 Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted, or prevent complete alignment of several fixtures in a row.
- .3 Mounting methods for fixtures on or in suspended ceilings are to be as follows:
  - .1 Secure surface mounted equipment with twist clip fasteners to inverted 'T' bar ceilings and independently support clips using jack chain to structure above.
  - .2 Where cross member supports are required above the ceiling to provide support points, these are to be steel channels or angles.
  - .3 Toggle bolts of the Snap-On or spring-in type are not to be used through drywall, tile or similar type ceilings.
  - .4 Lay-in or recessed luminaires (or luminaires mounted to the lower surface of suspended ceilings) shall be secured to the building structure. Each fixture shall be secured at opposite ends by a minimum of No. 12 AWG (2.70mm) galvanized soft annealed, mild steel wire (pencil rod) or fixture chain of adequate strength.
- .3 Suspension Length:
  - .1 The suspension length for all ceiling-mounted, suspended types of lighting fixtures, as listed in the Fixture Schedule, shall be the overall length from the ceiling to the lowest point of the fixture body, reflector, or glassware in its hanging position.
  - .2 The length of the stems or chain hangers of suspended fluorescent lighting fixtures shall be adjusted to hang all fixture bodies in the same room level and in the same horizontal plane, unless specifically required to be otherwise on the electrical drawings.
- .4 Chain Hangers:
  - .1 Where fixtures are specified to be chain hung, the chain used shall be No. 4 Tensile bright zinc coated with a strength of 181 kg. Attachments shall be made using No. 105 'S' hooks. Wires running down chain to fixture shall be run in flexible conduit and shall be attached to chain with cable clips.

### 3.4 WIRING

- .1 Connect luminaires to lighting circuits as detailed on drawings.
- .2 Refer to Section 26 05 05 – Basic Materials and Methods for acceptable wiring methods.
- .3 Refer to Section 26 09 24 – Lighting Control Devices and drawings for lighting controls.

### 3.5 CLEANING

- .1 Immediately prior to completion of project, provide a final cleaning of fixtures in accordance with Section 26 05 00 – General Electrical Requirements and Division 1.

### END OF SECTION



1 General

**1.1 SUMMARY**

- .1 All conditions of the Contract apply to the work of this Section.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – General Electrical Requirements  
.2 Contractor shall be responsible for co-ordinating this section with all related sections.

**1.3 REFERENCE STANDARDS**

- .1 CSA C22.2 No.141 - Emergency Lighting Equipment.  
.2 CAN/CSA C860 - Performance of Internally Lighted Exit Signs.  
.3 OESC Section 46 - Emergency Power Supply, Unit Equipment, Exit Signs and Life Safety Systems.  
.4 NFPA 101-2015, Life Safety Code.

**1.4 SCOPE**

- .1 Provide a complete and operational exit sign system capable of operating (upon loss of normal power) for a minimum of 30 minutes under full load conditions.

**1.5 WARRANTY**

- .1 Exit signs and combination exit sign/emergency lighting units shall be fully warranted to be free of defects in material and workmanship under normal use for a period of one (1) year.  
.2 Exit sign unit equipment batteries shall be warranted to be free of defects in material and workmanship under normal use for a period of one (1) year full and nine (9) years Pro Rata.  
.3 LED lamps used in Exit signs shall be warranted to be free of defects in material and workmanship under normal use for a period of ten (10) years.  
.4 The full warranty period shall begin on the date of substantial completion of the project.

**1.6 MATERIAL**

- .1 All material shall be specification grade, where applicable, new and carry CSA approval or special inspection approval (in accordance with OESC).  
.2 Similar devices and items shall be from one manufacturer throughout the project.  
.3 Equipment detailed in this specification is based on AimLite. Alternate equipment supplied by one of the following manufacturers (equivalent to that specified) will also be acceptable: Emergi-Lite or Lumacell.

2 Products

**2.1 EXIT SIGNS**

- .1 General:  
.1 Exit signs to comply with the latest editions of CSA 22.2 No. 141 and CSA C860.  
.2 LED, less than 2.5W.  
.3 Universal mounting directly on junction box and c/w knockouts for conduit, single or double face as required (refer to drawings).  
.4 Faceplate(s): multiple legend films for pictogram and direction selection.

.5 Voltage: 120VAC, with self-powered option for emergency operation.

.2 Public Areas

.1 Refer to lighting schedule on drawings.

.2 Extruded aluminum housing, white finish.

## **2.2 COMBINATION EMERGENCY LIGHTING AND EXIT SIGN**

.1 General

.1 Where a combination emergency lighting unit & exit sign is to be provided, units shall be in accordance with above.

.2 Public areas:

.1 Refer to lighting schedule on drawings.

.2 Extruded aluminum housing, white finish.

3 Execution

### **3.1 GENERAL**

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION**

.1 Install exit lights to manufacturer's recommendations, listing requirements, and local regulatory requirements.

.2 Emergency and exit lighting shall be fed from the central battery inverter system.

.3 Ensure that exit light circuit breaker is locked in on position.

### **3.3 CLEANING**

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

1 General

1.1 GENERAL

- .1 All conditions of the Contract apply to the work of this Section.

1.2 RELATED WORK

- .1 Section 26 05 00 – General Electrical Requirements

1.3 REFERENCES

- .1 Ontario Electrical Safety Code
- .2 Ontario Building Code
- .3 Ontario Fire Code
- .4 CAN/ULC-S524-14, Installation of Fire Alarm Systems
- .5 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems
- .6 CAN/ULC-S537-04, Verification of Fire Alarm Systems
- .7 CAN/ULC-S561-20, Installation and Services for Fire Signal Receiving Centres and Systems
- .8 CAN/ULC-S1001-11, Integrated Systems Testing of Fire Protection and Life Safety Systems

1.4 SCOPE

- .1 Provide new fully addressable single stage fire alarm signaling devices to suit existing system with interior notification devices in specific areas as indicated in the drawings.
- .2 Provide testing and verification of fire alarm system in accordance with the requirements of CAN/ULC-S537.
- .3 Provide integrated systems testing of fire alarm and fire protection systems in accordance with the requirements of CAN/ULC-S1001-11.
- .4 Provide new fully addressable initiating fire alarm devices to suit existing system in select few areas as noted in drawings.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Electrical Requirements and the requirements of Division 1.
- .2 A complete description of system architecture and operation.
- .3 Detailed riser diagrams identifying all devices including but not limited to locations of isolation modules required by code, conductors, raceways, initiating zones, signaling circuits and terminations. A complete listing of all devices to be annunciate on the LCD display. Listing shall include device address, type and descriptive label.
- .4 Step-by-step operating sequence, cross referenced to logic flow diagram.
- .5 Calculation showing battery capacity for the require operation to meet code requirements.
- .6 Integrated Systems Testing Plan and Report as per latest issue of CAN/ULC-S1001-11.

1.6 WARRANTY

- .1 The Fire Alarm / Life Safety System manufacturer shall supply a one (1) year warranty from date of verification for all control system, field devices, and appliances. Contractor shall warrant the installed system to be free from any defects of material and installation for a period of one (1) year from acceptance by the engineer.

- .2 Any deficiencies shall be immediately corrected at no additional cost to the owner.
- .3 The Fire Alarm Manufacturer's authorized service organization shall provide a separate maintenance contract for a period of two years from the date of system commissioning. As part of the systems maintenance, the service company will provide printed reports which detail the sensitivity of each smoke detector installed in the system, and the date of the report.

## 2 Products

### 2.1 GENERAL

- .1 Section Includes:
  - .1 The minimum requirements for the Integrated Life Safety System. The system shall include, but not limited to, all equipment, materials, labour, documentation and services necessary to furnish and install a complete, operational system to include, but not limited to, the following functions:
    - .1 Smoke and fire detection & off-premise notification
    - .2 Interconnection with other building systems (elevator, air handling unit, air circulating fans, etc.)
- .2 Manufacturer
  - .1 All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system. The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Existing fire alarm control panel is Edwards model.
- .3 General
  - .1 The Contractor shall furnish all labor, services and materials necessary to install new initiating and signalling devices to suit existing fire alarm control panel. The System shall comply in all respects with all pertinent codes, rules, regulations and laws of the local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories of Canada (ULC) listings.
  - .2 It is further intended that upon completion of this work, the Owner be provided with:
    - .1 Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.
    - .2 Complete documentation of system(s) testing.
    - .3 Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULC listings, and is/are in proper working order.

### 2.2 WIRING

- .1 Power Wires: solid copper conductors, type RW90, rated 600 volt XLPE insulation in approved metal raceways. Minimum #12 AWG.
- .2 Fire Alarm Wires and Cables:

- .1 Audible/Visual Signal Circuit Wiring - solid copper conductors, type FAS105, rated 600Volt XLPE insulation in approved metal raceways. Minimum #14 AWG.
- .2 Addressable loops and Initiation Circuit Wiring – solid copper conductors, type FAS105, 300V PVC flame retardant jacket, shielded. Canada Wire - Securex. Minimum wire size shall be #18 AWG.
- .3 Coordinate and confirm fire alarm system wiring requirements with fire alarm system representative prior to start of work.

## 2.3 GRAPHIC (PASSIVE TYPE)

- .1 Full colour mylar film of building indicating street, building floor plan and fire alarm zones corresponding to the fire alarm annunciator.
- .2 All text shall be black with red "YOU ARE HERE" text and directional arrow.
- .3 Provide a solid backing and enclose in an extruded aluminum metal frame with a minimum 3mm (1/8") plexiglas cover.
- .4 Graphic is to be bolted or screwed securely to the wall using tamperproof mounting hardware. One graphic shall be supplied for the main control panel and each remote annunciator location.
- .5 Graphic must be approved by Consultant and local fire authorities prior to manufacture; submit shop drawings in accordance with the requirements of Section 26 05 00 – General Electrical Requirements and Division 1.

## 2.4 ANNUNCIATION

- .1 Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, monitor, trouble and component status messages and control menu.
- .2 The LED Annunciator rows shall contain the following format:
  - .1 Provide one row of red (alarm) and yellow (trouble) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).
  - .2 Provide one row of red (alarm) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).
  - .3 Provide one row of yellow (supervisory) LED's. LED's in each row shall be arranged in columns, one column per type of supervisory type device, and shall illuminate upon receipt of an supervisory signal from the associated device(s) (i.e., 2nd floor sprinkler valve supervisory switch)
- .3 The LED annunciator shall be provided with 25% spare LED's minimum. Each pair of LED's shall be labeled "Spare".
- .4 The LED Annunciator shall contain the following switches:
  - .1 Provide eight (8) two position switches for system by-pass functions. Actual switch function shall be determined by the owner.
- .5 Provide 1 pair of #14 AWG twisted wire for data network.
- .6

## 2.5 POWER SUPPLY



- .1 System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately be annunciated as battery trouble and identify the specific power supply affected.
- .2 All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section as per ULC. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of OESC. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.
- .3 Provide sufficient battery capacity for standby operation of entire system for 24 hours followed by 30 minutes in alarm condition (full load). Batteries shall only be utilized to a maximum of 70 % of their rated capacity. Provide battery calculations to verify this requirement is met.

## 2.6 INITIATION DEVICES (ADDRESSABLE)

- .1 Manual Pull Stations
  - .1 Fire Alarm / Life Safety System shall incorporate single stage microprocessor-based addressable Manual Pull Stations connected over a 2 wire electronic communications loop, using both broadcast and serial polling protocols. All Manual Pull Stations shall display communications and alarm status via LED's mounted on their integral, factory assembled module.
  - .2 All addressing of the Manual Pull Stations shall be done electronically, and the electrical location of each station shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the Manual Pull Station will not be dependent on their electrical location on the circuit.
  - .3 All Manual Fire Alarm station shall be suitable for operation in the following environment:
    - .1 Temperature: 32°F to 120°F (0°C to 49°C)
    - .2 Humidity: 0-93% RH, non-condensing
- .2 Smoke/Heat Detectors
  - .1 Provide intelligent multi-sensor smoke and heat detectors. The multi-sensor analog detector shall gather analog information from each of its two sensors: an optical type smoke sensor and a rate-of-rise heat sensor. The integral microprocessor measures and analyzes smoke and heat sensor readings to make an alarm decision based on historical data.
  - .2 Each detector shall be capable of adapting to ambient environmental conditions and the integral heat sensor shall be capable of causing an alarm when it reaches its rate-of-rise and fixed temperature alarm set point.
  - .3 The detector shall have a ULC Smoke Sensitivity Range of 0.53-3.94% obscuration/ft. The alarm smoke obscuration per foot setting shall be field selectable to any one of five sensitivity settings.
  - .4 The detector shall be protected by a ULC listed protective guard in areas where subjected to mechanical damage or abuse. The design must be 100% compatible with

the detector and must not affect the detector sensitivity or reduce detector spacing. The guard shall be low profile and suitable for flush or surface mounted detectors.

- .5 The multi-sensor detector shall be suitable for operation in the following environment:
  - .1 Temperature: 32°F to 100°F (0°C to 38°C)
  - .2 Humidity: 0-93% RH, non-condensing
  - .3 Elevation: no limit
- .3 Duct Smoke Detectors
  - .1 Photoelectric Smoke Detector
    - .1 Photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to detect visible particulates produced by combustion. The integral microprocessor shall dynamically examine values from the sensor and initiate a system alarm based on the analysis of data.
    - .2 The alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5% smoke obscuration per foot. The photo detector shall be suitable for operation in the following environment:
      - .1 Temperature: 32°F to 120°F (0°C to 49°C)
      - .2 Humidity: 0-93% RH, non-condensing
      - .3 Elevation: no limit
  - .2 Duct Detector Housing:
    - .1 The Analytical Microprocessor-based photoelectric smoke detector shall be readily adaptable for use in air duct smoke detection applications, using a housing that mounts to the outside of the duct. When used for duct smoke detection, the smoke detectors will not forfeit any of the system functionality that they have when used as area smoke detectors.
    - .2 The duct smoke detection housing shall allow the detector to sample and compensate for, variations in duct air velocity between 300 and 4,000 feet per minute.
  - .3 Remote Alarm LED and Test Station
    - .1 Provide a Remote Alarm LED and Remote Test Station; to be located in the vicinity of the duct detector.
- .4 Detector Bases
  - .1 Detector Base - Standard
    - .1 Mounting bases shall support all microprocessor-based detector types detailed in this specification
    - .2 Removal of the respective detector shall not affect communications with other addressable devices.
    - .3 Field wiring connections shall be made to the room side of the base, so that wiring connections can be made or disconnected by the contractor without the need for remove the mounting base from the electrical box. Bases will have the option of external LED operation, Relay Base or Data Line Isolator Base.
  - .2 Detector Base - Isolator
    - .1 The isolator base shall support all Addressable Detector types and have the following requirements:

- .2 The isolator shall operate within a minimum of 23msec of a short circuit condition on the analog communication wiring.
- .3 An analog addressable detector mounted with an isolator base shall only use 1 address on the loop. It shall be possible to provide one isolator for every detector to achieve the highest level of survivability possible. The analog loop controller shall support up to 250 devices including 125 modules and 125 detectors with 125 isolator bases.
- .4 In a Class A configuration, the analog loop controller shall identify an isolated circuit condition and provide communications to all non-isolated analog devices.
- .5 Isolators are required between all Floor Areas as defined in the OBC.

## 2.7 NOTIFICATION DEVICES

- .1 General
  - .1 All appliances which are supplied for the requirements of this specification shall be ULC Listed.
  - .2 All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to ensure absolute compatibility between the appliances and the control panels, and to ensure that the application of the appliances are done in accordance with the single manufacturer's instructions.
  - .3 Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.
- .2 Self-Synchronized Horns and Strobes
  - .1 Provide electronic horns, strobes and combination horn/strobes to match existing.
  - .2 Voltage and wiring to match existing horn/strobe circuit.
  - .3 The horn shall be selectable for continuous or synchronized temporal operation. The horn shall provide an output of 94 dB peak (measured at 3m) using a low frequency tone for superior wall penetration.
  - .4 The strobe shall be selectable for a continuous or temporal synchronized flash rate to match the horn and meet the intent of the Ontario Building Code, Appendix Clause 3.2.4.20 (1). The strobe output shall be synchronized and selectable (15, 30, 75 or 110 candela (cd)). The light output shall be an even "Full Light" pattern throughout the strobes protected area. Strobes utilizing a traditional specular reflector with uneven light distribution are not acceptable.
  - .5 The horn/strobe shall be an ultra-low profile single gang design, finished in UV stable textured red and shall not protrude more than 1" from the wall.
  - .6 All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed. The devices shall mount to a standard single gang electrical box and have an optional trim ring for 2-gang, octagonal or 4" square boxes. The signalling device series shall share a common appearance and be available in a horn, strobe or combination horn/strobe unit as listed on the plans.

## 2.8 INTELLIGENT MODULES

- .1 General
  - .1 Fire Alarm System shall incorporate microprocessor-based addressable modules for the monitoring and control of system Input and Output functions over a 2 wire electronic communications loop, using both broadcast and serial polling protocols.

- .2 All modules shall display communications and alarm status via LED indicators. The function of each connected module shall be determined by the module type, and shall be defined in the system software through the application of a personality code. All addressing of the Microprocessor-based Addressable Modules shall be done electronically, and the electrical location of each module shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out.
- .3 The addressing of the modules will not be dependent on their electrical location on the circuit. All field wiring to the Microprocessor-based Addressable Modules shall be supervised for opens and ground faults and shall be location identified to the module of incidence. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Modules to assist in troubleshooting system faults.
- .4 Each module shall be suitable for operation in the following environment:
  - .1 Temperature: 32°F to 120°F (0°C to 49°C)
  - .2 Humidity: 0-93% RH, non-condensing
- .2 Single Input Module:
  - .1 Microprocessor-based Addressable Modules shall be used to provide one (1) supervised Class B (style B) input circuit capable of latching operation for use with contact devices, non-damped water flow switches, non-latching supervisory sprinkler switches.
- .3 Dual Input Module:
  - .1 Microprocessor-based Addressable Modules shall be used to provide two (2) independent supervised Class B (style B) input circuits capable of operation with contact devices. Both of the input circuits shall be terminated to, and operated from, the same microprocessor-based addressable module.
  - .2 Modules configured for water flow operation shall have an automatic delay of 15 seconds before reporting the water flow alarm condition to the Fire Alarm Control Panel. The module shall monitor sprinkler supervisory switches and shall automatically report the supervisory function to the Fire Alarm Control Panel each time the associated dry contact closes.
- .4 Monitor Module:
  - .1 The Microprocessor-based Addressable Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The module shall automatically report the monitor function to the Fire Alarm Control Panel each time the associated dry contact closes.
- .5 Control Relay Module:
  - .1 Microprocessor-based Addressable Control Relay Modules shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc or 0.5 amps at 120 VAC to, control external appliances or equipment processes. The control relay module shall be rated for pilot duty applications. The position of the relay contact shall be confirmed by the system firmware.
- .6 Universal Class A/B Module,
  - .1 The Microprocessor-based Addressable Module Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The universal class A/B module shall support one of the following circuit types:
    - .1 Supervised Class A/B Normally-Open Alarm (Active) (Delayed) (Non-) (Latching).
    - .2 Form "C" dry relay contact rated at 2 amps @ 24 Vdc.
    - .3 Supervised Class A/B 2-wire Smoke Alarm (Verified)

- .4 Supervised Class A/B Signal Circuit, 24Vdc @ 2A.
- .7 Universal Input/Output Module Support
  - .1 Enclosure to provide mounting and wiring terminations for up to six addressable modules. The motherboard design shall provide two riser inputs that are common to all modules.

## 2.9 ACCESSORIES

- .1 Remote Annunciator
  - .1 LCD annunciator, complete with the following features:
    - .1 80 character (2 lines x 40 characters) Alphanumeric, back lit, liquid crystal display.
    - .2 Remote annunciation (audible and visual) and control functions as per control panel capabilities.
    - .3 Dedicated LED's to indicated System Alarm, Supervisory Service, System Trouble, and Power On.
    - .4 Panel mounted switches providing Alarm Silence, System Reset, and Acknowledgement of Alarm, Supervisory and Trouble conditions.
    - .5 Indication of "System Normal" status and time and date.
- .2 Weatherproof Covers
  - .1 Where noted on drawings, provide protective covers for devices located in wet or damp locations.
  - .2 STI Stopper or as recommended by fire alarm system manufacturer.
- .3 Fire Alarm Passive Graphic
  - .1 Full colour mylar film of building indicating street, building floors and fire alarm zones corresponding to the fire alarm annunciator. Provide a solid backing and enclose in an extruded aluminum metal frame with a minimum 1/8" (3mm) Plexiglas cover. Graphic is to bolted or screwed securely to the wall in location(s) as indicated on drawings. Graphic must be approved by Consultant and local fire authorities before manufacture.
  - .2 Provide a graphic adjacent to the control panel and remote annunciator.

## 3 Execution

### 3.1 SEQUENCE OF OPERATION

- .1 Operation: alarm signal operation to activate following the operation of the initiating devices as shown on drawings, including: Manual station; Fire detector; Flow Switch.
- .2 Alarm initiating devices shall be grouped in zones. The zone of the fire shall be indicated by an LED and LCD on the control panel, remote annunciators and the control panel.
- .3 The audible signals shall sound continuously at the rate of 3-3-3 pattern for the alarm.
- .4 The alarm shall sound for at least one minute after which it may be manually silenced at the alarm control panel. An "alarm silenced" LED shall turn on while the signals are in the silence mode. Should a new alarm occur on a different zone after signals are silenced the alarm devices shall resound.
- .5 An automatic alarm signal silence timer to silence the evacuation audible alarms 20 minutes after the last alarm event starts. This timer shall recycle for each alarm event.
- .6 The visual signals shall activate on alarm.



- .7 The auxiliary relay panel shall cause the following to happen:
  - .1 Signal central station / Security system.
  - .2 All designated fans and air handling equipment to shutdown as per smoke control sequence events.
- .8 Alarm initiating devices shall be grouped in zones. The zone of the fire shall be indicated by the electrically supervised lamp annunciator on the control unit and on the remote annunciators.
- .9 Operation of an alarm input device shall flash the alarm queue LED, sound a momentary audible signal, and annunciate on the alphanumeric LCD display. Display the type, condition, and a location message for the first alarm immediately without the need for operator response. Capture the display to annunciate an alarm in the event the shared display is annunciating events of a lower priority or is in the site programming mode. Turn on a respective red zone alarm LED at the control panel and at the remote annunciator.
- .10 Sort new (subsequent) events by type and log into type queues for display by emergency user selection. Sound a momentary audible signal for each event occurrence. Flash a queue LED when an unseen event exists in a queue. Update the display to annunciate the total by type and the chronological number of the event on display i.e. 3 alarm reports - #2 displayed.
- .11 Display the operational status of each signal circuit to inform the emergency user of the system signal programming.
- .12 The system manufacturer shall allow for one change to the software programming to revise the sequence of operation as directed by the Consultant.

### 3.2 INSTALLATION

- .1 The entire system shall be installed in accordance with the latest edition of CAN/ULC-S524 and the approved manufacturer's manuals and wiring diagrams.
- .2 The contractor shall furnish all labour, conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for a complete, functional life safety fire alarm system.
- .3 Provide all necessary power supply, interconnecting and remote signal wire in dedicated conduit throughout and installed in accordance with the manufacturer's wiring diagrams and the requirements of the Ontario Electrical Safety Code and the Electrical Safety Authority.
- .4 All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.
- .5 Wiring for fire alarm system shall be installed in metallic raceways (EMT conduit unless noted otherwise). Flexible metallic raceways may be utilized for drops to devices installed in drop ceilings (length not to exceed 3000mm).
- .6 Install wiring for alarm initiating circuits in separate raceway system from the alarm signal circuits.
- .7 Splicing of conductors is not permitted under any circumstances.
- .8 Wire all alarm signals in accordance with requirements by manufacturer and operation. Install resistor for signal circuit in suitable box adjacent to last signal device. If diodes are used, install in outlet box of last signal device of signal circuit and indicate on signal.
- .9 Isolation modules shall be furnished as required for site specific conditions.
- .10 Provide required number of signal circuits and wire alternatively. Meaning that signals on same circuit shall not be horizontally adjacent to each other.
- .11 Ensure continuity of ground through all raceways from ground buss in control panel to each device junction box.
- .12 Clear all wiring of shorts, opens and grounds on completion of work.

- .13 Mount detectors on ceiling as per latest edition of CAN/ULC-S524 standard unless otherwise specified herein with minimum and maximum distances as required for respective type of detector, at highest point where variations in ceiling height exist. Do not mount detectors on sides, undersides, or less than 450 mm from walls, beams, joints, ducts, open web steel joists or any obstruction (projecting more than 100mm below actual ceiling height). Do not mount detectors less than 450 mm from air handling outlets or air exhaust inlets.
- .14 Should interference from obstruction, lamp positions, air outlets or heat radiating surfaces be encountered in locating any detector where shown, locate detector as near as possible to shown position, clear of obstacles, but maintain a clear space of 450 mm on ceiling, below and around.
- .15 Identify signal circuit, alarm initiating circuit, auxiliary circuit and all other wiring at fire alarm control panel, annunciator, terminal boxes or elsewhere on completion of work with appropriate marking labels. Mark single conductors with suitable self-adhesive type, indelible numbered markers, identify cables with a clear polyester tag, attaches with a self-locking TY-RAP.
- .16 Provide, install and connect wiring and interconnecting wires and cables as specified herein, as required by control panel manufacturer and as shown on Drawings.

### 3.3 FIELD QUALITY CONTROL

- .1 Only directly prior to verification, all smoke detector protection shall be removed, and all smoke detectors shall be thoroughly cleaned.
- .2 The manufacturer's representative shall make an inspection of the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal and smoke actuated detectors and controls, whether or not manufactured by the manufacturer. The inspection shall comprise an examination and test of such equipment for the following:
  - .1 That the type of equipment installed is that designated by the specifications.
  - .2 That the wiring connections to all equipment components show that the installer undertook to have observed ULC requirements.
  - .3 That all products of combustion (smoke) detectors have been properly calibrated and adjustments set correctly.
  - .4 That the representatives equipment has been installed in accordance with the manufacturer's recommendations.
  - .5 That the supervisory wiring of all devices connected to a supervised circuit is operating and that the wiring, having been met to the satisfaction of the inspecting officials.
- .3 Testing to be done in the presence of the local building inspector and the local fire Marshall. Fire alarm system shall be verified as per the latest issue of CAN-ULCS537 Verification of Fire Alarm Systems standard.
- .4 Integration testing shall be completed in the presence of local building inspector and the local fire Marshall with a resulting report produced as per the latest issue of CAN/ULC-S1001-11 Integrated Systems Testing of Fire Protection and Life Safety System. Coordinate with Fire Protection system provider as required.
- .5 Arrange with Consultant, manufacturer of control equipment and all other installers of related and connected equipment to have a final functional acceptance test, giving ample notice to all parties concerned to be present.
- .6 Provide two - 2.0 hour (4 hours total) familiarization and instruction period, to familiarize user and/or appointed representatives, with working and function of system and equipment.
- .7 All testing methods are to be ULC approved. Do not use open flame or methods which will damage detectors. All testing methods are to be approved by the engineer prior to actual testing.

**3.4 DEMONSTRATION AND TRAINING**

- .1 Provide two (2), two (2) hour (4 hours total) familiarization and instruction sessions, to familiarize user and/or appointed representatives, with working and function of system and equipment. Sessions shall be scheduled on separate days.

**END OF SECTION**

1 General

1.1 GENERAL REQUIREMENTS

- .1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

- .1 This Section includes requirements for the supply, outdoor installation, testing and commissioning of a cartridge filter type recirculating dust collection system.
- .1 Dusts from abrasive blast cleaning of various road and railway vehicles and components in preparation for body work and coating operations.
  - .2 Return of filtered air into blast room
- .2 Work includes but is not limited to all materials and resources for supply, installation, testing, commissioning and approvals for the following:
- .1 Cartridge type dust collector complete with air movement fan(s).
  - .2 Explosion protection devices.
  - .3 Equipment platforms and access ladders/stairs and fall protection.
  - .4 Dust collection containers – forklift movable.
  - .5 Compressed air filter pulsing system.
  - .6 All electrical and controls including overall safety provisions and controls.
  - .7 Any required heaters required for operation in the installed location's outdoor climate.
  - .8 Ducting systems.
  - .9 All ductwork interconnections required between the main dust collection/filtering unit and any remotely located fan(s) and / or other related devices shall be provided as part of the general mechanical ductwork contract.
  - .10 Connections to all required utilities. (Utilities provided by Owner)
  - .11 Prestart safety review.
- .3 The dust collection system will be used with the following operations:
- .1 Dry blasting.
    - .1 Compressed air driven pressure pot systems.
  - .2 Estimated usage: 16 hours per week
    - .1 Dusts :
  - .3 Media and by-products (steel particles, paints, potential aluminum, etc.)
    - .1 Media including but not limited to sand, aluminum oxide based, other non-ferrite based
    - .2 Assumed NFPA 484 dust category:
      - .1  $50 \leq K_{st} \leq 200$  bar/m-sec.
- .4 General process:
- .1 The facility will use both dry blasting and wet (vapour) blasting systems.
  - .2 Wet and dry blasting will not normally occur on the same day.

- .3 The dust collector will only be activated during dry blasting operations.
- .4 Estimated dry blasting conveyed product generated:
  - .1 Particles and by-products: 350 lbs/ hr.

### 1.3 RELATED REQUIREMENTS

- .1 Not used

### 1.4 DEFINITIONS

- .1 Not used.

### 1.5 REFERENCE STANDARDS

- .1 Refer to the latest version of the following documents:
  - .1 Air Movement and Control Association International
    - .1 AMCA Publications 99, Standards Handbook.
    - .2 AMCA Standard 220, Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings.
    - .3 AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
    - .4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
  - .2 American Society for Testing and Materials International, (ASTM)
    - .1 ASTM A653/A653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
    - .2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
    - .3 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
    - .4 ANSI/ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
    - .5 ANSI/NFPA 91: Standard for Exhaust Systems for Air Conveying of Materials
    - .6 ANSI/AMCA Standard 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
  - .4 Canadian Standards Association
    - .1 CSA Standard C22.1, Canadian Electrical Code.
    - .2 CSA CAN3-G40.21M – Structural Quality Steels.
  - .5 Underwriters Laboratories of Canada (ULC)
    - .1 CAN/ULC-S102-1988 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.
  - .6 International Organisation for Standardization:
    - .1 ISO-5801, Industrial Fans - Performance Testing Using Standardized Airways.

### 1.6 SUBMITTALS



- .1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:
  - .1 Total Weight
  - .2 Shipping breakdowns
  - .3 Foundation loads (forces) and layout indicating placement of all electrical conduits, anchor bolts, and any equipment that must be installed in the concrete work of the foundations.
  - .4 Accessories shipped loose by packaged equipment supplier, showing their final location in field assembly.
  - .5 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.
  - .6 Unit dimensions.
- .2 Submit manufacturer's detailed composite wiring diagrams for power and control systems showing factory installed wiring, field wiring, sequences of operation and all control devices. Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.
- .3 Type of lubricants used.
- .4 Lifting plan for unloading and placing of equipment, including mass distribution drawings showing point loads and total unit weight.
- .5 Elevations, sections and details of support and operating components.
- .6 Overall Assembly / Installation drawings and related documents.

#### **1.7 CLOSEOUT SUBMITTALS/MANUALS**

- .1 Submit the following in Operations and Maintenance Manuals.
  - .1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - .2 Safety precautions.
  - .3 Functional description detailing operation and control.
  - .4 Performance criteria and maintenance data.
  - .5 Operating instructions and precautions.
  - .6 Component parts availability including names and addresses of spare part
  - .7 Suppliers.
  - .8 Consumables.
  - .9 Lubrication schedule indicating lubrication points and type of lubricant recommended.
  - .10 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.
  - .11 Detailed dis-assembly and re-assembly instructions for major components complete with photographs.
  - .12 Final tests and commissioning reports.
  - .13 Items submitted to Owner's Representative: keys, tools, special devices, maintenance manuals.
  - .14 Record Drawings.

## 1.8 QUALITY ASSURANCE

- .1 Designer Qualifications:
- .2 The design shall be prepared by persons with, or under continued direct supervision by a qualified technical person, with at least ten (10) years of experience in design of industrial dust collectors of this type and scope.
- .3 In addition, the following system designs shall be approved and stamped by a qualified Professional Engineer licenced to practice in the state or province where the system is designed and built:
  - .1 Structural design

## 1.9 MANUFACTURER QUALIFICATIONS:

- .1 The Manufacturer(s) of the system shall:
- .2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.
- .3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

## 1.10 MANUFACTURER'S REPRESENTATIVE:

- .1 A qualified manufacturer's representative shall be available to:
  - .1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.
  - .2 Be on site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):
    - .1 Initial start-up and ongoing testing. Include for 1 site day.
    - .2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 - Training.

## 1.11 DELIVERY, STORAGE AND HANDLING

- .1 The system shall be assembled, tested, and painted, and dismantled only sufficiently for proper shipment.
- .2 Pack the system components in such a way as to adequately protect them against damage during transportation, unloading, setting in place, and assembly.
- .3 Pay all charges, fees, insurance, import/export duties, custom fees and all expenses related to transportation of the system and accessories to the site.
- .4 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to unload the equipment to a designated laydown area at site.
- .5 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to move equipment from laydown area and placement at final location.
- .6 Vendor shall familiarize himself or herself with the limitations of delivering the equipment to the site. Delivery shall be by truck.
- .7 All miscellaneous materials, tools and spare parts shall be delivered to the site in sealed containers adequately protected against the intrusion of moisture or foreign matter.
- .8 Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.

- .9 All materials shall be delivered to the site with their original manufacturer's markings and identification intact.
- .10 The Owner's Representative reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog

#### **1.12 SITE CONDITIONS**

- .1 The Manufacturer is responsible for providing all necessary information to the Owner's Representative for coordination and proper relation of all work to the site.
- .2 The Manufacturer shall verify all existing dimensions of the site and of the rail equipment that relate to fabrication of the system including connecting ductwork, and notify the Owner's Representative of any discrepancy before ordering equipment and material, and starting fabrication or installation.

#### **1.13 WARRANTY**

- .1 Provide complete parts and labour warranty, with no cost to the customer, for a period of a minimum of 12 months from the date of entry into service.
- .2 Refer to Supplementary Conditions.

#### **1.14 TRAINING**

- .1 Provide training as noted below.
  - .1 On site, to train in all aspects of equipment and system(s) operation(s), repair and maintenance.
  - .2 Each of the groups listed below shall be trained on separate days as follows:
    - .1 System Operators: 2 groups of 4 persons: 1 hour session per group.
      - .1 General familiarization.
      - .2 Hands-on operation
      - .3 Basic troubleshooting.
  - .2 Maintenance Mechanics and Electricians: 2 groups of 4 persons. (1 hour per session)
    - .1 General electrical and mechanical maintenance.
    - .2 Hands on.
    - .3 Troubleshooting – basic and control system functions, including for any PLC.

#### **1.15 SPARE PARTS INFORMATION AND TECHNICAL SUPPORT**

- .1 Provide:
  - .1 Recommended list of spare parts for the complete system.
  - .2 Spare parts list shall show the original equipment manufacturer part numbers.
  - .3 Closest source of spare parts, preferably within Northern Ontario, and Canada.
  - .4 Contact number for future technical support.
  - .5 Records of unit design, fabrication and testing: maintained on file by the manufacturer for the life of the equipment (minimum of 30 years).

#### **2 Products**

##### **2.1 RECIRCULATING CARTRIDGE FILTER TYPE**

- .1 General

- .1 Refer to drawings.
- .2 CSA or ETLC approved.
- .3 Designed for outdoor installation and operation in temperatures ranging from -30C to +30C as measured in the shade.
- .4 Basis of Design:
  - .1 Camfil Gold Series
  - .2 Products meeting the specifications will be given consideration as approved equals.
- .2 Performance:
  - .1 Airflow: 56,000 CFM (26,415 Litres per second) @ 8 in. Water Column ( 3.48 kPA) external static pressure (ESP) .
  - .2 Minimum ESP does not include:
    - .1 Dust collector filter unit internal losses
    - .2 Fan inlet, internal, discharge conditions
    - .3 Any factory connections between dust collector and fan inlets
    - .4 Silencer(s)
    - .5 Explosion and backflow prevention devices supplied as part of this specification.
  - .3 Maximum available space for the required unit(s), including all unit mounted device, maintenance access requirements as indicated on the drawings.
- .3 Construction
  - .1 All steel construction.
  - .2 Minimum 10 ga steel enclosure, and as required for explosion rating of unit.
  - .3 Welded structural steel member framing and enclosure reinforcements, suitable for all imposed loads including installation location seismic, snow and wind loads.
  - .4 Framing designed for unimpeded removal / insertion of underside dust containers.
  - .5 Coatings:
    - .1 Steel to be acid washed or zinc-iron alloy coated (Galvaneal, WipeCoat, etc.) to provide enhanced corrosion protection with good paint adhesion
    - .2 All exterior surfaces to be factory painted.
      - .1 Factory standard coating and colours
      - .2 Baked on powder coat, or industrial urethane coating.
  - .6 Filter access platform
    - .1 Structural steel, with fall protection railings, kick plate, and self closing gate.
      - .1 Extended height guard rail systems as required to suit filter access requirements.
    - .2 Ladder access from grade level, with personal fall restraint system (cage alone is not acceptable).
    - .3 Designed and installed to provide ergonomically acceptable access to filters for changeout, including when the filter door is open.

- .7 Intake (dirty air) Section
  - .1 Flanged inlet
  - .2 Inlet blowback prevention damper (refer to Explosion protection section)
  - .3 Impaction baffle(s)
  - .4 Hinged filter access doors for dirty side filter removal, complete with snap lock or rotating handle door latches (threaded knobs are not acceptable)
- .8 Filtration:
  - .1 To provide recirculated air meeting the most stringent of:
    - .1 Minimum MERV 14 rating.
    - .2 Expelled dust limit: Maximum 1 milligram / cubic metre (0.45 ppm by weight)
  - .2 Vertically oriented mechanically clamped cartridge filters.
  - .3 Tool-less cartridge removal/replacement, without need to enter into the filter chamber.
  - .4 Polyester open pleated type cartridges, with 100% active media exposure.
  - .5 Filter air to cloth ratio: less than 3.6 CFM/sq.ft.
  - .6 Secondary filter system to maintain performance in case of primary filtration system failure/rupture.
  - .7 Filter cleaning:
    - .1 Automatic pulse type compressed air.
      - .1 Dedicated pulse timer board or equivalent controller
    - .2 Header pipe assemblies and steel spun venturis for optimum cleaning
    - .3 Compressed air manifold complete with pressure gauge and drain valve
    - .4 NEMA-4 solenoid valve enclosure pre-piped to mounted diaphragm valves.
    - .5 Compressed air discharge silencers
  - .8 Differential pressure purge fitting
    - .1 For connection to control panel mounted photohelic gauge
- .9 Dust Handling:
  - .1 Twin-sloped bottom hopper(s)
  - .2 Minimum 250mm diameter discharge.
  - .3 Flexible connectors to dust container lid.
  - .4 Dust collection containers
    - .1 Minimum 2 cubic yard (1.5 cubic meter) capacity steel welded fabrication, for each hopper discharge location.
    - .2 Self dump, manual lever actuated.
    - .3 Complete with hinged lids, with flexible connector receiver.
    - .4 Integral fork lift fork tubes.



- .5 Painted finish
    - .1 Urethane paint applied as per paint manufacturer's preparation and application recommendations.
    - .2 Standard factory colour.
- .10 Clean air side plenum
  - .1 Flanged air outlet c/w matching flange
  - .2 Acoustically lined.
  - .3 Quick opening inspection port.
- .4 Fan
  - .1 Preference will be given to fan(s) mounted on top of the dust collector unit.
  - .2 Industrial grade design and fabrication,
  - .3 Centrifugal backward inclined, non overloading wheel
  - .4 Premium efficiency TEFC motor
    - .1 S.F. 1.25
    - .2 Class F insulation
    - .3 Suitable for Inverter duty.
- .5 Explosion Protection
  - .1 Designed and installed as per NFPA recommendations for the stated dust KSt
  - .2 Inlet duct:
    - .1 Inlet explosion isolation system
    - .2 Flow activated passive type
    - .3 Dust collector shut down switch (in the event of isolation system activation)
  - .3 Housing:
    - .1 316 stainless steel rupture disc type.
    - .2 Burst detector.
    - .3 To operate in conjunction with inlet duct system.
    - .4 Ductwork to release vented air to safe discharge area.
    - .5 Weather hood / duct design to prevent rain/snow entry in venting ductwork.
  - .4 Discharge ductwork:
    - .1 As required by unit configuration and NFPA recommendations for air returning to work space.
      - .1 Galvanized steel or painted to match dust collector paint specifications.
- .6 Electrical:
  - .1 CSA approved components and panel(s).
  - .2 480 volt, 3 phase power connection.
  - .3 Single point power connection.
  - .4 May be integrated with main control panel

- .5 NEMA 12 enclosure, suitable for installation in Electrical room (refer to electrical drawings).
- .6 Fan Motor starter(s):
  - .1 Supplied by dust collector manufacturer:
    - .1 Integral to main control panel, or
    - .2 Separately mounted in suitable enclosure.
  - .2 Motor control method:
    - .1 Soft start, non reversing, or
    - .2 VFD drive.
- .7 Controls
  - .1 May be integrated into main power panel.
  - .2 CSA approved components and panel
  - .3 NEMA 12 enclosure, complete with,
    - .1 Lockable main disconnect, fused.
    - .2 Single point power connection.
    - .3 Control voltage: maximum 120V
    - .4 Automatic fan speed control adjustment
      - .1 Ductwork system static pressure monitoring based.
      - .2 Password protected
    - .5 Automatic pulse controller
    - .6 Local Panel / Remote Panels control selector
    - .7 Fan Mode selection: ON / OFF / AUTO
    - .8 Pulse cleaning mode selector: DEMAND / OFF/ CONTINUOUS
    - .9 System Start/stop push buttons
    - .10 Emergency Stop, non-illuminated mushroom head button
    - .11 Photohelic filter system differential pressure gauge
    - .12 Pilot lights (all to be LED):
      - .1 Local Panel /Remote Panel Control
      - .2 Fan On
      - .3 Pulse activity
      - .4 Filter change indicator
      - .5 Explosion protection system activation
        - .1 For each component of the system.
    - .13 Auxiliary contacts (minimum two input, 2 output)
    - .14 Fused door disconnect
  - .8 Remote control panel:
    - .1 Two panels for Blast Room location

- .2 NEMA 4 enclosures
- .3 Start/Stop push buttons.
- .4 LED indication of:
  - .1 System Power ON
  - .2 Fan(s) ON
  - .3 Filter changeout required
  - .4 Remote panel control active
  - .5 General explosion system actuation
- .5 Emergency Stop, non-illuminated mushroom head button

## 2.2 CONTROL SEQUENCES

- .1 Main Disconnect Switch to ON
- .2 Main Control Panel or Remote Control Panels:
  - .1 Start button depressed
    - .1 Fan motor starts
      - .1 Fan on indicator light confirms fan operation
    - .2 Dust Collector auto-pulsing module actuated
      - .1 Pulse indicator light confirms operation
      - .2 Filter cleaning pulse occurs automatically while air flows
  - .2 Stop or E-stop button depressed
    - .1 Fan motor stops
- .3 Dust collection duct damper system (by others)
  - .1 Damper system shut down signal
    - .1 Fan(s) stop
  - .2 Damper system restart signal
    - .1 Fan(s) restart.

## 3 Execution

### 3.1 PREPARATION

- .1 Provide reviewed Shop Drawings, to trades responsible for installation.

### 3.2 FACTORY TEST:

- .1 At any time during the manufacture of the equipment, subject to reasonable notice, the Owner's Representative or their designers may visit the Manufacturer's facility to inspect manufacturing and quality control processes.
- .2 The Manufacturer shall perform a comprehensive operational test of the subassemblies and system specified herein. The test shall test all components, subsystems, systems, software and hardware.
- .3 Provide all lubricants, hydraulic oils, cleaning compounds, and similar materials required for the factory test.

- .4 Any changes of equipment that can cause an unsafe condition shall be re-tested.

**3.3 INSTALLATION**

- .1 Install in accordance with reviewed shop drawings, and manufacturer's recommendations.

**3.4 TESTING AND COMMISSIONING.**

- .1 Provide all material and resources for testing of systems.
  - .1 Owner will provide dust generation for testing as required.
- .2 Make all necessary adjustments.
- .3 Complete final site cleanup.

**END OF SECTION**

1 General

1.1 GENERAL REQUIREMENTS

- .1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

This Section includes requirements for the supply, installation, testing and commissioning of a system of stainless steel open trough horizontal screw conveyors (augers) to transport used wet blast cleaning and dry blast cleaning abrasive media, water, and by-products.

The conveying systems will be used with the following operations:

- .1 Dry blasting.
- .1 Compressed air driven, pressure pot systems
  - .2 Conveyed product: Media and by-products (iron based particles, paints, etc.)
    - .1 Media including but not limited to sand, aluminum oxide based, other non-ferrite based
    - .2 Assumed media and particulate maximum density: 150 lbs/cu.ft. (2400 kg/m3)
  - .2 Vapour (wet) blasting
    - .1 Compressed air driven, water and media mixture, currently using GRACO Ecoquip EQs (skid) system with integral water tank, having the following approximate capacities (as taken from publication "Instructions EcoQuip 2™ EQs, EQc, and EQ Trailer Unit Vapor Abrasive Blast System" GRACO doc # 3A7467E rev. E)
      - .1 Maximum Water Capacity: 115 usg (435 litres)
      - .2 Maximum Abrasive Capacity: 880 lbs (400kg) based on #80 grit Garnet media
    - .2 Conveyed product:
      - .1 Soupy-slurry consisting of:
        - .1 Water,
        - .2 Wetted media (as per dry media), and
        - .3 Wetted by-products (as per dry blasting).
      - .2 Assumed water/wetted media and particulate density:
        - .1 100 lbs/ cu.ft.

1.3 GENERAL PROCESS AND RATES:

- .1 Blasting is currently operating on one 8 hour shift per day.
- .2 Dry and wet blasting will not occur on the same day.
- .3 Conveyors will move spent media, liquids and by products to the discharge location into a dewatering/media reclamation system as indicated in another specification section.
- .4 Gap between screw and trough will allow media/particulate layer to form, and liquid will tend to accumulate and drain / dry slowly through this layer.
- .5 Estimated dry blasting conveyed product generated:
  - .1 particles and by-products: 400 lbs/ hr. (185 kg/hr.)
- .6 Estimated wet blasting conveyed product generated:



- .1 Based on use of only one Ecoquip unit, that is filled twice during an 8 hour blasting shift:
  - .1 Average of 220 lbs of media in 35 gallons of water per hour (100kg of media in 145 kg (145 litres) of water per hour).
  - .2 Confirm values with end users.
- .2 Water only washdown may occur after wet blasting.
  - .1 Traces of media or particulates may be present.
  - .2 Estimated 10 usgpm (380 litres/minute) flow.
  - .3 Water will flow through blast room conveyors and into the media system dewatering unit as per normal media reclaim.

#### 1.4 RELATED REQUIREMENTS

- .1 Not used

#### 1.5 DEFINITIONS

- .1 Base Metal Thickness: Thickness dimensions are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic coated steel sheets.

#### 1.6 REFERENCE STANDARDS

- .1 All references standards specified herein imply the latest edition of the standards.
  - .1 ABMA American Bearing Manufacturer's Association
  - .2 AGMA American Gear Manufacturer's Association
  - .3 AISC American Institute of Steel Construction
  - .4 ANSI American National Standards Institute
  - .5 ASME American Society of Mechanical Engineers
  - .6 ASTM American Society for Testing and Materials
  - .7 AWS American Welding Society
  - .8 CEMA Conveyor Equipment Manufacturers Association
  - .9 CSA Canadian Standards Association
  - .10 EEMAC Electrical and Electronic Manufacturer's Association of Canada
  - .11 FM Factory Mutual
  - .12 IEC International Electrotechnical Commission
  - .13 IEEE Institute of Electrical & Electronic Engineers
  - .14 ISA International Society of Automation
  - .15 ISO International Organization for Standardization
  - .16 MPTA Mechanical Power Transmission Association
  - .17 NEMA National Electrical Manufacturer's Association
  - .18 OHS Ontario Occupational Health and Safety Act and Regulations
  - .19 OSHA Occupational Safety and Health Administration
  - .20 SAE Society of Automotive Engineers
  - .21 SSPC The Society for Protective Coating

- .22 ULC Underwriter's Laboratories of Canada
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
  - .2 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes
  - .3 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - .4 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .5 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip Plate, and Flat Bar
  - .6 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with improved Formability, and Ultra-High Strength
  - .7 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)
- .3 Canadian Standards Association (CSA):
  - .1 CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
  - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing or Irregularly Shaped Articles
  - .3 CSA-S16, Design of Steel Structures
  - .4 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members
  - .5 CSA W47.1, Certification of Companies for Fusion Welding of Steel
  - .6 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum
  - .7 CSA W59, Welded Steel Construction (Metal Arc Welding)
  - .8 CSA Z432 – Safeguarding of Machinery
- .4 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating
  - .2 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers International (NACE):
  - .1 SSPC-SP 1, Solvent Cleaning
  - .2 SSPC-SP 2, Hand Tool Cleaning
  - .3 SSPC-SP 3, Power Tool Cleaning
  - .4 SSPC-SP 6/ NACE No. 3, Commercial Blast Cleaning
- .6 The latest edition of a code or standard at the time of contract award will govern.
- .7 In addition, comply with all Local and Regional Statutory Regulations, Codes and Standards.
- .8 In the event of conflict between the drawings, specifications, data sheets and/or the purchase order, obtain clarification before proceeding with the work.

## 1.7 SUBMITTALS

- .1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:
- .2 Total Weight
- .3 Shipping breakdowns
- .4 Foundation loads (forces) and layout indicating placement of all electrical conduits, anchor bolts, and any equipment that must be installed in the concrete work of the foundations.
- .5 Accessories shipped loose by packaged equipment supplier, showing their final location in field assembly.
- .6 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.
- .7 Unit dimensions.
- .8 Submit manufacturer's detailed composite wiring diagrams for power and control systems showing factory installed wiring, field wiring, sequences of operation and all control devices. Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.
- .9 Type of lubricants used.
- .10 Lifting plan for unloading and placing of equipment, including mass distribution drawings showing point loads and total unit weight.
- .11 Elevations, sections and details of support and operating components.
- .12 Overall Assembly / Installation drawings and related documents.

## 1.8 CLOSEOUT SUBMITTALS/MANUALS

- .1 Submit the following in Operations and Maintenance Manuals.
  - .1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - .2 Safety precautions.
  - .3 Functional description detailing operation and control.
  - .4 Performance criteria and maintenance data.
  - .5 Operating instructions and precautions.
  - .6 Component parts availability including names and addresses of spare part
  - .7 Suppliers.
  - .8 Consumables.
  - .9 Lubrication schedule indicating lubrication points and type of lubricant recommended.
  - .10 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.
  - .11 Detailed dis-assembly and re-assembly instructions for major components complete with photographs.
  - .12 Final tests and commissioning reports.
  - .13 Items submitted to Owner's Representative: keys, tools, special devices, maintenance manuals.

.14 Record Drawings.

## **1.9 QUALITY ASSURANCE**

- .1 Designer Qualifications:
- .2 The design shall be prepared by persons with, or under continued direct supervision by a qualified technical person, with at least ten (10) years of experience in design of CEMA type screw conveyors, of this type and scope.
- .3 In addition, the following system designs shall be approved and stamped by a qualified Professional Engineer licenced to practice in the state or province of system is designed and built:
- .4 Electrical works.

## **1.10 MANUFACTURER QUALIFICATIONS:**

- .1 The Manufacturer(s) of the system shall:
- .2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.
- .3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

## **1.11 MANUFACTURER'S REPRESENTATIVE:**

- .1 A qualified manufacturer's representative shall be available to:
  - .1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.
  - .2 On site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):
    - .1 Initial start-up and ongoing testing. Include for 1 site day.
    - .2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 - Training.

## **1.12 DELIVERY, STORAGE AND HANDLING**

- .1 The system shall be assembled, tested, and painted, and dismantled only sufficiently for proper shipment.
- .2 Pack the system components in such a way as to adequately protect them against damage during transportation, unloading, setting in place, and assembly.
- .3 Pay all charges, fees, insurance, import/export duties, custom fees and all expenses related to transportation of the system and accessories to the site.
- .4 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to unload the equipment to a designated laydown area at site.
- .5 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to move equipment from laydown area and placement at final location.
- .6 Vendor shall familiarize himself or herself with the limitations of delivering the equipment to the site. Delivery shall be by truck.
- .7 All miscellaneous materials, tools and spare parts shall be delivered to the site in sealed containers adequately protected against the intrusion of moisture or foreign matter.

- .8 Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.
- .9 All materials shall be delivered to the site with their original manufacturer's markings and identification intact.
- .10 The Owner's Representative reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog

#### 1.13 SITE CONDITIONS

- .1 The Manufacturer is responsible for providing all necessary information to the Owner's Representative for coordination and proper relation of all work to the site.
- .2 The Manufacturer shall verify all existing dimensions of the site and of the rail equipment that relate to fabrication of the system including infeed conveying systems and rail transfer table systems and notify the Owner's Representative of any discrepancy before ordering equipment and material, and starting fabrication or installation.

#### 1.14 WARRANTY

- .1 Provide complete parts and labour warranty, with no cost to the customer, for a period of 12 months from the date of entry into service.
- .2 Refer to Supplementary Conditions.

#### 1.15 TRAINING

- .1 Provide training as noted below.
  - .1 On site, to train in all aspects of equipment and system(s) operation(s), repair and maintenance.
  - .2 Each of the groups listed below shall be trained on separate days as follows:
    - .1 System Operators: 2 groups of 4 persons: 1 hour session per group.
      - .1 General familiarization.
      - .2 Hands-on operation
      - .3 Basic troubleshooting.
- .2 Maintenance Mechanics and Electricians: 2 groups of 4 persons. (1 hour per session)
  - .1 General electrical and mechanical maintenance.
  - .2 Hands on.
  - .3 Troubleshooting – basic and control system functions, including for any PLC.

#### 1.16 SPARE PARTS INFORMATION AND TECHNICAL SUPPORT

- .1 Provide:
  - .1 Recommended list of spare parts for the complete system.
  - .2 Spare parts list shall show the original equipment manufacturer part numbers.
  - .3 Closest source of spare parts, preferably within Northern Ontario, and Canada.
  - .4 Contact number for future technical support.
  - .5 Records of unit design, fabrication and testing: maintained on file by the manufacturer for the life of the equipment (minimum of 30 years).



2 Products

2.1 TROUGHED SCREW CONVEYORS

.1 General

- .1 Provide complete conveyor systems, complete with control functions, as indicated on the drawings and in this specification.
- .2 The equipment operates indoors in a humid, wet and dusty environment. Provide all necessary safeguards and protection for optimal performance of the equipment.
- .3 Provide equipment having a minimum design life of thirty (30) years for operation at rated design loading for.
  - .1 16 hours per day, 5 days per week, 50 weeks per year.
- .4 Standardize equipment sizes to the maximum extent possible to keep the cost of spare parts to a minimum.
- .5 Ensure screw conveyors and feeders start, operate, and stop smoothly and safely in the fully loaded condition under normal/emergency and all climatic conditions without over-stressing of components, structures, or associated systems.
- .6 All warning signs and safety signs shall be in the English language and/or using pictograms.
- .7 Provide all assemblies and components with suitable lifting devices to allow for easy off-loading, installation, and removal at site.
- .8 Provide lifting lugs or devices for components heavier than 20 kg.

.2 Safety

- .1 The design shall conform to all safety and personnel protection requirements of The Occupational Health and Safety Act (OHSA), and of all Authorities Having Jurisdiction.
- .2 A pre-start safety review shall be provided.
- .3 Provide safety guards around all moving parts in accordance with Occupational Safety and Health Administration (OSHA).
- .4 Provide dust-tight covers to protect any exposed parts where dust penetration might be harmful.

.3 Technical Requirements

- .1 Design, fabricate, inspect and test screw conveyors to be suitable for site conditions and in accordance with this specification, and the current versions of the following specific standards:
  - .1 ANSI / CEMA 350 – Screw Conveyors for Bulk Materials;
  - .2 ANSI / CEMA 300 – Screw Conveyors – Dimensional Standards;
  - .3 ASME B20.1 – Safety Standard for Conveyors and Related Equipment.
- .2 It is not intended for the Vendor to depart this standard specification; however, clearly list and explain any deviation from this specification in the proposal. The lack of such listing will indicate that no such deviation exists.

.4 Materials of Construction

- .1 Provide materials of construction in accordance with the specification, equipment data sheets, drawings and the Vendor's recommendation for the duty and service conditions specified.

- .2 Ensure no substitution of the materials of construction after the purchase order has been issued. Substitutions require written approval by the Engineer.
- .3 Fabricate all equipment using only new materials of first grade quality, free from defects impairing strength, durability and appearance.
- .5 Mechanical
  - .1 General
    - .1 Design equipment to withstand the loadings exerted by drive, material load, weight of the equipment, reaction of supports, impact, shock, temperature, internal and external pressure, earthquake, and any other loadings that may be present.
    - .2 Design equipment for ease of cleaning and maintainability.
    - .3 Ensure material discharge from a screw conveyor is continuous, at the rate at which it is received, without significant conveyor induced pulsing or surging.
    - .4 Ensure that all of the installation conforms in all respects to environmental standards, and occupational safety and health standards for air emissions and exposure limits.
    - .5 Include in the documentation or drawings all materials specifications, dimensions, tolerances, and fits for the proper design, supply, manufacture, fabrication, and assembly of conveyor components. Do not change the design, materials, specifications, dimensions, tolerances, and fits without the written approval of the Engineer.
    - .6 All information shown on the documents and drawings are for reference only. Vendor is to verify all the provided data and is responsible for screw conveyors design.
    - .7 Screw conveyor sizing may vary in the final design.
  - .2 Screw Flighting
    - .1 Design screw for the product as described in this specification.
    - .2 Vendor to recommend type of screw flight/pitch based on material handled.
    - .3 Minimum outside diameter: 9 inches (225 mm).
    - .4 Provide all screw conveyors with sectional type flighting, minimum 4.7 mm (3/16") thick AR200 steel, full pitch, continuously welded both sides on steel schedule 40 pipes, and complete with flange on both ends for couplings and end shaft connections. Provide hard surfacing on the edge and leading face of the screw flights.
    - .5 Provide screws with a centre tube made from a single piece of straight seamless pipe or tubing of required schedule with a solid piece of shaft at the end of each pipe.
    - .6 Ensure consecutive flights are aligned so that the end of one flight and the beginning of the next flight are in the same place.
  - .3 Shafts
    - .1 Fabricate drive and tail shafts from steel, welded to flange for screw flighting connections. Surface harden all shafts. Tightly fit shafts into the tube and drill both pieces to ensure alignment. Ensure the entire assembly, including flights, is true after all operations have been completed.

- .2 Provide flanged couplings for all screw flight connections. Fabricate couplings from SPS 245 steel or equal. Harden all couplings.
- .3 Ensure shafting is free of any sharp corners and shaft ends are chamfered.
- .4 Ensure drive shafts and pipe ends are designed with a minimum safety factor of 2.0 for both bending and torsion.
- .5 Ensure support shafts are the same diameter as the drive shaft.
- .6 Machine pipe ends to a 0.005" shaft clearance fit in such a manner to ensure drive and floating shaft are parallel and on the same centres.
- .7 Provide quick release keys on both ends of the shaft.
- .8 Large diameter shafts may be turned down at bearing and attachment locations. Limit turn-downs to the following ratios:
  - .1 Major/minor diameter:  $\leq 1.50$
  - .2 Fillet radius/minor diameter:  $\leq 0.025$
- .9 Coat all exposed areas of the shaft with a thick layer of non-water soluble rust inhibitor.
- .4 Hangers and Hanger Bearings
  - .1 Minimize the quantity of conveyor hangers.
  - .2 Ensure all hangers have a rigid, formed steel frame that provides the least obstruction to the flow of material. Type 226 hangers with white iron bushings are preferred.
  - .3 Mount all hangers inside the conveyor trough and equip them with slotted holes to facilitate assembly and alignment.
  - .4 Ensure hanger materials match the materials used for screw flighting.
  - .5 Provide non-expansion bearing on the drive side and expansion bearing on the other side. Ensure all bearings supports have a shim allowance for vertical adjustment and adjusting screws for horizontal adjustment. Position bearings cold to allow for thermal growth.
  - .6 Ensure hanger bearings are not installed under or over inlet or discharge chutes. Flanged bearings are not acceptable.
- .5 Drives
  - .1 Ensure screw conveyor drives are sized to start in a fully loaded "flooded" condition (i.e. 100% trough load).
  - .2 Ensure all drive assemblies are shop assembled, inspected and undergo performance testing before shipment to site.
  - .3 Provide in-line planetary gear drive or shaft mounted drive, for motor sizes up to 55 kW (75 HP). Provide shaft mounted speed reducers complete with torque arm and motor mounting brackets..
  - .4 Provide a dual bearing support system for the head end shaft for shaft mounted reducers.
  - .5 Select speed reducers with mechanical power rating in accordance with AGMA Class II standards, with a minimum service factor of 1.4 based on the installed motor power rating.

- .6 Select speed reducers with thermal rating that is not less than the motor nameplate power. Use of external cooling for reducers is not acceptable.
- .7 Provide speed reducers with anti-friction bearings and triple labyrinth seals to exclude abrasive dust particles, dirt, and moisture from entering the bearings.
- .8 Provide speed reducers with cast steel housings, equipped with air breathers designed for use in a dusty atmosphere.
- .9 Provide lubrication fittings that are readily accessible for proper maintenance.
- .10 Ensure breather oil filler port and drain are specific to mounting locations.
- .11 Provide sight glass oil level indicator.
- .12 Ensure all screw conveyors are equipped with zero speed switches.
- .13 Provide a common base plate with electric motors, couplings, and other drive components.
- .6 Trough End Bearings
  - .1 Provide trough ends with outboard, self-aligning, adapter mounted roller bearings, SKF Explorer Series or equivalent.
  - .2 Ensure bearing selection process and rating of bearings is in accordance with ABMA standards with a minimum L10 bearing life of 100,000 hours.
  - .3 Provide pillow blocks with triple labyrinth (taconite) seals to prevent the ingress of dust or water to the bearings. Select the labyrinth seal to avoid sliding contact and minimize resistance to rotation as much as possible.
  - .4 Provide thrust bearings at the discharge end of screw conveyors so as to place the screw in tension.
  - .5 Ensure end bearing has sufficient floating space for thermal expansion.
- .7 Trough End Seals
  - .1 Provide split type packed gland seals where the drive shaft extends through the trough.
  - .2 Locate the seals outside the trough to facilitate assembly and replacement of packing material. Provide access for removal/re-stuffing of packing gland during maintenance without removal or any other item.
- .6 Troughs
  - .1 Trough(s) for the cross screw conveyor shall, by design or by hanger design, provide a slope 1% towards the final discharge location. All other troughs shall be installed horizontally without slope.
  - .2 Trough design shall accommodate the transition of dry and wetted by products from the concrete floor of the room, into the trough by the transfer plate (by other).
    - .1 Refer to detail on drawings.
  - .3 Provide U-troughs with formed gasketed connection flanges, constructed from a minimum 10 gauge (3.2mm) thick 304 stainless steel material.
  - .4 Trough design to accommodate concrete floor to trough transition flanges, for flow of wet or dry blasting by-products, and water in general.
  - .5 Ensure trough ends are suitable for the end bearings and seals used.

- .6 Fabricate the end plates from a minimum 6 mm thick plate of the same material as the trough.
- .7 Provide gaskets at the flanged inlet and outlets and all the trough connections.
- .7 Trough Covers
  - .1 Provide trough covers fabricated from the same material as the trough, where required for safety, and where trough is not otherwise guarded/covered.
  - .2 Provide covers with flanged and drilled inlet spout(s) where required.
  - .3 Provide the trough cover with a neoprene gasket and quick release pivoted multiple style spring clamps attached via chain.
- .8 Supports
  - .1 Provide and fabricate all required trough supports, and any other required supports from minimum 6 mm thick plate of the same material as the trough.
  - .2 Troughs shall be supported from the floor of the trench in which the augers are being installed.
  - .3 Provide sliding supports to consume thermal expansion of troughs along the conveyors.
  - .4 Provide fixed support at drive side and sliding supports along the troughs.
  - .5 Cross screw conveyor trough supports shall accommodate or provide the 1% trough slope of that auger.
  - .6 Supports shall provide vertical, horizontal, and lateral support and restraint of the overall conveyors, using mechanical fasteners or other means not requiring cutting or welding for removal and reinstallation.
- .9 ELECTRICAL SYSTEMS
  - .1 All electrical components and systems delivered to site must have CSA, cUL/ULC, or equivalent third party certification acceptable to the Authority Having Jurisdiction. The Manufacturer shall be responsible for all resources and costs to obtain any special acceptances required from the Authority Having Jurisdiction.
  - .2 Main power supply: 480 Volt / 3 phase / 60 Hz:
  - .3 Transformation to other voltages if required shall be included as part of the supply of this equipment.
  - .4 Single point power connection to main power/control panel.
  - .5 Conformance to the requirements of the Canadian Electrical Code, all applicable CSA standards and those of the Authority Having Jurisdiction.
  - .6 All Blast Room and Reclaim Room area enclosures, wiring and devices, and installation methods shall be designed for interior use in a dusty and wet environment, All penetrations and cabinet entry points to use watertight and vapour tight glands and seals.
  - .7 Motors:
    - .1 TEFC
    - .2 Class F insulation, 40C Ambient,
    - .3 1.15 SF
    - .4 Inverter duty rated if used with VFDs
  - .8 Main system power cabinet to include lockable disconnect switch.



- .9 Integral reversing motor starters.
  - .1 Line voltage starters acceptable for motors up to 6kW (5HP)
  - .2 VFD or softstart to be used for motors greater than 6kW (5HP)
- .10 Machine grounding:
  - .1 Ground all electrical equipment.
  - .2 All electrical components and systems shall be factory installed onto the system subassemblies so that field wiring shall be limited to interconnection between the individual subassemblies by installing contractor.
- .10 GENERAL CONTROL REQUIREMENTS:
  - .1 Maximum 120 volt control voltage.
  - .2 Conformance to all applicable CSA standards and those of the Authority Having Jurisdiction.
  - .3 Control system design shall include the design of full system including all required control and communication wiring, using rigid conduit for all routing.
  - .4 Key control: Operations of all functions shall be prevented without the key. Same key shall operate all control panels. Provide 4 such keys.
  - .5 The make and model of any PLC used in the design must be confirmed as acceptable with the Owner's Representative.
  - .6 All indicators and other lights to be LED type.
  - .7 Control Station:
    - .1 NEMA 12 enclosure with hinged clamp type closure cover, unless otherwise indicated.
    - .2 Engraved anodized aluminum legend plates with contrasting text colour mechanically fastened to enclosure or device.
    - .3 Plastic lamacoid identifiers may only be used inside of enclosures, unless otherwise approved by Owner's Representative.
    - .4 Control devices mounted in the cover shall be shop wired, bundled and wired to a terminal strip mounted to a stand-off panel in the enclosure.
    - .5 All control components and systems shall be factory installed onto the system subassemblies so that field wiring shall be limited to interconnection between the individual subassemblies by installing contractor.
- .11 CONVEYOR CONTROL SYSTEM OPERATIONS:
  - .1 Main control panel (in Electrical Room).
    - .1 Controls may be integrated into main power/disconnect panel.
    - .2 ON/OFF:
      - .1 Drive system power ON/OFF
      - .2 LED indicator light.
    - .3 Local/Remote Selector
      - .1 Local: control from main panel
      - .2 Remote: control from panels in Blast Room and Reclaim Room

- .4 Conveyor Directional Selector for each conveyor drive system:
  - .1 Forward/OFF/Reverse Selector:
    - .1 Forward:
      - .1 Maintained Normal position.
      - .2 Conveyors feeding to discharge
    - .2 Reverse:
      - .1 Momentary - hold to maintain.
      - .2 Conveyors feeding away from discharge
  - .2 With LED directional indicators.
- .5 Emergency Stop:
  - .1 Mushroom button (backlight type) for drive system.
  - .2 Stops all drives.
- .6 Motor status indicators:
  - .1 For each drive motor.
  - .2 Running indicator
  - .3 Motor fault/not running
- .2 Blast Room and Reclaim Room Control Panels
  - .1 NEMA4 enclosure, with hinged clamped closure cover.
  - .2 Locations:
    - .1 Blast room: wall near cross auger location. Field confirm.
    - .2 Reclaim Room: wall adjacent to conveyor discharge location. Field confirm.
- .3 One panel as follows (North wall of Blast Room)
  - .1 Conveyor Directional Selector for each conveyor drive system:
  - .2 Control panel active LED indication of
  - .3 Forward/OFF/Reverse Selector:
    - .1 Forward:
      - .1 Maintained Normal position.
      - .2 Conveyors feeding to discharge
    - .2 Reverse:
      - .1 Momentary - hold to maintain.
      - .2 Conveyors feeding away from discharge
  - .4 Emergency Stop:
    - .1 Mushroom button (backlight type) for drive system.
    - .2 Stops all drives.
  - .5 Motor status indicators:
    - .1 For each drive motor.

- .2 Running indicator
      - .3 Motor fault/not running
    - .4 One panel as follows (South wall of Blast Room)
      - .1 Emergency Stop:
        - .1 Mushroom button (backlight type) for drive system.
  - .12 PAINTING AND LABELLING
    - .1 Prime and finish coat the equipment with the exception of wearing surfaces, and non-ferrous materials not requiring atmospheric protection.
    - .2 Coating system as follows, or approved equivalent:
      - .1 Primer: High solids, rust inhibitive, universal, phenolic alkyd metal primer.
        - .1 SSPC-SP6/NAC 3 preparation.
        - .2 Apply coating within 8 hours of blasting to avoid flash rusting.
        - .3 Minimum DFT: 3 mils
        - .4 Sherwin Williams Kem Bond HS or approved equivalent.
      - .2 Top Coat: urethane alkyd enamel
        - .1 Preparation as per manufacturer's recommendation.
        - .2 2 coats, DFT: 2 mils per coat.
        - .3 Sherwin Williams Pro Industrial, or approved equivalent.
    - .3 Colour: safety yellow or as otherwise approved by Owner's Representative, from coating manufacturer's standard colours.
  - .13 Labels:
    - .1 Language – all signs, controls, documentation, etc. to be provided in English
    - .2 To include industry recognized graphical symbols where they exist.
- 3 Execution
  - 3.1 **FACTORY TEST:**
    - .1 At any time during the manufacture of the equipment, subject to reasonable notice, the Owner's Representative or their designers may visit the Manufacturer's facility to inspect manufacturing and quality control processes.
    - .2 The Manufacturer shall perform a comprehensive operational test of the subassemblies and system specified herein. The test shall test all components, subsystems, systems, software and hardware.
    - .3 Provide all lubricants, hydraulic oils, cleaning compounds, and similar materials required for the factory test.
    - .4 Any changes of equipment that can cause an unsafe condition shall be re-tested.
  - 3.2 **INSTALLATION**
    - .1 Install in accordance with reviewed shop drawings, and manufacturer's recommendations.
  - 3.3 **TESTING AND COMMISSIONING.**
    - .1 Provide all material and resources for testing of systems.

- .1 Owner will provide media for conveyor loading.
- .2 Make all necessary adjustments.
- .3 Complete final site cleanup.

**END OF SECTION**

1 General

1.1 GENERAL

- .1 Design, manufacture, supply, installation, testing, and certification of a fully operational underslung overhead travelling bridge crane.
- .2 Coordination with Supplier and Installer of crane runway beams as required.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedure
- .2 Section 01 74 11 - Cleaning
- .3 Section 01 74 21 – Construction Demolition Waste Management and Disposal
- .4 Section 01 77 00 – Closeout Procedure
- .5 Section 01 78 00 – Closeout Submittals
- .6 Section 01 79 00 – Demonstration and Training
- .7 Section 05 12 23 – Structural Steel for Buildings

1.3 REFERENCES

- .1 Refer to the current versions of:
- .2 American Institute of Steel Construction (AISC):
  - .1 AISC 325 Steel Construction Manual, Thirteenth Edition.
- .3 American Gear Manufacturers Association (AGMA):
  - .1 AGMA 6013-A06, Standard for Industrial Enclosed Gear Drives.
- .4 American Society for Testing and Materials (ASTM):
  - .1 ASTM A325M, Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
  - .2 ASTM A563M, Specification for Carbon and Alloy Steel Nuts (Metric).
  - .3 ASTM-A668 – Specification for Steel Forging, Carbon & Alloy for General Industrial Use.
- .5 ASME International (ASME):
  - .1 ASME B30.16 Overhead Hoists (Underhung)
- .6 Canadian Standards Association (CSA):
  - .1 CAN/CSA-B167 – Overhead cranes, gantry cranes, monorails, hoists, and jib cranes.
  - .2 CSA Standard C22.1, Canadian Electrical Code.
  - .3 C22.2 NO. 33 - Construction and Test of Electric Cranes and Hoists.
  - .4 CAN/CSA G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CAN/CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members.
  - .6 CSA-S136.1 Commentary on CSA Standard S136.
  - .7 CSA W47.1, Certification of Companies for Fusion Welding
  - .8 Steel Structures.



- .9 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
- .10 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.
- .7 Crane Manufacturers Association of America (CMAA):
  - .1 CMAA #74 Specifications for Top Running and Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoist.
  - .2 MMA MH27.2 – Specification for Enclosed Track Underhung Cranes and Monorail Systems
- .8 Monorail Manufacturers Association (MMA)
  - .1 Monorail Manufacturers Association (MMA) MH27.1 – Specification for Patented Track Underhung Cranes and Monorail Systems

#### 1.4 DESIGN RESPONSIBILITY

- .1 The crane shall be designed by a Professional Engineer, registered in the Province of fabrication, with a minimum of 5 years of experience in the design of this type of equipment.
- .2 The Professional Engineer shall be responsible for establishing design requirements, compliance to applicable codes, standards and regulations, testing and commissioning of system and providing final certification of system.

#### 1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings shall include all the major systems including and not limited to the following information:
  - .1 General arrangement drawing showing:
    - .1 Overall crane layout in relation to the building
    - .2 Overall dimensions and clearances.
    - .3 Hoist capacity.
    - .4 Hook lift and reach coverage, including dimensions relative to the nearest building gridline(s).
  - .2 Other important features of the crane.
    - .1 Runway and bridge conductor arrangement.
  - .3 Crane identification number.
  - .4 CMAA classification.
  - .5 Total weights, crane wheel loads, reaction loads at interface and terminal points. Provide details of bridge wheel/crane rail and bridge/end stop interfaces.
  - .6 Electrical drawings, showing load and power requirements, schematic wiring diagram, electrical connection point, control panel, inter-wiring details, bill of material for electrical components, lockout, etc.
  - .7 Type of primer and coatings.
  - .8 Bill of materials.
- .3 All shop drawings shall be prepared and stamped by Professional Engineers of respective disciplines registered in the Province of Ontario.

## 1.6 QUALIFICATIONS

- .1 Supplier, and Installing Contractor, and its personnel shall have a minimum five years of demonstrated experience in the related field of design, fabrication, installation, testing and certification of this type of equipment.

## 1.7 QUALITY ASSURANCE

- .1 Manufacturer's technical representatives shall supervise the installation, testing and commissioning of the respective equipment and components.

## 1.8 DESIGN REQUIREMENTS

- .1 Design cranes in accordance with the applicable standards and codes.
- .2 Design crane systems to be capable of lifting the full rated capacity at any location along the crane bridge and runway beam.
- .3 Crane systems shall be designed to fit within the space allocated on the drawings.
- .4 Cranes shall remain operational under the following conditions:
  - .1 Building sway under wind loads:  $H/400$  (H: Height of building).
  - .2 Deflection of building roof trusses and beams under live loads:  $L/360$  (L: Span)
  - .3 Deflection of roof joists under live loads:  $L/240$  (L: Span)
  - .4 Vertical deflection of bridge crane runway beams under crane loads:  $L/1000$  (L = span)
  - .5 Lateral deflection of bridge crane and monorail runway beams under crane loads:  $L/600$  (L = Span)
- .5 Each wire rope shall be capable of lifting its full rated capacity from the floor level to the clear hook height.

## 1.9 PRE-START HEALTH AND SAFETY:

- .1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

## 1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

## 2 Products

### 2.1 ELECTRIC TRAVELLING OVERHEAD CRANE

- .1 Performance:
  - .1 Capacity: 2 tons (1800 kg)
  - .2 Operating Dimensions:
    - .1 Refer to the drawings
    - .2 Maximum installed height to highest point of crane: refer to drawings?
    - .3 Minimum clearance under crane bridges: 19 ft – 6 in. (6000 mm).
    - .4 Minimum hook lift, as measured from hook bowl to floor: 19 ft. – 6 in. (6000 mm)
  - .3 Variable Operating Speed, all motions powered.
  - .4 Accelerate to, operate at, and brake from all operating speeds under full load, according to CMAA requirements.
  - .5 Provide maximum operating speeds of at least:

- .1 Hoist ft/min (m/min.): 15 (4.5)
- .2 Trolley ft/min (m/min.): 20 (15.2)
- .3 Bridge ft/min (m/min.): 60 (18.3)
- .2 General
  - .1 Design in accordance with all applicable standards including CSA, HMI and CMAA specifications, whichever is more stringent, and meet the requirements described in the specifications.
  - .2 Welding shall be to CSA standards and AWS.
  - .3 Welders shall be qualified under the Canadian Welding Bureau.
  - .4 Sub-assemblies or pre-welded assemblies imported from US shall be qualified under the AWS.
  - .5 End stops may not act on bridge wheels.
  - .6 Provide safe, smooth acceleration of a full load from rest to maximum speed for the crane bridges, trolleys and hoists.
  - .7 Provide for "inching" or "jogging" of the crane bridges, trolleys and hoists under full load to allow for correct positioning of the load.
  - .8 Provide drop-stop lugs on all underslung trolleys, and all underslung end trucks.
- .3 Bridge
  - .1 Wheelbase of the trucks shall be designed to CMAA standards.
  - .2 Dedicated end plates for bridge travel end stop contact.
  - .3 End trucks
    - .1 Minimum four wheels per end truck with a minimum of one driven wheel per end truck.
    - .2 Separate synchronized motor drive for each end truck, with integral electrically released brake.
    - .3 Enclosed ball or roller bearing gear drive speed reducer for each driven wheel.
  - .4 Trolley
    - .1 Electric motor with integral electrically released brake.
    - .2 Rigid construction designed to transmit full loads to bridge.
    - .3 Energy absorbing end stop bumpers.
  - .5 Hoist
    - .1 Wire rope type.
    - .2 Electric motor with multi-stage, totally enclosed ball or roller bearing gear reduction.
    - .3 Load speed control.
    - .4 Electrically released load holding brake.
    - .5 Flexible shaft coupling for separate base mounted motors.
    - .6 CMAA 70 Class C or equivalent HMI rating.
    - .7 Wire rope guide.

- .8 Overload protection (adjustable) set for 110% of the rated capacity.
- .6 Wire Rope
  - .1 Minimum of three full wraps of rope remaining on drums with hook contacting floor.
  - .2 Provide manufacturer's certificate for minimum breaking strength of each wire rope.
  - .3 End connections designed for 100% of rope breaking strength, and in accordance with rope manufacturers recommended practice.
- .7 Hooks and Hook Blocks
  - .1 360 swivel type hook with ball or roller thrust bearing.
  - .2 Steel safety latch and spring.
  - .3 Fully enclosed load sheaves on sealed ball or roller bearings.
  - .4 Forged steel hook rated for lifting applications.
  - .5 Provide test certificates for each hook.
  - .6 The hook blocks shall have permanent capacity marking.
- .8 Controls:
  - .1 Voltage not to exceed 120 volts.
  - .2 Radio remote control system with receiver and transmitter
    - .1 Crane manufacturer's recommended product.
    - .2 Non-licenced type
    - .3 Conformance to all requirements of all Authorities Having Jurisdiction for the location of the installation and use.
    - .4 Minimum 100 ft. operating range
    - .5 Rechargeable batteries (2 sets) and charger.
    - .6 Belt Pack type
    - .7 Stepless joystick controls.
    - .8 Motion control as follows:
      - .1 Bridge: North, South
      - .2 Trolley: East, West
      - .3 Hoist: Up, Down
      - .4 E-stop
      - .5 Start/Horn actuation
- .4 Runway and Structure:
  - .1 The runways shall consist of standard structural steel shapes, included as part of the building roof structure installations.
- .5 Painting
  - .1 All surfaces of the structural crane parts shall be cleaned, primed and painted.

- .2 Clean metal surfaces shall be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.
- .3 Apply two coats of industrial grade paint on the surfaces of the structure crane parts.
- .4 Finish color shall be safety yellow.
- .5 Apply rust preventing compound on machined surfaces.
- .6 After completion of installation, thoroughly clean and touch-up the paint work as required.
- .6 Labelling:
  - .1 Provide crane systems with permanent capacity labels as follows:
    - .1 Rated capacity in kilograms.
    - .2 Marked on each side of the bridge girder.
  - .2 Hook block permanently marked with system capacity.
  - .3 Place the rated capacity labels on crane, hoist and load blocks at height and location easily read from floor level and loading position.
  - .4 Underside of the bridge shall be permanently labelled with arrows indicating direction of travel, which coordinates with the directions shown on the transmitter control.
  - .5 A corrosion- resistant nameplate shall be fixed to the bridge, and trolley/hoist assembly with the following information.
    - .1 Name of manufacturer
    - .2 Mfg.'s model number and serial number
    - .3 Capacity in Kilograms
    - .4 Date of manufacture (month and year)

## 2.2 ELECTRICAL REQUIREMENTS

- .1 Main Power: 480 volt / 3phase / 60hz.
- .2 Provide and install all electrical equipment, runway conductors, load side power and control wiring for the complete operation of the crane systems as described in this specification.
- .3 Electrical Motors:
  - .1 Crane duty.
  - .2 Motor shall have class "F" insulation and shall be thermally protected by heat sensors embedded in the windings.
- .4 Controllers:
  - .1 Thermal magnetic circuit breaker or fused disconnect switch over current and short circuit protection for each motor and controller in all three phases.
  - .2 Lockable breaker or disconnect switch, for OFF position.
  - .3 Circuit breaker shall be provided for each individual crane motor.
  - .4 Provide standard controls VFD on all motions.
  - .5 Limiting Devices:
    - .1 Hoist Movement:



- .1 Provide a geared limit switch on each hoist drum to control upper and lower limit range.
- .2 Set lower limit to protect minimum 3 wraps on the drum.
- .6 Electrical Wiring, Conduit and Fittings:
  - .1 Threaded rigid steel conduit shall be used. Electrical metallic tubing (EMT) not acceptable.
  - .2 Wiring – stranded copper, in accordance with CSA C22.1, except minimum size 12 AWG XLPE RW90.
  - .3 Wiring between controllers and resistors – heat, moisture and abrasion resistant cable.
- .7 Provide individual power factor correction capacitors, for all motors 3.7 kW and larger. Size capacitor to achieve a power factor of 0.95 pf.
- .8 All wiring connections to electrical equipment in control enclosures shall be terminated on terminal strips with lugs or spades and properly identified with slip on plastic labels.
- .9 A separate green insulated ground conductor shall be provided to establish effective grounding system of all electrical equipment such as motors, brakes, starters, pull button stations, boxes, etc.
- .10 Cross bridge electrification shall be festooned cable on trolleys and track.
- .11 Runway shall be electrified using insulated conductor bars.

## **2.3 MAINTENANCE AND SERVICING DESIGN**

- .1 Make all parts subject to servicing, adjustment or replacement by operating or maintenance personnel readily accessible. Design which renders servicing, adjustment or replacement unduly difficult under field conditions will not be acceptable.
- .2 Provide any special tools required for servicing or adjustment..
- .3 Plan manufacturing, delivery, installation, testing, commissioning and certification of crane systems to meet the approved construction schedule.
- .4 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.
- .5 Verify the installation of the crane runway beam prior to the installation of the crane rail. Any deviations to the runway steel shall be reported and documented for rectification. The report shall be provided to builder and consultant.

## **3 Execution**

### **3.1 INSTALLATION**

- .1 Erect crane support structure to tolerances per CMAA 74 and CSA S16.
- .2 Install crane systems in accordance with drawings and specifications meeting the requirements of all applicable codes, standards, specifications and regulations.
- .3 Do not modify crane components in any manner without advance, written approval by crane manufacturer.
- .4 Provide all necessary material, labour, tools and equipment for the installation.
- .5 Ensure that installation is carried out within the tolerances specified in this Section, and applicable codes and standards.

- .6 Complete all necessary electrical connections to building connection point.
- .7 Supply and install supports, hangers, etc. required to support electrical services from building connection point to cranes.
- .8 Upon completion of installation, touch up and restore to new condition, damaged or defaced factory finished surfaces.
- .9 Remove protective coverings and clean exposed surfaces after completion.
- .10 Install the main disconnect and control panel for the crane at an accessible location at ground level.
- .11 All hoist equipment shall be installed in accordance with manufacturer's instructions and recommendations.
- .12 Bolted connections shall be in accordance with torque tightening procedures specified in
- .13 AISC Manual, Part 5.

### **3.2 TESTING, COMMISSIONING, CERTIFICATION AND TRAINING**

- .1 All crane equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the bridge and trolley to determine the following:
  - .1 The equipment shall perform smoothly and safely.
- .2 All tests shall be carried out with the crane systems loaded at 125 percent of capacity.
- .3 Provide all necessary material, labour, tools and equipment required for all testing and commissioning.
- .4 Supplier shall provide the test weight loads.
  - .1 Test weights shall be of minimal size and clearly labelled.
- .5 Any defects shall be corrected by the Supplier without any expense to the Consultant.
- .6 Hook Block Tests
  - .1 Establish a permanent throat base reference dimension before proof load testing, by making two trammel point marks on opposite sides of the hook throat.
- .7 Crane Tests
  - .1 Test the cranes in accordance with applicable standards.
- .8 Hook Tests
  - .1 Inspect all hooks for throat spread after completion of the crane load tests. Re-measure the distance between trammel points.
  - .2 An increase of 1% or more of the throat dimension based on the hook throat opening will constitute failure of this inspection. Replace hooks failing to pass the inspection and retest at Trade Contractor's expense.

### **3.3 TRAINING AND DEMONSTRATION**

- .1 Upon successful completion of testing and commissioning of crane, after the delivery of all documentation (manuals, drawings, certificates, etc) and prior to issuance of Certificate of Completion, carry out equipment and system demonstration and training.
- .2 Demonstrate operations and maintenance of equipment and systems and provide training to Owner's operations and maintenance personnel.
- .3 Provide certified personnel to demonstrate operation of crane.
- .4 Provide Engineer a minimum of 7 days advance notice in writing of demonstration.

- .5 Prior to demonstration, submit project record documents and operating and maintenance manuals to the Engineer.
- .6 Instruct maintenance personnel (1 hour minimum allowance) in basic maintenance and use of the crane

**END OF SECTION**

1 General

**1.1 GENERAL**

- .1 Design, manufacture, supply, installation, testing, and certification of a manual chain hoist and trolley, for monorail (by others).
- .2 Coordination with supplier and installer of monorail as required.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedure
- .2 Section 01 74 11 - Cleaning
- .3 Section 01 74 21 – Construction Demolition Waste Management and Disposal
- .4 Section 01 77 00 – Closeout Procedure
- .5 Section 01 78 00 – Closeout Submittals
- .6 Section 01 79 00 – Demonstration and Training

**1.3 REFERENCES**

- .1 Refer to the current versions of:
- .2 ASME International (ASME):
  - .1 ASME B30.16 Overhead Hoists (Underhung)
  - .2 ASME HST-2 Performance Standard for Hand Chain Manually Operated Chain Hoists
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA-B167 – Overhead travelling cranes – Design, inspection, testing, maintenance, and safe.
- .4 Hoist Manufacturer's Institute (HMI) documents.

**1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings shall include all the major systems including and not limited to the following information:
  - .1 General arrangement drawing showing:
    - .1 Overall dimensions and clearances.
    - .2 Hoist Working Load Limit (WLL).
    - .3 Trolley WLL.
  - .2 HMI classification.
  - .3 Bill of materials.

**1.5 QUALIFICATIONS**

- .1 Supplier, and Installing Contractor, and its personnel shall have a minimum five years of demonstrated experience in the related field of design, fabrication, installation, testing and commissioning of this type of equipment.

**1.6 QUALITY ASSURANCE**

- .1 Manufacturer's authorized technical representative shall supervise the installation, and testing of the respective equipment and components.

## **1.7 DESIGN REQUIREMENTS**

- .1 Design equipment in accordance with the applicable standards and codes.
- .2 Hoist shall be capable of lifting its full rated capacity from the floor level to the clear hook height.

## **1.8 PRE-START HEALTH AND SAFETY:**

- .1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

## **1.9 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.

## **2 Products**

### **2.1 MANUAL TROLLEY**

- .1 Underslung, four wheel.
- .2 Suspension system to match hoist:
  - .1 Regular Hook Suspension Type
    - .1 WLL: ½ ton (455kg)
- .3 Adjustable width – to suit monorail beam.
- .4 Steel universal tread flanged hardened wheels with permanently lubricated shielded ball bearings.
- .5 Drop stops in event of wheel failure.
- .6 Steel side plates and connector pin
- .7 Hoist suspension plate for hook mounted hoist.
- .8 Acceptable product: CM 633 series or approved equivalent.

### **2.2 MANUAL CHAIN HOISTS**

- .1 Top hook mount
  - .1 One unit: WLL: ½ ton (455 kg)
- .2 Steel or aluminum housing
- .3 Integral overload protection
- .4 Automatic brake for positive load control
- .5 Spur gearing for greater lift with minimum effort
- .6 Approved lifting chain and hook with safety latch.
- .7 Welded hand chain
- .8 Steel container for lifting chain
- .9 Machined, forged lift wheel pockets
- .10 Lift chain length: 10 ft (3m).
- .11 Acceptable Product: CM Cyclone, or approved equivalent.
- .12 Painting



- .13 Manufacturer's standard paint and colours.

## **2.3 LABELLING:**

- .1 Hook block permanently marked with hoist capacity.
- .2 A corrosion resistant nameplate shall be fixed to the trolley and hoist with the following information.
  - .1 Name of manufacturer
  - .2 Mfg.'s model number and serial number
  - .3 Capacity in tons
  - .4 Date of manufacture (month and year)

## **2.4 MAINTENANCE AND SERVICING DESIGN**

- .1 Make all parts subject to servicing, adjustment or replacement by operating or maintenance personnel readily accessible. Design which renders servicing, adjustment or replacement unduly difficult under field conditions will not be acceptable.
- .2 Provide any special tools required for servicing or adjustment.

## **3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with drawings and specifications meeting the requirements of all applicable codes, standards, specifications and regulations.
- .2 Do not modify components in any manner without advance, written approval by product manufacturer.
- .3 Provide all necessary material, labour, tools and equipment for the installation.
- .4 Ensure that installation is carried out within the tolerances specified in this Section, and applicable codes and standards.
- .5 Upon completion of installation, touch up and restore to new condition, damaged or defaced factory finished surfaces.
- .6 Remove protective coverings and clean exposed surfaces after completion.

### **3.2 TESTING, COMMISSIONING, CERTIFICATION AND TRAINING**

- .1 All equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the trolley to determine the following:
  - .1 The equipment shall perform smoothly and safely.
- .2 All tests shall be carried out with the hoist/trolley loaded at 125 percent of capacity.
- .3 Provide all necessary material, labour, tools and equipment required for all testing and commissioning.
- .4 Supplier shall provide the test weight loads.
  - .1 Test weights shall be of minimal size and clearly labelled.
- .5 Any defects shall be corrected by the Supplier without any expense to the Consultant.
- .6 Hook Block Tests
  - .1 Establish a permanent throat base reference dimension before proof load testing, by making two trammel point marks on opposite sides of the hook throat.

.7 Hook Tests

- .1 Inspect all hooks for throat spread after completion of the crane load tests. Re-measure the distance between trammel points.
- .2 An increase of 1% or more of the throat dimension based on the hook throat opening will constitute failure of this inspection. Replace hooks failing to pass the inspection and retest at Trade Contractor's expense.

**3.3 TRAINING AND DEMONSTRATION**

- .1 Upon successful completion of testing and commissioning of hoist/trolley, after the delivery of all documentation (manuals, drawings, certificates, etc) and prior to issuance of Certificate of Completion, carry out equipment and system demonstration and training.
- .2 Demonstrate operations and maintenance of equipment and systems and provide training to Owner's operations and maintenance personnel.
- .3 Provide certified personnel to demonstrate operation of hoist/trolley
- .4 Provide Engineer a minimum of 7 days advance notice in writing of demonstration.
- .5 Prior to demonstration, submit project record documents and operating and maintenance manuals to the Engineer.
- .6 Instruct personnel (1/2 hour minimum allowance) in basic maintenance and use of the hoist/trolley.

**END OF SECTION**

1 General

**1.1 GENERAL REQUIREMENTS**

- .1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

**1.2 SUMMARY**

- .1 This Section includes requirements for the design, supply, installation, testing and commissioning of a skid/frame mounted abrasive blast media reclaim system, including but not limited to the following components.
- .2 Work includes but is not limited to all materials and resources for design, supply, installation, testing, commissioning and approvals for the following:
- .1 Receiving system for used media and by products.
- .1 Dry and wet
- .2 From below grade level cross auger transporting media/by products from blast room
- .2 Primary liquid separation
- .1 Prior to, inside, or after Media elevator (see next item)
- .2 With drainage of the majority of wet blasting water to adjacent building sump or tank by other division.
- .3 Media elevator
- .1 Lift of media (dry and wet) from Receiving System to reclaim system on main floor
- .4 Media buffering.
- .1 Provide buffer space to compensate between used media/by-product delivery rates and reclaim system rates.
- .2 Provide further gravity dewatering as required.
- .5 Media bypass.
- .1 To allow by pass of reclaim system.
- .6 Wet media drying
- .1 Final drying of dewatered media.
- .2 May be incorporated with final media cleansing operations.
- .7 Media cleansing
- .1 Removal of contaminants and broken media no longer suitable for reuse.
- .2 Dust collection system to contain all dust producing activities.
- .3 Dust collection container – forklift movable.
- .8 Reclaimed Media Delivery System
- .1 From cleansing unit to clean media hopper
- .2 Dust collection
- .9 Reclaimed media receiving container.
- .10 Welded steel frame for major assembly.

- .11 Interconnecting duct work and components.
- .12 All electrical and controls including overall safety provisions and controls.
- .13 Connections to all required utilities. (Utilities provided by Owner)
- .14 Startup and Testing
- .15 Prestart safety review.
- .3 System shall be configured to fit within the spaces indicated on the drawings.

### 1.3 GENERAL PROCESS:

- .1 The facility will use both dry blasting and wet (vapour) blasting systems.
- .2 Blasting is currently operating on one 8 hour shift per day.
- .3 Dry and wet blasting will not occur on the same day.
- .4 The media reclamation will be required during both wet and dry blasting operations.
- .5 Dry blasting.
  - .1 Compressed air driven, pressure pot systems
  - .2 Conveyed product: Media and by-products (iron based particles, paints, etc.)
    - .1 Media including but not limited to sand, aluminum oxide based, other non-ferrite based
    - .2 Assumed media and particulate maximum density: 150 lbs/cu.ft. (2400 kg/m3)
- .6 Vapour (wet) blasting
  - .1 Compressed air driven, water and media mixture, currently using GRACO Ecoquip EQs (skid) system with integral water tank, having the following approximate capacities (as taken from publication "Instructions EcoQuip 2™ EQs, EQc, and EQ Trailer Unit Vapor Abrasive Blast System" GRACO doc # 3A7467E rev. E)
    - .1 Maximum Water Capacity: 115 usg (435 litres)
    - .2 Maximum Abrasive Capacity: 880 lbs (400kg) based on #80 grit Garnet media
  - .2 Conveyed product:
    - .1 Soupy-slurry consisting of:
      - .1 Water,
      - .2 Wetted media (as per dry media), and
      - .3 Wetted by-products (as per dry blasting).
    - .2 Assumed water/wetted media and particulate density:
      - .1 100 lbs/ cu.ft.
- .7 General process and rates:
  - .1 Estimated dry blasting conveyed product generated:
    - .1 Particles and by-products: 400 lbs/ hr. (185 kg/hr.)
  - .2 Estimated wet blasting conveyed product generated:
    - .1 Based on use of only one Ecoquip unit, that is filled twice during an 8 hour blasting shift:

- .1 Average of 220 lbs of media in 35 gallons of water per hour (100kg of media in 145 kg (145 litres) of water per hour).
- .2 Confirm values with end users.
- .3 Water only
  - .1 Occasional room floor washdown may occur after wet blasting.
  - .2 Traces of media or particulates may be present.
  - .3 Estimated 10 usgpm (380 litres/minute) flow.
  - .4 Water will flow through blast room conveyors and into the media system dewatering unit as per normal media reclaim.

#### 1.4 RELATED REQUIREMENTS

- .1 Not used.

#### 1.5 DEFINITIONS

- .1 Not used.

#### 1.6 REFERENCE STANDARDS

- .1 Refer to the latest version of the following documents:
  - .1 Air Movement and Control Association International
    - .1 AMCA Publications 99, Standards Handbook.
    - .2 AMCA Standard 220, Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings.
    - .3 AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
    - .4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
  - .2 American Society for Testing and Materials International, (ASTM)
    - .1 ASTM A653/A653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
    - .2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
    - .3 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
    - .4 ANSI/ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
    - .5 ANSI/NFPA 91: Standard for Exhaust Systems for Air Conveying of Materials
    - .6 ANSI/AMCA Standard 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
    - .2 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base
  - .4 Canadian Standards Association
    - .1 CSA Standard C22.1, Canadian Electrical Code.



- .2 CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
- .3 CAN/CSA-G164-M92, Hot Dip Galvanizing or Irregularly Shaped Articles
- .4 CSA-S16, Design of Steel Structures
- .5 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members
- .6 CSA W47.1, Certification of Companies for Fusion Welding of Steel
- .7 CSA W59, Welded Steel Construction (Metal Arc Welding)
- .8 CSA Z432 – Safeguarding of Machinery
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers International (NACE):
  - .1 SSPC-SP 1, Solvent Cleaning
  - .2 SSPC-SP 2, Hand Tool Cleaning
  - .3 SSPC-SP 3, Power Tool Cleaning
  - .4 SSPC-SP 6/ NACE No. 3, Commercial Blast Cleaning
- .6 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-1988 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.
- .7 International Organisation for Standardization:
  - .1 ISO-5801, Industrial Fans - Performance Testing Using Standardized Airways.

## 1.7 SUBMITTALS

- .1 Submit the following information in electronic document format (pdf, etc.) with the additional requirements as specified for each:
  - .1 Total Weight
  - .2 Shipping breakdowns
  - .3 Foundation loads (forces) and layout indicating placement of all electrical conduits, anchor bolts, and any equipment that must be installed in the concrete work of the foundations.
  - .4 Accessories shipped loose by packaged equipment supplier, showing their final location in field assembly.
  - .5 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.
  - .6 Unit dimensions.
- .2 Submit manufacturer's detailed composite wiring diagrams for power and control systems showing factory installed wiring, field wiring, sequences of operation and all control devices. Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.
- .3 Type of lubricants used.
- .4 Lifting plan for unloading and placing of equipment, including mass distribution drawings showing point loads and total unit weight.
- .5 Elevations, sections and details of support and operating components.

- .6 Overall Assembly / Installation drawings and related documents.

## **1.8 CLOSEOUT SUBMITTALS/MANUALS**

- .1 Submit the following in Operations and Maintenance Manuals.
  - .1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - .2 Safety precautions.
  - .3 Functional description detailing operation and control.
  - .4 Performance criteria and maintenance data.
  - .5 Operating instructions and precautions.
  - .6 Component parts availability including names and addresses of spare part
  - .7 Suppliers.
  - .8 Consumables.
  - .9 Lubrication schedule indicating lubrication points and type of lubricant recommended.
  - .10 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.
  - .11 Detailed dis-assembly and re-assembly instructions for major components complete with photographs.
  - .12 Final tests and commissioning reports.
  - .13 Items submitted to Owner's Representative: keys, tools, special devices, maintenance manuals.
  - .14 Record Drawings.

## **1.9 QUALITY ASSURANCE**

- .1 Designer Qualifications:
- .2 The design shall be prepared by persons with, or under continued direct supervision by a qualified technical person, with at least ten (10) years of experience in design of industrial media reclaiming systems of this type and scope.
- .3 In addition, the following system designs shall be approved and stamped by a qualified Professional Engineer licenced to practice in the state or province where the system is designed and built:
  - .1 Structural design

## **1.10 MANUFACTURER QUALIFICATIONS:**

- .1 The Manufacturer(s) of the system shall:
- .2 Demonstrate at least ten (10) years of experience designing, manufacturing, supervising installation, and providing product support for this type of equipment.
- .3 Be capable of providing product support in the areas of operation, installation, engineering and product development, repair departments, and spare parts.

## **1.11 MANUFACTURER'S REPRESENTATIVE:**

- .1 A qualified manufacturer's representative shall be available to:

- .1 Provide technical support to the installer, by telephone throughout the installation period, between 7am and 5pm Eastern Time, Monday through Friday throughout the installation period.
- .2 Be on site for a minimum of 8 hours per day at each of the following milestones (1 site day in total):
  - .1 Initial start-up and ongoing testing. Include for 1 site day.
  - .2 Training: Provide technical representative to train Owner's Representative's maintenance personnel in operation and maintenance of specified equipment as indicated in Section 1.14 - Training.

#### **1.12 DELIVERY, STORAGE AND HANDLING**

- .1 The system shall be assembled, tested, and painted, and dismantled only sufficiently for proper shipment.
- .2 Pack the system components in such a way as to adequately protect them against damage during transportation, unloading, setting in place, and assembly.
- .3 Pay all charges, fees, insurance, import/export duties, custom fees and all expenses related to transportation of the system and accessories to the site.
- .4 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to unload the equipment to a designated laydown area at site.
- .5 Provide all necessary labor, materials, hoisting equipment, tools and all incidentals required to move equipment from laydown area and placement at final location.
- .6 Vendor shall familiarize himself or herself with the limitations of delivering the equipment to the site. Delivery shall be by truck.
- .7 All miscellaneous materials, tools and spare parts shall be delivered to the site in sealed containers adequately protected against the intrusion of moisture or foreign matter.
- .8 Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.
- .9 All materials shall be delivered to the site with their original manufacturer's markings and identification intact.
- .10 The Owner's Representative reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog

#### **1.13 SITE CONDITIONS**

- .1 The Manufacturer is responsible for providing all necessary information to the Owner's Representative for coordination and proper relation of all work to the site.
- .2 The Manufacturer shall verify all existing dimensions of the site and of the rail equipment that relate to fabrication of the system including connecting ductwork, and notify the Owner's Representative of any discrepancy before ordering equipment and material, and starting fabrication or installation.

#### **1.14 WARRANTY**

- .1 Provide complete parts and labour warranty, with no cost to the customer, for a period of a minimum of 12 months from the date of entry into service.
- .2 Refer to Supplementary Conditions.

#### **1.15 TRAINING**

- .1 Provide training as noted below.

- .1 On site, to train in all aspects of equipment and system(s) operation(s), repair and maintenance.
- .2 Each of the groups listed below shall be trained on separate days as follows:
  - .1 System Operators: 2 groups of 4 persons: 1 hour session per group.
    - .1 General familiarization.
    - .2 Hands-on operation
    - .3 Basic troubleshooting.
  - .2 Maintenance Mechanics and Electricians: 2 groups of 4 persons. (1 hour per session)
    - .1 General electrical and mechanical maintenance.
    - .2 Hands on.
    - .3 Troubleshooting – basic and control system functions, including for any PLC.

#### **1.16 SPARE PARTS INFORMATION AND TECHNICAL SUPPORT**

- .1 Provide:
  - .1 Recommended list of spare parts for the complete system.
  - .2 Spare parts list shall show the original equipment manufacturer part numbers.
  - .3 Closest source of spare parts, preferably within Northern Ontario, and Canada.
  - .4 Contact number for future technical support.
  - .5 Records of unit design, fabrication and testing: maintained on file by the manufacturer for the life of the equipment (minimum of 30 years).

### **2 Products**

#### **2.1 GENERAL**

- .1 Design and provide all equipment and controls necessary to provide the overall reclaim system performance as indicated in this section.
- .2 Refer to drawings for general locations and available spaces for the system.
- .3 Designed for indoor installation and operation in temperatures ranging from 10C to +40C.
- .4 System shall be skid/frame mounted to the extent possible, to simplify original site installation and possible future relocation.
- .5 The system shall be able to process media at the following minimum rates:
  - .1 Dry Blasting / Dry media: to match the rate of used dry media delivered by cross auger, based on the production rates indicated in Part 1 of this document..
  - .2 Wet Blasting / Wet media: such that the wet media delivered by the cross auger during one 8 hour shift is reclaimed within a total period of 16 hours including the shift, based on the production rates indicated in Part 1 of this document.
  - .3 Provide media buffering storage system to adapt cross auger media delivery rates and media drying/cleaning processing rates.
- .6 All components, and assembled electrical/control panels shall be CSA or ETL approved.

#### **2.2 MEDIA RECEIVING SYSTEM**

- .1 Installed below grade in open pit.

- .2 Receive continuous delivery of media from Blast Room cross auger (by other discipline).
- .3 Transfer media to primary dewatering system

### **2.3 PRIMARY DEWATERING SYSTEM**

- .1 Unit may be incorporated in the Media Receiving , Media Elevating, and / or Reclaim Buffering systems (see items below).
- .2 Provide gravity drainage to separate majority of water from incoming products of wet blasting operations, with minimal loss of reusable media, in order to minimize media dryer load.
- .3 Provide discharge for separated liquid.
  - .1 1-1/2 inch nominal outlet with isolation ball valve with NPT connections.
  - .2 Discharged liquid will flow into sump for subsequent pumping to oil-water-separator, all by other discipline.

### **2.4 MEDIA ELEVATING SYSTEM**

- .1 Provide enclosed system to lift media received from cross auger, from pit level to next processing stage.
  - .1 Originally dry used media,
  - .2 Wet and/or dewatered used media, according to component locations and layout.
  - .3 Buffer capacity as required.

### **2.5 SYSTEM BYPASS**

- .1 Discharge used media without processing through drying/reclamation system.
- .2 Discharge chute

### **2.6 MEDIA DRYING AND CLEANING SYSTEM**

- .1 Provide system for batch or continuous drying of dewatered media.
- .2 To provide level of dryness required for subsequent re-use of media.
- .3 Enclosed gravity fall air-wash system for final cleaning of dry/dried media.
- .4 Automatic moisture sensing and dryer activation.
- .5 Provide dust collection and discharge system for collected contaminants.
- .6 Provide reclaimed media discharge system complete with flexible connection to reclaimed media container.

### **2.7 RECLAIMED MEDIA CONTAINER**

- .1 For collection, transport, and transfer of reclaimed blast media directly into existing blast pots and existing Ecoquip units.
- .2 For each reclaimed media discharge location
- .3 Minimum 8 cubic foot (0.23 cubic meter) capacity
- .4 Steel welded fabrication
- .5 Complete with hinged lid with flexible connector receiver.
- .6 Sloped bottom.
- .7 Bottom slide gate discharge with actuating lever (for leverage)
  - .1 2 inch nominal size



- .2 24 inch long discharge hose
- .8 Integral fork lift fork tubes.

## **2.8 SERVICE ACCESS PLATFORMS**

- .1 All maintenance points and serviceable components of the reclaim system shall be located vertically within 1.5m of the floor, or the equipment shall include integrated maintenance / service access work platforms as required to meet the 1.5m height requirement.
- .2 Such access platforms shall:
  - .1 be fully supported from the equipment itself, unless otherwise approved by ONTC,
  - .2 provide a minimum working standing surface of 39 in. x 39 in. (1m x 1m), to suit the minimum horizontal work clearance, whichever is greater, and
  - .3 include ladder access with any fall protection to meet the requirements of the Authorities Having Jurisdiction.

## **2.9 RECIRCULATING CARTRIDGE FILTER DUST COLLECTOR FOR RECLAIM SYSTEM**

- .1 Capture dusts produced by the various reclaim activities.
- .2 All steel construction.
- .3 Framing designed for unimpeded removal / insertion of underside dust containers.
- .4 Elimination of moisture collected from media drying.
- .5 Filtration:
  - .1 Cartridge type filters.
  - .2 Suitable for exposure to moist air (as may occur from media drying process).
  - .3 If any air is expelled outside of unit into the room, the released air shall be filtered to contain maximum particulate matter of:
    - .1 1 milligram / cubic metre (0.45 ppm by weight)
  - .4 Tool-less cartridge removal/replacement.
  - .5 Polyester open pleated type cartridges, with 100% active media exposure.
  - .6 Filter air to cloth ratio: less than 3.6 CFM/sq.ft.
  - .7 Automatic pulse compressed air filter cleaning (pulse cycle duration and frequency adjustable)
  - .8 Differential pressure indication
- .2 Sloped bottom hopper(s)
  - .1 Flexible connector to dust container lid.
- .3 Dust container
  - .1 Provide 205 L (nominal) steel barrel or similar
    - .1 Lid with quick release steel clamp, and adapter for flexible connector hose.
    - .2 Will be placed on wood pallet, or similar skid, provided by ONTC

## **2.10 FINISH:**

- .1 Externally sourced products to use suppliers standard coating and colour.

- .2 Unfinished purchased products, and all other non wearing surfaces shall be coated as follows, or as otherwise approved by ONTC.
  - .1 Primer: High solids, rust inhibitive, universal, phenolic alkyd metal primer.
    - .1 SSPC-SP6/NAC 3 preparation.
    - .2 Apply coating within 8 hours of blasting to avoid flash rusting.
    - .3 Minimum DFT: 3 mils
    - .4 Sherwin Williams Kem Bond HS or approved equivalent.
  - .2 Top Coat: urethane alkyd enamel
    - .1 Preparation as per manufacturer's recommendation.
    - .2 2 coats, DFT: 2 mils per coat.
    - .3 Sherwin Williams Pro Industrial, or approved equivalent.
  - .3 Or approved equivalent

## **2.11 SYSTEM ELECTRICAL:**

- .1 CSA approved components and panel(s).
- .2 480 volt, 3 phase power connection.
- .3 Single point power connection.
- .4 May be integrated with main control panel
- .5 NEMA 12 enclosure, suitable for installation in Reclaim Room (refer to electrical drawings).
- .6 Motors:
  - .1 TEFC
  - .2 Class F insulation, 40C Ambient,
  - .3 1.15 SF
  - .4 Inverter duty rated if used with VFDs
- .7 Motor starter(s):
  - .1 Integral to main control panel, or
  - .2 Separately mounted in suitable enclosure.
- .2 Motor control method:
  - .1 Soft start, non reversing, or VFD.

## **2.12 CONTROLS**

- .1 May be integrated into main electrical panel.
- .2 CSA approved components and panel
- .3 NEMA 4 enclosure, complete with,
  - .1 Lockable main disconnect, fused.
  - .2 Single point power connection.
  - .3 Control voltage: maximum 120V
  - .4 Local Panel / Remote Panels control selector

- .5 Overall Reclaim System Start/stop push buttons for all components when components in AUTO mode.
  - .6 Reclaim / Reclaim Bypass selector switch.
  - .7 Individual Component mode selection for all system components: ON / OFF / AUTO, including
    - .1 Received media elevator
    - .2 Internal transfer systems including main bucket elevator
    - .3 Drying system
    - .4 Dust collector
    - .5 Additional components as may be included
  - .8 Dust Collector Pulse cleaning mode selector: DEMAND / OFF/ CONTINUOUS
  - .9 Emergency Stop, non-illuminated mushroom head button
  - .10 Dust Collector Photohelic filter system differential pressure gauge
  - .11 Indicator lights (all to be LED):
    - .1 Local Panel /Remote Panel Control
    - .2 Reclaim / Reclaim Bypass
    - .3 System Power ON
    - .4 Received media lift ON
    - .5 Reclaim elevator ON
    - .6 Dust collector
      - .1 Fan ON
      - .2 Filter changeout required
      - .3 Pulse activity
      - .4 Filter change indicator
  - .12 Auxiliary contacts (minimum 2 input, 2 output)
- .2 Remote control panel:
- .1 One panel for Blast Room location
  - .2 NEMA 4 enclosure
  - .3 Start/Stop push buttons for overall system
  - .4 Reclaim / Reclaim Bypass selector.
  - .5 LED indication of:
    - .1 Remote panel control active (if selected from main panel)
    - .2 Reclaim / Reclaim Bypass mode
    - .3 System ON
    - .4 Dust collector Filter changeout required
  - .6 Emergency Stop, non-illuminated mushroom head button

## 2.13 CONTROL SEQUENCES

- .1 General
  - .1 All components shall be interlocked to operate as required by the overall system, and for safety.
- .2 Main Disconnect Switch to ON
- .3 Local / Remote Panel Selection
  - .1 Control provided by selected panel.
- .4 Main Control Panel or Remote Control Panels:
- .5 Start button depressed
  - .1 All system motors start
    - .1 Indicators confirm ON for each motor.
  - .2 Dust Collector auto-pulsing module actuated
    - .1 Pulse indicator light confirms operation
  - .3 Media drying:
    - .1 Drying function operates based on media moisture sensor.
      - .1 Media automatically recirculates through system until attained the required dryness level (adjustable).
  - .4 Permissive sent to media conveyor controller
    - .1 Enables conveyors to operate when in "AUTO" mode. Refer to conveyor specifications.
    - .2 Via dry contactor
  - .5 Stop or E-stop button depressed
    - .1 All system components shut down.

## 3 Execution

### 3.1 PREPARATION

- .1 Provide reviewed Shop Drawings, to trades responsible for installation.

### 3.2 FACTORY TEST:

- .1 At any time during the manufacture of the equipment, subject to reasonable notice, the Owner's Representative or their designers may visit the Manufacturer's facility to inspect manufacturing and quality control processes.
- .2 The Manufacturer shall perform a comprehensive operational test of the subassemblies and system specified herein. The test shall test all components, subsystems, systems, software and hardware.
- .3 Provide all lubricants, hydraulic oils, cleaning compounds, and similar materials required for the factory test.
- .4 Any changes of equipment that can cause an unsafe condition shall be re-tested.

### 3.3 INSTALLATION

- .1 Install in accordance with reviewed shop drawings, and manufacturer's recommendations.

**3.4 TESTING AND COMMISSIONING.**

- .1 Provide all material and resources for testing of systems.
  - .1 Owner will provide dry and wet media and blasting process to provide used media for testing.
- .2 Make all necessary adjustments.
- .3 Complete final site cleanup.

**END OF SECTION**