



ST. CLAIR CATHOLIC
DISTRICT SCHOOL BOARD

Lighting the Way ~ Rejoicing in Our Journey

Addendum # 001

TENDER NUMBER: 619-CP2003

Renovations and Atrium Project

Our Lady of Fatima Catholic School

545 Baldoon Road, Chatham, ON

Submission Deadline and Location:

Thursday March 19, 2020

2:00:00 PM Local Time

Reception Desk, Catholic Education Centre

420 Creek Street, Wallaceburg, ON

ISSUED: February 24, 2020

ADDENDUM #001

This addendum forms part of the Contract Bid Documents and amends the original drawings and specifications issued for Bid on February 19th. 2020.

TABLE OF CONTENTS

Page(s)

ADDENDUM # 1 (Including cover)	3
Attachments:	
Revised Document Index	5
Division 01 – General Conditions: Revised and added Sections	63
Division 06 –Wood Plastics and Composites: Missing sections added.	16
Mechanical and Electrical Specifications: Issued	214
Mechanical Drawings: Issued	26
Electrical Drawings: Issued	14

TOTAL PAGE COUNT FOR THIS ADDENDUM	341
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PART A – GENERAL

.1 MANDATORY SITE VISIT

At the beginning of the meeting, the SCCDSB and WDAI emphasized that the Site Visit is a MANDATORY visit for General Contractors. The Board therefore, will only receive offers from the contractors listed below:

Our Lady of Fatima Catholic School - Mandatory Site Visit Attendance List

Company	Name of Representative	Email
Westhoek Construction	Dave Thorpe	dave@westhoek.on.ca
Elgin Contracting	Nancy Myshrall	admin@elgincontracting.com
Onyx General Contracting	Abdul Mhdie	info@onyx-gc.com
Vince Ferro Construction LTD.	Brian Miles	vferro@mnsi.net
Oscar Construction	Katherine Armbruster	oscarcst@mnsi.net
Elmara Construction	Colin Stass	colinst@elmara.com
Norlon Construction	Matt Pilecki	mpilecki@norlon.ca
Bill Hoekstra General Contracting	Andrew Clark	info@bh-gc.com
Aveiro Constructors	Ron Caughlin	estimating@aveiroconstructors.com
Intrepid Construction	Anthony Tandarive	anthony@intrepidgeneral.ca

.2 QUESTIONS AND ANSWERS

No questions were formally addressed. Contractors are to issue questions in writing only as set out in the bid documents:

This concludes Addendum #001.

SPECIFICATIONS

<u>SECTION</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>
	Cover.....	1
	Index.....	5
	Bid Form & Instructions.....	26
	Supplementary Conditions.....	31
	Designated Substance Report.....	58

Division 1 - General Requirements

Section 01 00 05 – General Requirements	5
Section 01 21 00 – Allowances	1
Section 01 29 00 – Valuation of Changes to Work	2
Section 01 31 10 – Project Coordination	4
Section 01 31 20 – Project Meetings	6
Section 01 32 18 – Construction Schedule	2
Section 01 33 00 – Submittal Procedures	4
Section 01 35 30 – Health and Safety	4
Section 01 35 43 – Environmental Protection	2
Section 01 45 00 – Cutting, Fitting and Patching	1
Section 01 45 10 – Testing Services	2
Section 01 50 00 – Temporary Facilities	7
Section 01 56 00 – Temporary Barriers and Enclosures	6
Section 01 61 00 – Common Product Requirements	5
Section 01 77 00 – Close out Procedures	2
Section 01 78 00 – Close out Submittals	7
Section 01 56 00 – Temporary Barriers and Enclosures	6
Section 01 90 00 – General Requirements for Building Envelope	3

Division 2 - Site Work

Section 02 41 00 - Selective Demolition	4
---	---

Division 3 - Concrete

Section 03 10 00 - Concrete Forms and Accessories	4
Section 03 20 00 - Concrete Reinforcement	4
Section 03 30 00 - Cast in Place Concrete	7
Section 03 35 00 - Concrete Finishing	3
Section 03 39 00 - Concrete Curing	1

Division 4 - Masonry

Section 04 00 00 – Masonry Procedures	2
Section 04 05 12 – Mortar and Grout	3
Section 04 22 00 – Unit Masonry	14

Division 5 – Metals

Section 05 12 25 – Structural Steel	8
Section 05 31 00 – Metal Roof and Deck	6
Section 05 41 10 – Light Gauge Metal Framing	9
Section 05 41 11 – Light Gauge Metal Framing Elevation	1
Section 05 50 00 – Metal Fabrications	4

Division 6 - Wood and Plastic

Section 06 10 00 - Rough Carpentry	6
Section 06 20 00 – Finish Carpentry	4
Section 06 41 00 – Casework	5

Division 7 - Thermal and Moisture Protection

Section 07 21 13 – Board and Batt Insulation	5
Section 07 21 29 – Sprayed Insulation Polyurethane	8
Section 07 26 00 – Vapour and Air Barrier	6
Section 07 46 13 – Preformed Metal Siding & Soffit	6
Section 07 52 00 – 2 Ply Modified Bitumen Membrane Roofing	10
Section 07 53 23 – EPDM	8
Section 07 62 00 – Flashing and Sheet Metal	5
Section 07 72 23 – Roof Hatches	3
Section 07 84 00 – Fire Stopping and Smoke Seal	5
Section 07 92 13 – Joint Sealants	8

Division 8 – Doors and Windows

Section 08 11 00 – Metal Doors and Frames	8
Section 08 11 16 – Aluminum Doors and Frames	12
Section 08 35 00 – Sliding Grilles	5
Section 08 41 26 – All Glass Doors and Screens	8
Section 08 71 10 – Finishing Door Hardware & Schedule	19
Section 08 80 00 – Glazing	7

Division 9 – Finishing

Section 09 21 16 – Gypsum Board Assemblies	11
Section 09 30 13 – Ceramic Tiling	5
Section 09 51 13 – Acoustical Panel Ceilings	5
Section 09 61 00 – Preparation and repair of existing floors	3
Section 09 65 19 – Resilient Tile Flooring	6
Section 09 65 20 – Resilient Sports Flooring	5
Section 09 91 00 – Painting	14
Finish Schedule	1

Division 10 - Specialties

Section 10 11 00 – Visual Display Surfaces	4
Section 10 14 00 – Signage	2
Section 10 21 14 – Metal Toilet Compartments	5
Section 10 28 00 – Washroom Accessories	4
Section 10 51 11 – Lockers	4

Division 11 - Equipment

Section 11 61 23 – Retractable Stage	4
Section 11 67 00 – Athletic Equipment	3

Division 31 – Site and Infrastructure

Section 31 22 19 – Topsoil and Finish Grading	4
Section 31 23 00 – Excavation and Backfill	6
Section 31 66 15 – Helical Pier Foundations	6

Mechanical and Electrical Specifications

Refer to General Index for Mechanical and Electrical Specifications	214
---	-----

DRAWING LIST**Architectural**

A000 – COVER PAGE
A010 – LIFE SAFETY PLAN AND SITE PLAN
A050 – ASSEMBLY TYPES
AD100 – DEMOLITION FLOOR PLAN
AD200 – DEMOLITION REFLECTED CEILING PLAN
AD300 – DEMOLITION EXTERIOR AND INTERIOR ELEVATIONS
A100 – CONSTRUCTION FLOOR PLAN
A120 – FLOOR FINISH PLAN
A150 – ENLARGED FLOOR PLANS – CLASSROOMS
A151 – ENLARGED FLOOR PLANS
A152 – WASHROOM GROUPS, FINISH PLANS, AND ELEVATIONS
A153 – GYMNASIUM ENLARGED PLAN
A175 – CONSTRUCTION ROOF PLAN
A176 – DEMOLITION ROOF PLAN
A177 – ROOFING DETAILS
A178 – ROOFING DETAILS
A200 – CONSTRUCTION REFLECTED CEILING PLAN
A300 – CONSTRUCTION EXTERIOR ELEVATIONS
A301 – CONSTRUCTION EXTERIOR ELEVATIONS
A400 – BUILDING ELEVATIONS
A401 – BUILDING ELEVATIONS
A500 – WALL SECTIONS
A501 – WALL SECTIONS
A600 – PLAN DETAILS
A601 – PLAN DETAILS
A602 – PLAN DETAILS
A650 – SECTION DETAILS
A651 – SECTION DETAILS
A652 – SECTION DETAILS
A653 – SECTION DETAILS
A654 – SECTION DETAILS
A800 – TYPICAL CLASSROOM ELEVATIONS – NORTH WING
A801 – TYPICAL CLASSROOM ELEVATIONS – SOUTH WING
A802 – KINDERGARTEN AND KITCHENETTE INTERIOR ELEVATIONS
A803 – INTERIOR ELEVATIONS – ATRIUM
A804 – INTERIOR ELEVATIONS – CORRIDOR

A805 – INTERIOR ELEVATIONS – CORRIDOR
A806 – INTERIOR ELEVATIONS – GYMNASIUM
A900 – MILLWORK DETAILS
A901 – MILLWORK DETAILS
A1000 – SCHEDULES
A1001 – ROOM FINISH SCHEDULE
A1002 – GLAZING ELEVATIONS

Civil

P4-SE1 – Site Servicing and Grading Plan
P4-SE2 – Notes and Details

Mechanical

M101 – MECHANICAL LEGEND AND DRAWING LIST
M102 – SCHEDULES
M103 – DETAILS
M201 – PART GROUND FLOOR PLAN – DRAINAGE
M202 – PART GROUND FLOOR PLAN – DRAINAGE
M203 – PART GROUND FLOOR PLAN – PLUMBING
M204 – PART GROUND FLOOR PLAN – PLUMBING
M205 – PLUMBING DETAILS
M301 – PART GROUND FLOOR PLAN – FIRE PROTECTION NORTH
M302 – PART GROUND FLOOR PLAN – FIRE PROTECTION SOUTH
M401 – PART GROUND FLOOR PLAN – HEATING
M402 – PART GROUND FLOOR PLAN – HEATING
M501 – PART GROUND FLOOR PLAN – AIR DISTRIBUTION
M502 – PART GROUND FLOOR PLAN – AIR DISTRIBUTION
M601 – MECHANICAL ROOF PLAN
M602 – MECHANICAL ROOF PLAN DEMOLITION
M701 – PART GROUND FLOOR PLAN – DRAINAGE DEMOLITION
M702 – PART GROUND FLOOR PLAN – DRAINAGE DEMOLITION
M703 – PART GROUND FLOOR PLAN – PLUMBING DEMOLITION
M704 – PART GROUND FLOOR PLAN – PLUMBING DEMOLITION
M705 - PART GROUND FLOOR PLAN – FIRE PROTECTION DEMOLITION
M706 – PART GROUND FLOOR PLAN – FIRE PROTECTION DEMOLITION
M707 – PART GROUND FLOOR PLAN – HEATING DEMOLITION
M708 – PART GROUND FLOOR PLAN – HEATING DEMOLITION
M709 – PART GROUND FLOOR PLAN – AIR DISTRIBUTION DEMOLITION
M710 – PART GROUND FLOOR PLAN – AIR DISTRIBUTION DEMOLITION

Electrical

E101 – ELECTRICAL LEGEND, DRAWING LIST, SCHEDULES, ABBREVIATIONS, AND ELECTRICAL GENERAL NOTES
E201 – PART GROUND FLOOR PLAN NORTH – LIGHTING AND FIRE ALARM
E202 – PART GROUND FLOOR PLAN SOUTH – LIGHTING AND FIRE ALARM
E301 – PART GROUND FLOOR PLAN NORTH – POWER AND SYSTEMS
E302 – PART GROUND FLOOR PLAN SOUTH – POWER AND SYSTEMS
E401 – ELECTRICAL RISERS
E501 – ELECTRICAL DETAILS
E502 – ELECTRICAL DETAILS
E601 – PART GROUND FLOOR PLAN NORTH – LIGHTING AND FIRE ALARM DEMOLITION
E602 – PART GROUND FLOOR PLAN SOUTH – LIGHTING AND FIRE ALARM DEMOLITION
E701 – PART GROUND FLOOR PLAN NORTH – POWER AND SYSTEMS DEMOLITION
E702 – PART GROUND FLOOR PLAN SOUTH – POWER AND SYSTEMS DEMOLITION

Structural

S100 – FOUNDATION PLAN
S101 – ROOF FRAMING PLAN
S200 – SCHEDULES
S201 – ELEVATIONS
S202 – JOIST REINFORCING
S301 – SECTIONS
S302 – SECTIONS
S303 – SECTIONS
S304 – SECTIONS
S305 – SECTIONS
S306 – SECTIONS
S400 – TYPICAL DETAILS
S401 – TYPICAL DETAILS
S402 – TYPICAL DETAILS
S403 – TYPICAL DETAILS
S404 – TYPICAL DETAILS
S405 – TYPICAL DETAILS

End of Section

PART 1 - GENERAL

1.1. DESCRIPTION OF WORK

.1 Work under this Contract covers construction of the:

**Our Lady of Fatima
Renovations and Atrium Project**

.2 Maintain at job site, one copy each of the following:

- .1 Contract drawings
- .2 Specifications
- .3 Addenda
- .4 Reviewed shop drawings
- .5 Contract Instructions/Bulletins
- .6 Change orders
- .7 Field test reports
- .8 Copy of approved work schedule
- .9 Manufacturers' installation and application instructions
- .10 Site visit reports

1.2. CODES AND STANDARDS

- .1 Perform work in accordance with the current edition of the Ontario Building Code (OBC) and any other code of provincial or local application provided that in any case of conflict or discrepancy, more stringent requirements shall apply.
- .2 Meet or exceed requirements of specified standards, codes and referenced documents.

1.3. PROJECT MEETINGS

- .1 Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.4. SETTING OUT OF WORK

- .1 Assume full responsibility for an execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as straight edges and templates required to facilitate inspection of work.
- .4 Supply stakes and other survey markers required for laying out work.

1.5. LOCATIONS OF EQUIPMENT & FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum suable space and in accordance with manufacturer's recommendations for safety.
- .3 Inform Consultant of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.6. CONCEALMENT

- .1 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.7. CUTTING, FITTING AND PATCHING

- .1 Execute cutting (including excavation), fitting and patching required to make work fit properly together.
- .2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.
- .3 Define and mark energy sources, provide appropriate shut off or lockout provisions to ensure safety prior to any cutting, boring or demolition.
- .4 Obtain all required locates, maintain service markings, keep accurate records of service locations and notify Owner and Consultant of locate outcomes.

- .5 Obtain Structural Consultant's approval before cutting, boring or sleeving load-bearing members.
- .6 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .7 Fit work airtight to pipes, sleeves, ducts and conduits.
- .8 Cutting and patching of new or existing work to accommodate installation of work of Mechanical and Electrical trades is the responsibility of the trade performing the installation.

1.8. EXISTING SERVICES

- .1 Before commencing Work, establish location and extent of service lines in area of work and notify Consultant of findings.
- .2 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

1.9. ADDITIONAL DRAWINGS

- .1 Four (4) complete sets of Drawings and Specifications are furnished to the General Contractor. Additional sets may be printed from PDF copies of documents at the cost of the General Contractor.
- .2 Consultant may furnish additional drawings to assist proper execution of work. These drawings will be issued for clarification only. Such drawings shall have the same meaning and intent as if they were included in original documents.
- .3 Drawings provide overall dimensions to finished surfaces or grid lines. The General Contractor is responsible for verifying all dimensions and determining any additional dimensions required for layout or coordination.
- .4 The General Contractor shall coordinate the layout of all building components and systems, including ceilings, bulkheads, and service spaces to avoid interference before installation. The General Contractor shall revise services or components not properly coordinated in advance, at no additional cost to the Owner.

1.10. WORK SCHEDULE

- .1 Provide schedule showing anticipated progress stages and final completion of work within time period required by Contract Documents.
- .2 Utilize a digital Gantt chart format correlated to cost breakdown format showing progress of each trade division against a baseline.

- .3 Provide an updated schedule with each payment application. Failure to provide an acceptable schedule will result in the monthly general accounts being withheld.

1.11. COST BREAKDOWN

- .1 Submit breakdown of Contract prices by Specification Division and Section and aggregating contract price. After approval by Consultant, cost breakdown will be used as the basis for progress payment.
- .2 Indicate initial set up costs separately from ongoing site operation costs. Provide a complete list of initial costs with invoices for specific items including insurance and bonds.
- .3 Ongoing site operation costs shall include the cost of the Superintendent at full time for the duration of the work.

1.12. CONTRACTOR'S USE OF SITE

- .1 Use of the site is as illustrated on the Site Plan and is restricted to the area of the site within the construction barrier.
- .2 The General Contractor shall restore surfaces damaged by construction outside of the construction area to their original condition, at no additional cost to the Contract.

1.13. WORKMANSHIP

- .1 Workmanship is to be of the best quality, executed by workers experienced and skilled in respective duties for which they are employed.
- .2 Do not employ any unfit person or anyone unskilled in their required duties. A minimum of five years' trade experience is required for work on this project or tradesman who has completed and passed their apprenticeship program or other educational program acceptable to the Consultant. An apprentice accompanied by a qualified trade instructor is allowed.
- .3 When requested by the Consultant, provide a completely finished sample of each element of the work for review by the Consultant. Once accepted, this sample will be used to determine the workmanship expected for the remaining work.
- .4 Decisions as to quality or fitness of workmanship in cases of dispute rest solely with the Consultant, whose decision is final. The General Contractor shall enforce such decisions with the respective subtrades.

1.14. DEFICIENCIES

- .1 The Consultant will periodically review the work and advise the General Contractor in writing of review.

- .2 Deficiencies which remain outstanding for over one month's time will entitle the Consultant to not certify any further payment for that respective trade division until the deficiencies are corrected to the Consultant's satisfaction.

END OF SECTION

Part 1 General

1.1. PROCEDURE

- .1 The manner in which cash allowances and contingency allowances will be addressed is as specified in the Contract Documents as amended by the Supplementary General Conditions.
- .2 No expenditure against Cash Allowances shall be made or incurred except as instructed by the Consultant in writing.
- .3 No additional mark up for the Contractor's expense and profit will be allowed where individual specific purpose Cash Allowances are exceeded.
- .4 The amounts listed are deemed to be all inclusive but not to include Value Added Taxes (H.S.T.).

1.2. SPECIFIC PURPOSE CASH ALLOWANCES

Cash Allowances are stipulated in APPENDIX B: Bid Form – Item B3.

END OF SECTION

Part 1 General

1.1. GENERAL

- .1 All prices described in this Section shall include the total cost of materials, labour, tools, equipment, fees, bonding, insurance, testing, preparation of drawings, submittals, calculations, supervision, inspections, deliveries, travelling, out-of-town accommodations, rentals, duties, taxes, head office and site office overheads, profits, and all other direct and indirect expenses required to fully perform the specified Work.
- .2 Changes to Work shall be established by using current Fair Wages labour rates, including mandatory benefits, prevailing local market prices of materials and/or equipment, taxes, specific fees related to the change only, and overhead costs as defined below.
- .3 Overhead shall include all costs of:
 - .1 Operating head office and site facilities
 - .2 Head office and site personnel
 - .3 Custom duties, basic permits and other licenses required by jurisdictional authorities
 - .4 Bonding
 - .5 Insurance
 - .6 All services
 - .7 Calculations, inspections, testing
 - .8 Deliveries, travelling, out-of-town accommodations
 - .9 Hand and small power tools required for the efficient completion of the Work
- .4 The following maximum mark-ups for overhead and profit and fee may be applied as appropriate to the net costs assessed as above where the effect of the contemplated change is an increase in the Contract Sum. If the effect of the change is a decrease in the Contract Sum, no mark-up shall be applied:
 - .1 Work carried out by Contractor's own forces – 10% for Profit and Overhead
 - .2 Work carried out by Subcontractors:
 - .1 Subcontractor's mark-up – 10%

- .2 Contractor's mark-up – 5%
- .3 The above mark-ups are applicable to all contractor and subcontractor relationships, not just for the General Contractor and their subcontractors.

1.2. CHANGES TO WORK

- .1 Conform to the requirements of the General Conditions for pricing contemplated and/or changes to the Work.
- .2 Any costs related to preparation of the necessary documentation for changes/contemplated changes are deemed to be included in the specified overhead and profit.

END OF SECTION

Part 1 General

1.1. GENERAL

- .1 Erect the Work in accordance with the Contract Documents and be responsible for delays or costs resulting from failure to properly inspect or coordinate the Work and for replacement or corrective work required.
- .2 Refer to Additional Requirements in Section 01 00 05.

1.2. PRECONSTRUCTION CHECKLIST

- .1 The following items are required prior to commencing any work on the site:
 - .1 Signed contracts or a Letter of Intent from the Owner
 - .2 Performance/Labour and Materials Payment Bonds
 - .3 Workers Compensation Insurance Certificate of Clearance
 - .4 Insurance Certificates of General Liability naming the Owner and Consultants
 - .5 Automobile Insurance Certificate
 - .6 Equipment Insurance Certificate
 - .7 Builders Risk Insurance Certificate
 - .8 Building Permit
 - .9 Construction Progress Schedule
 - .10 Contract breakdown by Specification Division and Section. Sample draft supplied by General Contractor for Consultant's approval.
 - .11 Shop drawing and sample submittal schedule. Shop drawing schedule should show a critical path delivery date, which may be referenced into Construction Progress Schedule.
 - .12 Drawings and Specifications with all addendum items marked at pertinent pages
 - .13 Arrangements made for immediate installation and hook up for items specified under Temporary Facilities Section 01 51 00.

1.3. IDENTIFICATION OF SYSTEMS

- .1 Provide identification of electrical and mechanical system installations and other automated systems or equipment in compliance with Contract Documents.

1.4. COMMISSIONING AND SYSTEMS DEMONSTRATIONS

- .1 Provide testing, adjusting, balancing and certification and commissioning of mechanical and electrical installations and other automated system or equipment in accordance with Section 01 77 00, and Division 22, 23, & 23 and 26 & 27.
- .2 Instruct Owner's designated representatives in operation and maintenance of mechanical and electrical installations and other automated systems or equipment in accordance with Section 01 77 00, and Division 22, 23, & 23 and 26 & 27.

1.5. PROJECT ADMINISTRATION

- .1 Project Manager: Submit resume giving name and qualifications.
- .2 Superintendent: Submit resume giving name and qualifications.
- .3 The above are reviewed and qualified by Consultant. Once accepted, they are to remain on project for complete duration, unless directed otherwise by Consultant.
- .4 The Consultant will provide one warning in the event of a concern with the performance of the General Contractor's personnel. The General Contractor shall remove such personnel if so directed by the Consultant, and submit a substitute's name and qualifications for the Consultant's approval.

1.6. LINES OF COMMUNICATION

- .1 Site Instructions are in written form only and are issued by the Consultant. If such instructions involve a change in cost or schedule, work shall not proceed until this change is accepted by Change Directive or Change Order. Proceeding without such acceptance in advance will imply no change in cost or time.
- .2 Bulletins are descriptions of changes to the work for which a quotation is requested. General Contractor shall submit changes in costs and schedule for the changes. Cost submitted must include a complete breakdown of labour and material quantities showing how the cost has been determined.
- .3 Change Directives are instructions to proceed with changes to the work in a Bulletin at an upset cost or as otherwise indicated. General Contractor shall submit changes in costs and schedule for the changes, with labour and material breakdowns. The final cost approved will not exceed the original upset limit.

- .4 Change Orders are the acceptance of the cost and scope of changes of the work. These are signed by the Owner, Consultant and Contractor and become part of the Contract.
- .5 A Certificate indicates the amount of the Contractor's monthly billing approved for payment. Two copies are sent to the Contractor and one copy to the Owner. The Contractor shall sign one copy once he receives payment and return it to the Consultant.

1.7. COOPERATION

- .1 Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the Work and set in place or instruct separate Subcontractors as to their location.
- .2 Supply items to be built in, as and when required, together with templates, measurements, shop drawings and other related information and assistance.

1.8. DIMENSIONS

- .1 Verify dimensions at the Place of Work before commencing shop drawings. Before fabrication commences, report discrepancies to Consultant in writing. Incorporate accepted variances on shop drawings and as-built records.

1.9. COOPERATION WITH OWNER

- .1 Owner reserves the right to commence moving furniture, fitments and equipment into building as soon as areas become available, and Contractor and Subcontractors shall be required to cooperate closely with Owner and coordinate the Work to ensure that Owner's requirements are accommodated.

1.10. COORDINATION

- .1 Coordinate and ensure workers, Subcontractors, and Suppliers cooperate to ensure that the Work will be carried out expeditiously and in proper sequence.
- .2 Make adjustments to allow adjustable work fit to fixed work.

1.11. BUILDING DIMENSIONS AND COORDINATION

- .1 Take necessary dimensions for the proper execution of the Work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
- .2 Verify that the Work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as

- set out by requirements of the Contract Documents, and ensure that the work installed in error is rectified before construction resumes.
- .3 Check and verify dimensions referring to interfacing of services. Verify such dimensions with interconnected portions of the Work.
 - .4 Do not scale directly from Drawings. Obtain clarification from Consultant if there is ambiguity or lack of information.
 - .5 Details and measurements of any work which is to fit or to conform with work installed shall be taken at the Place of Work.
 - .6 Advise Consultant of discrepancies and omissions in the Contract Documents that affect aesthetics or that interfere with services, equipment or surfaces. Do not proceed with work affected by such items without clarification from Consultant.
 - .7 Prepare and submit setting drawings, templates and other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels.
 - .8 Subcontractors shall direct related Subcontractors on site of specific locations required for sleeves and openings.
 - .9 Prepare interference drawings to properly coordinate the Work, where necessitated, in accordance with Section 01 71 00.

END OF SECTION

Part 1 General

1.1. ADMINISTRATIVE

- .1 Schedule and administer meetings every 2 weeks (or more frequently as required) with the Consultant throughout the progress of the Work. Schedules to be updated with the Consultant every 2 weeks for distribution at each meeting.
- .2 Prepare agenda for such meetings.
- .3 Contractor shall chair and record the minutes of such meetings. Contractor shall distribute copies of minutes to the Owner, the Consultant, and all others in attendance within 3 days after date of meeting.
- .4 Distribute written notice of each meeting 4 days in advance of meeting date to the Consultant and the Owner and other affected parties.
- .5 Representatives of parties attending meetings shall be authorized to act of behalf of the parties they represent. Subcontractors and Suppliers do not attend meetings unless authorized by the Consultant and the Owner.
- .6 Prepare and distribute monthly progress reports containing updated schedules, shop drawing logs, requests for interpretation logs, submittals and budget.

1.2. CONTRACT START-UP MEETING

- .1 After award of Contract, request a meeting of parties in Contract to discuss and resolve administrative procedures and responsibilities prior to the commencement of the Work.
- .2 The Owner, the Consultant, the Contractor, site superintendent(s), and major subcontractors will be in attendance.
- .3 Agenda to include the following:
 - .1 Appointment of official representative of participants in the Project.
 - .2 Status of permits, fees and requirement of authorities having jurisdiction. Action required.
 - .3 Requirements for Contract modification and interpretation procedures, including, but not limited to: requests for interpretation, Bulletins, Change Orders, Change Directives, Supplemental Instructions, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .4 Schedule of submission of samples, colour chips, and items for Owners and/or Consultant's consideration, Section 01330.

- .5 Construction schedule and progress scheduling Section 01 32 18.
- .6 Delivery schedule of specified equipment, Section 01 32 18.
- .7 Appointment of inspection and testing agencies or firms,
- .8 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to Consultant for review of the Work.
- .9 Requirements for temporary facilities, signs, offices, storage sheds, utilities, fences.
- .10 Security requirements at and for the Place of the Work.
- .11 Owner supplied Products.
- .12 Record drawings.
- .13 Maintenance manuals.
- .14 Take-over procedures, acceptance, warranties.
- .15 Progress claims, administrative procedures, holdbacks.
- .16 Insurances, transcripts of policies.
- .17 Contractor's safety procedures.
- .18 Cleaning area for vehicles.
- .19 Workplace Safety and Insurance Board Certificate.

1.3. PRE-INSTALLATION MEETINGS

- .1 During the course of the Work prior to Substantial Performance of the Work, schedule pre-installation meetings as required by the Contract Documents and coordinated with the Consultant.
- .2 As far as possible, pre-installation meetings shall be scheduled to take place on the same day as regularly scheduled progress meetings.
- .3 Agenda to include the following:
 - .1 Appointment of official representatives of participants in the Project.
 - .2 Review of existing conditions and affected work and testing thereof as required.
 - .3 Review of installation procedures and requirements.

- .4 Review of environmental and site condition requirements.
- .5 Schedule of the applicable portions of the Work.
- .6 Schedule and submission of samples, colour chips and items for Consultant's consideration.
- .7 Requirements for temporary facilities, site signs, offices, storage sheds, utilities, fences.
- .8 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to Consultant for review of the Work.
- .9 Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests in accordance with contract requirements.
- .10 Delivery schedule of specified equipment.
- .11 Special safety requirements and procedures.
- .4 The following shall be in attendance:
 - .1 Contractor
 - .2 Subcontractors affected by the Work for which the pre-installation meeting is being conducted
 - .3 Consultant
 - .4 Manufacturers' representatives, as applicable
 - .5 Inspection and testing company, as applicable

1.4. PROGRESS MEETINGS

- .1 During the course of the Work prior to Substantial Performance of the Work, schedule progress meetings as directed by the Consultant.
- .2 Attendees at progress meetings shall include the following:
 - .1 Contractor
 - .2 Contractor's site superintendent(s)
 - .3 Consultant
 - .4 Owner

- .3 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting
 - .2 Review of items arising from proceedings
 - .3 Review of progress of the Work since previous meetings
 - .4 Filed observations, problems, conflicts
 - .5 Problems that impede compliance with construction schedule
 - .6 Review of off-site fabrication delivery schedules
 - .7 Review of material delivery dates/schedule
 - .8 Corrective measures and procedures to regain construction schedule
 - .9 Revisions to construction schedule
 - .10 Progress, schedule, during subsequent period of the Work
 - .11 Review submittal schedules: expedite as required
 - .12 Review status of submittals
 - .13 Maintenance of quality standards
 - .14 Pending changes and substitutions
 - .15 Review of Contract modifications and interpretations including, but not limited to: requests for interpretation and log, Bulletins, Change Directives, Change Orders, Site Instructions, for effect on construction schedule and on Contract time
 - .16 Review of status of as-built documents
 - .17 Other business

1.5. PRE-TAKEOVER MEETING

- .1 Prior to application for Substantial Performance of the Work, schedule a pre-takeover meeting.
- .2 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting
 - .2 Review of items arising from proceedings

- .3 Review of procedures for Substantial Performance of the Work, completion of the Contract, and handover of the Work
- .4 Field observations, problems, conflicts
- .5 Review of outstanding Contract modifications and interpretations including, but not limited to: requests for interpretation and log, Bulletins, Change Directives, Change Orders, Site Instructions, for effect on construction schedule and on Contract time
- .6 Problems which impede Substantial Performance of the Work
- .7 Review of procedures for deficiency review. Corrective measures required
- .8 Review of arrangements for hydro, heating and other services
- .9 Progress, schedule, during succeeding period of the Work
- .10 Review submittal requirements for warranties, manuals, and all demonstrations and documentation required for Substantial Performance of the Work
- .11 Review of keying and hardware requirements
- .12 Review of status of as-built documents and record drawings
- .13 Status of commissioning and training
- .14 Other business

1.6. POST-CONSTRUCTION MEETING

- .1 Prior to application for completion of Contract, schedule a post-construction meeting. Four days prior to date for meeting, Consultant shall confirm a date for meeting based on evaluation of completion requirements.
- .2 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting
 - .2 Confirmation that no business is arising from proceedings
 - .3 Confirmation of completion of the Contract, and handover of reviewed documentation from the Consultant to the Owner
 - .4 Confirmation of completion of Bulletins, Change Directives, Change Orders, Site Instructions

- .5 Problems that impede Contact completion
- .6 Identify unresolved issues or potential warranty problems.
- .7 Confirmation of completion of deficiencies
- .8 Corrective measures required
- .9 Confirmation of arrangements for hydro, heating and other services
- .10 Confirm submittal requirements for warranties, manuals and demonstrations and documentation for Contract completion are in order.
- .11 Review of procedures for communication during post-construction period
- .12 Handover of reviewed record documents by the Consultant to the Owner
- .13 Handover of Contract completion insurance policy transcripts by Contractor
- .14 Submission of final application for payment
- .15 Review and finalize outstanding claims, pricing and allowance amounts.
- .16 Status of commissioning and training
- .17 Demobilization and the place of Work restoration
- .18 Review of requests for interpretation log
- .19 Other business

1.7. SPECIAL MEETINGS

- .1 Owner and/or Consultant reserve the right to require special meetings which may be held on short notice and at which attendance by Contractor and representatives of affected Subcontractors and Suppliers is mandatory. Contractor shall keep detailed and accurate meeting notes and distribute copies promptly to all in attendance and those affected by agreements made at such meetings.

END OF SECTION

Part 1 General

1.1. SCHEDULE

- .1 Before commencement of Work, submit Construction Schedule (GANTT) to Consultant's and Owner's approval.
- .2 Schedule shall show:
 - .1 Commencement and completion dates of Contract
 - .2 Commencement and completion dates of Trades
 - .3 Order and delivery times for materials and equipment, where possible
 - .4 Dates for submission of Shop Drawings, material lists and samples
 - .5 Any other information relating to the orderly progress of Contract, considered by Contractor to be pertinent
- .3 Commencement of the Contract and the construction is deemed to be the date of notification by the "Letter of Intent" from the Owner.
- .4 The work for this project MUST attain Substantial Performance as stipulated in the Bid Documents.

1.2. UPDATING AND MONITORING

- .1 Set up format of Construction Schedule to allow plotting of actual progress against scheduled progress.
 - .1 Allow sufficient space for modifications and revisions to the Schedule as Work progresses.
 - .2 Format shall be approved by the Consultant.
- .2 Copy of Schedule shall be displayed in Site Office during the complete construction period and actual progress plotted weekly.
- .3 Updated and Progress Reporting:
 - .1 Arrange participation, on Site and off Site, with Subcontractors and Suppliers, as and when necessary for the purpose of updating schedule and monitoring progress.
 - .2 Reviews of progress by inspections and meetings will be conducted at least once a month or as directed by Consultant.

1.3. COMPLETION

- .1 Completion of the Work for this Project shall be certified by the Consultant.
- .2 The Work will not be certified complete unless all requirements of these documents and those of regulatory agencies are met. The certification shall include all the requirements of Division C, Part 1.3, Paragraph 1.3.3 of the Ontario Building Code, all millwork and fitments, all finishes, fully operational mechanical and electrical systems, all life safety systems and temporary hoarding. All Work shall be as required and delineated by the Drawings and Specifications.

END OF SECTION

Part 1 General

1.1. SECTION INCLUDES

- .1 Shop drawings and product data
- .2 Samples
- .3 Certificates and transcripts

1.2. REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2 – 2008, Stipulated Price Contract

1.3. ADMINISTRATIVE

- .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units, converted values are acceptable.
- .5 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 coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .9 Keep one reviewed copy of each submission on site.

1.4. SHOP DRAWINGS AND PRODUCT DATA

- .1 Refer to CCDC 2 GC 3.10.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 10 work days for Consultant's review of each submission.
- .4 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .5 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date
 - .2 Project title and number
 - .3 Contractor's name and address
 - .4 Identification and quantity of each shop drawing, product data and sample
 - .5 Other pertinent data
- .7 Submissions shall include:
 - .1 Date and revision dates
 - .2 Project title and number
 - .3 Name and address of:
 - .1 Subcontractor
 - .2 Supplier
 - .3 Manufacturer

- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances
 - .3 Setting or erection details
 - .4 Capacities
 - .5 Performance characteristics
 - .6 Standards
 - .7 Operating weight
 - .8 Wiring diagrams
 - .9 Single line and schematic diagrams
 - .10 Relationship to adjacent work
- .8 After Consultant's review, distribute copies.
- .9 Submit one PDF copy of the drawings for each requirement requested in specification Sections, one PDF copy will be returned after review.
- .10 Delete information not applicable to project.
- .11 Supplement standard information to provide details applicable to project.
- .12 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5. SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Consultant's business address.

- .3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .6 Make changes in samples which Consultant may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

END OF SECTION

Part 1 General

1.1. REFERENCES

- .1 Refer to and comply with Bid Documents: Section PART 2: RFT Process, Terms and Conditions - 2.40 Health and Safety.
- .2 Canada Labour Code, Canada Occupational Safety and Health Regulations.
- .3 Canadian Standards Association (CSA)
 - .1 CSA S350-M1980, Code of Practice for Safety in Demolition of Structures
- .4 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990

1.2. SUBMITTALS

- .1 Submit Site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Site-specific safety hazard assessment
 - .2 Safety and health risk or hazard analysis for site tasks and operation
- .2 Submit Construction Safety Checklists after completion.
- .3 Submit copies of reports or directions issued by Federal and Provincial health and safety inspector.
- .4 Submit copies of incident and accident reports.
- .5 Submit to Consultant with Material Safety Data Sheets (MSDS).
- .6 Personnel training requirements including as follows:
 - .1 Names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.
- .7 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments. Revise plan as appropriate and resubmit plan to Consultant.
- .8 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.

1.3. FILING FOR NOTICE OF PROJECT

- .1 Apply for Ministry of Labour – Notice of Project.

1.4. WORK PERMIT

- .1 Assume Building Permit related to project prior to commencement of Work. Owner will pay for costs associated with the application of the Building Permit.

1.5. SAFETY ASSESSMENT

- .1 Perform site-specific safety hazard assessment related to project.

1.6. MEETINGS

- .1 Pre-construction Meetings: Attend health and safety pre-construction meeting.

1.7. REGULATORY REQUIREMENTS

- .1 Comply with specified standards and regulations to ensure safe operations at site containing hazardous or toxic materials.

1.8. GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Relief from or substitution for any portion or provision of minimum Health and Safety Guidelines specified herein or reviewed site-specific Health and Safety Plan must be submitted to Consultant in writing. Consultant will respond in writing, either accepting or requesting improvements.

1.9. RESPONSIBILITY

- .1 Be responsible for safety of persons and property on site and for protection of persons off site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10. COMMUNICATION REQUIREMENTS

- .1 Comply with Ontario Health and Safety Act.
- .2 Provide Consultant with Material Safety Data Sheets (MSDS).

1.11. UNFORESEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Consultant verbally and in writing.

1.12. POSTED DOCUMENTS

- .1 Provide documents as follows and post on site:
 - .1 Safety Policy
 - .2 Health and Safety Representative
 - .3 General Requirements – Constructor’s name
 - .4 Worker’s Compensation Board Form 82
 - .5 Worker’s Compensation Board Regulation 1101
 - .6 Ministry of Labour Orders
 - .7 Occupational Health and Safety Act
 - .8 Material Safety Data Sheets
 - .9 Floor Plan
 - .10 Notice of Project
 - .11 Joint Health and Safety Committee Members
- .2 Comply with provincial general posting requirements.

1.13. CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by Consultant or Authorities Having Jurisdiction.
- .2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

- .3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.14. BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.15. POWDER ACTUATED DEVICES

- .1 Use of powder actuated devices is not permitted.

1.16. WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Health and Safety Officer to stop or start Work when, at Health and Safety Officer's discretion, it is necessary or advisable for reasons of health or safety. Consultant may also stop Work for health and safety considerations.

END OF SECTION

Part 1 General

1.1. FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.2. DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3. DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4. SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Consultant.

1.5. POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.

- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

END OF SECTION

Part 1 General

1.1. GENERAL REQUIREMENTS

- .1 This Section is intended to describe method of cutting, fitting and patching required to complete the work or to make its many parts fit together properly. Refer to Section 01 00 05 for additional information
- .2 Notify Consultant of alteration which affects: a) Structural Integrity b) Moisture or Air Barriers c) Fire Separations.
- .3 Execute cutting, fitting and patching to complete the work and to make good all surface appearances to blend in with adjoining surfaces without blemish.
- .4 Fit parts together, to integrate and bond into with other work.
- .5 Remove and replace defective and non-conforming work.
- .6 Refer to Structural Drawings for lintels required for carrying building components above openings.
- .7 Inspect and acquaint oneself with knowledge of existing conditions, including elements subject to damage or movement during cutting and patching.
- .8 Beginning of cutting or patching means acceptance of existing conditions.

1.2. PATCHING

- .1 Use only compatible patching materials of the same or higher quality as the material being patched.

1.3. CUTTING

- .1 Execute cutting by the most suitable methods to avoid damage to other work, and which will provide proper surfaces to receive finishes.

1.4. FITTING

- .1 Fit together different parts of the work to create a consistent finished appearance.

1.5. PATCHING

- .1 Refinish patched surfaces to match adjacent surfaces. Provide control joints in continuous surfaces to terminate patching.

END OF SECTION

Part 1 General

1.1. RELATED WORK SPECIFIED ELSEWHERE

- .1 Refer to particular requirements for inspection testing to be carried out by a qualified testing laboratory as specified under various Sections.

1.2. APPOINTMENT AND PAYMENT

- .1 Unless otherwise specified, the Consultant will appoint the Testing and Inspection Agency on behalf of the Owner to carry out the inspection and testing specified in various Sections of the Specifications.
- .2 Where so specified, payment for the services of the Testing and Inspection Agency will be paid for by Cash Allowance – refer to Section 01 21 00.
- .3 The Contractor shall be responsible for and pay for the following:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for the Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by the Contractor.
- .4 Where tests or inspections by designated testing laboratory reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Consultant may require, to verify acceptability of corrected work.

1.3. CONTRACTOR'S RESPONSIBILITIES

- .1 Furnish labour and facilities to:
 - .1 Provide access to work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

- .2 Notify testing laboratory sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, provide representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good work that is covered before required inspection or testing is complete and approved by Consultant.

END OF SECTION

Part 1 General

1.1. GENERAL

- .1 Accept responsibility for all temporary structures and comply with applicable rules and regulations. Pay all taxes.
- .2 The expression “provide” shall be deemed to include the provision, installation and finishing, maintenance, servicing and removal of the Work described. All work damaged by temporary installations shall be repaired and made good at no extra cost to the Owner.
- .3 Maintain temporary facilities in good condition.
- .4 Clean site offices daily.
- .5 Clean sanitary facilities daily.
- .6 When building is enclosed, if appropriate or if so directed by the Consultant, remove temporary structures and provide equivalent enclosed accommodations within the building.
- .7 On completion, or at earlier date if facility no longer requires or if alternative accommodation is provided within building, clear away temporary facilities and make good all work disturbed.
- .8 Clean streets and sidewalks as required to prevent accumulation of debris, waste or soil.

1.2. TRAFFIC CONTROL AND SECURITY

- .1 Provide necessary traffic control and security personnel as required for the safe performance of the Contract and security of the premises. Provide all necessary flagmen to ensure the safe delivery of materials to the site and signage to direct and protect pedestrian and vehicular traffic.
- .2 Conform to the requirements of local authority.
- .3 Conform to the requirements of the insurance companies providing coverage for this Contract.

1.3. ACCESS

- .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads and provide snow removal during period of work.

- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.4. CONTRACTOR'S SITE OFFICE

- .1 Provide office spaces large enough to accommodate a separate Contractor's office, general office/drawing storage room and meeting room.
- .2 Furnish office spaces with at least 2 drawing lay down tables, 2 drawing storage racks, three-drawer filing cabinet, shelving and coat hooks, 2 desks and table and chairs for Site Meetings (to accommodate a minimum of twelve people).
- .3 Install lighting to provide at least 70 foot candles using surface mounted shielded commercial fixtures with 10% upward lighting component.
- .4 Insulate building and provide heating and cooling system to maintain 22°C inside temperature. Provide as a minimum two operable windows for cross ventilation.
- .5 Provide telephone, fax machine or laptop with email and cellular phone for Superintendent with voicemail.

1.5. STORAGE SHEDS

- .1 Erect secure weather-tight sheds in which to store construction materials that require protection from the elements. Include construction and operating hardware, with security locks, as required.
- .2 Build sheds with floors clear of grade and so that no damage is suffered by stored materials from flooding.
- .3 Install lighting in storage areas and heat in those storage areas containing materials damaged by low temperature.
- .4 Separate storage for painters' materials and tools from other storage areas.
- .5 Locate all sheds where directed.
- .6 Each Subcontractor shall provide his own shed, including heat and light, for his employees, and his storage.
- .7 Locate both field offices and storage sheds within barriers erected to enclose the site.

1.6. SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition. Have toilets maintained in sanitary conditions under contract. Clean and disinfect site of the toilets.

1.7. SITE ENCLOSURES

- .1 Erect temporary site enclosure around Construction Area and around Contractor's Work Area using minimum 1820 mm high modular construction fencing, secured to ensure stability. Provide lockable truck gates as required.
- .2 Temporarily extend site enclosure as required to complete service connections that may be outside of the Contractor's Work Area until area is made safe.

1.8. ENCLOSURE OF STRUCTURE

- .1 Include in the work temporary enclosure for building as required to protect it, in its entirety or in its parts, against the elements, to maintain environmental conditions required for work within the enclosure, and to prevent damage to materials stored within. Design enclosures that are structurally self sufficient and that do not overload the building structure. Design enclosures to withstand wind pressures required for the building by jurisdictional authorities. Use structural framing of building for support of temporary enclosure framing only upon verification that the load limits of the building frame will not be exceeded. Keep surfaces of enclosures free of snow and ice to avoid overloading of the building structure. Erect enclosures to allow complete accessibility for the installation of materials during the time enclosures remain in place.
- .2 Neatly construct temporary exterior doors, hang on hinges and fit with padlocks.
- .3 Provide temporary partitions and enclosures as required to protect the work and guard against burglary or malicious damage.

1.9. TEMPORARY SERVICES

- .1 Provide, install, maintain and locate where directed, the following temporary facilities for the Work and for all trades except where specified otherwise and remove them upon completion of the Work. These facilities shall be considered minimal and shall be increased as necessary. Pay all charges and billings in connection therewith.
- .2 Light and Power: Make connections available to any part of the Work within distance of 30 metres extension. Provide power at temporary storage shed and field office.
- .3 Install lighting for emergency evacuation, safety and security throughout the Project as required by jurisdictional authorities. Light to be evenly distributed, and at intensities to ensure that proper installations and applications are achieved.

- .4 Water: Provide water service to construction site until permanent water service is installed. Provide backflow prevention for construction water.
- .5 Maintain fire protection as required by jurisdictional authorities.

1.10. HEATING AND VENTILATING

- .1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment. Use of direct-fired heaters discharging waste products into work areas will not be permitted.
- .2 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of work.
 - .2 Protect work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Maintain minimum temperature of 15°C or higher where specified during construction and completion of the finish Work and maintain until acceptance of structure by Consultant.
- .4 Maintain ambient temperature and humidity levels as required for comfort of office personnel.
- .5 Ventilating:
 - .1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.

- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
 - .6 Use of new systems for temporary heating, ventilating or air conditioning will not be permitted.

1.11. DRAINAGE

- .1 Refer to Contract Documents for site drainage and pumping requirements.

1.12. CONSTRUCTION AIDS

- .1 Select, operate and maintain hoisting equipment and cranes as may be required. Operate such equipment only by qualified hoist or crane operators. Make hoist available for Work of each Section.
- .2 Erect scaffolding, independent of walls. Use scaffolding so as to interfere as little as possible with the Work. When not in use, move scaffolding as necessary to permit other work. Construct and maintain scaffolding in rigid, secure and safe manner. Remove scaffolding promptly when no longer required. Scaffolding shall permit convenient access to all levels for all workmen and inspection staff.

1.13. GENERAL PROTECTION

- .1 Without limiting the Contractor's responsibility to provide all necessary protection, the Contractor shall:
 - .1 Remove snow and ice as may be required for the protection and/or execution of the Work. Do not use salt under any circumstances.
 - .2 Wet all areas to prevent dust from rising and power hose daily to remove dirt. During cold weather, ensure that mud is scraped off areas outside hoarding as well as in.

- .3 Provide as required to permit Work to continue without interruption, tarpaulins, polyethylene, plastic or wood coverings to close in building prior to installation of windows and doors.
- .4 Protect materials and equipment delivered to the Site in the Owner's name for installation in the Work.
- .2 Any Work damaged by failure to provide protection as required or damaged as a result of lack of adequate temporary heat shall be removed and replaced with new, at no additional cost to the Owner.
- .3 Each Trade shall avoid damaging the Work of other Trades. Conduct the Work and provide protective covering as necessary to meet this requirement. Make good at own expense any damage resulting from failure to meet this requirement. Protective measures shall be to Consultant's approval.
- .4 If it is necessary to work on roof after installation of roof coverings, protect membrane with plywood sheets or similar materials.
- .5 Provide all necessary shoring, bracing and sheeting as required for safety and execution of the Work.

1.14. PARKING AND EQUIPMENT STORAGE

- .1 Facilities for parking of vehicles and temporary storage for machinery and equipment shall be within the Contractor's Work Area.

1.15. SITE SIGNS AND NOTICES

- .1 Only notices for safety or instructions are permitted on site.
- .2 Signs and notices for safety or instructions to be in French and English language, or commonly understood graphic symbols.
- .3 Maintain signboards, signs and notices for duration of project. Remove and dispose of signs off site on completion of project.

1.16. SCAFFOLDING

- .1 Construct and maintain scaffolding in rigid, secure and safe manner.
- .2 Erect scaffolding independent of walls. Remove promptly when no longer required.

1.17. REMOVAL OF TEMPORARY FACILITIES

- .1 Remove temporary facilities from site when directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 13 00 Sheet Waterproofing
- .3 Section 07 84 00 Fire Stopping and Smoke Seal
- .4 Section 09 21 16 Gypsum Board Assemblies
- .5 Section 09 91 00 Painting

1.02 REFERENCE STANDARDS

- .1 Volatile Organic Compound (VOC) Concentrations Limits for Architectural Coatings Regulations
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-17 Douglas Fir Plywood.
- .3 CAN/CSA-A82.27-M91 Gypsum Board Products
- .4 South Coast Air Quality Management District (SCAQMD): Rule 1113 - Architectural Coatings.
- .5 Green Seal, Inc.:
 - .1 GS-11 Standard for Paints and Coatings (Latest Edition).
 - .2 GC-03 - Environmental Criteria for Anti-Corrosive Paints.

1.03 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.04 HOARDING

- .1 Erect temporary construction site enclosures using interlocking welded metal panels 2.4 m high. Fence shall be freestanding on asphalt and anchored in loose terrain.
- .2 Apply plywood panels vertically as need for privacy and additional security.
- .3 Provide one lockable truck entrance gate and at least one pedestrian gate/door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

- .5 Paint public side of site enclosure/walkways in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .6 Erect temporary barriers around trees and plants designated to remain. Barriers shall be constructed using new 1.2 m high construction safety fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre maximum. Protect from damage by equipment and construction procedures.
- .7 Maintain all barriers and fence in good repair.

1.05 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.06 WEATHER ENCLOSURES

- .1 Provide weather tight 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 for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.07 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Repair any damage caused by the installation and removal of temporary screens at no additional cost.
- .3 Maintain and relocate protection until such work is complete.

1.08 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.09 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.10 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Consultant locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.13 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

PART 2 - PRODUCTS

2.01 MATERIALS – FOR INTERNAL BARRIERS

- .1 Plywood 13 mm minimum thickness Douglas Fir exterior grade plywood "B" or better for paint finish.
- .2 Structural Lumber: Rafters, posts, planking and bracing, N.L.G.A. No. 2 grade minimum.
- .3 Roll Plastic dust barrier: 6mil. Polyethylene roll sheets of a width and length to meet requirements for a dust proof barrier. Joints to be taped with Acrylic Tuck Tape by 3M.
- .4 Waterproof Membrane: "Bituthene" Regular by W.R. Grace Materials Ltd., or approved alternative.
- .5 Exterior alkyd paint to approved manufacturer.
- .6 Interior fire-retardant paint to approved manufacturer.
- .7 Steel Studs: 0.55 mm thick, wipe coated galvanized, having knurled flanges 32 mm wide with edges doubled back at least 4.8 mm, with girts as required.
- .8 Gypsum Board: To meet specified requirements of CAN/CSA-A82.27; fire rated board classified for hazard by ULC and labelled as such.

2.02 CHAIN LINK FENCING FOR EXTERIOR SITE ENCLOSURES

- .1 Galvanized Link Fabric: 50mm mesh, No. 9 gauge woven steel wire, zinc coated after weaving, to meet specified requirements of ASTM A392.
- .2 Tube: 90mm diameter for end posts, 45mm for top rail, 60mm for line posts, standard, butt welded steel, galvanized, Schedule 40, to meet specified requirements of ASTM A120. Hollow metal structural steel tubing with minimum wall thickness of 0.100" and meeting specified requirements of CSA G40.21, Grade 50W.
- .3 Tension Wire: No. 6 gauge single strand, finished to match fabric.
- .4 Fabric Bands: Galvanized steel to fit tubing.
- .5 Rail Fittings: Galvanized steel for caps, top tails guides.
- .6 Galvanizing: Galvanize fittings, accessories and steel tube by hot dip method after fabrication to meet specified requirements of CSA Standard G164.
- .7 Approved manufacturers: Frost Fencing, Lundy Steel Fencing, Donald Greening or other approved alternate. Materials need not be new however, they must be able to remain in place and perform as required for the duration of the Project.
- .8 Fence height: 1830mm high unless noted otherwise.
- .9 Commercially available temporary construction fencing may be approved at the discretion of the architect.

PART 3 – EXECUTION

3.01 FABRICATION AND INSTALLATION - HOARDING

- .1 Install hoarding, fencing and sidewalk protection to the exterior of the building in accordance with approved Shop Drawings and By-laws of the City of Sarnia, and in accordance with documents.
- .2 Provide posts, planking and plywood.
- .3 Provide pedestrian and vehicular entrances as required, complete with swing or sliding gates, screened openings and all necessary hardware including locks.
- .4 Paint complete hoarding in colour selected by Consultant.
- .5 Maintain hoarding in good condition at all times.
- .6 Repair any hoarding removed or damaged, to satisfaction of the Consultant and authorities.

- .7 Wash all hoarding at least every two months.
- .8 Remove hoarding and fencing from site only when authorized by the Consultant.

3.02 FABRICATION AND INSTALLATION - BARRIER

- .1 Install barriers within the existing building to separate a work area from the remainder of the building.
- .2 Barriers shall be erected such that it is self-supporting and braced on work area side.
- .3 Erect a barrier of one hour fire rated drywall construction and to meet the requirements of Section 092116 and ULC Design No.W408 or W409.
- .4 Barriers shall not allow for the passage of airborne dust.
- .5 Maintain minimum clearance for exits and access to exits.
- .6 Relocate, temporarily any existing life safety devices which may become hidden or obscure due to the erection of barrier.
- .7 Maintain barriers in good stable condition at all times.

3.03 FABRICATION AND INSTALLATION - CHAIN LINK FENCING

- .1 Posts shall be spaced at 3000mm on centre maximum and shall be driven into the ground a minimum of 1200mm deep.
- .2 Install at 40mm above grade, a single strand of tension wire with turnbuckles at each end.
- .3 Install at top of fabric, a 45mm diameter top rail with appropriate caps and holders.
- .4 Install fabric under tension under anchor to the posts, top rail and bottom tension wire at 450mm on centre.
- .5 At end post, attach fabric and 6mm x 19mm tension bands at 300mm on centre.
- .6 Provide a 45mm diameter brace between end posts at mid height.
- .7 At completion of project, completely remove temporary fencing and patch all disturbed areas to match existing.
- .8 All fencing and components will remain the property of the Contractor.

3.04 **EXCEPTION**

- .1 Temporary/movable perimeter fencing barriers for site work is may be approved by the consultant where construction activities require staged construction perimeters.

- .2 Where permanent hoarding is not specifically indicated, provide safety fencing at perimeter of property adjacent of streets and adjacent residential properties, separating public access areas from the work site, where no other barrier is present.

END OF SECTION

Part 1 General

1.1. SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation
- .2 Manufacturer's instructions
- .3 Quality of Work, coordination and fastenings
- .4 Existing utilities

1.2. REFERENCE STANDARDS

- .1 Canadian Construction Association
 - .1 CCDC 2 – 2008, Stipulated Price Contract
- .2 Conform to these standards, in whole or in part, as specifically requested in specifications.
- .3 If there is a question as to whether any product or system is in conformance with applicable standards, Consultant reserves the right to have such products or systems tested to prove or disprove conformance.
- .4 The cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Tender, except where specific date or issue is specifically noted.

1.3. QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective products, whenever identified prior to completion of Work, 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.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4. AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5. 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 seal and labels intact. DO not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooded platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber, doors, and other materials subject to warping on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Consultant.
- .9 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. DO not paint over name plates.

1.6. TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Owner. Unload, handle and store such products.

1.7. 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 re-installation at no increase in Contract Price or Contract Time.

1.8. QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, 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 anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.9. COORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10. CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floor, wall and ceiling assemblies, except where indicated otherwise.
- .2 Before installation, inform Consultant if there is interference. Install as directed by Consultant.

1.11. REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12. LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Consultant of conflicting installation. Install as directed.

1.13. FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected Specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly, and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14. FASTENINGS – EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15. PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load-bearing structural member, unless specifically indicated, without written approval of Consultant.

1.16. EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities with minimum of disturbance to Work.
- .2 Protect, relocate, or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped services.

END OF SECTION

Part 1 General

1.1. GENERAL

- .1 This section is intended to include criteria for and requirements of the final completion of the Contract.
- .2 Conform to OAA/OGCA Take-Over Procedures Document No. 100, latest edition.

1.2. FINAL CLEANING

- .1 When the Work is substantially performed, remove surplus products, tools, construction machinery and equipment not required for the performance of the remaining Work.
- .2 Remove waste products and debris. Dust, mop and vacuum clean all surfaces before the inspection process commences. Clean and polish removing stains, spots, marks and dirt from glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .3 Broom clean and wash exterior walks, steps and surfaces. Rake clean other surfaces of grounds. Sweep and wash clean site paved areas. Remove dirt and other disfigurations from exterior surfaces.

1.3. PROCEDURE

- .1 Upon written notification from the General Contractor that the Project has reached Substantial Performance together with a copy of their own inspection lists showing all Work is completed, the Consultant will make a comprehensive deficiency inspection, and provide a deficiency list to the General Contractor, unless in the Consultant's opinion, the Project is not substantially complete.
- .2 Upon written notification from the General Contractor that all items in the deficiency list have been completed, the Consultant will inspect the Work with the Superintendent and provide the General Contractor with a re-inspection list if any items are outstanding, including any new deficiencies resulting from the correction of the original list.
- .3 Within 10 working days of the second inspection, the Consultant will make a final inspection of the Work and provide the General Contractor with a final deficiency list if any items are outstanding. If so, the Owner will have the right to provide the General Contractor with 5 days' notice, complete the outstanding Work, on a time and material basis and deduct the cost of completion from the balance owing the Contractor.

- .4 Until **ALL** deficiencies are completed, the final month's operation cost, as determined in Section 01005 General Instructions, Item 1.11.3 Cost Breakdown will be withheld from the General Contractor, in addition to costs for specific items.

END OF SECTION

Part 1 General

1.1. SECTION INCLUDES

- .1 As-built, samples, and specifications
- .2 Equipment and systems
- .3 Product data, materials and finishes, and related information
- .4 Operation and maintenance data
- .5 Spare parts, special tools and maintenance materials
- .6 Warranties and bonds
- .7 Final site survey

1.2. RELATED SECTIONS

- .1 Section 01 31 10 – Project Coordination

1.3. SUBMISSION

- .1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Consultant one digital copy of operating and maintenance manuals.
- .3 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .4 If requested, furnish evidence as to type, source and quality of products provided.
- .5 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .6 All submissions are to be electronic medium delivered on Flash Drive.
- .7 An amount of 1.5% of the contract (completion retention) will be withheld from the final progress payment until complete submittals required in this Section are received and accepted by the Consultant.

1.4. FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Flash Drive is to be properly indexed to list all of the data organized into the appropriate category. Consult with the architect to define the index prior to preparing the upload of contents to the flash drive.
- .3 When multiple Flash Drives are used, correlate data into related consistent groupings. Identify contents of each Flash Drive on the jacket of the Drive.
- .4 Identify each Flash Drive with type or printed title i.e. 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange Data Index content by Section numbers and sequence of Table of Contents.
- .6 Provide AutoCAD files of all As-Built drawings in .dwg format on Flash Drive.
- .7 Arrange Data Index content by Discipline i.e. Architectural, Civil, structural etc. Drawings to be organized by consecutive numbering.
- .8 Provide all contract administration correspondence by consecutive numbering for Site Meeting Minutes, Bulletins, Change Directives, Change Orders, Site Instructions, etc.) on flash drive.

1.5. CONTENTS – EACH VOLUME

- .1 Table of Contents: Provide title of project:
 - .1 Date of submission
 - .2 Names, addresses and telephone numbers of Consultant and Contractor with name of responsible parties
 - .3 Schedule of products and systems, indexed to content of volume
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Training: Schedule training of Owner's representatives on all systems, at the Owner's convenience.

1.6. AS-BUILT DRAWINGS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Consultant one record copy of:
 - .1 Contract Drawings
 - .2 Specifications
 - .3 Addenda
 - .4 Change Orders and other modifications to the Contract
 - .5 Reviewed shop drawings, product data, and samples
 - .6 Field test records
 - .7 Inspection certificates
 - .8 Manufacturer's certificates
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. DO not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Consultant.
- .6 Upon completion of project, provide AutoCAD files of all as-built drawings in .dwg format on Flash Drive.

1.7. RECORD ACTUAL SITE CONDITIONS

- .1 Record information on set of drawings, provided by Consultant.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction
- .4 Field changes of dimension and detail
- .5 Changes made by Change Orders
- .6 Details not on original Contract Drawings
- .7 References to related Shop Drawings and modifications
- .5 Specifications: Legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items
 - .2 Changes made by Addenda and change orders
- .6 Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections

1.8. EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: Include description of unit or system and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel Board Circuit Directories: Provide electrical service characteristics, controls, and communications.
- .3 Include installed colour-coded wiring diagrams.
- .4 Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: Include routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation and maintenance instructions.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour-coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports.
- .15 Additional Requirements: As specified in individual specification sections.

1.9. MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: Include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: As specified in individual specifications sections.

1.10. SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.

- .4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .5 Obtain receipt from Owner for delivered products and submit prior to final payment.

1.11. MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items of Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .5 Obtain receipt from Owner for delivered products and submit prior to final payment.

1.12. SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

1.13. STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.14. WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

- .2 List subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible Principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

PART 1 - GENERAL

1.01 QUALITY CONTROL

- .1 The Contractor is fully responsible for continuous examination and inspection of the Work related to the exterior assemblies to ensure compliance with the Contract Documents.
- .2 Materials and workmanship shall be subject to inspection and testing at any time. Cooperate in permitting access for inspection and testing to places where work is being done or stock is being stored.
- .3 In addition to Consultant site review, the Owner may provide quality control inspection and testing as specified.
- .4 Allow sufficient time for testing, evaluation, alterations and retesting so as not to affect the Progress Schedule for the Work.
- .5 The Consultant or Owner's inspection and testing agency may require testing of connections and special prefabricated inserts, as part of the work of this Section.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE

- .1 Building envelope includes, but is not limited to, slabs-on-grade, foundation walls, cladding systems, glazing systems, louvres, doors, frames, mechanical and electrical penetrations of assemblies, sealants, air and vapour barrier materials, roofing and waterproofing.
- .2 Design and engineer as required by applicable Section of the Specifications, fabricate, erect or install building envelope in compliance with the Ontario Building Code, other regulations and requirements of authorities having jurisdiction, with the stringent requirements to govern.
- .3 Take into account tolerance limitations of the structure, creep, deflection and other movements of the structure, both during the Work and in service.
- .4 Allow for expansion and contraction of components caused by ambient, temperature range and surface temperature variation of components, and structural movements, without causing distortion, failure of fastening, joints and/or air/vapour barrier seals, undue stress or other defects detrimental to appearance and/or performance.

- .5 Accommodate, by means of expansion and contraction provisions, any movements in the building assemblies themselves and between the assemblies and the building structure, caused by structural movements, both deflection and racking; and/or thermal expansion and contraction, without distortion, damage, misalignment of joints, breakage of air/vapour barriers, water and air penetration through the assembly, or glass breakage.
- .6 Method of attachment to the structure shall take into account site peculiarities such that there shall be no possibility of site and air vibrations or normal temperature movements of the building to loosen, weaken and/or fracture the connection between building envelope assembly components and the structure or between the components themselves.
- .7 Reinforce building envelope assembly components, as required, so that the members can safely sustain design loads.
- .8 Assemble and secure assemblies in manner which will keep stresses on sealants within the sealant manufacturers' recommended maximum.
- .9 Construct building envelope wall and window assemblies based on "Rain Screen" principle as advocated by the National Research Council of Canada. All voids between the assembly components as well as those between components and structure shall have:
 - .1 Gaskets, baffles, overlaps, seals and compartmentalization as required to provide a barrier "Rain Screen" to effectively prevent excessive rain water entry into any of the building envelope cavities but allow pressure equalization of cavity air spaces.
 - .2 Air barriers and seals as required to prevent entry of interior building air into building envelope cavities, and exterior air into the building. Air barriers and seals shall be able to withstand design pressures.
 - .3 Such provisions in the form of openings between cavities and the building exterior of sufficient cross sections to provide adequate pressure equalization. Openings shall be effectively baffled against direct rain water entry.
 - .4 Thermal separators, isolators and seals placed to eliminate contact between interior humid air and a cold surface or structural component to prevent condensation and ice build-up on such surfaces during cold weather.
- .10 Comply with the design and performance requirements specified in the Ontario Building Code, with the most stringent requirements to govern, and as specified herein, including the following principles:
 - .1 Drain to exterior face of the wall or window assembly, any water entering at joints and any condensation occurring within the building envelope assembly.
 - .2 Design, fabricate and install the assembly to minimize specified materials' ability to transmit moisture through capillary action.

- .3 Design, fabricate and install the assembly to be watertight to the interior under the interior and exterior design conditions in combination with the movements occurring due to loads imposed.
- .11 The requirements for an air barrier and a vapour barrier are intended to be provided at same plane in the building envelope design, unless otherwise indicated or specified. In such cases, the Drawings and Specifications refer to “air/vapour barrier”. The definition of the air/vapour barrier for the purpose of these Specifications is “a continuous membrane including joints of membrane between components and to adjacent construction which prevents or retards passage of moisture laden air and the diffusion of water vapour through it”.
- .12 Design sealant joints with strict regard for sizing of joint and parallel orientation of contract surfaces. Ensure support for both sealant and backer rod.
- .13 This project incorporates the design principles of positive air and vapour leakage control at the building enclosure line. Drawing details illustrate continuity of air/vapour barrier penetrating elements such as door, window and louver frames.
- .14 The barrier extends nominally from foundation line, vertically along exterior walls and to positive contact with roof air/vapour barrier.
- .15 In order to maintain the continuity of the envelope, the interfacing of various building elements requires close coordination by all trades involved with the exterior building elements. The positive mechanical connections and seal of transition medium extending from the primary wall air/vapour barrier to the insulation line of window or door frame, shall be made with proper construction sequencing established by Contractor to ensure such interfacing. All such transition installation shall be inspected by Consultant prior to concealing with subsequent construction.
- .16 Manufacturers of such window or door frames shall ensure that correctly designed and positioned metallic legs, extensions or recesses are provided at the thermal break line to facilitate connections of rigid or flexible transition medium as indicated prior to setting such elements in their allotted openings.
- .17 Provide completed installations free from vibrations, wind whistles, and noise due to thermal and structural movement and wind pressure.
- .18 Design building envelope assemblies to prevent damage due to earthquake forces as required by the Ontario Building Code.

PART 3 – EXECUTION

NOT USED

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 09 91 00 Painting
- .2 Section 07 92 00 Sealants.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - .3 ASTM C578-18, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - .4 ASTM C1289-18a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - .5 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
 - .6 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
 - .7 ASTM D5055-156, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
 - .8 ASTM D5456-18, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .9 ASTM F1667-18 Standard Specification For Driven Fasteners: Nails, Spikes, And Staples
- .2 CSA International
 - .1 CAN/CSA O80 Wood Preservation
 - .2 CAN/CSA-A123.2-03(R2018), Asphalt Coated Roofing Sheets.
 - .3 CSA O112.9-10(2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
 - .4 CSA O121-17, Douglas Fir Plywood.
 - .5 CAN/CSA O122-16, Structural Glued-Laminated Timber.
 - .6 CSA O141-05(R2014), Softwood Lumber.
 - .7 CSA O151-17, Canadian Softwood Plywood.
 - .8 CSA O153-13(R2017), Poplar Plywood.
 - .9 CSA O325-16, Construction Sheathing.

- .10 CSA O437 Series-93(R2011), Standards on OSB and Waferboard.
- .11 CAN/CSA-Z809-16, Sustainable Forest Management.
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber [2010].
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-(A2016), Architectural Coatings.
 - .2 SCAQMD Rule 1168-(A2017), Adhesives and Sealants Applications.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S706.1:2016, Standard for Wood Fibre Insulating Boards for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Product Data:
 - 1. Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.4 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board. Plywood, particleboard, OSB and wood based composite panels in accordance with CSA standards.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wood from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

- .1 Description:
 - .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CSA O141 Softwood Lumber.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 Ontario Building Code Section 4.3
 - .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 S2S is acceptable for utility use where concealed: sound and free of imperfections or deficiencies making unsuitable for use_.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Post and timbers sizes: "Standard" or better grade.
 - .3 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .1 For Utility use: Unsanded Sheathing Grade

2.2 ACCESSORIES

- .1 Polyethylene film: 0.15 mm thick (6Mil).
- .2 Air seal: closed cell polyurethane or polyethylene.
- .3 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .4 General purpose adhesive: to CSA O112.9.
- .5 Nails, spikes and staples: to ASTM F1667 galvanized at exterior locations, at interior high humidity locations and for treated lumber; plain finish elsewhere. Use spiral shank nails generally.
- .6 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .7 To hollow masonry use toggle bolts: to solid masonry and concrete use expansion shields and lag bolts; to steel use bolts or welded stud fasteners. Use lead or inorganic fibre plugs for fasteners in concrete and masonry. Provide washers at bolt heads and nuts. Galvanize fasteners at exterior locations, at high humidity interior locations and for treated lumber.
- .8 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .9 Wood Preservative:

- .1 Preservative in accordance with manufacturer's recommendations for surface conditions:
 - .1 Copper naphthenate or pentachlorophenol solution to meet specified requirements of CSA Standard O80.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant 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 Consultant.

3.2 INSTALLATION

- .1 Lay out items installed by this Section carefully and to accommodate requirements of other Sections. Cut and fit members accurately; erect them in position indicated by Drawings; align, level, square, plumb, and secure them permanently in place. Brace work temporarily as required. Join members only over solid backing.
- .2 Lay out items installed by this Section carefully and to accommodate requirements of other Sections. Cut and fit members accurately; erect them in position indicated by Drawings; align, level, square, plumb, and secure them permanently in place. Brace work temporarily as required. Join members only over solid backing.
- .3 Cooperate with other Sections to ensure that unity of actions will ensure orderly progress to meet construction schedule.
- .4 Supply anchors, bolts, and inserts, required for installations of this Section, to those performing the work of other Sections and who are responsible for their installation.
- .5 Include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, and strap iron required for installations by this Section; and for all operating hardware required by this Section for temporary use.
- .6 Do not attach installations of this Section by wood plugs or blocking in concrete or masonry. Use lead shields, expansion shields, concrete nails, or similar methods only as approved.
- .7 For general strapping, set preservative treated nominal 19 mm x 38 mm wood strips vertically and spaced at 400 mm o.c., unless otherwise indicated.
 - .1 Shim to provide a true face plane. Install intermediate horizontal strapping at all joints to wall finishes applied over grounds.

- .2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .8 Install members true to line, levels and elevations, square and plumb.
- .9 Construct continuous members from pieces of longest practical length.
- .10 Install spanning members with "crown-edge" up.
- .11 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .12 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.
- .13 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
 - .1 Drawings are representative only. Install required provisions for fastening, located and secured to suit site conditions, and adequate for intended support.
 - .2 Nominal 38mm thickness.
- .14 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners. Drawings are representative only. Install required provisions for fastening, located and secured to suit site conditions, and adequate for intended support.
- .15 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .16 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .17 Countersink bolts where necessary to provide clearance for other work.

3.3 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 Waste Management: separate waste materials for recycling
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction. Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 The Work of this Section, and Related Work specified in other Sections shall comply with all requirements of Division 1 – General Requirements.

1.02 SECTION INCLUDES

- .1 Provision of all labour, materials, equipment and incidental services necessary to Provide all Finish Carpentry including the following:
 - .1 Supply and installation of all running wood trim.
 - .2 Supply and installation of all custom cabinets and classroom communications panel.

1.03 RELATED SECTIONS

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 09 90 00 Painting and finishing
- .3 Electrical Division Coordinate electrical and data installations in cabinets.

1.04 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI A208.2-2002; Medium Density Fiberboard for Interior Use
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A153/A153M-16a; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 Architectural Woodwork Institute (AWI)/Architectural Woodwork Manufacturers Association of Canada (AWMAC):
 - .1 AWI and AWMAC; Architectural Woodwork Quality Standards latest Version.
- .4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-71.20-M88; Adhesive, Contact, Brushable
- .5 Canadian Hardwood Plywood and Veneer Association (CHPVA):
 - .1 CHPVA Official Grading Rules for Canadian Hardwood Plywood.
- .6 Canadian Standards Association (CSA):
 - .1 CSA B111-1974 (R2003); Wire Nails, Spikes and Staples.
 - .2 CSA O112 Series-M1977 (R2006);Standards for Wood Adhesives.
- .7 National Hardwood Lumber Association (NHLA):
 - .1 NHLA Rules for the Measurement and Inspection of Hardwood and Cypress January 1, 2007.

- .8 National Lumber Grades Authority (NLGA):
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2003.

1.05 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .3 Indicate all materials, thicknesses, finishes and hardware.
 - .4 Details must be minimum 1:10 scale.
- .2 Samples
 - .1 Submit Samples in accordance with Section 01 33 00.
 - .2 Submit Samples of each type and profile of all standing and running trim.
 - .3 Submit duplicate Samples not less than 102mm x 152mm (4" x 6") size of final plastic laminate and melamine composite panel colours and finish selected by Consultant from manufacturer's full standard range including woodgrains.
 - .4 Submit duplicate Samples of factory veneer finish not less than 152mm x 305mm (6" x 12") size labeled with sample production date, of representative veneer, indicating range and variation that can be expected.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Protect materials against dampness during and after delivery.
- .2 Store materials in ventilated areas, protected from extreme changes of temperature or humidity

1.07 EXTENDED WARRANTY

- .1 Submit Extended Warranty documents in accordance with Section 01 78 00.
- .2 Provide an Extended Warranty for finish carpentry work for a period of two (2) years from the date of Substantial Performance of the Work against warpage, opening of joints, shrinkage and similar defects.

PART 2 - PRODUCTS

2.01 LUMBER MATERIALS

- .1 Rough Lumber: SPF softwood, No. 2 grade or better, S4S, kiln dried with moisture content 19% or less.
- .2 Softwood Finish Lumber: Douglas Fir softwood species, NLGA No. 1 Grade, S4S, kiln-dried with moisture content 19% or less in accordance with CAN/CSA-O141.
- .3 Hardwood Lumber: Grade A, White Birch, moisture content 4 1/2%, then tempered to a moisture content of 6%, in accordance with National Hardwood Lumber Association (NHLA) and AWMAC premium grade.
 - .1 Board widths 8" and less must be supplied in one piece; edge glueing or jointing is not acceptable.

- .4 Hardwood plywood:
 - .1 Thickness: min 16 mm or as detailed.
 - .2 Face veneer Birch
 - .3 Grade A

2.02 PANEL & TRIM MATERIALS

- .1 Douglas Fir Plywood (DFP): to CSA-O121, G2S, standard construction, thickness as indicated.
- .2 Canadian Softwood Plywood (CSP): to CSA-O151, G2S, standard construction, thickness as indicated.
- .3 Medium Density Overlay Plywood (MDO): to CSA-O151, G2S, standard construction, thickness as indicated.
- .4 Poplar Plywood (PP): to CSA-O153, G2S, standard construction, thickness as indicated.
- .5 Hardwood Plywood (HP): to CSA 0115, G2S, birch, architectural grade, thickness as indicated.
- .6 Mat-formed wood particleboard (PB): to ANSI A208.1, minimum density 641 kg/m³ (40.0 lbs./ft³), thickness as detailed on Drawings.
- .7 Wood Veneer Panels (WVP)
 - .1 Core: Medium Density Fiberboard (MDF).
 - .2 Face Veneer & Edges: AWMAC Premium Grade, quarter-cut, select Birch, slip-matched veneers with face characteristics 40% AA, 40% A, and 20% ranging between A and AA.

2.03 ACCESSORIES

- .1 Nails and staples: to CSA B111; galvanized to ASTM A153/A153M for exterior work, interior humid areas and for treated lumber; electroplated elsewhere.
- .2 Wood screws: to ANSI/ASME B18.6.1, electroplated steel, type and size to suit application.

2.04 ADHESIVES

- .1 Contact Adhesive: conforming to CAN/CGSB-71.20.
- .2 Hot Melt Adhesive: of approved manufacturer.
- .3 Resorcinol Adhesive: conforming to CSA-O112.
- .4 Sealer: approved water-resistant sealer or glue.

2.05 FINISH

- .1 Stain Grade Birch is designated as "Clear Finish" on the Drawings. Refer to Section 09 91 00 for finish definitions and specifications.

- .2 MDF trim shall be factory primed and is designated as "Paint Finish" on the Drawings. Refer to Section 09 91 00 for finish definitions and specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

- .1 Prior to commencing the Work of this Section, carefully inspect installed Work of other trades and verify that such Work is complete to the point where Work of this Section may properly commence. Provide Notice in Writing to the Consultant and Contractor of conditions detrimental to the proper and timely completion of the Work of this Section.
- .2 Do not begin installation until all unsatisfactory conditions are resolved. Beginning Work of this Section constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.02 QUALITY OF WORK

- .1 Perform finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects. Form joints to conceal shrinkage.
- .3 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
- .4 Select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
- .5 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
- .6 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

3.03 INSTALLATION

- .1 Standing And Running Trim
 - .1 Butt and cope internal joints of baseboards, mitre external corners. Mitre all corner joints of casing. Butt and cope all baseboard and trim where intersecting with door casing.
 - .2 Fit backs of baseboards and casing snugly to wall surfaces.
 - .3 Make necessary joints in baseboard using a 45° scarf joint.
 - .4 Install door and window trim in single lengths without splicing.
- .2 Wood Veneer Panels
 - .1 Secure panels and perimeter trim using adhesive recommended for purpose by manufacturer. Fill nail holes caused by temporary fixing with filler matching wood in colour.

- .2 Secure panels and perimeter trim using concealed fasteners wherever possible, or alternately using counter sunk screws plugged with matching wood plugs.

END OF SECTION

PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

- .1 Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section**

- .1 Section 06 10 00: Finish Carpentry
.2 Section 09 91 00: Painting and Finishing
.3 Section 07 92 00: Sealants
.4 Division 22: Plumbing
.5 Division 23: HVAC
.6 Division 26: Electrical Services

.3 **Installation of Work Supplied by This Sections Specified Other Sections**

- .1 Section 03 30 00: To install blocking, anchors and inserts.
.2 Section 04 05 00: To install blocking, anchors and inserts.
.3 Section 09 21 16: To install support framing.

.2 **Quality Assurance**

.1 **Subcontractor Qualifications**

- .1 Provide custom casework specified in this Section only by a fabricator who has adequate plant, equipment and skilled tradesmen to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.

.3 **References**

.1 **Reference Standards**

- .1 Reference standards quoted in Contract Documents refer to: CAN/CSA-A172-M79, High Pressure, Paper Base, Decorative Laminates.
.2 Fabricate custom casework to Custom Quality Standard of either:
.1 AWI Specification, Architectural Woodwork Quality Standards and Guide Specifications, 1973, by Architectural Woodwork Institute.
.2 AWMAC Specification, Quality Standards for Architectural Woodwork of the Architectural Woodwork Manufacturers Association of Canada, Seventh Edition, 1984.

.4 **Submittals**

.1 **Shop Drawings**

- .1 Submit shop drawings.

.2 **Samples**

- .1 Submit samples of each specified finish wood species, and in each cut.
.2 Submit samples of plastic laminate.

.5 **Delivery, Storage, and Handling**

- .1 Package and otherwise protect custom casework from damage during handling, delivery, and storage. Provide temporary skids under large or heavy units.
- .2 Do not deliver custom casework to site until conditions are such that no damage will occur to it while in storage. Ensure that relative humidity in storage areas does not exceed 55%.

.6 **Warranty**

.1 **Extended Warranty**

- .1 Warrant installation specified in this Section covering the period for four (4) years beyond the expiration of the warranty period specified in the General Conditions to the Contract. Warranty shall be against defects of material and workmanship.

PART 2 - PRODUCTS

.1 **Products**

- .1 Unspecified materials which form a part of complete assemblies shall be of manufacturer's standard.

.2 **Materials**

- .1 Conform to AWI or AWMAC quality grade standards defined in specified reference standards and as specified for custom casework items for lumber and plywood materials and their machining and sanding.
- .2 Ensure that veneered panels and solid finger jointed and edge laminated members, where admissible for incorporation are matched for grain configuration and uniformity of colour throughout all surfaces exposed to view which are to receive a natural or stained finish.

.3 **Solid Wood**

- .1 Exposed for Transparent Finish: Plain sawn natural birch.
- .2 Semi-Exposed: Same as for exposed.
- .3 Concealed: At option of fabricator.

.4 **Plywood**

- .1 Exposed for Transparent Finish: Rotary cut, Select Grade, Birch.
- .2 Semi-Exposed: Same as exposed plywood.
- .3 Concealed: At option of fabricator.

.5 **Particleboard**

- .1 To meet specified requirements of CAN/CSA-O188.1-M78, for Custom Standard of minimum Grade S.

.6 **Plastic Laminate**

- .1 To meet specified requirements of CAN/CSA-A172-M79.
 - .1 For Postformed Counter Tops: Type 2, Postforming, 2a Standard, 1.25 mm thick.
 - .2 For Exterior Faces of Cabinets: Type 1, General Purpose 1b Standard, 1.6 mm thick
 - .3 For Cabinet Lining and Shelves: Liner Sheet, Type 1, General Purpose, 1c Light Duty, 0.75 mm thick.

- .4 Backing Sheet: In same thickness as face sheet.
- .5 Surface Finish: Furniture Finish, except for backing sheet.
- .6 Colour: Selected from manufacturer's standard solid colour range.

.7 **Mouldings**

- .1 Resilient white P.V.C. extrusions, suitable for solvent welded.
- .2 Formed extrusions to suit unit profiles.

.8 **Hardware**

- .1 Shelving supports: steel lug clips for rear support; spring loaded, retractable, fiberglass filled nylon plunger assemblies with sliding tab for front supports.
- .2 Drawer Slider: ball bearing, carrier, minimum 3/4 extension, of quality to operate adequately for size and capacity of drawer.
- .3 Door Hinges: extruded aluminum, to withstand weight in excess of 75kg when fully open, semi-concealed pivot.
- .4 Catches: magnetic type, for doors and drawers.
- .5 Pulls: metal wire pull 'D' style with a metal back plate, suitable for use with keyed locks.
- .6 Coat Rod: chrome plated 16 and 18 gauge steel tube, minimum 25mm in diameter with an integral wood seat.
- .7 Casters: composite plastic "doughnut" wheel with nylon or steel ball bearing glider, plate or stem type and height to suit anticipated weight and use.
- .8 Coat Hooks: Henkel breakaway release hooks
- .9 Locks: for use with pulls, keyed as required with metal keeper.

.9 **Finishes**

- .1 Polyurethane type conforming to CGSB Specification 1-GP-175M, semi-gloss finish, in colours to be selected from manufacturer's standard range.

.3 **Fabrication**

- .1 Fabricate custom casework specified in this Section to meet workmanship specifications in Section 400, Casework, of AWI/AWMAC Custom Quality Standard, except as modified, and as follows:
 - .1 Conceal edge grain of exposed and semi-exposed plywood and particleboard using solid hardwood edges for stain finish or P.V.C. moldings.
 - .2 Assemble cabinet body members with adhesive.
 - .3 Where permitted, drive power-driven Tee head nails or staples with long dimension parallel to grain.
 - .4 Install dust panels between drawers.
- .2 Shop fabricate work of this Section in as large units as possible.
- .3 Incorporate services, fixtures, and trim in units as indicated on drawings or specified in Divisions 22 or 23, or both and 26. Make all necessary cutouts to template information.
- .4 Fabricate counter tops with post-formed plastic laminate facing.

.4 **Schedule**

.1 **Boxes – upper and lower casework**

- .1 Fabricate of 19mm plywood, with interlocking tongue and groove joints using white glue and staples.
- .2 Provide P.V.C. extrusions at all edges of unit.
- .3 Router cut slots and holes to permit coupling and to accept standard shelving and accessory parts.

.2 **Shelving**

- .1 Fabricate of 19 mm birch, in sizes to suit boxes do not span greater than 750mm.
- .2 Router cut openings and holes for shelf supports.

.3 **Drawers**

- .1 Fabricate of 15mm plywood rails, 19mm birch fronts and 9mm particle board bottom.
- .2 Fabricate in sizes to suit boxes.
- .3 Router cut openings for pulls and drawer slides.

.4 **Doors**

- .1 Fabricate of 19mm plywood, in sizes to suit containers.
- .2 Router cut openings for pulls and hinges.

.9 **Bases**

- .1 Fabricate of laminated plywood, 110mm high.
- .2 Base to be leveling type, located at each corner of base.
- .3 Finish on exterior base to match door/container finish.

.10 **Finishing**

- .1 Conform to requirements of Section 09 91 00.
- .2 Sand each coat between applications of finish.
- .3 Shop finish with polyurethane finish, 3 coat system using oil modified polyurethane, conforming to CGSB Specification 1-GP-175M, semi-gloss finish.

PART 3 - EXECUTION

.1 **Examination**

- .1 Before commencing installation, ensure that grounds, strapping, blocking, and mounting surfaces are satisfactory for fitting and adequate for securing of custom casework.
- .2 Take site measurements of construction to which custom casework must conform, and through which access must be made, before it is delivered to site, to ensure that adaptation is not required which would result in construction delay.

.2 **Preparation**

.1 **Protection**

- .1 Ensure that means is provided for protection of custom casework from damage and deterioration before, during and following installation, and otherwise until

project completion, in accordance with Division 01.

.3 **Installation**

- .1 Install units plumb and level without distortion.
- .2 Shim as necessary with concealed shims.
- .3 Accurately scribe and closely fit face plates, filler strips, and trim strips to irregularities of adjacent surfaces.

.4 **Adjustment and Cleaning**

- .1 Adjust operating parts of units to move freely, without excessive play, and to fit accurately.
- .2 Ensure that when doors are installed with hinged stiles adjacent, both doors can open simultaneously without binding.
- .3 Refinish damaged and defective custom casework before completion of project. Refinishing of exposed surfaces shall show no discernible variation in appearance.
- .4 Clean custom casework for specified finishing.
- .5 Final cleaning is specified in Section 01 70 00.

.5 **Casework Schedule**

- .1 Work of this Section will include the supply, fabrication and installation of cabinetwork and shelving. Refer to Drawings for details and locations.

End of Section

ELECTRICAL SPECIFICATIONS

SECTION 16001 - ELECTRICAL GENERAL PROVISIONS.....	22
SECTION 16100 - BASIC MATERIALS AND METHODS.....	8
SECTION 16155 - MOTORS, STARTERS AND WIRING.....	3
SECTION 16400 - SERVICE AND DISTRIBUTION.....	4
SECTION 16500 - LIGHTING.....	4
SECTION 16500 - APPENDIX	
C+B Emergency Lighting Test Form.	1
SECTION 16550 - LIGHTING CONTROL SYSTEMS.....	7
SECTION 16700 - COMMUNICATIONS RACEWAYS.....	4
SECTION 16705 - SECURITY AND ACCESS CONTROL SYSTEM. ...	5
SECTION 16710 - VOICE DATA STRUCTURED CABLING SYSTEM. .	6
SECTION 16712 - INTERCOM SYSTEM.....	5
SECTION 16721 - FIRE ALARM SYSTEM.....	10
SECTION 16820 - ELECTRIC HAND DRYERS.....	2

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 This Section and Division 1 - General Requirements applies to and governs the work of all Sections of Division 15.
- 1.2 **MECHANICAL SYSTEMS COMMISSIONING**
- 1.2.1 The mechanical systems of this project will be thoroughly commissioned by a Third Party Commissioning Agent engaged by the Owner. Assist and cooperate with the commissioning agent as required. Include all related costs in the Base Bid.
- 1.3 **VISITING SITE**
- 1.3.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. No extras will be granted due to lack of a thorough preliminary investigation of the site.
- 1.3.2 Remove and replace existing ceiling tile to inspect ceiling space for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.
- 1.3.3 Contractors visiting for site investigation must sign in at the main office. Upon arrival, review and sign the on-site Designated Substances Report prior to site investigation.
- 1.4 **CONTRACT DRAWINGS**
- 1.4.1 Mechanical Drawings show Mechanical work only and are not intended to show Structural details, Electrical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements. Any dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.
- 1.4.2 Only the general location and route of piping and ductwork is shown. Install all piping and ductwork neatly to conserve headroom. All piping and ductwork to be installed parallel to building lines unless shown otherwise.
- 1.4.3 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided notice of change is given prior to roughing-in.
- 1.4.4 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.
- 1.4.5 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

- 1.4.6 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.
- 1.4.7 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.
- 1.4.8 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.
- 1.4.9 All dimensions and sizes are in SI units. Generally, units are in millimetres. All exceptions to this are noted. Pipe sizes are in accordance with ANSI Standards. See Detail Sheet at end of this Section.
- 1.5 SHOP DRAWINGS**
- 1.5.1 Submit Manufacturers' Shop Drawings, Electrical Wiring Diagrams and Control System Drawings to the Consultant. Provide title sheet for Shop Drawing submitted. Include project name, Shop Drawing item (including Specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.
- 1.5.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.
- 1.5.3 Submit all shop drawings electronically in Adobe Acrobat PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be "book marked" using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by Contractor as specified below.
- 1.5.4 Catalogues, manuals or price lists will not be accepted as Shop Drawings. Before submission, check Shop Drawings, make necessary corrections, apply stamp "Checked and Certified Correct", sign and date.
- 1.5.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.
- 1.5.6 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is 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 subtrades.

- 1.5.7 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.
- 1.5.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.
- 1.5.9 Prepare all Drawings in SI units.

1.6 FIELD DRAWINGS

- 1.6.1 Submit, to the General Contractor, Drawings accurately showing all openings for ducts, pipes, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.
- 1.6.2 Assume full responsibility for the detailed coordination of all Division 15 work. Prepare Field Drawings to determine the exact location of each service. On these Drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.
- 1.6.3 If the General Contractor separates the Fire Protection Sprinkler System work from the other work of Division 15, the General Contractor assumes full responsibility for this coordination work including the preparation of the Field Drawings.

1.7 AS-BUILT DRAWINGS

- 1.7.1 The Contractor will be provided with Mechanical and Electrical Files used to produce the contract documents. The following digital formats were used and are to be maintained: AutoCAD, Revit, and PDF. The Contractor is to print Drawings from the PDF files provided.
- 1.7.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.
- 1.7.3 Transfer information from the marked prints to AutoCAD files and Revit model on a monthly basis to match the software that version the original files were created in.. Have the marked prints and updated CAD/Revit prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.
- 1.7.4 Prior to testing, balancing and final commissioning, complete the transfer of marked prints to the AutoCAD files and Revit model. Fill in the Owner's equipment numbering system in the Schedules on the Drawings and on the plans where blank placeholder tags have been shown.

- 1.7.4.1 AutoCAD format files are to match exactly the layering system and symbology of the Consultant. Bind all external references.
- 1.7.4.2 Revit model will be completed as per the project Revit/BIM deliverable. If no deliverable is defined, minimally the "Sheets" included under the "02-Construction" subset in the model, should properly display the as-built condition. Bind/Insert all linked files in the Revit model.
- 1.7.4.3 **Revit/Bim Deliverable**
- 1.7.4.3.1 Model will not include engineering, analytics or systems symmetry functionality (i.e. defined or totally connected systems).
- 1.7.4.3.2 All engineering and manufacturer information contained in the model will only be considered correct for identification with regard to the corresponding specification and scheduling purposes.
- 1.7.4.3.3 MEP components should be modeled by the Contractor to be as close as possible to as-built conditions but must still produce an acceptable printed as-built document.
- 1.7.4.3.4 The "Sheets" included under the "02-Construction" subset in the model, should properly display the as-built condition.
- 1.7.4.3.5 MEP Model components (i.e. piping, conduit) may not be modelled the proper size but identified correctly.
- 1.7.4.3.6 MEP Model components will be represented properly on floor plans (i.e. symbology) but not necessarily in elevations.
- 1.7.4.3.7 MEP equipment and other items that are generally required for coordination among disciplines (i.e. ceiling components) will be included in the model (approximate size shown). Many services will be shown in schematic fashion (i.e., not necessarily at correct elevation or in exact position required).
- 1.7.4.3.8 Due to the schematic nature of many portions of the model, services are likely to conflict and clash with various other services and structure. In some cases this is intentional so that services display properly on sheets. The Consultant will not be responsible for providing to the Contractor a detailed, accurate or clash free model without compensation, as the Owner has not required or paid for this work to be done by the Consultant. In turn, the Consultant will not require the Contractor to provide a more detailed, accurate or clash free model for the project as-built documentation than was originally provided to the Contractor. Responsibility for creation of accurate Field Drawings and resolving minor interferences remains with the Contractor.
- 1.7.5 Mark Drawings "As-Built Drawings" and insert name and logo of Contractor. Submit one set of printed "As-Built Drawings" for review by the Consultant. Remove Engineers Stamp. Include Contractors name and Logo.
- 1.7.6 Submit completed As Built Drawings on disks in same digital data software program, and version as original contract documents. Also provide one set of Drawings with the Operating and Maintenance Manuals.

1.7.7 For the purposes of Contract payments, As Built Drawings will be assumed to have a value of \$2,000.00. This will not be released until As Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 2018.

1.8 CONFLICTS AND PRECEDENCE

1.8.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.

1.8.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.

1.8.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.9 FIRESTOPPING

1.9.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:

1.9.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.

1.9.1.2 Certification that proposed firestopping materials and assemblies comply with CAN-ULC S115 "Standard Method of Fire Test for Firestop Systems".

1.9.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

1.9.2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to As Built Drawings.

1.9.3 Comply with all requirements of Ontario Building Code Clause 3.1.9, "Building Services in Fire Separations and Fire Rated Assemblies".

1.9.4 Submit one sample of the components of each firestop system to the Consultant for review.

1.10 MAINTENANCE AND OPERATING INSTRUCTIONS

1.10.1 Assemble three sets of equipment literature (cuts), operating instructions, maintenance instructions, pressure test results, certificate, other pertinent data and Letter of Warranty. Place in three ring binders, complete with index pages, indexing tabs and cover identification at front and side. Submit to Consultant for approval.

1.10.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant possesses three approved sets. Include copies of approved Shop Drawings and name and address of Spare Parts' Suppliers with manuals.

- 1.10.3 Provide two electronic copies of the maintenance and operating manual in Adobe Acrobat PDF format on a compact disc or DVD and submit with the final version of manuals. Provide separate files on the disc in accordance with the sections of the hard copy manuals. Divide the maintenance manuals into sections which correspond with Specification Sections.
- 1.10.4 The following information is to be contained within the Sections:
- 1.10.4.1 A list of names, addresses and telephone numbers of the Consultants, General Contractor and Mechanical Contractor. Written warranty of the Mechanical systems. A copy of the valve directory, giving number, valve location, normal valve position and purpose of valve. Copy of all natural gas fitter tags.
- 1.10.4.2 A copy of all pressure tests and operational tests for pumping systems. A list of names, addresses and telephone numbers of all suppliers. A copy of all approved Shop Drawings.
- 1.10.4.3 A complete and comprehensive lubrication, maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) schedule for maintenance and lubrication.
- 1.10.4.4 A complete list of all air filter sizes, quantities and types, corresponding with unit designations.
- 1.10.4.5 Copies of warranties.
- 1.10.4.6 Complete control diagrams, wiring diagrams and description of control system and the functioning of the system.
- 1.10.4.7 Copy of the project Testing and Balancing Report.
- 1.11 **REGULATIONS AND PERMITS**
- 1.11.1 Carry out all work in accordance with the latest editions of applicable municipal and provincial codes, regulations, bylaws, and requirements of local Authority Having Jurisdiction. In no instance, however, is the standard established by the Drawings and Specifications to be reduced by the codes referred to above. Apply for and obtain any necessary permits. Pay any necessary fees.
- 1.11.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner's safety and security policies and procedures and conform to all regulations of the current Occupational Health and Safety Act.
- 1.11.3 Submit copies of CRN Certificates for all boilers and registered pressure vessels. Arrange and pay for TSSA certification of all boilers with a heating surface area greater than 2.78 m² (30 ft²).
- 1.11.4 Arrange and pay for TSSA inspection and certification for all piping systems and equipment regulated by TSSA.

1.12 MATERIAL AND EQUIPMENT

- 1.12.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.
- 1.12.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.
- 1.12.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.
- 1.12.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.
- 1.12.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.
- 1.12.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.
- 1.12.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.

1.12.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause "List of Mechanical Subcontractors and Manufacturers".

1.13 **INTERPRETATION OF CONTRACT DOCUMENTS**

1.13.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

1.14 **SITE VISITS**

1.14.1 The Mechanical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

1.15 **PROGRESS DRAWS**

1.15.1 Mechanical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Mechanical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

1.16 **WARRANTY**

1.16.1 Warranty all workmanship and make good any defects for one year after Substantial Completion. Warranty material and equipment supplied by the manufacturers for one year after Substantial Completion. Make good damage caused due to defects and workmanship.

1.16.2 Where equipment specified in Sections of Division 15 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause "Material and Equipment".

2.2 **BACKFILL**

2.2.1 Use backfill material in accordance with the requirements of Division 2 unless specified or shown otherwise.

2.3 CONCRETE

2.3.1 Use concrete in accordance with the requirements of Division 3 unless specified or shown otherwise.

2.4 SLEEVES

2.4.1 In general, sleeves are not required through walls or floors except for penetrations through Service Room walls or floors or foundation walls.

2.4.2 For all pipes passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

2.4.3 For sleeves through mechanical room floors, use Schedule 40 steel pipes with annular fins continuously welded at midpoint.

2.4.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.5 FIRESTOPPING

2.5.1 Use only service penetration firestop components and assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptable to the Consultant.

2.5.2 All pipe insulation passing through the fire separation to be approved with the listing of the firestop system.

2.5.3 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

2.5.4 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Tremco

2.6 FIRE CLOSURES

2.6.1 Use only fire damper assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptable to the Consultant.

2.7 ESCUTCHEON PLATES

2.7.1 Use chrome or nickel-plated brass, solid type, with set screws for ceiling or wall mounting.

2.8 ACCESS DOORS

2.8.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.8.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24" x 24") for body entry, and 300 mm x 300 mm (12" x 12") for hand entry, unless noted otherwise. Use the following access doors:

- Masonry Walls - Acudor UF-5000
- Drywall Walls - Acudor DW-5040
- Drywall Ceilings - Acudor BP58, match ceiling thickness
- Fire-Rated - Acudor FW-5050/FB-5060 to match fire separation

2.8.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Adam
Price

2.9 ELECTRICAL EQUIPMENT

2.9.1 This building will be fully sprinklered. Use sprinkler proof electrical equipment or shield equipment in such a way as to prevent the sprinkler system water from entering the electrical equipment and/or interfering with its operation.

2.10 ELECTRIC MOTORS

2.10.1 Provide motors of adequate size and type for intended service. Use CSA approved motors with the following characteristics:

- 250 watts (1/3 hp) and under - 115 volt, 60 hertz, single phase
- 370 watts (1/2 hp) and over - 60 hertz, three phase, voltage as shown on Drawings.

2.10.2 Motors are to be the voltage specified. Step down or step up transformers will not be accepted.

2.10.3 Motors 250 watts (1/3 hp) and under: Use continuously rated squirrel cage induction type with capacitor start, NEMA Design Class "B" with NEMA "N" or better starting characteristics and a minimum of Class "B" insulation, unless specified otherwise..

2.10.4 Motors 370 watts (1/2 hp) and over: Use continuously rated squirrel cage induction type NEMA Design Class "B" with NEMA "B" or better starting characteristics and a minimum of Class "B" insulation.

2.10.5 Use open drip-proof type motor with a 1.15 service factor for motors located in dry locations indoors, unless specified or required otherwise by the motor location.

- 2.10.6 Use totally enclosed motors outdoors and in locations subject to water spray. Totally enclosed motors must be fan cooled and have a 1.0 service factor.
- 2.10.7 Use totally enclosed explosion-proof (TEXP) motors where indicated to prevent ignition of external gas.
- 2.10.8 All enclosures shall be rolled steel band or cast iron construction. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins and shall have, as a minimum, all information as described in CSA C22.2 No 100-04 (R2009).
- 2.10.9 Unless specified otherwise, starters for electric motors will be provided by Division 16. Where multi-speed motors are specified, ensure that motors are compatible with starters supplied under Division 16. All two speed motors to be single winding, unless specified otherwise. Provide inverter duty motors where indicated on drawings.
- 2.10.10 All motors 0.75 kW (1 hp) and above, use premium efficiency type motors in accordance with NEMA Premium efficiency standard.
- 2.11 **ELECTRICAL WIRING**
- 2.11.1 Meet all requirements of Division 16 for all wiring included in Division 15 and pre-wired equipment provided by Division 15.
- 2.11.2 Ensure all pre-wired electrical equipment is CSA approved. Where this is not possible, arrange and pay for special Electrical Safety Authority approval.
- 2.11.3 All electrical wiring, both line voltage and low voltage, for equipment supplied by Division 15 is the responsibility of Division 15. Line voltage wiring from power panels to starters and from starters to motors will be supplied and installed by Division 16.
- 2.12 **IDENTIFICATION NAME LABELS**
- 2.12.1 Identification name labels, directional arrows and colour bands for ductwork and piping to be plastic coated pressure sensitive "Brady" or "Westline" selfstick labels, waterproof, colourfast, dirt and grease resistant. For pipes up to and including 65 mm (2-1/2") diameter, use markers 28 mm (1-1/8") high. For pipes 80 mm (3") diameter and over, and all ductwork, use markers 57 mm (2-1/4") high. For all piping exposed to view, use Smillie McAdams Summerlin Coil - Mark pipe covers.
- 2.12.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":
- Visionmarker
- 2.13 **VALVE AND CONTROLLER TAGS**
- 2.13.1 Use brass valve and controller tags with 32 mm (1-1/4") stamped code lettering and numbers filled with black paint. Hang a copy of the valve chart in Mechanical Room.

2.14 EQUIPMENT NAMEPLATES

2.14.1 Use minimum size 90 mm x 40 mm x 2.4 mm (3-1/2" x 1-1/2" x 3/32") thick laminated phenolic plastic nameplates with black face and white lettering. Lettering to be minimum 6 mm (1/4") high.

2.15 BELT AND MACHINE GUARDS

2.15.1 Provide OSHA compliant expanded metal guards in steel frames to protect drives of all belt driven equipment and all equipment with exposed rotating or moving parts. Firmly bolt guards in place and make easily removable for servicing. Provide openings in metal guards to permit use of a tachometer without removing the guard.

2.16 FLASHING

2.16.1 For locations with multiple roof penetrations serving a single piece of equipment, such as for roof mounted split system condensing units, use Portals Plus, Inc. Alumi-Flash system consisting of 100 mm (4") high, one piece spun aluminum base with deck flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations. Flashing is for Division 15 use only.

2.16.2 For plumbing vent roof penetrations, use Thaler SJ-38 "Stack Jack" insulated flashing consisting of 330 mm (13") high, one piece spun aluminum base with deck flange, urethane insulation line and EPDM base seal. Size seals to suit pipe diameter.

3 Execution

3.1 GENERAL

3.1.1 Instruct and supervise other Sections doing related work.

3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.1.3 Install pipes, ducts and tubing, which are to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

3.1.4 Install all ceiling components in direct accordance with reflected ceiling plans.

3.1.5 Mechanical Drawings show approximate locations for wall-mounted devices and fixtures. Clarify exact location and mounting height with Consultant prior to roughing-in.

3.1.6 All serviceable equipment installed on the roof (including boiler vents) to be installed minimum 3.0 m (10'-0") from roof edge.

3.2 DISSIMILAR METALS

3.2.1 Separate dissimilar metals by means of gaskets or shims of approved material or use dielectric unions or flanges in order to prevent electrolytic action. Where piping

of dissimilar metals is connected, use approved dielectric unions or couplings. A brass fitting or brass valve may also be used in making connections between copper and steel piping.

3.3 STORAGE OF MATERIALS

3.3.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

3.4 EXCAVATION AND BACKFILL

3.4.1 Be responsible for any excavation and backfill required for work of Division 15. Slope or shore all trenching in accordance with all current regulations and safety standards. Where any pipes pass under building footings, backfill under footings with lean concrete.

3.4.2 Use materials and standards of compaction for backfill in accordance with Division 2 unless specified otherwise.

3.4.3 If changes are required in locations, depth of excavating or related data, advise the Consultant in reasonable time to avoid disruption of work sequence.

3.5 SUPPORTS AND BASES

3.5.1 Provide structural work required for installation of equipment provided under this Division.

3.5.2 Where piping and/or equipment is to be supported by steel stud walls, use brackets and supports which attach to steel studs. Support equipment independently of wall sheathing.

3.5.3 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.

3.5.4 Set all floor-mounted equipment on concrete bases at least 100 mm (4") high. Provide bases, anchor bolts and any special isolation bases. Concrete bases for air handling equipment are to be sized to suit unit drain air seal requirements, but 100 mm (4") to remain as minimum. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the Shop Drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as Shop Drawings, are available at the site.

3.5.5 Carry out all concrete work in accordance with requirements of Division 3. Provide wire mesh, rebar and all necessary reinforcing.

3.5.6 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to existing floors.

3.6 **CONCRETE INSERTS**

3.6.1 **General**

3.6.1.1 Anchors for the support of pipes, ducts and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped. The use of inserts cast into the concrete is the preferred option.

3.6.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and "prying action". Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

3.6.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.6.2 **Installation of Cast in Place Inserts:** Ensure that anchors are accurately placed and "fixed" in position with sufficient rigidity to maintain their position during the placement of concrete. Do not displace reinforcing to install anchors without the prior permission of the Consultant.

3.6.3 **Installation of Inserts in Hardened Concrete:**

3.6.3.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.6.3.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.6.3.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.6.4 **Sleeves Embedded in Concrete:** Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.6.4.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.6.4.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.6.4.3 Sleeves through beams will be permitted only as directed by the Consultant.

3.6.4.4 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.

3.7 SLEEVES

3.7.1 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.

3.7.2 Provide sheet metal framing around ducts through masonry walls in exposed areas to ensure a clean finish around ducts.

3.8 FIRESTOPPING

3.8.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all piping, tubing, ducts, conduits, electrical wires and cables, and other similar mechanical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section "Firestopping and Smoke Seals" for building assembly and fire separation types and locations.

3.8.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code. For all penetrations through a Mechanical Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.

3.8.3 At each fire stopping penetrating location, provide a fire stopping identification label indicating the system number installed, products used, date installed and the installer's name. Locate label on penetrating service at the penetration location.

3.8.4 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractor's choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the report to the Consultant. Report to include as a minimum, confirmation fire stopping shop drawings were used during review, locations where destructive testing was completed, confirmation all fire stopping locations were reviewed and installed systems meet the manufacturer requirements.

3.8.5 Install duct fire damper assemblies in strict accordance with manufacturer's instructions provided with each assembly.

3.9 CUTTING AND PATCHING

3.9.1 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant. All cutting and patching to be done by the trade specializing in the materials to be cut.

- 3.9.2 Flash holes through walls and roof to make weatherproof.
- 3.9.3 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.
- 3.9.4 Where pipes and ducts are shown on the Mechanical Drawings passing through existing walls, floors, and roof, cut and patch the necessary openings. Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 15. Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Get approval of Consultant before any cutting is started. Electrical conduits with live wiring may be embedded in concrete floor slabs.
- 3.9.5 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.
- 3.10 **ELECTRICAL EQUIPMENT**
- 3.10.1 Where electrical equipment provided by this Division is not of sprinkler proof design, provide shields to prevent the sprinkler system water from entering the electrical equipment and/or interfering with its operation.
- 3.11 **ELECTRICAL WORK**
- 3.11.1 Perform all electrical work included in the work of this Division in accordance with the requirements of Division 16.
- 3.12 **PAINTING**
- 3.12.1 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.
- 3.12.2 Paint all steel framework provided by this Division with a chromium oxide primer.
- 3.12.3 Paint all exterior piping. Use two coats of paint. Use colours as selected by the Consultant.
- 3.12.4 Paint all new and existing gas piping. Use two coats of paint. Use colours as selected by the Consultant.
- 3.12.5 Where walls are cut and patched for mechanical work, paint walls to match existing. For walls less than 9.3m² (100 sq ft), paint entire wall. For walls larger than 9.3m² (100 sq ft), paint area of patch. Painting to be completed by painting contractor.
- 3.12.6 Include the cost of all painting in the Lump Sum Contract Price for the work of Division 15.

3.13 ACCESS DOORS

3.13.1 Supply access doors wherever equipment, valves, dampers, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by Division 9.

3.14 IDENTIFICATION

3.14.1 Identify all new piping and ductwork using name labels. Apply labels at 7 m (24') intervals and at all branch connections, valves, and access panel locations. Identify fan system number at each ductwork label. Mark each pipe in a space or area less than 7 m (24') at least once with a name label. Apply arrows indicating flow direction beside each name label.

3.14.2 To ensure permanent bond, apply 3M Adhesive EC-1341 to the surface of the insulation or pipe material. Apply the label with its own adhesive on this surface. Remove any labels "lifting" or "peeling". Clean the surface and repeat the procedure specified with a new label. Where labels do not adhere, use pipe banding tape spirally wrapped for full length of label. Apply label over the banding tape.

3.14.3 Provide nameplate identifying equipment type, identification number, service and area served on each piece of mechanical equipment.

3.14.4 Identify all manual and automatic control valves on all systems using brass tags attached with non-ferrous chains. For existing buildings, obtain copies of the existing valve tag schedules and follow the existing numbering system format using higher numbering sequential to existing numbers. Prepare a schedule of all tags for each system showing designating number, service and function. Include these schedules in the Operating and Maintenance Manuals and in the Mechanical Room.

3.14.5 Provide identification of all duct balancing dampers. Identify both support points of balancing damper and bottom of duct. Fluorescent orange spray paint is acceptable.

3.14.6 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

3.15 PIPING

3.15.1 General

3.15.1.1 Conceal all piping except in equipment rooms, unfinished areas, and where specifically noted. Unless shown otherwise, install all above ground piping parallel to building walls and partitions.

3.15.1.2 Install escutcheon plates at walls, floors and ceilings where piping is exposed. Install piping to conserve headroom.

3.15.1.3 In locations where space is provided for future or other equipment requiring connection to systems installed under this Contract, install services with shutoff valves and caps to allow connection to the system without interruption.

- 3.15.2 **Drain Hose Connections:** Provide drain hose connections at the base of all risers, on the suction side of all pumps and in all locations shown on Drawings.
- 3.15.3 **Supports and Hangers**
- 3.15.3.1 Provide all hangers, supports and sway braces in accordance with ANSI B31.1 and the Ontario Building Code. Support all piping in accordance with the Ontario Building Code.
- 3.15.3.2 Use Anvil beam clamps.
- 3.15.3.3 Use line size adjustable wrought steel clevis type hangers for horizontal piping 32 mm and less (1-1/4" and less). For copper pipe, wrap pipe with tape at all hangers or use Anvil Figure CT-99C adjustable tubing ring hangers.
- 3.15.3.4 For piping 40 mm and over (1-1/2" and over) use adjustable wrought steel clevis type hangers large enough for pipe insulation. See Section 15260 for insulation shields.
- 3.15.3.5 Where specified and/or shown on Drawings and in schedules, use spring hangers. See Drawings for details.
- 3.15.3.6 Unless specified otherwise, support piping at maximum spacing as shown and within 460 mm (18") of each side of all valves and bends.
- 3.15.3.7 Support all plumbing piping in accordance with the Ontario Plumbing Code.
- 3.15.3.8 Support horizontal cast iron drainage piping at 1.5 m (5') maximum spacing. Where the drain has successive fittings with no pipes between the fittings exceeding 800 mm (1') in length, support the drain at intervals not exceeding 1 m (3'). Where mechanical joints are used, provide double hangers and sway bracing.
- 3.15.3.9 Where cast iron pipe with mechanical joints is used, support piping on both sides of horizontal joints within 460 mm (18") of joint each side, at all branch ends, and at all points where there is a change in direction. Where the pipe is 150 mm (6") or larger in horizontal runs, brace to prevent horizontal movement at each branch or change in direction. Use braces, blocks, rodding or other suitable method recommended by the joint manufacturer. Provide Inspection Report from the manufacturer's representative certifying the installation is in accordance with their published installation data.
- 3.15.3.10 Do not support piping from other piping or equipment, or from metal roof decking.
- 3.15.3.11 **Schedule:**

Pipe Size mm	20	25	32	40	50	65	80	100 to 200	
Max. Span m	1.8	2.1	2.4	2.4	3	3.4	3.7	4.3	

3.15.4 **Anchors:** Install anchors where shown and where required. Use "U" bolts for piping 80 mm (3") in diameter and less. For piping over 80 mm (3") diameter, use steel fabricated anchors welded directly to pipe.

3.15.5 **Provision for Expansion:** Make proper allowance for thermal expansion and contraction whether shown on the Drawings or not. Use adequate offsets on all takeoffs to allow for expansion and contraction of mains. Weld all steel pipe forming an expansion loop regardless of size. Silver solder all copper pipe forming an expansion loop regardless of size. Use Flexonics or Anvil pipe alignment guides where shown and where required. Provide pipe guides for piping on either side of expansion loops, expansion joints and expansion compensators in accordance with "Standards of the Expansion Joint Manufacturers Association, Inc."

3.16 **USE OF FANS**

3.16.1 Do not use any fan supplied under this Contract for ventilation while the building is under construction. The building must be "broom clean" and all painting finished before permission will be granted for testing fans.

3.16.2 The Consultant reserves the right to use any piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same before final completion and acceptance of the work. Such tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment and/or materials due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials and/or workmanship of any kind. Supply all labour and equipment required for such tests. Trial usage will not initiate or affect in any way the warranties required for devices being tested.

3.17 **INSPECTION AND TESTING**

3.17.1 **General:** Inspect and test all piping. Repair any leaks and retest until satisfactory. Do not cover or close in piping until inspection and tests are completed. Thoroughly test all systems before making arrangements for the final demonstration in the presence of the Owner's staff. At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found and retest.

3.17.2 **Soil, Waste, Vent and Building Drains:** Seal all openings in section under test, then fill with water to a height of 3 m (10') above top of section. Maintain water level for at least two hours. Test in sections as the work progresses. After all fixtures have been placed, apply a smoke test to the satisfaction of the local Plumbing Inspector.

3.17.3 **Fire Protection Systems:** Test in accordance with current NFPA and Fire Underwriter's Survey recommendations.

3.17.4 **H.W. Heating - Domestic Hot and Cold Water - Heat Pump Water:** Apply a hydrostatic test of 1034 kPa (150 psig) or 1-1/2 times working pressure, whichever is greater, for two hours.

3.17.5 **Natural Gas:** Test in accordance with latest CSA B149.1.

3.18 PERFORMANCE VERIFICATION

3.18.1 All systems must be thoroughly tested by the Technical Representative of the system manufacturers before arrangements are made for the final demonstration in the presence of the Owner's staff.

3.18.2 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

3.18.3 Systems to be tested are:

- Rooftop Air Handling Unit(s)
- Controls
- Heat Pump System

3.18.4 The manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant.

3.18.5 Comply with all requirements of Section 15990, "Commissioning".

3.19 START-UP SERVICES

3.19.1 Provide the services of a qualified person to be on call and available to the site within one hour, for 2 weeks after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation. Provide a similar service for one week after switchover to the opposite air conditioning cycle (heating or cooling).

3.20 WELDING

3.20.1 All welding is to be compliant with CSA W59-03 (for steel) or CSA W59.2-M (for aluminum). Welding is to be performed by tradesmen certified to CSA W47.1 (steel) or CSA W47.2 (aluminum). Inspectors shall be qualified to CSA W178.2. Provide proof of certification upon request.

3.20.2 For welding of stainless steel, use the provisions of the American Welding Society standard AWS D1.6/1.6M. When provisions of this standard conflict with provisions of applicable CSA standards, the CSA standards shall take precedence.

3.20.3 Welding and cutting tasks shall be carried out in accordance with CSA 117.2.

3.21 PLACING IN OPERATION

3.21.1 Upon completion of all work and before turning over the job, test each system for proper operation.

3.21.2 Flush through all drains and properly adjust flush valves and other fixtures.

3.21.3 Open and clean all new and existing traps, strainers and scale pockets after two weeks' operation.

- 3.21.4 Clean out all new and existing room heating units, terminal heating and cooling units, and all air handling equipment with a vacuum cleaner when building is completed.
- 3.21.5 Steam clean all existing convectors and wall-fin elements in the rooms where changes have been made. Do this after all other work has been completed.
- 3.21.6 Engage chemical treatment vendor of Owner's choice to oversee cleaning and treatment of hydronic system. Completely flush system and refill with chemical cleaning compound. Operate the system for 24 hours at as high a temperature as possible with all control valves wide open, so that the compound reaches all parts of system. Drain, thoroughly flush and refill. Add corrosion treatment chemicals in recommended quantity to final filling. Provide report from chemical treatment vendor at completion of work.
- 3.21.7 For each new filter bank, provide one extra set of filters.

3.22 COOPERATION BETWEEN TRADES

- 3.22.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

3.23 MAINTENANCE OF EXISTING SERVICES

- 3.23.1 Take every precaution to locate and protect existing services so that no unscheduled interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.
- 3.23.2 The operation of the building by the Owner for day-to-day activities takes precedence over all construction related scope of work. The Contractor may be asked to cease work immediately in these instances and directed to work at another time. Assume all construction related activities which will impact the day-to-day operations of the facilities will be done after hours. Include all costs associated with after hours and overtime hours in the Base Bid. Additional costs related to after hours or overtime hours after Award of Contract will not be entertained.
- 3.23.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Before any interruptions of service or restriction of use of any service, provide seven days prior written notice to the Consultant and Owner.

3.24 PROTECTING AND MAKING GOOD

- 3.24.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.
- 3.24.2 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

3.25 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT

3.25.1 Remove existing material and equipment where shown or specified. Unless noted or specified otherwise, all material and equipment which is removed becomes the property of the Contractor and must be immediately removed from the site.

3.26 EXAMINATION OF EXISTING EQUIPMENT

3.26.1 Report all damaged, defective and non-functioning equipment shown for reinstallation or relocation to the Consultant prior to removal and storage. All equipment will be assumed to be fully functional unless reported otherwise prior to removal.

3.26.2 Devices and equipment damaged during removal, storage or reinstallation will be replaced at no cost to the Owner.

3.27 ALTERNATIVE, SEPARATE, UNIT AND IDENTIFIED PRICES

3.27.1 Refer to Division 1 Specifications.

3.28 CASH ALLOWANCES

3.28.1 Include in the Base Bid price, cash allowances of:

3.28.1.1 \$50,000.00 to cover the cost of the work of Section 15900 "Controls" and Section 15990 "Controls Commissioning".

3.28.2 Any amounts in excess of the cash allowances will be paid by the Owner. Return any unused portions of the cash allowances in full to the Owner.

3.29 PHASING

3.29.1 The work on this project is to be phased to enable continuous operation of the Owners facilities. See the Architectural Drawings and Specifications regarding the proposed phasing of the work. Provide for temporary services, connections, bypasses, etc. to enable the phasing as described. Carry all associated costs in the Bid.

3.30 FIRE SAFETY IN EXISTING BUILDINGS

3.30.1 Where temporary shutdown of sprinkler systems, standpipe systems or other fire protection systems is required, do all work in compliance with Article 1.1.1.2, Clause 2.8.2.1.1.G and Subsections 6.4.1 and 6.5.2 of the Fire Code.

3.31 DEFICIENCY REVIEW

3.31.1 The Mechanical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Mechanical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still

outstanding, the Mechanical Contractor shall correct them and again notify the Consultant in writing. Charges to the Mechanical Contractor may result from repeat visits after the second visit.

- 3.31.2 The Mechanical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Mechanical Contractor will be responsible for uncovering any concealed services for inspection.

3.32 **HOURLY LABOUR RATE**

- 3.32.1 Hourly labour rate shall be the actual rate paid to the worker as posted by the local Union Agreement plus a burden mark-up of 100% to compensate for contributions, assessments, employment insurance, health insurance, pension plans, WSIB, taxes, vacation pay, travel, parking, welfare, union package and membership dues, supervision, material handling, training, rest periods, down time, breaks, personal hygiene, small tools, clean up time, profit, other benefits paid to the worker and all other costs incurred by the Company including meetings, office time. Travel time to and from the site shall be at no charge to the Owner. For the purpose of mechanical work, the journeyman plumber union rate will be used for all trades completing any mechanical work.

3.33 **TEMPORARY WATER SERVICE**

- 3.33.1 Provide a Reduced Pressure type backflow preventer at each temporary water service connection used for construction purposes. Completely remove all temporary facilities once permanent systems are tested and operational.

3.34 **LIST OF MECHANICAL SUBCONTRACTORS AND MANUFACTURERS**

- 3.34.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause "Material and Equipment". Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

3.34.2 **Subcontractors**

Insulation
Sheet Metal
Sprinkler System
Testing and Balancing

3.34.3 Manufacturers

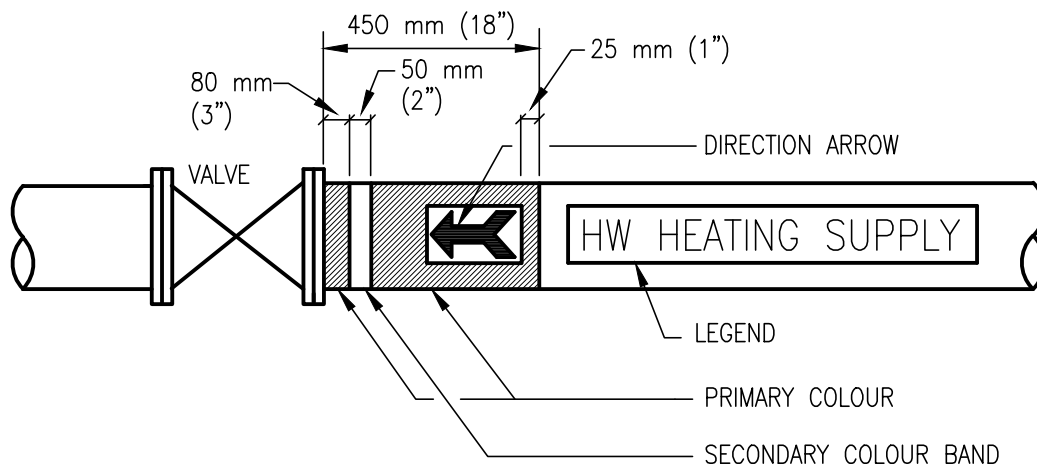
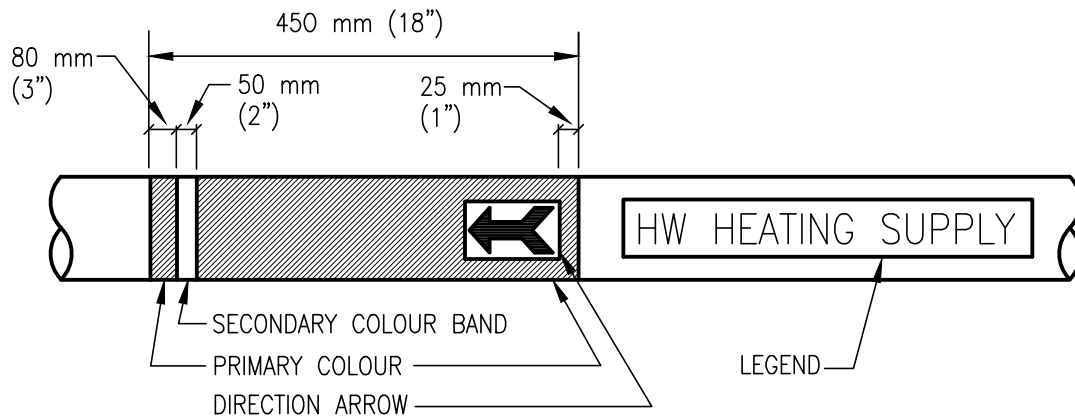
Exhaust Fans
Floor and Roof Drains
Grilles, Registers and Diffusers
Heat Pumps
Heaters
Noise and Vibration Control
Plumbing Brass
Plumbing Fixtures
Rooftop Air Handling Unit
Sprinkler Heads

END OF SECTION

SECTION 15001

A P P E N D I X

**Identification of Piping Systems
Typical Detail of Automatic Air Vent
Air Seal for Drains from Air Handling Equipment
Duct Liner Installation at Fire Damper**

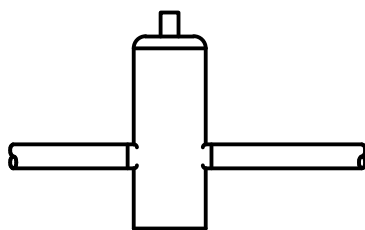
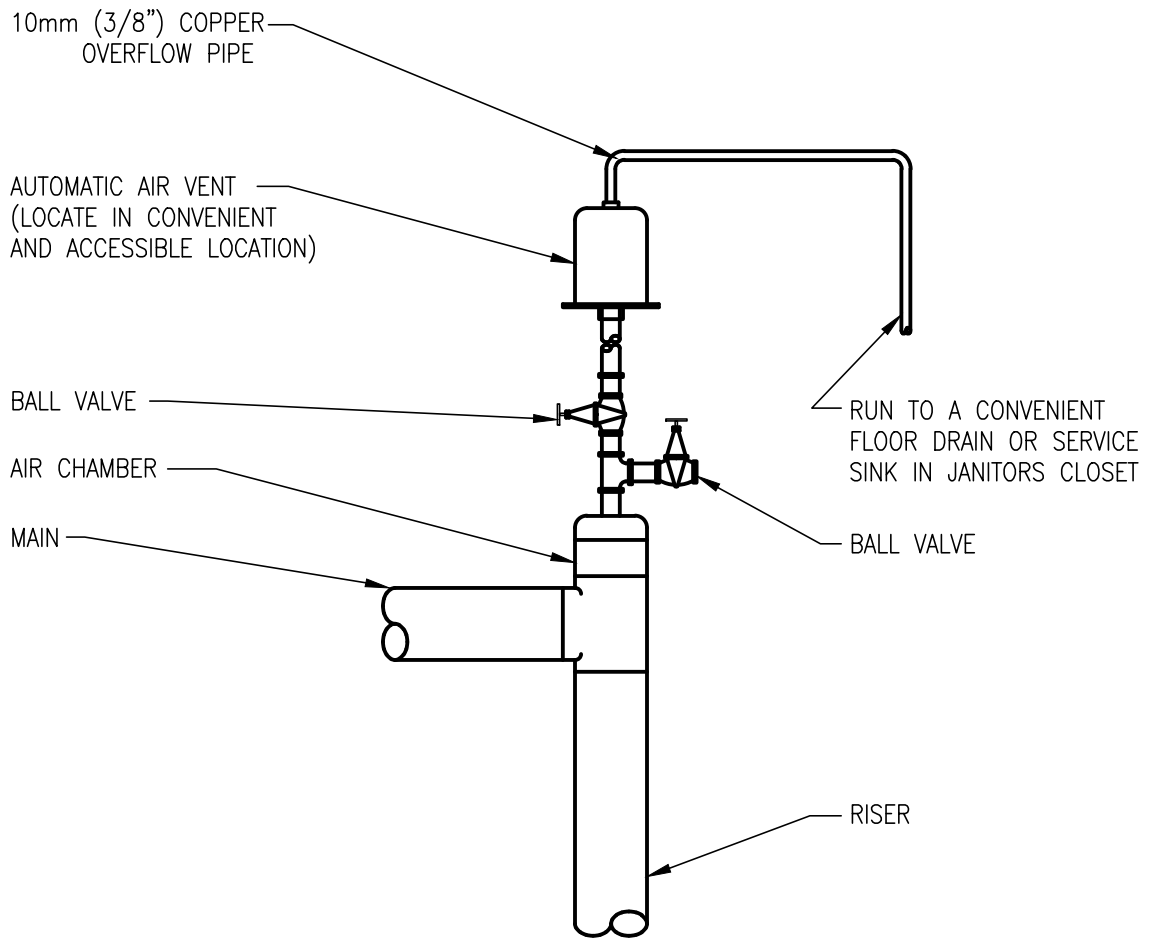


Chorley + Bisset
CONSULTING ENGINEERS

TITLE

IDENTIFICATION OF PIPING SYSTEMS

DETAIL NO.



FOR AIR VENT ON LEVEL
PIPING USE AIR CHAMBER
AS ABOVE.

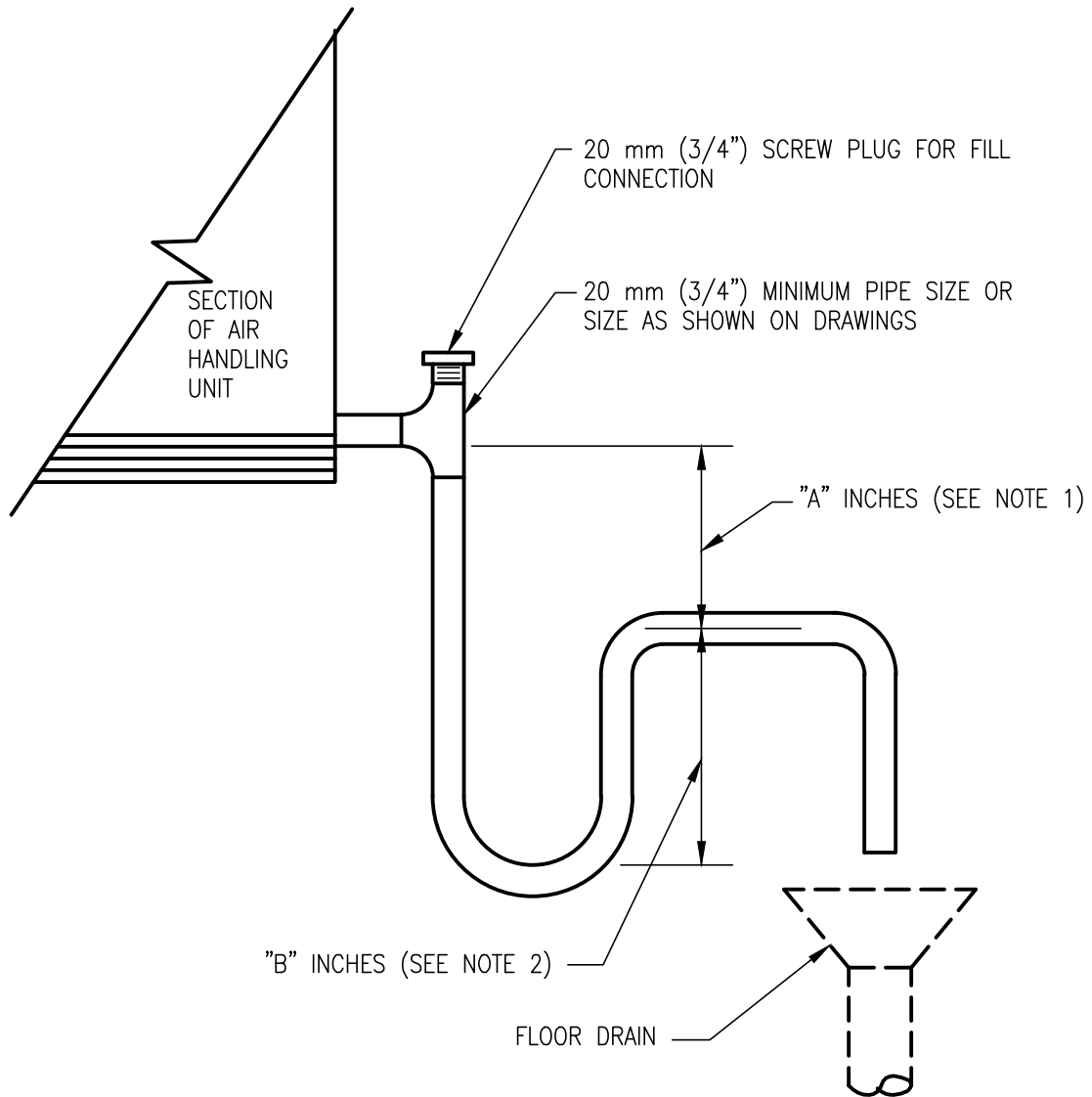


Chorley + Bisset
CONSULTING ENGINEERS

TITLE

TYPICAL DETAIL OF
AUTOMATIC AIR VENT

DETAIL NO.



NOTES

1. "A" MUST BE EQUAL TO OR GREATER THAN THE NEGATIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(DRAW THROUGH COIL)
2. "B" MUST BE EQUAL TO OR GREATER THAN 1/2 OF THE NEGATIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(DRAW THROUGH COIL) OR
"B" MUST BE EQUAL TO OR GREATER THAN THE POSITIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(BLOW THROUGH COIL)

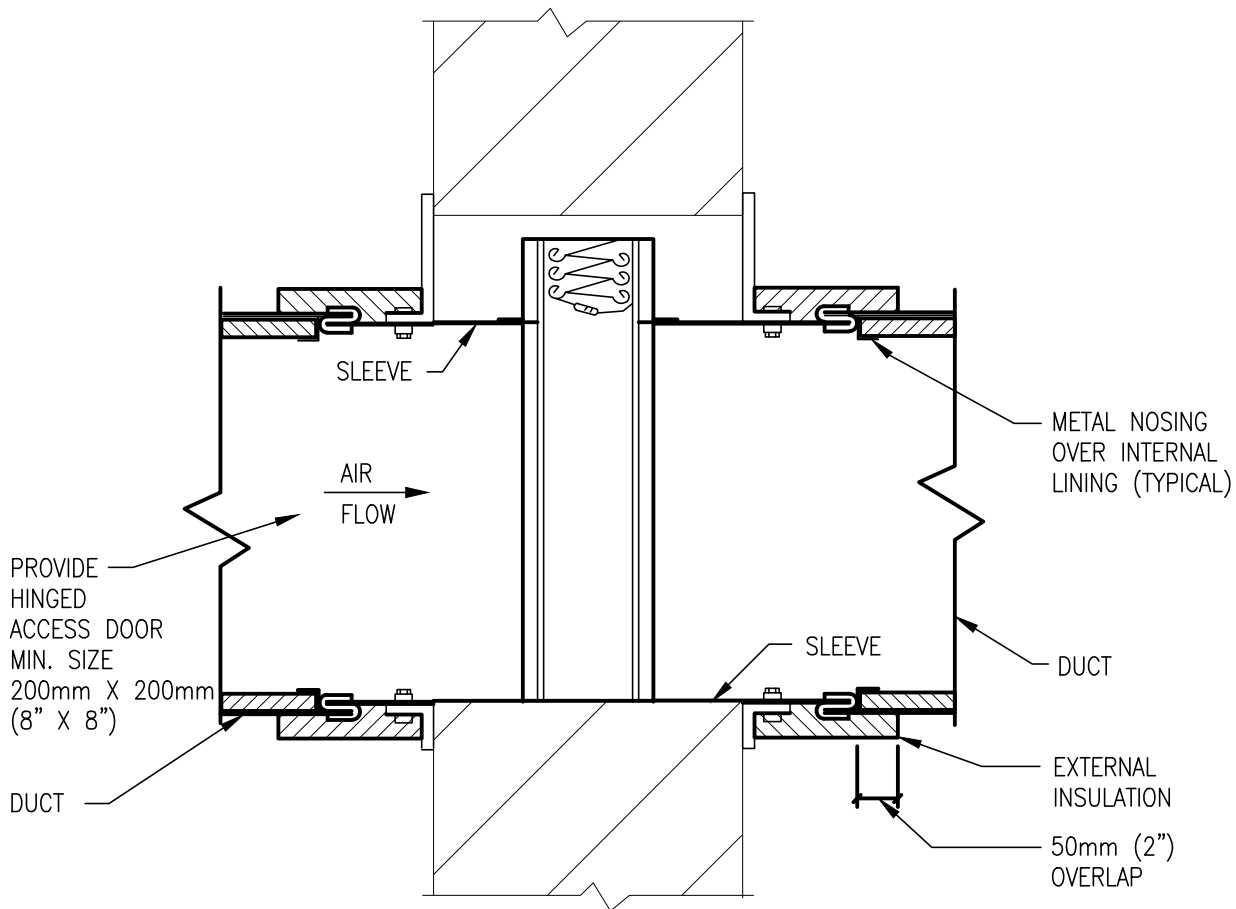


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TITLE

AIR SEAL FOR DRAINS FROM
AIR HANDLING EQUIPMENT

DETAIL NO.



Chorley + Bisset
CONSULTING ENGINEERS

TITLE

DUCT LINER INSTALLATION AT FIRE DAMPER

DETAIL NO.

-
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Heat Pump Water System:** The water source heat pump system is being extended to serve the Building.
- 1.2.2 **Hot Water Heating System:** The existing hot water heating system is being extended to serve new the heaters.
- 1.2.3 **Energy Recovery Ventilation Systems:** A new rooftop air handling unit will provide ventilation air and exhaust air for the renovated area.
- 1.2.4 **Supply Air, Return Air and Exhaust Air:** Heat pumps will supply and return air from the spaces. Various exhaust systems will serve the building.
- 2 Products
- 2.1 **GENERAL**
- 2.1.1 Furnish all test equipment. All equipment will remain the property of the testing and balancing company. Use recently calibrated instruments. Provide verification of calibration to the Consultant when requested.
- 2.1.2 Approved testing and balancing companies for this project are:
- Air Audit Inc.
C. J. Zettler & Associates Ltd.
- 2.2 **MATERIALS**
- 2.2.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions", Clause "Material and Equipment".
- 2.3 **DUCT ACCESS HOLE PLUGS**
- 2.3.1 Use Duro Dyne Type IP 4 duct access hole plugs.
- 3 Execution
- 3.1 **GENERAL**
- 3.1.1 Include all labour, engineering and test equipment required to adjust and balance all heating, ventilating, air conditioning and exhaust systems installed or altered under this Contract.

- 3.1.2 Check rotation of all fans and pumps. Advise appropriate trade if any corrections are needed. Ensure corrections are made before starting any testing or balancing.
- 3.1.3 Ensure that all control valves, devices and equipment interlocks are operating in the manner required for the correct performance of the systems.
- 3.1.4 Where existing systems are modified, rebalance the entire existing system as required.
- 3.1.5 Carry out testing and balancing under both extreme summer and extreme winter conditions. If you wish to simulate these conditions, obtain approval from the Consultant before beginning work.

3.2 JOB CONDITIONS

- 3.2.1 Schedule this work in cooperation with other trades involved.
- 3.2.2 Do not begin testing and balancing until the systems have been completely installed, tested and put in running order. Correct operation of equipment and system components and cleanliness of piping and ductwork is the responsibility of the appropriate trade.

3.3 SUBMITTALS

- 3.3.1 Record all test data and submit three copies of completed reports to the Consultant. A copy of the final report is to be included in each of the Operation and Maintenance Manuals.
- 3.3.2 Use data sheets which are approved by the Consultant to record measurements. Include schematic diagrams of all systems identifying branches, inlets, outlets and equipment. Submit sample sheets for review using same procedure as for Shop Drawings.
- 3.3.3 Provide a Deficiency List to the Contractor for all materials and installation methods which are found not to be complying with the Specifications and, where specified, quantities could not be achieved within the required tolerances. Submit copy of Deficiency List to the Consultant at the same time it is issued to the Contractor.
- 3.3.4 Submit electronic pdf version of report, complete with index page, indexing tabs and cover page.
- 3.3.5 Record all test data in SI units.

3.4 AIR SYSTEMS

- 3.4.1 Test and adjust fan speeds and dampers to deliver the required air quantities. For belt driven fans, determine size of sheaves required to properly balance systems and operate systems at minimum static pressures. Install selected sheaves. Sheaves will be supplied by fan supplier.

- 3.4.2 For each rooftop air handling unit provide static pressure profile including pressure drop across each individual unit component (i.e. coils, filter banks, fans, energy recovery wheels, etc) as well as static pressure in intake plenums, discharge supply ducts and return air ducts. Include the exhaust fan pressure differential whether exhaust fan is located within air handling unit or not.
- 3.4.3 **Constant Volume Systems:** Make pitot tube traverse of main supply and return air ducts to measure total air quantities.
- 3.4.4 Seal duct access holes with plugs. Do not use duct tape to seal access holes.
- 3.4.5 Test and adjust each diffuser, grille and register to within 10% of design requirements and also adjust so as to minimize drafts in all areas.
- 3.4.6 Coordinate with Section 15600, "Liquid Heat Transfer", to adjust wire taps on heat pump units to give required air quantities. Where required air quantities fall between heat pump speeds, use higher speed setting rather than lower one.
- 3.4.7 Record data as specified in Clause "Balancing Data".
- 3.5 **WATER SYSTEMS**
- 3.5.1 Prior to testing and balancing of these systems:
- 3.5.1.1 Verify that all strainers are clean.
- 3.5.1.2 Check new and existing expansion tanks and ensure that the systems are not air bound and are completely filled with water as required.
- 3.5.1.3 Check air vents at coils and high points of the systems to verify that all are installed and operating freely.
- 3.5.1.4 Position all automatic valves, hand valves, and balancing valves for full flow through coils, heat exchangers, heat pumps, individual room heating elements, etc.
- 3.5.2 Measure and adjust circulating water pump flow capacities to design quantities. For variable speed pumping systems, assist controls trade in setting static pressure controls at minimum required pressure. Record static pressure setting.
- 3.5.3 Balance all main branches and terminal equipment where balancing devices are installed. See Piping Schematics for locations. Lock all balancing valves. This includes heat pumps, force flow units and convectors, etc. Balance to within 5% of design requirements.
- 3.5.4 Mark and record flow readings of balancing devices. Where flow measuring devices are not installed, balance using design temperature differences.
- 3.5.5 Record data as specified in Clause "Balancing Data".

3.6 **BALANCING DATA**

3.6.1 Include the following information in the test report:

3.6.1.1 **Motors:**

Manufacturer
Model and/or Serial Number
Rated amperage and voltage
Rated kW (hp)
Rated rpm
Corrected full load amperage
Measured amperage and voltage
Calculated kW (hp)
Measured rpm
Sheave size, type and manufacturer

3.6.1.2 **Fans:**

Manufacturer
Model and/or Serial number
Rated L/s (cfm)
Rated rpm
Rated pressure rise
Measured L/s (cfm)
Measured rpm
Measured pressure rise
Pulley size, type and manufacturer
Belt size and quantity
Performance curve by manufacturer

3.6.1.3 **Pumps:**

Manufacturer
Model and/or Serial number
Rated flow rate
Rated Head
Measured discharge pressure (full flow and no flow)
Measured suction pressure (full flow and no flow)
Measured L/s (gpm)
Operating Head
Operating rpm
Performance curve by manufacturer
Static Pressure Setpoint (Variable Speed Systems)

3.6.1.4 **Air Systems (including inlets and outlets):**

Grille, register or diffuser reference number and manufacturer
Grille, register or diffuser location
Design air quantity
Effective area factor and size
Measured air quantity

3.6.1.5 Heat Transfer Elements (Coils, Heat Exchanger etc.):

Manufacturer and type
Design inlet and outlet temperatures (air and water side)
Design pressure drop (air and water side)
Measured inlet and outlet temperatures (air and water side)
Measured pressure drop (air and water side)
Measured flow rate (air and water side)

3.6.1.6 Testing and Balancing Instruments:

Types
Serial Numbers
Dates of calibration

3.7 DUCT LEAK TESTING

3.7.1 Perform leakage testing on representative sections, as selected by the Consultant, involving at least 25% of the duct distribution systems. Include all ductwork types (rectangular, round) and pressure classifications in the leak testing.

3.7.2 Test duct systems to the following SMACNA standards.

Pressure Class	Seal Class	Leakage Class
All	A	6

3.7.3 Refer to Section 15800, Clause "Duct Leak Testing".

3.7.4 Test ductwork before ducts are insulated, painted or concealed.

3.7.5 Immediately advise Contractor of any defects discovered during test. Retest systems after defects have been corrected.

3.8 FINAL INSPECTION AND ACCEPTANCE

3.8.1 After submission of balancing report, arrange a final inspection with the Consultant.

3.8.2 At final inspection recheck points or areas selected by the Consultant.

3.8.3 For each system, if more than 10% of the measurements at the selected recheck stations deviate by 10% or more from those in the Report, then the Report for that system will be rejected as unacceptable.

3.8.4 If Report is rejected, rebalance systems deemed to be unacceptable, submit new Reports, and make reinspection at no extra cost to the Owner.

3.8.5 Permanently mark settings of dampers and other adjustment devices so that adjustment can be restored if disturbed. Type of marking and method of application to be approved by the Consultant.

END OF SECTION

-
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **MECHANICAL SYSTEMS COMMISSIONING**
- 1.2.1 The mechanical systems of this project will be thoroughly commissioned by a Third Party Commissioning Agent engaged by the Owner. Assist and cooperate with the commissioning agent as required. Include all related costs in the Base Bid.
- 1.3 **DESCRIPTION OF WORK**
- 1.3.1 Provide sound attenuators in air systems where shown.
- 1.3.2 Provide vibration controls for all rotating and reciprocating equipment.
- 1.3.3 Provide vibration isolation for piping that is connected to equipment where vibration isolation is specified.
- 1.4 **SHOP DRAWINGS**
- 1.4.1 Submit Shop Drawings in accordance with the Clause "Shop Drawings" in Section 15001 for the following equipment and materials:
- Vibration Control Equipment
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions", Clause "Material and Equipment".
- 2.2 **VIBRATION CONTROL EQUIPMENT**
- 2.2.1 **General:** Use Vibro Acoustics Limited materials and equipment. See Schedules for types, details and static deflections.
- 2.2.2 **Springs:** All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have k_x/k_y ratios of at least 0.9. All springs shall be fully colour coded to indicate capacity.
- 2.2.3 **Spring Hanger Supports:** Model SHR, vibration isolator hanger supports with steel springs and welded steel housings. Hangers shall be designed for a minimum of 15 degree angular misalignment from vertical before support rod contacts housing.

2.2.4 **Open Spring Isolators:** Model FS open type spring isolators with equal stiffness in the horizontal and vertical planes. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (0.25") thick, bonded to the base plate.

2.2.5 **Type "S" Bases:** Provide bases large enough to support both equipment and driving motor, complete with motor slide rails where applicable. Bases shall be of welded construction with cross members to form an integral support platform. Structural steel members shall be designed to match supported equipment. Vibration bases for fans shall have adjustable motor slide rails as indicated on the schedule, and accommodate motor overhang. Bases shall be painted or hot-dipped galvanized for complete corrosion resistance.

2.2.6 **Vibration Isolation Pads**

2.2.6.1 Isolator pads shall be selected to ensure that deflection does not exceed 20% of isolator free height.

2.2.6.2 **Type "N" Neoprene Pads:** Use minimum 10 mm (0.375") thick neoprene pads with ribbed geometry on both sides.

2.2.6.3 **Type "NSN" Neoprene Pads:** Use minimum 10 mm (0.375") minimum thick ribbed neoprene pads bonded to each side of a 3.5 mm (10 ga) minimum galvanized metal plate.

2.2.7 The products of the following manufacturer which meet this Specification will be considered equal, subject to requirements of Clause "Material and Equipment":

VAW
Vibron

3 Execution

3.1 **VIBRATION CONTROL EQUIPMENT**

3.1.1 Provide Vibration Control Equipment as directed in the Schedule on the Drawings. Install in accordance with manufacturer's recommendations.

3.1.2 Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

3.1.3 Coordinate size, dowelling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and wind restraint device manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately dowelled in to structural slab.

3.1.4 Coordinate locations and sizes of structural supports with locations of vibration isolators and wind restraints (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).

- 3.1.5 Block and shim all bases level so that all ductwork, piping and electrical connections can be made to a rigid system at the proper operating level, before isolators are adjusted. Ensure that there are no rigid connections or incidental physical contacts between isolated equipment and the building structure or nearby systems.
- 3.1.6 There shall be no rigid contact of isolated piping, ductwork, or equipment with shaft walls, floor slabs, partitions, or conduits.
- 3.1.7 Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
- 3.1.8 Mount fans, as indicated on the Drawings, on structural steel vibration bases common to both fan and motor. There shall be a minimum operating clearance of 1" (25 mm) between steel bases and the structure.
- 3.1.9 Provide height-saving brackets where recommended by the manufacturer for equipment stability, or operating height requirements.

3.2 PIPING ISOLATION

- 3.2.1 Support all piping connected to isolated equipment with spring hanger supports on at least the first three support points. Unless specified or shown otherwise, use a static deflection of twice the deflection of the isolated equipment, but not more than 50 mm (2") at the first support point; use a static deflection of 25 mm (1") at remaining isolated support points.
- 3.2.2 Spring hanger isolators shall be cut in to the hanger rods and installed after the system is filled. Alternatively, provisions must be made to ensure piping does not change height during installation and start-up.
- 3.2.3 Isolator hangers shall be installed with the housing a minimum of 1/4" (6 mm) below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.

3.3 INSPECTION

- 3.3.1 Provide the services of a factory trained representative of the noise and vibration control manufacturer to make a thorough inspection of each system after startup. Submit a written report to the Consultant.

END OF SECTION

-
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.1.2 All products used must have a flame spread rating less than 25 and a smoke developed classification not more than 50 when tested in accordance with CAN/ULC-S102.
- 1.1.3 **Environmental Requirements:** Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics and insulation cements.
- 1.1.4 **Quality Assurance:** Insulation materials must be manufactured at facilities certified and registered to ISO 9000 Quality Standard.
- 1.1.5 **Storage of Materials:** Protect materials from dirt, water, chemical and mechanical damage before, during and after installation. Provide and install waterproof sheeting to protect insulation in unfinished areas as required. Remove any damaged materials from the site immediately. Remove and replace at no additional cost any installed materials which are damaged.
- 1.1.6 **Delivery:** Deliver insulation, coverings, cements, adhesive coatings, etc., to the site in Manufacturer's original containers with the manufacturer's stamp or label affixed showing flame and smoke ratings of the products, name of manufacturer and brand.
- 1.2 **DEFINITIONS**
- 1.2.1 In this Specification, "exposed to view" means all services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings or shafts. It also refers to ductwork inside horizontal and vertical architectural enclosures across the roof and down the faces of the building.
- 1.2.2 In this Specification, "exposed to weather" means all services located outdoors without an architectural enclosure.
- 1.3 **SHOP DRAWINGS**
- 1.3.1 Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.
- 1.3.2 Submit Shop Drawings in accordance with the Clause "Shop Drawings" in Section 15001 for the following equipment and materials:
- Duct and Piping Insulation Types, noting application for each product
 - Finishing Cement
 - Lagging Adhesive
 - Lavatory Drain Insulation
 - Pipe and Duct Insulation Coverings
 - Piping Insulation Inserts

2 Products

2.1 MATERIALS

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions", Clause "Material and Equipment".

2.2 PIPING INSULATION INSERTS

2.2.1 Make rigid insulation inserts equal in thickness to the adjoining insulation. Use Johns Manville Thermo 12/Gold hydrous calcium rigid pipe insulation. Minimum width should be equal to 50% of pipe circumference. Use the following insert lengths:

Nominal Pipe Size		Insert Length	
mm	(inches)	mm	(inches)
40 - 65	(1-1/2 - 2-1/2)	250	(10)
80 - 150	(3 - 6)	300	(12)

2.3 PIPING INSULATION INSERT SHIELDS

2.3.1 Use minimum 18 gauge galvanized metal shields. Form shields to fit insulation and extend up to the pipe centre line. Make length 100 mm (4") less than length of associated insert.

2.4 LAVATORY DRAIN INSULATION

2.4.1 Use McGuire ProWrap seamless lavatory insulation kits, manufactured of anti-microbial closed cell moulded vinyl material.

2.4.2 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Truebro

2.5 PIPE INSULATION

2.5.1 Piping

2.5.1.1 Use Johns Manville Micro-Lok glass fibre insulation with factory applied AP-T Plus jacket. Jacket to consist of aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing.

2.5.1.2 In areas exposed to view, finish with Johns-Manville, Zeston 2000 PVC (20 mil) 0.51 mm thickness "Cut and Curled" jacketing. Use Zeston "Perma-Weld" solvent welding adhesive to permanently seal all PVC joints. Taping or tacking of jackets will not be accepted. Use white jackets.

2.5.2 Valves and Fittings

2.5.2.1 Insulate valves and fittings with factory precut Johns Manville Hi-Lo temp insulation inserts or Johns Manville Microlite 16 kg/m³ (1 lb/ft³) density glass fibre insulation.

2.5.3 Pipe Thickness Schedule

Fluid Design Operating Temperature Range (°C)	Insulation Conductivity		Nominal Diameter (mm)				
	Conductivity Range W/(m°C)	Mean Rating Temperature (°C)	less than 25	24 and 32	40 to 80	100 & 150	200 & up
Heating Systems (Steam, Steam Condensate, Hot Water & Combined Heating/Cooling)							
Above 177	0.046 - 0.049	121	110	125	125	125	125
121 - 177	0.042 - 0.045	93	80	100	110	110	110
94 - 120	0.039 - 0.043	65	65	65	65	80	80
60 - 93	0.036 - 0.042	52	40	40	50	50	50
40 - 59	0.035 - 0.040	38	25	25	40	40	40
Domestic and Service Hot Water Systems							
40 & greater	0.035 - 0.040	38	25	25	40	40	40
Domestic Cold Water (Sanitary, Storm and Condensate Drains)							
4 - 24	0.033 - 0.039	24	25	25	25	25	25

2.5.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

- CertainTeed
- Johns Manville
- Knauf
- Teqtix
- Manson
- Ottawa Fibre
- Owens Corning
- Roxul

2.6 AIR DUCTS

2.6.1 On all round ducts, and on rectangular ducts not exposed to view with both dimensions 610 mm (24") and smaller, use Johns Manville Microlite Type 75 flexible blanket fibreglass insulation with FSK facing. Product must meet the requirements of ASTM C 1290, and include aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing. Maximum thermal conductivity 0.042 W/m°C (0.29 Btu-in/hr²ft²°F) in accordance with ASTM C 518. Use 40 mm (1-1/2") thickness.

2.6.2 On rectangular ducts exposed to view, and on rectangular ducts not exposed to view with one dimension 660 mm (26") or larger, use Johns Manville Spin-Glas Type 814 rigid fibreglass insulation board, 48 kg/m³ (3 lb/ft³) density, with FSK facing. Product must meet the requirements of ASTM C 612, and include aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing. Maximum thermal conductivity 0.033 W/m°C (0.23 Btu-in/hr²ft²°F) at 24°C (75°F) mean temperature. Use 40 mm (1-1/2") thickness.

2.6.3 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

CertainTeed
Johns Manville
Knauf
Manson
Ottawa Fibre
Roxul

2.7 **FINISHING CEMENT**

2.7.1 Use Ryder hydraulic setting finishing cement.

2.8 **LAGGING ADHESIVE**

2.8.1 Use white Childers CP-50A HV or Fosters 81-42W water based fire retardant lagging adhesive.

2.9 **DUCT INSULATION COVERING (EXPOSED TO VIEW)**

2.9.1 **Canvas Covering:** Use UL listed fabric 220 g/m² (6.5 oz/y²) fire retardant canvas covering

2.9.2 **Laminate Cladding:** Venture Tape Model 1577CWWME zero permeability, 0.20 mm (0.008") thick, self adhesive multi-ply embossed white laminate cladding.

2.10 **PIPE INSULATION COVERING (EXPOSED TO VIEW)**

2.10.1 **Piping:** Finish with Johns Manville Zeston 2000 PVC 0.51 mm (20 mil) thickness "Cut and Curled" jacketing. Use Zeston "Perma-Weld" solvent welding adhesive to permanently seal all PVC joints. Use white covers.

2.10.2 **Valves and Fittings:** Finish with Johns Manville Zeston 2000 PVC insulated fitting covers 0.51 mm (20 mil) thickness. Use Zeston "Perma-Weld" solvent welding adhesive to permanently seal all PVC joints. Use white covers.

2.10.3 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Proto
Walton Plastics Inc.

3 Execution

3.1 **GENERAL**

3.1.1 Install all insulation in strict accordance with manufacturer's published recommendations.

3.1.2 Install all insulation continuous through walls and sleeves.

3.1.3 Do not apply insulation until piping has been tested and approved.

3.1.4 Do not insulate unions or flanges at connections to equipment. In these locations, and in all other locations where insulation ends, finish with vapour resistant mastic.

3.1.5 Insulate ALL components of insulated systems unless specifically excluded.

3.1.6 Extend all surface finishes to protect all surfaces, ends and raw edges of insulation.

3.1.7 Patch and make good any existing insulation and covering which is damaged during the work of this Contract. Use material of the same quality as existing.

3.2 **FIRESTOPPING**

3.2.1 Where an insulated pipe passes through a fire separation, use only ULC labelled piping insulation in accordance with ULC Listed firestop system being used. See Section 15001, Clause "Firestopping".

3.2.2 Extend ULC labelled pipe insulation through fire separation and 50 mm beyond fire separation on both sides. Tightly butt joints and wrap with approved joint tape.

3.3 **PIPING SYSTEMS**

3.3.1 **Storm Drainage System:** Insulate horizontal sections of rainwater leaders including all elbows connecting to vertical piping. Where horizontal sections connect to roof drains, also insulate underside of drains and drain bodies, including any vertical piping between underside of drain and drain body.

3.3.2 **Sanitary Drainage System:** Insulate horizontal sections from combination drains, floor drains, open hub drains, water closets and urinals from fixture to point of connection with soil stacks.

3.3.3 **Other Systems:** Insulate the following piping systems in their entirety:

- Hot Water Heating
- Domestic Cold Water
- Domestic Hot Water
- Domestic Hot Water Recirculation
- Condensate Drains

3.3.3.1 Use the following Mean Rating Temperatures when selecting insulation thicknesses:

Hot Water Heating : 60 - 93°C (141 - 200°F)

3.3.4 **Insulation Application**

3.3.4.1 **Hanger Points:** Provide an insulation insert and shield at each hanger point on all systems. On cold lines, vapour seal butt joints on each side of insert.

3.3.4.2 **Pipe:** Apply insulation over clean dry pipe. Butt all joints firmly together. Seal all jackets neatly in place. Wrap butt joints with a minimum 75 mm (3") wide strip of the jacketing material. Use a vapour barrier adhesive on all "cold" lines.

3.3.4.3 **Fittings and Valves**

3.3.4.3.1 For pipe sizes 40 mm (1-1/2") and smaller, insulate with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Insulation ends may be mitred at elbows and sealed with tape.

3.3.4.3.2 For pipe sizes 50 mm (2") and larger, insulate with factory precut insulation inserts or with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Insulation ends may be mitred at elbows and sealed with tape.

3.3.4.3.3 **Cold Systems:** Provide a continuous vapour barrier on the insulation for the following systems:

- domestic cold water (potable and non potable)
- condensate drains

3.3.4.3.4 On components which require service, fabricate easily removable and reusable insulation sections e.g. suction guides for circulating pumps and pump casings. Test ports on balancing valves to be accessible outside of insulation.

3.3.5 **Finishing**

3.3.5.1 **Exposed to view:** In all locations where the insulation will be exposed to view, finish with pipe covering, excluding soft copper refrigerant piping. Use solvent welding adhesive to permanently seal all joints. Taping or tacking of jackets will not be accepted. Follow strictly manufacturer's installation procedures for cold and hot systems.

3.4 **AIR DUCTS**

3.4.1 **General**

3.4.1.1 Seal all vapour retardant jacket seams and penetrations with UL Listed tape and adhesive.

3.4.1.2 See Section 15800, "Air Distribution", for internal duct insulation. Where ductwork is internally insulated, external insulation is not required.

3.4.1.3 Externally insulate the sections of plenums specifically identified on the Drawings.

3.4.1.4 Externally insulate fire damper sleeve assemblies where duct system is internally lined. See Detail Sheet in Section 15001, "Mechanical General Provisions".

3.4.2 Supply Air Ductwork

3.4.2.1 Externally insulate all supply air ductwork upstream of volume boxes, including ductwork within return air plenums and sound attenuators. Externally insulate all other supply air ductwork, with the exception of internally lined sections and ductwork within a return air plenum.

3.4.2.2 Externally insulate all supply air ductwork in Mechanical Rooms, including sound attenuators.

3.4.2.3 Externally insulate all ductwork exposed on the roof.

3.4.3 Return Air Ductwork

3.4.3.1 Externally insulate the sections specifically identified on the Drawings.

3.4.3.2 Externally insulate all ductwork exposed on the roof.

3.4.4 Exhaust Air Ductwork

3.4.4.1 Externally insulate the sections specifically identified on the Drawings. Insulate the first 1.5 m (5') adjacent to outside walls or roof.

3.4.4.2 Externally insulate all ductwork exposed on the roof.

3.4.5 Application

3.4.5.1 On round and oval ducts adhere insulation to ducts with a flame resistant, quick tacking adhesive. Apply adhesive in 100 mm (4") wide strips at 200 mm (8") centres. Butt all circumferential joints and overlap all longitudinal joints a minimum 50 mm (2"). Staple all joints on 150 mm (6") centres. Tape all joints with minimum 76 mm (3") wide reinforced vapour barrier tape as recommended by insulation manufacturer.

3.4.5.2 On rectangular ducts, use adhesive and impale insulation over mechanical fasteners. Provide 100% coverage of adhesive on sheet metal, all exposed insulation edges, and all transverse joints. Provide mechanical fasteners per Insulation Manufacturer's published recommendations. Insulate behind duct balancing damper operators.

3.4.6 Finish

3.4.6.1 In locations where the insulation will be exposed to view, finish with canvas. Provide 25 mm x 25 mm (1" x 1") galvanized steel sheet metal angle corner bead over duct insulation along all duct corners. Securely paste canvas on with a two coat application of lagging adhesive over the entire surface. Apply canvas between coats of adhesive, while first coat is still wet. Stretch canvas tight and smooth with overlapping seams located where least visible. Apply second coat of adhesive immediately following application of canvas. Do not use metal bands.

3.4.6.2 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.

3.4.6.3 Self adhesive aluminum covering will be acceptable in lieu of canvas. Follow manufacturer's installation recommendations.

3.5 LAVATORY DRAIN INSULATION

3.5.1 Insulate drain and supply pipes on all barrier free lavatories. Use moulded offset drain and water supplies covers.

3.6 ACM INSULATION

3.6.1 Re-insulate services where ACM insulation is removed by abatement contractor. Coordinate quantities and location with abatement contractor prior to tender close. Follow the Ontario Ministry of Labour's Latest Requirements. Re-insulate in accordance with this Section.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Fire Extinguishers:** Provide portable fire extinguishers meeting all requirements of the Ontario Building Code and the Ontario Fire Code.
- 1.2.2 **Sprinkler System:** Extend the existing wet type automatic sprinkler system to completely protect the renovated parts of the building, as shown on the Drawings. Design and build the system in accordance with the requirements of NFPA 13, the Ontario Building Code and the Owner's Insurance Underwriter, Fire Underwriter's Survey (FUS). Follow FUS guidelines for Occupancy Hazard Classification.
- 1.3 **SHOP DRAWINGS**
- 1.3.1 Submit Shop Drawings in accordance with the Clause "Shop Drawings" in Section 15001 for the following equipment and materials:
- Fire Extinguishers and Cabinets
 - Sprinkler Heads
- 1.3.2 See requirements for Design Drawings in Part 3 of this Section.
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions" Clause "Materials and Equipment".
- 2.1.2 Use only material and equipment which is Underwriters' Laboratories of Canada Listed and FUS approved for the application intended.
- 2.2 **PIPE AND FITTINGS**
- 2.2.1 Unless specified otherwise, use standard black steel pipe with screwed or flanged cast iron sprinkler fittings suitable for 1200 kPa (175 psig) pressure, cold water, non-shock. Use screwed or flanged type joints between pipe and fittings or valves. Mechanical type Victaulic or Gruvlok couplings, Canadian Underwriter's Listed and FUS approved, may be used. Ensure wall thickness of pipe is in accordance with NFPA No. 13 for the type of connections used.
- 2.3 **VALVES**
- 2.3.1 Use only Underwriters' Laboratories of Canada Listed valves.

2.4 FIRE EXTINGUISHERS AND CABINETS

2.4.1 Use National Fire Equipment Ltd. Badger Advantage Model No. ADV-5550, 2.3 kg (5 lb) multi-purpose dry chemical extinguishers with a rating of 3A40BC. Provide complete with wall brackets.

2.4.2 Where fire extinguisher cabinets are shown, use National Fire Equipment Ltd., Model CE950-3-SS fully recessed fire extinguisher cabinet, 225 mm x 610 mm x 150 mm (9" x 24" x 6"). Use 18 gauge steel tub with 18 gauge 304 stainless steel door with satin finish and 5 mm (3/16") Duolite safety glass. Use doors with rounded corners, concealed hinges, and flush latch.

2.4.3 The following manufacturer of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Wilson & Cousins

2.5 SPRINKLER HEADS

2.5.1 Use ULC listed Tyco quick response sprinkler heads as follows:

- Model RFII concealed sprinkler with white finish in all areas with suspended ceilings, unless shown or noted otherwise
- Upright sprinkler, chrome finish in all areas without suspended ceilings, including Gym, unless shown or noted otherwise
- Pendant or upright sprinkler, rough bronze finish, guard, in mechanical and electrical rooms without suspended ceilings only (corrosion resistant where noted)

2.5.2 Use wire sprinkler guards with baked synthetic red enamel finish where shown on the Drawings.

2.5.3 Provide Tyco Sprinkler Cabinets with spare sprinklers and accessories. Use minimum 0.9 mm thick (20 gauge) steel cabinets finished in red lacquer and suitably labelled. Cabinets to contain:

- Spare sprinklers of each type per NFPA 13
- sprinkler wrench
- sprinkler wrench for concealed sprinklers

2.5.4 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause "Material and Equipment":

Reliable Automatic Sprinkler Co.
Victaulic
Viking Corp.

-
- 3 Execution
- 3.1 **INSTALLATION**
- 3.1.1 **Sprinkler System:** Provide complete system designed, constructed, installed and tested in accordance with NFPA 13, FUS and the Ontario Building Code.
- 3.2 **WATER SERVICE**
- 3.2.1 Extend existing system.
- 3.2.2 A hydrant flow test was performed on March 13, 2018. See the Appendix for the Flow Results. Base system design on flow test results. Include a suitable safety factor as dictated by NFPA 13 and FUS. Shop drawings of the existing fire protection system will be available to the successful contractor.
- 3.3 **DRAWINGS**
- 3.3.1 The Fire Protection Drawings show sprinkler types and locations, main piping layouts and zoning. Use this information as a basis to produce a set of Fabrication Drawings for a sprinkler system which will completely protect all of the renovated areas of the building areas. Coordinate the preparation of these Drawings with all other trades to avoid conflict with other services.
- 3.3.2 Sprinkler systems are to be designed by a Fire Protection Engineer using hydraulic calculations. Engage an Engineer registered with Professional Engineers Ontario who specializes in Fire Protection Engineering and is both qualified and insured in accordance with the requirements of Division C of the 2012 OBC. That individual will be designated herein as the Fire Protection Engineer for the project. Submit Fire Protection Engineer's proof of liability insurance with Shop Drawings.
- 3.3.3 The Fire Protection Engineer will apply his or her seal to all Fire Protection Drawings prepared for construction. The Fire Protection Engineer will be responsible for General Review during Construction for the work of this Section, in accordance with the 2012 OBC.
- 3.3.4 The Fire Protection Engineer is to size all piping and indicate sprinkler head and pipe locations on working Drawings. Sprinkler head locations and quantities shown in the Bid Documents are for general layout purposes only, to identify approximate locations and quantities and sprinkler head types to be used. The Contractor is responsible for determining exact locations and quantities of sprinkler heads. Piping locations are shown where critical only. The Contractor is responsible for determining exact locations for piping.
- 3.3.5 Piping is to be sized to suit available pressure from the municipal water main system without use of a fire pump. Use low pressure requirement sprinkler heads where required.
- 3.3.6 Provide sufficient number of sprinkler heads, whether shown on the drawings or not, to achieve coverage as required by NFPA 13 and FUS.

- 3.3.7 Prepare the Drawings in AutoCAD 2010. Show sprinkler heads on Architectural Reflected Ceiling Plans. Architect will provide AutoCAD drawing files for overlays.
- 3.3.8 Before starting installation, submit six copies of Fabrication Drawings and Hydraulic Calculations to FUS for approval. Submit copies of Drawings, duly approved by the Owner's Insurance Underwriters, to the Consultant for final review prior to commencing work. Submit two copies to local Building Department for plan review.
- 3.3.9 Use sprinkler heads, piping and fittings suitable for the temperature of the environment (e.g. extremes of hot or cold, humidity). Use high temperature heads in Mechanical and Electrical Rooms.
- 3.3.10 Where architectural reflected ceiling plans show ceilings which are not continuous from wall to wall, provide sprinkler coverage both above and below ceiling.
- 3.3.11 Where architectural reflected ceiling plans show ceilings which are not continuous from wall to wall, provide sprinkler coverage both above and below ceiling.

3.4 DRAINS, AIR VENTS AND TEST CONNECTIONS

- 3.4.1 Provide drain cocks with hose thread at all low points of the system not drainable through the main drain valve at service entrance, in accordance with NFPA 13 requirements. Provide air vents, flushing and test connections as required by NFPA 13 and FUS.

3.5 COOPERATION

- 3.5.1 Cooperate with other trades on the job and so arrange work that no delay is caused to any other trade. Examine all Drawings paying particular attention to lighting fixtures, structural steel, heating and plumbing piping, ductwork and electrical conduit, so that the installation of the sprinkler system will not interfere with other work.

3.6 IDENTIFICATION

- 3.6.1 Provide every valve with a tag indicating its purpose (i.e. sprinkler drain valve, sprinkler test valve, sprinkler control valve). This is in addition to the tag required for the valve chart. Securely fasten tags to the valves so they are not easily removed.
- 3.6.2 On the main sprinkler system control valve in the Mechanical Room provide a white rectangular sign with 25 mm (1") high red letters stating "MAIN SPRINKLER CONTROL VALVE - DO NOT CLOSE". Secure this sign to the valve or piping so it is not easily removed and is visible to approaching personnel.

3.7 SPRINKLER GUARDS

- 3.7.1 Provide guards where specifically identified on drawings.

3.8 TESTING

3.8.1 Test complete system in accordance with Underwriters' Laboratories of Canada, NFPA 13 and FUS requirements. Notify Consultant a minimum of 48 hours in advance of each test so arrangements can be made to have these tests witnessed. Note that work may progress in a phased manner and the systems will need to be tested and made operational in phases.

3.8.2 Test the operation of every valve supervisory device, flow alarm switch and pressure switch.

3.9 SYSTEM FLUSHING

3.9.1 Flush the complete sprinkler systems after installation.

3.10 FIRE EXTINGUISHERS

3.10.1 Install fire extinguishers in accordance with the manufacturer's recommendations.

3.11 SPACING OF SPRINKLERS

3.11.1 Sprinkler heads must be centred both ways in ceiling tiles.

3.12 EXPOSED AREAS

3.12.1 In all areas exposed to view, provide a decorative grade installation. Pay particular attention to neat pipe layout. Degrease all pipe and fittings, to be suitable for painting.

END OF SECTION

SECTION 15300
A P P E N D I X
Hydrant Flow Test Report



183 Exeter Road, Unit #A
London, Ontario N6L 1A4
☎ (519) 652-5086
FAX (519) 652-8719

HYDRANT FLOW TEST REPORT

Location: **Our Lady of Fatima**
545 Baldoon Rd,
Chatham

Date: **March 13, 2018**

Test by: **Jamie Tomes, C&H Fire Suppression Systems Inc.**

Witness: **Chatham-Kent PUC Hydrant Operators (x2)**

Test #1.

HYD # (Static Hydrant):

Static Reading: **72psi**

Residual Reading: **65psi**

HYD # (Flowing Hydrant):

Nozzle Size **2.5"**

Discharge Coefficient **0.9**

Flow **1130USgpm**

Test #2.

HYD # (Static Hydrant):

Static Reading: **72psi**

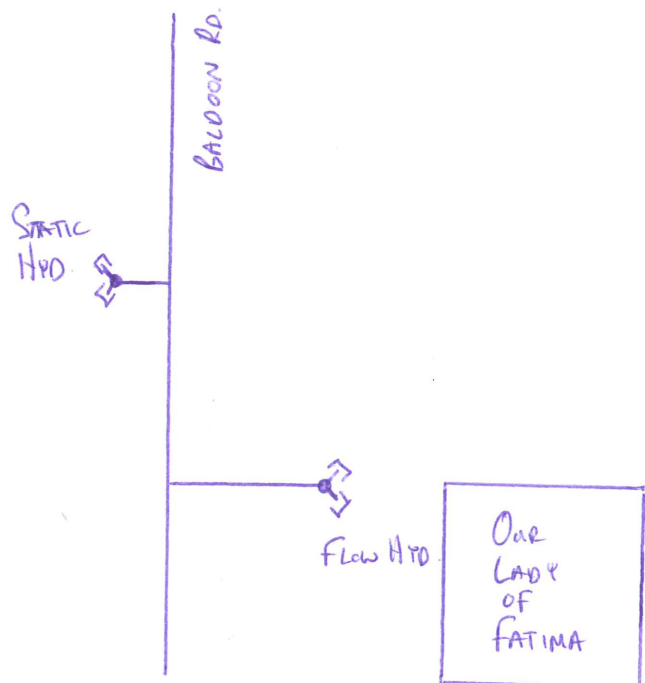
Residual Reading: **61psi**

HYD # (Flowing Hydrant):

Nozzle Size **2x2.5"**

Discharge Coefficient **0.9**

Flow (Total) **1680USgpm**



-
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **MECHANICAL SYSTEMS COMMISSIONING**
- 1.2.1 The mechanical systems of this project will be thoroughly commissioned by a Third Party Commissioning Agent engaged by the Owner. Assist and cooperate with the commissioning agent as required. Include all related costs in the Base Bid.
- 1.3 **DESCRIPTION OF SYSTEMS**
- 1.3.1 **Domestic Cold Water:** Extend the existing system complete with connections to fixtures and equipment requiring cold water connections as shown and/or as specified. Connect to the existing system where shown on the drawings.
- 1.3.2 **Domestic Hot Water:** Extend the existing system complete with connections to fixtures and equipment requiring hot water connections as shown and/or as specified.
- 1.3.3 **Domestic Hot Water Recirculation:** Extend the existing system complete with connections as shown and/or as specified.
- 1.3.4 **Sanitary Drainage:** Extend the existing soil and waste drainage system complete with connections to fixtures and equipment as shown and/or as specified.
- 1.3.5 **Storm Drainage:** Revise the existing system complete with connections as shown on the drawings.
- 1.3.6 **Natural Gas:** Extend the existing natural gas piping system complete with connections to equipment as shown and/or specified.
- 1.3.7 **Condensate Drainage:** Provide indirect condensate drainage system complete with connections to fixtures and equipment as shown and/or as specified.
- 1.4 **SHOP DRAWINGS**
- 1.4.1 Submit Shop Drawings in accordance with Section 15001, "Shop Drawings" for the following equipment and materials:
- Cleanouts
 - Floor Drains
 - Flow Control Valves
 - Plumbing Fixtures
 - Roof Drains
 - Rooftop Piping Supports
 - Shock Absorbers
 - Trap Seal Valves
 - Vacuum Breakers
 - Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions" Clause "Material and Equipment".

2.2 **PIPE AND FITTINGS**

2.2.1 Select the most economical use of the materials named below. Unless specified or shown otherwise, either material may be used or a combination of materials, whichever provides the greatest economy.

2.2.2 For all piping systems, use only solder and fluxes containing no lead.

2.2.3 **Domestic Water Piping (Hot, Cold, HW Recirc. System)**

2.2.3.1 Use hard drawn copper, Type "L" to ASTM B88, with soldered or flanged joints and bronze or copper fittings.

2.2.3.2 Use Class 150 cast copper solder fittings to ANSI/ASME B16.18 or wrought copper and lead free copper alloy solder fittings to ANSI/ASME B16.22. Use Class 150 lead free cast bronze flanged fittings to ANSI/ASME B16.24.

2.2.4 **Storm Drainage Piping:** Use cast iron Class 4000 pipe and fittings to CSA B70, with mechanical joints. Mechanical joints to be rubber compression gasket type with stainless steel clamps and hardware. For below grade piping only, use PVC pipe and fittings to CSA B181.2, with solvent cement joints.

2.2.5 **Sanitary Drainage Piping (Including Vent Piping):** Use cast iron Class 4000 pipe and fittings to CSA B70, with mechanical joints, or seamless copper Type DWV pipe to ASTM B306 with cast or wrought copper fittings and soldered joints. Mechanical joints to be rubber compression gasket type with stainless steel clamps and hardware. For below grade piping only, use PVC pipe and fittings to CSA B181.2, with solvent weld joints.

2.2.6 **Natural Gas Piping:** Above grade, both inside and outside the building, use Schedule 40 black steel pipe with malleable iron or steel fittings. All materials must meet the requirements of CSA B149.1.

2.2.6.1 **Indirect Drainage and Condensate Draining Piping:** Use seamless copper Type DWV pipe to ASTM B306 with cast or wrought copper fittings and soldered joints.

2.3 **CLEANOUTS**

2.3.1 Use cleanouts of the same size as drainage pipe on piping up to 100 mm (4") diameter, not less than 100 mm (4") on size 150 mm (6") and 200 mm (8"), and not less than 150 mm (6") on larger size pipe. No aluminum components will be permitted.

- 2.3.2 For line cleanouts, use Watts CO-450-RD epoxy coated cast iron cleanout ferrule complete with countersunk threaded brass plug, stainless steel wall access cover and stainless steel vandal resistant screw.
- 2.3.3 For stack cleanouts, use Bibby Ste Croix cast iron Barret style stack cleanout with gasketed cast iron cover.
- 2.3.4 In floor with vinyl or similar finish, use Watts CO-200-T-1-34 epoxy coated cast iron floor cleanout with round adjustable nickel bronze access cover and frame, tile recess and secondary closure plug.
- 2.3.5 In porcelain, ceramic and other quarry tile floors, use Watts CO-200-S-1-34 epoxy coated cast iron floor cleanout with square adjustable nickel bronze access cover and frame, and secondary closure plug.
- 2.3.6 In concrete floors or carpeted floors, use Watts CO-200-RX-4-34 epoxy coated cast iron floor cleanout with round adjustable heavy duty ductile iron access cover and frame, and secondary closure plug.
- 2.3.7 In terrazzo floors use Watts CO-200-US-1-34 epoxy coated cast iron floor cleanout with square adjustable nickel bronze access cover and frame, with recess for terrazzo and secondary closure plug.
- 2.3.8 In floors with surface membranes, use Watts CO-100-C-RFC-7-1-34 epoxy coated cast iron cleanout with anchor flange, cast iron reversible membrane clamp, and RFC satin nickel bronze cleanout top with surface membrane clamp.
- 2.3.9. The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Enpoco
Jay R. Smith
Mifab
Zurn

2.4 FLOOR DRAINS

- 2.4.1 **General:** No aluminum components will be permitted. Provide flashing clamps on all drains installed in floors with membranes. Confirm membrane floor locations with Division 1.
- 2.4.2 **Funnel Floor Drains in Millwork (Drawing Reference FFD):** Watts Ancon FD-200-EF-1 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron "P" trap and Type NB, 100 mm (4") round funnel.
- 2.4.3 **Floor Drains in Finished Areas Not Specifically Designated (Drawing Reference FD):** Watts FD-200-5-1 cast iron floor drain with XH, adjustable 140 mm (5-1/2") diameter Type NB, heavy duty nickel bronze strainer with clear epoxy coating. Provide separate cast iron "P" trap.

- 2.4.4 **Mechanical Room (Drawing Reference FD):** Watts FD-300-50 cast iron floor drain with adjustable 180 mm (7") diameter CI strainer and heavy duty cast iron grate.
- 2.4.5 **Funnel Floor Drains in Finished Floor (Drawing Reference FFD):** Watts FD-200-EG-1 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron "P" trap and Type NB, 100 mm x 230 mm (4" x 9") oval funnel.
- 2.4.6 **Funnel Floor Drains in Unfinished Floor (Drawing Reference FFD):** Watts FD-300-G-50 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron "P" trap and Type CI, 100 mm x 230 mm (4" x 9") oval funnel.
- 2.4.7 In floors with surface membrane, use Watts FD-100-C-FC7-1 with strainer and surface membrane clamp.
- 2.4.8 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Enpoco
Jay R. Smith
Mifab
Zurn

2.5 ROOF DRAINS

- 2.5.1 **Conventional Roof Drain (Drawing Reference RD):** Watts RD-100-BEDKW-1 cast iron roof drains complete with bearing pan, extension, deck clamp, cast dome and waterproofing flange.
- 2.5.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment".
- Enpoco
Jay R. Smith
Mifab
Zurn

2.6 VALVES

- 2.6.1 Use valves of same manufacturer except where approved otherwise by the Consultant.
- 2.6.2 Unless otherwise specified, use valves designed for minimum 1380 kPa (200 psig) CWP (Cold Working Pressure).
- 2.6.3 Use flanged, screwed or solder ends to suit pipe lines, and non-heating malleable iron handles. Use rising stems where space permits. Use valves with extended valve stems where piping is to be insulated.
- 2.6.4 Use only industrial class valves meeting ANSI, ASTM, ASME and applicable MSS standards. Specification MSS-SP-80, MSS-SP-110, MSS-SP-70, 85,71, MSS-SP-72, MSS-SP-67.

- 2.6.5 All valves supplied for this project shall have a current and valid Canadian Registration Number (CRN) for the Province of Ontario. Upon request, suppliers shall provide a copy of statutory declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration.
- 2.6.6 All valves are to comply NSF/ANSI 372 with lead content below 0.25%.
- 2.6.7 **Domestic Water Systems up to 1400 kPa (200 psi)**
- 2.6.7.1 **Ball Valves 50 mm and under:** For sizes 50 mm (2") and smaller, use Kitz Model 858/859 lead free ball valve with 4140 kPa (600 psig) water oil or gas pressure rating, two piece full port forged brass body to ASTM C46750 (Lead Free Brass), PTFE seats, double "O" ring steam seals, SnNi plated forged brass vented solid ball to ASTM C46750, blowout proof brass stem, lever handle.
- 2.6.7.2 **Butterfly Valves:** For sizes 65 mm (2-1/2") to 300 mm (12"), use Kitz Model 6141EL, ductile iron body with 2" extended neck to allow for insulation, lug type, with 1034 kPa (150 psi) pressure rating. Stainless steel stem with top and bottom bushings of dissimilar materials with positive stem retention mechanism. Stainless steel disc and molded or bonded style EPDM seat. Valve shall be capable of providing bi-directional "Dead End Service" at full rated pressure with the down stream flange removed. Manufactured in accordance with MSS-SP-67, MSS-SP-25 and API-609. Provide lever on sizes 65 mm (2-1/2") to 100 mm (4"). On valves 150 mm (6") and over use manual gear operators. Gear operators to be permanently lubricated, self locking, with large size position indicator. All operators to have lockout capability.
- 2.6.7.3 **Hose Bibbs/Drain Hose Connections c/w Cap & Chain:** : For sizes 13 mm (1/2") and 20 mm (3/4"), use Kitz Model 868C/869C ball valves with cap and chain, 4140 kPa (600 psig) water oil or gas pressure rating, cast brass body to ASTM C46750, full port, PTFE seats and packing, nickel plated forged brass C46750 vented solid ball, blowout proof stem, lever handle.
- 2.6.7.4 **Lead Free Frost Proof Wall Hydrants:** Watts HY-725 concealed, non-freeze key operated wall hydrant with nickel bronze box and door, chrome plated hydrant face, integral vacuum breaker, 19 mm (3/4") hose connection, lead free cast bronze head, seat casting and internal working parts, galvanized wall casing, and hydrant key.
- 2.6.8 **Natural Gas Systems Isolation Valves**
- 2.6.8.1 For sizes 50 mm (2") and under, use Kitz Model 58, Class 150 ball valve with 4140 kPa (600 psig) water oil or gas pressure rating , cast brass body to ASTM C37700, full port, TFE seats, double "O" Ring or teflon packing, chrome plated brass ball, lever handle. Must be CGA approved to 125 psig.
- 2.6.8.2 For sizes 65 mm (2-1/2") to 200 mm (8") use Kitz 150SCTBZM, Class 150 flanged full port ball valve with cast steel body, stainless steel ball and stem, RPTFE packing and seats, locking lever handle. Must be CGA approved to 125 psig.

2.6.9 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Apollo	(Industrial Class)
Kitz	(Industrial Class)
Nibco	(Industrial Class)
Toyo	(Industrial Class)

2.7 FLOW CONTROL VALVES (FCV)

2.7.1 Use Griswold Controls Model "K Valve" automatic flow control valve, lead free forged brass body valve complete with inlet shutoff valve with stainless steel ball, removable stainless steel regulator cartridge and two pressure/temperature taps in body. Assembly to have minimum 2760 kPa (400 psig) water oil or gas pressure rating. Valve to be factory set to maintain specific flow rate at differential pressures between 7 and 100 kPa (1 and 14 psi). Use line sized valves. Flow rates are indicated on Drawings.

2.7.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

FDI

2.8 SHOCK ABSORBERS

2.8.1 Provide Watts LF15M2 Series lead free shock absorbers ahead of all solenoid valves, flush valves, or other quick-closing valves. Provide in other locations where shown on Drawings.

2.8.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Jay R. Smith
P.P.P.
Zurn

2.9 ESCUTCHEON PLATES

2.9.1 Provide one piece, brushed aluminum escutcheon plates at all points where pipes pass through walls, floors or ceilings into finished areas.

2.10 TRAP SEAL VALVES

2.10.1 PPP, P Series trap primer valves. Provide chrome plated finish In exposed locations.

2.10.2 Electronic trap priming manifold systems will be acceptable in lieu of base specified valves. Arrange and pay for power connections to the system and included this cost in the Base Bid.

2.10.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Jay R. Smith
Zurn

2.11 ROOFTOP PIPING SUPPORTS

2.11.1 Use UV stabilized EcoBlok EB9-S, made from recycled rubber material. Provide pipe supports complete with galvanized Unistrut style fasteners mounted to the top of the support. All mounting hardware to be stainless steel.

2.11.2 The following manufacturer of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Portable Pipe Hangers

2.12 PLUMBING FIXTURES

2.12.1 Refer to Section 15410 "Plumbing Fixtures".

3 Execution

3.1 SANITARY AND STORM PIPING

3.1.1 Where pipe sizes are not shown on the Drawings and are not specified, size in accordance with the requirements of the Ontario Plumbing Code.

3.1.2 Install piping and connect to, or rough-in for, all fixtures as shown or as specified. Conceal piping in walls or ceilings in finished areas. Where sewers pass under footings, backfill with lean concrete.

3.1.3 Use the following minimum slopes on horizontal drains, unless indicated otherwise on the Drawings:

Fixture waste or drains	2%
Drains up to and including 80 mm (3")	2%
Drains 100 mm (4") and up to 150 mm (6")	1%
Drains over 150 mm (6")	0.5%

3.1.4 Use only lead free solder and fluxes.

3.2 UNIT DRAIN CONNECTIONS

3.2.1 Connect up all drains, blowdowns, condensate drains from fan cabinets, pumps, coils, condensers, etc. Run drains to combination drains or open hub drains without crossing or interfering with walkways. See Detail Sheet in Section 15001, "Mechanical General Provisions" for drains from air handling equipment.

3.3 VENTING

3.3.1 Vent all fixtures in accordance with local and provincial regulations. Run vents as directly as possible and grade properly to drain back to the fixture connection. Connect the bottom of all vent stacks into soil or waste stacks for drainage. Conceal vents in walls and ceilings in finished areas. Carry vent stacks through roof where shown or where required and project at least 600 mm (24") above roof deck.

3.4 FLASHING

3.4.1 Carry vent, waste and soil stacks through roof where shown on Drawings or where required. Supply all flashing materials. Use materials as specified in Section 15001 - Mechanical General Provisions.

3.5 CLEANOUTS

3.5.1 Install cleanouts behind walls so that the bolted cover on the cleanout will be within 25 mm (1") of the finished wall. Wall cleanout access doors to be installed minimum 200mm (8") above finished floor.

3.5.2 Conceal cleanouts in finished walls with access doors. See Section 15001 "Mechanical General Provisions".

3.5.3 Place cleanouts where shown, at end of all drainage lines, at all changes of direction greater than 45°, and at the base of all stacks.

3.5.4 Bring cleanouts up to floor level in all buried pipe and in all horizontal runs above grade where specifically shown. For all other cleanouts in horizontal runs above grade, leave with access from ceiling space. Bring cleanouts in concealed vertical pipes to a wall surface.

3.5.5 Locate floor cleanouts clear of fixed furniture and equipment. In corridors, locate cleanouts near walls but clear of base.

3.6 FLOOR DRAINS

3.6.1 Connect all floor drains, combination drains, running traps, and open hubs to trap seal valves.

3.6.2 Connect all floor drains into sanitary drainage systems unless specifically shown otherwise.

3.7 ROOF DRAINS

3.7.1 Locate and connect roof drains to piping. Drawings show general locations only. Roof drains will be installed under Division 7 and supplied by this trade.

3.8 WATER PIPING

3.8.1 Use only lead free solder and fluxes.

- 3.8.2 Connect required service to plumbing fixtures, hose bibbs, etc., as shown or as specified.
- 3.8.3 After installation, thoroughly flush out complete system of water piping and remove all scale, etc.
- 3.9 **NATURAL GAS PIPING**
- 3.9.1 Install in accordance with the latest CAN/CSA-B149.1, Natural Gas and Propane Installation Code and subsequent supplements, and the latest Ministry of Energy & Resources Management Regulations.
- 3.9.2 Provide vents to atmosphere for all safety devices and regulators, as required by Code.
- 3.9.3 Generally, do not install piping concealed within walls. Where this is required, install all piping which is concealed in concrete or masonry walls, or piping which passes through walls or floors, in pipe sleeves so that pipe can be removed or tested in compliance with Code. For piping in other walls, ensure access doors are provided.
- 3.9.4 Provide manufactured gas pipe supports for all roof-mounted piping. Pipe supports shall be spaced in accordance with Code. Arrange piping to accommodate expansion and provide expansion loops as required to suit pipe runs. Refer to Section 15001 "Mechanical General Provisions", Clause "Piping".
- 3.9.5 Make a copy of all gas fitter tags for inclusion in the O+M manuals. Laminate all gas fitter tags before securing them to the system.
- 3.10 **ROUGHING-IN**
- 3.10.1 Where shown on Drawings, rough-in hot and cold water systems, drain and vent. Cap off all piping and provide shutoff valves on hot and cold water piping.
- 3.11 **VALVES**
- 3.11.1 Install a valve at takeoff point in each main branch which takes off from main and in all locations shown.
- 3.11.2 Install drain valves with hose connections at all low points and at all branch valves for upfeed risers.
- 3.11.3 Use line size valves unless noted otherwise.
- 3.11.4 Use line sized valves unless noted otherwise. Use ball valves on sizes up to 65 mm (2-1/2") size and butterfly valves on larger size pipe. Use ball valves or gate valves either side of water meter.
- 3.11.5 Mount interior hose bibbs with centre at a point 760 mm (30") above finished floor unless noted otherwise.

3.12 VACUUM BREAKERS AND BACKFLOW PREVENTERS

- 3.12.1 Provide vacuum breakers and backflow preventers where shown on the Drawings and where required by the Ontario Building Code. Use line sized devices unless shown or noted otherwise on the Drawings.
- 3.12.2 Run drain from backflow preventer vent/drain connection to nearest floor drain.
- 3.12.3 Size vacuum breaker to suit maximum design flow rates of fixture or equipment served.
- 3.12.4 Install backflow preventers in accordance with CAN/CSA-B64.10, Manual for the Selection, Maintenance and Field Testing of Backflow Prevention Devices, including mounting height and clearance recommendations.

3.13 EXISTING SYSTEMS

- 3.13.1 Maintain systems in operation throughout construction, using temporary systems where shown. Disconnect existing systems only when temporary or permanent replacement systems are operational.
- 3.13.2 Construct the temporary systems to the same standards of material and installation as the permanent systems.

3.14 STERILIZATION OF POTABLE WATER SYSTEMS

- 3.14.1 All chlorination and sampling must be completed and tested by a person holding a Water Distribution Licence Class 1 thru 4 and sampling submitted to an accredited laboratory. Provide certified reports.
- 3.14.2 Thoroughly flush the domestic hot and cold water piping systems using clean potable water to remove dirt and other contaminants. Remove all faucet screens prior to flushing and reinstall after completion of flushing.
- 3.14.3 Disinfect domestic hot and cold water piping systems using a liquid chlorine solution. Introduce the liquid chlorine to ensure the chlorine is distributed throughout the sections being tested. Apply chlorine to achieve a minimum chlorine concentration of 10 mg/L throughout the sections being tested. Leave the 10 mg/L chlorine solution in place for 24 hours.
- 3.14.4 Test the chlorine residual after 24 hours. If tests show a minimum chlorine residual of 5 mg/L, flush the disinfected sections and recharge with potable water. If the chlorine residual is found to be less than 5 mg/L, repeat the disinfecting procedure until satisfactory results are obtained.
- 3.14.5 After the systems have been flushed and recharged with potable water, arrange and pay for bacteriological tests to be conducted by an independent testing agency. Provide certified reports. If there is evidence of contamination, repeat the disinfecting procedure until satisfactory results are obtained. Obtain the Building Inspector's permission before placing the systems in normal operation.

END OF SECTION

-
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **SHOP DRAWINGS**
- 1.2.1 Submit Shop Drawings in accordance with Section 15001, "Shop Drawings".
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions" Clause "Material and Equipment".
- 2.2 **PLUMBING FIXTURES**
- 2.2.1 **General**
- 2.2.1.1 Provide white fixtures unless specified otherwise. Use only first quality fixtures. Warped or distorted fixtures will not be accepted. Use fixtures of a single manufacturer only where possible. Likewise use a single manufacturer for faucets, supplies and drains.
- 2.2.1.2 All plumbing fixtures, faucets and supplies to meet NSF 372, with lead content below 0.25%.
- 2.2.1.3 Use only new plumbing fixtures, certified by CAN/CSA-B45.0 and closet seats, fittings and trim, certified by CAN/CSA B125, and free from cracks, scratches, wrench marks, or imperfections of any kind. Replace any permanently stained, chipped or marred fixtures or connections.
- 2.2.1.4 Use factory chrome plated items for all visible parts of the fixture trim including faucets, escutcheons, waste, strainers, traps, supplies, stops, etc.
- 2.2.1.5 Unless specified otherwise, the following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Plumbing Fixtures - American Standard, Eljer, Kohler, Mansfield
 - Plumbing Brass - Chicago Faucets, Delta Commercial, T&S Commercial, Moen Commercial
 - Flush Valves - Sloan, Zurn
 - Water Closet Seats - Beneke, Centoco, Viceroy
 - Stainless Steel Sinks - Architectural Metal Industries, Franke Kindred
 - Thermostatic Mixing Valves - Acorn, Bradley, Chicago Faucets, Delta Commercial, Lawler, T&S Commercial
 - Mop Sinks - Acorn, Fiat, Stern Williams
 - Drinking Fountains - Acorn, Elkay, Franke Kindred, Halsey Taylor, Oasis
 - Washfountains - Acorn, Bradley

2.2.2 Fixture Carriers

2.2.2.1 Water Closet: Watts ISCA Series enamelled or epoxy coated, heavy duty cast iron carriers with metal couplings. Exact model number will vary depending on wall space available, mounting height of fixture and required stack connections.

2.2.2.2 Urinals: Watts Model CA-311 heavy duty urinal carrier for support of urinal independent of wall.

2.2.2.3 Lavatories: Watts Series 400 heavy duty carriers to support all wall hung lavatories independent of the wall.

2.2.2.4 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause "Material and Equipment":

Jay R. Smith
Watts
Zurn

2.2.3 Water Closet (Drawing Reference WC1) (Wall Hung Flush Valve)

2.2.3.1 Bowl: American Standard High Efficiency FloWise AFWall Model 3351-128, wall hung, 4.8 litres per flush, for flush valve, vitreous china water closet with elongated syphon jet flush action bowl, fully glazed 2-1/8" (54 mm) ball pass internal trapway, 10" x 12" (254 mm x 304 mm) large water surface, 1-1/2" (38 mm) top spud.

2.2.3.2 Flush Valve: Sloan "Royal" 111-1.28-YO flush valve, 4.8 litres per flush, chrome plated, factory set flow, quiet action diaphragm type with non-hold open feature, vacuum breaker, back-check angle stop with seat bumper.

2.2.3.3 Seat: Centoco No. 1500STSCC elongated, extra heavy duty solid plastic white open front seat less cover, with stainless steel check hinges, stainless steel posts, washers and nuts.

2.2.4 Water Closet (Drawing Reference WC2) (Wall Hung Barrier Free Flush Valve)

2.2.4.1 Bowl: American Standard High Efficiency FloWise AFWall Model 3351-128, wall hung, 4.8 litres per flush, for flush valve, vitreous china water closet with elongated syphon jet flush action bowl, fully glazed 50 mm (2") ball pass internal trapway, 254 mm x 304 mm (10" x 12") large water surface, 40 mm (1-1/2") top spud. Mount 406 mm (16") to top of rim.

2.2.4.2 Flush Valve: Sloan "Regal" 111-1.28-YG flush valve, 4.8 litres per flush, chrome plated, factory set flow, quiet action diaphragm type with non hold open feature, vacuum breaker, back-check angle stop with extended seat bumper.

2.2.4.3 Seat: Centoco No. 820STS Seat, elongated, heavy duty solid plastic white open front seat with cover, reinforced stainless steel check hinges, stainless steel posts, washers and nuts.

- 2.2.5 **Water Closet (Drawing Reference WC3) (Floor Mount Flush Valve)**
- 2.2.5.1 Reserved
- 2.2.6 **Water Closet (Drawing Reference WC4) (Floor Mount Barrier Free Flush Valve)**
- 2.2.6.1 Reserved
- 2.2.7 **Water Closet (Drawing Reference WC5) (Floor Mount Tank)**
- 2.2.7.1 **Bowl:** American Standard Cadet Pro Model 215CA.004 floor-mounted, two piece vitreous china water closet with elongated bowl, 4.8 litres per flush, 80 mm (3") flush valve, lined tank. 1 kg MaP test performance. Use brass floor flange.
- 2.2.7.2 **Supply:** McGuire H166LKN3-Ball heavy duty ball valve supply, chrome plated, polished, rigid horizontal with vandalproof loose key angle stop, escutcheon and flexible riser.
- 2.2.7.3 **Seat:** Centoco No. 1500STSCC elongated, extra heavy duty solid plastic white open front seat less cover, with stainless steel check hinges, stainless steel posts, washers and nuts.
- 2.2.8 **Urinal (Drawing Reference UR1)**
- 2.2.8.1 **Urinal:** American Standard High Efficiency FloWise Washbrook Model 6501-125 barrier free, vitreous china, 0.5 litre per flush, washout flush action, 20 mm (3/4") top spud, integral flush spreader, open trap, stainless steel removable strainer and 50 mm (2") outlet connection.
- 2.2.8.2 **Flush Valve:** Sloan "Regal" 186-0.125 ES-S Optima, hard wired electronic flush valve, 0.5 litre per flush, chrome plated, factory set flow, quiet action diaphragm type with non-hold open feature, vacuum breaker, back-check angle stop, chrome plated wall cover plate and sensor, EL-154 transformer.
- 2.2.9 **Washfountain (Drawing Reference LA1)**
- 2.2.9.1 Bradley MF2933-IR-OBC Terreon Tri-Fount three station barrier free washfountain with infrared sensor module, solenoid valve and control transformer. **Washfountain must meet all barrier free requirements of Ontario Building Code, and provide 500 mm of trough length per User.** Architect to select colour from custom Designer colour chart.
- 2.2.9.2 Terreon construction, pedestal to consist of stainless steel mounting panel and precast Terreon side panels. Provide heavy gauge stainless steel front access panel with vandal-resistant closure.
- 2.2.9.3 Serve each of three 1.9 lpm (0.5 gpm) flow regulated spray nozzles with separate and independent solenoid valve and common mixing valve. Provide check stops, strainers and flexible stainless steel supply hoses for both hot and cold water lines. Set.thermostatic mixing valve set at 105°F.

- 2.2.10 **Washfountain (Drawing Reference LA2)**
- 2.2.10.1 Bradley MG-2/IR-OBC Express Lavatory System barrier free washfountain with infrared sensor module, solenoid valve and control transformer for two users. Washfountain must meet all barrier free requirements of Ontario Building Code, and provide 500 mm of trough length per User. Architect to select colour from custom Designer colour chart.
- 2.2.10.2 Terreon construction for bowl and sprayhead, pedestal to consist of stainless steel mounting frame. Provide heavy gauge stainless steel front access panel with vandal-resistant closure.
- 2.2.10.3 Serve each of two 1.9 lpm (0.5 gpm) flow regulated spray nozzles with separate and independent solenoid valve and common mixing valve. Provide check stops, strainers and flexible stainless steel supply hoses for both hot and cold water lines, and thermostatic mixing valve set at 105°F.
- 2.2.11 **Washfountain (Drawing Reference LA3)**
- 2.2.11.1 Bradley MF2922-IRP-OBC Terreon Tri-Fount two station corner mount washfountain with infrared sensor module, solenoid valve and control transformer. **Washfountain must provide 500 mm of trough length per User.** Architect to select colour from custom Designer colour chart.
- 2.2.11.2 Terreon construction, pedestal to consist of stainless steel mounting panel and precast Terreon side panels. Provide heavy gauge stainless steel front access panel with vandal-resistant closure.
- 2.2.11.3 Serve each of two 1.9 lpm (0.5 gpm) flow regulated spray nozzles with separate and independent solenoid valve and common mixing valve. Provide check stops, strainers and flexible stainless steel supply hoses for both hot and cold water lines. Set.thermostatic mixing valve set at 105°F.
- 2.2.12 **Lavatory (Drawing Reference LA4) (JK/SK Washrooms, Electronic Faucet)**
- 2.2.12.1 **Lavatory:** American Standard 0373.050 Penlyn basin, 4" (102 mm) centres, 18" x 15 7/8" x 6 7/8" (457 mm x 403 mm x 175 mm) deep, wall hung, vitreous china, front overflow, for concealed arm support.
- 2.2.12.2 **Faucet:** Chicago faucet Ecast, Model 116.706.AB.1 with dual beam infrared sensor, lead free cast brass body designed for 4" c-c mounting. Provide hardwired 12 volt A/C transformer and E2805 vandal resistant .5 gpm (1.9 l/min) spray outlet. Connect tempered water to faucet using Lawler Model 516 thermostatic mixing valve with in-line check stops. Temperature range 35°C to 46°C (95°F to 115°F). Locate valve in block wall behind surface mounted stainless steel access door. See Drawings for location.
- 2.2.12.3 **Supply:** McGuire H170BVRB supply, heavy pattern, chrome plated, polished, short rigid horizontal integral sweat tubes with vandalproof loose key ball valve angle stop, escutcheon and braided flexible riser.

- 2.2.12.4 **Drain:** McGuire 155A drain, chrome plated with open grid strainer. McGuire 8872C P Trap, 32 mm (1-1/4"), chrome plated, polished cast brass with cleanout and escutcheon.
- 2.2.13 **Lavatory (Drawing Reference LA5) (DC Classrooms, Electronic Faucet)**
- 2.2.13.1 Reserved.
- 2.2.14 **Lavatory (Drawing Reference LA6) (Wall Hung Barrier Free, Staff)**
- 2.2.14.1 **Lavatory:** American Standard 0954.000 Murro, barrier free vitreous china wall-hung basin with overflow, for concealed wall hanger, 100 mm (4") centres.
- 2.2.14.2 **Faucet:** Chicago Faucets Ecast 802-V317XKCP faucet, chrome plated, 100 mm (4") centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, with vandal resistant 1.9 lpm (0.5 gpm) spray aerator outlet and cast brass 100 mm (4") blade handles. Connect tempered water to faucet using Lawler Model 516 thermostatic mixing valve with in-line check stops. Temperature range 35°C to 46°C (95°F to 115°F). Locate valve in block wall behind surface mounted stainless steel access door. See Drawings for location.
- 2.2.14.3 **Supplies:** McGuire H170BVRB supplies, heavy pattern, chrome plated, polished, short rigid horizontal integral sweat tubes with vandalproof loose key ball valve angle stops, escutcheons and braided flexible risers.
- 2.2.14.4 **Drain:** McGuire 155A drain, chrome plated with open grid strainer. McGuire 8872C P Trap, 32 mm (1-1/4"), chrome plated, polished cast brass with cleanout and escutcheon.
- 2.2.15 **Single Compartment Sink (Drawing Reference SS1) (Classrooms)**
- 2.2.15.1 **Sink:** Franke Kindred Commercial LBS6808, 521 mm x 508 mm x 203 mm (20" x 20-1/2" x 8") 20 gauge, Type 302 stainless steel single bowl countertop sink, with backledge drilled for 200 mm (8") centre faucet set. Sink complete with 90 mm (3-1/2") crumb cup strainer and 40 mm (1-1/2") tailpiece, self-rimming with gasket and hold down clamps.
- 2.2.15.2 **Faucet:** Chicago Faucets Ecast 1100-GN8AVPA-369CP deck mounted faucet, chrome plated, 200 mm (8") centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 200 mm (8") cast brass rigid gooseneck spout with 8 lpm (2.2 gpm) flow aerator outlet and cast brass lever handles. Provide stops on supply piping and wall escutcheons.
- 2.2.15.3 **Mixing Valve (where applicable):** Connect tempered water to faucet using Lawler Model 516 thermostatic mixing valve with in-line check stops. Temperature range 35°C to 46°C (95°F to 115°F). See drawings for locations.
- 2.2.15.4 **Waste:** Cast brass P trap, 40 mm (1-1/2"), with unions, cleanout and escutcheon.

- 2.2.16 **Single Compartment Sink (Drawing Reference SS2) (Art Classroom Large Sink)**
- 2.2.16.1 Reserved.
- 2.2.17 **Single Compartment Sink (Drawing Reference SS3) (JK/SK Play Sink)**
- 2.2.17.1 Reserved.
- 2.2.18 **Single Compartment Sink (Drawing Reference SS4) (Kitchen Handwash)**
- 2.2.18.1 **Sink:** Franke Kindred Commercial LBS1306, 280 mm x 330 mm x 150 mm (11" x 13" x 6") 20 gauge, Type 302 stainless steel single bowl countertop sink, with backledge drilled for 100 mm (4") centre faucet set. Sink complete with 90 mm (3-1/2") crumb cup strainer and 40 mm (1-1/2") tailpiece, self-rimming with gasket and hold down clamps.
- 2.2.18.2 **Faucet:** Chicago Faucets Ecast 895-317CP deck mounted faucet, chrome plated, 100 mm (4") centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 100 mm (4") solid brass rigid gooseneck spout with 8 lpm (2.2 gpm) flow aerator outlet and 100mm (4") blade handles.
- 2.2.18.3 **Waste:** Cast brass P trap, 40 mm (1-1/2"), with unions, cleanout and escutcheon.
- 2.2.19 **Double Compartment Sink (Drawing Reference SS5) (Double Sink)**
- 2.2.19.1 **Sink:** Franke Kindred Commercial LBD6408, 790 mm x 520 mm x 200 mm (31-1/4" x 20-1/2" x 8") 18 gauge, Type 304 stainless steel double bowl countertop sink, with back ledge drilled for 200 mm (8") centre faucet set. Sink complete with 90 mm (3-1/2") crumb cup strainers and 40 mm (1-1/2") tailpieces, self-rimming with gasket and hold down clamps.
- 2.2.19.2 **Faucet:** Chicago Faucets Ecast 1100-L9VPA-369CP deck mounted faucet, chrome plated, 8" (203 mm) centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 225 mm (9") cast brass swing spout with vandal-resistant 8 lpm (2.2 gpm) flow aerator outlet and cast brass lever handles. Provide stops on supply piping and wall escutcheons.
- 2.2.19.3 **Waste:** Cast brass P trap 40 mm (1-1/2") with unions, cleanout and escutcheon.
- 2.2.20 **Drinking Fountain (Drawing Reference DF1, with water bottle filler)**
- 2.2.20.1 Use Franke Model KEPAC-SBF-STN, barrier free combination drinking fountain and water bottle filler. Unit is to be wall hung, lead-free, 18 gauge stainless steel with no. 4 satin finish, flexible bubbler guard, strainer, push pad manual activation, external stream height adjustment. Mechanically activated wall mounted bottle filler cabinet recessed in to frame with brushed stainless steel finish. Surface mount frame assembly.
- 2.2.20.2 **Supply:** Use McGuire HST11LK supply, chrome plated loose key with straight stop.

2.2.20.3 **Drain:** McGuire 155A drain, chrome plated with open grid strainer. McGuire 8872C P Trap, 32 mm (1 1/4"), chrome plated, polished cast brass with cleanout and escutcheon.

2.2.21 **Mop Service Sink (Drawing Reference MS1)**

2.2.21.1 **Sink:** Stern Williams Serviceptor SB 900 Mop Sink, 610 mm x 610 mm x 305 mm deep (24" x 24" x 12") floor mounted, precast terrazzo, with one piece stainless steel cast integral cap on all four sides and integral drain with strainer. "PB" splash panels, stainless steel for two sides.

2.2.21.2 **Faucet:** Chicago Faucet Ecast 897-RCF service sink faucet, rough chrome 8" (203 mm) centres, wall-mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, cast brass lever handles, body mounted vacuum breaker, integral stops, 36" (915 mm) hose and hanger, wall brace and pail hook.

2.2.21.3 **Waste:** 80 mm (3") cast iron "P" trap.

3 Execution

3.1 **PLUMBING FIXTURES**

3.1.1 Provide compression type shutoff valves or ball valves at each fixture in addition to the faucets on each fixture. For countertop sinks, use ball valves.

3.1.2 Where fixture connections pass into walls, floors, or ceilings, provide proper escutcheons.

3.1.3 When installing accessories, take great care to avoid marring chrome plating. Wrench or other tool marks on the plating will be sufficient cause for rejection.

3.1.4 Unless shown otherwise, use the following sizes of hot and cold water and waste connections to fixtures:

<u>Fixture</u> mm (in)	<u>Hot Water</u> mm (in)	<u>Cold Water</u> mm (in)	<u>Waste</u> mm (in)
Lavatory	15 (1/2)	15 (1/2)	32 (1-1/4)
Water Closet (Flush Valve)	----	25 (1)	80 (3)
Water Closet (Flush Tank)	----	15 (1/2)	80 (3)
Urinals (Flush Valve)	----	20 (3/4)	40 (1-1/2)
Mop Sink	15 (1/2)	15 (1/2)	80 (3)
Drinking Fountain	----	15 (1/2)	32 (1-1/4)
Wall Hydrants	----	20 (3/4)	----

Sink	15 (1/2)	15 (1/2)	40 (1-1/2)
Wash Fountain	25 (1)	25 (1)	50 (2)

3.1.5 Caulk all around bases of water closets, lavatories, wash fountains and other built-in equipment. Seal all edges which abut walls and floors.

3.1.6 Mount fixtures with finished floor to rim dimensions as follows:

Drawing Reference	Height mm (in)
WC1	375 (15)
WC2	410 (16)
UR1	one at 380 (15), all others at 480 (19)
LA3, 6	840 (33)
LA4	610 (24)
DF1	at JK/SK: 610 (24) bubbler height others at 760 (30) bubbler height

3.1.7 Confirm all mounting heights with Architect prior to roughing in.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Heat Pump Water System:** The water source heat pump system will be extended to serve the renovated areas of the building. The system includes heat pumps, circulating pumps, a fluid cooler and heat exchanger.
- 1.2.2 **Hot Water Heating System:** The existing hot water heating system will be extended to serve the renovated areas of the building.
- 1.2.3 **Heat Recovery System:** A rooftop heat recovery ventilation system will serve the renovated area.
- 1.3 **SHOP DRAWINGS**
- 1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause "Shop Drawings", for the following equipment and materials:
- Automatic Air Vents
 - Combination Shutoff and Balancing Valves
 - Convector
 - Force Flow Heaters
 - Heat Pumps
 - Rooftop Air Handling Unit
 - Strainers
 - Vacuum Breakers
 - Valves
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal as defined in Section 15001, "Mechanical General Provisions" Clause "Material and Equipment".
- 2.2 **PIPING AND FITTINGS**
- 2.2.1 **General**
- 2.2.1.1 Use the following materials for all piping systems provided by this Section.
- 2.2.1.2 Use long radius elbows. Where the mains are 100 mm (4") diameter or greater and where branches are smaller by two pipe sizes or more, cut-ins will be permitted. For all other branch connections, use manufactured tees.

2.2.1.3 For flanged connections use stainless steel spiral wound graphite gaskets and high tensile strength bolts, nuts and washers. Use welding neck, RF flanges.

2.2.2 **Water Piping for Sizes 50 mm (2") and Smaller.** Use either copper or steel pipe as follows:

2.2.2.1 **Copper**

Pipe - Type L hard drawn copper

Joints - Solder (Use only lead free solder)

Fittings - Wrought copper or cast bronze

Unions - 1030 kPa (150 psig) octagon end, bronze

2.2.2.2 **Steel**

Pipe - Black steel, Schedule 40, ASTM A-53B

Joints - Screwed

Fittings - 860 kPa (125 psig) cast iron

Unions - 1030 kPa (150 psig) malleable iron, brass to iron ground joint seat

2.2.3 **Water Piping for Sizes 65 mm (2-1/2") and Larger:**

Pipe - Black steel, Schedule 40, ASTM A-53B

Joints - Welded and flanged

Fittings - 1030 kPa (150 psig) Schedule 40 steel

Unions - 1030 kPa (150 psig) slip-on

2.3 **VALVES**

2.3.1 **General**

2.3.1.1 Use the following valves for all piping systems provided by this Section, unless specified otherwise.

2.3.1.2 Use only industrial class valves complying with MSS Specification SP-80.

2.3.1.3 All valves supplied for this project shall have a current and valid Canadian Registration Number for the Province of Ontario with TSSA. Upon request, suppliers shall provide a copy of statutory declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration.

2.3.1.4 All valves to have extended locking handles complying with MSS Specification SP-80.

2.3.2 **Butterfly Valves**

2.3.2.1 Use iron body valves with 2" extended neck to allow for insulation, lug type having bi-directional pressure rating of 1380 kPa (200 psi). Stem to be stainless steel with positive retention mechanism. Valve to have aluminum bronze disc and molded or bonded style EPDM seat. Valve to be capable of providing bi-directional "Dead End Service" at full rated pressure with the down stream flanged removed. Valve is

suitable for both chilled water and hot water operation. Valve to be manufactured in accordance to MSS-SP-67, MSS-SP-25 and API-609.

- 2.3.2.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Kitz / Toyo
Keystone / Tyco
Nibco

2.3.3 Ball Valves

- 2.3.3.1 Kitz 68/69, bronze body, full port (CGA approved) with stainless steel ball and stem. Use valves with extension stems when installed in insulated piping. Use locking lever handle where "lockable valve" is noted on the Drawings.

- 2.3.3.2 The following manufacturers of the above two items of equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Jenkins
Kitz
Nibco

2.3.4 Combination Balancing and Shutoff Valves

- 2.3.4.1 Use T&A combination balancing and shutoff valves with ANSI flanges and locking adjustment.

- 2.3.4.2 Balancing Valves will all be designed for flow measurement, flow balancing and positive shutoff. Size valves in accordance with manufacturer's published guidelines. Provide extended differential ports to enable access without removing insulation.

- 2.3.4.3 Valves to be calibrated globe style with differential ports providing flow measurement, balancing and positive shutoff. Do not exceed 910 mm (3') head at fully open position.

2.3.5 Drain Hose Connections

- 2.3.5.1 Full port, bronze body ball valves with stainless steel stems and ball – Kitz 68 with brass hose adaptor, cap and chain.

- 2.3.5.2 The following manufacturers of the above item of equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Jenkins
Kitz
Nibco

2.4 STRAINERS

2.4.1 Use Spirax Sarco Y-type removable stainless steel strainers, maximum P. D. 6 kPa (0.9 psig). Use line size strainers. Ahead of all circulating pumps, use 3.2 mm (1/8") perforations. Use 1.6 mm (1/16") perforations in all other locations.

2.4.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Zurn

2.5 GAUGE COCKS

2.5.1 Use Trerice Type FFG No 735 needle valve of polished brass for 2100 kPa (300 psig) operating pressure, threaded both ends.

2.6 VACUUM BREAKERS

2.6.1 Use Spirax Sarco Type VS 15 mm (1/2") thermostatic air vents.

2.6.2 Maximum allowable pressure of 2,068 kPa (300 PSIG).

2.6.3 Maximum allowable temperature 400°C (750°F).

2.6.4 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Armstrong
Bell & Gossett

2.7 AUTOMATIC AIR VENTS

2.7.1 Use Spirax Sarco Canada Type 13W, Awn-150, 1030 kPa (150 psig) float type air vents with semi-steel body and cap, stainless steel float, stainless steel valve seat and neoprene valve head.

2.7.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Armstrong
Bell & Gossett
Hoffmann

2.8 WALL-FIN CONVECTORS

2.8.1 Use minimum 16 gauge steel casings complete with Series 40, 108 mm x 108 mm (4-1/4" x 4-1/4") aluminum fins on 32 mm (1-1/4") copper tube. Use sloped top, bottom inlet, stamped top outlet configuration. Coat casings with baked on primer and finish exterior surfaces with baked on enamel of Architect's choice from standard colour chart. See Equipment Schedule for capacities and details. Provide wall-to-wall cabinets where shown on the Drawings.

- 2.8.2 Provide manual air vents with all units. Chrome plate exposed vent assemblies.
- 2.8.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Engineered Air
Rittling
Sigma
Trane

2.9 RADIANT CEILING PANELS

- 2.9.1 Furnish Sigma linear radiant ceiling system consisting of panels of type, size and capacity shown on Drawings. Base panel capacities on 21°C (70°F) air temperature, 66°C (150°F) average water temperature and 71°C (160°F) entering water temperature. Use panel widths as shown on the Drawings.

- 2.9.2 Fabricate radiant panels from 1.52 mm (16 gauge) extruded aluminum with 12 mm (1/2") copper tubing mechanically attached to the top of the panel. Secure the copper tubes with aluminum saddles extending minimum half way around the tubes and bond the tubes to the saddles with non-hardening heat conductive paste. Operating weight of panels is to be no more than 10.5 kg/m² (2.15 lb/ft²).

- 2.9.3 Factory finish with standard off-white paint.

- 2.9.4 Provide panel circuiting to match the end connection arrangements indicated on the floor plan Drawings. Panels to run wall to wall.

- 2.9.5 Furnish panels with 360° interconnecting loops and 180° return "U" bands as required to suit the arrangements shown on the Drawings.

- 2.9.6 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Airtex
Airtite
Frenger
Rittling

2.10 FORCE FLOW HEATERS

- 2.10.1 Use Sigma cabinet unit heaters. Refer to Equipment Schedule for types, sizes and capacities.

- 2.10.2 Use cabinets suitable for mounting arrangements indicated in Schedule. Equip cabinets with return and discharge grilles to suit unit arrangement and installation.

- 2.10.3 Furnish heating coils with aluminum fins mechanically bonded to seamless copper tubing. Roll or braze tubes into cast iron or steel headers and test to 2070 kPa (300 psig) pressure.

- 2.10.4 Provide units complete with direct drive forward curved fan, coil, 25 mm (1") thickness MERV 8 pleated type filter, casing, split capacitor type motor, speed controller and automatic air vent. Provide a spare set of filters with each unit.
- 2.10.5 Provide cabinet enclosure fabricated from 1.52 mm (16 gauge) steel coated inside and out with baked on primer and finished on exterior surfaces with baked on enamel of a colour selected from the manufacturer's standard colours.
- 2.10.6 Ceiling units access doors to be hinged and chained.
- 2.10.7 Provide a starter with three speed controller. Mount controller inside unit for wall-mounted types. For ceiling applications, provide starter suitable for remote recessed wall installation.
- 2.10.8 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Engineered Air
Rittling
Trane

2.11 HEAT PUMPS

- 2.11.1 Use Daikin SmartSource water source heat pumps, A.R.I. certified and CSA approved and fully charged with R-410A in all sizes. All units to meet the efficiency requirements of ASHRAE 90.1-2010. Units to consist of DX air coil, compressor, blower, water coil, condensate drain pan, capillary tube expansion device, filter, reversing valve and controls. See Equipment Schedule for sizes and capacities. Use 2-stage heat pumps as indicated ins schedule on drawing.
- 2.11.2 Casing and cabinet fabricated from powder coated, heavy gauge galvanized steel. Internally insulated with 10 mm thick (3/8") thickness closed cell foam. Provide removable panel for access to fan, compressor and control box compartment. Units to have insulated stainless steel drain pan and solid state electronic condensate overflow protection switch.
- 2.11.3 Refrigerant circuit to include a rotary compressor (sizes to 018) or scroll compressor (sizes 024 and larger), capillary expansion tubes, finned tube heat exchanger, reversing valve, water to refrigerant coaxial heat exchanger, access valves and safety controls. Equip compressors with external vibration mounts and thermal overload protection. Heat exchangers rated for 2756 kPa (400 psig) on water side and 3450 kPa (500 psig) on refrigerant side.
- 2.11.4 Unit to include direct drive, forward curved centrifugal fan with a multi-speed, ECM type fan motor isolated from the fan housing with integral mounting brackets. Include on board controller with manual ECM motor speed adjustment dial. Fan wheels to be dynamically balanced. See Drawings for locations of fan outlets. PSC motors will be acceptable on nominal 3/4 ton and 1 ton sizes only.
- 2.11.5 For each heat pump, provide Belimo 1030 kPa (150 psi) bronze body, full port ball style control valves and actuators with stainless steel ball and stem and teflon seals. Use two way, on/off control valves, non-spring return, and provide wire harness for

field connection to heat pump controller. When wired to heat pump controller, controller to open valve prior to starting compressor.

2.11.6 Provide control box which includes: controls for compressor, reversing valve, and fan motor; 50 VA control power transformer, and a terminal block for low voltage field wiring connections. Operating and safety controls to include: low suction temperature (freezestat) switch; high refrigerant pressure lock out switch; compressor overload protection; and supply fan overload protection.

2.11.7 Provide means of remotely resetting each individual heat pump from the Building Control System. Use a unit mounted relay to interrupt power to the heat pump control board on signal from the building automation system. Signal from the control system can be 24 V, 120 V or 0-10 V.

2.11.8 Units to have microprocessor based control system. Unit control logic to provide heating and cooling operation as required by the thermostat. Control systems to provide the following:

- time delay compressor operation
- delayed de-energization of the reversing valve
- compressor short cycle protection
- random unit startup
- high refrigerant pressure alarm
- low suction pressure alarm
- brownout alarm
- service diagnosis

In addition the microprocessor to include the following functions based on remote signals:

- emergency shutdown
- night setback override
- pump restart on night setback

The microprocessor control board to include the following diagnostic functions:

- normal mode
- high pressure fault
- low temperature fault
- condensate overflow
- brown-out
- load shed
- unoccupied mode
- emergency shutdown

Provide "Fan", "Cool", "Heat" inputs and dry contacts for alarm output.

2.11.9 Provide neoprene vibration isolation pads for vertical heat pumps, as well as 860 kPa (125 psi) at 50°C (120°F) working pressure flexible connector hoses with stainless steel braid, bronze ends and one swivel end.

- 2.11.10 Provide 25 mm (1") thick throwaway filters serviceable from either side with a duct collar for ducted return connections. Provide additional set of filters for each unit.
- 2.11.11 Heat pump units to have extra quiet construction including mass plate and additional sound insulation. Include optional sound package which features sound attenuating compressor blankets combined with sound attenuating material strategically applied within the air handling compartment to further reduce sound transmission. Sizes 007 to 019 will have sound attenuating material in the compressor compartment in lieu of compressor blankets.
- 2.11.12 In addition to the one year full warranty as specified in Section 15001 "Mechanical General Provisions", provide an additional three year warranty on all parts, including the ECM fan motor, compressor, and the entire refrigeration circuit.
- 2.11.13 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Carrier
 - Climate Master
 - Florida Heat Pump
 - Trane
- 2.12 **ROOFTOP AIR HANDLING UNIT (Drawing Reference RTU-102)**
- 2.12.1 Use Daikin Rebel rooftop units specifically designed for outdoor application with a weatherproof cabinet. Cooling capacity, heating capacity and fan performance shall be AHRI certified. Complete unit shall be ETL- Canada listed.
- 2.12.2 The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply and exhaust fan assemblies, a refrigeration circuit run test, a unit control system operations checkout, test and adjustment of the gas furnace, a unit refrigerant leak test and a final unit inspection.
- 2.12.3 **Casing**
- 2.12.3.1 Panels and access doors shall be constructed as a 50-mm (2") nominal thick, thermally broken double wall assembly, injected with foam insulation for an R-value of not less than R-13. The outer casing shall be constructed of galvanized steel, phosphatized and painted with a polyester resin topcoat with a natural beige color. Finished panel surfaces must withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.
- 2.12.3.2 Unit base shall overhang the roof curb for water runoff and shall have a formed recess that seats on the roof curb gasketing to provide a positive weather tight seal.
- 2.12.3.3 Service doors shall be provided for the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable. Service doors must be lockable with stainless steel bolt and lock nut.

- 2.12.3.4 Unit cabinet shall be designed to operate at total static pressures up to 5 inches w.g.
- 2.12.4 **Filters:** The filter section shall be provided with a 100 mm (4") final filter rack. Provide Camfil 30/30 MERV 8A filters and a spare set of final filters.
- 2.12.5 **Fans**
- 2.12.5.1 Supply and exhaust fans shall be single width, single inlet centrifugal Airfoil type. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. Fans shall be direct drive.
- 2.12.5.2 Fan assemblies shall be statically and dynamically balanced for quiet operation. Provide slide out rails for servicing and maintenance of the fan.
- 2.12.5.3 The fan motor shall be a totally enclosed ECM motor that is speed controlled by the rooftop unit controller. Motor safeties shall include thermal overload protection and phase failure protection. Motors shall be premium efficiency, inverter duty. Fan assemblies shall be a slide out type for servicing and maintenance.
- 2.12.5.4 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.
- 2.12.6 **Cooling Coil**
- 2.12.6.1 Evaporator coils shall be multi row type fabricated from seamless copper tubing mechanically bonded to high efficiency aluminum plate fins. Each evaporator coil refrigerant circuit shall be fed with an electronically controlled expansion valve. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face area active at all load conditions.
- 2.12.6.2 Provide a stainless steel sloped primary drain pan under the cooling coil and beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot and be connected to a stainless steel drain connection extending through the base. Polymer drain pans will not be accepted.
- 2.12.7 **Economizer**
- 2.12.7.1 Unit shall be provided with an outdoor air economizer section. The economizer shall include outdoor, return, and exhaust air dampers. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream
- 2.12.7.2 The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be opposed blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 4 cfm / square foot of damper area at 1" differential pressure per ASHRAE 90.1 Energy Standard.

- 2.12.7.3 A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.
- 2.12.7.4 Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.
- 2.12.8 **Energy Recovery Section**
- 2.12.8.1 The energy recovery cassette is to be rated in accordance with ARI Standard 1060 and must bear the ARI certification symbol.
- 2.12.8.2 The energy recovery cassette is to contain a total energy recovery heat wheel constructed of a light weight polymer material with permanently bonded desiccant coating. The energy recovery wheel media must be capable of removal from the cassette and replacement without the use of tools. Wheel media to be cleanable using hot water or light detergent without degrading the efficiency.
- 2.12.8.3 Provide defrost control and rotation detection controls.
- 2.12.8.4 The exhaust fan to be backward inclined type. Fan and motor to be dynamically balanced. A backdraft damper is to be included with the exhaust fan. Outside air and exhaust air filters to be 50 mm (2") thick, pleated, MERV 8.
- 2.12.9 **Condensing Section**
- 2.12.9.1 Outdoor coils shall have seamless copper tubes, mechanically bonded to aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil.
- 2.12.9.2 Fan motors shall be ECM type. The rooftop controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit within acceptable limits. Mechanical cooling shall be provided to 0° F. Motor safeties shall include thermal overload protection and phase failure protection.
- 2.12.9.3 The condenser fan shall be dynamically designed for low noise generation with low tip speeds. Fan blade shall be of a composite material.
- 2.12.9.4 The unit shall have a single inverter driven scroll compressors. The unit controller must control the speed of the compressor to maintain the discharge air temperature. Unit must be capable of operating at 20% of cooling capacity or lower, except nominal 5 ton units for which modulation down to 30% will be acceptable.
- 2.12.9.5 The refrigeration circuit shall have both low and high pressure safety switches. Temperature sensors shall be provided for measuring suction and discharge temperature of the refrigerant.

2.12.9.6 Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for compressor startup under low head pressure conditions. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

2.12.9.7 Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

2.12.10 Natural Gas Fired Heating Section

2.12.10.1 The rooftop unit shall include a natural gas heating section. The gas furnace design shall be a natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

2.12.10.2 The heat exchanger tubes shall be stainless steel. The module shall be complete with a furnace controller and control valve capable of 10:1 modulation. Unit shall be able to modulate heating output down to 10%.

2.12.10.3 The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

2.12.10.4 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

2.12.11 Electrical

2.12.11.1 Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with CSA standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be CSA recognized.

2.12.11.2 A terminal block shall be provided for the main power connection and a terminal board shall be provided for the low voltage control wiring. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit.

2.12.11.3 Each compressor and condenser fan motor shall be furnished with contactors and internal thermal overload protection. Supply fan motors shall be supplied with external overload protection.

2.12.12 Controls

2.12.12.1 Each unit shall be equipped with a Daikin MicroTech III microprocessor based control system. The unit control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interface. The unit control system shall perform all unit control functions including scheduling, unit diagnostics and safeties.

- 2.12.12.2 The DDC control system shall permit starting and stopping of the unit locally or remotely. A set of contacts shall be provided for unit enable/disable, outside air damper minimum position, discharge air temperature reset, and general alarm status.
- 2.12.12.3 The unit control system shall have the ability to communicate with an independent Building Management System (BMS) via a direct BACnet MSTP or LONworks communication connection, coordinate with section 15900. The independent BMS system shall have access to "read only" variables and "read & write" variables. Communications shall not require field mounting of any additional sensors or devices at the unit. The BMS system shall be capable of interacting with the individual rooftop controllers in the following ways:
- Monitor controller inputs, outputs, set points, parameters and alarms
 - Set controller set points and parameters
 - Clear alarms
 - Reset the discharge air temperature set point
- 2.12.12.4 The controller shall have a 4 line x 20 character display with all information and instructions shown in plain English. A keypad shall allow information and controls to be accessed. The microprocessor shall have a programmable time clock, store current and past alarm conditions.
- 2.12.12.5 The display shall provide the following information:
- Unit status including # of stages or % capacity for fans, heating, cooling and economizer.
 - Supply, return, outdoor, and space air temperature
 - Duct and building static pressure; the control contractor is responsible for providing and installing sensing tubes
 - Inverter compressor speed and refrigeration circuit pressures and temperatures
 - Outside air damper position and economizer mode
 - Cooling and heating changeover status
 - Occupied, unoccupied, and dirty filter status
 - Date and time schedules
 - Alarm faults
- 2.12.12.6 The following set points shall be adjustable:
- Control mode (Off / Auto / Cool Only / Fan Only / Heat Only)
 - Occupancy mode (Auto / Tenant Override / Occupied / Unoccupied)
 - Changeover mode (return air, space temperature or network signal)
 - Cooling and heating discharge air temperature control
 - Compressor lockouts and timers
 - Economizer changeover (enthalpy or dry bulb)
 - Scheduling
 - Building static pressure control
- 2.12.12.7 The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure set point.

- 2.12.12.8 Supply air reset options shall include; return air temperature, outdoor air temperature, space temperature, airflow (VAV), network signal, external signal (1-5 vdc or 0-20 mA)
- 2.12.13 **Roof Curb:** Each unit shall be provided with a prefabricated 14 gauge spring isolation roof curb with minimum 25 mm (1") static deflection.
- 2.12.14 **Startup Service and Warranty:** Manufacturer shall furnish a factory trained service technician to perform the unit startup. Manufacturer shall provide instruction to the owner's personnel on the operation and maintenance of the unit. Factory technician to provide copy of start up log to owner and to demonstrate operation and maintenance to owners' representative. The warranty period shall commence at the date of initial startup and shall continue for a period of one (1) year not to exceed eighteen (18) months from shipment. Manufacturer's warranty shall include all parts and labour to install parts. Provide an additional 4 years parts only warranty for compressor and refrigeration system leaks.
- 2.12.15 The following manufacturer of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":
- Aeon
Engineered Air
Greenheck
Trane
- 3 Execution
- 3.1 **PIPING**
- 3.1.1 **General**
- 3.1.1.1 Use flanges or unions on all piping connections to equipment.
- 3.1.1.2 Support all piping connected to isolated equipment with spring hanger supports for at least the first three support points.
- 3.1.1.3 Install all control valves, fittings, water temperature sensors and flow switches supplied by Section 15900 "Controls".. See Section 15900 "Controls" for equipment supplied.
- 3.1.1.4 See Section 15001 "Mechanical General Provisions" Clause "Piping".
- 3.1.2 **Water Piping**
- 3.1.2.1 Provide drain valves with hose connections at base of all risers, at all low points in piping distribution, and at low points on all equipment connections. Drain valves to be ball valves.
- 3.1.2.2 For upfeed take off top of pipe. For downfeed take off bottom of pipe.

3.2 VALVES

- 3.2.1 Unless specifically noted, shown or specified otherwise, shutoff valves may be either butterfly valves or ball valves. Do not use ball valves for sizes greater than 50 mm (2"). Where butterfly valves are required to isolate a piece of equipment, provide an extra set of flanges if necessary to allow removal or repair of equipment without disturbing valves.
- 3.2.2 Use line sized valves unless shown or specified otherwise.

3.3 AIR VENTS

- 3.3.1 Provide automatic air vents at all high points in piping system and at all points where piping drops to form loops.
- 3.3.2 Use manual air vents only where shown or specified.
- 3.3.3 See Detail Sheet included with Section 15001 "Mechanical General Provisions" for installation requirements.

3.4 CONVECTORS

- 3.4.1 Make connections to elements with brass seated unions. Install a shutoff valve on each supply and combination shutoff and balancing valve on each return. Provide manual air vent. Locate control valves above accessible ceilings or behind access doors.

3.5 FORCE FLOW HEATERS

- 3.5.1 Make connections to elements with brass seated unions. Install a shutoff valve on each supply and balancing valve on each return. Locate control valves above accessible ceilings or behind access doors.
- 3.5.2 Provide mounting frames to support cabinet force flow heaters from main structure and to allow flush mounting.

3.6 VIBRATION CONTROL EQUIPMENT

- 3.6.1 Install all vibration control equipment supplied by Section 15240, "Noise and Vibration Control", for equipment provided by this trade.
- 3.6.2 Use vibration isolators on all piping connected to vibrating equipment in mechanical rooms. Install all flexible pipe connectors and hangers as per manufacturer's instructions.

3.7 ROOFTOP AIR HANDLING UNITS

- 3.7.1 Comply with manufacturer's rigging and installation instructions for unloading the units and moving to the final location.
- 3.7.2 Assemble all sections in accordance with manufacturer's recommendations and under manufacturer's representative's supervision. Seal all joints between sections

and all pipe and conduit penetrations. Use caulking as recommended by manufacturer for seams. Use rubber grommets and retaining plates for pipes and conduits. Fill all grease lines.

3.7.3 Provide individual deep seal traps for drains from outside air intake and cooling coil. See Detail Sheet included with Section 15001, "Mechanical General Provisions". For rooftop units, pipe condensate drain discharge to nearest roof drain.

3.7.4 Pipe vent openings on each coil and bring together outside cabinet. Provide a pet cock on each vent connection.

3.7.5 Provide all piping for coils.

3.7.6 Provide the services of the unit manufacturer's service representative to supervise assembly work, inspect the final assemblies, and supervise startup.

3.8 **ROOF CURB INSULATION**

3.8.1 Provide roof attenuation under roof-mounted units as follows:

3.8.2 Mount all new rooftop units on prefabricated roof curb.

3.8.3 Inside the curb and curb adaptor, apply two layers of 25 mm (1") thick, 4.5 lb/ft³ density, insulating board on roof deck. Stagger board joints. Butt board sections tightly to sides of ductwork and curb.

3.8.4 Seal all board joints and edges with acoustic sealant.

3.8.5 Advise Consultant when this work is complete, for his review. Seal joints to satisfaction of Consultant.

3.9 **HEAT PUMP SYSTEM**

3.9.1 Provide the services of a factory trained representative to be present at system startup and to instruct the Owner in system operation.

3.9.2 Install isolators which are supplied with individual heat pump units.

3.9.3 Install heat pumps so that they can easily be removed for servicing.

3.9.4 Connect supply and return piping together to allow for chemical cleaning of system. Do not connect heat pump units to piping system until after system is chemically cleaned. See Section 15001, "Mechanical General Provisions".

3.10 **ACCESS DOORS**

3.10.1 Provide access doors with quick fastening latches for access to all dampers, coils, thermostats, valves and any other concealed devices which require servicing.

3.11 COMBINATION SHUTOFF AND BALANCING VALVES

3.11.1 Provide water flow balancing valves and flow meters in all locations shown. Install in accordance with manufacturer's recommendations.

3.12 AIR AND WATER SYSTEM TESTING AND BALANCING

3.12.1 Cooperate with and assist the air and water testing and balancing company. See Section 15200, "Testing and Balancing".

3.12.2 Change wire taps on individual heat pump units to allow for proper air balancing.

3.12.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.12.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

3.13 WATER TREATMENT SYSTEMS

3.13.1 Install all water treatment equipment as shown and in accordance with manufacturer's recommendations. Provide all necessary piping and accessories. See Section 15715, "Water Treatment".

3.13.2 Mechanical Contractor to flush, drain, clean and refill heat pump and heating system, provide bypasses, etc, as directed by Water Treatment Contractor. See Section 15001, "Mechanical General Provisions".

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Heat Pump System:** A water source heat pump system serves the renovated areas of the building.
- 1.2.2 **Energy Recovery Systems:** A new rooftop energy recovery ventilation system serve the renovated area of the building.
- 1.2.3 **Exhaust Air Systems:** Various exhaust systems serve the building.
- 1.3 **SHOP DRAWINGS**
- 1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause "Shop Drawings" for the following equipment and materials:
- access doors
 - brick vent
 - duct sealer
 - ductwork gauges, material and methods of support for each pressure type, shape (i.e. round, rectangular) and size range.
 - exhaust fans
 - flexible ductwork
 - fire dampers
 - grilles, registers and diffusers
 - range hoods
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal as defined in Section 15001 "Mechanical General Provisions", Clause "Material and Equipment".
- 2.2 **DUCTWORK**
- 2.2.1 **Standards:** Construct all ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual "HVAC Duct Construction Standards - Metal and Flexible".
- 2.2.2 **Materials:** Unless specified otherwise, fabricate all ductwork from galvanized steel. Use SMACNA recommended thicknesses except where specified otherwise. Where aluminum construction is shown or specified, use utility grade aluminum.
- 2.2.3 **Rectangular - Low Pressure:** Use SMACNA 2" W.G. pressure class. Use SMACNA recommended sheet metal thicknesses.

- 2.2.4 **Rectangular - Medium Pressure:** Fabricate according to current SMACNA standards for static pressures in duct up to 1490 Pa (6" W.G.).
- 2.2.5 **Round - Medium Pressure:** Fabricate according to current SMACNA standards for static pressures in duct up to 1490 Pa (6" W.G.). Use Alpha or Plascad spiral round ducts. Use machine formed fittings. Use conical type takeoffs. Where round ductwork is shown internally lined, use Alpha or Plascad acoustic thermal duct consisting of Alpha free-flow spiral duct lined with 50 mm fibreglass insulation and 28 gauge steel perforated interior liner.
- 2.2.5.1 Where round ductwork is exposed to view, a decorative grade installation is required. Arrange for special handling and shipping to avoid dents and minimize scratches.
- 2.2.6 **Flexible Type Round Ducts**
- 2.2.6.1 Where not exposed to view, use Thermaflex Type M-KC or FlexMaster equivalent insulated flexible duct with a woven fibreglass fabric core with a flame resistant coating permanently bonded to a coated wire helix. Minimum positive pressure rating of 4 kPa (16"w.g.) for sizes 100 to 250 mm (4 to 10 ") and 2.5 kPa (10" w.g.) for sizes 300 to 410 mm (12 to 16"). Insulate duct with minimum 40 mm (1-1/2") thickness of 12 kg/m³ (0.75 lb/ft³) density fibreglass and bidirectional reinforced metallized film outer vapour barrier.
- 2.2.6.2 Flexible ductwork will not be permitted where exposed to view.
- 2.2.6.3 Flexible duct must bear ULC approval labels and conform to flame spread and smoke developed ratings as required by the Ontario Building Code.
- 2.3 **FIRE DAMPERS**
- 2.3.1 Use only dynamic type fire damper assemblies tested in accordance with CAN4-S112-M "Standard Method of Fire Test of Fire Damper Assemblies" and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptance to the Consultant. Label each damper to indicate compliance with these requirements. Provide fusible links with a 70°C (158°F) rating unless noted otherwise on Drawings. Links shall comply with ULC-S505 "Standard for Fusible Links for Fire Protection Service". Fabricate all dampers from galvanized steel except in copper and aluminum duct systems. In these systems, use all stainless steel construction.
- 2.3.2 Provide damper assemblies whose fire protection ratings comply with Ontario Building Code requirements for the fire resistance ratings of the fire separations through which the protected openings pass. Provide an approval label, stating the fire rating, from a recognized independent testing laboratory acceptable to the Consultant, on each assembly.
- 2.3.3 For ducts with either face dimension of 300 mm (12") or less, and for all medium pressure ducts, use low resistance type dampers with 100% free area.
- 2.3.4 Provide with each fire damper, detailed installation instructions. Include illustrations and adequate information to attain proper and safe installation of the fire damper assemblies.

2.3.5 The products of the following manufacturers will be considered equal, subject to the requirements of Clause "Material and Equipment":

Alumavent
Price
Nailor
Ruskin

2.4 **INTERNAL DUCT LINING**

2.4.1 Use Schuller/Manville "Permacote Linacoustic" fibreglass duct liner with air stream surface protected with "Permacote", acrylic coating. Coating to be treated with anti-microbial agent so as not to support growth of fungus or bacteria as determined by ASTM G21 and G22. Liner to meet or exceed Life Safety Standards as established by NFPA 90A and 90B, have a NRC not less than 0.7, and a thermal conductivity of 0.36 W/m.K (0.0208 Btuh/ft/°F) at 23.9°C (75°F).

2.4.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Knauf
Manson
Fiberglas

2.5 **DUCT ACCESS DOORS**

2.5.1 Use Nailor Industries Inc. 0800 Series duct access doors. For duct dimension up to 300 mm (12") use 250 mm x 150 mm (10" x 6") door. For duct dimension up to 600 mm (24"), use 380 mm x 250 mm (15" x 10") door. For all larger ducts, use 660 mm x 510 mm (26" x 20") door.

2.5.2 For insulated ducts, use doors factory insulated with 25 mm (1") thick fibreglass insulation.

2.5.3 The following manufacturer will be considered equal, subject to the requirements of Clause "Material and Equipment":

Alumavent
Price
Nailor
Ruskin

2.6 **FLEXIBLE DUCT CONNECTORS**

2.6.1 Use Duro Dyne "Durolon" or Ventfabrics "Ventlon" pre-assembled flexible duct connectors with 150 mm (6") fabric width.

2.6.2 The following manufacturer will be considered equal, subject to the requirements of Clause "Material and Equipment":

Thorburn

2.7 GRILLES, REGISTERS AND DIFFUSERS

2.7.1 Use manufacturer of grilles, registers and diffusers shown in schedule on drawings. Provide types, accessories and finishes as noted in the Equipment Schedules. See Drawings for sizes.

2.7.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Standard GRD's: Kreuger
Nailor
Price
Titus
Tuttle & Bailey

High Induction GRD's: Effective HVAC
KlimaKontor
NAD Klima
Trox

2.8 BALANCING DAMPERS

2.8.1 For ducts 930 cm² (144 in²) and less in cross sectional area, use single blade dampers with locking quadrant and pin on far side. For larger ducts use, multi-blade, opposed blade dampers with external operator and locking quadrant. Provide spacers to maintain clearance between duct and damper blades.

2.9 DUCT SEALER

2.9.1 Use Duro Dyne DSW water based high pressure duct sealer.

2.9.2 The following manufacturers of the above material will be considered as equal, subject to requirements of Clause "Material and Equipment":

Childers
Multi-Purpose
3M Canada Inc.
United Sheet Metal

2.10 BIRDSCREENS

2.10.1 Use 12 mm x 12 mm (1/2" x 1/2") galvanized steel wire mesh mounted in reinforced steel frame.

2.11 RANGE HOODS

2.11.1 Use Broan BKDF130SS range hood, 760 mm (30") wide, three speed setting, cUL listed, HVI certified 1.5 sones at 47 l/s (100 cfm), stainless steel finish, ducted. Provide halogen lamps with units.

2.12 BRICK VENT

2.12.1 Use Greenheck, Model BVF or BVE, sizes as noted on the Drawings. Use model BVF for installation in existing walls and model BVE for installation in new walls. Construct using 40 mm (1-1/2") deep, 45° drainable blade type louvres with storm stops. Use 3.0 mm (0.125") louvre blades and 3.0 mm (0.125") frames, fabricated from extruded aluminium. Provide square mesh insect screen on interior face of louvre. Architect to select colour.

2.12.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ventex

2.13 EXHAUST AIR FANS

2.13.1 General

2.13.1.1 See Equipment Schedules for types, details and capacities.

2.13.1.2 Provide felt edged backdraft dampers on all systems which are not provided with automatic control dampers.

2.13.1.3 Size V-belt drives for 150% of motor nominal horsepower. Provide belt guards.

2.13.1.4 Use fixed drive pulleys on fans greater than 0.75 kW (1 hp). Use adjustable drive pulleys on fans 0.75 kW (1 hp) or less.

2.13.1.5 Use arrangement and motor location to suit fan location.

2.13.1.6 Use bearings of ball bearing type, grease lubricated. Provide extended grease fitting where required for easy access.

2.13.1.7 Use fan classification in accordance with A.M.C.A. Pressure Limitations. Use a minimum of Class I construction on all fans unless specified otherwise. Submit certified Fan Performance Curves and fan sound level ratings based on A.M.C.A. Standards to the Consultant with Shop Drawings.

2.13.2 **Roof-Mounted Exhaust Fans:** Use Cook centrifugal exhaust fan with spun aluminum housing. Mount motor and drive housing on vibration isolators and seal from exhaust air stream. Provide prefabricated sound curb with a minimum height of 380 mm (15"). Provide spark-proof wheel. Provide birdscreen and safety disconnect switch.

2.13.3 The following manufacturers of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":

Roof-Mounted Exhaust Fans: Carnes
Greenheck
Jenn Air
Penn Barry

2.14 TURNING VANES

2.14.1 Use Rouane turning vanes as manufactured by S.E. Rozell and Sons Ltd. in all square elbows. Assemble vanes with Duro Vane Rail JVR-2 for 50 mm (2") radius vanes spaced 38 mm (1-1/2").

2.15 ROOFTOP AIR HANDLING UNIT AND HEAT PUMPS

2.15.1 See Drawings and refer to Section 15600 "Liquid Heat Transfer".

3 Execution

3.1 DUCTWORK

3.1.1 General

3.1.1.1 Construct ALL ductwork located inside Mechanical Equipment Rooms to Medium Pressure duct standards. Unless specified otherwise, construct ALL other ductwork to Low Pressure duct standards. Construct all ducts designated on Drawings as round to Medium Pressure duct standards.

3.1.1.2 Fabricate and install ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual "HVAC Duct Construction Standards - Metal and Flexible".

3.1.1.3 Pay particular attention to Section 15001 "Mechanical General Provisions", Clause "Cutting and Patching". This will be strictly enforced on this project. Coordinate work with trades responsible for floor and wall construction to reduce difficulty of making tight seals.

3.1.1.4 Fabricate all ductwork to the clear inside dimensions shown on the Drawings. Where internal lining is specified, dimensions shown are inside insulation.

3.1.1.5 Do not suspend ducts from metal roof deck.

3.1.1.6 Make duct connections to fans and heat pumps with flexible duct connectors.

3.1.1.7 Install access doors for easy access to each damper, thermostat, coil, valve, or other concealed device which requires servicing.

3.1.1.8 Provide backdraft dampers where shown or specified.

3.1.1.9 Install fire damper assemblies in strict accordance with manufacturer's instructions provided with each fire damper. See Detail Sheet in Section 15001 for installation requirements where ducts are internally lined.

3.1.1.10 Install dampers and duct sensors as supplied by Section 15900, "Controls".

3.1.1.11 Where ductwork has to be altered from dimensions shown due to construction conditions, use the same effective cross sectional areas, without exceeding a 4 to 1 aspect ratio. Carry out such changes at no additional cost to the Owner.

- 3.1.1.12 Install ductwork to maximize clear floor to ceiling heights.
- 3.1.1.13 Transitions are described in the direction of air flow. For converging transitions, use a maximum slope of 1 in 4 and, for diverging transitions, use a maximum slope of 1 in 7.
- 3.1.1.14 Paint interior of ductwork for at least 610 mm (24") behind supply, return and exhaust grilles and registers with matte black paint so as to render ductwork invisible from occupied space. Do not paint ductwork which is internally lined.
- 3.1.1.15 Apply one coat zinc chromate primer over all welded surfaces.
- 3.1.1.16 If there is a conflict between the duct sizes shown on the floor plans and the duct sizes shown on sections, elevations or details, the floor plans will govern.
- 3.1.1.17 Install duct smoke detectors supplied by Division 16.
- 3.1.1.18 Seal all transverse joints, longitudinal seams and duct wall penetrations to SMACNA Seal Class A standards.
- 3.1.2 **Low Pressure - Rectangular Ductwork**
 - 3.1.2.1 Fabricate and install according to current SMACNA standards. Use 2" W.G. pressure class. Use SMACNA recommended sheet metal thicknesses. Fabricate with all flat surfaces wider than 450 mm (18") either cross broken or transverse beaded, regardless of whether the duct is insulated, lined or bare.
 - 3.1.2.2 Use elbows in the following order of preference:
 - 3.1.2.2.1 Full radius elbows with inside radius equal to duct width.
 - 3.1.2.2.2 For duct takeoff to a single register, diffuser, grille or branch, use balancing dampers.
- 3.1.3 **Medium Pressure Ductwork**
 - 3.1.3.1 Fabricate and install according to current SMACNA standards for 1490 Pa (6" W.G.) pressure class.
 - 3.1.3.2 **Round Ductwork**
 - 3.1.3.2.1 Provide a decorative grade installation where ductwork is exposed to view, outside of Mechanical Rooms. Use satin coat finish, degreased and suitable for field painting without etching duct surfaces.
 - 3.1.3.2.2 Make all joints in ductwork exposed to view using "Spiralmate" round duct connector system or equivalent.
 - 3.1.3.2.3 Rotate spiral seams on duct-to-duct joints so that the seam provides a continuous helical pattern across the joint.

3.1.3.2.4 Fasten diffuser collars to duct using pop rivets. Provide a finishing fillet of elastomer seal at the collar-duct junction.

3.1.3.2.5 Space hangers at equal intervals. Fasten hangers to duct system using ring collars as shown on the Drawings.

3.2 FLEXIBLE DUCTS

3.2.1 In lieu of the solid duct connections shown, flexible ducts may be used to connect diffusers to duct runouts.

3.2.2 Length of flexible duct must not exceed 1.8 m (6') and maximum one 90° elbow will be permitted. Use hangers and supports to ensure duct does not sag. Make all duct connections using Duro-Dyne FT-2 high fibreglass tape, sheet metal screws, and Duro-Dyne S-W high pressure duct sealer. Installation to be UL Listed treatment as published by the manufacturer.

3.3 INTERNAL DUCT LINING

3.3.1 Install lining in accordance with liner manufacturer's published recommendations and SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Use both adhesive and welded pin mechanical fasteners. Select pin lengths to limit insulation compression to 3 mm (1/8"). Butter butt joints with a fire resistant coating and extend 50 mm (2") on either side of joint to stop air from lifting insulation. Repair liner surface penetrations with adhesive meeting ASTM C919. Pins must be welded to duct.

3.3.2 Internally line ducts where shown on Drawings. Use 25 mm (1") thickness, unless designated otherwise.

3.3.3 Where plenums are not specified, internally line outside air intake ducts with 37 mm (1-1/2") thickness. Finish with two 3 mm (1/8") thick coats of asphalt or vinyl mastic. Apply glass reinforcing fabric between coats. Lap joints by 100 mm (4").

3.4 GRILLES, REGISTERS AND DIFFUSERS

3.4.1 Cooperate on the job with other trades so that grilles, registers and diffusers do not conflict with lights, etc. Bring any conflict between grilles, registers and diffusers and the work of other trades to the attention of the Consultant before any ductwork is installed. See Architect's reflected ceiling plan for location of grilles, registers and diffusers.

3.4.2 Install frame for each grille, register and diffuser to suit the type of building construction.

3.5 FLEXIBLE DUCT CONNECTORS

3.5.1 Make all duct connections to fans, heat pumps and fluid cooler with preassembled duct connectors.

3.6 TESTING AND BALANCING

- 3.6.1 Cooperate with the Testing and Balancing trade. See Section 15200, "Testing and Balancing". Make any changes deemed necessary by the Testing and Balancing trade to permit proper testing and balancing of the systems.
- 3.6.2 Provide additional balancing dampers where required by the Testing and Balancing Company.
- 3.6.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.
- 3.6.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

3.7 DUCT LEAK TESTING

- 3.7.1 Duct leakage tests are specified in Section 15200, "Testing and Balancing".
- 3.7.2 Cap and seal ducts for the test sections as directed by the Testing and Balancing trade. Provide all necessary fittings and duct connections as required for the leak testing procedure.
- 3.7.3 Ensure all required duct access doors are installed before tests are started.
- 3.7.4 Immediately correct defects discovered during test and arrange for retesting until satisfactory results are obtained.

END OF SECTION

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- 1 General
- 1.1 **CASH ALLOWANCE**
- 1.1.1 The work of this section is included in a Cash Allowance. See Section 15001, "Mechanical General Provisions" for details.
- 1.1.2 The existing Building Control System was provided by Durell Control Systems. For the work of this Section, use only Durell Control Systems. Contact Gary Vieira at 905-685-5432 .
- 1.1.3 The work of this project is to be performed only by skilled factory-trained technicians under the direction of experienced engineers, all of whom shall be properly trained and qualified for this work and who are employed directly by the firms listed above.
- 1.2 **REQUIREMENTS**
- 1.2.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.2.2 Conform to the requirements of "Master Specifications for DDC Control System Upgrades prepared for SCCDSB", July 2004. These specifications are available from the SCCDSB on request. Follow all requirements of the following Sections of the Master Specification:
- Section 13820 - General Profile of the Work
 - Section 13830 - Hardware Specifications
 - Section 13840 - Software Specifications
 - Section 13850 - Execution of the Contract General Specifications
 - Section 13860 - Acceptance of Work
 - Section 13870 - Documentation and Training
 - Section 13880 - Warranty
- 1.3 **SCOPE OF WORK**
- 1.3.1 This Section of the Contract includes the execution of all Mechanical Systems Controls called for or implied by the Drawings and Specifications, together with all necessary incidentals whether referred to or not, as required to complete the work to the full intent and meaning of the Drawings and Specifications. This includes the supply and installation of complete digital and electric controls systems as indicated.
- 1.3.2 Existing electronic/electric, direct digital control (DDC) system to be extended to make the new mechanical and electrical systems controls completely operational.
- 1.3.3 Supply for installation by others, the following:
- Control valves
 - Control dampers
- 1.3.4 The Controls Subcontractor is responsible for arranging, coordinating and supervising the installation of the above devices in a suitable manner and location.

- 1.3.5 Wire components of temperature control system in accordance with the requirements of Division 16. Include wiring between control components and electrical circuits of fans, pumps, and any other equipment or apparatus as indicated in this section or required for the proper functioning of controls as described in this section. Provide necessary transformers, relays, etc. to accomplish specified control function. All controls provided by this Section to be wired by this Section.
- 1.3.6 For each controller, choose a unit that will provide a minimum of 10% spare points of the total available points, for each type of point, for future use. If these additional points will necessitate the installation of an expansion module for the controller, which will otherwise not include any connected points, seek Consultant's direction and provide expansion modules where directed by Consultant.
- 1.3.7 Controls Contractor must attend site meetings twice monthly to review progress of the work for the construction period 5 months prior to substantial completion through to the completion of the project.
- 1.3.8 Remove all redundant control systems in areas of work. Turn over existing controllers to SCCDSB.
- 1.3.9 Where existing systems are modified, the existing control system serving these systems should be updated to provide control of these new components to provide a fully functional and independent existing control system.
- 1.4 **COMMISSIONING**
- 1.4.1 Commission the entire system as described in Section 15990, "Building Control System Commissioning". Work is to be performed only by skilled factory-trained technicians under the direction of experienced engineers, all of whom shall be properly trained and qualified for this work and who are employed directly by the firms listed above.
- 1.5 **SHOP DRAWINGS AND SUBMITTALS**
- 1.5.1 Controls Contractor must submit a list of schedule milestones with the project shop drawings, indicating phasing of controls installation, e.g. at substantial completion of mechanical room piping, controls contractor requires X additional days for terminations, testing and commissioning, etc.
- 1.5.2 **Direct Digital Control System Hardware**
- 1.5.2.1 A complete bill of materials of equipment to be used indicating quality, manufacturer, model number, and other relevant technical data.
- 1.5.2.2 Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:
- Direct Digital Controller (Controller panels)
Transducers/Transmitters
Sensors (Including Accuracy Data)
Actuators

Control Valves
Control Dampers
Switches

1.5.2.3 Wiring Diagrams and layouts for each control panel. Show all termination numbers.

1.5.2.4 Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware.

1.5.3 Central System Hardware and Software

1.5.3.1 Complete Bill of material and equipment used, indicating quantity, manufacturer, model number, and other relevant technical data.

1.5.3.2 Schematic Diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers model numbers and functions. Show all interface wiring to the control system.

1.5.3.3 Riser diagrams of wiring between central control unit and all control panels.

1.5.4 Controlled Systems

1.5.4.1 A complete description of the operation of the control system, including sequences of operation. The description shall include a reference to the schematic diagram of the controlled system.

1.5.4.2 A point list for each system controller including both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, and the location of the I/O device. Software flag points, alarm points, etc.

1.5.5 Maintenance Data

1.5.5.1 In addition to requirements specified in 15001 "Mechanical General Provisions", upon completion of the work, the control manufacturer shall provide three sets of Maintenance Data to the Mechanical Contractor for inclusion in Project Maintenance Manuals and affix a fourth, plastic coated set near or at the appropriate control panel. Maintenance Data to include the following:

1.5.5.2 Copies of the complete, approved, Shop Drawings

1.5.5.3 Copy of the Electrical Safety Final Inspection Certificate

1.5.5.4 Project Record Drawings

1.5.5.5 As-built versions of the submittal Shop Drawings

1.5.5.6 Operations Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables

1.5.5.7 Licences, guarantees, and warranty documents for all equipment and systems.

1.6 ACCEPTANCE PROCEDURES

1.6.1 Refer to SCCDSB Master Specification. Upon completion of the system, the Control Contractor to indicate in writing to the Consultant that the acceptance procedure can commence.

1.7 TRAINING

1.7.1 Refer to SCCDSB Master Specification.

1.8 WARRANTY

1.8.1 Refer to SCCDSB Master Specification. All controls, equipment and material to be unconditionally warranted for a period of one year from the date of acceptance by the Owner. The warranty period is to commence when the building is turned over for occupancy.

1.8.2 Provide warranty service at no cost to the Owner for the warranty period. This to include, but not limited to the following:

- Emergency repair service on regular working hour basis during warranty.
- Replacing defective parts and components as required.
- Servicing by factory trained and employed service representatives of system manufacturer.

1.9 WIRING, CONDUIT AND CABINETS

1.9.1 All of the installation requirements, be they temporary or permanent, to comply with the Canadian Electrical Code and all local and Provincial codes.

1.9.2 For future expansion purposes, the Contractor to ensure that wires are available in all conduits to accommodate the addition of possible future points to maximum capability of panel.

1.9.3 The Contractor to supply, install and connect all conduits, boxes and wiring between the different components related to the Control System, including all required line voltage to the equipment. All power to be from appropriately sized dedicated circuits from the nearest electrical panel with space provided by the Contractor. Circuits to be identified inside each control panel and on Shop Drawings using the same code. Provide circuit breaker lock-offs and clearly mark breaker(s) with "BCS".

1.9.4 All high voltage wiring, 50 volts or more, to be a minimum of #12 gauge copper stranded TNN, run in conduit. All low voltage wiring, less than 50 volts, to be a minimum of #18 gauge copper stranded TEW-105.

1.9.5 All signal and communications wiring for the local field panels to be multi conductor, shielded twisted pairs, with ground drain wire. All drain wires to be grounded at the panel end. The other end to be protected from grounding with a dielectric material/electrical tape.

1.9.6 If wiring picks up unwanted noise, correct problem by replacing or rerouting wire at no additional expense to the Board.

- 1.9.7 Wiremold and/or raceway may not be used unless specifically approved by the Consultant and as specified in Division 16100.
- 1.9.8 FT6 wiring is to be acceptable in all rooms except Mechanical and Electrical Rooms, and exposed areas (refer to reflected ceiling plans). Wiring to be installed parallel to building lines or approved by the Consultant. In areas where cable tray or other raceway has been provided by other trades for communications, coordinate with other trade and locate wiring in raceway.
- 1.9.9 Use thin-walled Electrical Metallic Tubing (EMT) conduit complete with T & B 5120 Series watertight steel ring couplings and connectors in all Mechanical Rooms and Electrical Rooms, and set screw connectors and couplings in all other exposed installations in finished areas. OZ/Gedney 7000 Series/Crouse Hinds 600 Series equals.
- 1.9.10 Flexible conduit to be used only in areas where vibrations and/or expansion joints are present. The length of any run of flexible conduit not to exceed 2 m.
- 1.9.11 All conduit to be supported at least every 1.525 m, and in accordance with the Ontario Electrical Safety Code. Supports to also be located at all connectors along the length of the conduit.
- 1.9.12 In damp or weather exposed areas, the conduit and related equipment to be suitable for the application.
- 1.9.13 All conductors to be continuous from device to panel.
- 1.9.14 High and low voltage wire to not be run in the same conduit.
- 1.9.15 Sensor, power and control wiring to be run in separate conduit.
- 1.9.16 Where wiring penetrates fire separation, use firestop sealant to maintain fire wall ratings.
- 1.10 PULL BOXES AND JUNCTION BOXES**
- 1.10.1 All boxes to comply with the Canadian Electrical Code in reference to size, capacity, etc.
- 1.10.2 All boxes to be fabricated of galvanized metal, unless otherwise warranted.
- 1.10.3 A pull box to be located every 30 m. The Contractor is responsible for the location and for obtaining any required approvals from the Consultant.
- 1.10.4 In suspended ceilings, all boxes to be installed on the structure.
- 1.10.5 All boxes to be clearly marked with "BCS" as part of the energy management system.
- 1.11 WIRING IDENTIFICATION**
- 1.11.1 The two extremities of all wiring to be identified using the same code and cross referenced to the Record Drawings.

1.11.2 The terminal strips to be numbered. All Drawings to show wire identification codes and terminal numbers.

1.11.3 The identification to be done using plastic ring or band type. Paper with adhesive backing or Type C plastic labels are not acceptable.

1.11.4 The following colour code to apply to all wiring:

Power	
White	Neutral
Red, Yellow, Blue	Phase leads
Black	Switch travellers, for single pole switched circuits, the phase colour shall be carried through the switch to the outlet.

1.11.4.1 All ground wiring to be green.

1.11.4.2 All 24 VAC wiring to be brown - load side; yellow - neutral side of transformer.

1.12 **NAMEPLATES**

1.12.1 Identify each piece of equipment and panel with nameplate identifying equipment and functions in plain English, using the local naming convention.

1.12.2 Use laminated plastic nameplates of at least 75 mm x 25 mm x 3 mm (3" x 1" x 1/8") with black face and white centre and 6 mm (1/4") high engraved lettering. To be securely attached to equipment by screws. Dymo tape name tags are not acceptable. Provide black phenolic nameplates engraved with white letters for all electrical equipment, panels, disconnect switches, etc., as directed.

1.12.3 Identify motorized equipment as follows:

Heat Pump Units	HP-401, etc.
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1.12.4 Identify the motor, starter and branch circuit breaker and disconnecting means.

1.12.5 Index terminal strips and tag wires. Label exposed junction boxes including function and nature of service. Tag all wires within the junction boxes including purpose and nature of service.

1.12.6 Use self adhesive strip or clip on style plastic markers for wire tags. Secure tags to each individual wire at both ends.

2 Products

2.1 **CONTROL ELEMENTS**

2.1.1 **Controllers**

2.1.1.1 Refer to SCCDSB Master Specification.

- 2.1.1.2 For each heat pump, etc. as required, provide a unitary controller module complete with mounting enclosure.
- 2.1.1.3 Provide individual local control panels to control fluid cooler, air handling equipment, boilers, pumps, rooftop unit and all other equipment.
- 2.1.1.4 Where controller is NEMA 1 rated, a separate NEMA 1 enclosure is not required for the controller.
- 2.1.2 **Automatic Control Valves and Operators**
- 2.1.2.1 Contractor is responsible for the selection of control valves whose entire characteristics are suitable for the required application, including sizing, pressure rating, flow co-efficient, flow characteristics, close-off rating, fail position and allowable leakage factor.
- 2.1.2.2 Use only Belimo ball style control valves with stainless steel ball and stem and Teflon seals for sizes 12 mm (1/2") through 50 mm (2"). Plug, globe or zone style control valves will not be acceptable. For larger valves, use Belimo globe style control valves. Ensure that straight-through water valves are single seated with equal percentage flow characteristics.
- 2.1.2.3 Use 3-way valves which are linear for each port giving constant total flow. On valves 50 mm (2") and smaller, use screwed 1030 kPa (150 psig) bronze bodies. On valves 65 mm (2-1/2") and larger, use flanged 860 kPa (125 psig) cast iron bodies. Size valves based on maximum 21 kPa (3 psi) pressure drop.
- 2.1.2.4 Use Belimo proportional action actuators. Size actuators to control valves against the maximum pump pressure or dynamic closing pressure, whichever is greater. Provide spring returns so that the valves "fail safe" in normally open or closed position as dictated by freeze, fire, or other temperature protection. Fail in place valves without spring return will be acceptable only for individual radiant ceiling panel control valves only. Spring return valves must be provided for all other services including individual convectors, etc.
- 2.1.3 **Automatic Control Dampers and Operators**
- 2.1.3.1 Contractor is responsible for the selection of proper control dampers for the project, including sizing, pressure rating, flow co-efficient, flow characteristics, close-off rating and allowable leakage factor.
- 2.1.3.2 Use Tamco Series 1000 dampers. Use Series 9000 for outside air and exhaust air service. Equivalent Ruskin/Alumavent dampers will also be acceptable. Use opposed blade dampers for modulating service and parallel blade dampers for two-position service.
- 2.1.3.3 Blades on multi blade dampers not to exceed 200 mm (8") in width and 1220 mm (48") in length.
- 2.1.3.4 Use Belimo electronic, spring return, low voltage (24 VAC) operators with electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. Mechanical end switches or magnetic clutch

to deactivate the actuator at the end of rotation are not acceptable. Provide endswitches where specified.

2.1.3.5 Proportional actuators to accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. Actuators to provide a 2 to 10 VDC position feedback signal.

2.1.3.6 Size operators to control dampers against the maximum fan pressure or dynamic closing pressure, whichever is greater. Provide spring returns so that the dampers "fail safe" in normally open or closed position as dictated by freeze, fire, or other temperature protection.

2.1.4 **Space Temperature Sensors**

2.1.4.1 Space temperature sensors in classrooms, offices and other regularly occupied rooms to be equipped with LCD display, limited setpoint adjustment and pushbutton for occupancy override. Sensors to be programmed not to display the room temperature.

2.1.4.2 In change rooms, washrooms, corridors, vestibules, gymnasiums, LAN rooms, mechanical rooms and other regularly unoccupied rooms, use only Greystone blank stainless steel coverplate style sensors.

2.1.4.3 All space sensors are to be located away from any direct influence from air diffusers or areas affected by drafts.

2.1.5 **Temperature Sensors, Thermostats, Freezestats and Firestats**

2.1.5.1 All temperature sensors to be k OHM thermistors, with a suitable range to match the application. For hot water loop, use RTD sensors. The accuracy to be $\pm 0.2^{\circ}\text{C}$ maximum.

2.1.5.2 **Only Greystone sensors will be accepted for water temperature sensors and air temperature sensors.**

2.1.5.3 All temperature sensors shall be mounted in an enclosure suitable for the application.

2.1.5.4 Outdoor temperature sensor is to be mounted in an enclosure complete with sunshield and shall be thermally isolated from all indoor conditions. Conduit entrance to sensor must be sealed with duct seal or equivalent sealant and mounted on a North wall, in a serviceable location, away from any building exhaust/intake vents.

2.1.5.5 All mixed air temperatures to be sensed with averaging sensors having a minimum active length of at least three duct cross sector.

2.1.5.6 Sensor averaging elements are to be mounted in straight sections of duct, in serpentine fashion, equally spaced to provide adequate coverage of duct cross section to prevent stratification. Furthermore, sensor's installation must not present a safety hazard nor impede access to fan compartments.

- 2.1.5.7 All return and supply air temperatures to be sensed with duct-mounted sensors having a minimum probe length sufficient to reach the middle third of the duct space.
- 2.1.5.8 All liquid temperature sensors to be mounted in wells.
- 2.1.5.9 Freezestats to be low limit, normally closed DPDT, manual reset thermostats complete with cover and case. Switch to open on temperature fall. Provide 6.1 m (20') capillary sensing element. Provide on all air handling units and wire to starter 120 volt control circuit. Wire second pole to DDC panel for indication of status.
- 2.1.5.10 Firestats shall be high limit, normally closed DPDT, manual reset thermostats complete with cover and case. Switch to open on temperature rise. Provide on all air handlers and exhaust fans and wire one pole to starter 120 volt control circuit. Wire second pole to DDC panel for indication of status.
- 2.1.5.11 Provide wire guards in all public areas.
- 2.1.6 **Relays and Contactors**
- 2.1.6.1 All interfacing/control relays and contactors to be sized to match the application. Low voltage coils to be used wherever possible, except where it is financially beneficial to use high voltage coils.
- 2.1.6.2 Mount interfacing relays in control cabinets, where possible. Do not locate relays within electrical starter enclosure. If necessary, use separate enclosure to house interface relays.
- 2.1.6.3 Contactors to be equipped with auxiliary contacts wherever such status indication is required.
- 2.1.6.4 All contactors are to be mounted in a NEMA 1 cabinet, enclosing contactor, transformer, protection, etc.
- 2.1.7 **Current Sensing Relays:** All equipment status monitoring to be accomplished through the use of a current monitoring sensor. This device should output a 4-20 mA or 0 - 10 V signal proportional to measured current. Provide sensors to monitor status of all new electrically driven, mechanical equipment. (Include all new unit ventilators, fans, pumps and rooftop units). Wire to the BCS.
- 2.1.8 **Differential Pressure Sensors:** Use Rosemount or Veris self-contained strain gauge type sensor with reverse polarity protection, NEMA 4 enclosure, accuracy \pm 0.25% of calibrated span.
- 3 Execution
- 3.1 **GENERAL**
- 3.1.1 Use competent tradesmen regularly employed by the manufacturer of the control equipment to install control system.
- 3.1.2 Unless noted otherwise, mount all room sensors and thermostats at 1200 mm (47") above floor or in the classroom control module.

- 3.1.3 DDC controller to be mounted in same room as equipment being controlled. Where this is not practical, provide a communication interface at equipment location for communication to DDC panel. Provide Points List on inside of DDC panels.
- 3.1.4 Nomenclature in DDC programming to match Control Shop Drawing nomenclature. DDC panels to be labelled as per Shop Drawings.
- 3.1.5 Provide a copy of all graphical interfaces to Consultant for review at completion of programming.
- 3.1.6 Remove all redundant controls and return control components to the Owner.

3.2 WIRING

- 3.2.1 Conceal wiring in all finished areas.
- 3.2.2 Provide an installation which follows horizontal and perpendicular lines to fit into the layout of the area. Properly support and install in a neat and workmanlike manner throughout.

3.3 NAMEPLATES

- 3.3.1 Install nameplates at all duct mounted devices including transmitters, controllers, gauges, etc. Similarly label manual switches, unless they are delivered with standard nameplates.

3.4 CONTROL PANELS

- 3.4.1 Mount all equipment inside the cabinet. Mount a plasticized "as-built" control diagram for water system, complete with control piping and wiring layout, on the face of door section. Locate panels in main Mechanical Rooms. Do not locate in ceiling spaces.

3.5 ELECTRICAL WORK

- 3.5.1 Provide all wiring from power supplies to valves, dampers, thermostats, sensors, etc., and all necessary control transformers and relays required for the control system. Provide power from nearest panel.
- 3.5.2 Coordinate electrical requirements with the electrical trade. Arrange and pay for any modifications necessary to complete the work of this section.
- 3.5.3 Provide all necessary control wiring for equipment specified under Division 15.
- 3.5.4 Conceal all wiring. Install wiring in conduit within block walls. In unfinished areas exposed to view, install wiring in conduit. Tie-wrap fire-rated cable elsewhere. Wire in accordance with Division 16 requirements.

3.6 DDC CONTROL SYSTEM

- 3.6.1 Vendor's representatives to install complete control system providing adjustment of all controlled systems.

3.6.2 Vendor's representatives to provide full startup, calibration and commissioning of complete system. Connect all mechanical equipment in accordance with the Specifications.

3.7 PERFORMANCE VERIFICATION

3.7.1 Provide verification check sheets for all new control points and all associated control sequences. This work must be done, submitted and approved by the consultant prior to the commissioning agent being engaged and final payment being released. The approved reports are to be included in the maintenance manuals.

3.7.2 Verification check sheets for each piece of equipment must contain list of all control points associated with this piece of equipment. Proper operation of each sensor, actuator, terminal unit, or any other control point must be confirmed in the field by direct observation (if possible) and through the graphical user interface. Each verification sheet must be dated and signed by controls contractor.

3.7.3 Setup and verify trends for all new equipment and all control points. Provide trend verification sheets and sample sheets indicating trended points for consultant's approval

3.7.4 One month after these checks and commissioning are complete, setup a meeting with mechanical contractor, Owner and consultant to confirm the operation of all new equipment. At this meeting all trends will be reviewed and confirmed with the Owner. Prior to the meeting the Controls contractor will be required to provide trend graphs or numerical data in Excel spread sheet form, for all monitored systems for the last month of operation. If numerical data is provided the date/time data must follow Excel formatting.

3.7.5 Controls contractor will be responsible for correcting of all deficiencies found during this process and will be required to submit trends to verify operation of all equipment after making corrections.

3.8 ROOFTOP MAKEUP AIR UNIT (Drawing Reference RTU-102)

3.8.1 System Description

3.8.1.1 This is a constant volume 100% outside air system which includes a rooftop air handling unit with modulating natural gas heating and modulating electric dx cooling. The unit provides tempered ventilation air to heat pumps throughout the areas to be renovated.

3.8.1.2 This air system will be enabled for operation during scheduled occupied hours.

3.8.1.3 The unit includes variable refrigerant flow DX cooling, for modulating control of cooling capacity and high cooling efficiency. Because of the increased complexity of this system, the units have limited ability to accept external control signals. Most functions will be controlled by the onboard controller, with BCS monitoring through BACnet MSTP.

3.8.2 Control Devices

3.8.2.1 Provide a dedicated unitary controller for each rooftop air handling unit. Connect to a terminal strip provided within the unit.

3.8.2.2 The following terminals will be provided by the unit manufacturer for BCS control:

- unit enable/disable digital input
- outside air damper minimum position analog input
- supply air temperature setpoint analog input

3.8.2.3 The following terminals will be provided by the unit manufacturer for BCS monitoring:

- alarm status digital output

3.8.2.4 Provide BCS supply air discharge and return air dry bulb temperature sensors and relative humidity sensors. Locate these sensors within the building in the ductwork, with the supply air temperature sensor just upstream of the first branch takeoff. These sensors are in addition to the sensors supplied with the unit and wired back to the unit controller. These points will still be displayed on the graphic in the event of loss of BACnet MSTP communications with the unit.

3.8.2.5 Provide current sensors for supply fan, energy recovery wheel motor and each of the cooling compressors. Monitor status and display on the graphic.

3.8.2.6 Each unit will be provided with a BACnet communications module. Coordinate with section 15600. Connect to it and map relevant points to the BCS for BCS monitoring. Allow for mapping of up to 80 BACnet points per unit. Consultant will provide a list of points to be mapped. Approximately 30 of these points indicate temperatures, operating modes, equipment speeds or status and are to be shown on the graphic. The remaining points are for fault indication and are to be annunciated to the BCS on activation.

3.8.2.7 A supply air temperature sensor and other sensors will be provided with the rooftop unit. Install the sensors as instructed by the rooftop unit manufacturer and connect them to the unit onboard controller.

3.8.2.8 Provide an analog differential pressure sensor for the filter rack.

3.8.3 Schedule and Startup

3.8.3.1 Schedule occupied/unoccupied operation of unit.

3.8.3.2 Operate the supply fan continuously during occupied hours for provision of ventilation air.

3.8.3.3 At all other times the unit is to be off.

3.8.3.4 Provide adaptive optimum start/stop sequence for each unit.

3.8.3.5 Through the graphical interface provide an individual Event Mode button to allow the Operator to override the schedule and program in events. During event mode, the system is to enable the "Occupied Day Mode" for the entire scheduled event. Return the room to occupied space temperature setpoints starting one hour (adjustable) prior to the start of the event.

3.8.4 Occupied Mode Air Temperature Control

3.8.4.1 Provide a 2.5°C (5°F) deadband between heating and cooling operation, as required by ASHRAE 90.1. Provide adjustable heating and cooling setpoints.

3.8.4.2 The unit will modulate the economizer dampers, VRF cooling and natural gas fired heating in sequence to maintain its supply air discharge temperature setpoint. Operate energy recovery wheel continuously during occupied mode except for during economizer operation. Provide the supply air discharge temperature setpoint to the rooftop unit controller through the terminal. The supply air discharge temperature setpoint minimum is 15°C (59°F).

3.8.4.3 Reset the supply air discharge temperature setpoint to satisfy the average space temperature sensor values. Maximum permitted supply air temperature during occupied hours is 29°C (85°F).

3.8.5 Safeties and Miscellaneous Controls

3.8.5.1 Use the BCS supply air discharge temperature sensor for low limit protection. Stop the fans, close the dampers and alarm to BAS if supply air temperature falls below 4°C (40°F) (adjustable from graphic).

3.8.5.2 Use the BCS return air temperature sensor to stop the supply fan if the return air temperature exceeds 57°C (135°F).

3.8.5.3 Monitor differential pressure drop across the filter bank. Display filter pressure drop on graphic and alarm when pressure drop exceeds filter change setpoint. Initial setpoint to be 250 kPa (1.0"w.c.).

3.8.6 Graphic Display

3.8.6.1 Provide graphic display of air handling unit and equipment internal components such as supply fan, dampers, cooling stages, temperatures, status points, energy recovery wheel, etc. Display must include all monitored and controlled functions, sensors, etc, with all alarms shown and all setpoints easily adjustable.

3.8.6.2 Include a button on the graphic which displays a unit specific summary of how the unit is controlled. This summary is to include the description of operation presented at the start of this control sequence. This summary is to be displayed on the screen beside the unit graphic, so that both can be viewed at the same time.

3.9 **HEAT PUMPS**

- 3.9.1 For each heat pump, provide a room temperature sensor and a unitary controller. Locate room temperature sensor in classroom control module or on wall, as shown on Drawings. Connect to occupancy sensor in room. Occupancy sensor will be provided by Division 16.
- 3.9.2 Provide all sensors, relays, transformers and interlocks required for operational sequences described below. Power wiring will be provided by Division 16. "Fan", "Cool" and "Heat" digital inputs and "Alarm Status" digital outputs will be provided by the unit manufacturer on a labelled terminal strip. Provide supply air temperature sensor and supply fan current sensor for each heat pump.
- 3.9.3 In addition to points above, the following are to be visible from the BCS: fan status, supply air temperature, heat or cool command. Certain heat pumps have two stages of heating/cooling. Coordinate with section 15600. Alarm to BCS on high or low space temperature, fan failure, or heat pump general alarm.
- 3.9.4 Provide remote reset from the BCS. Coordinate with the heat pump manufacturer.
- 3.9.5 Program an individual operational schedule for one zoned groups of heat pumps which will enable occupied mode operation. Zones are: Classrooms, Gymnasium, Administration Area. Connect each heat pump to classroom occupancy sensors provided by Division 16. Use signal from occupancy sensor to start occupied mode operation when enabled by schedule. Override schedule when temperature sensor pushbutton is activated.
- 3.9.6 **Occupied mode:** Operate fan continuously and cycle stages of heating and cooling to maintain occupied mode space temperature setpoint.
- 3.9.7 **Unoccupied mode:** For scheduled unoccupied hours or when there is no occupancy sensed, cycle the fan and stages of heating as required to maintain unoccupied mode space temperature setpoint.
- 3.9.8 A two position two way control valve will be provided with each heat pump by Section 15600. Control valve is to open prior to compressor operation. Connect control valve wiring harness to manufacturer's terminal strip.
- 3.9.9 Where supplemental perimeter heating is provided in rooms served by heat pumps, such as radiant panels or wallfin convectors, use perimeter heat as first stage of heat during occupied hours. During unoccupied hours, use heat pump to be first stage of heating.

3.10 **FORCE FLOW HEATERS**

- 3.10.1 Provide wall thermostat and cycle fan to maintain space temperature setpoint.

3.11 **CONVECTORS**

- 3.11.1 Provide thermostatic control valve or space temperature sensor and two way control valve and operator. Modulate to maintain space temperature setpoint. See part 3 heat pump clause for control of units located in rooms served by heat pumps.

3.12 EXHAUST FANS

3.12.1 For all fans, provide exhaust air damper and actuator, current sensor and relay. Provide start/stop and status.

3.13 UTILITY PHASE LOSS MONITORING

3.13.1 Connect and monitor power meter form C output provided by Division 16 and provide "Phase Loss" alarm point monitoring. Meter is located in Electrical Room in new addition.

3.13.2 On activation of phase loss alarm, shut down all BAS controlled three phase equipment and alarm to BAS. Automatically restart equipment in zoned groups once Phase Loss alarm is cleared. Minimum stop to start time is 2 minutes (adjustable).

3.14 CONTROL SYSTEM ACCEPTANCE

3.14.1 A complete system check-out is required. Before starting this, provide a detailed step-by-step checkout plan.

3.14.2 Demonstrate to the Owner's satisfaction at job site, the methods, test gear and simulation equipment to be used in check-out of each part of control system. Demonstrate the actual hook-up of test gear, exercise of inputs, trouble isolation and correction technique, and final operation test of a typical remote panel. Owner may check the operation of all sensors, transducers with own equipment to ensure proper operation.

3.14.3 After completion of the check-out, make all necessary corrections and repeat the check. When the system is fully operational, demonstrate in full detail, all functions/indications to the Owner.

3.14.4 Submit a checkout list to the Owner documenting that each point has been checked and is operating satisfactorily. The check should include field wiring, relay operation and HAND/OFF/AUTO checkout.

3.15 PROGRAM START AND STOP TIMES

3.15.1 Provide optimal start and stop times programming to compensate for outside temperature. Provide morning warm up routine.

3.15.2 For all systems using hot water or heat pump loop for cooling or heating, program an individual, dedicated warm-up or cool-down cycle to bring space temperature from night setback to occupied temperature setpoint. During that cycle all outside air dampers must remain closed. Program each system individually with optimum temperature recovery time. Follow Standard ASHRAE 90.1.

3.15.3 Program various system operational times based on the normally occupied periods of the building. Program a yearly calendar to allow for daylight savings time and standard time changes. Provide separate weekly time schedules for heat pumps, exhaust fans, and each air handler.

3.15.4 Provide graphical links to fan systems including display of operating schedule, Timed Overrides and Event Mode programming. Timed override shall allow for operation of the fan systems for a 2 hour (adjustable by super user) period, mechanical cooling shall be locked out. Event mode shall allow fans to operate in normal daytime operation for a user adjustable, defined period of operation using a calendar type function. Upon entry of an Event, a report shall be generated and sent to the school board indicating the date, duration, user, and permit number. Event mode shall be linked to associated heat pumps within the building, refer to heat pump sequences above.

3.16 **TREND LOGS**

3.16.1 Set up trend logs to continuously monitor critical parameters for each system. Consultant will assist in determining critical parameters.

3.17 **ENVIRONMENTAL ALARMS**

3.17.1 Provide sensors and digital outputs to the building security alarm panel for environmental alarms. Provide individual alarms to the security system on: Low space temperature in any room (coordinate setpoint with SCCDSB, active only for ambient below 5°C). Submit proposed setpoints for each alarm for Owner approval. Provide graphic displaying settings so that Owner can easily modify. Alarm outputs to be on native BCS network.

Security System Labels:

- Low space temperature in any room "Low Space"

END OF SECTION

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- 1 General
- 1.1 **DESCRIPTION**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.1.2 Perform commissioning of the complete Building Control System (BCS), including every device, input and output. A Commissioning Agent (CA) will be engaged by the General Contractor to verify commissioning has been performed in accordance with the requirements of this Section.
- 1.1.3 Attend all commissioning meetings and perform all commissioning responsibilities assigned by the CA at those meetings.
- 2 Products
- 2.1 **TEST EQUIPMENT**
- 2.1.1 Provide all test equipment necessary to fulfill testing and calibration requirements of this Division. Provide two-way radios for use by CA during commissioning, if required.
- 3 Execution
- 3.1 **SUBMITTALS**
- 3.1.1 Provide two copies of Record Drawings and Shop Drawings for the CA's review and use. Inform CA of any differences between actual systems and systems described in Shop Drawings. On one of the Record Drawing sets, mark the locations of network panels and interconnecting wiring. Indicate wiring types on Drawings.
- 3.2 **TEST PROCEDURES**
- 3.2.1 A test form or checklist will be provided by the CA for each Mechanical and Electrical equipment item controlled or monitored by the BCS. Prior to commissioning, test and calibrate all control devices, inputs and outputs, verify correct operation of devices and controls sequences, and complete test forms. Use a skilled technician who is familiar with the building to perform this work. Submit test forms to the CA for review.
- 3.2.2 Test forms will generally include the following:
- Calibration of all inputs and devices
 - Check of points list stored in each panel
 - Operational check of all valves and dampers
 - Check that all specified sequences are set up, debugged and fully operable
 - Check of battery backup and power-up after power failure restart functions
 - Check of trending and graphing features
 - Check of global commands features
 - Check of schedules and alarms
 - Synchronization of workstation and field panel clock settings
 - Check of field panel functionality using portable workstation

- Check that all graphic screens and value readouts are completed
- Check of setpoint changing features and functions
- Check of night setback, morning warmup operation
- Check of communications to remote sites
- Check of fire alarm interlocks
- Check of security system interlocks with environmental alarms
- Check of optimum start/stop and sequential equipment staging/alternating

3.2.3 Prior to testing, ensure all wiring connections for all voltages are properly terminated, ensure all wiring is properly identified, and ensure all wiring requirements of Section 15900, "Controls", are met.

3.3 **COMMISSIONING**

3.3.1 When the CA is satisfied the testing is complete, commissioning will be scheduled. Commissioning will consist of verification of operation of all points, sequences and features, witnessed and directed by the CA and the Owner's representative. Commissioning to be performed by the same technician who performed the testing described in Clause 3.2.

3.3.2 Allow a minimum of five days for assisting CA during commissioning. This does not include time spent in verification and testing described in Clause 3.2 above.

3.4 **PERFORMANCE VERIFICATION**

3.4.1 Provide verification check sheets for all new control points and all associated control sequences. This work must be done, submitted and approved by the consultant prior to the commissioning agent being engaged and final payment being released. The approved reports are to be included in the maintenance manuals.

3.4.2 Verification check sheets for each piece of equipment must contain list of all control points associated with this piece of equipment. Proper operation of each sensor, actuator, terminal unit, or any other control point must be confirmed in the field by direct observation (if possible) and through the graphical user interface. Each verification sheet must be dated and signed by Controls Contractor.

3.4.3 Setup and verify trends for all new equipment and all control points. Provide trend verification sheets and sample sheets indicating trended points for consultant's approval.

3.4.4 One month after these checks and commissioning are complete, set up a meeting with Mechanical Contractor, Owner and Consultant to confirm the operation of all new equipment. At this meeting all trends will be reviewed and confirmed with the Owner. Prior to the meeting the Controls Contractor will be required to provide trend graphs or numerical data in Excel spread sheet form, for all monitored systems for the last month of operation. If numerical data is provided the date/time data must follow Excel formatting.

- 3.4.5 Controls Contractor will be responsible for correcting of all deficiencies found during this process and will be required to submit trends to verify operation of all equipment after making corrections.

END OF SECTION

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- 1 General
- 1.1 **GENERAL PROVISIONS**
- 1.1.1 This Section and Division 1 - General Requirements apply to and govern the work of all Sections of Division 16.
- 1.2 **VISITING SITE**
- 1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. **NO EXTRAS WILL BE GRANTED DUE TO LACK OF A THOROUGH PRELIMINARY INVESTIGATION.**
- 1.2.2 Remove and replace existing ceiling tiles to inspect ceiling for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.
- 1.2.3 Contractors visiting for site investigation must sign in at the main office. Upon arrival, review and sign the on-site Designated Substances Report prior to site investigation.
- 1.3 **CONTRACT DRAWINGS**
- 1.3.1 Electrical Drawings show Electrical work only and are not intended to show Structural details, Mechanical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements only.
- 1.3.2 Electrical Drawings indicate only the general locations of equipment and outlets. Wiring requirements are shown diagrammatically. Responsibility for the detailed layout of equipment, outlets, raceways and wiring is part of the work of this Division. Specific outlet locations are detailed on elevations.
- 1.3.3 If shown, only the general location and route of conduit, cable trays and communication hooks are shown. Install all services neatly to conserve headroom. All conduit, cable trays and communication hooks are to be accessible after work by other trades is complete. Install all services parallel to building lines unless shown otherwise.
- 1.3.4 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.
- 1.3.5 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.
- 1.3.6 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

- 1.3.7 All dimensions and sizes are in SI units, Generally units are in millimetres. All exceptions to this are noted.

CONDUIT SIZES

Imperial (Inches)	½	¾	1	1-¼	1-½	2	2-½	3	3-½	4	4-½	5	6
S.I. (metric) (mm)	16	21	27	35	41	53	63	78	91	103	116	129	155

1.4 SHOP DRAWINGS

- 1.4.1 Submit Manufacturers' Shop Drawings, Electrical Wiring Diagrams and Control System Drawings to the Consultant. Provide title sheet for Shop Drawing submitted. Include project name, Shop Drawing item (including Specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.
- 1.4.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.
- 1.4.3 Submit all shop drawings electronically in Adobe® Acrobat® PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be “book marked” using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by Contractor as specified below.
- 1.4.4 Catalogues, manuals or price lists will not be accepted as Shop Drawings. Before submission, check Shop Drawings, make necessary corrections, apply stamp “Checked and Certified Correct”, sign and date.
- 1.4.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.
- 1.4.6 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is 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 subtrades.
- 1.4.7 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.

- 1.4.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.
- 1.4.9 Prepare all Drawings in SI units.
- 1.4.10 Shop Drawings to include the following:
- 1.4.10.1 Indicate details of construction, dimensions, capacities, weight and electrical performance characteristics of equipment or material.
- 1.4.10.2 Where applicable, include wiring, single line and schematic diagram including interconnect with work of other sections.
- 1.4.10.3 Include manufacturer's special installation instructions where applicable.
- 1.5 **FIELD DRAWINGS**
- 1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for busducts, conduits, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.
- 1.5.2 Assume full responsibility for the detailed coordination of all Division 16 work. Prepare Field Drawings to determine the exact location of each service. On these drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.
- 1.5.3 If the General Contractor separates the Communication, Security or similar work from the other work of Division 16, the General Contractor assumes full responsibility for this coordination work including the preparation of the Field Drawings.
- 1.6 **AS-BUILT DRAWINGS**
- 1.6.1 The Contractor will be provided with Mechanical and Electrical Files used to produce the contract documents. The following digital formats were used and are to be maintained: AutoCAD, Revit, and PDF. The Contractor is to print Drawings from the PDF files provided.
- 1.6.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.
- 1.6.3 Contractor shall take as-built measurements, prior to backfill, of all buried ductbanks and conduits under floor slab. Show routing, depths and dimensions from fixed points on as-built drawings.
- 1.6.4 Transfer information from the marked prints to AutoCAD files and Revit model on a monthly basis to match the software that version the original files were created in.. Have the marked prints and updated CAD/Revit prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.

- 1.6.5 Prior to testing, balancing and final commissioning, complete the transfer of marked prints to the AutoCAD files and Revit model. Fill in the Owner's equipment numbering system in the Schedules on the Drawings and on the plans where blank placeholder tags have been shown.
- 1.6.5.1 AutoCAD format files are to match exactly the layering system and symbology of the Consultant. Bind all external references.
- 1.6.5.2 Revit model will be completed as per the project Revit/BIM deliverable. If no deliverable is defined, minimally the "Sheets" included under the "02-Construction" subset in the model, should properly display the as-built condition. Bind/Insert all linked files in the Revit model.
- 1.6.5.3 **Revit/Bim Deliverable**
- 1.6.5.3.1 Model will not include engineering, analytics or systems symmetry functionality (i.e. defined or totally connected systems).
- 1.6.5.3.2 All engineering and manufacturer information contained in the model will only be considered correct for identification with regard to the corresponding specification and scheduling purposes.
- 1.6.5.3.3 MEP components should be modeled by the Contractor to be as close as possible to as-built conditions but must still produce an acceptable printed as-built document.
- 1.6.5.3.4 The "Sheets" included under the "02-Construction" subset in the model, should properly display the as-built condition.
- 1.6.5.3.5 MEP Model components (i.e. piping, conduit) may not be modelled the proper size but identified correctly.
- 1.6.5.3.6 MEP Model components will be represented properly on floor plans (i.e. symbology) but not necessarily in elevations.
- 1.6.5.3.7 MEP equipment and other items that are generally required for coordination among disciplines (i.e. ceiling components) will be included in the model (approximate size shown). Many services will be shown in schematic fashion (i.e., not necessarily at correct elevation or in exact position required).
- 1.6.5.3.8 Due to the schematic nature of many portions of the model, services are likely to conflict and clash with various other services and structure. In some cases this is intentional so that services display properly on sheets. The Consultant will not be responsible for providing to the Contractor a detailed, accurate or clash free model without compensation, as the Owner has not required or paid for this work to be done by the Consultant. In turn, the Consultant will not require the Contractor to provide a more detailed, accurate or clash free model for the project as-built documentation than was originally provided to the Contractor. Responsibility for creation of accurate Field Drawings and resolving minor interferences remains with the Contractor.

1.6.6 Mark Drawings "As-Built Drawings" and insert name and logo of Contractor. Submit one set of printed "As-Built Drawings" for review by the Consultant. Remove Engineers Stamp. Include Contractors name and Logo.

1.6.7 Submit completed As Built Drawings on disks in same digital data software program, and version as original contract documents. Also provide one set of Drawings with the Operating and Maintenance Manuals.

1.6.8 For the purposes of Contract payments, As Built Drawings will be assumed to have a value of \$2,000.00. This will not be released until As Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 2018.

1.7 **SIMULTANEOUS PROJECTS**

1.7.1 Other projects may be under construction simultaneously on this site during the course of this construction project. The Owner will not be the "constructor" as defined by The Ontario Health & Safety Act & Regulations. This Contractor is to maintain a separation between this project and all other Contractors, by time or space, as defined by The Ontario Health & Safety Act & Regulations.

1.8 **CONFLICTS AND PRECEDENCE**

1.8.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.

1.8.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.

1.8.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.9 **FIRESTOPPING**

1.9.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:

1.9.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.

1.9.1.2 Certification that proposed firestopping materials and assemblies comply with CAN4-115-M.

1.9.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

1.9.2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to As Built Drawings.

1.9.3 Comply with all requirements of Ontario Building Code Clause 3.1.9, "Building Services in Fire Separations and Fire Rating Assemblies".

1.10 MAINTENANCE AND OPERATING INSTRUCTIONS

1.10.1 For the Electrical Division 16 work only, assemble three sets of equipment literature (cuts), operating instructions, maintenance instructions, voltage test results, certificate, other pertinent data and Letter of Warranty. Place in three ring binders, complete with index pages, indexing tabs and cover identification at front and side. Submit to Consultant for approval.

1.10.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant possesses approved sets. Include copies of reviewed Shop Drawings and name and address of Spare Parts' Suppliers with manuals.

1.10.3 Provide two electronic copies of the maintenance and operating manual in Adobe Acrobat PDF format on a USB Drive and submit with the final version of manuals. Electronic copy of manual to be provided as one file formatted with bookmarks in accordance with the sections of the hard copy manuals. Do not include separate files in sub folders. Divide the maintenance manuals into sections which correspond with Specification Sections.

1.10.4 The following information is to be contained within the Sections:

1.10.4.1 **Section 1:** A list of names, addresses and telephone numbers of the Consultants, General Contractor and Electrical Contractor. Written warranty of the Electrical systems.

1.10.4.2 **Section 2:** Electrical Safety Authority Inspection Permit, Fire Alarm Verification Report and Certificate, Emergency Lighting Verification Letter.

1.10.4.3 Remaining Sections - By Specification Section

1.10.4.3.1 A list of names, addresses and telephone numbers of all suppliers. A copy of all reviewed Shop Drawings.

1.10.4.3.2 A complete and comprehensive maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) for maintenance.

1.10.4.3.3 Copies of warranties.

1.10.4.3.4 Complete control diagrams, wiring diagrams and description of applicable control systems and the functioning of the system.

1.11 REGULATIONS AND PERMITS

1.11.1 Carry out the work in accordance with the latest editions of relevant codes, local bylaws, and requirements of local Authority Having Jurisdiction. Apply for and obtain permits and pay all fees. Consultant will submit Drawings to Electrical Safety Authority if required.

- 1.11.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all St Clair Catholic District School Board safety and security policies and procedures and conform to all regulations of the current Occupational Health & Safety Act.
- 1.11.3 After completion of the work, furnish to Consultant a Certificate of Unconditional Approval from Inspecting Authorities.
- 1.12 **MATERIAL AND EQUIPMENT**
- 1.12.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.
- 1.12.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.
- 1.12.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.
- 1.12.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.
- 1.12.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.
- 1.12.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

- 1.12.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.
- 1.12.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause "List of Electrical Subcontractors and Manufacturers".
- 1.13 **INTERPRETATION OF CONTRACT DOCUMENTS**
- 1.13.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.
- 1.14 **SITE VISITS**
- 1.14.1 The Electrical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.
- 1.15 **PROGRESS DRAWS**
- 1.15.1 Electrical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Electrical Contractor will be responsible for the validity of supplier and subcontractor draw claims.
- 1.16 **WARRANTY**
- 1.16.1 Warranty all workmanship, material and equipment supplied by Division 16 for one year after Substantial Completion except where specifically specified otherwise. Make good damage caused due to defects and workmanship.
- 1.16.2 Where equipment specified in Sections of Division 16 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.
- 1.17 **DIMENSIONS AND QUANTITIES**
- 1.17.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.
- 1.17.2 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or

assemble equipment at the final location which will be considered as part of equipment installation.

1.17.3 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.

1.17.4 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.

1.17.5 Make any necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions, without adjustment to Contract price.

1.17.6 Provide work in accordance with the approved Schedule to meet completion date and specified interim Schedules.

1.18 COOPERATION BETWEEN TRADES

1.18.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

1.19 COOPERATE WITH OWNER'S STAFF

1.19.1 Maintain close cooperation with Owner's staff. The Owner will determine the times during which work may be carried out in certain areas. If the work cannot be completed in the allowed time, the Contractor may be required to clean up the area and finish the work at some future time.

1.19.2 Shutdowns will be scheduled during unoccupied times. Include any overtime wages due to conditions stipulated above in the Bid Price.

1.19.3 Provide seven day's minimum notice, in writing, prior to any interruptions of service or restriction of use of any service.

1.19.4 Provide all phase testing, as required, prior to disconnecting existing and connecting new to avoid damage to equipment.

1.19.5 The Owner's operations must take precedence over Contractors' operations at all times. Interruptions due to noise, drilling, etc., will not be allowed without Owner's prior approval.

1.19.6 Include any overtime wages due to conditions stipulated above in the Bid Price.

1.20 EXAMINATION OF DAMAGED DEVICES

1.20.1 Report all damaged, defective and non-functioning devices and equipment shown for reinstallation or relocation to the Consultant prior to removal and storage. All

devices and equipment will be assumed to be fully functional unless reported otherwise prior to removal.

1.20.2 Devices and equipment damaged during removal, storage or reinstallation will be replaced at no cost to the Owner.

2 Products

2.1 MATERIALS

2.1.1 Use materials specified herein or approved equal as defined in Clause "Material and Equipment".

2.2 SLEEVES

2.2.1 In general, sleeves are not required through walls or floors except in service room floors and foundation walls.

2.2.2 Use Schedule 40 steel pipe sleeves through concrete structural members, walls and floor slabs. Extend sleeves minimum 1" AFF and seal pipe to sleeve.

2.2.3 For all conduits passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

2.2.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.3 FIRESTOPPING

2.3.1 Use only service penetration firestop components and assemblies tested in accordance with CAN.ULC S115 "Fire Tests of Firestop Systems" and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptable to the Consultant.

2.3.2 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

2.3.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

3M
Hilti
Tremco

2.3.4 Where communications J hooks or cable trays are shown passing through rated walls, provide thru-wall fitting and 103 mm (4") conduit stubs. Provide quantity as required to maintain cross-sectional area of cable tray, or minimum one fitting per communication J hooks. Thru-wall fitting to be suitable for use in plenum spaces and maintain one, two, three or four hour fire rating in drywall, concrete and block penetrations. To be Legrand FlameStopper.

2.4 ACCESS DOORS

2.4.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.4.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24" x 24") for body entry, and 300 mm x 300 mm (12" x 12") for hand entry, unless noted otherwise. Use the following access doors:

Masonry Walls	Acudor UF-5000
Drywall Walls	Acudor DW-5040
Drywall Ceilings	Acudor BP58, match ceiling thickness
Fire-Rated	Acudor FW-5050/FB-5060 to match fire separation
Wet Areas, Operating Rooms	Acudor UF-5000 (stainless)

2.4.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Adam
Ancon LeHage
E. H. Price

2.5 SPRINKLER PROOF EQUIPMENT

2.5.1 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.

2.6 IDENTIFICATION NAME LABELS

2.6.1 Provide white lamacoid identification labels with black uppercase lettering, minimum 14 pt Arial or Helvetica typeface, for identification of all MCCs, switchboards, distribution panels, panelboards, transformers and transfer switches.

2.6.2 Submit a complete list of nameplate wording for review by Consultant prior to installation.

2.6.3 Warning plates are to be red with white letters, minimum 14 pt Arial or Helvetica typeface, as indicated on drawings.

2.7 FLASHING

2.7.1 For locations with roof penetrations serving a piece of equipment, such as for roof mounted split system condensing units, receptacles, etc, use Portals Plus, Inc. Alumi-Flash system consisting of 100 mm (4") high, one piece spun aluminum base with deck flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations. Flashing is for Division 16 use only.

2.7.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Portals Plus

3 Execution

3.1 GENERAL

3.1.1 Instruct and supervise other Sections doing related work.

3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.1.3 Install conduit, which is to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

3.1.4 Carry out all work in accordance with the latest regulations of the Ontario Electrical Safety Code and all applicable Municipal, Provincial and Federal Codes and Regulations. In no instance, however, is the standard established by the Drawings and Specifications, to be reduced by any of the Codes referred to above.

3.1.5 Install all ceiling components in direct accordance with reflected ceiling plans.

3.1.6 Electrical Drawings show approximate locations for wall-mounted devices. Clarify exact location and mounting height with Consultant prior to roughing-in.

3.1.7 All serviceable equipment installed on the roof (including receptacles) to be installed minimum 3 m (10'-0") from roof edge unless otherwise noted on Drawings.

3.2 STORAGE OF MATERIALS

3.2.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

3.3 SUPPORTS AND BASES

3.3.1 Provide structural work required for installation of equipment provided under this Division.

3.3.2 Set all floor-mounted equipment on concrete bases at least 100 mm (4") high. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the Shop Drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as Shop Drawings, are available at the site.

3.3.3 Extend existing concrete bases as required for replacement or new equipment. Match existing height.

- 3.3.4 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to new and existing floors.
- 3.3.5 Provide all brackets and supports required in steel stud walls. All conduits and equipment must be supported on brackets or supports attached to steel studs. Do not support materials or equipment from wall sheathing.
- 3.3.6 Provide independent support; brackets and unistrut structures where required to install electrical equipment; disconnect switches, splitters, panels, etc:
- in areas where the equipment is located on walls/columns that are not suitable for direct installation.
 - When installation away from structural building elements is called for.
 - When it is necessary to elevate the electrical equipment to ensure code compliance or ergonomical operator access.
- 3.3.7 For all supports of suspended or wall hung electrical equipment, provide structural drawings stamped and signed by a structural engineer holding a P.Eng. designation and registered in the Province of Ontario. This engineer is to submit proof of professional liability insurance. Equipment to be supported from the bottom.
- 3.3.8 Do not mount starters, VFD's, etc. on building equipment.
- 3.3.9 Do not suspend luminaires greater than 11.3kg (25 lbs), cable tray, conduit racks, etc from metal roof deck. Provide supports as required to suspend from roof joists.
- 3.3.10 Provide lintels for double-width and adjacent tubs and multiple conduits running in parallel, where located in block and poured walls.
- 3.4 **CONCRETE INSERTS**
- 3.4.1 **General**
- 3.4.1.1 Anchors for the support of conduits and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped.
- 3.4.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and "prying action". Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.
- 3.4.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.
- 3.4.2 **Installation of Cast in Place Inserts:** Ensure that anchors are accurately placed and "fixed" in position with sufficient rigidity to maintain their position during the placement of concrete. Do not displace reinforcing to install anchors without the

prior permission of the Consultant.

3.4.3 Installation of Inserts in Hardened Concrete:

3.4.3.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.4.3.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.4.3.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.4.3.4 Inserts to be zinc plated female concrete anchors. Nylon or plastic anchors are not acceptable.

3.4.4 Concrete screws without anchors are not acceptable.

3.5 SLEEVES

3.5.1 **Sleeves Embedded in Concrete:** Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.5.1.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.5.1.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.5.1.3 Sleeves through beams will be permitted only as directed by the Consultant.

3.5.1.4 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.

3.5.2 Provide sleeves for all conduits which pass through service room floors and foundation walls. Sleeves to extend minimum 1" above finished floor.

3.6 FIRESTOPPING

3.6.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all conduits, electrical wires and cables, and other similar electrical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section "Firestopping and Smoke Seals" for building assembly and fire separation types and locations.

3.6.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the

fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code. For all penetrations through a Service Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.

3.6.3 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractor's choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the report to the Consultant. Report to include as a minimum, confirmation fire stopping shop drawings were used during review, locations where destructive testing was completed, confirmation all fire stopping locations were reviewed and installed systems meet the manufacturer requirements.

3.6.4 Provide instruction wall labels on both sides of wall for all thru-wall penetrations using FlameStopper. Locate adjacent to penetration as required to be visible from standing position.

3.7 **CUTTING AND PATCHING**

3.7.1 Flash holes through walls and roof to make weatherproof.

3.7.2 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant.

3.7.3 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.

3.7.4 Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Get approval of Consultant before any cutting is started.

3.7.5 Where conduits are required to pass through existing walls, floors, and roof, cut and patch the necessary openings.

3.7.6 Where recessed electrical equipment is removed or replaced with equipment of a smaller size, patch openings to match existing wall material.

3.7.7 Where wiring devices (switches, receptacles, etc) are removed from drywall walls, remove device box and patch opening to match existing wall.

3.7.8 Where wiring devices (switches, receptacles, etc) are removed from poured concrete or block walls, remove device and provide blank coverplate.

3.7.9 Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 16.

3.7.10 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.

3.7.11 All cutting and patching to be done by the trade specializing in the materials to be cut.

3.8 **PAINTING**

3.8.1 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.

3.8.2 Paint both sides and edges of plywood backboards for electrical and communications equipment before installing equipment. Use one coat fire retardant primer and two coats fire retardant paint.

3.8.3 Paint disconnect switch or breaker for fire alarm and exit light systems in red enamel. Use one coat of primer and one finish coat.

3.8.4 Where walls and/or ceilings are cut and patched for electrical work including the removal of existing devices, paint walls and ceilings to match existing. For walls and ceilings less than 9.3m² (100 sq ft), paint entire wall. For walls and ceilings larger than 9.3m² (100 sq ft), paint area of patch. Painting to be completed by painting contractor.

3.8.5 Include the cost of all painting in the Lump Sum Contract Price for the work of Divisions 16.

3.9 **ACCESS DOORS**

3.9.1 Supply access doors wherever equipment, junction boxes, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by the trade specializing in the materials receiving access doors.

3.10 **IDENTIFICATION**

3.10.1 Colour code control wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components. Match existing colour coding in use on site. Verify with Owner prior to installation.

3.10.2 All branch circuits shall be:

Phase A - red
Phase B - black
Phase C - blue

3.10.3 Identify all disconnects, starters, and other control equipment with lamacoid nameplates indicating the equipment controlled and all panels, transformers, etc identifying equipment name.

- 3.10.4 Lamacoid labels to be mechanically attached with self-tapping screws or rivets. Lamacoid labels attached using adhesive methods are not acceptable.
- 3.10.5 Identify the panel and circuit number for each wiring device with self-adhesive label on the coverplate. Use clear tape with black 14 pt Arial or Helvetica typeface. Locate labels for receptacles on front of coverplate and labels for switches on rear of coverplate.
- 3.10.6 Identify all pull boxes, junction boxes or octagon boxes located in the ceiling cavity with the exact use of the box, including circuits contained within. Felt pen is acceptable.
- 3.10.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.
- 3.11 **LOCKS AND KEYS**
- 3.11.1 Where locked panelboards, control panels, terminal cabinets, etc., are specified, use a separate key pattern for each system with all locks in each system common to one key. Provide seven keys of each pattern to the Owner on a 25 mm (1") key ring. Submit one set of keys with manuals.
- 3.12 **TESTING**
- 3.12.1 All systems must be thoroughly tested before arrangements are made for the final demonstration in the presence of the Owner's staff. Systems to be tested are:
1. Emergency Lighting
 2. Lighting Control Systems
 3. Security and Access Control Systems
 4. Voice / Data Cabling
 5. PA / Intercom Systems
- 3.12.2 For the following systems, the manufacturer's Testing Representative must be present for the test period and submit a Certificate of Operation to the Consultant:
1. Fire Alarm
- 3.12.3 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.
- 3.12.4 See also Specification Section 16950 "Commissioning and Field Quality Control".
- 3.13 **TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION**
- 3.13.1 Temporary electrical power is available at the site. Cooperate with owner for use of this power.
- 3.13.2 Tie in at one location only, as directed. Distribute temporary power from this location.

- 3.13.3 Arrange and pay for the cost of inspection of the temporary service.
- 3.13.4 Notify the monitoring company and Owner each and every time a part of the fire alarm system is shut down and reactivated.
- 3.13.5 Completely remove all temporary facilities when they are no longer required.
- 3.13.6 Provide fixed temporary lighting for open areas, stairwells and each enclosed room. In open areas and enclosed rooms use 150W A21 lamps, or equivalent, at spacings not exceeding 7.5m. In stairwells use one 100W A21 lamp, or equivalent, at each landing. Lighting to be on dedicated circuits.
- 3.13.7 Temporary lighting stipulated in this Section, do not include provisions for higher intensity lighting required for a specific operation (concrete finishing, plastering, etc.). This will be the responsibility of the specific trade requiring the higher intensity.
- 3.13.8 Provide minimum two 120V 20A GFCI receptacles, on dedicated circuits, per 150 m² construction area.
- 3.13.9 Temporary power requirements stipulated in this Section, do not include provisions for electric space heating, electric welders, or any other item of equipment which requires either a 3 phase supply or connection to a single phase circuit rated in excess of 20 amperes. Any trade using equipment which falls into above categories is to be responsible for providing additional facilities required for such equipment, including any increased sizing. This Division is responsible to see the connection to the temporary system is safe.
- 3.13.10 Use non-metallic sheathed cable, Type NMW-10, #12 AWG, manufactured in accordance with CSA Spec. C22.2 No. 38, for all temporary lighting branch circuit wiring.
- 3.13.11 **Temporary Fire Alarm Devices**
- 3.13.11.1 Notify the local Fire Department and Owner each and every time a part of the fire alarm system is shut down and reactivated.
- 3.13.11.2 Provide new temporary hard wired fire alarm detectors, pull stations and notification appliances within the construction area.
- 3.13.11.2.1 Provide one 135°F rate-of-rise heat detector for every 465 m² (5000 ft²) of floor area.
- 3.13.11.2.2 Provide smoke detectors in all temporary corridors spaced maximum 10m (30 ft).
- 3.13.11.2.3 Provide a manual pull station at every exit/entrance to the construction area.
- 3.13.11.2.4 Provide one surface mounted bell for every 560 m² (6000 ft²) of floor area.
- 3.13.11.3 Use #14 AWG, AC-90 cable for temporary wiring to devices.
- 3.13.11.4 Connect devices to dedicated fire alarm zones, grouped on a floor-by-floor basis. Provide zone cards as required to suit existing fire alarm panel.

3.13.11.5 Completely verify temporary fire alarm devices any time temporary devices are added, removed or relocated.

3.13.11.6 Once the permanent fire alarm system is operational completely remove all temporary devices and wiring. Turn devices over to the Owner.

3.14 EQUIPMENT SCHEDULE

3.14.1 Equipment Schedules are as shown on Drawings.

3.14.2 In general, the motor or item numbers shown in the Equipment Schedules coincide with those numbers shown for Mechanical Trades.

3.15 GROUNDING

3.15.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Ontario Electrical Safety Code latest edition and the Inspection Authority.

3.15.2 Provide a separate green ground conductor in all raceways.

3.15.3 Ground secondary neutrals of transformers to building ground conductor.

3.15.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.15.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to "Everdur" metal.

3.15.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.15.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.15.8 Provide a separate #14 green ground wire for all isolated ground receptacles.

3.16 START-UP SERVICES

3.16.1 Provide the services of a qualified person to be on call and available to the site within one hour, for 2 weeks after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation.

3.17 MAINTENANCE OF EXISTING SERVICES

3.17.1 Take every precaution to locate and protect existing services so that no interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.

3.17.2 Be responsible for maintaining continuity of existing services, and for programming work so that the Owners can carry out their normal business uninterrupted, with the exception of scheduled shutdowns for connection to or rerouting of existing services, at a time agreed to by the Owners, on weekdays, over weekends or after normal working hours.

3.17.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Give seven days prior notice to the Consultant and Owner.

3.18 PROTECTING AND MAKING GOOD

3.18.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.

3.18.2 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

3.18.3 Coordinate and cooperate with other trades, taking into account existing installations, to assure best arrangement of equipment in available space. For critical locations, prepare interference and installation drawing showing work of various sections as well as existing installations, for approval before commencing work.

3.18.4 All new equipment shall be delivered to site wrapped in plastic and removed only after room is thoroughly cleaned and painted, if applicable. Where existing or new equipment must be operational throughout construction in adjacent spaces, ensure door sweeps are installed and mechanical ventilation systems are fully operational. Provide filters with minimum filtration rate of 10 micron (MERV 5) on all make-up air and supply ducts. Ensure filters are regularly changed to maintain adequate airflow.

3.19 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT

3.19.1 Remove existing material and equipment where shown or specified. Equipment such as Fire Alarm devices, and any other special devices are to be turned over to the Owner. Relocate these items to a designated storage site as directed by Owner. Other material and equipment which is removed becomes the property of the Contractor, and must be immediately removed from the site.

3.20 REBATES AND INCENTIVES

3.20.1 Provide all invoices and proof of purchase documentation to Owner as requested for application by Owner for rebates and incentives. All incentives will be paid to the Owner.

3.21 CASH ALLOWANCES

3.21.1 Refer to Section 01020 for cash allowances carried by the General Contractor.

3.21.2 Any amounts in excess of the cash allowances will be paid by the Owner. Return any unused portions of the cash allowances in full to the Owner.

3.22 DEFICIENCY REVIEW

3.22.1 The Electrical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Electrical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Electrical Contractor shall correct them and again notify the Consultant in writing. Charges to the Electrical Contractor may result from repeat visits after the second visit.

3.22.2 The Electrical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Electrical Contractor will be responsible for uncovering any concealed services for inspection.

3.23 HOURLY LABOUR RATE

3.23.1 Hourly labour rate shall be the actual rate paid to the worker as posted by the local Union Agreement plus a burden mark-up of 100% to compensate for contributions, assessments, employment insurance, health insurance, pension plans, WSIB, taxes, vacation pay, travel, parking, welfare, union package and membership dues, supervision, material handling, training, rest periods, down time, breaks, personal hygiene, small tools, clean up time, profit, other benefits paid to the worker and all other costs incurred by the Company including meetings, office time. Travel time to and from the site shall be at no charge to the Owner. For the purpose of electrical work, the journeyman electrician rate will be used for all trades completing any electrical work.

3.24 LIST OF ELECTRICAL SUBCONTRACTORS AND MANUFACTURERS

3.24.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause "Material and Equipment". Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

3.24.2 Subcontractors

Fire Alarm System
Data Wiring
PA System
Security System

3.24.3 **Manufacturers**

Disconnect Switches
Emergency Lighting / Exit Signs
Fire Alarm Devices
Intercom System
Lighting Control System
Luminaires (by Type)
Motor Control Equipment
Panelboards
Security System
Structured Wiring
Wiring Devices

END OF SECTION

-
- 1 General
 - 1.1 **GENERAL REQUIREMENTS**
 - 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions".
 - 1.2 **DESCRIPTION OF SYSTEM**
 - 1.2.1 Provide all new wiring and raceways. Where possible, conceal all wiring and raceways above ceilings, in walls and partitions. See Section 16001, "Electrical General Provisions".
 - 2 Products
 - 2.1 **MATERIALS**
 - 2.1.1 Use materials specified herein or approved equal as defined in Clause "Material and Equipment".
 - 2.1.2 All outlet boxes, wiring devices, equipment and accessories must be C.S.A. approved and be designed for the application intended.
 - 2.2 **RACEWAYS**
 - 2.2.1 Use E.M.T. in concealed locations in concrete block walls, drywall partitions and for main and branch circuit wiring above ceiling spaces.
 - 2.2.2 Use minimum 1/2" (16 mm) conduit for power wiring and 3/4" (21 mm) conduit for motor circuits.
 - 2.2.3 Raceways for motors and equipment are to be dedicated home runs back to source and shall not be grouped with adjacent motors and equipment.
 - 2.2.4 Refer to Section 16700 for communication raceways.
 - 2.2.5 Use set screw steel couplings and connectors. Use raintight steel couplings and connectors complete with "O" rings, in sprinklered buildings.
 - 2.2.6 Use red conduit for Fire Alarm wiring concealed above ceilings, in concrete walls and in mechanical and electrical rooms.
 - 2.2.7 For new devices on existing block or poured concrete walls exposed in finished areas, provide metallic single compartment raceway and appropriate bases.
 - 2.2.8 Use conduit expansion coupling for expansion joint crossing.
 - 2.2.9 Use flexible metal conduit for all final connections to motors and other equipment subject to vibration or which has adjustable mountings. Minimum size 1/2" (16 mm).
 - 2.2.10 Use rigid PVC underground and in concrete floors, unless otherwise noted. Provide marking tape for underground installations in accordance with Ontario Electrical Safety Code.

2.2.11 For exterior above grade installations, use rigid aluminum conduits and fittings. All boxes and conduit bodies shall be die-cast, copper-free aluminum with aluminum covers and neoprene gaskets.

2.2.12 Fasten all raceways with approved supports. Use clamps and all mounting hardware of the same material as the conduit or compatible material to prevent galvanic corrosion.

2.3 **CONDUCTORS**

2.3.1 Aluminum conductors are NOT permitted on this project.

2.3.2 Use minimum copper #12 AWG RW-90XLPE **stranded** for branch circuiting and receptacle wiring.

2.3.3 Use RWU-90XLPE wire in all below grade locations.

2.3.4 Use minimum size of #14 AWG RW-90XLPE for control wiring.

2.3.5 Type AC-90 cable may be used for final drops (maximum 2 m [6.5']) to lighting fixtures and devices in accessible ceiling spaces. **DO NOT USE AS MAIN BRANCH WIRING FROM PANELBOARDS OR FOR BRANCH CIRCUIT WIRING (i.e. RECEPTACLES, ETC.).**

2.3.6 For wiring to heating equipment, recessed lighting fixtures or where body of fluorescent fixture is used as raceway, use conductors with high temperature insulation of type approved by Electrical Safety Authority.

2.3.7 Use all wire and cable insulation rated 600 volts minimum unless specified otherwise.

2.4 **OUTLET BOXES**

2.4.1 Use only masonry approved boxes in concrete and masonry construction.

2.4.2 Use 100 mm (4") square or utility type boxes for surface-mounted boxes and 100 mm (4") octagonal boxes for ceiling outlet boxes. Use multi-gang boxes for grouped devices. Use wrap-around covers for utility boxes. Use cast aluminium FS type boxes where surface mounted in finished areas.

2.4.3 Use flush-mounted boxes complete with adjustable ears, extension rings and plate rings as required. Do not use shallow or narrow boxes.

2.4.4 Provide FS type boxes c/w rain tight fittings where surface mounted in service rooms or for any surface boxes in sprinklered buildings not located above ceilings.

2.5 **WIRING DEVICES**

2.5.1 Use specification grade wiring devices, types and ratings shown on the Drawings.

- 2.5.2 Switched receptacles to be black. Use red devices for receptacles\switches fed from emergency circuits.
- 2.5.3 Confirm colour of wiring devices and plates with Consultant prior to ordering.
- 2.5.4 **Receptacles**
- 2.5.4.1 125 volt 15 amp white self-testing Tamper Resistant GFCI Duplex Receptacle (CSA 5-15R)
Hubbell Catalogue No. GFTRST15W
- 2.5.4.2 125 volt 15 amp white U-ground Tamper Resistant Duplex Receptacle (CSA 5-15R)
Pass & Seymour Catalogue No. TR62W, or equivalent.
Alternative manufacturers to provide equivalent grade or better.
- 2.5.4.3 125 volt 20 amp white self-testing Tamper Resistant GFCI Duplex Receptacle (CSA 5-20R)
Hubbell Catalogue No. GFTRST20W
- 2.5.4.4 125 volt 20 amp white U-ground Tamper Resistant Duplex Receptacle (CSA 5-20R)
Pass & Seymour Catalogue No. TR63W, or equivalent.
Alternative manufacturers to provide equivalent grade or better.
- 2.5.4.5 125/250 volt 50 amp Range Receptacle (CSA 14-50R)
Hubbell Catalogue No. 9450A
- 2.5.5 **Switches**
- 2.5.5.1 125 volt 20 amp white single pole switch
Hubbell Catalogue No. HBL-1221-W
- 2.5.6 **Cover Plates**
- 2.5.6.1 In general, use 302 stainless steel face plates for all flush-mounted devices and die-cast face plates for all surface-mounted devices.
- 2.5.6.2 All receptacles exposed to weather to have die-cast aluminum duplex gasketed spring door in-use covers.
- 2.5.7 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":
- Cooper
Hubbell
Leviton
Pass & Seymour
- 2.5.8 **Wall Box Dimmers**
- 2.5.8.1 All devices are to be CSA certified and UL listed, specifically for the required loads (i.e. incandescent, fluorescent, low voltage, electronic low voltage). Universal dimmers are not acceptable.

- 2.5.8.2 All dimmers and switches are to provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.
- 2.5.8.3 Dimmers are to meet ANSI/IEEE Standard C62.41-1980, tested to withstand voltage surges of up to 6000 volts and current surges of up to 200 amps without damage, and UL 20 limited short circuit test.
- 2.5.8.4 Dimmer control is to be a linear slide beside an air gap rocker switch. The dimmer switch will provide a smooth and continuous Square Law dimming curve for 0-10V dimming loads.
- 2.5.8.5 Dimmer switches are to be voltage regulated so that +10% variation line voltage will not cause more than a +5% variation in load voltage when dimmer is operating at 40 volt (5% light output).
- 2.5.8.6 Dimmers will utilize an LC filtering network to minimize interference with properly installed radio, audio, and video equipment.
- 2.5.8.7 Faceplate is to snap onto the device with no visible means of attachment bright chrome finish. Heat fins are not to be visible on front of device.
- 2.5.8.8 Dimmer switches for line voltage incandescent loads will be minimum 1000 watt rated, Lutron Diva Preset Series when decora type single pole switches are specified and Lutron Ariadni Preset Series when toggle type single pole switches are specified. For loads over 1000W, provide suitable power packs.
- 2.5.8.9 Dimmer switches for 0-10V loads with switched-off, Lutron Diva Preset Series. Provide power packs when load exceeds rating of standard dimmer.
- 2.5.8.10 Provide single pole 3 way dimmer switches as indicated on Drawings. All dimmer switches are to be compatible.
- 2.5.8.11 At locations with multiple dimmer devices, provide one seamless, multi gang faceplate Lutron Claro CW series. Do not gang dimmer switches with other devices.
- 2.6 DISCONNECT SWITCHES**
- 2.6.1 Unless specified otherwise, fused or unfused disconnect switches to be conditionally hp rated, heavy duty type with visible break industrial safety switches in general purpose or weatherproof enclosures as required.
- 2.6.2 For 120V mechanical equipment, provide Hubbell Cat. #HBL1379D disconnect switch with aluminum housing and lockable switch.
- 2.6.3 For equipment above ceilings such as fans and heat pumps single phase and three phase 30A and below: Hubbell Cat # HBL1372 disconnect switch with aluminum housing or equivalent to be approved by Consultant.

2.6.4 For exterior roof mounted equipment single phase and three phase 30A and below: Hubbell Cat # HBL13R series NEMA 3R disconnect switch with aluminum housing. Or equivalent to be approved by Consultant.

2.6.5 The door to be mechanically interlocked with the operating handle to prevent it from being opened when the switch is in the "ON" position. The handle is to be capable of being padlocked in the "OFF" or "ON" position.

2.6.6 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Eaton
Schneider
Siemens

2.7 **OVERCURRENT PROTECTIVE DEVICES - FUSES**

2.7.1 Provide fuses for all fusible equipment in this Contract.

2.7.2 Fuse interrupting rating is to be 200,000 amps RMS symmetrical unless otherwise noted.

2.7.3 Rated as noted on the Drawings, 600 volts AC, fuses will be CSA certified HRCI J/Class J Time Delay with dimensions and current limiting performance in accordance with CSA Specification C22.2 No. 106-05 or UL Standard 198C for Class J fuses. HRCI/JY fuses are not acceptable.

2.7.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Cooper Bussmann
General Electric Power Controls
Littlefuse
Mersen

3 Execution

3.1 **GENERAL**

3.1.1 Unless shown otherwise, the minimum size of all raceways and conductors to be in accordance with the Ontario Electrical Safety Code.

3.2 **CONDUIT INSTALLATION**

3.2.1 Conceal all conduits except in equipment rooms, unfinished area, and where specifically noted. Flush mount all devices, starters, etc., in finished areas. Install all exposed conduits parallel to building walls and partitions.

3.2.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

- 3.2.3 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- 3.2.4 Run parallel or perpendicular to building lines.
- 3.2.5 Run conduits in flanged portion of structural steel. Do not pass conduits through structural members except as indicated.
- 3.2.6 Group conduits wherever possible on suspended surface channels.
- 3.2.7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- 3.2.8 Horizontal runs of conduit will not be permitted in walls unless noted otherwise.
- 3.2.9 In any case, horizontal runs must be located above level of door or transom frames in area.
- 3.2.10 Vertical conduits must be supported at each floor slab and at the top and bottom of each riser.
- 3.2.11 Conduits must be supported from building structure. Provide independent unistrut under obstructions such as ductwork for support as required. Support unistrut from structural members. Do not secure to underside of metal pan roof deck.
- 3.2.12 Conduit placement should follow the following priority:
- Below grade
 - In walls or partitions
 - In ceiling cavity
 - Exposed
- 3.2.13 Maintain continuity of ground through all connection points. Use sealer lubricant on all threaded connections embedded in concrete, buried in ground or exposed outdoors.
- 3.2.14 Leave all conduit systems finished complete with outlet boxes, coverplates, bushings, caps, nylon fish wire, etc. Provide bushings for all sleeves.
- 3.3 CONDUCTORS**
- 3.3.1 Join #8 AWG and larger conductors with compression connectors properly sized. On #10 AWG and smaller, relaxed wing-nut type connectors may be used. Ideal Industries 451, 452 or 453.
- 3.3.2 Size conductors for a maximum of 2% voltage drop from the supplying panel to the furthest outlet in the circuit. In calculating voltage drop, use 80% of overcurrent rating or design load where known, whichever is less.

3.3.3 Draw wiring into raceways only after all other work that may cause injury to the wire is completed. Use only wiring lubricants that do not shorten insulation life. Use continuous lengths for feeders to panels and large equipment. Do not splice without permission from Consultant.

3.4 **GROUNDING**

3.4.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Electrical Safety Code latest edition and the Inspection Authority.

3.4.2 **Provide a separate ground conductor in all raceways.**

3.4.3 Ground secondary neutrals of transformers to building ground conductor.

3.4.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.4.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to "Everdur" metal.

3.4.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.4.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.4.8 Provide a separate #14 green ground wire for all outlets connected to a GFCI circuit breaker.

3.5 **NEUTRALS**

3.5.1 Provide a separate neutral conductor to each receptacle located adjacent to a data outlet.

3.6 **OUTLET BOXES**

3.6.1 Support all boxes independently of the conduits running to them. Use flush boxes in areas where concealed conduit is used.

3.6.2 Check the Drawings to ensure that no outlets are roughed-in at inaccessible locations, where built-in furniture, counters, etc., are to be installed. In such locations, install the outlets above and clear of the trim by approximately 100 mm (4") unless shown otherwise on the Drawings.

3.6.3 **DO NOT INSTALL OUTLET BOXES OF ANY SYSTEM BACK TO BACK.** Offset as necessary to prevent sound transmission between areas.

3.7 WIRING DEVICES

- 3.7.1 Install light switches on lock jamb side of the door as finally hung. Check door swing before roughing-in. Install switches with the "ON" position up. Locate switch as close as practical to door jamb but not closer than 1". Coordinate location with built-in and Owner supplied equipment and furnishings.
- 3.7.2 When two or more devices are grouped together, mount under a common coverplate unless shown otherwise.
- 3.7.3 Mount light switches at height as indicated on Drawings.
- 3.7.4 Mount duplex receptacles 25 mm (1") above a countertop backsplash to bottom of device coverplate.

3.8 DIMMERS

- 3.8.1 Dimmer switches are to be flush mounted in single or ganged backboxes. Provide sufficient backboxes to ensure that the dimmer switch is installed without the removal of any cooling fins. Do not gang dimmer switches with other electrical devices other than other dimmers.
- 3.8.2 Provide a dedicated neutral conductor from the lighting panel to each dimmer switch.
- 3.8.3 For ganged dimmer switches, provide P touch labelling system 1/4" high black lettering on a clear field nameplate identifying the dimmer load.
- 3.8.4 Provide manufacturer recommended flush backboxes.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions".
- 1.1.2 **Sprinkler Shields**
- 1.1.2.1 This building will be fully sprinklered. All surface mounted panels and enclosures will include sprinkler shields. Ensure all conduit and fittings in sprinklered areas meet the requirements outlined in 16001 clause "Sprinkler Proof Equipment"
- 1.2 **RELATED WORK**
- 1.2.1 **Power supply wiring and raceways for motors of mechanically driven equipment:** Supply and installation of wiring and disconnect at motor by Division 16, unless otherwise noted on Drawings.
- 1.2.1.1 Wiring and raceways for control devices and instruments, such as automatic temperature and pressure control systems, electrical interlocks between starters, field devices and control panels, heat sensors, water temperature controls, thermostatic controls, "ON-OFF" multi-speed controller for cabinet unit heaters: Supply and installation by Division 15.
- 1.2.1.2 Control wiring and conduit for unit heaters and forced flow units for their associated thermostats and control by Division 15.
- 1.3 **REFERENCES**
- | | | |
|----------------------|---|---|
| CSA C22.2 No. 14-05 | - | Industrial Control Equipment |
| CSA C22.2 No. 100-04 | - | Motors and Generators |
| CSA C390-10 | - | Energy Efficiency Test Methods for 3-Phase Induction Motors |
- 1.4 **SYSTEM DESCRIPTION**
- 1.4.1 **Design Requirements**
- 1.4.1.1 Divisions supplying motor-driven equipment are to supply and install factory-wired package assembly, field instruments and control devices, including relevant raceway and wiring forming an integral part of automated control system of equipment.
- 1.4.1.2 Division 16 is to supply and install "power train" such as power supply equipment (switchgears, distribution boards, distribution panels, panelboards), disconnect switches, circuit breakers and splitter boxes, complete with wiring and raceways to termination point at motor or designated power terminals of assembled equipment (packaged unit).
- 1.4.1.3 Division 16 is to install separately mounted starters and other specified motor control devices handed over by other Division, necessary to complete "power train".

1.4.1.4 Division 16 is to incorporate into motor control centre all starters, controls, terminals, equipment and wiring as specified herein and/or as indicated on Drawings.

1.5 **SUBMITTALS**

1.5.1 Submit Shop Drawings as defined in General Conditions of the Contract, to include but not limit following:

1.5.1.1 **Starters and Controllers:** Mounting method and dimensions, starter size and type, layout of identified internal and front panel components, enclosure types, wiring diagram for each type of starter and interconnection diagrams.

1.6 **SPRINKLER SHIELDS**

1.6.1 This building will be fully sprinklered. All surface mounted panels and enclosures will include sprinkler shields. Ensure all conduit and fittings in sprinklered areas meet the requirements outlined in 16001 clause "Sprinkler Proof Equipment"

2 Products

2.1 **PILOT DEVICES, RELAYS AND CONTACTORS**

2.1.1 Selector switches are to be standard duty, oil tight type. When separately mounted, they are to be located in their own enclosures.

2.1.2 Unless noted otherwise, pilot lights to be oil tight, long-life LED type, with transformer.

2.1.3 Install double voltage relays and/or CSA approved segregated auxiliary contacts as required to perform interlocking or other functions. Contacts to suit application.

2.1.4 Relays, other than double voltage, to be electrically operated and electrically held and to have coils of the voltage and the number of contacts to suit the details of the control scheme. Relays to be Square D Class 8502 or equal.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Motor**

3.1.1.1 Installation by Division supplying motor-driven equipment is to comply with governing regulatory authority requirements, applicable Sections of Division 16, and with motor manufacturer's recommended methods.

3.1.1.2 Terminate power supply cables to motor terminal box using flexible conduit connection.

3.1.1.3 Check for correct direction of rotation, with motor not coupled from driven equipment. Cooperate with other Sections supplying motor-driven equipment, to ensure initial start of each motor is correct.

3.1.2 Starters

- 3.1.2.1 Install starters and connect wiring as indicated on Drawings, in accordance with Code requirements, and in accordance with approved wiring diagrams and manufacturer's Drawings.
- 3.1.2.2 Where multiple devices are located in close proximity, provide 19 mm (3/4") thick plywood panel sized to accommodate group-mounted disconnect switches, starters, splitter box and other required control devices.
- 3.1.2.3 Provide raceways, boxes, cables and wirings from panelboards or switchgear through splitters, starters and field disconnect switches to complete power supply required for motors.
- 3.1.2.4 Provide raceways and wirings for control devices and instruments for installation by Division 16 when specified herein. Other control wiring and conduits for field instruments and devices forming part of automated control system for equipment are to be supplied and installed by Divisions installing such system and equipment.
- 3.1.2.5 Provide raceways and wiring, and terminate in designated power supply connection points of pre-wired equipment or package unit supplied by other Divisions. All other outgoing control wiring and conduits are to be installed by Divisions supplying and installing pre-wired equipment or package unit.
- 3.1.3 Check in field and coordinate motor nameplate full load amperes and service factor to ensure correct fuses and overload relay heater elements are installed. Set adjustable relays.
- 3.1.4 Provide lamacoid nameplates on front cover of starters, separately-mounted control stations, and field-mounted disconnect switches, indicating function or equipment service identification as indicated on Drawings.

3.2 TESTS AND INSPECTION

- 3.2.1 Operate switches and contactors to verify correct functioning.
- 3.2.2 Operate selector switch or pushbuttons for performance of starting and stopping sequences of contactors and relays. Confirm delays and Fire Alarm override function as specified.
- 3.2.3 Inspect and test starter operation as per starter manufacturer's instructions.
- 3.2.4 Full responsibility for proper performance of motors is to be assumed by Division installing such motors.

END OF SECTION

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- 1 General
 - 1.1 **GENERAL REQUIREMENTS**
 - 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions" and Section 16100, "Basic Materials and Methods".
 - 1.2 **DESCRIPTION OF WORK**
 - 1.2.1 Provide panelboards and circuit breakers as indicated on the Drawings.
 - 1.3 **SPRINKLER SHIELDS**
 - 1.3.1 This building will be fully sprinklered. All surface mounted panels and enclosures will include sprinkler shields. Ensure all conduit and fittings in sprinklered areas meet the requirements outlined in 16001 clause "Sprinkler Proof Equipment"
 - 2 Products
 - 2.1 **MATERIALS**
 - 2.1.1 Use materials specified herein or approved equal.
 - 2.1.2 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.
 - 2.1.3 Unless noted otherwise on the Drawings or in Specifications, user operated devices, display and controls shall be located between 125mm (5") and 1830mm (72") from bottom of floor mounted equipment.
 - 2.2 **DISTRIBUTION EQUIPMENT**
 - 2.2.1 **Panelboards**
 - 2.2.1.1 Use panelboards of the circuit breaker type, complying with the requirements contained in the Panel Schedules.
 - 2.2.1.2 Panelboards are to have formed galvanized steel tubs and shop finished enamelled covers.
 - 2.2.1.3 All panelboards to have hinged doors with chrome plated locks and catches. Flush-mounted panelboards to have concealed hinges and trim fasteners, flushlock and large rigid covers. All parts of the panel are to be of welded construction.
 - 2.2.1.4 Provide gutter space and barriers in panelboard where required by Inspection Authorities.
 - 2.2.1.5 Each breaker or switch to be clearly identified with a factory stamped circuit number on silkscreened metal tape or lamacoid. Double section panels must have circuit numbers factory installed, indicating from 1 - 84. Circuit numbers are to be

mechanically fastened to panelboard. Two sided tape on accessories will not be accepted.

2.2.1.6 Use panelboards of type noted on the Panel Schedules. Bus to be copper and rated to withstand interrupting capacity of circuit breakers contained within.

2.2.1.7 Where panelboards are indicated with main contactors, contactors shall be enclosed within the same tub as the panelboard and with same interrupting rating as breakers.

2.2.1.8 Where space is indicated, bus the space for future breakers. Provide panel fronts with removable fillers in spaces.

2.2.1.9 Where equipped with main breakers mounted vertically, down position should open breaker.

2.2.2 **Distribution and Panelboard Circuit Breakers**

2.2.2.1 Unless noted otherwise on Drawings or panel schedules, circuit breakers are to be moulded case as rated below. Series rated breakers are not acceptable unless stated otherwise on the Drawings (ground fault breakers excluded).

2.2.2.2 Breakers are to be suitable for the panelboards provided. All breakers are to be bolted in place. Plug-in only type are not acceptable.

2.2.2.3 For 250V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 208 or 240 volt.

2.2.2.4 All circuit breakers smaller than 400A to be moulded case thermal-magnetic type providing inverse time-current tripping curves. Multi-pole breakers to have common-trip device with single handle.

2.2.2.5 All circuit breakers 400A and larger to have adjustable Long-time Short-time Instantaneous (LSI) solid state trip unit.

2.2.2.6 Shunt trip breakers to be 120V AC solenoid type. Electrically held shunt trip breakers are not acceptable.

2.2.2.7 Provide ground fault circuit interrupters breakers as indicated on Panel Schedules. Provide separate neutral conductors for each circuit. Unless noted otherwise, ground fault circuit interrupter breakers are Class A, Group 5mA.

2.2.2.8 Provide positive locking devices on the handles of breakers serving loads below. Trip units to remain free to function while locked in the ON position.

- exit signs
- emergency lighting and night light circuits
- Fire Alarm control panels
- Security System control panels
- door hardware

2.2.2.9 Provide quantity of spare breakers as called for on the Panel Schedules or Drawings

2.2.3 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Eaton
Schneider
Siemens

3 Execution

3.1 **DISTRIBUTION SWITCHBOARD AND DISTRIBUTION PANELS**

3.1.1 Provide lamacoid labels mechanically fastened to switchboards indicating connected load. Include room number and description of load for each breaker.

3.2 **PANELBOARDS**

3.2.1 Locate panelboards as indicated on the drawings. Confirm with Consultant prior to rough-in if panels cannot be installed in locations shown.

3.2.2 Install panelboards level and upright. Remove shipping supports only after securing.

3.2.3 Unless otherwise shown on the Drawings, mount panelboards 1830mm (72") above finished floor to top of panel and minimum 125mm (5") above finished floor.

3.2.4 Provide two empty 25 mm (1") conduit stubs into the ceiling cavity from all flush-mounted panelboards.

3.2.5 Provide a typewritten directory mounted under transparent cover identifying each breaker on the back of each panel door.

3.2.6 Provide new typewritten directories for all existing panelboards affected by work.

3.2.7 Contractor to provide updated schedules complete with room numbers. Trace out existing circuits as required.

3.2.8 Include room number and description of load for each breaker. For circuits serving mechanical equipment, indicate room number mechanical equipment serves. Coordinate on site with Division 15.

3.3 **COORDINATION STUDY**

3.3.1 Provide complete coordination study with all trip curves shown on log-log paper. Determine the settings for all overload trip units, fuse sizes and protective device settings. Set all trips to be selective, such that downstream devices trip first, then the main switchboard fuses. Calculate fault levels at all distribution, lighting and power panels and MCCs.

3.3.2 **Submit all Drawings and calculations to the Consultant for approval at time of submission of main switchboard.** All Drawings and calculations shall each be stamped by a qualified Engineer registered with Professional Engineers Ontario who is both qualified and insured in accordance with the requirements of Division C of the 2012 OBC. Submit Engineer's proof of liability insurance with Coordination Study

Shop Drawings.

- 3.3.3 Company completing the coordination study shall visit the site to obtain feeder lengths and distribution equipment information from site and information from utility as required to complete Coordination Study. This is not to be completed by the Electrical Contractor.
- 3.3.4 Include all new and existing mechanical equipment and elevators over 10 hp.
- 3.3.5 Each adjustable trip breaker shall be labelled with the proper setting. Labels shall be installed on the breaker behind Plexiglass windows or on lamacoid label next to breaker.
- 3.3.6 For each fusible disconnect, provide labelling showing size, type and current rating of maximum fuse size.
- 3.3.7 Representative of the company which completed the Coordination study shall adjust trip settings on adjustable breakers in accordance with Coordination Study on site.
- 3.3.8 **DO NOT ENERGIZE EQUIPMENT UNTIL ALL BREAKERS HAVE BEEN SET IN ACCORDANCE WITH THE COORDINATION STUDY.**
- 3.3.9 Representative of company shall provide letter to the Consultant stating that have visited the site and have set all trip devices have been set in accordance with the Coordination Study.
- 3.3.10 **Arc Flash Study and Labels**
- 3.3.10.1 Provide "Flash Hazard" report, based on IEEE 1584-2002 and IEEE 1584b-2011.
- 3.3.10.2 Provide "Flash Hazard" warning labels on each switchboard, panelboard, MCC and splitter.
- 3.3.10.3 Label shall be located so that it is clearly visible to persons before examination, adjustment, servicing, or maintenance of equipment. Locate label on the inside door of panelboards.
- 3.3.10.4 Labels to be applied only under the supervision of a representative of the company which completed the Arc Flash Study and Report.
- 3.3.10.5 Representative of the company which completed the Arc Flash Study shall provide a letter to the Consultant confirming they have visited the site and all Arc Flash Labels are installed in Accordance with the Arc Flash Study.
- 3.3.11 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Eaton
Schneider
Siemens

END OF SECTION

-
- 1 General
 - 1.1 **GENERAL REQUIREMENTS**
 - 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions" and Section 16100, "Basic Materials and Methods".
 - 1.2 **DESCRIPTION OF SYSTEMS**
 - 1.2.1 **Lighting Systems**
 - 1.2.1.1 Nominal 120 volt A.C.
 - 1.2.1.2 Branch circuit wiring from 120/208 volt, 3 phase, 4 wire panelboards.
 - 2 Products
 - 2.1 **GENERAL**
 - 2.1.1 Use materials specified herein or approved equal.
 - 2.1.2 Use the product of only one manufacturer for each type of luminaire.
 - 2.1.3 Refer to Luminaire Schedule on Drawings.
 - 2.2 **LED LUMINAIRES**
 - 2.2.1 All LED luminaires must bear an approved certification mark as per Ontario Electrical Safety Code Bulletin 2-7-29. A UL certification mark without the 'c' is not an approved certification mark.
 - 2.2.2 **Luminaires designed for LED lamps with integral driver** as specified below shall adhere to LED lamp manufacturer guidelines, certification programs, and test procedures for thermal management to guarantee the minimum lamp life and lumen maintenance as specified below.
 - 2.2.3 **Luminaires designed with integrated custom LED's.** shall be as specified on drawings or approved equal meeting the following requirements:
 - 2.2.3.1 Only products from manufacturers that have been in the lighting manufacturing business for minimum of 10 years will be considered.
 - 2.2.3.2 Modularity, shall be designed to allow for replacement of; driver, LED's, without specialised tools and without removing luminaire from the ceiling.
 - 2.2.3.3 Performance - LED luminaire with custom lamps must exceed LED lamp parameters specified below for efficacy and lumen maintenance by minimum 15%.
 - 2.2.3.4 Lumen Maintenance - at least 70% of initial lumens for at least 50,000 hours.
 - 2.2.3.5 Minimum luminous efficacy 50 lumens per watt (lm/W)

2.2.3.6 Warranty - Written warranty covering repair or replacement for a minimum of five (5) years from the date of purchase. Warranty must be included with maintenance manuals and have a toll-free (e.g., "800") number, or mailing address, or web site address for consumer complaint resolution and future LED replacement upgrade.

2.3 EXIT SIGNS

2.3.1 Signs to be suitable for wall and/or ceiling mounting and be provided with diffusers on the underside for down lighting and directional arrows in the face as indicated on the Drawings.

2.3.2 Signs to be green pictograms, Meeting CSA22.2 No. 141-10 with directional pictograms and faces as shown on the drawings.

2.3.3 Provide an LED (light emitting diode) type light source, maximum 3 watts, 120/347 volt power supply.

2.3.4 Signs to meet CSA-C860-01 "Performance of Internally Lighted Exit Signs".

2.3.5 Provide suitable clear acrylic guards as indicated on the Drawings.

2.3.6 Signs to be self-powered for 2 hours constructed from extruded, one-piece aluminum painted white, suitable for wall and/or ceiling mounting. To be Lumacell LA-3-W-S.

2.3.7 Combination exit/emergency lighting units to have die cast or extruded aluminum housing suitable for wall and/or ceiling mounting. Provide integral and remote 4W MR16 LED lamps as shown on the drawings. Unit to be 12 volt, capable of producing 50 watts for 1/2 hour at 120 volt, rated in accordance with CSA Standard C22-2-141. To be Lumacell LAC-2-W-1250-2-LD7.

2.3.8 The following manufacturers will be considered as equal subject to the requirements of Clause "Material and Equipment":

AimLite
Beghelli Luxnet
Emergi-lite
Hubbell
Lithonia
Lumacell
Lumaid
Stanpro
Uniglo

2.4 EMERGENCY LIGHTING

2.4.1 Emergency lighting units are to be Lumacell RG12S-144-LD7 with or without two unit mounted floodlights and remote heads as shown on plans. Remote heads to be die-cast with white powder coat finish. All floodlights to be 4 watt LED MR16 type. Units to be 12 volt with an 8 year minimum battery life expectancy, capable of producing 144 watts for 1/2 hour at 12 volt, rated in accordance with CSA Standard C22-2-141.

2.4.2 Emergency lighting units located in Electrical Rooms and Generator Rooms are to be Lumacell RG12S-250-LD7 with or without two unit mounted floodlights and remote heads as shown on plans. All floodlights to be 4 watt LED MR16 type. Units to be 12 volt with an 8 year minimum battery life expectancy, capable of producing 83 watts for 2 hours at 12 volt, rated in accordance with CSA Standard C22-2-141.

2.4.3 The following manufacturers will be considered equal subject to requirements of Clause "Material and Equipment":

AimLite
Beghelli Luxnet
Emergi-lite
Hubbell
Lithonia
Lumacell
Lumaid
Stanpro
Uniglo

2.5 **LUMINAIRE NOISE**

2.5.1 All ballasted luminaires are to be manufactured to reduce noise below room ambient noise level.

2.5.2 Any luminaire or group of luminaires which can be heard above ambient noise are to be quietened or replaced at no additional cost to the Contract.

2.6 **SPARE LUMINAIRES**

2.6.1 Provide a quantity of 1% spare luminaries (minimum 1) of each type used on project and turn over to Owner at Substantial Completion.

3 Execution

3.1 **INDOOR LIGHTING**

3.1.1 Install luminaires complete with the necessary accessories, conduit supports, ball aligners, hangers, mounting yokes, etc.

3.1.2 Check the type of ceilings before placing an order for luminaires.

3.1.3 Provide independent supports from slabs or steel above hung ceilings. Luminaires are not to be supported solely by the hung ceiling. Nylon inserts are not an approved fastening method for poured concrete. Do not secure to underside of metal pan roof deck.

3.1.4 Obtain revised locations from the Consultant when pipes or ductwork interfere with the proper mounting location of recessed luminaires before roughing-in conduit.

3.1.5 Take all necessary precautions to ensure that all luminaires, diffusers and lamps are left clean at the completion of the job.

3.1.6 Ensure that all luminaires including ballasts and lamps are in good working order at the completion of the job. Replace at no extra cost any defective or burned-out lamps.

3.2 LUMINAIRES IN SUSPENDED CEILINGS

3.2.1 Provide adequate additional chain hanger supports for all luminaires in suspended ceiling systems to approval of the Consultant, and in accordance with Ontario Electrical Safety Code Bulletin No. 30-4-12.2016.

3.2.2 All existing luminaires to be removed and reinstalled are to have new chain hangers provided.

3.2.3 Coordinate with the Architect and Ceiling Contractor to determine which ceilings have been designed and constructed to carry the weight of the luminaires, so the support chains can be eliminated.

3.2.4 Ensure all luminaires are mechanically secured to the ceiling system with manufacturer approved clips.

3.3 LUMINAIRE SCHEDULE

3.3.1 Refer to Drawings for luminaire type and description.

3.4 EMERGENCY LIGHTING

3.4.1 Test emergency for 1/2 hour and verify that the entire system is working properly. Contractor is to complete the Emergency Lighting Test Form and providing a line item for each and every device. A sample copy of the form is attached in the Appendix. Submit a letter and the completed form indicating each device has been tested, prior to occupancy. Letter to state the following: "The emergency lighting system has been tested for 1/2 hour and is working in accordance with the Drawings and Specifications".

3.5 REPLACEMENT LUMINAIRES

3.5.1 Prior to ordering new luminaires to replace existing, Contractor to verify voltage of existing luminaires.

3.6 EXIT SIGNS

3.6.1 Locate exit signs as required to prevent obstruction from view. Mount on walls where possible.

3.6.2 Mount exit signs as required to prevent plumbing, structural supports, etc from obstructing view of exit sign. Provide pendant mounts as required for ceiling mounted signs.

END OF SECTION

SECTION 16500

A P P E N D I X

Emergency Lighting Test Form

-
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions" and Section 16100, "Basic Materials and Methods".
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Stand Alone Lighting Control**
- 1.2.1.1 Provide stand alone lighting control devices as shown on plans and specified herein.
- 1.2.2 **Digital Lighting Management:**
- 1.2.2.1 Provide Digital Management Control devices as shown on plans and specified herein.
- 1.3 **SUBMITTALS**
- 1.3.1 Submit a lighting control sequence of operation schedule with shop drawings outlining control sequence for each type of room. Group rooms with identical sequence of operation and indicate room numbers.
- 1.3.2 Schedule to identify number of lighting zones, zone type (switching or dimming), auto-on operation (to preset lighting level if applicable), auto-off operation, daylight harvesting, work plane height and illumination as specified herein.
- 2 Products
- 2.1 **GENERAL**
- 2.1.1 Use materials specified herein or approved equal.
- 2.1.2 In general, switches and automatic wall switches to match wiring device colour. Faceplates for low-voltage switches to match wiring device faceplates. Refer to Section 16100.
- 2.2 **LINE VOLTAGE OCCUPANCY SENSORS**
- 2.2.1 Provide a complete occupancy sensor control system in each room indicated completed with sensor, control wiring and mounting hardware as indicated and specified herein and in manufacturer installation manuals:
- 2.2.2 The following Sensors to be provided:
- 2.2.2.1 **DT-200 Dual Technology Sensor**
- 40 kHz frequency ultrasonic transmission
 - Time delays: SmartSet (automatic), fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode

- Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity (for PIR sensitivity); ultrasonic sensitivity is variable with trimpot
- Built-in light level sensor (DT-200) – works from 2 to 200 foot candles
- Low voltage, momentary switch input for manual operation
- DT-I relay with N/O and N/C outputs; rated for 1 Amp at 24 VDC/VAC
- 2000 sq ft of walking motion mounted at 10 ft; 1000 sq ft of desktop motion

2.2.2.2 DT-300 Dual Technology Ceiling Sensor

- 40 kHz frequency ultrasonic transmission
- Advanced Signal Processing automatically adjusts detection threshold
- User-adjustable DIP switch time delay and sensitivity settings
- Isolated relay allows sensor to interface with building control systems
- Omni-directional transmission (360° coverage)
- Temperature and humidity resistant receivers
- Digital DIP switch time delay (15 seconds to 30 minutes)




2.2.2.3 DSW-100 Automatic Wall Switch

- 100/230/277 VAC; 50/60 Hz operation
- Minor motion coverage of 15' x 15' major motion coverage of 35' x 30'
- Time delays: SmartSet (automatic), fixed (5,10,15,20,or 30 minutes), walk-through, test-mode
- Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity
- Compatible with all electronic ballasts and PL lamp ballast systems
- Occupancy sensor to match wiring device colour

2.2.2.4 DSW-200 Automatic Wall Switch

- 100/230/277 VAC; 50/60 Hz operation
- Minor motion coverage of 15' x 15' major motion coverage of 35' x 30'
- Time delays: SmartSet (automatic), fixed (5,10,15,20,or 30 minutes), walk-through, test-mode
- Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity
- Compatible with all electronic ballasts and PL lamp ballast systems
- Occupancy sensor to match wiring device colour
- 50% auto on, dual relay type

2.2.3 Unless otherwise indicated, provide the following models according to the symbol type:

Type	Symbol	Wattstopper Cat. No.	Mounting
1		DT-200	wall at ceiling
2		DT-300	ceiling
3		DSW-100/200	wall at switch height

2.2.4 Provide DT-355 dual technology line voltage ceiling sensors in storage and service rooms.

- 2.2.5 Provide wire guards over sensors where indicated, plated steel 5mm (1/4") wire suitable for flat wall or corner mounting.
- 2.2.6 All Occupancy Sensors to be from one manufacturer, UL and cUL listed and have five year warranty.
- 2.2.7 **Power Packs**
- 2.2.7.1 Power pack shall be self-contained transformer and relay module in a NEMA 1 plenum use acceptable enclosure.
- 2.2.7.2 Power pack shall have two isolated relays rated for 100,000 cycles capable of switching 20 amp load utilizing zero crossing circuitry to protect from effects of inrush current and increase life.
- 2.2.7.3 Power pack shall have a switch input for each relay output which accept three-wire momentary, two-wire momentary push-button, or maintained low voltage switches as well as 24 VDC voltage devices.
- 2.2.7.4 Power pack shall have 16mm thread nipple for mounting to junction boxes.
- 2.2.7.5 Power pack shall provide separate an independent inputs for occupancy sensor, photocell, time clock and load shed signal devices.
- 2.2.7.6 Power pack shall provide a 24 VDC 150 mA output, with the relay connected for powering other devices.
- 2.2.7.7 Power pack time input shall provide selectable control scenarios for: hold-ON, to keep lighting controlled by occupancy sensors ON during timed occupancy; ON-only, to allow switches to only turn lighting ON and not OFF during timed occupancy; auto-ON, to turn ON lighting loads at the beginning of timed occupancy; after hour shut-off, to provide local switch operation of lighting loads after hours and then shutting them off after a selectable override time period of 30 minutes, 1 hour, 2 hours, or 4 hours.
- 2.2.7.8 Power pack shall have a standard 5 year warranty and be UL and CUL listed.
- 2.2.7.9 To be Wattstopper BZ-150 or approved equal.
- 2.2.8 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":
- Douglas
Greengate
Sensor Switch
Wattstopper
- 2.3 **ADDITIONAL SYSTEM COMPONENTS**
- 2.3.1 Provide auxiliary relays and other items as shown on the drawings:

2.4 DIGITAL LIGHTING MANAGEMENT

2.4.1 Provide a 100% digital lighting control system as shown on the drawings to meet space control requirements of AHSRAE/IESNA 90.1-2013. Provide occupancy/vacancy modes of operation. In general, provide two control circuits per lighting zone with one circuit configured in occupancy mode and other in vacancy mode.

2.4.2 Provide automatic shut-off of receptacles as shown on the drawings. Receptacles to be powered whenever spaces are occupied, regardless of overhead lighting.

2.4.3 System to be capable of adjustment, including programming and photosensors and occupancy sensor parameters, using software residing on a PC. Use of a handheld configuration tool may not be substituted for this programming ability. Room controllers to operate independent of programming PC.

2.4.4 All components to be self-configuring, digitally addressable, capable of ladderless configuration and will not have dip switches or potentiometers.

2.4.5 Provide contact closure to BAS for occupancy status.

2.4.6 Digital Room Controllers

2.4.6.1 Provide digitally addressable two relay controllers. Controllers to be self-configuring, automatically binding the room loads to the connected control devices without commissioning or the use of any tools.

2.4.6.2 Housing to be plenum rated and complete with nipple to mount to standard junction box.

2.4.6.3 Room controllers to have two integral on/off zero-crossing relays rated for 20A at 120V and three connections for digital lighting network connection.

2.4.6.4 Dimming room controllers to have three integral on/off zero-crossing relays rated for 20A at 120V with three 0-10V dimming outputs and three connections for digital lighting network connection.

2.4.6.5 Provide receptacle controllers for circuits as shown on the drawings.

2.4.6.6 WattStopper LMRC-210 (dimming).

2.4.7 Digital Switches

2.4.7.1 Low voltage momentary pushbutton switches to be in 2 equal-sized button configuration, white and compatible with standard decorator wall plates. Buttons to be field replaceable without removing switch from wall. WattStopper LMSW-102.

2.4.7.2 Low voltage switches shown connected to dimming room controllers to be momentary pushbutton switches with one button configuration and LED bar graph showing relative light level of controlled load, white and compatible with standard decorator wall plates. WattStopper LMDM-101.

2.4.7.3 Buttons to be field replaceable without removing switch from wall.

2.4.7.4 Switches to have two connection ports for digital network through-wiring.

2.4.8 Digital Occupancy Sensors

2.4.8.1 Digital occupancy sensors to provide automatic switching for specified load connected to a room controller. Sensors shall be interchangeable without the need for rewiring.




2.4.8.2 Sensors to have two connection ports for digital lighting network.

2.4.8.3 Sensors to use dual technology (passive infrared and ultrasonic or microphonic) for occupancy detection. Sensors must be initially triggered by both detection technologies.

2.4.8.4 Digital occupancy sensors shall provide digital calibration for sensitivity (0-100%), time delay (1-30 minutes) and test mode.

2.4.8.5 Multiple occupancy sensors shall be able to be added to the digital lighting network without additional configuration.

2.4.8.6 Unless otherwise indicated, provide the following models according to the symbol type:

Type	Symbol	Wattstopper Cat. No.	Mounting
1		LMDX-100	wall at ceiling
2		LMDC-100	ceiling
3		LMDW-102-W	wall at switch height

2.4.9 Digital Photosensors

2.4.9.1 Digital photosensors to provide automatic switching or dimming daylight harvesting capabilities for specified load connected to a room controller. Photosensors shall be interchangeable without the need for rewiring.

2.4.9.2 Sensors to have one connection port for digital lighting network.

2.4.9.3 Sensors to have a operational range for wavelengths between 400nm and 700nm and less than 5% sensitivity for wavelengths outside of this range. Light level range shall be from 1-10,000 footcandles complete with a deadband between the ON and OFF setpoints that will prevent the lights from cycling after they turn off.

2.4.9.4 Adjustable head and a mounting bracket shall accommodate multiple mounting positions and building materials. The photosensor may be mounted on a ceiling tile, skylight light well or backbox.

- 2.4.9.5 Open loop digital photosensors to have an internal photodiode to measure light with a 60 degree cutoff to avoid unwanted light from the interior of the room.
- 2.4.9.6 WattStopper LMLS-500.
- 2.4.10 **Isolated Relay Interface**
- 2.4.10.1 Provide Wattstopper LMRL-100 isolated relay interface to provide contact closure.
- 2.4.11 Other manufacturers must meet all of the above requirements and must submit shop drawings to Consultant for review minimum six working days prior to close for compliance review. Equal manufacturers will be added via addendum.
- 2.4.12 The following manufacturers will be considered as equal, subject to the requirements of Clause "Material and Equipment":
- Acuity Brands Control
Greengate
Wattstopper
- 3 Execution
- 3.1 **STAND ALONE LIGHTING CONTROL**
- 3.1.1 Program all occupancy sensors, where applicable, to SmartSet mode.
- 3.1.2 Program all occupancy sensors without SmartSet mode to a time delay of 20 minutes.
- 3.1.3 Demonstrate to consultant correct operation of occupancy and photo sensors.
- 3.1.4 Program all intelligent power packs for automatic ON operation of one circuit and manual ON operation of second circuit with automatic OFF operation for both circuits.
- 3.2 **DIGITAL LIGHTING MANAGEMENT**
- 3.2.1 Provide CMP rated Category 5e with RJ-45 connectors for all control wiring. Wiring in accessible ceiling space may be free run, supported by conduit for other systems. Do not attach cable to ceiling grid supports. In inaccessible ceilings and all walls, provide conduit and back boxes.
- 3.2.2 Digital lighting network cabling to be green throughout building. Contractor to ensure cabling colour is unique from other low voltage cabling (data, voice, BAS controls, etc).
- 3.2.3 Program all rooms for 50% automatic ON operation and 100% automatic OFF operation of all circuits. Programming to be in accordance with ASHRAE 90.1.
- 3.2.4 Adjust time delay so that controlled area remains lit for 5 minutes after occupant leaves area.

- 3.2.5 Provide assistance to BAS contractor as required to integrate, at minimum, occupancy status with BAS.
- 3.2.6 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a fully functioning system. Provide Consultant and Owner ten working days written notice of system startup and adjustment date.
- 3.2.7 Adjust high trim level for luminaires to obtain the following maximum lighting levels at the work plane. Provide high trim percentage and measured illuminance at work plane for each room in maintenance manual.

Space	Work Plane Height	Illuminance
Classrooms	760 mm	40 fc
Corridors	0 mm	30 fc
Gymnasium	0 mm	50 fc
Learning Commons	760 mm	40 fc
Maker Space	910 mm	40 fc
Offices	760 mm	40 fc

- 3.2.8 Provide room-by-room documentation on the commissioning of the system including sensor parameters, time delays, sensitivities, daylighting setpoints, sequence of operation, (e.g. manual ON, Auto OFF. etc.) and load parameters (e.g. blink warning, etc.)
- 3.2.9 Resubmit updated sequence of operation schedule to include high trim setting for each lighting zone and measured illumination at work plane.
- 3.2.10 Upon completion of commissioning, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.
- 3.2.11 Thirty days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's specific requirements. Provide a detailed report to the Consultant of re-commissioning activity.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 The requirements of the Instructions to Bidders, the Contract Forms, the General Conditions as amended, and the Supplementary General Conditions as hereinbefore written will form a part of the following Specifications and the Contractor will consult them in detail for instructions governing the work.
- 1.1.2 Conform to the requirements of Section 16001, "Electrical General Provisions".
- 1.2 **REFERENCES**
- ANSI/EIA/TIA-569B - Commercial Building Standard for Telecommunications Pathways and Spaces
- 1.3 **DESCRIPTION OF SYSTEMS**
- 1.3.1 **Data Communication System:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Section 16710 for cabling details.
- 1.3.2 **Security System:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Section 16705 for cabling details.
- 1.3.3 **Audio and Video Systems:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Sections 16760 and 16761 for cabling details.
- 1.3.4 **Door Hardware Elevations:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on the Door Hardware Elevations attached at the end of this section. All conduits are to be complete with nylon fishwire.
- 1.3.5 **Clocks:** Provide battery operated clocks in locations as shown on the Drawings.
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal.
- 2.2 **COMMUNICATION WIRING HANGERS**
- 2.2.1 Provide communications system wiring hangers as indicated on the Drawings.
- 2.2.2 Hangers are to be suitable for supporting up to 80 4-pair UTP low voltage cables with 50 mm (2") diameter loop. Provide multiple hangers on single support bracket as shown on details. Erico No. CAT32.

2.2.3 Provide all required 10 mm (3/8") threaded hanger rods, bolts, wall anchors, beam clamps and fittings as indicated on the Drawings and as required.

2.2.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment".

Caddy
 B-Line

2.3 COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT

2.3.1 Cables shall generally be installed in communication trays or conduit. All new conduit shall be thin wall EMT, sized for the cables required plus an additional 50% for future cables. Minimum conduit size shall be 3/4".

2.3.2 In general, the following table shall be used for communication conduit fill:

Conduit Size	3/4" 21mm	1" 27mm	1-1/4" 35mm	1-1/2" 41mm	2" 53mm	2-1/2" 63mm	3" 78mm
Max UTP	2	3	6	7	14	17	20
Max Coax	2	4	6	9	17	26	38

2.3.3 Cables shall NOT be attached to pipe or conduit or ductwork, etc.

2.3.4 Conduit ends shall be provided with non-metallic bushings to provide a round edge, which will not abrade the cable jacket.

2.3.5 **Telephone/Data:** Provide single gang device wall boxes, complete with 21 mm (3/4") conduit up to the cable tray or J hook system. Provide pull boxes and splice boxes as indicated, for every 30 m (100') of conduit, and more than two 90° bends or equivalent.

2.3.5.1 Stainless Steel faceplates specified in Section 16710 do not fit in all device boxes. Confirm compatibility with Data contractor prior to rough-in.

2.3.6 **Security/Access Control System:** Provide single gang device wall boxes, complete with 16 mm (3/4") conduit up to the cable tray or J hook system. Provide pull boxes and splice boxes as indicated, for every 30 m (100') of conduit, and more than two 90° bends or equivalent. All conduits to have pull strings from device wall boxes to cable tray.

2.3.7 PVC conduit is not allowed inside and will be removed at the contractor's expense.

2.4 CLOCKS

2.4.1 Battery operated quartz clock, 300 mm (12") diameter, 24 hour 1 - 12 outer ring, 00 - 24 inner ring, black housing, Simplex 6310-9425, Dukane 24ZBP212R or equal by American Time.

2.4.2 Provide suitable rechargeable batteries complete with two battery chargers and 10 spare rechargeable batteries. Turn over to Owner at end of project.

3 Execution

3.1 COMMUNICATION WIRING HANGERS

3.1.1 Refer to floor plans and details and install communication system wiring hangers as indicated.

3.1.2 Coordinate location of all hangers with Division 15 and building structure to ensure no conflicts. Hangers are to be mounted within 400 mm (16") of a 45° or 90° change in cable routing and on 910 mm (36") spacing.

3.1.3 Provide minimum three hangers on each support rod or as shown on the Drawings.

3.2 COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT

3.2.1 Provide 20 mm (3/4") conduit except as noted, from each wall outlet to accessible ceiling space. **Ensure end of conduit is fully accessible for cabling installers.**

3.2.2 Provide all conduits, outlet boxes and wiring for a complete system. Minimum size conduit to be 21 mm (3/4"), except where noted.

3.2.3 Where possible, run all conduit in the ceiling space and conceal all conduit within ceiling spaces, walls or partitions. Mount outlets at the same elevation above finished floor level as duplex receptacles or as noted on the floor plans.

3.2.4 Rigidly install all conduits, adequately supported and properly reamed at both ends. Join sections of conduits by approved couplings and conduit terminations at boxes, pull boxes, etc. using approved fittings.

3.2.5 The inside radius of bends not to be less than: Six times the internal diameter of conduits 50mm (2") and smaller.

3.2.6 Install conduits and boxes as per TIA/EIA-569-A.

3.2.7 Minimum size of pull boxes and splice boxes to be sized as per conduits and Tables 5, 2-2 and 5, 2-3 in TIA/EIA-569-A.

3.2.8 Conduits shall be grounded minimum at one end.

3.2.9 Conduit fill capacity shall not exceed 35%.

3.2.10 Cables and raceway shall maintain minimum 150mm (6") separation from sources of heat such as steam or hot water pipes, vessels and fittings, which are insulated, and minimum 610mm (24") from the same, which are uninsulated.

3.2.11 Pull wires must be provided in all conduits.

3.3 CLOCKS

- 3.3.1 Synchronise all clocks to Owner chosen time source before turning building over to Owner.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions".
- 1.1.2 Products will comply with the latest edition of the following Standards:
- CAN/ULC-S302-M91, Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults
CAN/ULC-S303-M91, Local Burglar Alarm Units and Systems
CAN/ULC-S306-03, Intrusion Detection Units
CAN/ULC-S319-05, Electronic Access Control Systems
CAN/ULC-S525-99, Audible Signal Appliances
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Security System**
- 1.2.1.1 Extend existing hardwired DSC security system including conduits, devices and all necessary components, as recommended by manufacturer.
- 1.2.1.2 Provide keypads, door contacts, motion sensors and headend equipment.
- 1.3 **SUBMITTALS**
- 1.3.1 Submit Shop Drawings in accordance with the General Conditions of the Contract and as specified in this Section.
- 1.3.2 Provide a written description of the proposed system configuration augmented with block diagrams identifying the location of all system components and associated cable routings.
- 1.3.3 Provide lists of all off-the-shelf and custom equipment, including equipment quantities.
- 1.3.4 Provide the mechanical, electrical and environmental specifications for all listed equipment and cable.
- 1.3.5 Provide an overview of any equipment installation techniques which may deviate from the standards contained in this Section. Expose all such installation techniques for prior approval by the Consultant.
- 1.4 **SPRINKLER SHIELDS**
- 1.4.1 This building will be fully sprinklered. All surface mounted panels and enclosures will include sprinkler shields. Ensure all conduit and fittings in sprinklered areas meet the requirements outlined in 16001 clause "Sprinkler Proof Equipment"

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- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal.
- 2.1.2 Conductors in inaccessible ceiling spaces and partitions are to be installed in electrical metallic tubing in accordance with Specification Section 16700.
- 2.1.3 Conceal all wiring above finished suspended ceilings, except where otherwise noted.
- 2.1.4 Outlet boxes are to be code gauge, galvanized steel, of a depth necessary to accommodate the number of wires and the device contained therein.
- 2.2 **SECURITY SYSTEM**
- 2.2.1 Existing Security System Control Panel is by DSC.
- 2.2.2 Consult with security system manufacturer to determine accessories and wiring diagrams required to extend the existing security system. Extras will not be granted for failure to consult with fire alarm manufacturer.
- 2.2.3 **Detection Devices**
- 2.2.3.1 Door contacts are to be sleeved to fit flush in door frame. Provide repulsion type magnet contacts, suitable for wide gap 2.22 cm (.875"), SPDT contacts, white finish, type similar to Sentrol 1078 CAQ series.
- 2.2.3.2 Motion detectors with digital motion detection (no analog detection) circuitry and shielded from EMI and RFI signals, 12 m x 12 m (40' x 40') range with 110° viewing angle, complete with form C relay and anti-tamper switch. DSC LC-120-PI.
- 2.2.4 **Wiring**
- 2.2.4.1 All wiring to be a minimum 22 gauge four conductor, CMP rated, as per manufacturer's recommendations.
- 2.2.5 All wiring to be a minimum 22 gauge four conductor, CMP rated, as per manufacturer's recommendations.
- 2.2.6 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":
- DSC
- 3 Execution
- 3.1 **GENERAL INSTALLATION**
- 3.1.1 Provide all necessary wiring, conduits, outlet boxes and devices for a complete system. Conceal all wiring.

- 3.1.2 Install all wiring to manufacturer's recommendations. Conceal all conduit within ceiling spaces, walls or partitions, where possible.
- 3.1.3 Submit complete detailed wiring diagrams with description of system upon completion as per Section 16100. Provide all required instructional support to permit correct use of system by staff members.
- 3.1.4 Coordinate with door hardware supplier all requirements for system components, door strikes, concealed door contacts in particular. Coordinate power and electrical parameters with the door hardware supplier.
- 3.1.5 Included in Base Bid for manufacturers representative to spend four hours on site for training Owner's Staff on the operations, maintenance and setup of the access control system. Notify Consultant seven days in advance of scheduled training.

3.2 SECURITY SYSTEM

- 3.2.1 Flush-mount door contacts in new doors/frames. Wire and connect each door contact to a separate system alarm zone as indicated.
- 3.2.2 Do not install detectors and door contacts until all room finishes, door trim and seals have been installed.
- 3.2.3 Mount entry delay horns in ceiling space above key pad.
- 3.2.4 Provide all necessary programming with documentation and backup. Update if available or provide one installation manual, two programming worksheets, 10 sets of User manuals, and 20 quick reference cards. Provide hardware means of convenient backing up and restoring the system program.
- 3.2.5 Wire all detection devices using form C contact and end of line resistor to provide full supervision against open circuits. Where provided, wire NC tamper switch in series with end of line resistor to provide trouble at panel if activated.

3.2.6 Operation

3.2.6.1 System Disarming

- 3.2.6.1.1 Opening a designated entry doors will activate door contacts.
- 3.2.6.1.2 Audible entry (delay horn) tone will advise the operator that the system is armed and the delay on entry has been activated. The operator has 15 seconds to enter their P.I.N. number to disarm the system.

3.2.6.2 System Arming

- 3.2.6.2.1 The last person leaving the premises will perform a visual check at the keypad to ensure all protected zones are clear.
- 3.2.6.2.2 In the event of a trouble on a zone, the LCD keypad will display in "English" text identifying the zone at fault. Should the user be unable to clear the affected zone, he/she will have the ability based on code authority to bypass the affected zone.

- 3.2.6.2.3 Once clear the user enters his/her P.I.N. number, arming the alarm system.
- 3.2.6.2.4 A user's definable time will allow egress through the designated exit.
- 3.2.6.2.5 Based on program definition the security system control panel will seize the telephone line, dial and connect to the monitoring station. A full transmission would include the user number arming the system along with any bypassed zones that the user may have bypassed.

3.2.6.3 Motion Detectors

- 3.2.6.3.1 On activation of a motion detector, the system panel will initiate an alarm signal.
- 3.2.6.3.2 On activation of a motion detector tamper switch, the system panel will initiate a trouble signal.

3.2.6.4 Door Contacts

- 3.2.6.4.1 Activation of a door contact defined as "instant", the system panel will initiate an alarm signal.
- 3.2.6.4.2 Activation of a door contact defined as "delay", the entry tone will sound and at the end of the programmed delay time period, the system panel will initiate an alarm signal if the system has not been disarmed.

3.3 VERIFICATION AND COMMISSIONING

- 3.3.1 Verify system and all connected components operation, and provide written Certificate of Verification.
- 3.3.2 Notify Owner and Consultant minimum seven days in advance of scheduled verification.
- 3.3.3 Provide all necessary tools, ladders and equipment.
- 3.3.4 Ensure appropriate subcontractors, and manufacturer's representatives and security specialists are present for verification.
- 3.3.5 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - 3.3.5.1 Sturdiness of equipment fastening.
 - 3.3.5.2 Non-existence of installation related damages.
 - 3.3.5.3 Compliance of device locations with drawings and reviewed shop drawings.
 - 3.3.5.4 Compatibility of equipment installation with physical environment.
 - 3.3.5.5 Inclusion of all accessories.

- 3.3.5.6 Device and cabling identification.
- 3.3.5.7 Application and location of ULC approval decals.
- 3.3.6 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
 - 3.3.6.1 Measurements of coverage patterns
 - 3.3.6.2 Connecting joints and equipment fastening.
 - 3.3.6.3 Compliance with manufacturer's specification, product literature and installation instructions.
- 3.3.7 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
 - 3.3.7.1 Operation of each device individually and within its environment.
 - 3.3.7.2 Operation of each device in relation with programmable schedule and or/specific functions.
- 3.4 **ACCESSORIES**
 - 3.4.1 Turn accessories (reference cards, proximity cards, etc.) over to Owner at end of construction. Provide signed letter from Owner listing items and quantities of accessories confirming receipt, and include in electrical manuals.

END OF SECTION

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- 1 General
 - 1.1 **CERTIFIED SYSTEM VENDOR**
 - 1.1.1 Data Communications work as specified will be the responsibility of the Contractor and equipment Vendor to:
 - 1.1.1.1 Provide a minimum 15 year complete system performance warranty.
 - 1.1.1.2 Provide a certified CAT 6 compliant wiring system compliant wiring system for based on contract documents.
 - 1.1.1.3 Perform the pulling of all voice and data system cables.
 - 1.1.1.4 **ONLY** qualified technicians directly employed by the Contractor and Vendor trained technicians will terminate all cables (at both ends), test and perform cross-connects.
 - 1.1.1.5 After completion, provide testing as per ANSI/EIA/TIA-568A Addendum 5 on all cable runs, and documentation of test results.
 - 1.1.1.6 Provide and install equipment as specified herein.
 - 1.1.1.7 Provide documentation of the installation.
 - 1.1.1.8 Provide System Vendor Letter of Certification/Warranty upon completion of job, which will include the notification of a CAT 6 compliant performance level, the Certification/Warranty Number, the identification of the installation by the location and installation date.
 - 1.1.2 Approved Certified System Vendors are required to provide a complete voice/data system including all cables, fibre optic cables, patch cable, outlet jacks, patch panels, fibre patch panels which meet compliance requirements.
 - 1.1.3 The Contractor's technicians are to have extensive training by the Certified System Vendor on the installation, terminations, testing and verification of the Vendors complete CAT6 system.
 - 1.1.4 The following manufacturers are considered as equal, subject to the requirements of Clause "Material and Equipment":
 - CAT 6: Hubbell or AMP
 - 1.2 **PREAPPROVED CONTRACTORS**
 - 1.2.1 AMP or Hubbell Certified System Vendors
 - 1.3 **SUBMITTALS**
 - 1.3.1 **Shop Drawings**
 - 1.3.1.1 Supply Shop Drawings in accordance with Section 16001 "Electrical General provisions". Do work in accordance with reviewed Shop Drawings.

- 1.3.1.2 Submit complete cabling system layout for voice and data, cable routing summary and cable outlet designations.
- 1.3.1.3 All cabling to be CMP rated.
- 1.3.1.4 Submit detailed layout drawings for termination racks.
- 1.3.1.5 Manufacturer's data on all devices, cables, patch panel, etc.
- 1.3.1.6 Detail exact location of equipment indicating wiring raceways, pull, junction and terminal boxes.

2 Products

2.1 **HORIZONTAL DISTRIBUTION SYSTEM**

- 2.1.1 The Horizontal Distribution System delivers connectivity from the Patch panel in the LAN Room to the work area. Four pair CAT6 UTP CMP rated cables will be used for this purpose.
- 2.1.2 Horizontal cabling will be terminated within the LAN Room and at the Telecommunications outlet, using the products specified herein. Quantities must be determined by the cable system installer after review of the Drawings.
- 2.1.3 Horizontal cabling for phones located in the school will be terminated on a dedicated patch panel in each LAN room.
- 2.1.4 Provide horizontal cabling for analog phone outlets as shown on the drawings. Terminate on 110 punch down block located in LAN Rooms.

2.2 **RACEWAY**

- 2.2.1 Refer to Section 16700 for raceway details.

2.3 **SYSTEM COMPONENTS**

- 2.3.1 **Jacks:** Provide suitable Cat 6 components to form an installed system.

- 2.3.1.1 **Jack Colours**

- DATA:** White

- Smart Board Link:** Orange

- Phone:** Black

- 2.3.1.2 Provide stainless steel flush mounted plates with label designations. Semtron FM-0E-AMP-LAB Series.

- 2.3.2 **Voice and Data Cable:** Provide cable solution to meet certification.

2.3.3 Patch Panels

2.3.3.1 ALL Patch Panels used must be of the same brand as the Cable and Modular Jack used. Patch panels must be installed in a specified location in a wall mounted rack or a wall bracket as required.

2.3.3.2 Patch panels must provide 24 or 48 ports, according to need and be wired to T568A. Patch panels must be augmented with horizontal management panels (front) and rear cable support, to properly dress, terminate and manage the installed cables and provided patch cords. **All cabling is to be terminated in numerical order according to the School's room number system. (Example: 100, 101, 101A, 101B, 102-1, 102-2, 103...).** The front of each module must be capable of accepting 9 mm to 12 mm labels. Patch panels must be UL Listed and CSA certified.

2.3.4 Provide minimum 25% spare capacity on all new patch panels.

2.3.5 Provide dedicated patch panels for VOIP telephone outlets.

2.3.6 Patch Cables

2.3.6.1 All patch cables supplied must be of the same brand as the terminations and horizontal cable used. Patch Cords used at the telecommunication rack and at the workstation must be prefabricated stranded Cat 6, 24 AWG, 4 pair assemblies.

2.3.6.2 In the wiring closet, 6' patch cords must be provided to cross-connect between the patch panels and network equipment. One patch cord per terminated outlet is to be provided. Six foot patch cords are to be labelled with Brady style numbers on both ends corresponding to the patch panel port number for which the cable is intended. As well, each workspace outlet to include one 10' Cat 6 patch cord.

2.4 TELECOMMUNICATIONS GROUND BUSBAR

2.4.1 Provide telecommunications ground busbar in each equipment room as shown on the Drawings. Busbar to be predrilled 1/4" thick copper with fiberglass-reinforced unsaturated polyester stand-off insulators.

2.4.2 For equipment rooms with 1 - 4 racks, provide 2" x 12" busbar with 9 predrilled holes. Erico EGBA series, pattern CC or equal.

2.4.3 For equipment rooms with 4 - 10 racks or rooms with raised access flooring, provide 2" x 24" busbar with 38 predrilled holes. Erico TGBA series or equal.

3 Execution

3.1 INSTALLATION

3.1.1 The Contractor will supply, install, test, document and certify the cable system according to this specification and must comply with cable plant installation and termination procedures as specified in the CSA T529-95 Standard for horizontal and backbone copper and fibre-optic cabling systems as well as the manufacturer's CSV cable installation practices.

- 3.1.2 The Contractor will correct deficiencies at no cost to the Owner.
- 3.1.3 Base Wiring includes:
1. Cable
 2. Jacks/Patch Panel
 3. Distribution and Termination
 4. Testing and Labelling
 5. Patch Cables
- 3.2 **IMPLEMENTATION**
- 3.2.1 **Horizontal Cabling and Termination**
- 3.2.1.1 Within the LAN Room, horizontal cable terminations and rack installation will be as per Drawing Details and SCCDSB specifications.
- 3.2.1.2 **Horizontal cabling** will be terminated on Patch panels, mounted in 19" standard racks within the LAN Room. Provide one dedicated data cable per telecommunications outlet (or as specified on Drawings). Horizontal data cable length to the farthest outlet will not exceed 90 m (295') as specified in CAN/CSA-T529. All Data cabling is to be Category 6 CMP. CMR cable will not be permitted.
- 3.2.1.3 Provide sufficient vertical and horizontal wire managers on the rack for Patch Cord management.
- 3.2.1.4 Unused ports on faceplates will be filled with the appropriate blank insert.
- 3.2.1.5 Each 4 pair cable to be terminated in an eight position module. Data pin/pair assignment must meet T568A Standard.
- 3.2.1.6 All cable runs will be completed without splices.
- 3.2.2 Support cables using cable clamps or wiring harnesses. Utilize cable trays and/or cable hanger to manage cable in orderly fashion.
- 3.2.3 Route all cable in such a way as to ensure maximum separations from sources of EMI as defined in CAN/CSA T529. Do not run cables above light fixtures, motors, speakers, air diffusers or similar locations.
- 3.2.4 Designate all data and voice outlets as per Drawings and Specifications.
- 3.2.5 Place all exposed cabling in a neat and professional manner and route as per Specifications and Drawings. Comb and/or route cabling in such manner as to ensure bundled cabling is neat and parallel to other cables in bundle. Tie-wrap all exposed cable bundles at maximum of every 200 mm (8").
- 3.2.6 Securely mount data and voice outlets at all work area locations using screws as opposed to self adhesive strips.

3.3 LABELLING

- 3.3.1 Labelling must conform to these following SCCDSB Standards:
- 3.3.1.1 Brady type labelling within 6" of each end of the horizontal cable to be used to indicate room number behind the patch panel. Brady type labelling within 6" of end of the horizontal cable to be used to indicate patch port number inside the receptacle box.
- 3.3.1.2 Labelling on the front coverplate of the outlet must be as follows: the word "DATA" and "PHONE" in capital letters, patch panel port number and closet number if more than one closet exists in the building.
- 3.3.1.3 Labelling on the label area of the patch panel using manufacturer supplied labelling material must indicate the room number and number of the drop within that room, if there is more than one.
- 3.3.1.4 All other labelling is to be done using mechanically printed labels on permanent self adhesive white labels with minimum 3/16" height.

3.4 TESTING

- 3.4.1 All cables will be tested as per ANSI/EIA/TIA-568B. All test records will be completed by the CSV. All test instrumentation, test records, and labour required for the testing will be supplied by the CSV/Contractor.
- 3.4.2 All cable faults will be corrected by the CSV/Contractor at no cost to the Owner. Splicing of cable pairs is not permitted for the repair of any cables. If a cable is found to be defective, it must be replaced.
- 3.4.3 Provide test result documentation within two weeks of completion of cable installation.
- 3.4.4 Inform Consultant 10 working days before testing is carried out so that the Consultant can witness all tests. Rectify wiring deficiencies immediately.
- 3.4.5 Carry out testing only after installation and termination/labelling of communications cabling at; floor tiles, surface-mounted telecommunications outlets, wall-mounted telecommunications outlets after substantial completion.
- 3.4.6 All test results will be verified by SCCDSB IT staff prior to invoicing.
- 3.4.7 The completed installation will be inspected by SCCDSB IT staff prior to invoicing.

3.5 DOCUMENTATION

- 3.5.1 Provide complete documentation of the installation and testing.
- 3.5.2 Provide Vendor Certification upon completion of cable installation.
- 3.5.3 Provide records and AutoCAD Drawings complete with all jack locations and numbers (voice and data).

3.5.4 All documentation will be verified by SCCDSB IT staff prior to invoicing.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 The requirements of the Instructions to Bidders, the Contract Forms, the General Provisions as hereinbefore written will form a part of the following Specifications and the Contractor will consult them in detail for instructions governing the work.
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Intercom System**
- 1.2.1.1 Furnish and install all equipment, accessories and materials in accordance with these Specifications and Drawings, necessary to provide a complete and functional intercommunication, paging, program and time signal (program clock) system.
- 1.2.1.2 All items of equipment will be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and Drawings detailing all interconnections.
- 1.2.1.3 The Contractor will be an established communications and Electronics Contractor that currently maintains a fully equipped service facility capable of rendering full and timely service to the system. Contractor must be authorized/qualified supplier and installer of the specified equipment.
- 1.2.1.4 Except where specifically noted, all equipment supplied will be the standard product of a single manufacturer of known reputation and experience in the industry.
- 1.2.1.5 The Contractor is to provide in-service training as required, to thoroughly acquaint the staff with all system features and functions at the convenience of the Owner's staff. Operator's manuals and user guides will be provided prior to training in order for the staff to familiarize themselves with the system.
- 1.2.1.6 It is the sole responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these Specifications. The functions and features specified are vital to the operation of this facility, therefore, inclusion in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of these Specifications.
- 1.2.1.7 **A copy of the PA/Intercom software must be turned over to the Owner complete with all passwords, etc., required to make programming modifications to the system. Proprietary programming software will not be acceptable.**
- 1.3 **SPRINKLER SHIELDS**
- 1.3.1 This building will be fully sprinklered. All surface mounted panels and enclosures will include sprinkler shields. Ensure all conduit and fittings in sprinklered areas meet the requirements outlined in 16001 clause "Sprinkler Proof Equipment"

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- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal.
- 2.1.2 Conceal all wiring above finished suspended ceilings, except where otherwise noted.
- 2.2 **INTERCOM SYSTEM**
- 2.2.1 This Specification includes but is not necessarily limited to the supply and installation of intercommunications system as described herein and as indicated on Drawings.
- 2.2.2 All equipment and component assemblies will be CSA certified or bear evidence of submission to "Special Inspection" procedures. System components will be as manufactured by Dukane and as follows:
- 2.2.2.1 The system will be a microprocessor controlled unit utilizing NMOS technology for memory, sensing and logic control and will lend itself to modular expansion to a total capacity of 150 stations.
- 2.2.2.2 The central switch will provide an RS232 serial data port for connection to a computer, for on-site diagnostics. It will be possible to determine circuit and software faults and facilitate software changes.
- 2.2.2.3 The central switch will utilize standard dual tone multi-frequency (DTMF) signalling for conformance with standard telephone systems and practices.
- 2.2.2.4 System control will be provided by a standard, single-line, "touch-tone" telephone set equipped with a "sidecar" digital display. Provision for a priority telephone will be provided. System to be integrated with School Key Telephone system via an unused C.O. port in the Electronic Key Service Unit (telephone system). (Provide "priority line" module to override control of normal telephone line).
- 2.2.2.5 Advanced automatic level control, volume limiters and voice operated switching will be an integral part of an intercom amplifier capable of delivering a minimum of 2 W (RMS) of audio power per station.
- 2.2.2.6 Control stations will be able to connect to a classroom by simply dialling the architectural number of the station.
- 2.2.2.7 The system is to maintain statistics of operation of the main system functions. Minimum diagnostic functions are:
- Check active list of activity within system.
 - DTMF test
 - I/O diagnostics of each line and device
 - Capability of checking each link, and blocking a defective link.
- 2.2.2.8 The system will provide facilities to assign a loudspeaker location to any one or more of the eight software programmable zones for zone paging or time-tone signalling (mechanical selection not permitted).

- 2.2.2.9 The system will be equipped with an audio power amplifier to facilitate the distribution of all-call announcements, zone paging, emergency evacuation tones and program material and to be rated at a minimum of 2 W/station.
- 2.2.2.10 Program selection to classrooms or classroom zones will be a “dial-up” procedure. Switchbanks are not to be provided.
- 2.2.2.11 Program sources may be external or originate from an AM-FM tuner/MP3 and a compact disk player.
- 2.2.2.12 The system will provide facilities for digital readout displays upon which incoming calls are identified by their designated architectural number. The display will show visually, in chronological order, three calls at a time. Provision to preview all calls will be provided.
- 2.2.2.13 Emergency calls will override normal calls and will annunciate with the letter “EMER” and the calling station number. Response to registered calls in the display will be acknowledged by the depression of a single button on an authorized administrative telephone.
- 2.2.3 The system will contain a master clock as follows:
 - 2.2.3.1 Capacity for storing 350 time signal events and 100 holiday events in non-volatile memory.
 - 2.2.3.2 Ability to review, edit and delete events. Events may be programmed to one, any or all eight zone circuits.
 - 2.2.3.3 Selection of any one of eight schedules to allow flexibility due to seasonal changes or special events.
 - 2.2.3.4 Fully automatic holiday program execution. Automatic Daylight Savings Time change.
 - 2.2.3.5 Separate bell duration for each zone circuit. Latched operation to control other devices.
 - 2.2.3.6 Ability to test all output zone circuits.
 - 2.2.3.7 Output relay, Type Form-C rated at 5 amps, 120 VAC to be provided on all eight zone circuits.
 - 2.2.3.8 Crystal-controlled time base for assured accuracy with lithium battery to provide not less than 5 years battery backup for timekeeping functions.
- 2.2.4 **Materials:** The intercom system central control unit to include:
 - 2.2.4.1 Central switch/master time and program clock.
 - 2.2.4.2 Audio power amplifier, 2 watts/station.

- 2.2.4.3 Commercial AM-FM tuner compact disk player/writer, MP3, Audio In, USB, iPod dock with digital display.
- 2.2.4.4 Factory assembled in a 508 mm (20") EIA steel cabinet complete with all necessary power supplies, blank panels and flexible connecting cables/terminal. Existing racks may be reused where compatible with the new equipment. Provide custom racks where required to suit mounting in existing millwork.
- 2.2.4.5 Administrative desktop base units.
- 2.2.4.6 Administrative desk unit LCD display located at Secretary's desk (master station).
- 2.2.4.7 PTT desk microphone. Location as shown or as directed.
- 2.2.5 **Speaker Assemblies**
- 2.2.5.1 **Classroom Modules:** Provide McBride 8LS822-19 speaker assembly, complete with white square baffle, 25/70 volt transformer and speaker. Provide McBride MCSW-1 call switch assembly with rocker selection of Call or Privacy, on MCWP13SW stainless steel single gang wall plate, mounted on classroom control panel.
- 2.2.5.2 **Ceilings:** Provide McBride 8LS822-19 speaker assembly, complete with white round baffle, 25/70 volt transformer and speaker. Unit to be installed in AEG E10 backbox in ceiling tiles.
- 2.2.5.3 **Gymnasiums:** Provide McBride 8LS822-19 speaker assembly, complete with white square baffle, 25/70 volt transformer and speaker. Unit to be installed in McBride MC20E recessed backbox for new applications or an McBride SMC20E backbox for retro-fit applications. Provide McBride MCSW-1 call switch assembly with rocker selection of Call or Privacy mounted at light switch height below speaker assembly.
- 2.2.5.4 **Washroom Station:** Provide McBride 8LS822-19 speaker assembly and McBride MC10E recessed backbox in conjunction with the Camden CX-WEC10 kit (installed by door hardware contractor). Refer to drawings for additional details.
- 2.2.5.5 **Outdoors (existing walls):** Provide Fourjay Industries IS4-T16 speaker assembly, complete with stainless steel grille cover, 25/70 volt transformer and 16W speaker.
- 2.2.5.6 **Mechanical Rooms:** Provide Fourjay Industries 205 Series 5 watt re-entrance horn with McBride MCSW-1 call switch assembly with rocker selection of Call or Privacy, on MCWP13SW stainless steel single gang wall plate with telephone handset.
- 2.2.6 The following manufacturers will be considered equal :
- Dukane CH1000 Series
Carehawk CH-1000 Series
Telecor SL

- 3 Execution
- 3.1 **INTERCOM SYSTEM**
- 3.1.1 Provide a complete functioning intercom system as specified and as indicated on the Drawings.
- 3.1.2 Provide all conduits, outlet and wiring for a complete system. All cable to be CMP rated. CMR cable will not be permitted.
- 3.1.3 Cables to be colour coded to manufacturer's recommendation.
- 3.1.4 **Testing**
- 3.1.4.1 Entire system is to be installed and tested by a qualified sound technician.
- 3.1.4.2 Upon complete, test each station and provide a comprehensive room-by-room report to the Consultant.
- 3.1.4.3 Allow for a minimum of two hour's instruction of operation on two different occasions. (Total of four hours). First training session to be completed during the week before School starts, at a time suitable to the Users.
- 3.1.4.4 In addition to the above, provide a qualified person familiar with the operation of the system to assist the School Administration in the operation of the system between 0800 hours and 1000 hours on the first day of school.

END OF SECTION

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- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions".
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Fire Alarm System**
- 1.2.1.1 Supply and install all equipment and accessories to extend the existing electrically supervised, coded, zoned fire alarm system by Edwards as described herein and as shown on plans. Fire alarm devices are to be in accordance with the Ontario Building Code and associated standards.
- 1.2.2 **Valve Supervisory System**
- 1.2.2.1 In conjunction with the fire alarm system, supply and install all equipment and accessories for an electrically supervised valve system.
- 1.2.2.2 The system is to provide individual supervision of sprinkler and fire standpipe supervised valves and flow switches indicated.
- 2 Products
- 2.1 **FIRE ALARM CONTROL PANEL**
- 2.1.1 Existing Fire Alarm Control Panel is Edwards QuickStart.
- 2.1.2 Consult with fire alarm manufacturer to determine accessories and wiring diagrams required to extend the existing fire alarm system. Extras will not be granted for failure to consult with fire alarm manufacturer.
- 2.2 **ADDRESSABLE DEVICES**
- 2.2.1 Provide suitable wire guards for all devices where indicated on the drawings.
- 2.2.2 **Manual Pull Stations:** Manual single action break-glass addressable pull stations to be Edwards SIGA-270. Provide flush box for all new installations. Provide auxiliary contacts as required for release of magnetic locks where noted on the drawings.
- 2.2.2.1 Provide STI Series Stopper II UL/ULC pull station cover with integral local alarm where indicated on the drawings. To be Edwards STI-1100.
- 2.2.3 **Photoelectric Smoke Detectors:** Addressable photoelectric smoke detectors to be Edwards SIGA-PS. Provide SIGA-SB standard sensor base, SIGA-RB sensor base with addressable supervised relay driver, or SIGA-AB4G audible base as indicated on the drawings.

- 2.2.4 **Automatic Heat Detectors:** Addressable fixed temperature/rate-of-rise sensing automatic heat detectors to be Edwards SIGA-HRD or SIGA-HFS with standard sensor base.
- 2.2.5 **Multi-Sensor Detectors:** Addressable combination photoelectric smoke detector and fixed temperature/rate-of-rise sensing automatic heat detector in one housing. To be Edwards SIGA-PHS. Provide SIGA-SB standard sensor base, SIGA-RB sensor base with addressable supervised relay driver, or SIGA-AB4G audible base as indicated on the drawings.
- 2.2.6 **Addressable Monitor Module:** For monitoring valves, flow switches, and conventional devices, Edwards SIGA-UM. Monitor modules shall be capable of powering 2-wire smoke detectors.
- 2.2.7 **Addressable Control Module:** Provide control relays to allow for various addressable control functions, Edwards SIGA-CR. Relays shall be rated for 0.5A at 120VAC. Relay to change to open state upon loss of communication.
- 2.2.8 **Duct Detectors:** Duct detectors are to be Edwards SIGA addressable smoke detectors. Provide NEMA 4X weatherproof duct housing enclosure with heaters where exposed to the weather.
- 2.2.8.1 For ducts with air velocity range of 30 to 1220 m/min (100 to 4000 ft/min), provide a Edwards SIGA-SD duct detector with sampling tube. Size of tube to be coordinated on site.
- 2.2.8.2 Provide ceiling-mounted remote indicators for each detector located within a ceiling space.
- 2.2.9 **Zone Isolation Modules:** Provide isolator at zone separations, fire separations and where required by the manufacturer. Alternately provide SIGA-IB isolator bases.
- 2.2.10 **Power Isolation Modules:** Provide 24VDC power isolator at zone separations, fire separations and where required by the manufacturer.
- 2.3 **NON-ADDRESSABLE DEVICES**
- 2.3.1 Provide suitable wire guards for all devices where indicated on the drawings.
- 2.3.2 **End-of-line Resistors:** To be sized to ensure correct supervisor current flows in each circuit. Provide faceplates for mounting on single gang plate bearing ULC label. Fire alarm faceplates material and colour are to match wiring device faceplate.
- 2.4 **NOTIFICATION APPLIANCES**
- 2.4.1 Provide suitable wire guards for all devices where indicated on the drawings.
- 2.4.2 **Horn:** Wall mounted horn devices are to have red housing with white "FIRE" lettering. Edwards G1RF-HD.

- 2.4.3 **Horn-strobes (Wall Mounted):** Wall mounted horn-strobe devices are to have red housing with white "FIRE" lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards G1RF-HDVM.
- 2.4.4 **Horn-strobes (Ceiling Mounted):** Ceiling horn-strobe devices are to have white housing with red "FIRE" lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards GCF-HDVM.
- 2.4.5 **Strobes (Wall Mounted):** Wall mounted strobe devices are to have red housing with white "FIRE" lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards GRF-VM.
- 2.4.6 **Strobes (Ceiling Mounted):** Ceiling mounted strobe devices are to have white housing with red "FIRE" lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards GCF-VM.
- 2.4.7 Provide red adapter skirt for surface mounted devices on walls.
- 2.4.8 Provide tile bridge for all devices mounted in acoustic ceiling tile ceilings.
- 2.4.9 Provide wire guard with mounting plate where indicated on the drawings.
- 2.5 **PASSIVE GRAPHIC ANNUNCIATOR**
- 2.5.1 Provide passive graphic mounted adjacent to the main panel and annunciator panels. Graphic is to be minimum 410 mm x 410 mm (16" x 16") graphic outline of building, minimum five zone identification colour, mounted in a frame behind a acrylic faceplate with tamperproof screws of building identifying each zone.
- 2.5.2 The graphic is to be designed with each zone a different colour to the adjacent zone for easy identification. All zones are to be displayed and labelled same as annunciator. Location of fire alarm system panels to be shown on passive graphic.
- 2.5.3 In partially sprinklered buildings, identify areas that are sprinklered utilizing hatching.
- 2.5.4 Identify locations of supervised valves, flow switches and other fire suppression systems. Passive graphic, annunciator and field device identification tags must be displayed and labelled verbatim.
- 2.5.5 Floor plans to be shown in 'track up' orientation based upon location of passive graphic.
- 2.6 **ANCILLARY DEVICES**
- 2.6.1 **Electromagnetic Door Holders:** Provide electromagnetic door holders, flush mounted, Edwards 1504-AQN5 or 1505-AQN5 as required. Confirm voltage prior to installation.
- 2.7 **WIRING**
- 2.7.1 Provide new wiring to conform with requirements of Ontario Electrical Safety Code Section 32, and applicable Codes and Standards. Size wiring in accordance with

Class 2 requirements, but protected from mechanical injury or other injurious conditions such as moisture, excessive heat or corrosive action in accordance with Class 1 requirements.

2.7.2 General wiring with a floor area, conductors to be solid copper Securix II, Type 105°C PVC, 300 volt. Minimum size of any conductor: for alarm receiving circuits and remote annunciators, #16 AWG solid. Wire resistance in these circuits not to exceed 50 ohms. For audible signal circuits minimum #16 AWG solid. Voltage drop to any signal not to exceed 10%.

2.7.3 Conductors in multi-conductor cables to have allowable temperature rating of at least 105°C (200°F).

2.7.4 All conductors to be as per Ontario Electrical Safety Code and installed in metallic raceway.

2.7.5 Install conductors entirely independent of all other wiring and do not enter fixture, raceway, box or enclosure occupied by other wiring.

2.7.6 Splices will not be permitted unless otherwise indicated on the Drawings or specified. Where splices are necessary and approved by the Consultant, use approval metal contact electrical crimp type connectors.

2.7.7 All wiring must be clear of shorts, open and grounds on completion of work.

2.8 **MANUFACTURER**

2.8.1 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Edwards

3 Execution

3.1 **FIRE ALARM SYSTEM INSTALLATION**

3.1.1 Fire alarm system installation to be in accordance with the latest edition of CAN/ULC S-524 "Standard for the Installation of Fire Alarm Systems".

3.1.2 **Wiring**

3.1.2.1 Riser diagrams on drawings show general design intent. Obtain complete wiring diagrams from Fire Alarm manufacturer prior to rough-in.

3.1.2.2 Provide all wiring in conduit and in accordance with Fire Alarm equipment manufacturer's requirements.

3.1.2.3 Identify signal circuit, 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.

3.1.2.4 All conventional initiating wiring to be Class B.

- 3.1.2.5 Provide addressable loops as indicated. All addressable wiring to be Data Communications Link Style A (DCLA). Provide line isolation devices at every circuit/zone change and every fire separation crossing, per CAN/ULC-S524 which automatically opens circuit when line voltage drops to protect the rest of the loops on either side.
- 3.1.2.6 Addressable loops must have at least 30% spare capacity for addition of future devices. Do not exceed 140 devices total on any addressable loop.
- 3.1.2.7 All initiating and D.C. signal circuits extending from the fire alarm control to be current limited and protected, in accordance with Ontario Electrical Safety Code requirements.
- 3.1.2.8 The extended circuit wiring to each alarm receiving circuit or signal circuit is to be individually supervised with no common wiring.
- 3.1.2.9 Install all wiring in EMT metal conduit above ceilings, and surface in mechanical spaces, and in maintenance/storage spaces with exposed ceilings.
- 3.1.3 **Control Panels, Transponders and Annunciators**
- 3.1.3.1 Install the main control panel and annunciators as shown on the Drawings.
- 3.1.4 Passive graphic, annunciator and field device identification tags provided by Fire Suppression Contractor must be displayed and labelled verbatim.
- 3.1.4.1 Review zone identification with Fire Inspection Department prior to programming, labelling and manufacturing passive graphics.
- 3.1.5 **Devices**
- 3.1.5.1 Install detectors in accordance with CAN/ULC Standard S524 latest edition "Installation of Fire Alarm Systems".
- 3.1.5.2 Location of devices shown on Drawings are approximate and must be adjusted to site conditions. If location of existing device to be replaced is not properly centred in individual rooms, adjust to suit.
- 3.1.6 Mount detectors on ceiling as per CAN/ULC Standard S524 standard unless otherwise specified herein, with the minimum and maximum distances as required for the respective type of detector, at the highest point where variations in ceiling height exist. Do not mount detectors on sides, on undersides, or less than 600 mm (20") from walls, beams, joints, ducts, open web steel joists, bulkheads or any structure projecting below actual ceiling height and less than 450 mm (18") from air handling or heating outlets.
- 3.1.7 Should interference from obstruction, lamp positions, air outlet or heat radiating surfaces be encountered in locating any detector where shown, locate the detector as near as possible to the indicated position, clear of obstacles, to the satisfaction of the Consultant, but maintain a clear space of 600 mm (24") on the ceiling, below and around.

- 3.1.7.1 Duct detectors to be mounted in supply air ducts unless otherwise indicated on the Drawings.
- 3.1.7.2 Mount end of line resistors beside last device. Document location of end of line resistors and place inside fire alarm control panel and in maintenance manuals. Provide PTouch labels on end of line faceplates indicating circuits contained within.
- 3.1.8 Locate all addressable monitor modules adjacent to equipment being monitored.
- 3.1.9 Locate all addressable control modules for motors adjacent to starters/motor control centres or building automation control panels as site directed.
- 3.1.10 Locate all addressable control modules not controlling motors within 3' of device being controlled, where practicable.
- 3.1.11 **Ancillary Devices**
- 3.1.11.1 Provide independent addressable control modules for each ancillary device shutdown.
- 3.1.11.2 Verify operating voltage of door hold open devices and magnetic locks supplied by door hardware contractor for tie into new system. Provide necessary transformation or relays.
- 3.1.11.3 Unless specified otherwise, power door hold-open devices from nearest unswitched lighting circuit.
- 3.1.11.4 Shutdown of fans to occur at starter separate from building automation controls. Where single point connections are provided to mechanical equipment, connect to fire alarm shutdown contact on mechanical equipment control panel.
- 3.1.11.5 Door hold open devices and latch retraction hardware to be installed in accordance with Ontario Building Code clause 3.1.8.12.
- 3.1.11.6 Magnetic locks to be installed in accordance with Ontario Building Code clause 3.4.6.15(4).
- 3.2 **VERIFICATION AND CERTIFICATION OF FIRE ALARM EQUIPMENT**
- 3.2.1 The Contractor is to provide a full set of Electrical Drawings and Specifications to the fire alarm system representative prior to starting the verification of the fire alarm system. Failure to do so may require the entire fire alarm system to be reverified. Fire alarm system representative to review drawings and provide comments to Consultant prior to commencing verification.
- 3.2.2 All construction work must be complete before verification of fire alarm system is started. Any modifications to the fire alarm installation after the verification has been commenced will require the entire system to be reverified. Where partial occupancies occur, the fire alarm system for the area to be occupied (including control units) shall meet the requirements of this Standard. Upon system completion, those parts of the fire alarm system tested to this Standard shall be retested in accordance with the requirements of CAN/ULC-S536, Standard for the

- Inspection and Testing of Fire Alarm Systems, prior to the release of the Verification Report.
- 3.2.3 Fire alarm technician to review existing building prior to date of verification and review any existing conditions requiring repair. Submit report minimum one week before commencing verification. Consultant will review and issue appropriate instruction.
- 3.2.4 Where a field device is replaced, the device shall be verified in accordance with CAN/ULC-S537-04.
- 3.2.5 Testing of all flow switches is to be with actual water flow activation. Supervised valve switches and other supervisory zones to be tested by closing valves or replicating the abnormal condition.
- 3.2.6 The Contractor is to engage the services of the Fire Alarm manufacturer's representative to verify the fire alarm system in accordance with CAN/ULC-S537-04.
- 3.2.7 Test all voice communication systems throughout building. Adjust speaker taps as required to provide a minimum common intelligibility scale (CIS) score of 0.70. Evaluate each acoustically isolated space separately. Provide appropriate reports for review by Consultant. Reports to include room name and number, speaker tap wattage, SPL and CIS at no less than 2 locations per room.
- 3.2.8 During the period of inspection by the manufacturer's representative, make available to the manufacturer's representative as many electricians as designated by the manufacturer's representative to complete the verification within the specified time frame.
- 3.2.9 Contractor is to supply Consultant with a list of deficiencies indicating areas where installation deviates from ULC Standards or Ontario Building Code. This list will be reviewed and authorized or rejected by Consultant prior to acceptance of certificate.
- 3.2.10 **Inspection Certification:** On completion of the inspection and when all the above conditions have been complied with, the Contractor is to provide to the Consultant:
- 3.2.10.1 A verification report identical to Appendix C of CAN/ULC-S537 completed by the fire alarm manufacturer's technician. Document C1 from CAN/ULC-S537 must be signed and dated by the technician upon completion of the verification.
- 3.2.10.2 A certificate of verification confirming that the inspection has been completed showing the conditions upon which such inspection and certification have been rendered. Certificate must be free of conditions noted. No additional exceptions or conditions are acceptable.
- 3.2.10.3 Proof of liability insurance for the inspection.
- 3.2.10.4 A letter separate from the Verification Report stating "All door hold open devices, including latch retraction/release have been tested by the fire alarm verifier and are installed and working, in accordance with Ontario Building Code 3.1.8.12".
- 3.2.10.5 Provide ESA Inspection Certificate.

3.2.11 Description of Fire Alarm System

3.2.11.1 Upon completion of the project, provide to the Owner a copy of CAN/ULC-S536-13 Appendix E "Description of Fire Alarm System for Inspection and Test Procedures". Provide type written copy of this form and provide soft copy with maintenance manuals.

3.3 FIRE WATCH - ALTERNATIVE MEASURES FOR OCCUPANT FIRE SAFETY

3.3.1 In the event of any shutdown of fire protection equipment or part thereof, the Fire Department and building occupants/owner should be notified. Instructions should be posted as to alternate provisions or actions to be taken in case of an emergency. These provisions and actions should be acceptable to the Chief Fire Official and be in accordance with the accepted Fire Safety Plan.

3.3.2 An attempt to minimize the impact of inoperative equipment should be made (i.e. where portions of a sprinkler, fire alarm system and standpipe system are taken out of service, the remaining portions will be maintained). Assistance and direction for specific situations should be sought from the Fire Department and be in accordance with the accepted Fire Safety Plan.

3.3.3 Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:

3.3.3.1 Notify the Fire Department and the monitoring station. Give your name, address and a description of the work and when you expect it to be corrected. The Fire Department should be notified in writing of shutdowns longer than 24 h;

3.3.3.2 Post notices on all floors by elevators and at entrances, stating the work and when it is expected to be completed;

3.3.3.3 Unless noted otherwise in the Fire Safety Plan, have staff or other reliable person(s) patrol the affected area(s) at least once every hour; and

3.3.3.4 Notify the Fire Department, the fire signal receiving centre, and building occupants/owner when work has been completed and systems are operational.

3.4 ANCILLARY DEVICE OPERATION

3.4.1.1 All door hardware connected to fire alarm are to release upon general alarm.

3.4.1.2 Outputs to building automation system and lighting control systems to activate upon general alarm.

3.4.1.3 Connect fire alarm panel to ULC remote monitoring station. Coordinate with Owner.

3.4.1.4 Outputs to shutdown air handling equipment to activate only upon activation of any duct detector. General alarm is not to shut down air handling equipment.

3.5 INSPECTION COSTS

3.5.1 Include all costs involved with this inspection in the total Bid Price.

3.6 TESTING

3.6.1 Tests of the complete system in the presence of the Owner and the Consultant are to include:

3.6.1.1 Spot check of devices to ensure proper connections and supervision.

3.6.1.2 Operation of an alarm initiating device on each detection circuit is to verify the required operation of alarm devices, annunciators, etc.

3.6.1.3 Operation of all other alarm initiating devices in a convenient, silent method (buzzer, light, meter, etc.) are to ensure connection to the proper circuit and function of the device.

3.6.1.4 Live smoke or open flame are not to be used for testing.

3.6.1.5 Test each area in stages to match the Work Schedule.

3.6.1.6 Demonstrate to Consultant and Owner the operation of ancillary functions (ie maglock and door hardware release, elevator recall, etc).

3.6.2 Provide assistance to the Fire Inspection Department for testing a minimum of 25% of the installed field devices and up to 100% of sprinkler/ standpipe devices (supervised valves, flow switches, etc). Correct deficiencies and retest any devices or zones operating incorrectly as directed by the Fire Inspection Department.

3.6.3 Integrated Systems Testing

3.6.3.1 Provide Integrated Systems Testing as indicated in CAN/ULC-S1001-11 "Integrated Systems Testing of Fire Protection And Life Safety Systems.

3.6.3.2 Contractor to engage with Fire Alarm manufacturer at testing phase or a 3rd party commissioning type contractor to arrange for this work. In general, systems to be tested for proper integration with the fire alarm system are noted in CAN/ULC-S1001-11 and include but are not limited to elevators, cooking equipment fire suppression systems, hold-open devices, electromagnetic locks, smoke control systems, emergency generators, audio/visual and/or lighting controls, notification systems, sprinkler systems, standpipe systems, fire pumps, water supplies, water supply control valves, freeze protection systems, fixed fire suppression systems.

3.6.3.3 Contractor to provide to consultant for approval, all proposed testing procedures and proposed reports prior to commencing test.

3.6.3.4 Provide completed reports upon completion of fire alarm verification and submission of verification reports and certificate.

3.7 TRAINING

3.7.1 The Contractor shall provide 2 hours training for the complete operation of fire alarm system.

3.8 SPARE PARTS

3.8.1 Provide spare fire alarm system parts, including programming and verification, as follows (minimum of 2):

Automatic Initiation Devices	:	10% of each type installed
Manual Pull Stations	:	5% of units installed
Signal Appliances	:	5% of each type installed
Monitor Modules	:	10
Control Modules	:	10
Duct Detector Housing	:	2

3.8.2 Turn spare parts over to Owner at end of construction. Provide signed letter from Owner listing items and quantities of accessories confirming receipt, and include in electrical manuals.

END OF SECTION

-
- 1 General
- 1.1 **GENERAL PROVISIONS**
- 1.1.1 Conform to the requirements of Section 16001, "Electrical General Provisions" and Section 16100, "Basic Materials and Methods".
- 1.2 **DESCRIPTION OF WORK**
- 1.2.1 Provide electric hand dryers, as indicated.
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal and must be CSA approved, ULC tested and listed.
- 2.2 **ELECTRIC HAND DRYERS**
- 2.2.1 Electric hand dryers to be no-touch type control, 120/208 volt single phase auto sensing, maximum 1500 watts, surface-mounted, stamped steel housing with white epoxy finish. Provide 5 year limited warranty.
- 2.2.2 Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands or other obstruction is not removed.
- 2.2.3 Combination Motor and Blower: vacuum type with automatic resetting thermal protector. 1/8 hp, 4800 RPM adjustable. Air velocity: 7300 LFM.
- 2.2.4 Heater: NiChrome resistance coil to provide an air temperature of 49°C (120°F) measured at average hand position of 102 mm (4") below air outlet.
- 2.2.5 Sound level not to exceed 67 dB.
- 2.2.6 The following manufacturers will be considered as equal subject to the requirements of Clause "Material and Equipment":
- American Dryer Advantage AD Series
- 3 Execution
- 3.1 **ELECTRIC HAND DRYERS**
- 3.1.1 Mount electric dryers securely to wall, as indicated, to prevent easy removal.
- 3.1.2 Dryer units are not to be installed until all wall, ceiling and floor finishes are applied, and all work within the room space is completed. Any units installed and damaged will be replaced at the expense of this Contractor.

- 3.1.3 Mounting height and location of dryers:
- 3.1.3.1 In washrooms with one dryer, mount at barrier free level. In washrooms with two or more dryers, mount one at barrier free level.
- 3.1.3.2 Mounting heights: (from bottom edge of dryer):
- | | |
|-----------------------|---------------|
| Men's Washroom | 1090 mm (43") |
| Women's Washroom | 1041 mm (41") |
| Kindergarten Washroom | 838 mm (33") |
| Barrier Free Washroom | 889 mm (35") |
- 3.1.3.3 Ensure a minimum clear floor space of 760mm by 1220mm (30" by 48") is provided in front of or parallel to hand dryers mounted at barrier free level.
- 3.1.3.4 Ensure hand dryers mounted at barrier free height are located within 610mm (24") horizontally from edge of barrier free lavatories or wash fountains. Notify Consultant prior to rough-in where hand dryer cannot be installed in this location.
- 3.1.3.5 Ensure a minimum of 510mm (20") is provided between adjacent hand dryers.

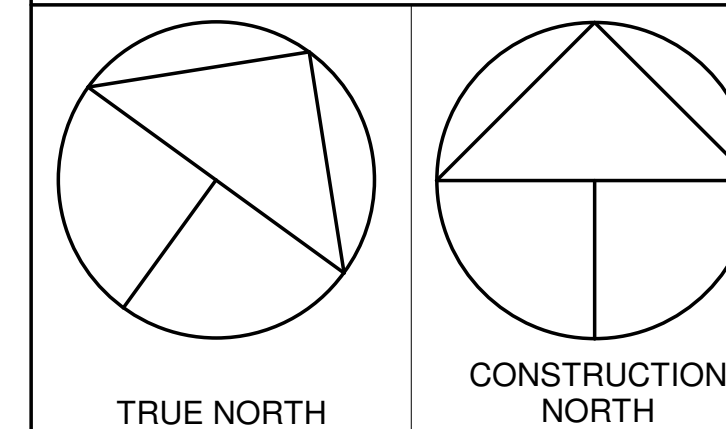
3.2 TESTING AND CLEANING

- 3.2.1 Inspect installation to verify secure and proper mounting. Test each dryer to verify operation, control functions, and performance. Correct deficiencies.
- 3.2.2 Clean surfaces and wash with mild soap.

END OF SECTION

MECHANICAL LEGEND					
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
PIPING					
	DOMESTIC COLD WATER		DRAIN WITH HOSE CONNECTION		CONCEALED SPRINKLER HEAD
	DOMESTIC HOT WATER		FREEZE PROOF WALL HYDRANT		UPRIGHT SPRINKLER HEAD c/w GUARD
	DOMESTIC HOT WATER RETURN		HOSE BIB		SIDEWALL SPRINKLER HEAD
	FIRE PROTECTION STANDPIPE SYSTEM		UNION		SIDEWALL SPRINKLER HEAD c/w GUARD
	FIRE PROTECTION SPRINKLER SYSTEM		PIPE ANCHOR		FIRE EXTINGUISHER - SURFACE MOUNTED
	CONDENSATE DRAIN		CLEANOUT IN WALL		FIRE EXTINGUISHER - RECESSED
	INDIRECT DRAIN		CLEANOUT PLUG		FIRE DEPARTMENT CONNECTION
	SANITARY DRAIN		CLEANOUT IN FLOOR		SIGHT GLASS
	STORM DRAIN		STRAINER		FIRE HOSE CABINET
	HEAT PUMP WATER RETURN		STRAINER c/w BLOW OFF		EXISTING DUCTWORK TO REMAIN - SINGLE LINE
	HEAT PUMP WATER SUPPLY		PIPE ALIGNMENT GUIDE		EXISTING DUCTWORK TO BE REMOVED - SINGLE LINE
	HOT WATER HEATING RETURN		FLEXIBLE CONNECTOR		EXISTING DUCTWORK TO REMAIN
	HOT WATER HEATING SUPPLY		EXPANSION JOINT (EJ) OR EXPANSION COMPENSATOR (EC)		EXISTING DUCTWORK TO BE REMOVED
	REFRIGERANT LIQUID		CAP		NEW DUCTWORK
	REFRIGERANT SUCTION	PIPING MISCELLANEOUS			
	NATURAL GAS		AUTOMATIC AIR VENT		INTERNALLY INSULATED DUCTWORK
	EXISTING PIPING TO REMAIN		MANUAL AIR VENT		EXTERNALLY INSULATED DUCTWORK
	EXISTING PIPING TO BE REMOVED		FLOOR DRAIN		BALANCING DAMPER
VALVES					
	SHUT OFF VALVE		FUNNEL FLOOR DRAIN		BACKDRAFT DAMPER
	CHECK VALVE		ROOF DRAIN		FIRE DAMPER
	COMBINATION SHUT-OFF, BALANCE & CHECK VALVE		FLANGES		OPPOSED BLADE DAMPER - AUTOMATIC OPERATOR
	PRESSURE REDUCING VALVE	CONTROLS			
	TWO-WAY CONTROL VALVE		THERMOMETER		
	THREE-WAY CONTROL VALVE		PRESSURE GAUGE		
	BALANCING VALVE		PRESSURE SWITCH		
	FLOW CONTROL VALVE		FLOW SWITCH		
	COMBINATION SHUT-OFF & BALANCING VALVE		THERMOSTAT		
	GAS VALVE				
	SUPERVISED VALVE				

MECHANICAL DRAWING LIST	
M101.4	MECHANICAL LEGEND, ABBREVIATIONS AND DRAWING LIST
M102.4	SCHEDULES
M103.4	DETAILS
M201.4	PART GROUND FLOOR PLAN - DRAINAGE
M202.4	PART GROUND FLOOR PLAN - DRAINAGE
M203.4	PART GROUND FLOOR PLAN - PLUMBING
M204.4	PART GROUND FLOOR PLAN - PLUMBING
M205.4	PLUMBING DETAILS
M301.4	PART GROUND FLOOR PLAN - FIRE PROTECTION NORTH
M302.4	PART GROUND FLOOR PLAN - FIRE PROTECTION SOUTH
M401.4	PART GROUND FLOOR PLAN - HEATING
M402.4	PART GROUND FLOOR PLAN - HEATING
M501.4	PART GROUND FLOOR PLAN - AIR DISTRIBUTION
M502.4	PART GROUND FLOOR PLAN - AIR DISTRIBUTION
M601.4	ROOF MECHANICAL PLAN
M602.4	ROOF MECHANICAL PLAN DEMOLITION
M701.4	PART GROUND FLOOR PLAN - DRAINAGE DEMOLITION
M702.4	PART GROUND FLOOR PLAN - DRAINAGE DEMOLITION
M703.4	PART GROUND FLOOR PLAN - PLUMBING DEMOLITION
M704.4	PART GROUND FLOOR PLAN - PLUMBING DEMOLITION
M705.4	PART GROUND FLOOR PLAN - FIRE PROTECTION DEMOLITION
M706.4	PART GROUND FLOOR PLAN - FIRE PROTECTION DEMOLITION
M707.4	PART GROUND FLOOR PLAN - HEATING DEMOLITION
M708.4	PART GROUND FLOOR PLAN - HEATING DEMOLITION
M709.4	PART GROUND FLOOR PLAN - AIR DISTRIBUTION DEMOLITION
M710.4	PART GROUND FLOOR PLAN - AIR DISTRIBUTION DEMOLITION

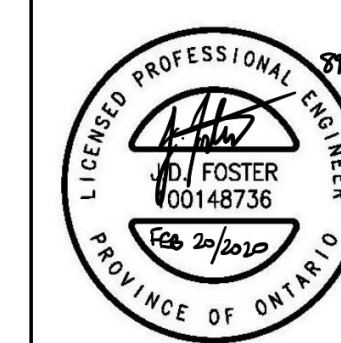


NOTES

LEGEND

ABBREVIATIONS													
AFF	ABOVE FINISHED FLOOR	EF	EXHAUST FAN	HZ	FREQUENCY	NTS	NOT TO SCALE	RECIRC	RECIRCULATING	SA	SUPPLY AIR	VOL	VOLUME
BHP	BRAKE HORSEPOWER	EG	EXHAUST AIR GRILLE	KW	KILOWATT	OA	OUTSIDE AIR	REL	EXISTING TO BE RELOCATED	SD	SUPPLY AIR DIFFUSER	W	WATT
BTU	BRITISH THERMAL UNIT	EWT	ENTERING WATER TEMPERATURE	l/s	LITERS PER SECOND	PD	PRESSURE DROP	REM	EXISTING TO BE REMOVED	SG	SUPPLY AIR GRILLE	WB	WET-BULB TEMPERATURE
DG	DOOR GRILLE	EX	EXISTING TO BE REMAIN	LAT	LEAVING AIR TEMPERATURE	PH	PHASE	RG	RETURN AIR GRILLE	T STAT	THERMOSTAT		
EAT	ENTERING AIR TEMPERATURE	HP	HORSEPOWER	LWT	LEAVING WATER TEMPERATURE	RA	RETURN AIR	RPM	REVOLUTIONS PER MINUTE	V	VOLT		

No.	DATE	ISSUED FOR TENDER & PERMIT	REV. No.
2	02/20/2020		
	MM/DD/YYYY	DESCRIPTION	



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
MECHANICAL LEGEND, ABBREVIATIONS AND DRAWING LIST

DATE PLOTTED	DRAWN BY	DRAWING No.
2020-02-20 3:49:27 PM	BMD	
SCALE	CHECKED BY	M101.4
AS INDICATED	JDF	
PROJECT No.	8906	

ROOFTOP AIR HANDLING UNIT																																																			
DRAWING REFERENCE	MANUFACTURER	SERVICE	MODEL	SUPPLY FAN				EXHAUST FAN				ENERGY RECOVERY WHEEL				MAX. WHEEL* PRESSURE DROP (Pa)		WINTER HEAT RECOVERY				SUMMER HEAT RECOVERY				COOLING CAPACITY			NATURAL GAS HEATING CAPACITY		O/A QUANTITY (l/s)	ELECTRICAL			INLET SOUND POWER LEVELS (dB)																
				AIR FLOW (L/s)	E.S.P. (Pa)	T.S.P. (Pa)	BHP (kW)	HP	AIR FLOW (l/s)	E.S.P. (Pa)	BHP (kW)	HP (QUANTITY)	O/A (l/s)	E/A (l/s)	COOLING TOTAL CAPACITY (kW)	HEATING TOTAL CAPACITY (kW)	SUPPLY AIR	EXHAUST AIR	SUPPLY TEMPERATURE (°C)		EXHAUST TEMPERATURE (°C)		SUPPLY TEMPERATURE (°C)		EXHAUST TEMPERATURE (°C)		TOTAL (kW)	SENSIBLE (kW)	EER	INPUT (kW)		OUTPUT (kW)	VPH/Hz	MCA	MOCp	1	2	3	4	5	6	7	8								
																			ENTERING	LEAVING	ENTERING	LEAVING	ENTERING	LEAVING	ENTERING	LEAVING										D.B.	W.B.	D.B.	W.B.	D.B.	W.B.	D.B.	W.B.	D.B.	W.B.						
RTU-102	DAIKIN	VENTILATION	DPS 025A	3,000	125	922	5.3	10 (1)	3,000	125	3.56	8 (1)	3,000	3,000	51	124	234	234	-20.6	-21.1	2.6	-0.2	21.1	11.7	2.6	-0.2	31.1	23.3	26.9	19.8	23.9	16.7	26.9	19.8	88.4	60.9	11	175.8	140.7	3,000	208/3/60	151.4	-	78	77	85	77	72	71	66	63

UNIT COMPLETE WITH VIBRATION ISOLATION ADAPTER ROOF CURB.
* INCLUDES ERW FILTER PRESSURE DROP

HEAT PUMPS												
DRAWING REFERENCE	MANUFACTURER	MODEL	COOLING CAPACITY		AIR QUANTITY (l/s)	EXTERNAL STATIC PRESSURE (Pa)	WATER FLOW (l/s)	MAX. WATER PRESSURE DROP (kPa)	HEATING CAPACITY (kW)	ELECTRICAL		MIN EER (DESIGN)
			TOTAL (kW)	SENSIBLE (kW)						VPH/Hz	MCA	
HP-401*	DAIKIN	WGS0091	2.61	1.89	135	95	0.12	25	3.60	208/1/60	5.6	13.1
HP-402*	DAIKIN	WGS0121	3.61	2.82	195	95	0.16	25	4.66	208/1/60	6.8	12.5
HP-403*	DAIKIN	WGS0191	4.71	3.70	290	95	0.25	25	6.81	208/1/60	11.3	13.8
HP-404**	DAIKIN	WGTH0261	7.10	5.5	380	95	0.32	25	8.7	208/3/60	11.1	14.7
HP-405**	DAIKIN	WGTH0321	8.7	6.4	480	95	0.39	25	11.0	208/3/60	15.9	13.5
HP-406**	DAIKIN	WGTH0381	10.6	8.0	590	95	0.47	25	13.3	208/3/60	19.5	14.6
HP-407**	DAIKIN	WLVC1120	32.6	27.5	2,245	95	1.58	35	44.8	208/3/60	41.5	10.7

1. COOLING SELECTION BASED ON 23.8/17.2°C ENTERING AIR, 32.2°C ENTERING WATER, 38.8° LEAVING WATER.
2. MAXIMUM PRESSURE DROP INCLUDES LOSSES THROUGH SUPPLY AND RETURN HOSES.
3. HEATING SELECTION BASED ON 21.1°C ENTERING AIR, 21.1° ENTERING WATER.
*SINGLE STAGE HEAT PUMPS.
**TWO STAGE HEAT PUMPS, PERFORMANCE SHOWN AT FULL LOAD CONDITIONS.

EXHAUST FANS																
DRAWING REFERENCE	SERVICE	MANUFACTURER	MODEL	AIR QUANTITY (L/S)	EXTERNAL STATIC PRESSURE (Pa)	FAN RPM	MOTOR HP	ELECTRICAL (VPH/Hz)	FAN INLET SOUND POWER LEVELS (dB)							
									1	2	3	4	5	6	7	8
EF-1	WASHROOM EXHAUST	COOK	90C17DEC	150	80	1292	FHP	120/1/60	61	65	67	55	50	45	40	37
EF-2	STORAGE EXHAUST	COOK	101C17DEC	240	100	1301	FHP	120/1/60	63	66	71	62	57	53	48	45
EF-3	CHANGE ROOM EXHAUST	COOK	101C17DEC	200	62	1050	FHP	120/1/60	57	61	62	55	51	46	42	39
EF-4	WASHROOM EXHAUST	COOK	90C17DEC	125	100	1334	FHP	120/1/60	61	65	66	55	50	46	41	38
EF-5	WASHROOM EXHAUST	COOK	90C17DEC	50	62	954	FHP	120/1/60	54	55	53	44	41	36	34	35
EF-6	WASHROOM EXHAUST	COOK	100C17DEC	260	95	1331	FHP	120/1/60	64	66	71	63	58	54	49	45
EF-7	WASHROOM EXHAUST	COOK	90C17DEC	125	62	1117	FHP	120/1/60	58	61	61	51	46	41	37	36

GRILLES, REGISTERS AND DIFFUSERS						
DRAWING REFERENCE	MANUFACTURER	MODEL	PANEL SIZE (mm)	NECK SIZE (mm)	AIR VOLUME (L/s)	REMARKS
SD-1	PRICE	SPD/31/B12	300x300	150ø	0-65	STEEL CONSTRUCTION SQUARE PLAQUE DIFFUSER, EQUALIZING GRID, WHITE FINISH
SD-2	PRICE	SPD/31/B12	610x610	200ø	66-110	STEEL CONSTRUCTION SQUARE PLAQUE DIFFUSER, EQUALIZING GRID, WHITE FINISH
SD-3	PRICE	SPD/31/B12	610x610	250ø	111-180	STEEL CONSTRUCTION SQUARE PLAQUE DIFFUSER, EQUALIZING GRID, WHITE FINISH
SD-4	PRICE	SPD-FR/31/B12	610x610	300ø	181-225	STEEL CONSTRUCTION SQUARE PLAQUE DIFFUSER, FIRE RATED, EQUALIZING GRID, WHITE FINISH
SD-5	KAMPMANN	KASWIRL-EL400	610x610	200ø	45-85	STEEL CONSTRUCTION SQUARE PANEL HIGH INDUCTION DIFFUSER, SIDE INLET PLENUM BOX, WHITE ECCENTRIC CYLINDERS, WHITE FINISH, CEILING MOUNTED.
SD-6	KAMPMANN	KASWIRL-EL500	610x610	225ø	86-110	STEEL CONSTRUCTION SQUARE PANEL HIGH INDUCTION DIFFUSER, SIDE INLET PLENUM BOX, WHITE ECCENTRIC CYLINDERS, WHITE FINISH, CEILING MOUNTED.
SD-7	KAMPMANN	KASWIRL-EL500	610x610	250ø	111-150	STEEL CONSTRUCTION SQUARE PANEL HIGH INDUCTION DIFFUSER, SIDE INLET PLENUM BOX, WHITE ECCENTRIC CYLINDERS, WHITE FINISH, CEILING MOUNTED.
SG-1	PRICE	SDGE/FIA/AS/B15	-	300x200	0-170	EXTRUDED ALUMINUM CONSTRUCTION CURVED FACE DUCT GRILLE, DOUBLE DEFLECTION CORE, CLOSED CELL FOAM GASKET, AIR SCOOP DAMPER, ALUMINUM FINISH.
SL-1	PRICE	SDS/75/11/16/XX/B15	SEE DWG	SEE DWG	0-20 / M	EXTRUDED ALUMINUM CONSTRUCTION CURVED FACE LINEAR SLOT GRILLE, ADJUSTABLE SLOT PATTERN CONTROLLER, EQUALIZATION GRID, SPIRAL DUCT MOUNTING, ALUMINUM FINISH.
RG-1	PRICE	PDDR/3/B12	610x300	560x250	0-260	STEEL CONSTRUCTION PERFORATED FACE GRILLE, HINGED FACE, WHITE FINISH
RG-2	PRICE	PDDR/3/B12	610x610	560x560	0-790	STEEL CONSTRUCTION PERFORATED FACE GRILLE, HINGED FACE, WHITE FINISH
RG-3	PRICE	98/S1	-	900x550	0-900	HEAVY DUTY GYM GRILLE, EXTRUDED ALUMINUM, 13mm BLADE SPACING, 45° DEFLECTION LONG BLADES, ALUMINUM FINISH
EG-1	PRICE	80/F/B12	250x250	250x250	0-140	EXTRUDED ALUMINUM CONSTRUCTION EGG CRATE GRILLE, ALUMINUM GRID CORE, FLAT BORDER, WHITE FINISH
DG-1	PRICE	97/L/A/B15	-	610x460	-	HEAVY DUTY GYM GRILLE, EXTRUDED ALUMINUM, 13MM BLADE SPACING, 0° DEFLECTING LONG BLADES, ALUMINUM FINISH

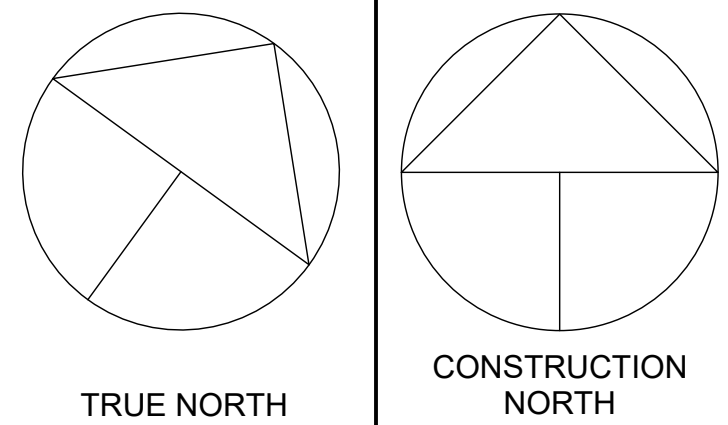
HEATING UNITS							
DRAWING REFERENCE	MANUFACTURER	MODEL	SIZE (LENGTH X HEIGHT X DEPTH (mm))	CAPACITY (W)	ELECTRICAL (VPH/Hz)	MOTOR HP	REMARKS
FF-420*	SIGMA	SFF06	1020 x 710 x 240	9290	120/1/60	FHP	RECESSED UNDUCTED WALL CABINET
FF-421*							
A-1**	SIGMA	SWE185S	SEE DRAWINGS x 460 x 150	910/m	-	-	1 ROW ENCLOSURE LENGTH AS SHOWN ON PLANS
A-2**	SIGMA	SWE245S	SEE DRAWINGS x 600 x 150	1150/m	-	-	2 ROW ELEMENT, DOUBLE SLOPE ENCLOSURE MOUNTED AT HIGH LEVEL
RP-1**	SIGMA	24-4	SEE DRAWINGS	387/m	-	-	4 TUBE RADIANT HEATING PANEL, CEILING MOUNTED

* SELECTED BASED ON 18°C EAT, 82°C EWT AND 64°C LWT
** ALL OTHER SELECTIONS BASED ON 18°C EAT, 82°C EWT AND 64°C LWT



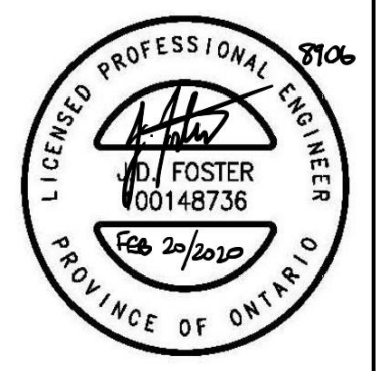
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250 CITY CENTRE AVE., SUITE 403 OTTAWA ON, K1R 6K7

KEY PLAN



NOTES

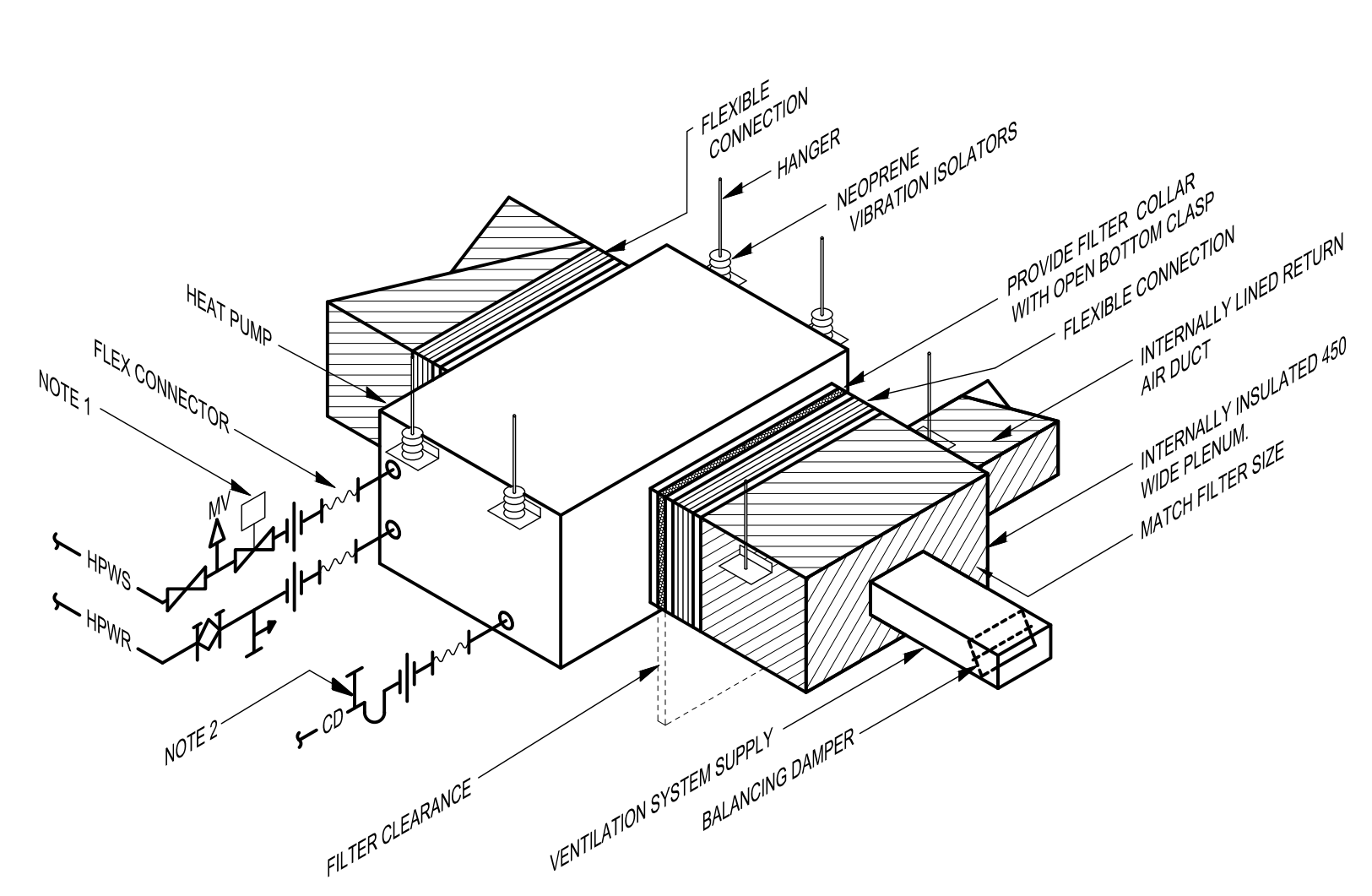
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02	04/02/2020	ISSUED FOR TENDER	REVISION	02



PROJECT TITLE
OUR LADY OF FATIMA

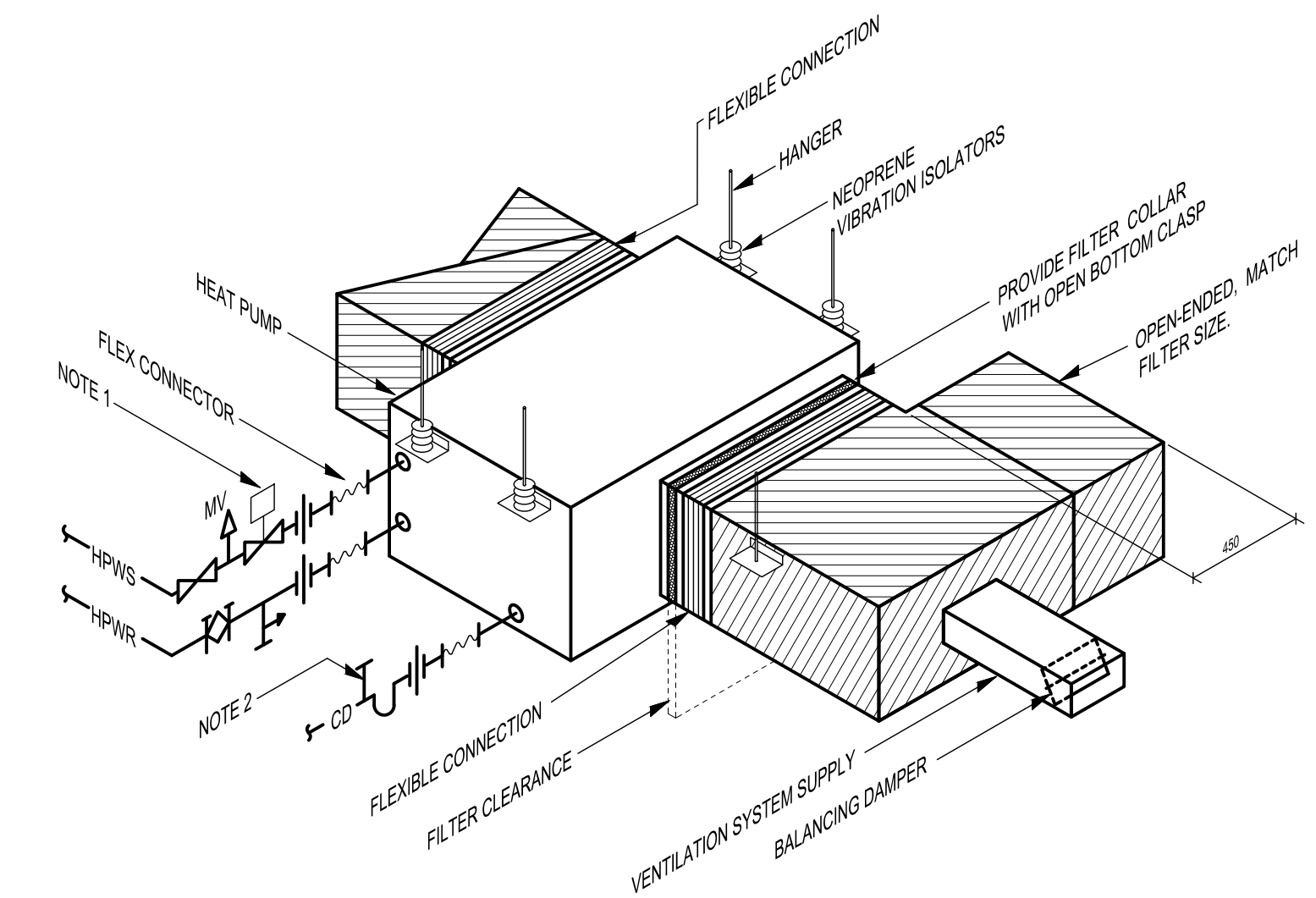
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SCHEDULES

DATE 01/11/2020	DRAWN BY BMD	DRAWING No. M102.4
SCALE NTS	CHECKED BY JDF	
PROJECT No. 8906		



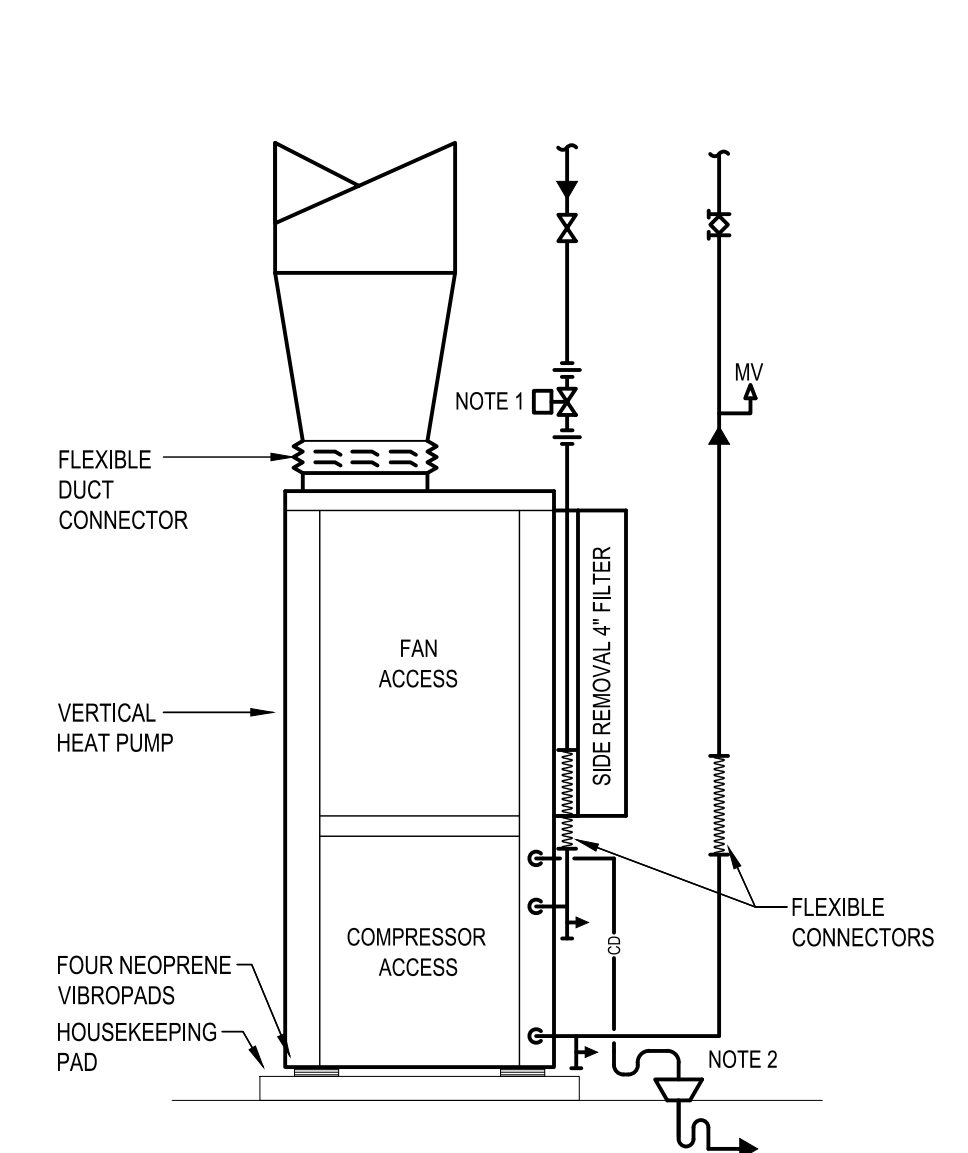
HEAT PUMP INSTALLATION DETAIL WITH DUCTED RETURN
N.T.S.

- NOTES:
- TWO WAY CONTROL VALVE SUPPLIED WITH HEAT PUMP AND INSTALLED BY DIV. 15
 - TRAP IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. PROVIDE LINE SIZE VERTICAL VENT MIN. 80mm LONG.
 - DEMONSTRATE TO OWNER AND CONSULTANT THAT FOR EACH HEAT PUMP THERE ARE NO PHYSICAL OBSTRUCTIONS WHICH BLOCK FILTER REPLACEMENT.
 - ROTATE FILTER HOLDER 180 DEGREES WHEREVER REQUIRED TO ENSURE UNIMPEDED FILTER CHANGES.



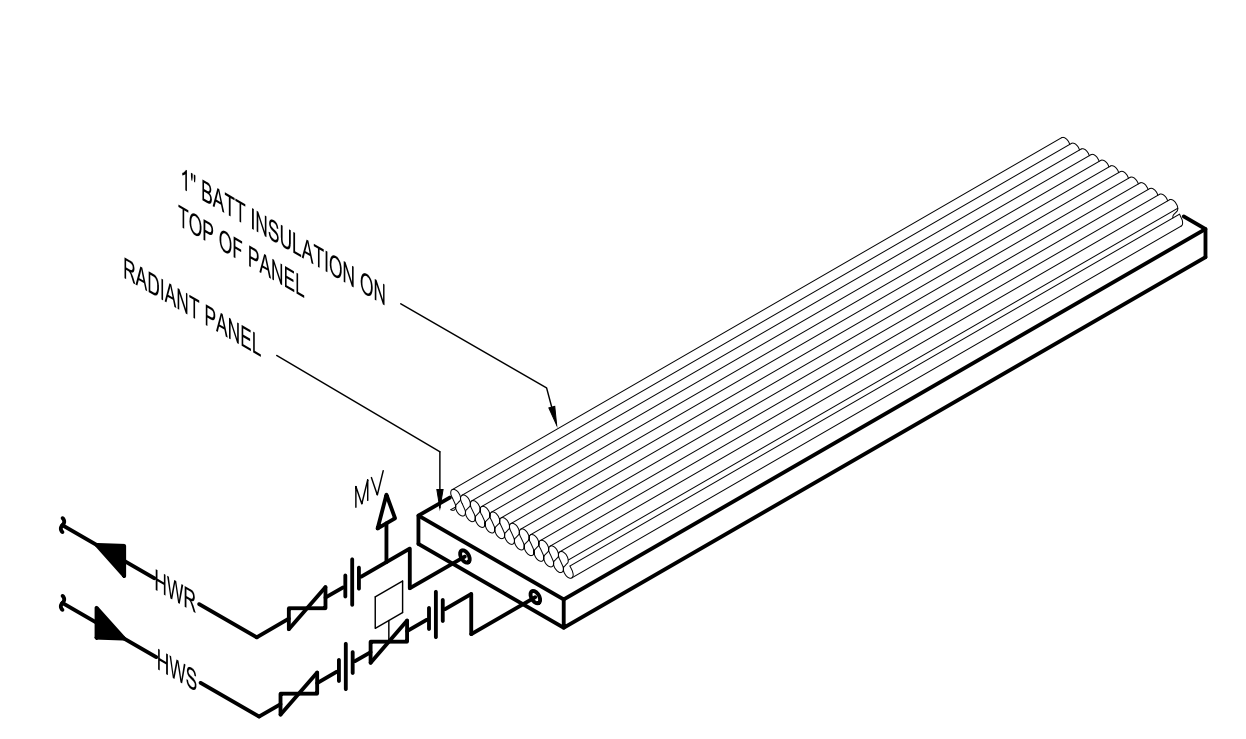
HEAT PUMP INSTALLATION DETAIL WITH RETURN PLENUM
N.T.S.

- NOTES:
- TWO WAY CONTROL VALVE SUPPLIED WITH HEAT PUMP AND INSTALLED BY DIV. 15.
 - TRAP IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. PROVIDE LINE SIZE VERTICAL VENT MIN. 80mm LONG.
 - DEMONSTRATE TO OWNER AND CONSULTANT THAT FOR EACH HEAT PUMP THERE ARE NO PHYSICAL OBSTRUCTIONS WHICH BLOCK FILTER REPLACEMENT.
 - ROTATE FILTER HOLDER 180 DEGREES WHEREVER REQUIRED TO ENSURE UNIMPEDED FILTER CHANGES.



TYPICAL VERTICAL HEAT PUMP INSTALLATION DETAIL.
N.T.S.

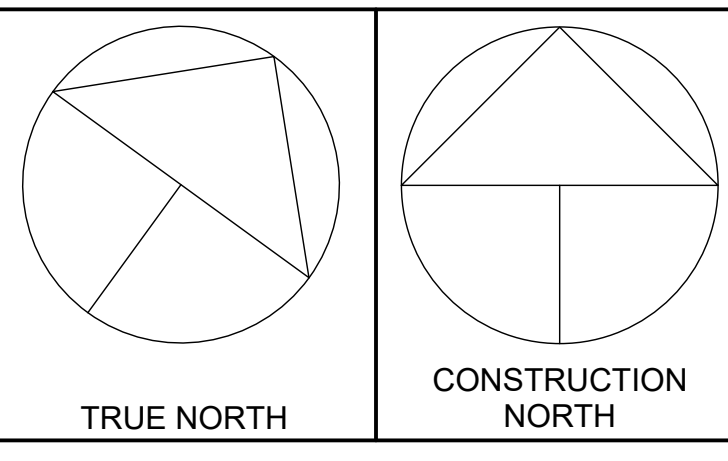
- NOTES:
- TWO WAY CONTROL VALVE SUPPLIED WITH HEAT PUMP AND INSTALLED BY DIV. 15.
 - TRAP IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. PROVIDE LINE SIZE VERTICAL VENT MIN. 80mm LONG.
 - DEMONSTRATE TO OWNER AND CONSULTANT THAT FOR EACH HEAT PUMP THERE ARE NO PHYSICAL OBSTRUCTIONS WHICH BLOCK FILTER REPLACEMENT.
 - ROTATE FILTER HOLDER 180 DEGREES WHEREVER REQUIRED TO ENSURE UNIMPEDED FILTER CHANGES.



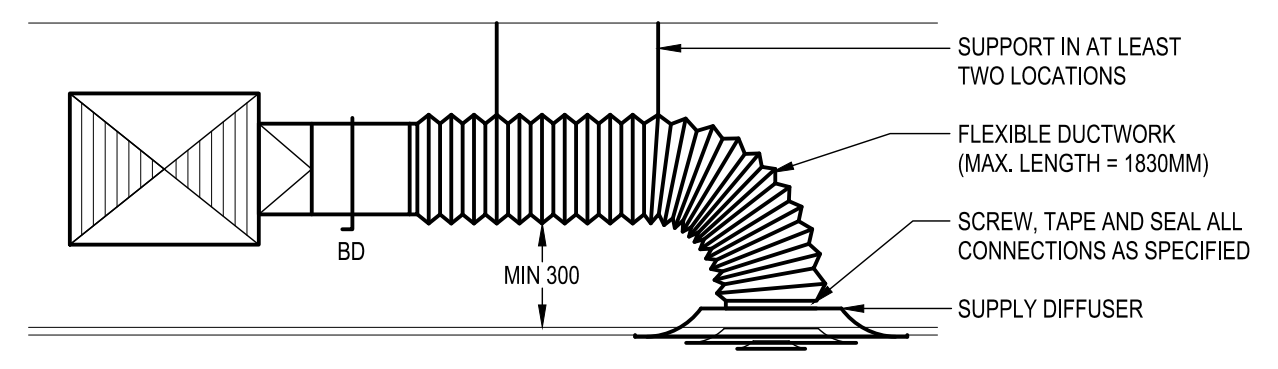
TYPICAL PIPING ARRANGEMENT FOR RADIANT PANELS - 2 WAY VALVE
N.T.S.

- NOTE:
- PROVIDE MEMORY STOP ON HWR BALL VALVE FOR BALANCING PURPOSES.

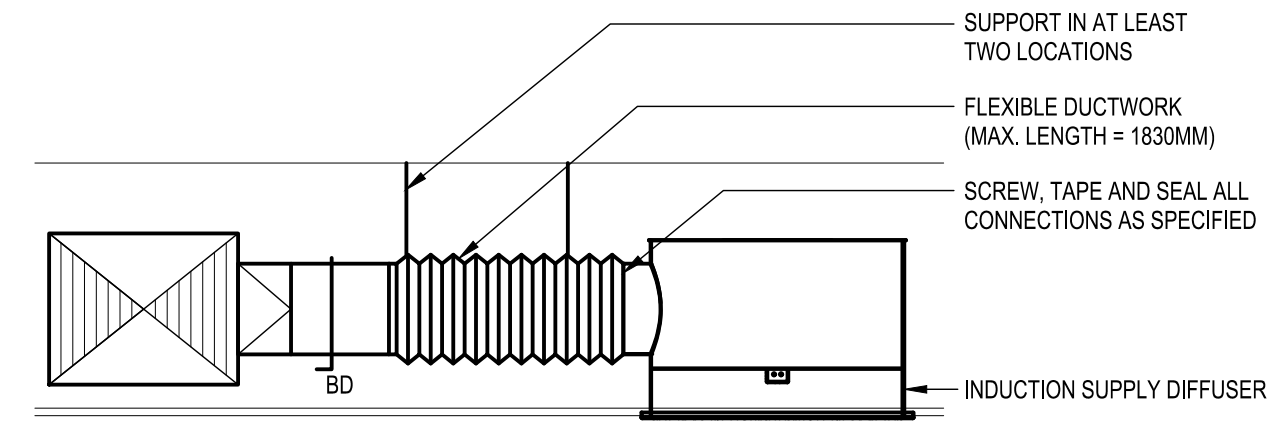
KEY PLAN



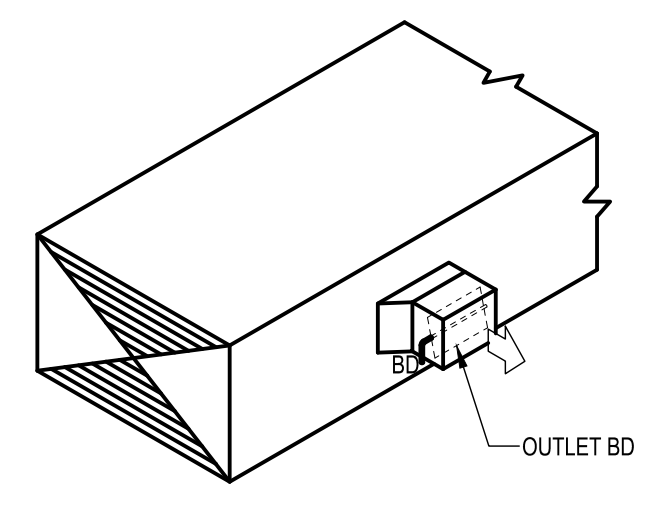
NOTES



TYPICAL RUNOUT TO SUPPLY DIFFUSER ON HEAT PUMP SYSTEM
N.T.S.

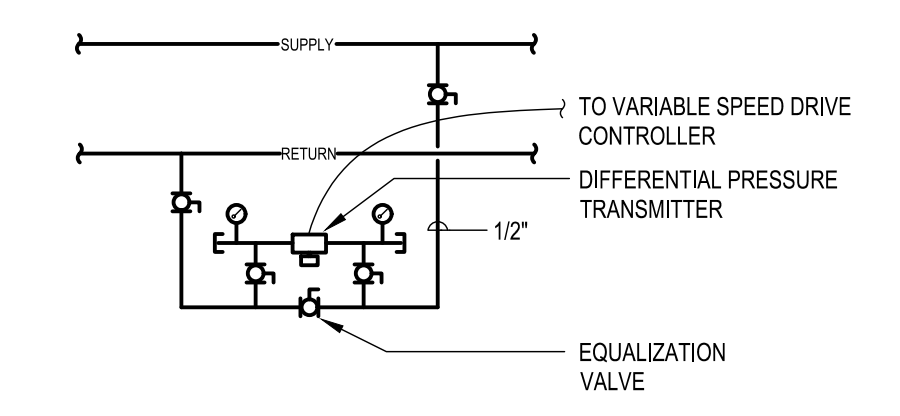


TYPICAL RUNOUT TO HIGH INDUCTION DIFFUSER ON HEAT PUMP SYSTEM
N.T.S.

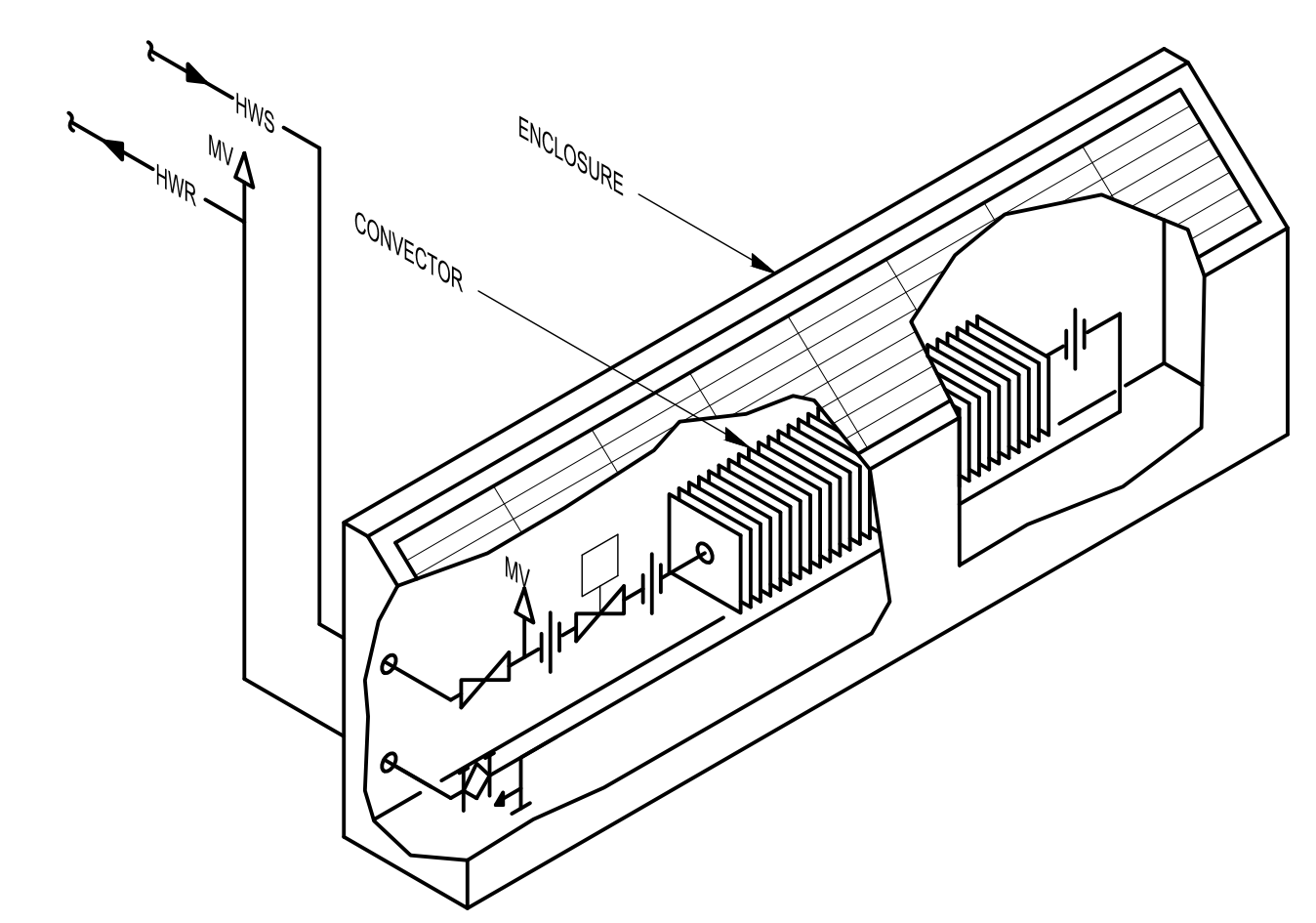


TYPICAL VENTILATION SYSTEM SUPPLY OUTLET
N.T.S.

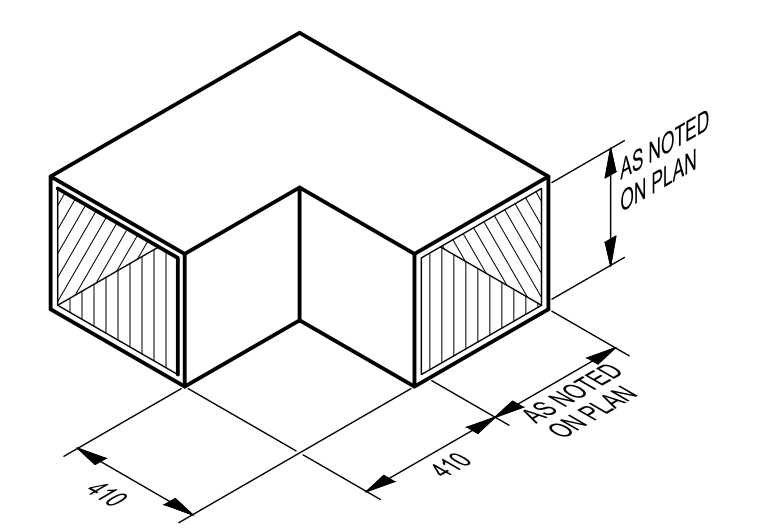
OUTLET BD SIZES	
BRANCH SIZE (mm)	AIR VOLUME(L/S)
200x150	0-95
200x200	96-150
250x200	151-190
250x250	191-265



DIFFERENTIAL PRESSURE SENSOR INSTALLATION DETAIL
N.T.S.

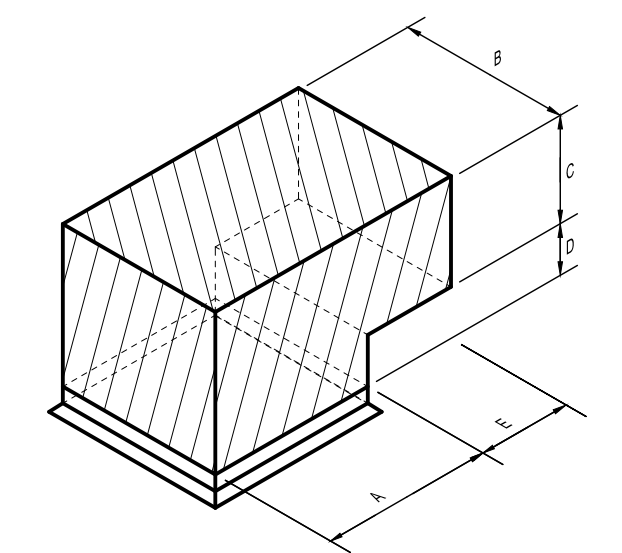


TYPICAL PIPING ARRANGEMENT FOR CONVECTORS - 2 WAY VALVE
N.T.S.

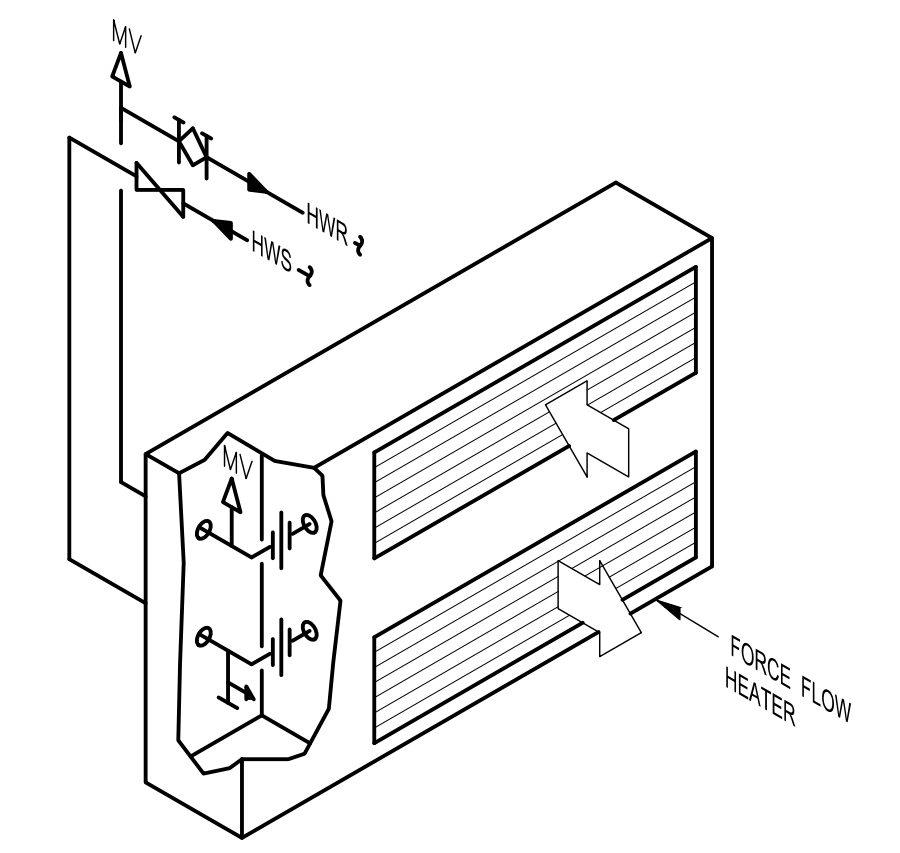


TRANSFER DUCT DETAIL
N.T.S.
NOTE:
1. INTERNALLY LINE DUCTWORK.

	DIMENSIONS				
	A	B	C	D	E
RR-1	560	560	300	200	300
RR-2	250	250	250	200	300

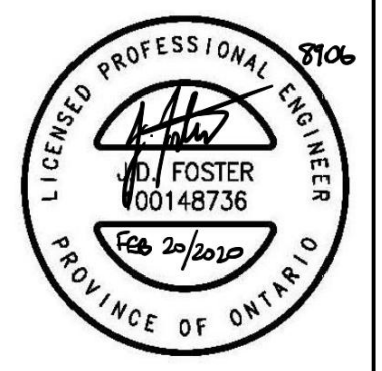


CEILING RETURN GRILLE & BOOT DETAIL
N.T.S.
NOTE:
1. INTERNALLY LINE DUCTWORK.



TYPICAL PIPING ARRANGEMENT FOR FORCE FLOW HEATERS
N.T.S.

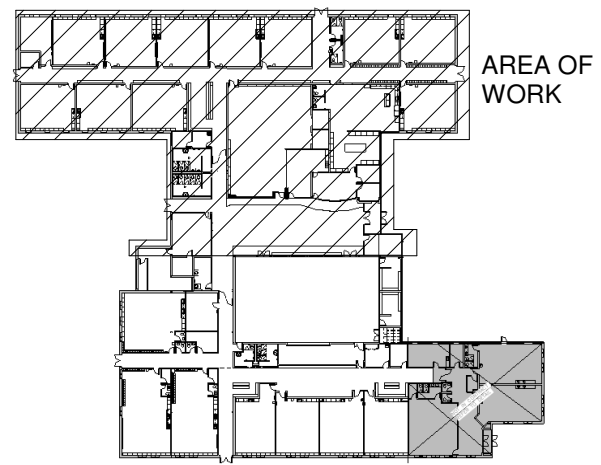
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01	02/19/2020	ISSUED FOR TENDER	JDF	01
02	04/02/2020	REVISION	JDF	02



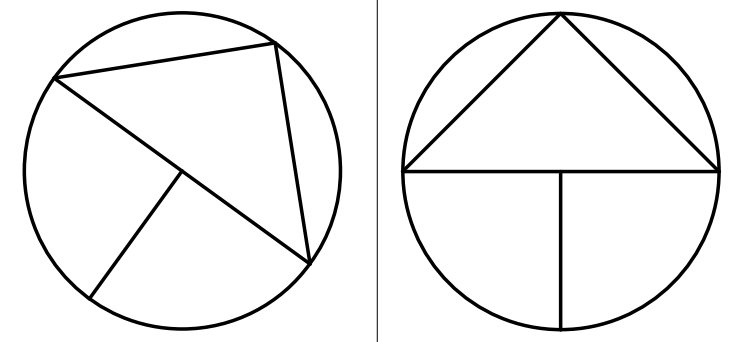
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
DETAILS

DATE	DRAWN BY	DRAWING No.
01/11/2020	BMD	M103.4
SCALE	CHECKED BY	
NTS	JDF	
PROJECT No.	8906	



KEY PLAN



TRUE NORTH
CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE	DESCRIPTION	REV.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

PART GROUND FLOOR PLAN - DRAINAGE

DATE PLOTTED 2020-02-20 3:49:32 PM

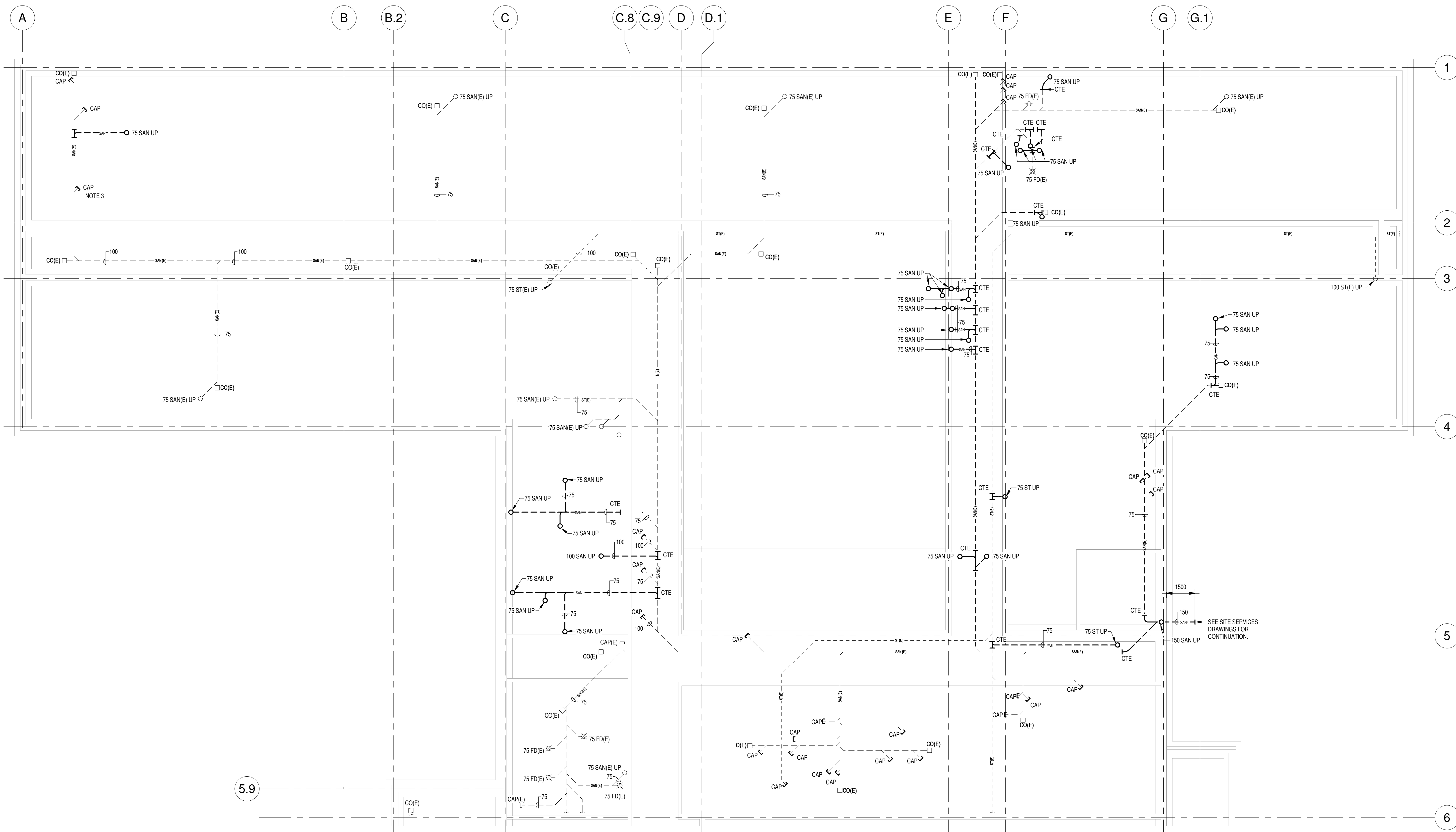
DRAWN BY BMD

CHECKED BY JDF

SCALE 1:100

PROJECT No. 8906

M201.4

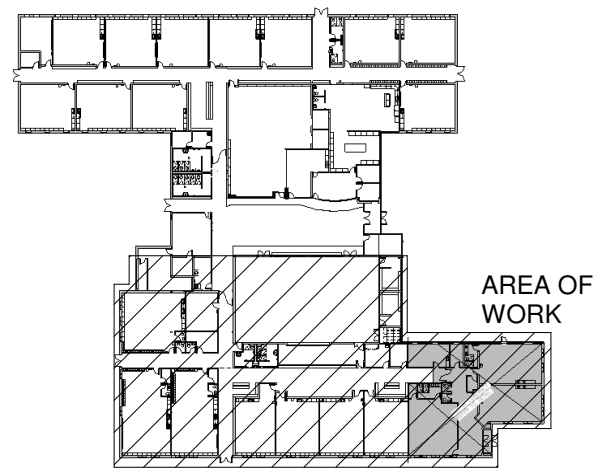


SEE CONTINUATION ON DRAWING M202.4

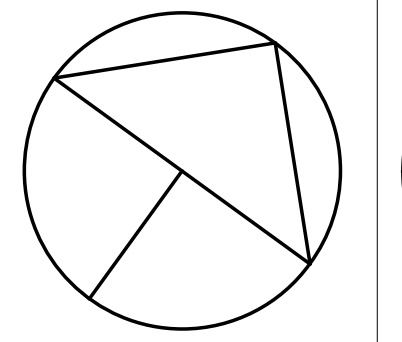
PART GROUND FLOOR PLAN DRAINAGE NORTH
SCALE 1:100

- NOTES:**
- MINIMUM BELOW GRADE PIPE SIZE IS 75 mm.
 - SCAN/LOCATE ALL EXISTING BELOW GRADE SERVICES BEFORE EXCAVATION/CUTTING.
 - CAP TO BE ACCESSIBLE ABOVE FLOOR.

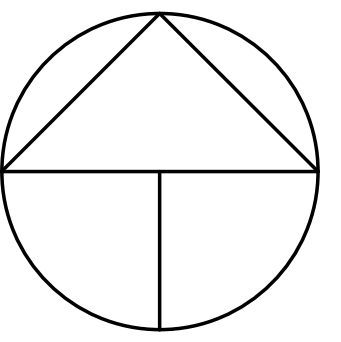
5.9



KEY PLAN



TRUE NORTH



CONSTRUCTION NORTH

NOTES

LEGEND

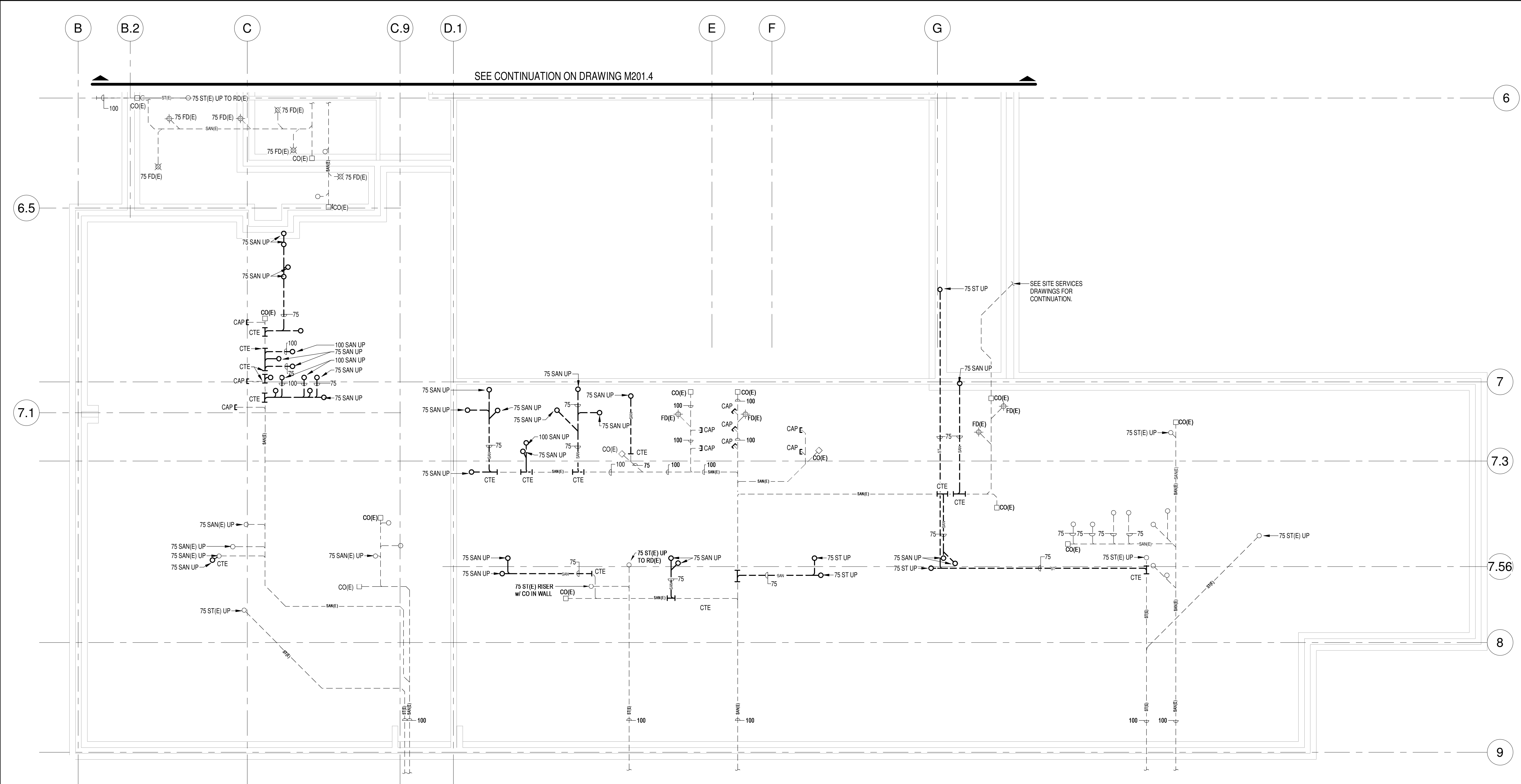
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2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



PROJECT TITLE
OUR LADY OF FATIMA

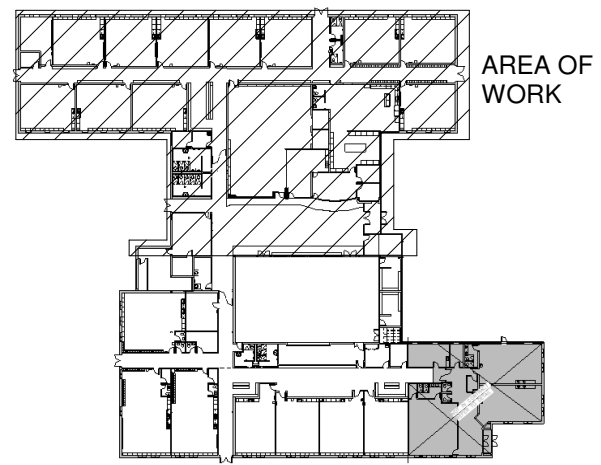
DRAWING TITLE
PART GROUND FLOOR PLAN - DRAINAGE

DATE PLOTTED 2020-02-20 3:49:38 PM	DRAWN BY BMD	DRAWING No.
SCALE 1 : 100	CHECKED BY JDF	M202.4
PROJECT No. 8906		

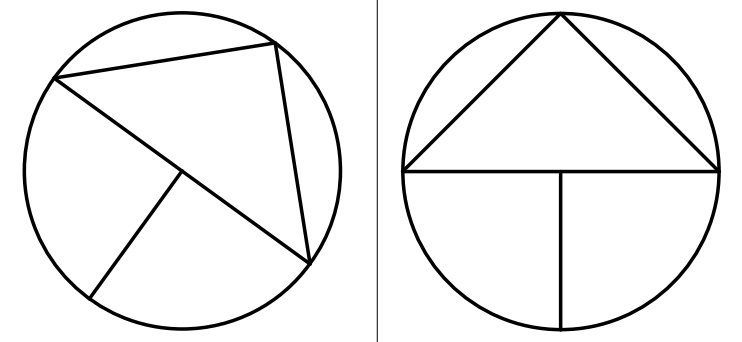


PART GROUND FLOOR PLAN DRAINAGE SOUTH
SCALE: 1:100

- NOTES:
1. MINIMUM BELOW GRADE PIPE SIZE IS 75 mm.
 2. SCAN/LOCATE ALL EXISTING BELOW GRADE SERVICES BEFORE EXCAVATION/CUTTING.



KEY PLAN



TRUE NORTH CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV.
2	02/20/2020	ISSUED FOR TENDER & PERMIT		
	MM/DD/YYYY			



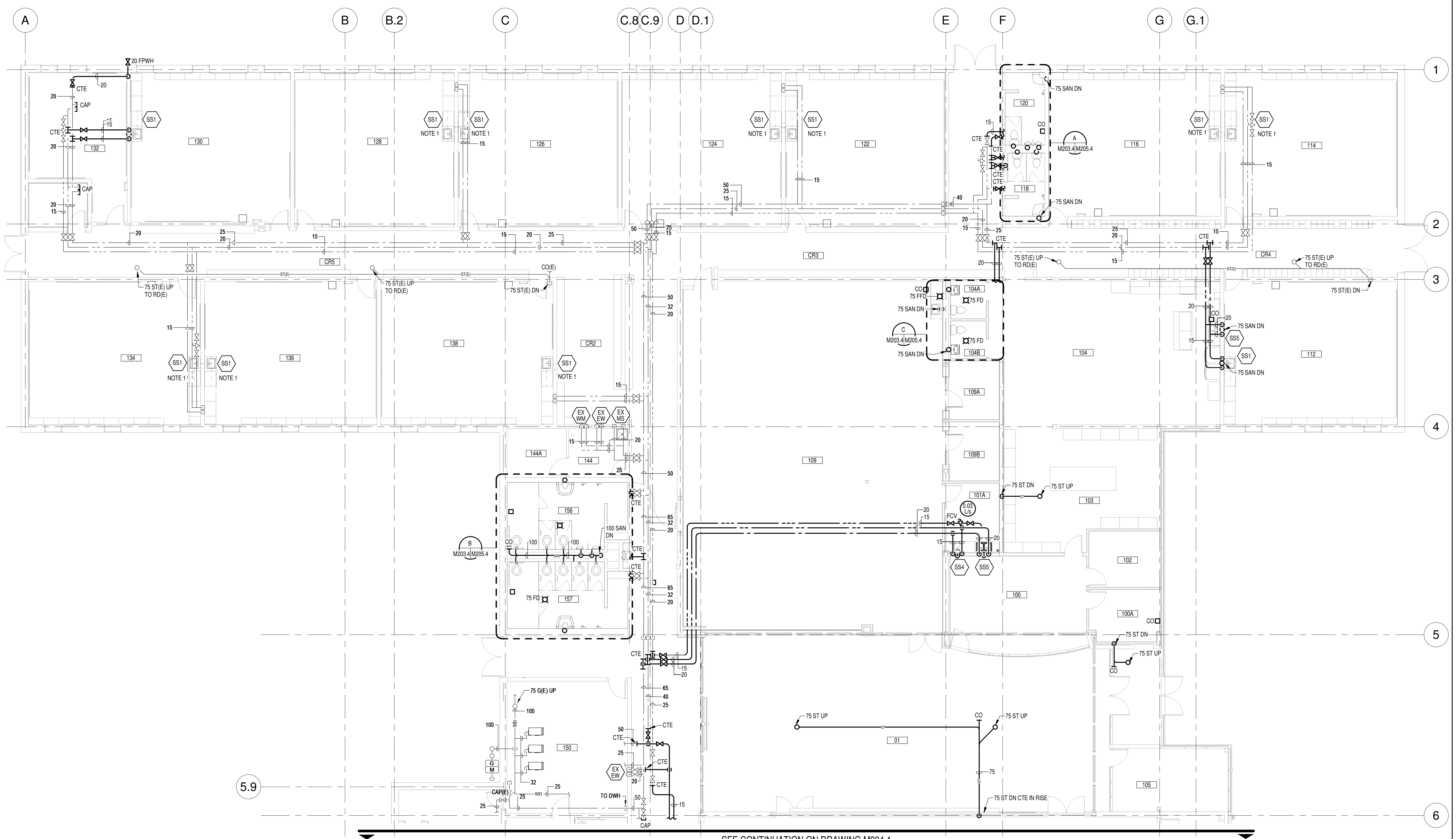
PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

PART GROUND FLOOR PLAN - PLUMBING

DATE PLOTTED 2020-02-20 3:49:45 PM	DRAWN BY BMD	DRAWING No.
SCALE 1 : 100	CHECKED BY JDF	M203.4
PROJECT No. 8906		

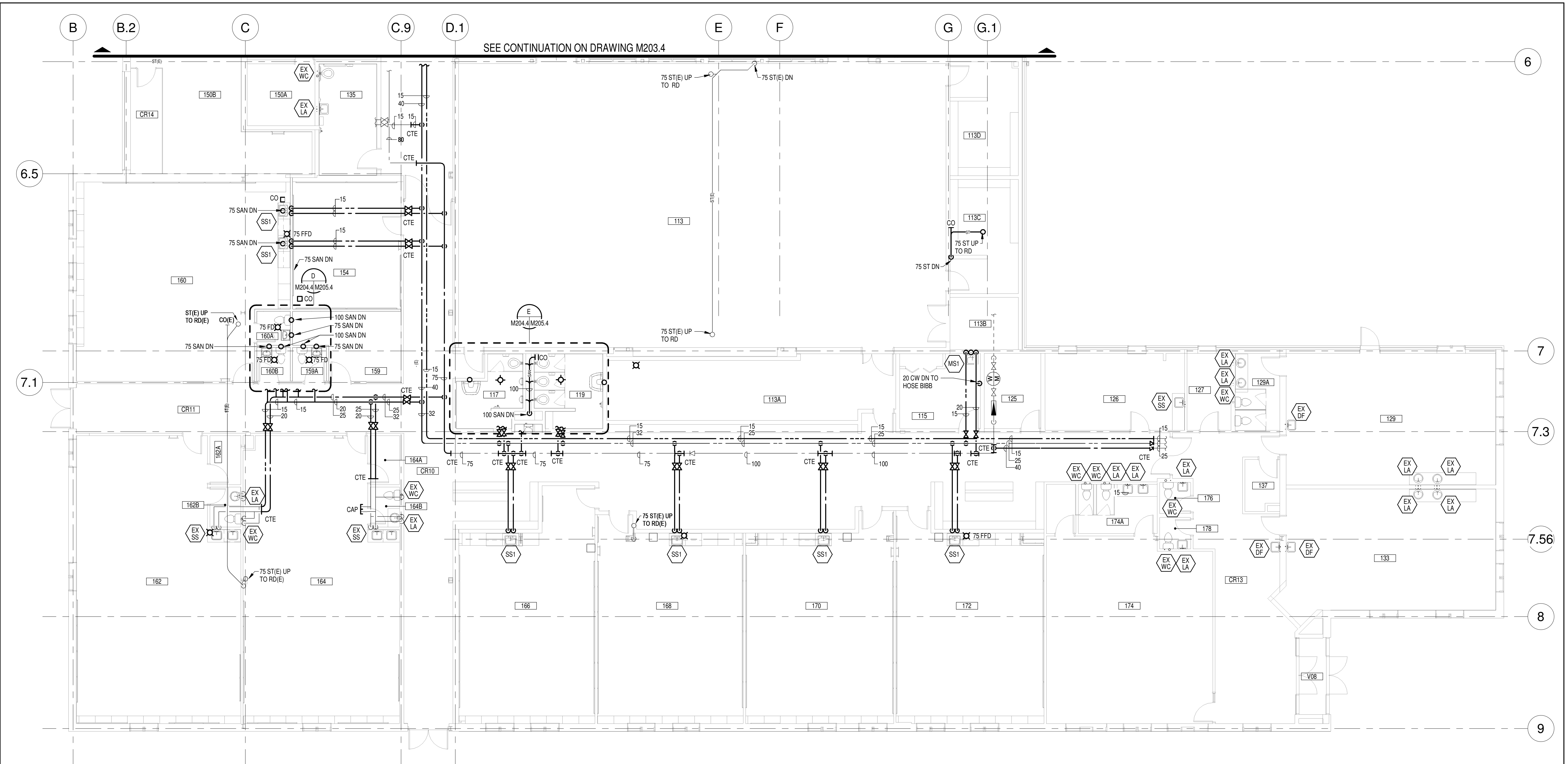


SEE CONTINUATION ON DRAWING M204.4

PART GROUND FLOOR PLAN PLUMBING NORTH
SCALE 1:100

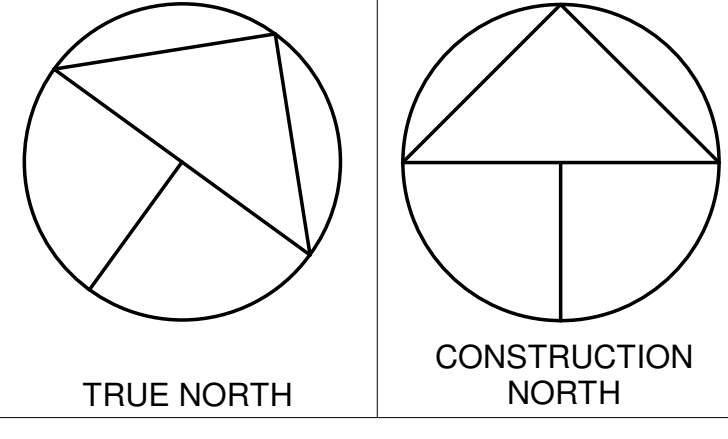
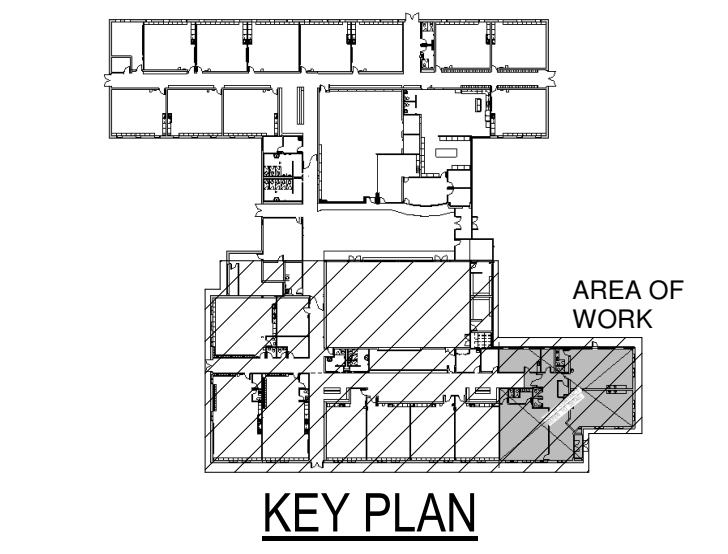
- NOTES:
- REWORK CW, HW AND SANITARY PIPING TO SUIT NEW SINK LOCATION WITHIN MILWORK.

5.9



PART GROUND FLOOR PLAN PLUMBING SOUTH
SCALE 1:100

- NOTES:**
- REWORK EXISTING SERVICES CW, HW, AND SANITARY TO SUIT NEW SINK LOCATION WITHING MILLWORK.



NOTES

LEGEND

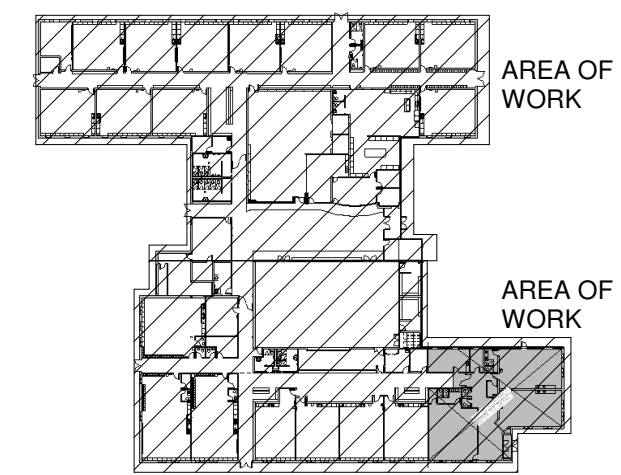
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	MM/DD/YYYY	DESCRIPTION	REV. No.



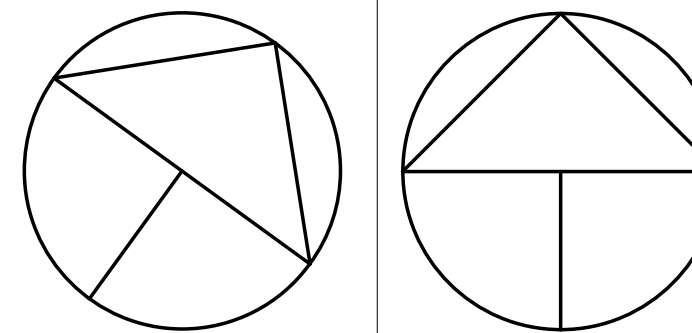
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - PLUMBING

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SCALE 1:100	CHECKED BY JDF	M204.4
PROJECT No. 8906		



KEY PLAN



TRUE NORTH CONSTRUCTION NORTH

NOTES

LEGEND

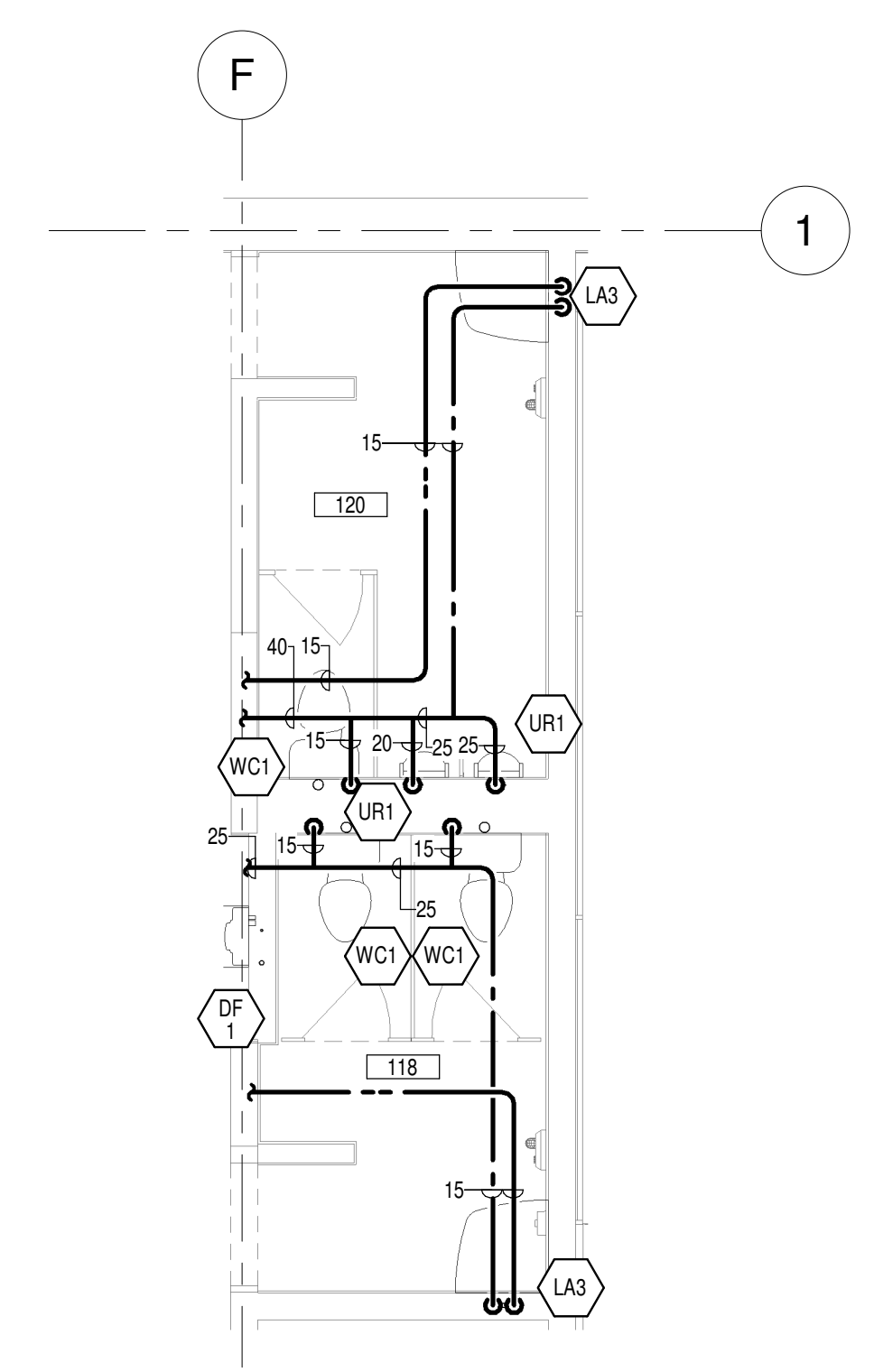
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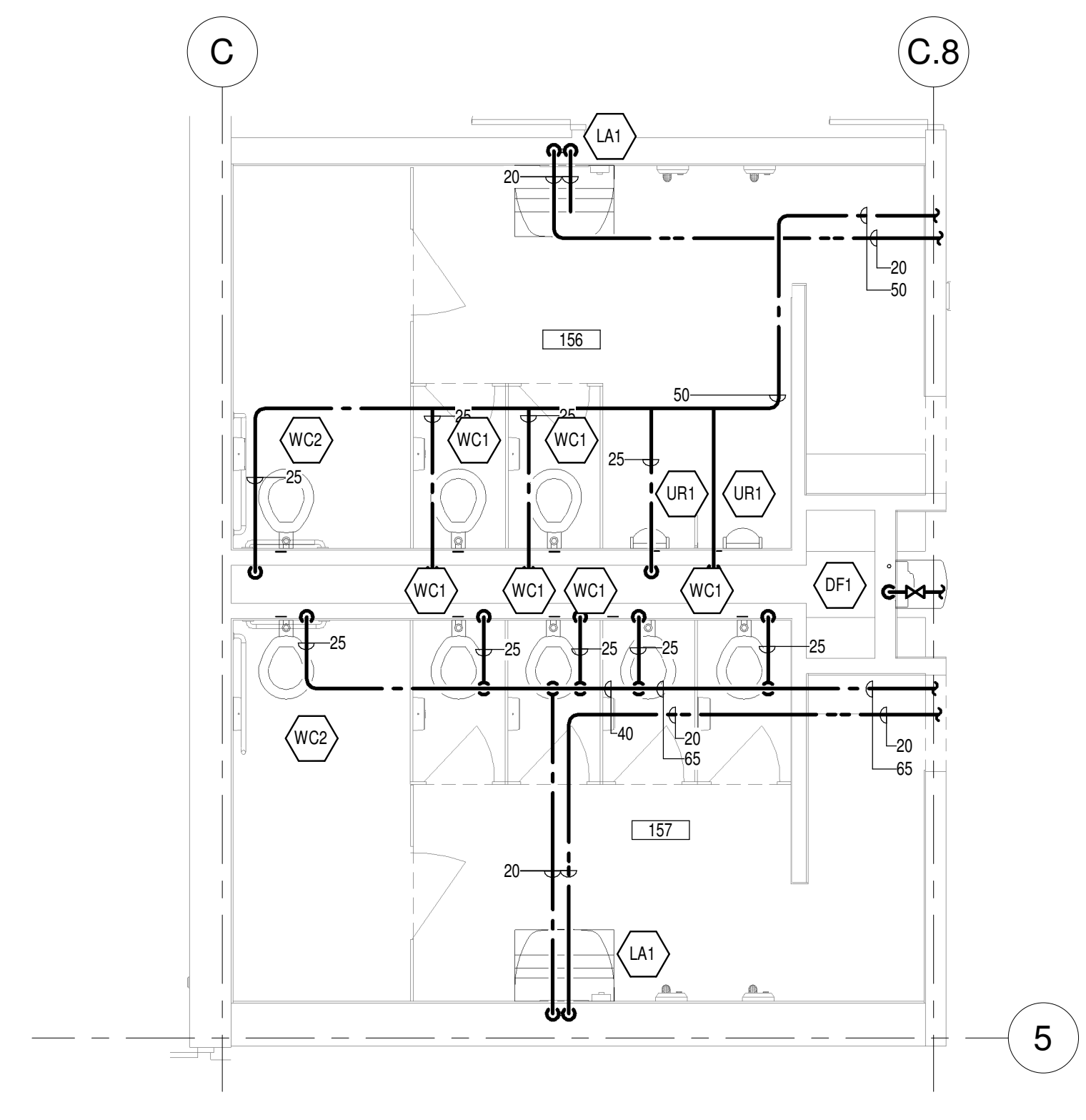
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PLUMBING DETAILS

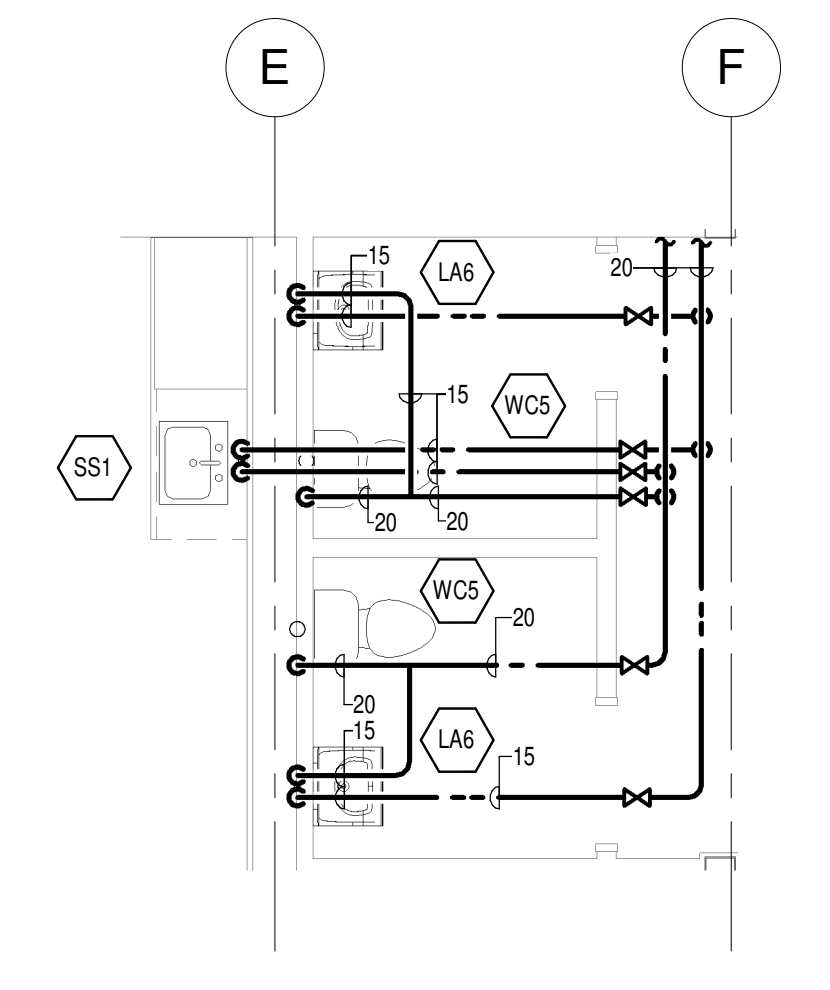
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SCALE As indicated	CHECKED BY JDF	M205.4
PROJECT No.		8906



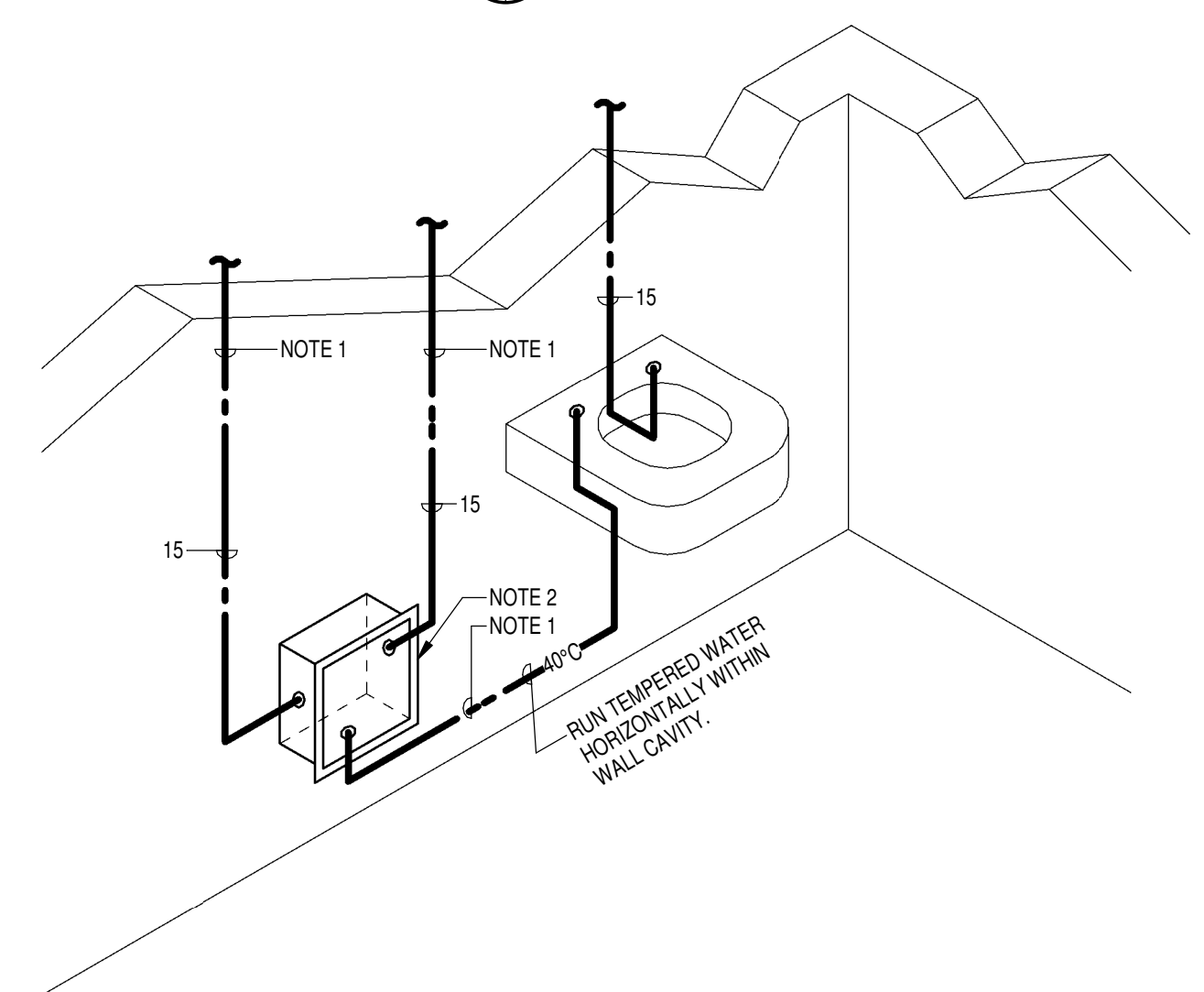
A DETAIL
M203.4/M205.4 SCALE 1:50



B DETAIL
M203.4/M205.4 SCALE 1:50

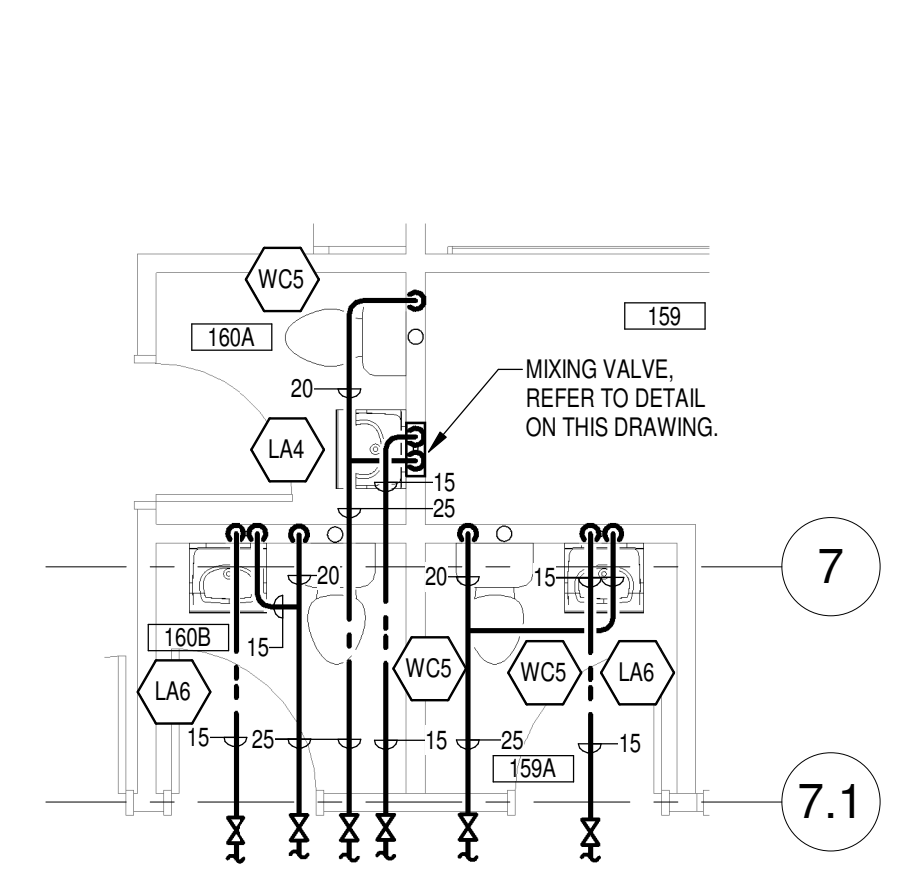


C DETAIL
M203.4/M205.4 SCALE 1:50

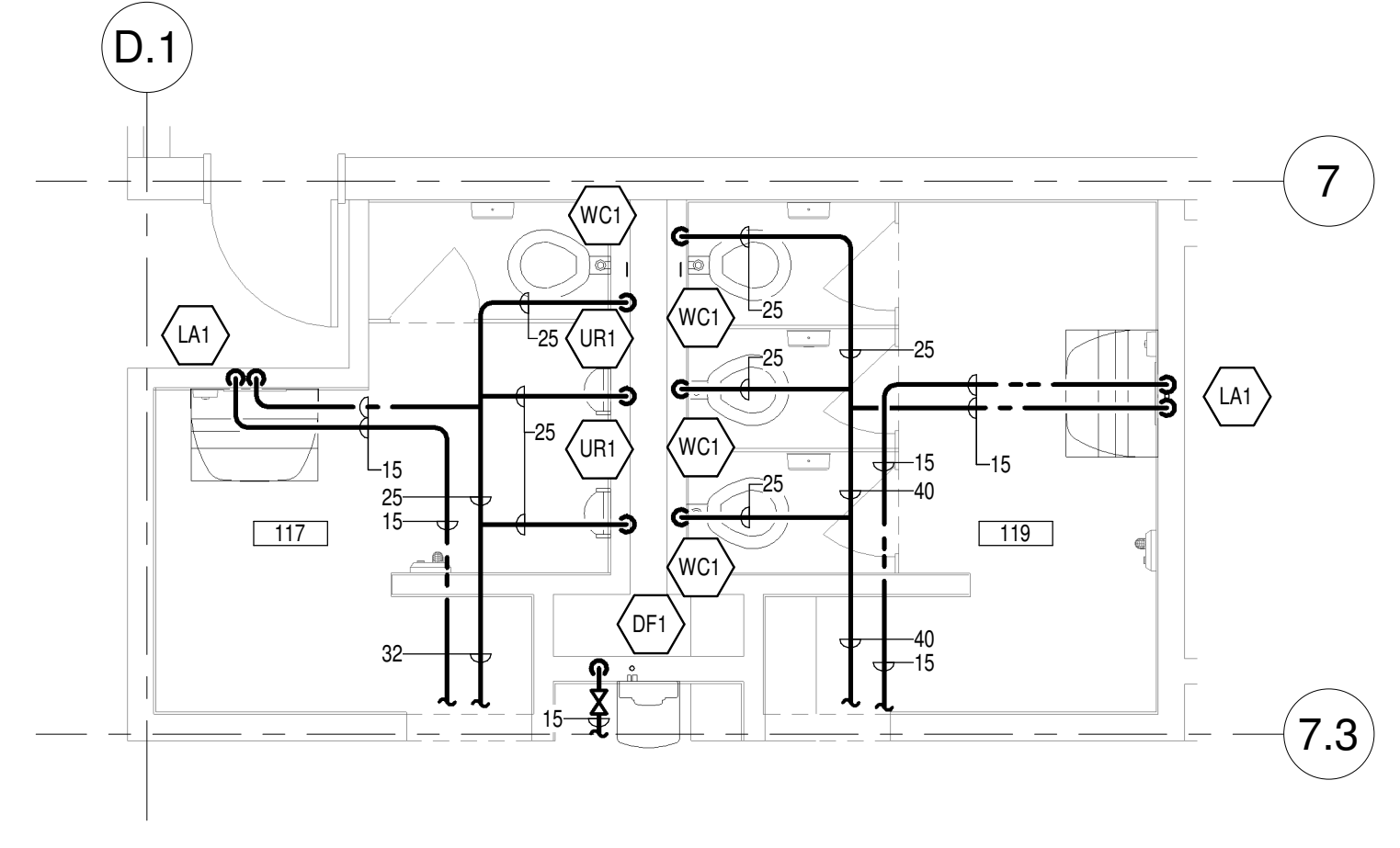


LAVATORY MIXING VALVE DETAIL

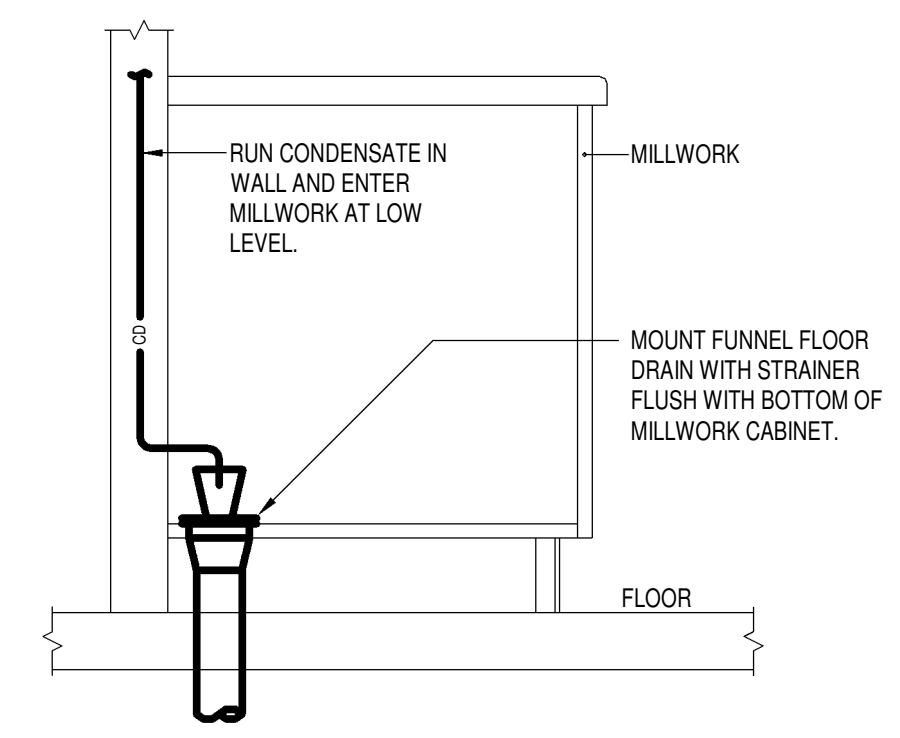
- SCALE NTS
- NOTES:**
- REFER TO SPECIFICATIONS FOR ALL FIXTURES MOUNTING HEIGHTS.
 - CONCEAL MIXING VALVE WITHIN BLOCK WALL. PROVIDE ACCESS DOOR AS SPECIFIED. MOUNT AT 150mm ABOVE FINISHED FLOOR.
 - RUN TEMPERED WATER HORIZONTALLY WITHIN WALL CAVITY.



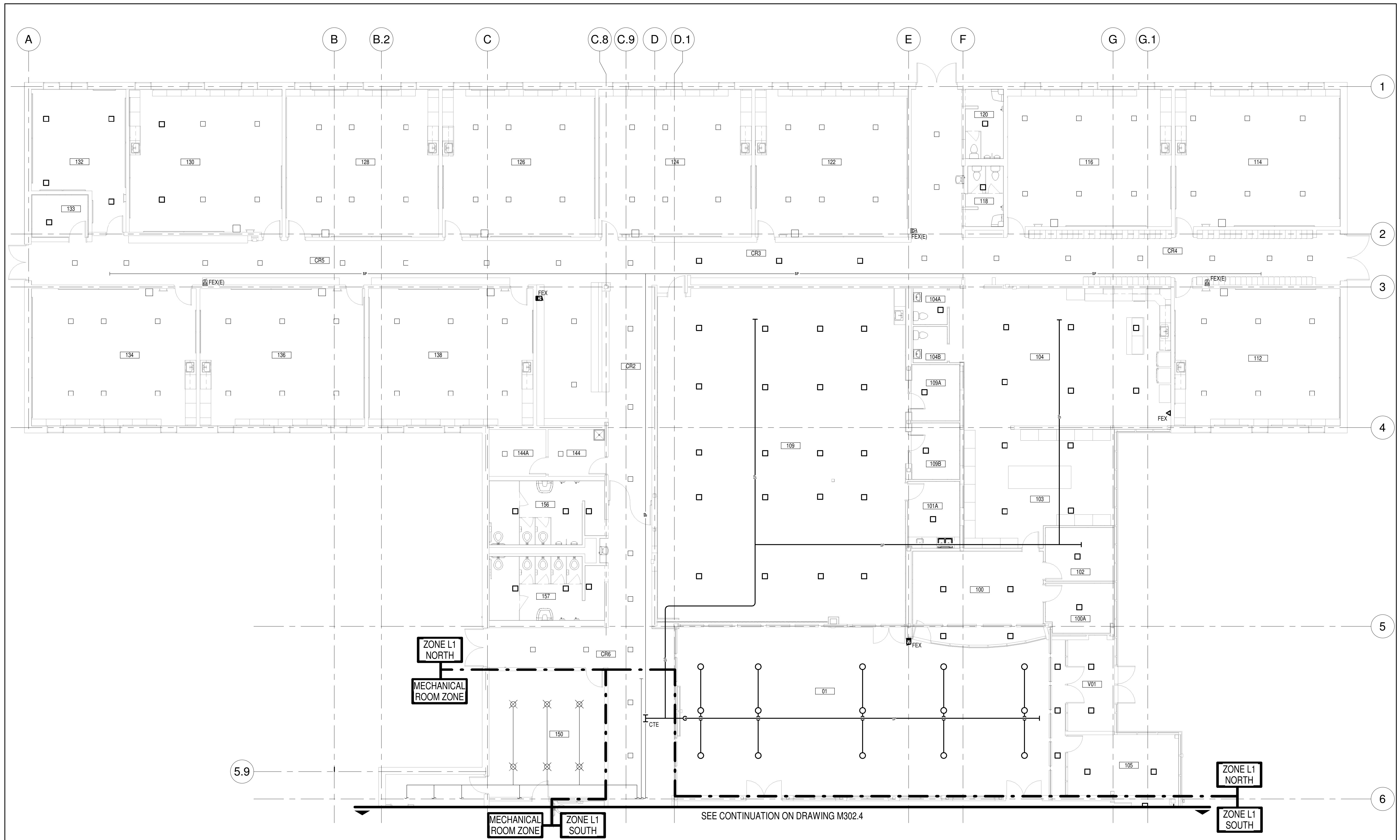
D DETAIL
M204.4/M205.4 SCALE 1:50



E DETAIL
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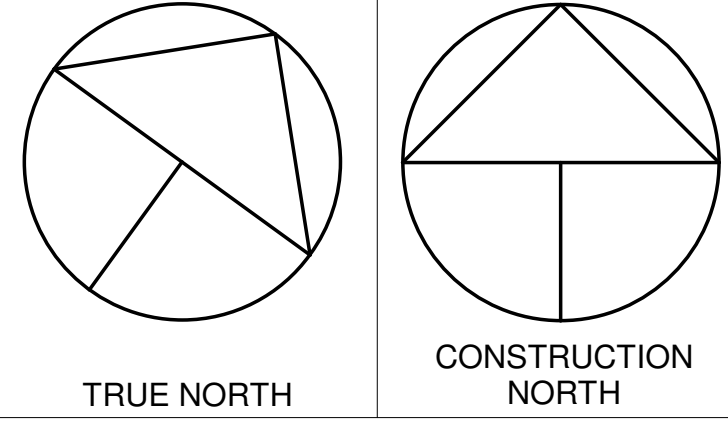
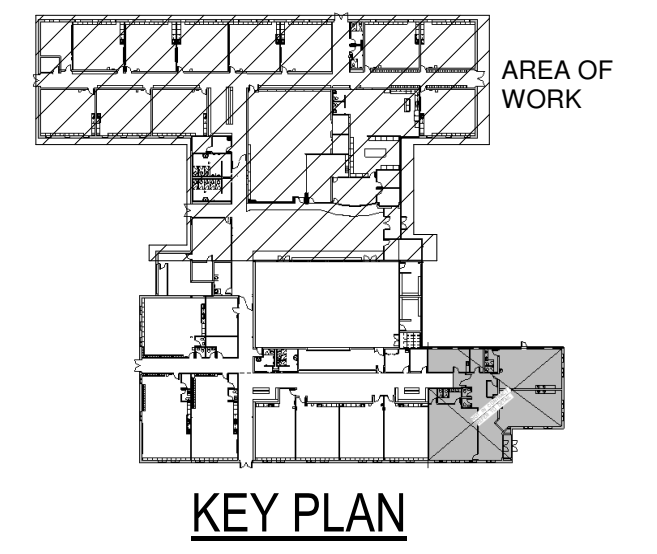


**FUNNEL FLOOR DRAIN
MILLWORK MOUNTING DETAIL**
N.T.S.



PART GROUND FLOOR PLAN FIRE PROTECTION NORTH
SCALE 1:100

- NOTES:
1. SPRINKLERS IN STAIRWELLS AND SHAFTS NOT SHOWN. PROVIDE COVERAGE IN ACCORDANCE WITH REQUIREMENTS OF NFPA 13.
 2. IN SOME AREAS, DROPPED CEILINGS ARE NOT CONTINUOUS TO WALLS. IN THOSE AREAS PROVIDE ADDITIONAL SPRINKLER COVERAGE ABOVE CEILINGS (NOT SHOWN). SEE ARCHITECTURAL REFLECTED CEILING PLANS.
 3. IN GENERAL, WHERE NEW SPRINKLER HEADS ARE SHOWN, CONNECT TO EXISTING BRANCH PIPING IN AREA.



LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY	DESCRIPTION	

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY	DESCRIPTION	

LEGEND

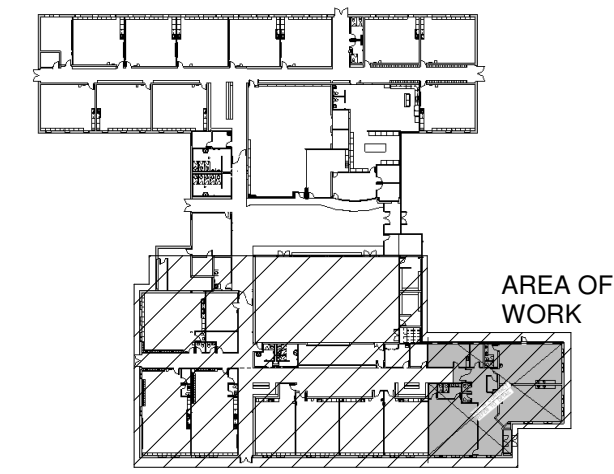
No.	DATE	ISSUED FOR TENDER & PERMIT	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY	DESCRIPTION	



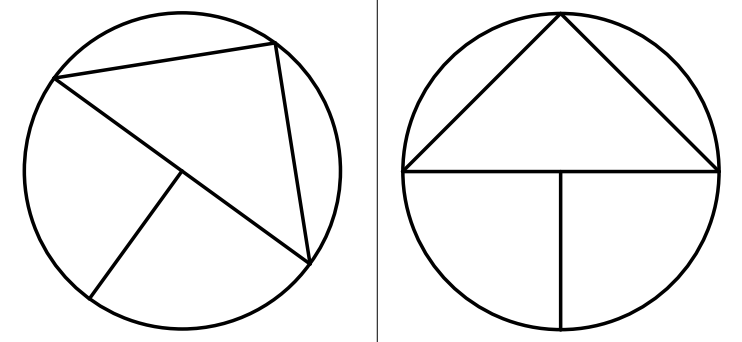
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - FIRE PROTECTION NORTH

DATE PLOTTED 2020-02-20 3:51:14 PM	DRAWN BY BMD	DRAWING No. M301.4
SCALE 1:100	CHECKED BY JDF	
PROJECT No. 8906		



KEY PLAN

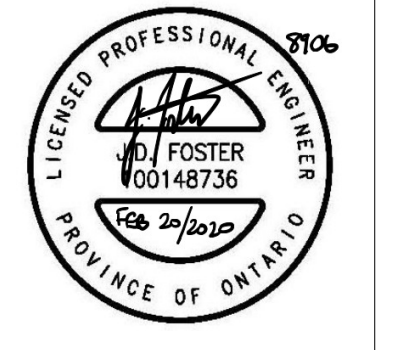


TRUE NORTH
CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE	DESCRIPTION	REV.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



PROJECT TITLE

OUR LADY OF FATIMA

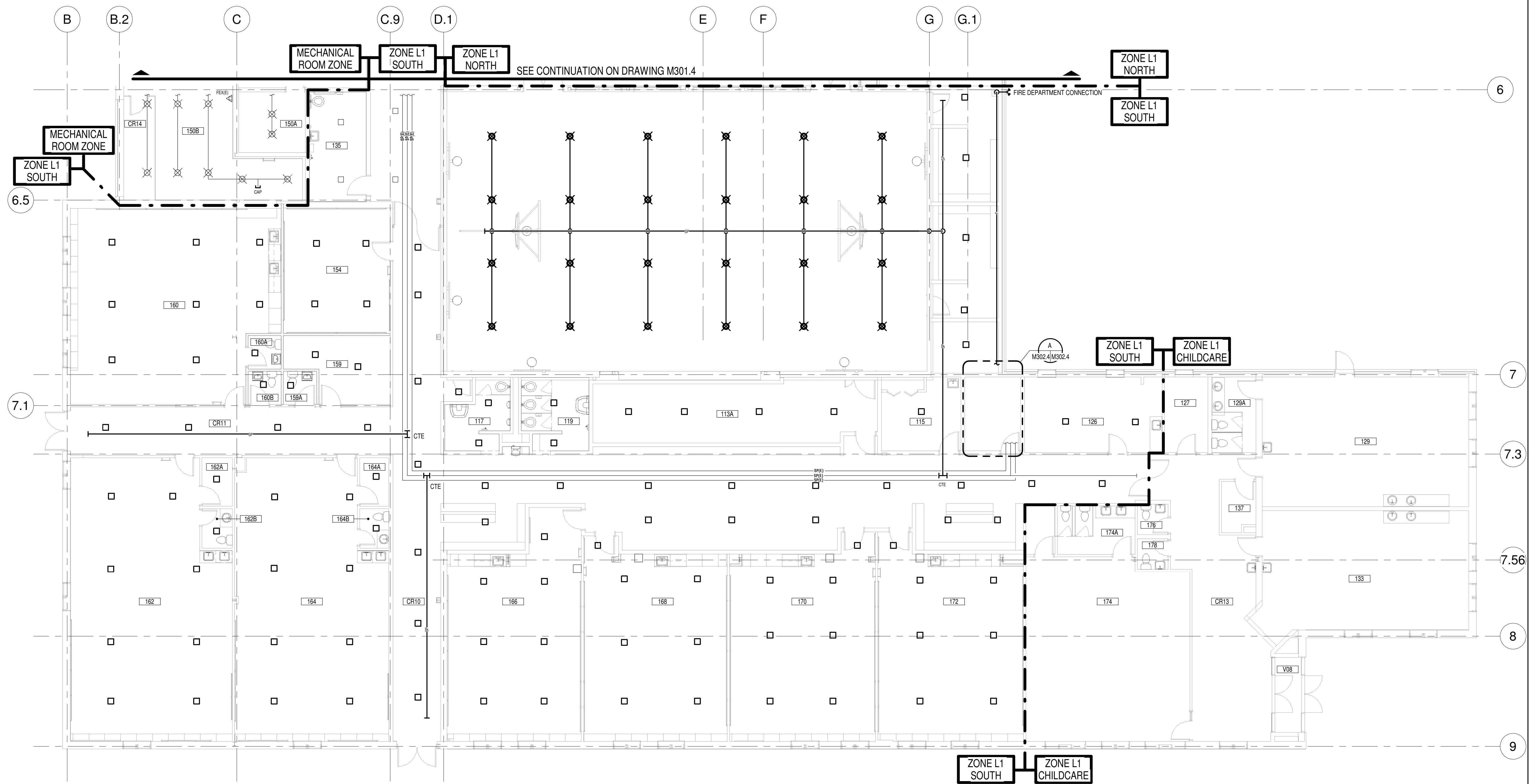
DRAWING TITLE

PART GROUND FLOOR PLAN -
FIRE PROTECTION SOUTH

DATE PLOTTED 2020-02-20 3:52:14 PM DRAWN BY BMD DRAWING No.

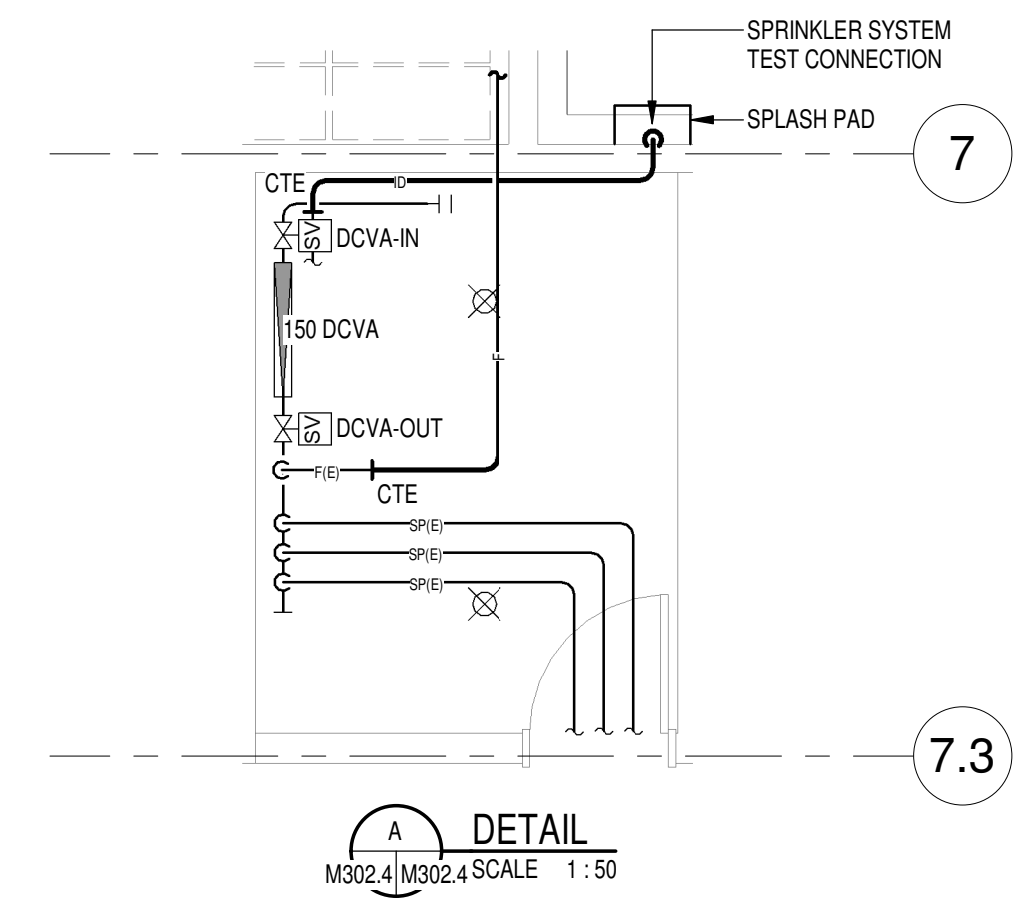
SCALE As indicated CHECKED BY JDF M302.4

PROJECT No. 8906

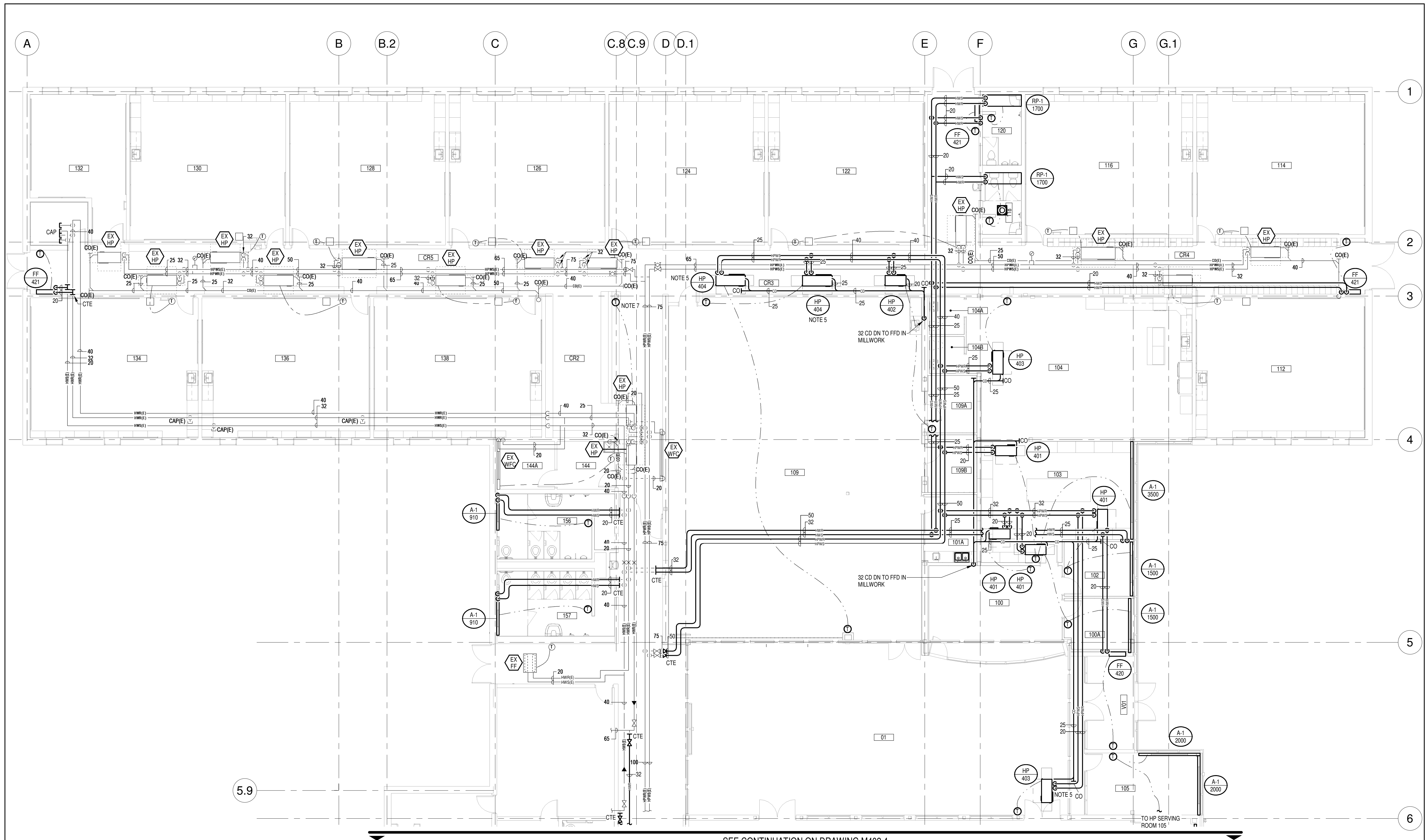


PART GROUND FLOOR PLAN FIRE PROTECTION SOUTH
SCALE 1:100

- NOTES:
1. SPRINKLERS IN STAIRWELLS AND SHAFTS NOT SHOWN. PROVIDE COVERAGE IN ACCORDANCE WITH REQUIREMENTS OF NFPA 13.
 2. GENERALLY, ALL NEW PIPING INSTALLED WITHIN CEILING SPACE IS TO BE INSTALLED AS HIGH AS POSSIBLE AND THROUGH EXISTING OWSJ WEBBING.
 3. IN SOME AREAS, DROPPED CEILINGS ARE NOT CONTINUOUS TO WALLS. IN THOSE AREAS PROVIDE ADDITIONAL SPRINKLER COVERAGE ABOVE CEILINGS (NOT SHOWN). SEE ARCHITECTURAL REFLECTED CEILING PLANS.
 4. ZONE L1 CHILD CARE ISA FUTURE ZONE. SHOWN FOR REFERENCE.



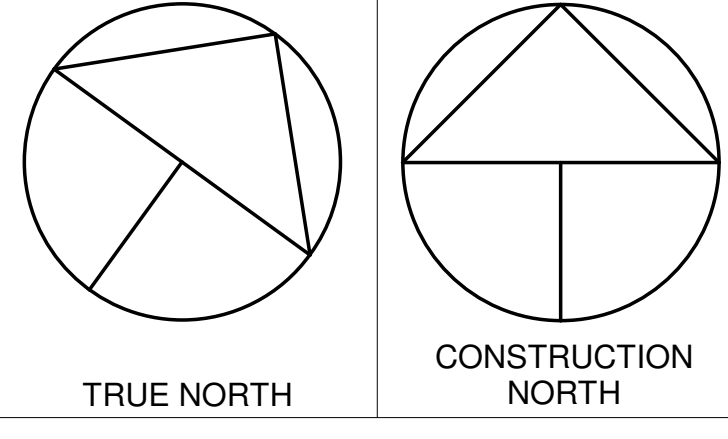
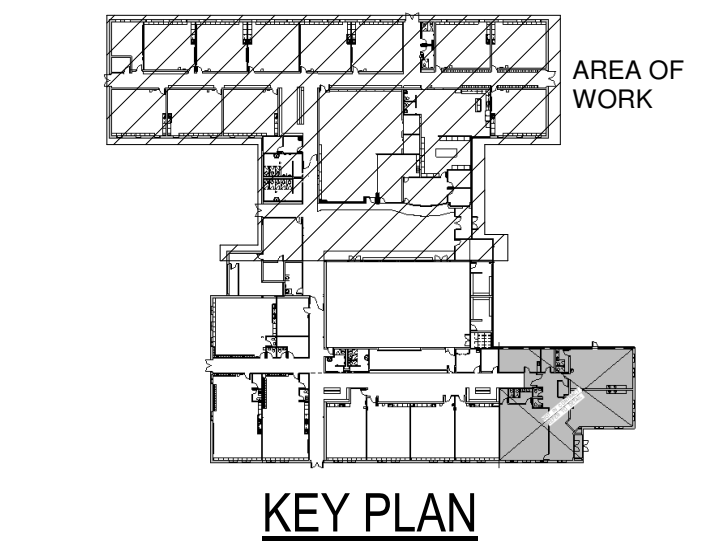
DETAIL A
M302.4/M302.4 SCALE 1:50



SEE CONTINUATION ON DRAWING M402.4

PART GROUND FLOOR PLAN HEATING NORTH
SCALE 1 : 100

- NOTES:**
- MINIMUM HWS AND HWR PIPE SIZE IS 20MM.
 - HEAT PUMP PIPING TO RUN IN JOIST SPACE.
 - ENSURE NO MECHANICAL OR ELECTRICAL SERVICES ARE INSTALLED DIRECTLY BELOW HEAT PUMPS.
 - SEE HEAT PUMP INSTALLATION DETAILS ON DRAWING M103.4.
 - INSTALL HEAT PUMP WITH NO CONTROL VALVE.
 - GENERALLY, ALL NEW PIPING INSTALLED WITHIN CEILING SPACE IS TO BE INSTALLED AS HIGH AS POSSIBLE AND THROUGH EXISTING OWSJ WEBBING.
 - RELOCATE EXISTING THERMOSTAT.



NOTES

LEGEND

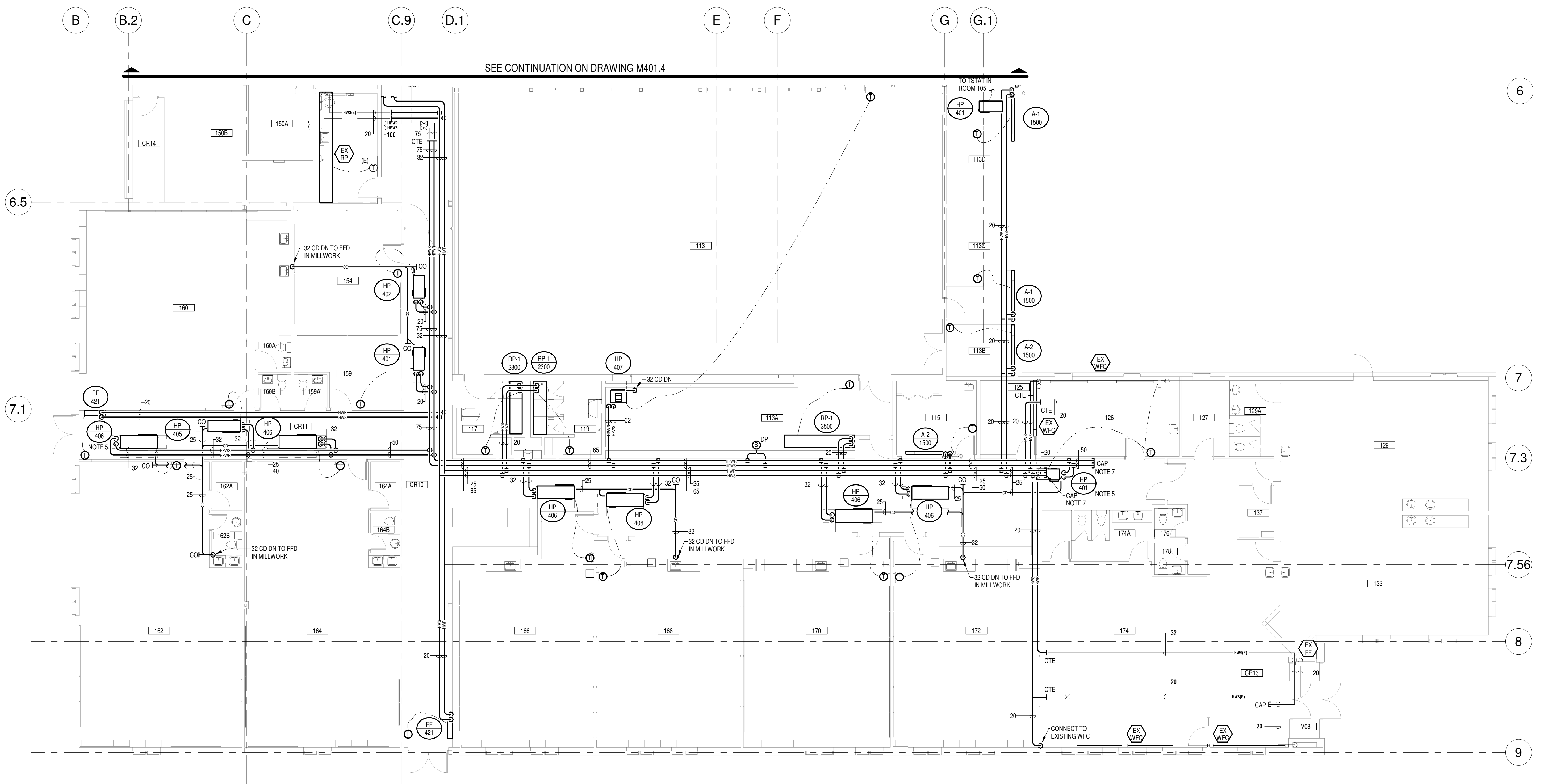
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2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY	DESCRIPTION	



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - HEATING

DATE PLOTTED 2020-02-20 3:52:28 PM	DRAWN BY BMD	DRAWING No.
SCALE 1 : 100	CHECKED BY JDF	M401.4
PROJECT No. 8906		

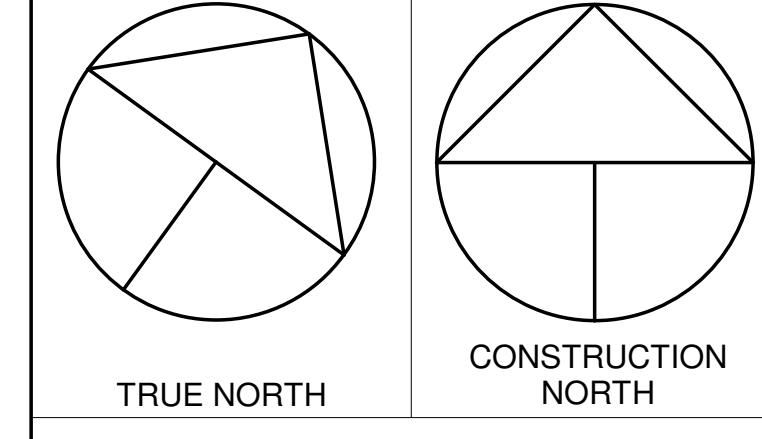
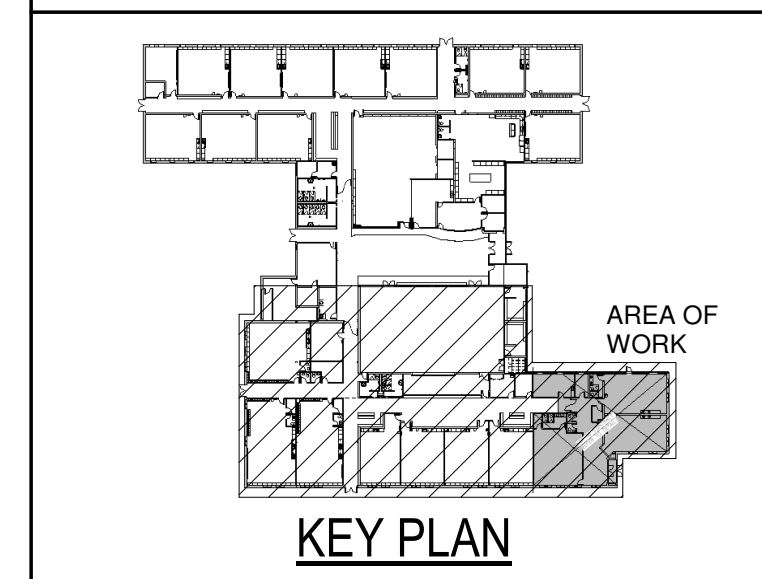


SEE CONTINUATION ON DRAWING M401.4

PART GROUND FLOOR PLAN HEATING SOUTH
SCALE: 1:100

NOTES:

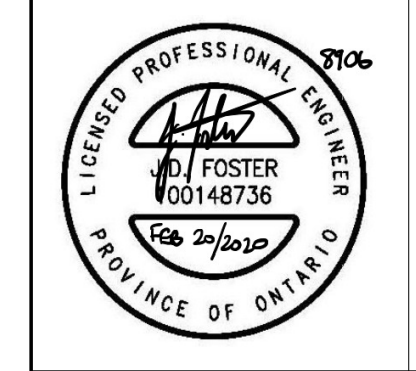
1. MINIMUM HWS AND HWR PIPE SIZE IS 20MM.
2. HEAT PUMP PIPING TO RUN IN JOIST SPACE.
3. ENSURE NO MECHANICAL OR ELECTRICAL SERVICES ARE INSTALLED DIRECTLY BELOW HEAT PUMPS.
4. SEE HEAT PUMP INSTALLATION DETAILS ON DRAWING M102.
5. INSTALL HEAT PUMP WITH NO CONTROL VALVE.
6. GENERALLY, ALL NEW PIPING INSTALLED WITHIN CEILING SPACE IS TO BE INSTALLED AS HIGH AS POSSIBLE AND THROUGH EXISTING OWSJ WEBBING.
7. SIZED TO SERVE CHLD AREA.



NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	REV.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY	DESCRIPTION	REV. No.



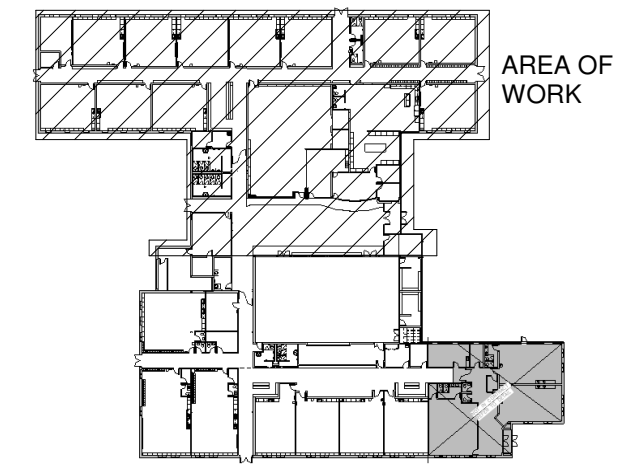
PROJECT TITLE

OUR LADY OF FATIMA

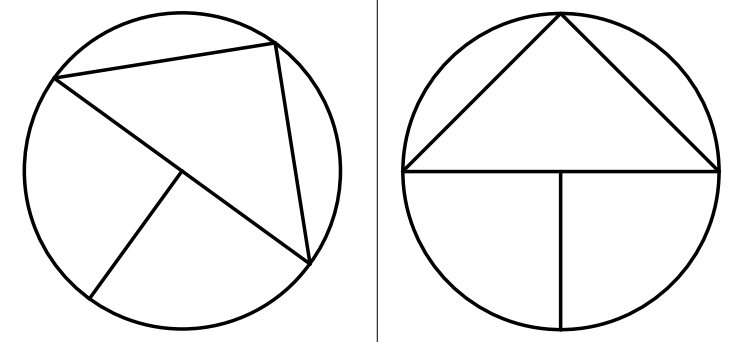
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PART GROUND FLOOR PLAN - HEATING

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SCALE 1:100	CHECKED BY JDF	M402.4
PROJECT No. 8906		



KEY PLAN

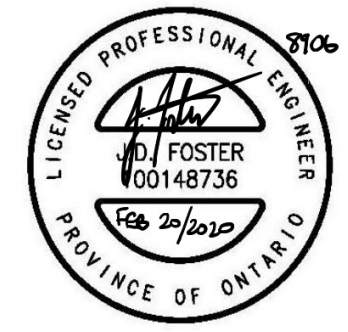


TRUE NORTH CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV.
2	02/20/2020			



PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

PART GROUND FLOOR PLAN - AIR DISTRIBUTION

DATE PLOTTED 2020-02-20 3:52:49 PM

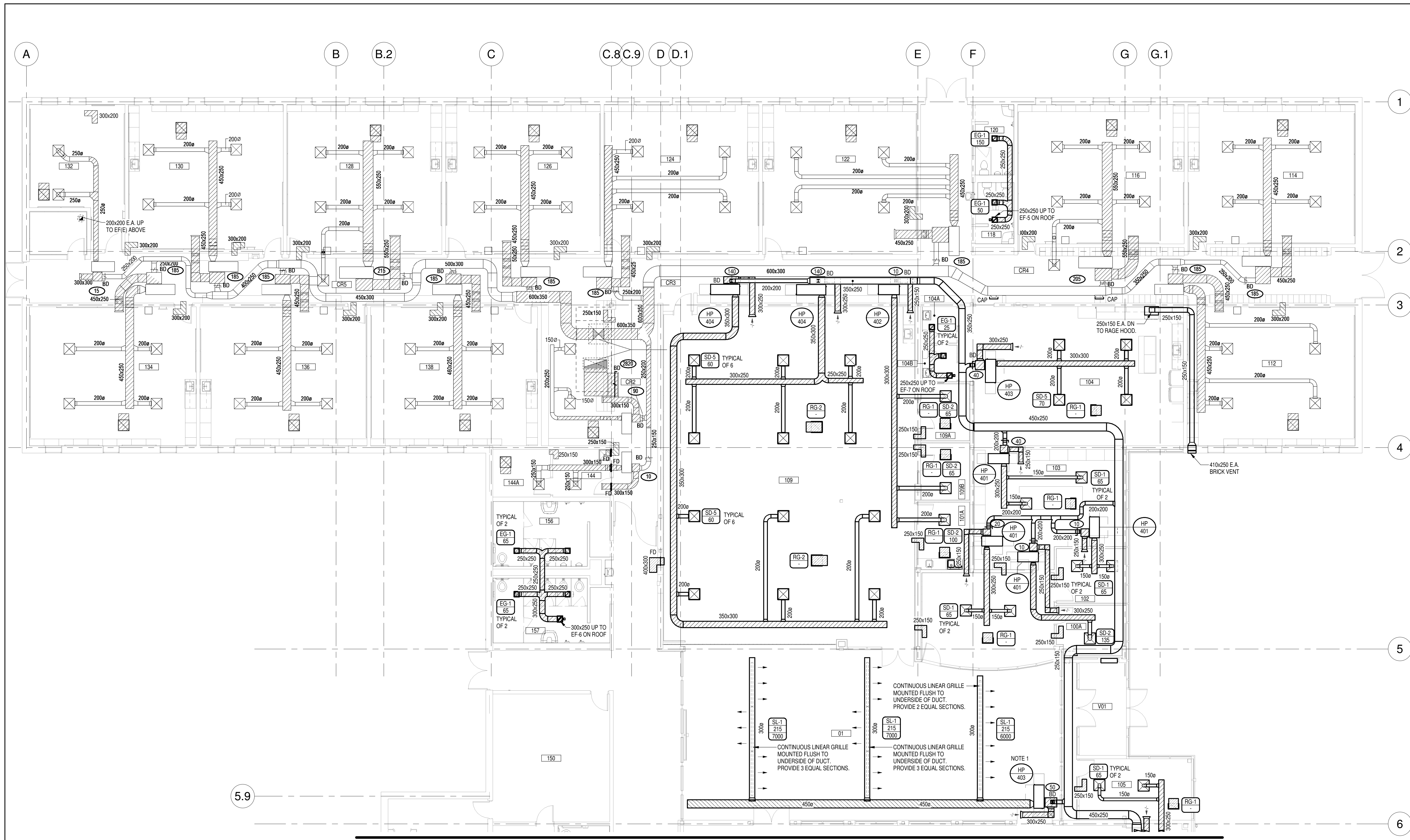
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PROJECT No. 8906

DRAWN BY BMD

CHECKED BY JDF

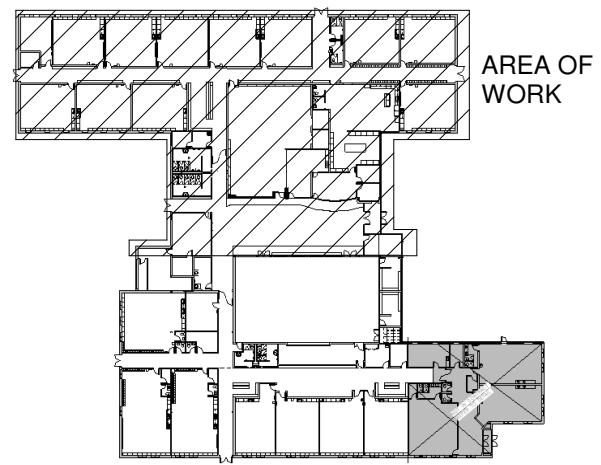
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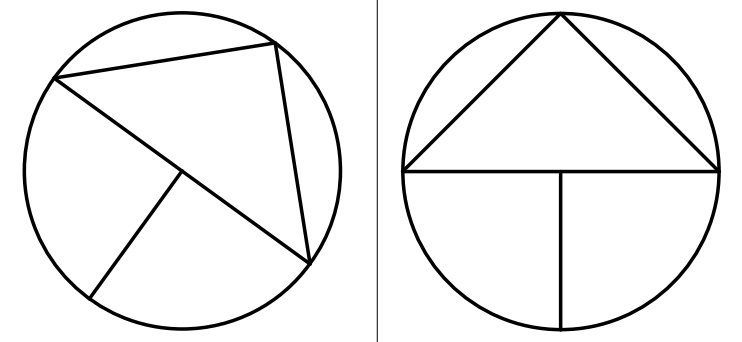
SEE CONTINUATION ON DRAWING M502.4

PART GROUND FLOOR PLAN AIR DISTRIBUTION NORTH
SCALE 1:100

- NOTES:
- ALLOW FOR PAINTING OF EXPOSED HEAT PUMP. ARCHITECT TO SELECT COLOUR.



KEY PLAN



TRUE NORTH

CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE	DESCRIPTION	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



PROJECT TITLE

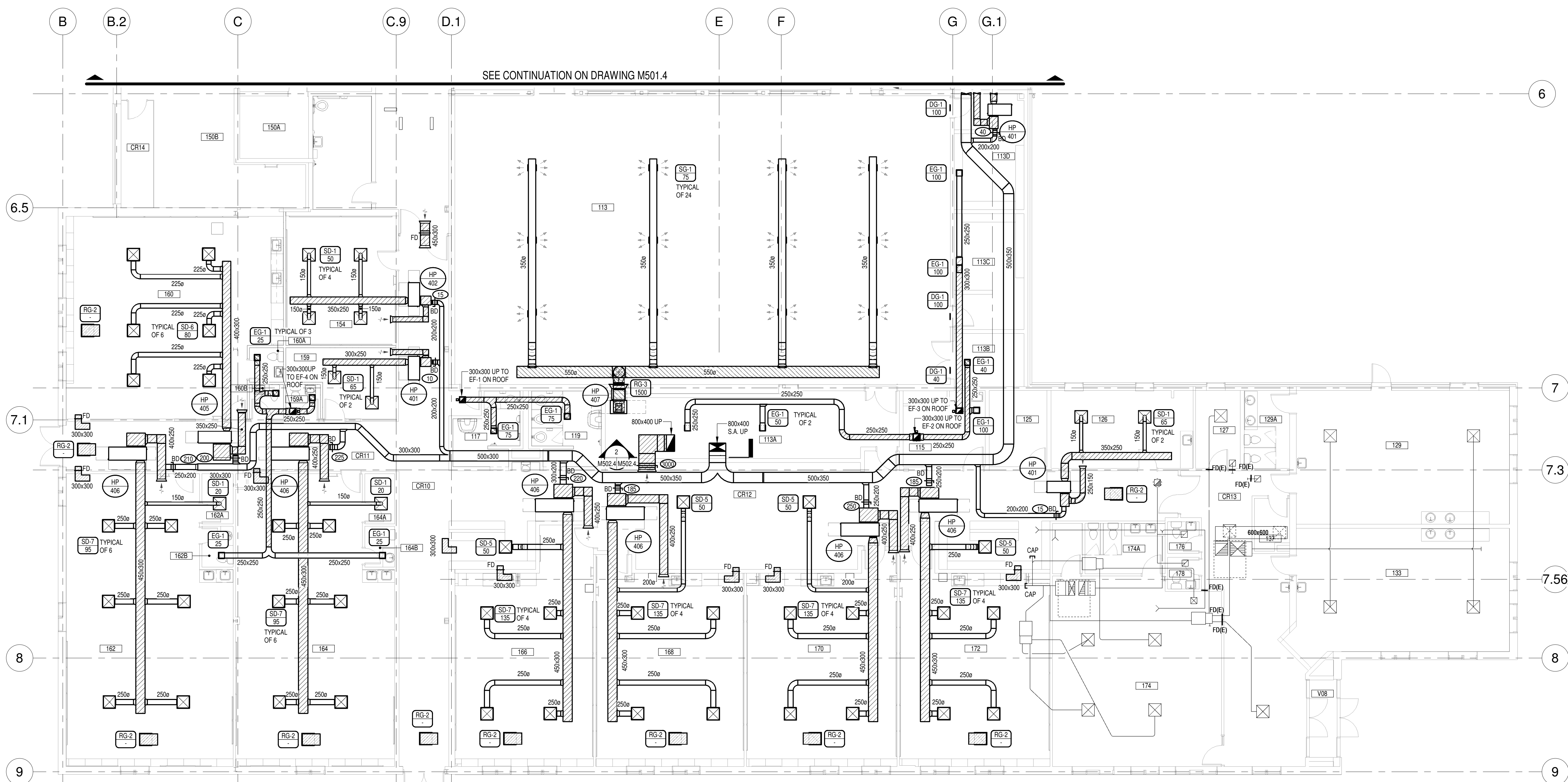
OUR LADY OF FATIMA

DRAWING TITLE

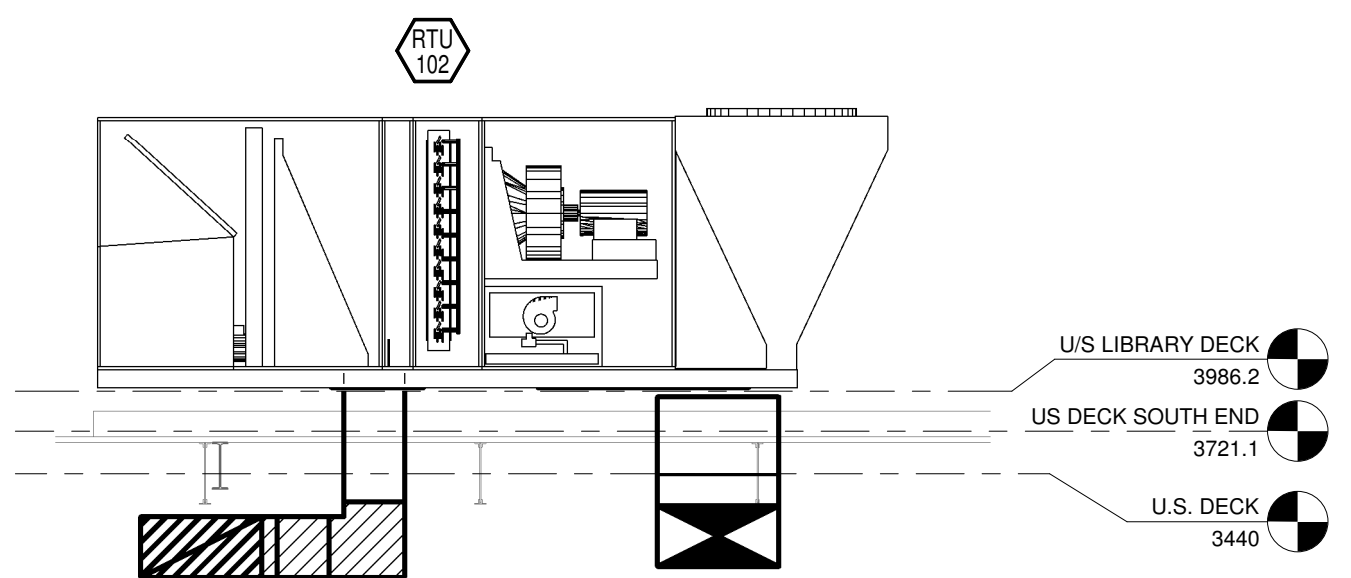
PART GROUND FLOOR PLAN - AIR DISTRIBUTION

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SCALE As indicated	CHECKED BY JDF	M502.4
PROJECT No.		8906

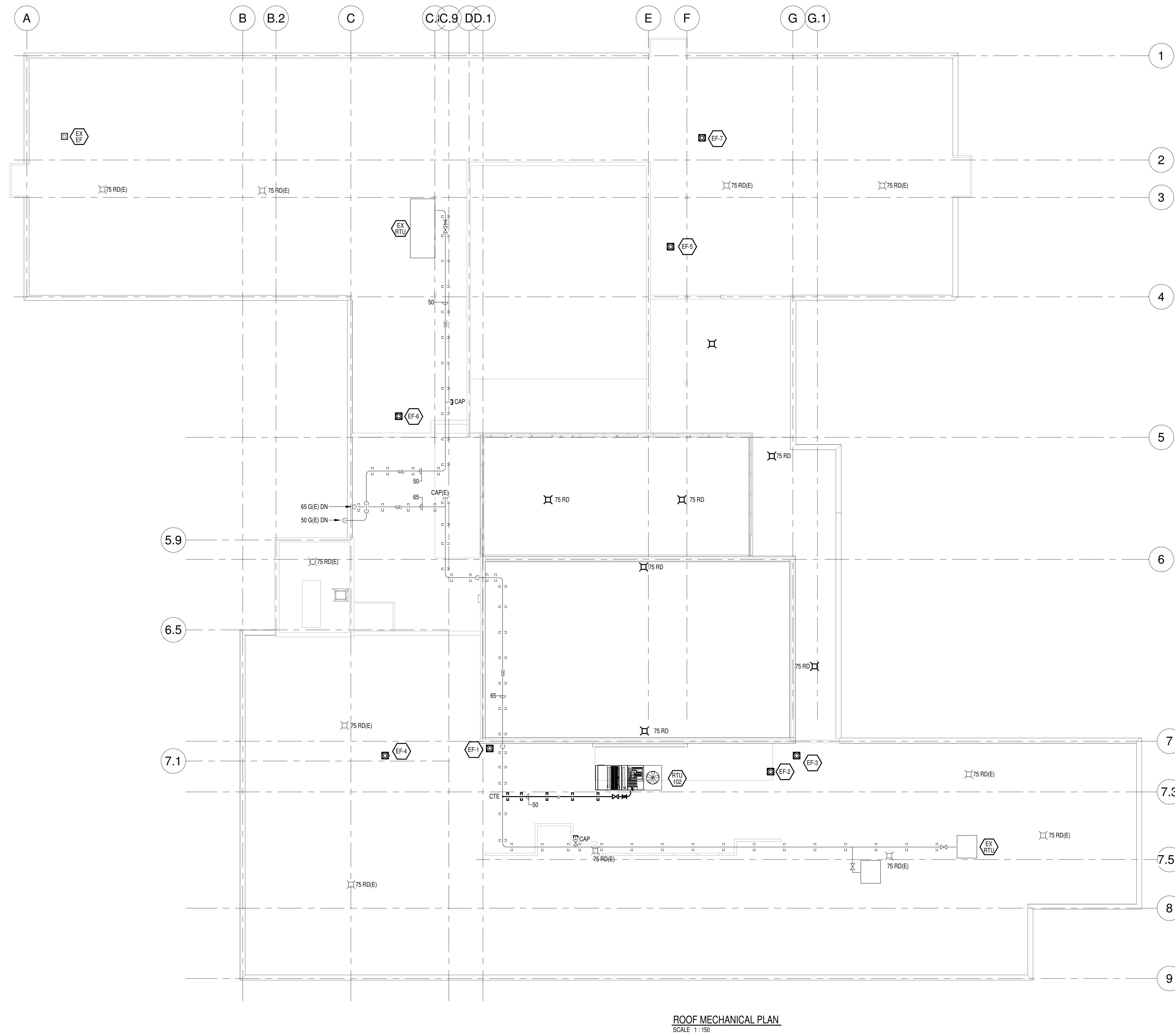
SEE CONTINUATION ON DRAWING M501.4



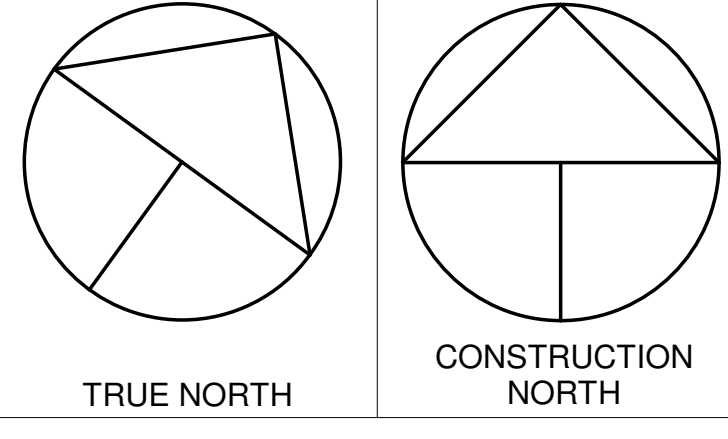
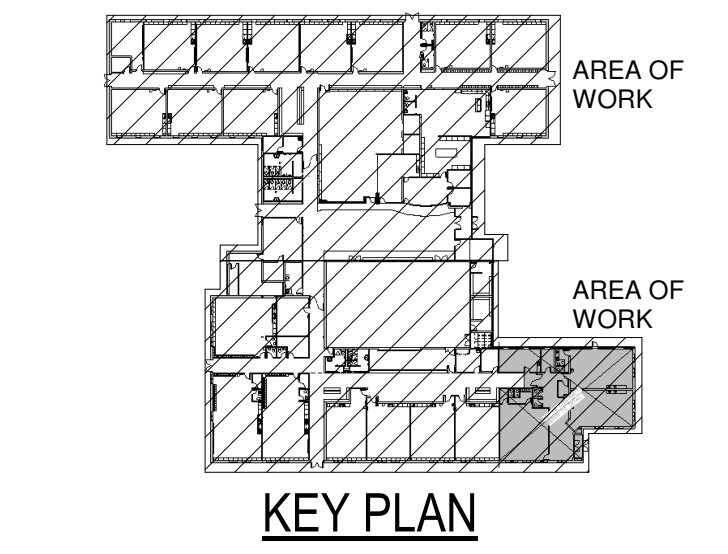
PART GROUND FLOOR PLAN AIR DISTRIBUTION SOUTH
SCALE: 1:100



SECTION 2
M502.4 | M502.4 SCALE: 1:50



ROOF MECHANICAL PLAN
SCALE 1 : 150



NOTES

LEGEND

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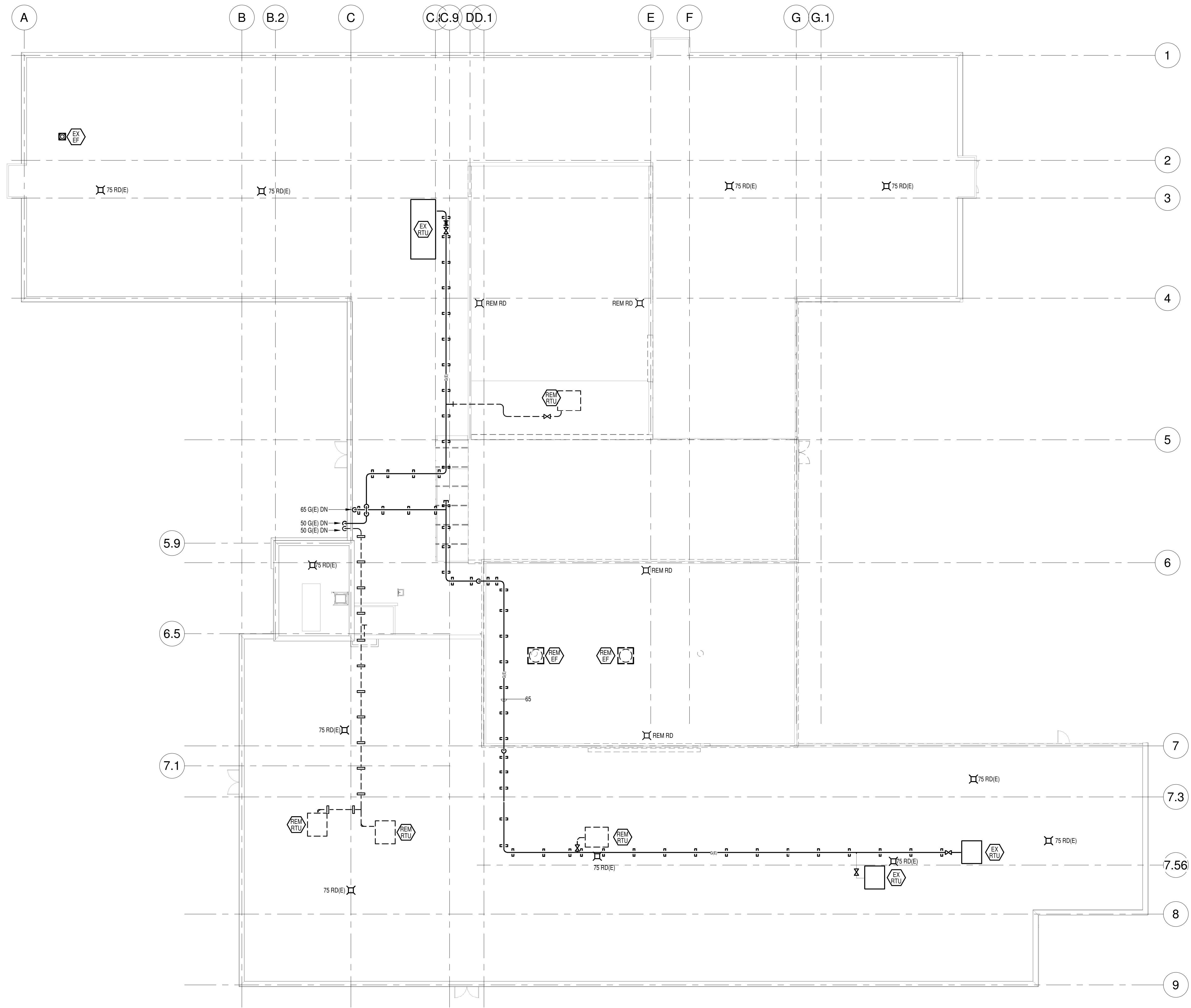
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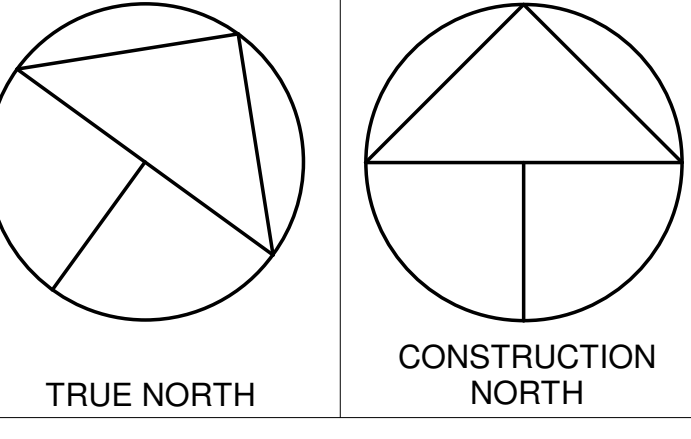
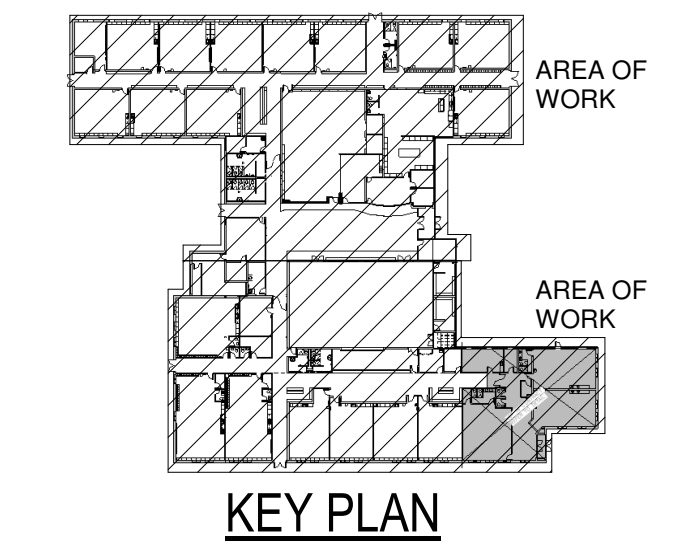
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
ROOF MECHANICAL PLAN

DATE PLOTTED 2020-02-20 3:53:01 PM	DRAWN BY BMD	DRAWING No.
SCALE 1 : 150	CHECKED BY JDF	M601.4
PROJECT No. 8906		



ROOF MECHANICAL PLAN DEMOLITION
SCALE 1:150



NOTES

LEGEND

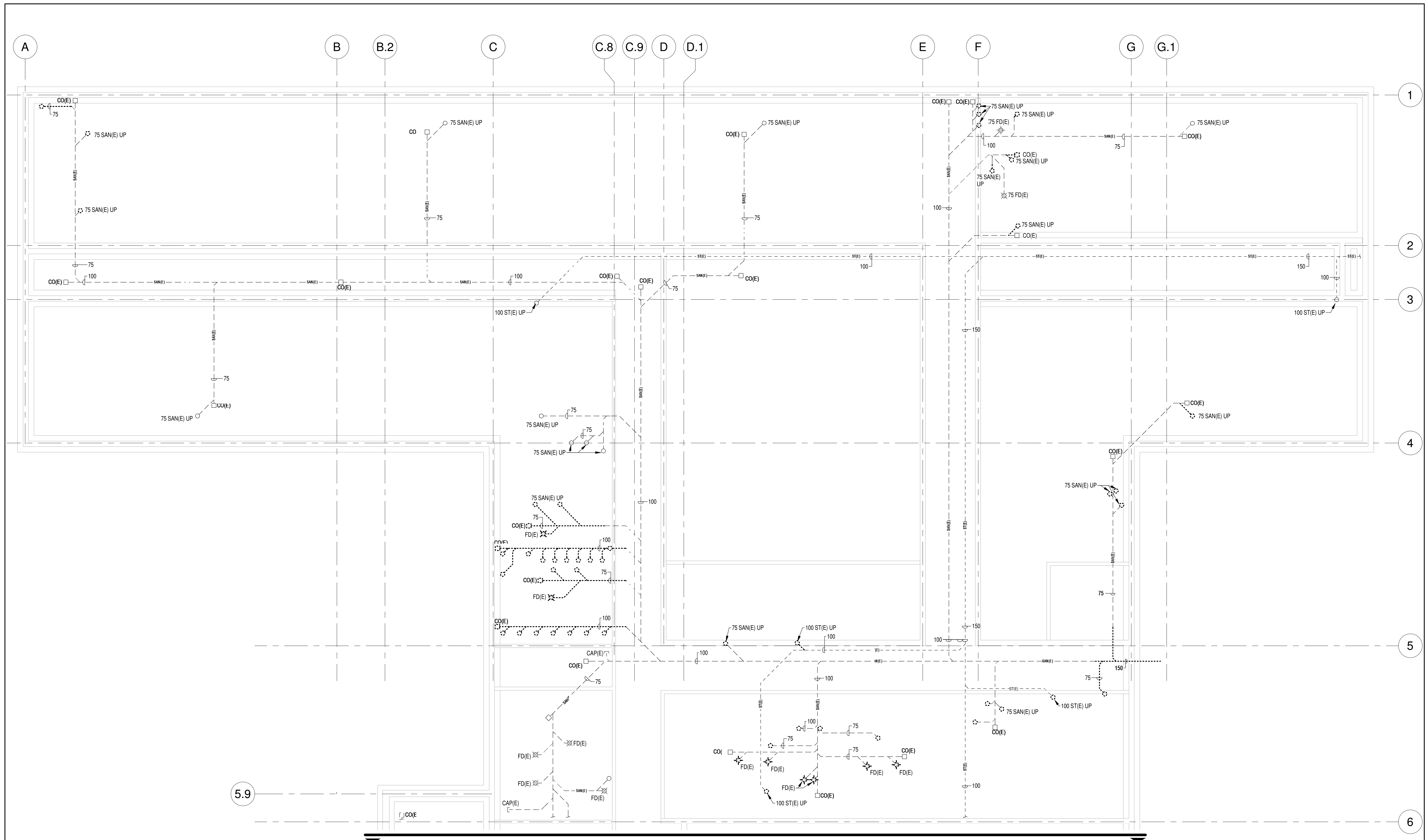
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PROJECT TITLE
OUR LADY OF FATIMA

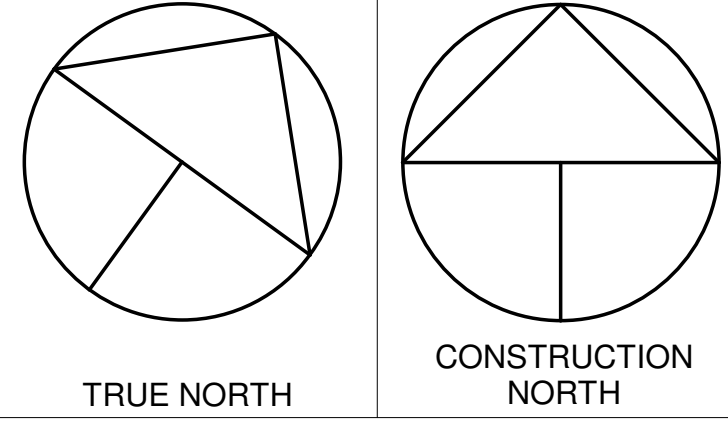
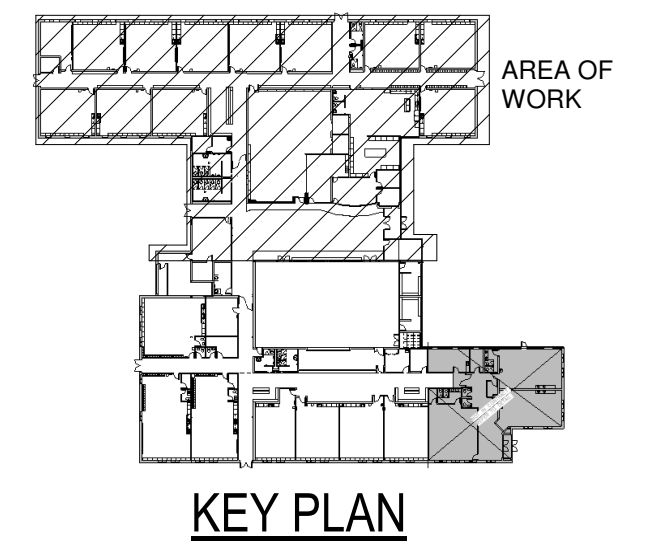
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**ROOF MECHANICAL PLAN
DEMOLITION**

DATE PLOTTED 2020-02-20 3:53:05 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:150	CHECKED BY JDF	M602.4
PROJECT No. 8906		



SEE CONTINUATION ON DRAWING M702.4

PART GROUND FLOOR PLAN DRAINAGE NORTH DEMOLITION
SCALE 1 : 100



NOTES

LEGEND

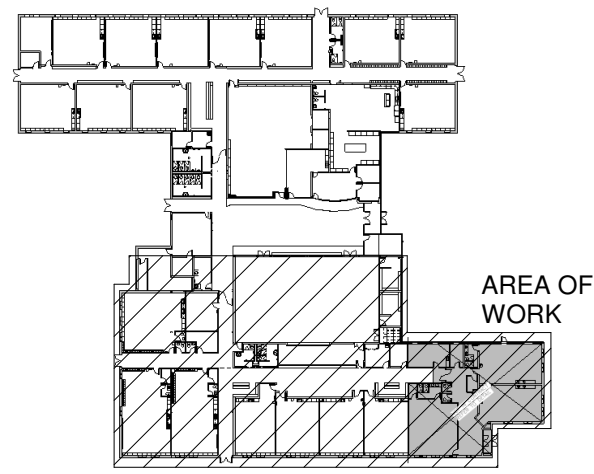
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2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



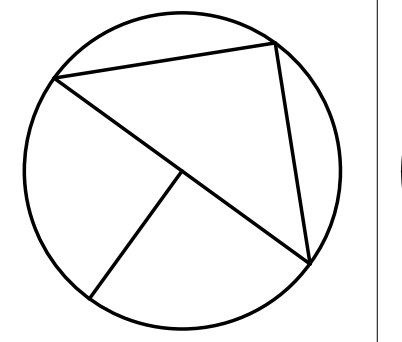
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - DRAINAGE DEMOLITION

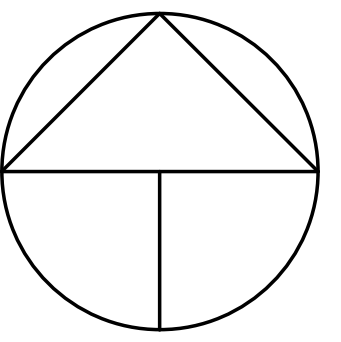
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SCALE 1 : 100	CHECKED BY JDF	M701.4
PROJECT No. 8906		



KEY PLAN



TRUE NORTH



CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE MM/DD/YYYY	ISSUED FOR TENDER & PERMIT DESCRIPTION	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	

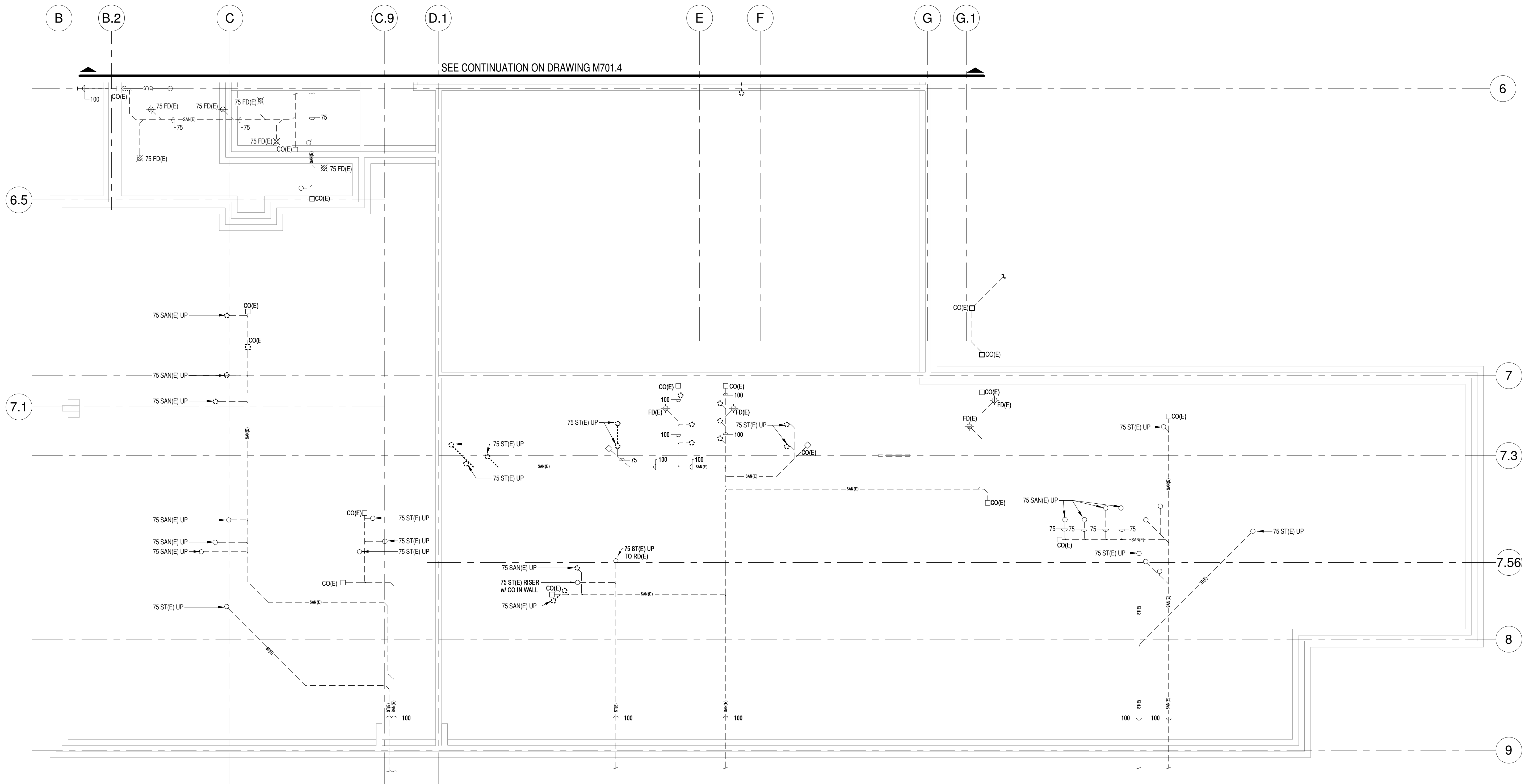


PROJECT TITLE
OUR LADY OF FATIMA

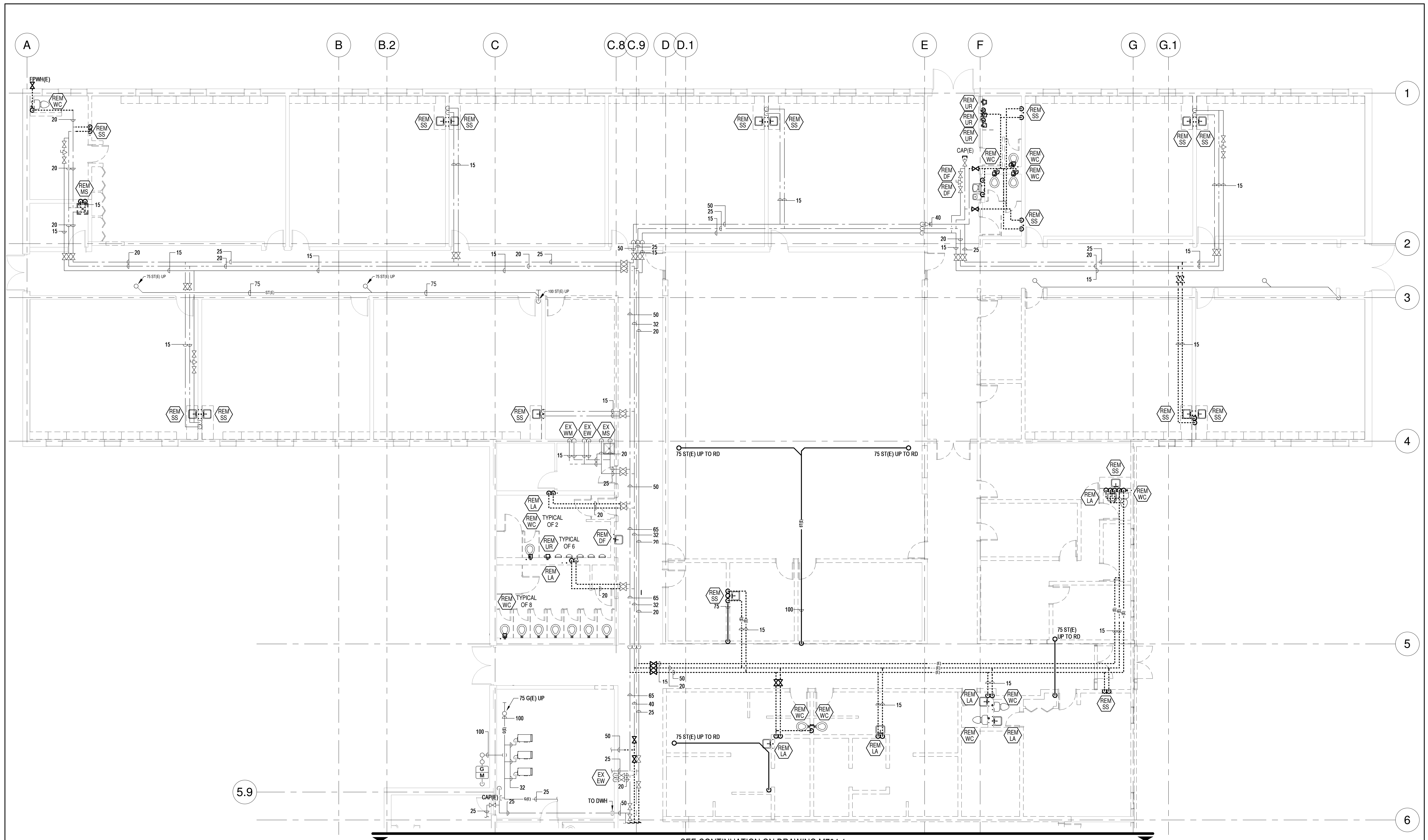
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**PART GROUND FLOOR PLAN -
DRAINAGE DEMOLITION**

DATE PLOTTED 2020-02-20 3:53:14 PM	DRAWN BY BMD	DRAWING No. M702.4
SCALE 1 : 100	CHECKED BY JDF	
PROJECT No. 8906		

SEE CONTINUATION ON DRAWING M701.4



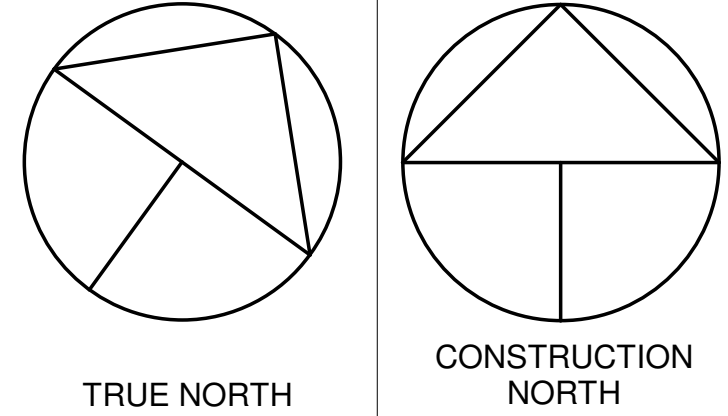
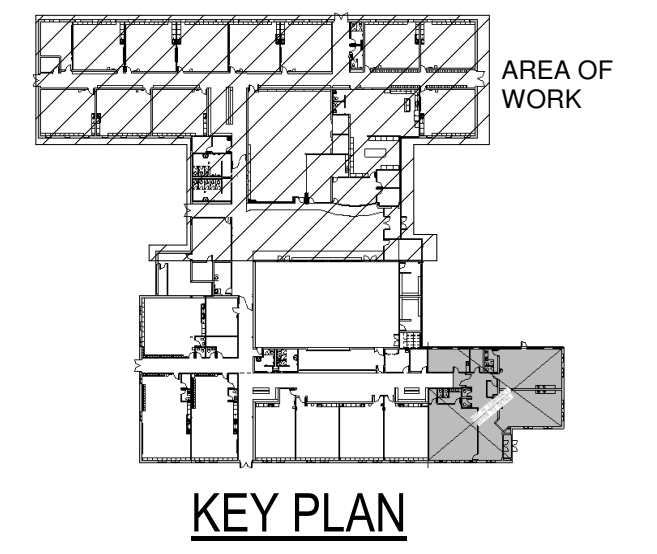
PART GROUND FLOOR PLAN DRAINAGE SOUTH DEMOLITION
SCALE 1 : 100



SEE CONTINUATION ON DRAWING M704.4

PART GROUND FLOOR PLAN PLUMBING NORTH DEMOLITION
SCALE 1:100

- NOTES:**
- SERVICES TO BE CUT BACK AND CAP CONCEALED WITHIN WALL OR UNDERGROUND.



NOTES

LEGEND

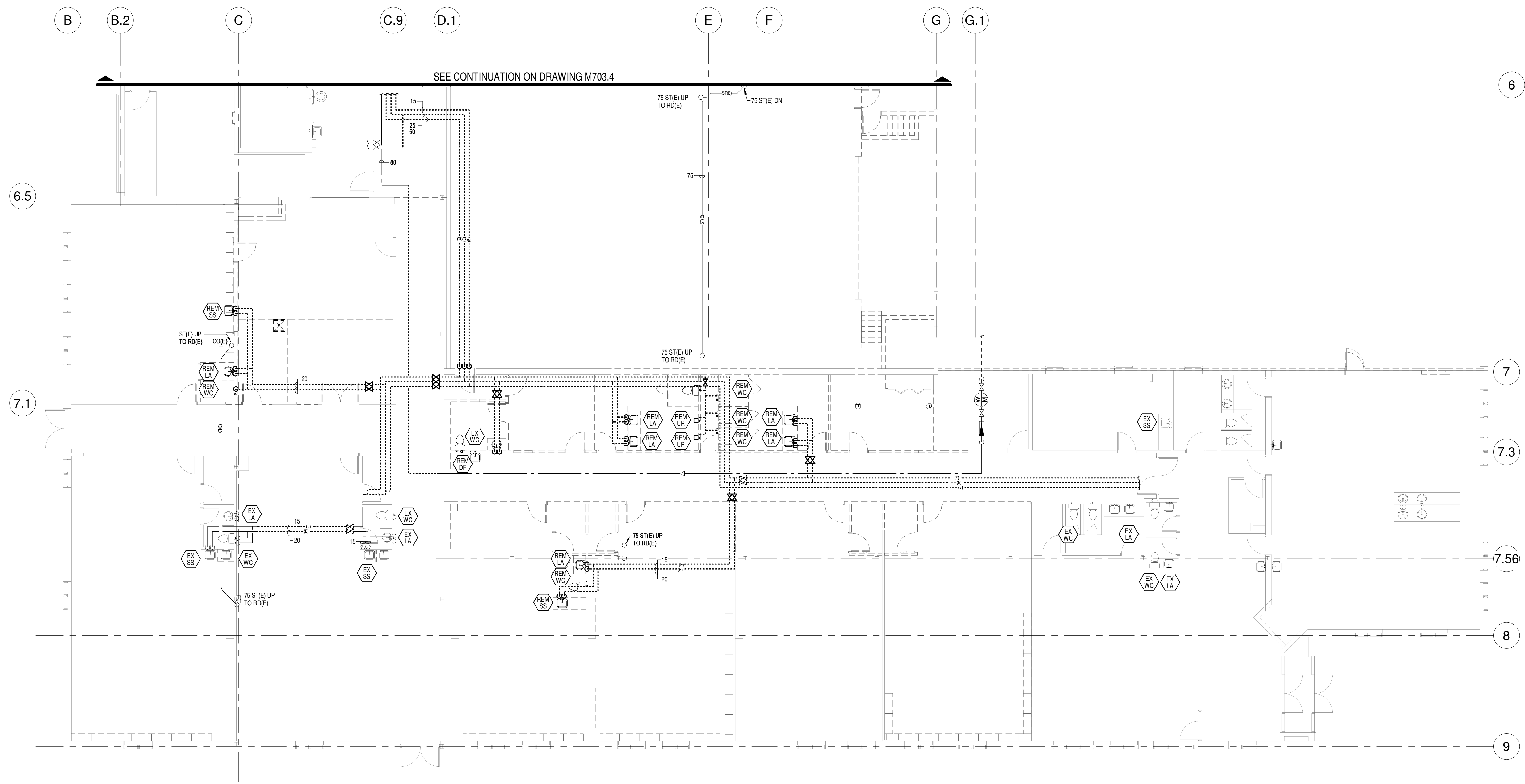
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PROJECT TITLE
OUR LADY OF FATIMA

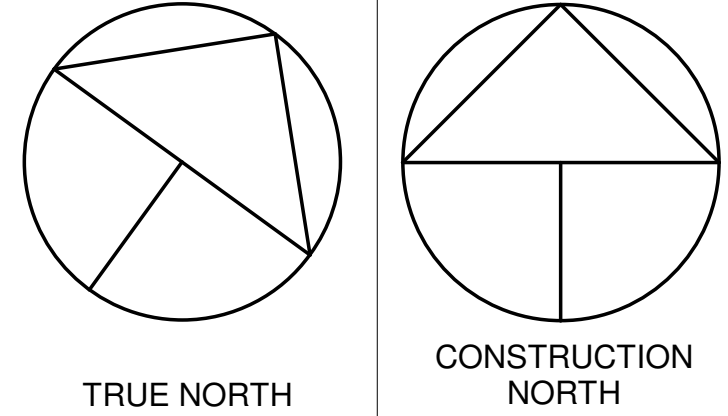
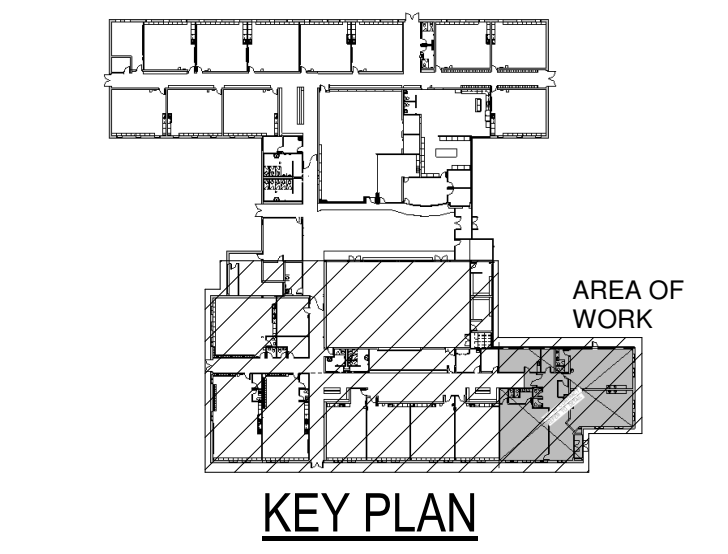
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PART GROUND FLOOR PLAN - PLUMBING DEMOLITION

DATE PLOTTED 2020-02-20 3:53:20 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M703.4
PROJECT No. 8906		



PART GROUND FLOOR PLAN PLUMBING SOUTH DEMOLITION
SCALE 1:100

- NOTES:**
- SERVICES TO BE CUT BACK AND CAP CONCEALED WITHIN WALL OR UNDERGROUND.



NOTES

LEGEND

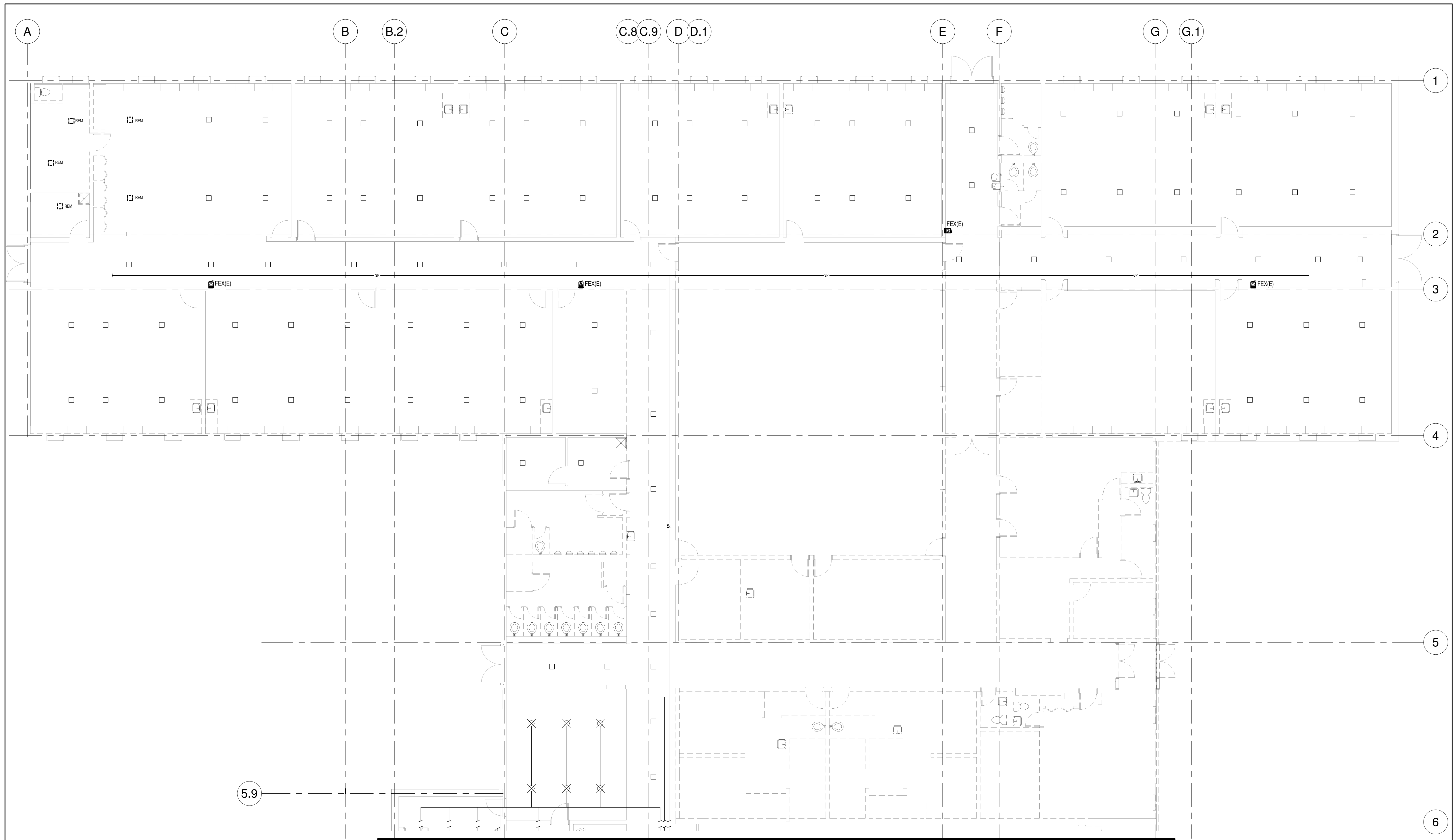
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PROJECT TITLE
OUR LADY OF FATIMA

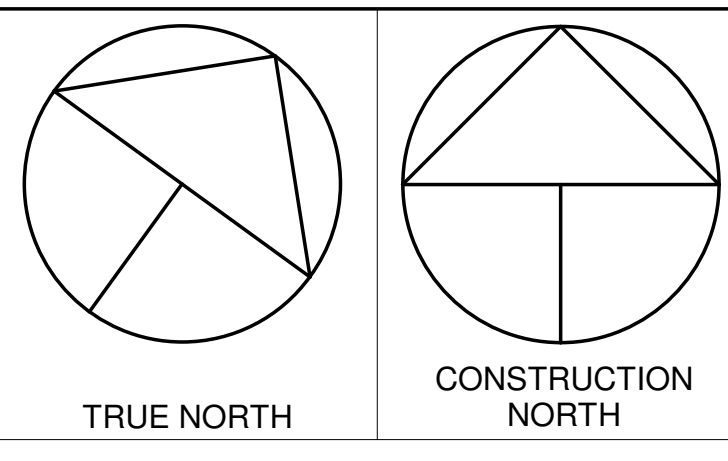
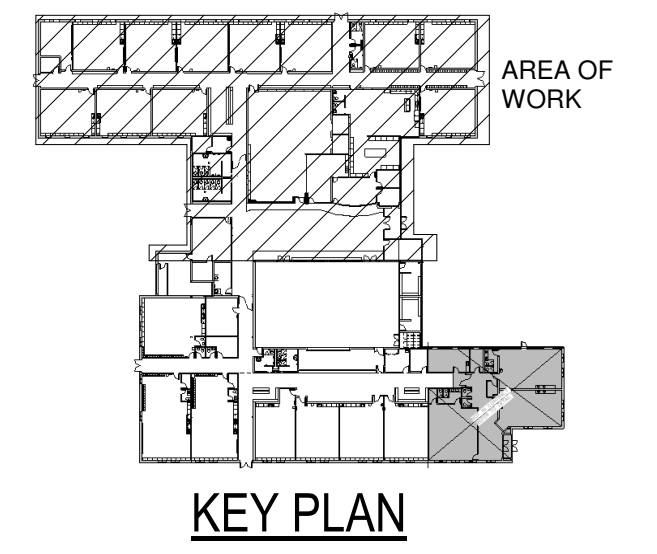
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PART GROUND FLOOR PLAN - PLUMBING DEMOLITION

DATE PLOTTED 2020-02-20 3:53:25 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M704.4
PROJECT No. 8906		



SEE CONTINUATION ON DRAWING M706.4

PART GROUND FLOOR PLAN FIRE PROTECTION NORTH DEMOLITION
SCALE 1:100



NOTES

LEGEND

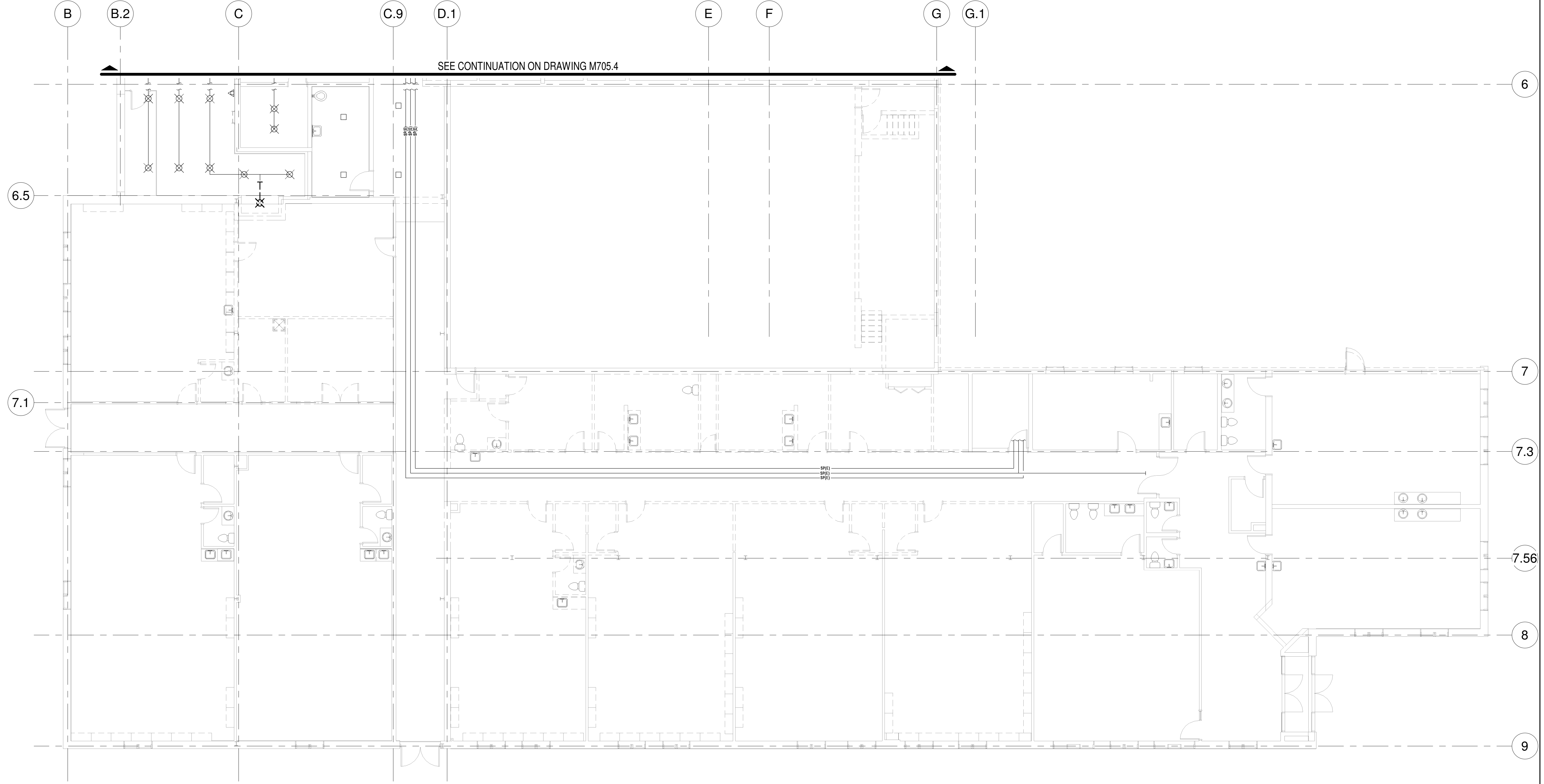
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2	02/20/2020	ISSUED FOR TENDER & PERMIT	



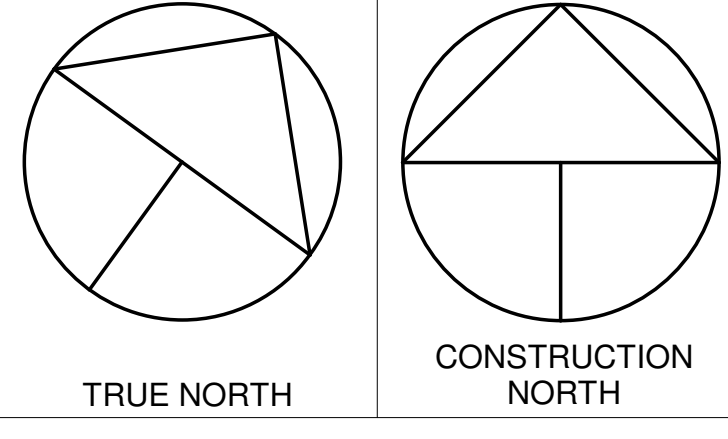
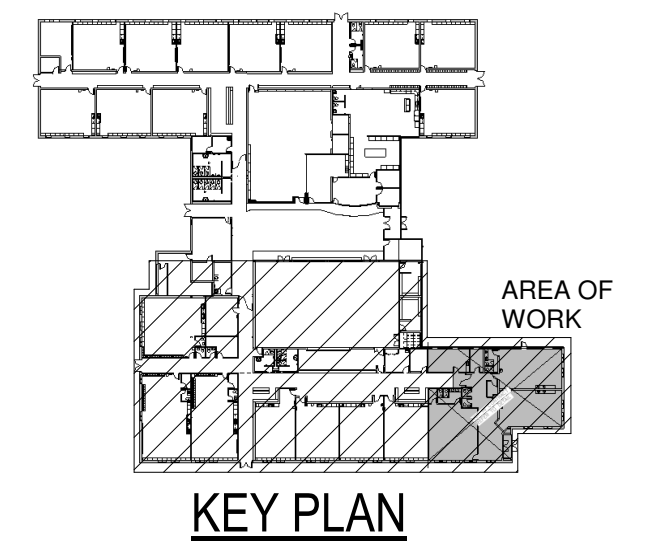
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
**PART GROUND FLOOR PLAN -
FIRE PROTECTION DEMOLITION**

DATE PLOTTED 2020-02-20 3:53:30 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M705.4
PROJECT No. 8906		



PART GROUND FLOOR PLAN FIRE PROTECTION SOUTH DEMOLITION
SCALE 1:100



NOTES

LEGEND

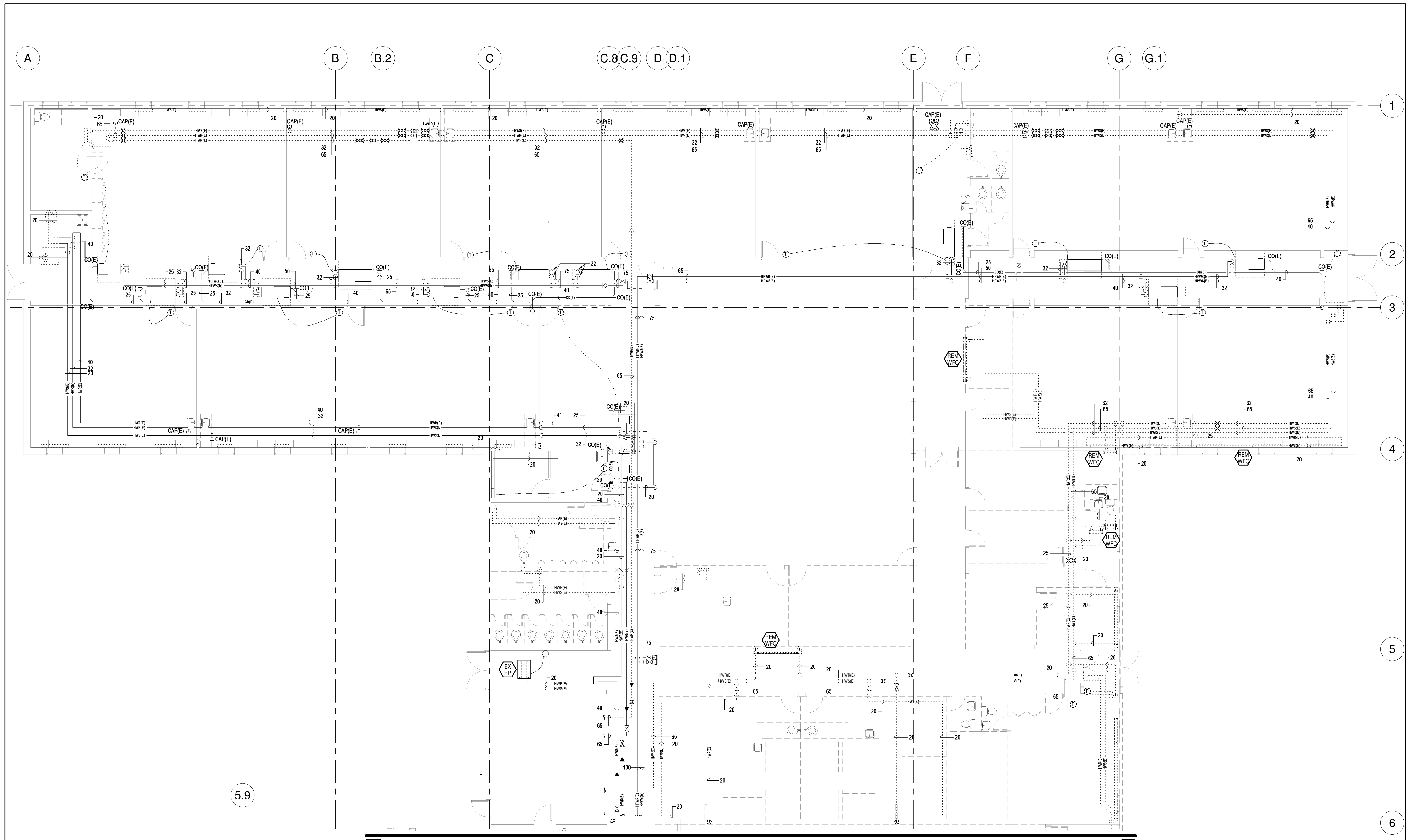
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2	02/20/2020	ISSUED FOR TENDER & PERMIT	



PROJECT TITLE
OUR LADY OF FATIMA

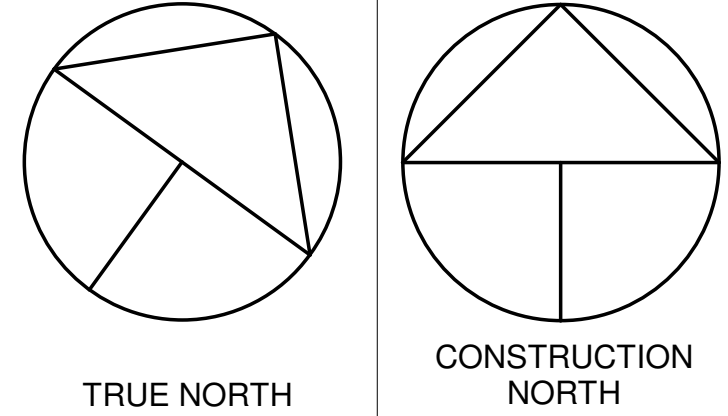
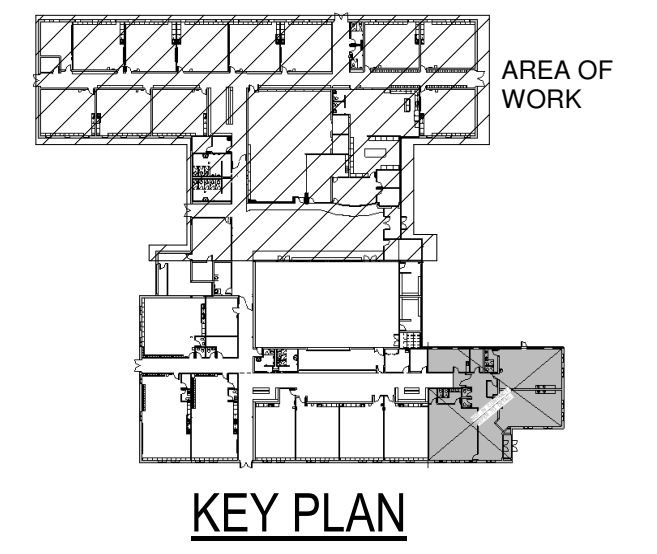
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**PART GROUND FLOOR PLAN -
FIRE PROTECTION DEMOLITION**

DATE PLOTTED 2020-02-20 3:53:34 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M706.4
PROJECT No. 8906		



SEE CONTINUATION ON DRAWING M708.4

PART GROUND FLOOR PLAN HEATING NORTH DEMOLITION
SCALE 1:100



LEGEND

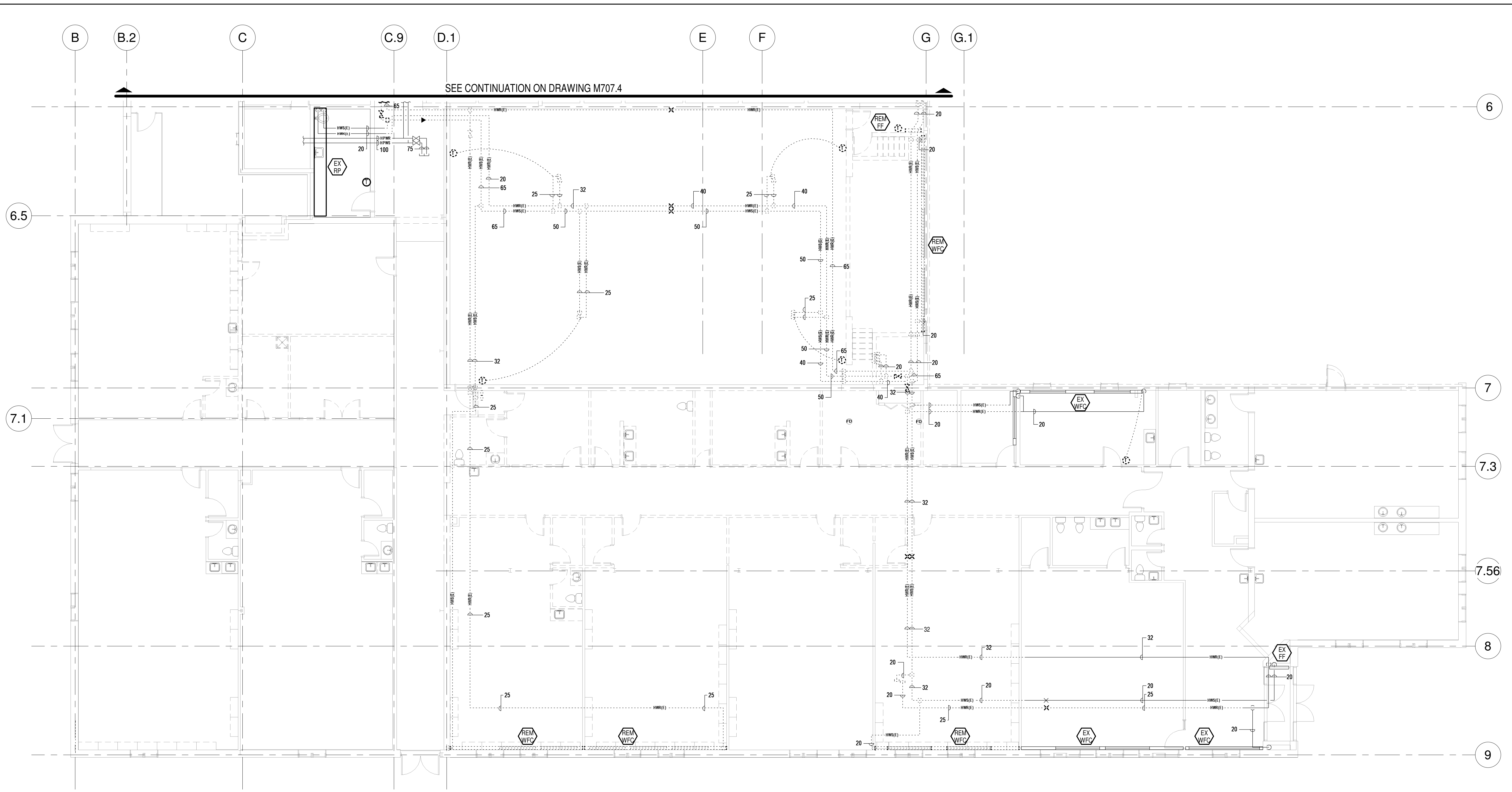
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PROJECT TITLE
OUR LADY OF FATIMA

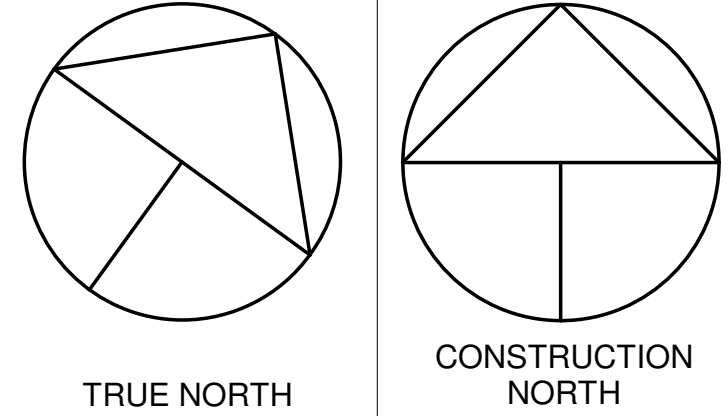
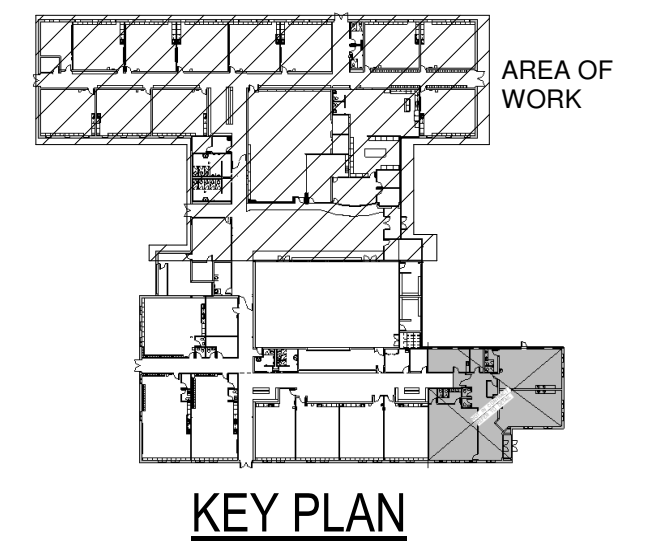
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PART GROUND FLOOR PLAN - HEATING DEMOLITION

DATE PLOTTED 2020-02-20 3:53:43 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M707.4
PROJECT No. 8906		



SEE CONTINUATION ON DRAWING M707.4

PART GROUND FLOOR PLAN HEATING SOUTH DEMOLITION
SCALE 1:100



NOTES

LEGEND

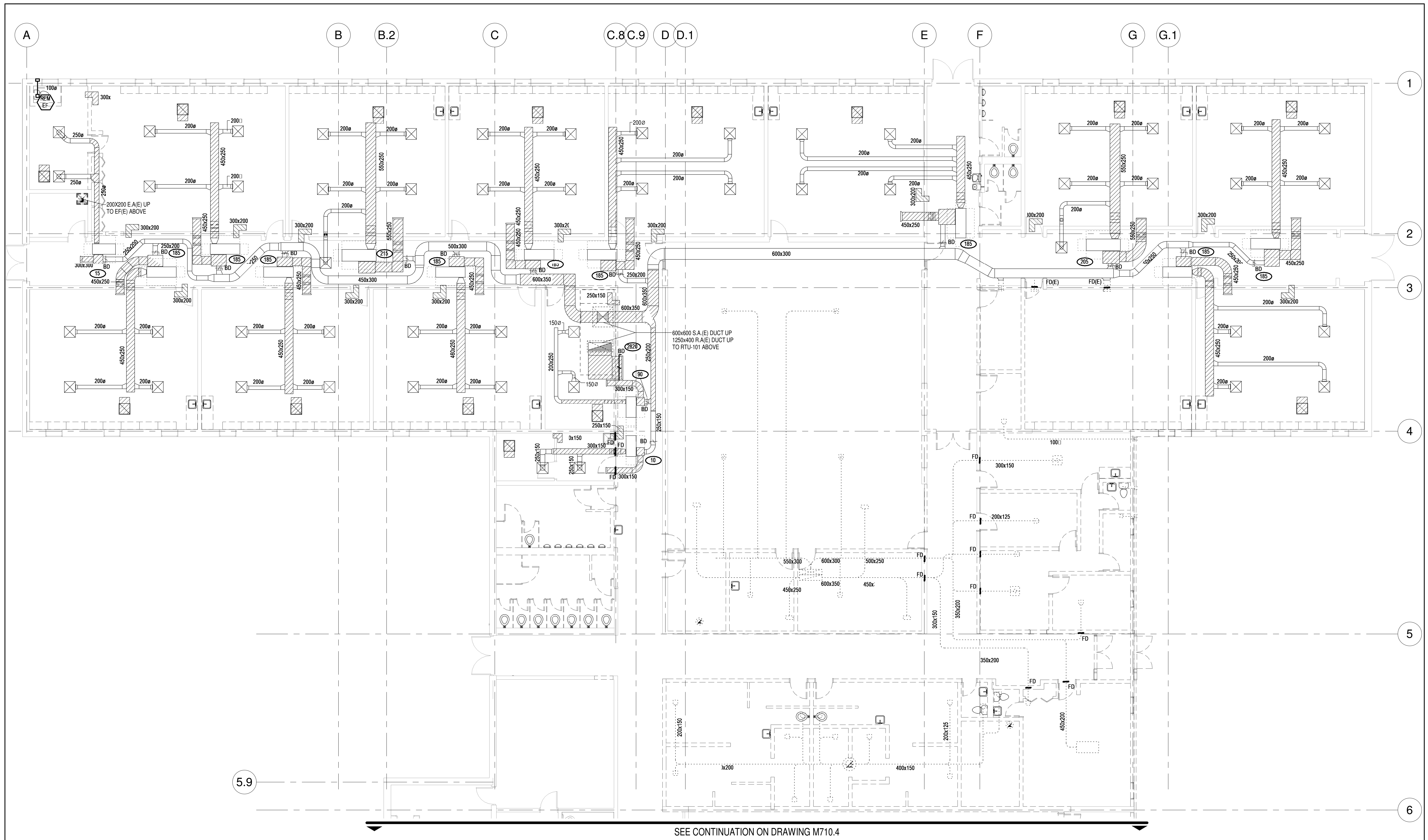
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PROJECT TITLE
OUR LADY OF FATIMA

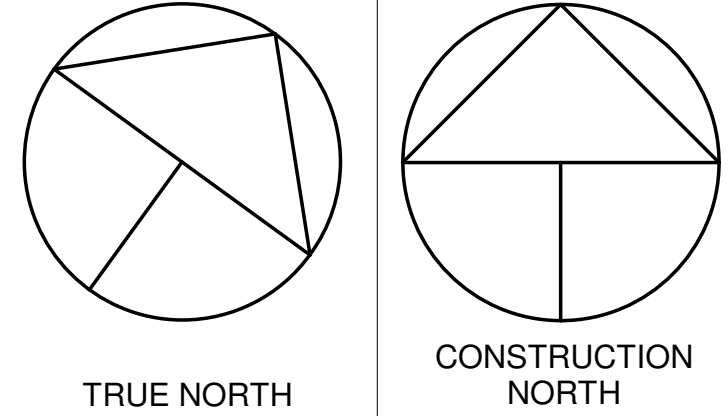
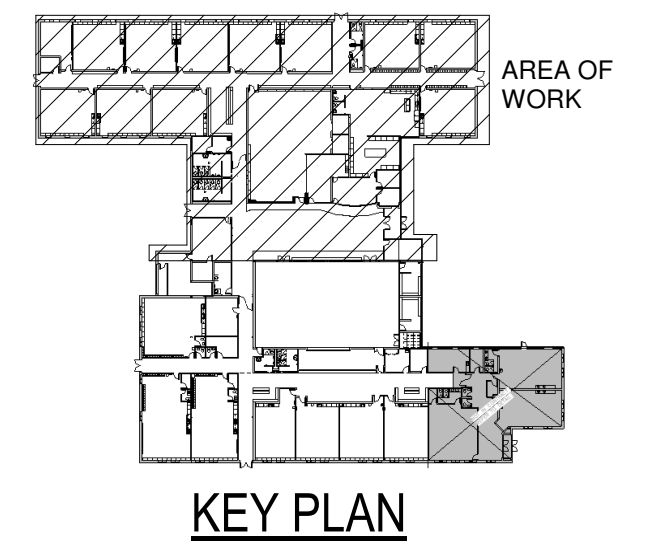
DRAWING TITLE
PART GROUND FLOOR PLAN - HEATING DEMOLITION

DATE PLOTTED 2020-02-20 3:53:48 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M708.4
PROJECT No. 8906		



SEE CONTINUATION ON DRAWING M710.4

PART GROUND FLOOR PLAN AIR DISTRIBUTION NORTH DEMOLITION
SCALE 1:100



NOTES

LEGEND

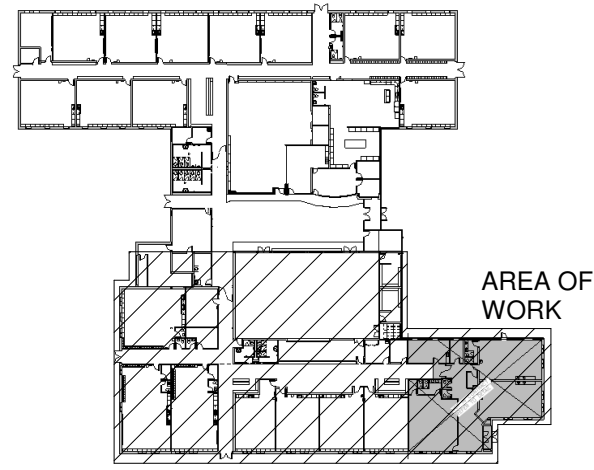
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2	02/20/2020	ISSUED FOR TENDER & PERMIT	



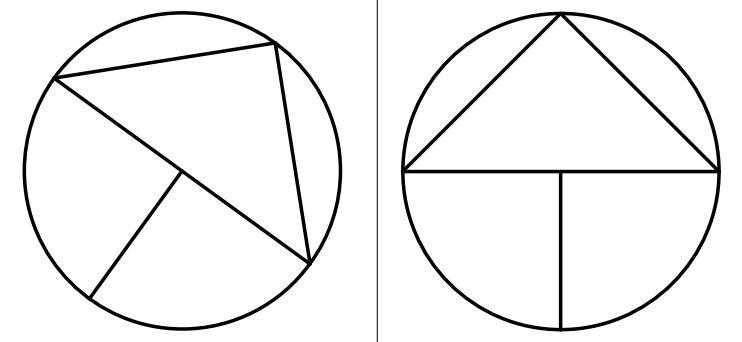
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - AIR DISTRIBUTION DEMOLITION

DATE PLOTTED 2020-02-20 3:53:54 PM	DRAWN BY BMD	DRAWING No.
SCALE 1:100	CHECKED BY JDF	M709.4
PROJECT No. 8906		



KEY PLAN



TRUE NORTH CONSTRUCTION NORTH

NOTES

LEGEND

No.	DATE	DESCRIPTION	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - AIR DISTRIBUTION DEMOLITION

DATE PLOTTED 2020-02-20 3:53:58 PM	DRAWN BY BMD	DRAWING No.
SCALE 1 : 100	CHECKED BY JDF	M710.4
PROJECT No. 8906		

SEE CONTINUATION ON DRAWING M709.4

PART GROUND FLOOR PLAN AIR DISTRIBUTION SOUTH DEMOLITION
SCALE 1:100

LUMINAIRE SCHEDULE								
TYPE	MANUFACTURER	MOUNTING		LAMPS	VOLTS	SYSTEM WATTS	EQUAL MANUFACTURERS	NOTES
		TYPE	HEIGHT					
A2	LITHONIA CAT # 2GTL4-40L-FW-EZ1-LP835 610mm x 1220mm RECESSED TROFFER, 3500K, A12 PATTERN ACRYLIC LENS, 0-10V DIMMING	RECESSED	CEILING	4000 LU LED	120	30.8W	CFI COLUMBIA, METALUX, WILLIAMS, PINNACLE, PHILLIPS	
A2B	MARK ARCHITECTURAL LIGHTING CAT # WHPSPR-2X4-4000LM-35K-MIN1-MVOLT 610mm x 1220mm RECESSED TROFFER, 3500K, 0-10V DIMMING TO 1%	RECESSED	CEILING	4000 LU LED	120	33.8W	LEDALITE, METALUX	
B2	LITHONIA CAT # GTL4-48L-FW-EZ1-LP835 3055mm x 1220mm RECESSED TROFFER, 3500K, A12 PATTERN ACRYLIC LENS, 0-10V DIMMING	RECESSED	CEILING	4800 LU LED	120	42W	CFI COLUMBIA, METALUX, WILLIAMS, PINNACLE, PHILLIPS	
D2	LITHONIA LIGHTING CAT # ZL1D-148-SMR-6000LM-FST-MVOLT-135K 1200mm STRIP LIGHT WITH COVERED END CAPS, 3500K, c/w WIREGUARD	SURFACE/ SUSPENDED	CEILING/ SEE DETAIL	5000 LU LED	120	41W	CFI METALUX	
J1	GOTHAM LIGHTING CAT # EVO4-3507-AR-MD-LS-MVOLT-GZ1 103mm (ROUND) APERTURE DOWNLIGHT, 3500K, 0-10V DIMMING TO 1%	RECESSED	CEILING	750 LU LED	120	8W	CALCULITE, PORTFOLIO	
L8	MARK ARCHITECTURAL LIGHTING CAT # SL2L-LP-8FT-RLP-35K-600LMF-MIN1-120 50mm x 2440mm LED LINEAR, 3500K, REGRESSED LENS, 0-10V DIMMING TO 1%	RECESSED	CEILING	600 LUFFT LED	120	6W/FT	PINNACLE, LEDALITE	
L20P	MARK ARCHITECTURAL LIGHTING CAT # S2LID-LP-20FT-35K-400LMF-125K-600LMF-MIN1-MVOLT 50mm x 6095mm SUSPENDED LINEAR PENDANT, 3500K, 0-10V DIMMING TO 1%	SUSPENDED	3200mm A.F.F.	400 LUFFT DOWN, 600 LUFFT UP LED	120	153W	PINNACLE, LEDALITE	
M2	LITHONIA LIGHTING CAT # IBC-2400LM-SEF-AFL-WD-MVOLT-GZ10-35K-WGX LED HIGH BAY c/w WIREGUARD, 3500K, 0-10V DIMMING	SUSPENDED	5000mm A.F.F.	24000 LU LED	120	154W	PHILLIPS, COOPER	

NOTES:
1. REFER TO ARCHITECTURAL REFLECTED CEILING DRAWINGS TO CONFIRM LUMINAIRE MOUNTING PRIOR TO ORDERING. SUPPLY APPROPRIATE MOUNTING CLIPS AND/OR TRIMS AS REQUIRED.

MECHANICAL EQUIPMENT SCHEDULE													
ITEM	DESCRIPTION	LOCATION	hp	MCA	PHASE	VOLTS	STARTER/CONTROL TYPE	FED FROM	BREAKER SIZE	POLES	CONDUCTOR SIZE	CONDUIT SIZE	NOTES
EXHAUST FANS													
EF-1	EXHAUST FAN	WASHROOM	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
EF-2	EXHAUST FAN	STORAGE	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
EF-3	EXHAUST FAN	CHANGE ROOM	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
EF-4	EXHAUST FAN	WASHROOM	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
EF-5	EXHAUST FAN	WASHROOM	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
EF-6	EXHAUST FAN	VARIOUS	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
EF-7	EXHAUST FAN	VARIOUS	1/4		1	120	DS, WP, CON		15	1	2#12	21mm	
HEATING UNITS													
FF-420	FORCE FLOW HEATER	VARIOUS	FHP		1	120	DS		15	1	2#12	21mm	
FF-421	FORCE FLOW HEATER	VARIOUS	FHP		1	120	DS		15	1	2#12	21mm	
ROOFTOP UNIT													
RTU-102	ROOFTOP UNIT	ROOF		151.4	3	208	DS, WP	PANEL DP1	175	3	3/20	53mm	
HEAT PUMPS													
HP-401	HEAT PUMP	VARIOUS		5.6	1	208	DS	VARIOUS	15	2	2#12	21mm	
HP-402	HEAT PUMP	VARIOUS		6.8	1	208	DS	VARIOUS	15	2	2#12	21mm	
HP-403	HEAT PUMP	VARIOUS		11.3	1	208	DS	VARIOUS	15	2	2#12	21mm	
HP-404	HEAT PUMP	VARIOUS		11.1	3	208	DS	VARIOUS	15	3	3#12	21mm	
HP-405	HEAT PUMP	VARIOUS		15.9	3	208	DS	VARIOUS	20	3	3#12	21mm	
HP-406	HEAT PUMP	VARIOUS		19.5	3	208	DS	VARIOUS	20	3	3#12	21mm	
HP-407	HEAT PUMP	VARIOUS		41.5	3	208	DS	VARIOUS	50	3	3#8	27mm	

NOTES:
1. DIVISION 16 TO OBTAIN COPIES OF MECHANICAL EQUIPMENT SHOP DRAWINGS AND COORDINATE ELECTRICAL SERVICES.
2. PROVIDE LOCAL NON-FUSED DISCONNECT SWITCHES AT MOTORS IN ACCORDANCE WITH SECTION 28-604 OF THE ONTARIO ELECTRICAL SAFETY CODE.
3. UNLESS INDICATED OTHERWISE ALL CONTROL WIRING IS BY DIVISION 15.

ELECTRICAL GENERAL NOTES	
1.	REFER TO ARCHITECTURAL AND MECHANICAL DRAWINGS, VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH THE EXISTING BUILDING, EQUIPMENT AND SYSTEMS TO DETERMINE THE FULL EXTENT OF DEMOLITION AND RENOVATION WORK.
2.	RENOVATIONS SHALL BE MADE ON THE EXISTING BUILDING AS INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN. REMOVE ALL REDUNDANT ELECTRICAL EQUIPMENT AND CONDUITS. ONLY CONDUITS AND DEVICE BOXES THAT ARE IN VERY GOOD CONDITION MAY REMAIN AND BE REUSED. ALL EQUIPMENT REMOVED AND NOT REUSED SHALL BE HANDLED OVER TO THE OWNER AND/OR BE DISCARDED AT THE OWNER'S DISCRETION.
3.	REMOVE, PROTECT AND REINSTALL IN THE SAME OR NEW LOCATION ON NEW SURFACES ALL EXISTING ELECTRICAL EQUIPMENT THAT WILL BE REUSED. EQUIPMENT IDENTIFIED FOR REUSE THAT IS LOST OR DAMAGED MUST BE REPLACED AT NO COST TO THE OWNER.
4.	FISH FLEX CONDUIT THROUGH ALL EXISTING DRYWALL PARTITIONS, EXISTING FURRED WALLS, EXISTING DRYWALL CEILINGS AND EXISTING BLOCK WALLS FOR NEW LIGHTING, POWER AND COMMUNICATION DEVICES. IF WALLS CANNOT BE FISHED, PROVIDE V500/700 SURFACE RACEWAY AND ASSOCIATED SURFACE BOXES.

ELECTRICAL LEGEND					
SYMBOL	DESCRIPTION	MOUNTING	SYMBOL	DESCRIPTION	MOUNTING
	LED LUMINAIRE - NORMAL POWER	SEE LUMINAIRE SCHEDULE		FIRE ALARM HORN c/w VISUAL SIGNAL	WALL 225mm (8 7/8") A.F.F.
	LED LUMINAIRE - NORMAL POWER	SEE LUMINAIRE SCHEDULE		FIRE ALARM HORN c/w VISUAL SIGNAL (CD AS INDICATED)	WALL 230mm (9 1/8") A.F.F. MIN 150mm (6") TO CEILING
	LED LUMINAIRE - NORMAL POWER	SEE LUMINAIRE SCHEDULE		FIRE ALARM VISUAL SIGNAL	CEILING MOUNTED
	LED LUMINAIRE - NORMAL POWER	SEE LUMINAIRE SCHEDULE		ADDRESSABLE CONTROL MODULE	
	EXIT SIGN WITH OR WITHOUT DIRECTIONAL ARROWS	CEILING MOUNTED		ADDRESSABLE MONITOR MODULE	
	EXIT SIGN WITH OR WITHOUT DIRECTIONAL ARROWS	WALL MOUNTED AT CEILING		MAGNETIC DOOR HOLD OPEN DEVICE BY DIVISION 16	AS NOTED
	EMERGENCY BATTERY PACK	WALL MOUNTED		FLOW SWITCH	
	EMERGENCY BATTERY PACK c/w DUAL HEADS	WALL MOUNTED		SUPERVISED VALVE	
	EMERGENCY LIGHT REMOTE HEAD	SURFACE MOUNTED		END OF LINE RESISTOR	1800mm (70") A.F.F.
	EMERGENCY LIGHT REMOTE DUAL HEAD	SURFACE MOUNTED		FIRE ALARM ANNUNCIATOR PANEL	1800mm (70") A.F.F. TO TOP OF UNIT
	OCCUPANCY SENSOR	WALL MOUNTED AT CEILING		FIRE ALARM CONTROL PANEL	1800mm (70") A.F.F. TO TOP OF UNIT
	OCCUPANCY SENSOR	CEILING MOUNTED	SECURITY		
	SINGLE POLE SWITCH	1100mm (43") A.F.F.		SECURITY SYSTEM CONTROL PANEL	1800mm (70") A.F.F. TO TOP OF UNIT
	OCCUPANCY SENSOR SWITCH	1100mm (43") A.F.F.		SECURITY SYSTEM ARM/DISARM KEY PAD	1195mm (47") A.F.F.
	LOW VOLTAGE SWITCH	1100mm (43") A.F.F.		DOOR POSITION SWITCH - CONCEALED	DOOR FRAME
	LOW VOLTAGE SWITCH - # DENOTES QUANTITY OF SWITCHES	1100mm (43") A.F.F.		MOTION DETECTOR	WALL AT CEILING
	ROOM CONTROLLER - DIMMING	ABOVE CEILING	COMMUNICATIONS		
	1520 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLE CSA 5-20R	460mm (18") A.F.F.		SINGLE DEVICE BOX c/w BLANK COVERPLATE AND 21mm CONDUIT TO ACCESSIBLE CEILING SPACE	460mm (18") A.F.F.
	1520 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLE CSA 5-20R	ABOVE COUNTER		DATA OUTLET	460mm (18") A.F.F.
	TWO 1520 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLE CSA 5-20R	460mm (18") A.F.F.		DATA OUTLET - TWO JACKS	460mm (18") A.F.F.
	TWO 1520 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLE CSA 5-20R	FLOOR MOUNTED		DATA OUTLET - TWO JACKS	FLOOR MOUNTED
	DIRECT POWER	AS NOTED		TELEPHONE OUTLET - WALL	1372mm (54") A.F.F.
	50 AMP 250 VOLT 4 WIRE GROUNDED RANGE RECEPTACLE	200mm (8") A.F.F.		INTERCOM SPEAKER WITH CALL SWITCH	1100mm (43") A.F.F.
	TRANSFORMER	AS NOTED		INTERCOM ADMINISTRATION CONTROL CONSOLE	DESK
	BARRIER FREE PUSH BUTTON			INTERCOM MICROPHONE, AM/FM RECEIVER AND CD PLAYER	DESK
	MOTOR			PAGING SPEAKER	CEILING MOUNTED
	FUSED DISCONNECT SWITCH			PAGING SPEAKER HORN	3550mm (11') A.F.F.
	MANUAL STARTER			PAGING SYSTEM HEAD END	1195mm (47") A.F.F.
	MAGNETIC STARTER			TELEVISION OUTLET	460mm (18") A.F.F.
	HAND DRYER	SEE SPECIFICATIONS		CLOCK	WALL MOUNTED
	DRINKING FOUNTAIN			CLASSROOM MODULE	SEE DETAIL
	CONTACTOR			DATA RACK - PLAN VIEW	
	VARIABLE FREQUENCY DRIVE		WIRING AND CONDUIT		
	RELAY			COMMUNICATIONS CABLE HANGER	
	LAPTOP CONNECTION	SEE DETAIL		GENERAL CIRCUIT CONDUIT	
	LCD TELEVISION	SEE DETAIL		EMT/CUTLER BREAKER c/w BUSHINGS AND NYLON FISH WIRE	
	ELECTRICAL PANEL	SEE PANEL SCHEDULE		SURGE PROTECTIVE DEVICE	
	SMOKE DETECTOR	CEILING MOUNTED		DIGITAL METERING SYSTEM	
	135°F RATE-OF-RISE TEMPERATURE FIRE DETECTOR	CEILING MOUNTED		METER	
	135°F FIXED TEMPERATURE FIRE DETECTOR	CEILING MOUNTED		TRANSFORMER - RISER DIAGRAM	
	PULL STATION	1200mm (47-1/4") A.F.F.		ELECTRICAL PANEL - RISER DIAGRAM	
	FIRE ALARM HORN	WALL 2300mm (91") A.F.F. MIN 150mm (6") TO CEILING			

ABBREVIATIONS			
XX	LOCATE XX ABOVE FINISHED FLOOR	REL	IF DASHED - EXISTING TO BE RELOCATED
AFF	ABOVE FINISHED FLOOR	REL	IF SOLID - EXISTING IN NEW LOCATION
C	CONDUIT	REM	EXISTING TO BE REMOVED
EX	EXISTING TO REMAIN	REP	EXISTING TO BE REPLACED WITH NEW
OC	OVER COUNTER - 230mm (9")	WG	WIREGUARD
P	POLE		

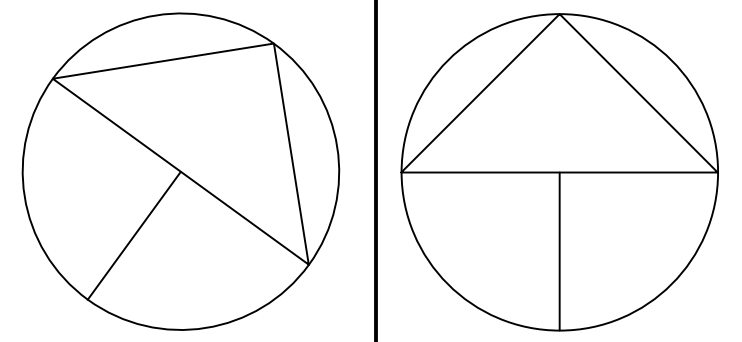
MOTOR CONTROL ABBREVIATIONS			
DC	DIRECT CONNECTION	H.O.A.	HAND OFF AUTO SELECTOR SWITCH
DS	UN-FUSED DISCONNECT SWITCH	MCA	MINIMUM CIRCUIT AMPACITY
FDS	FUSED DISCONNECT SWITCH	REC	DUPLEX RECEPTACLE
FHP	FRACTIONAL HORSE POWER	VFD	VARIABLE FREQUENCY DRIVE
FVNR	FULL VOLTAGE NON REVERSING STARTER c/w H.O.A. SWITCH	WP	WEATHER PROOF

DRAWING LIST	
E101.4	ELECTRICAL LEGEND, DRAWING LIST, SCHEDULES, ABBREVIATIONS, AND ELECTRICAL GENERAL NOTES
E102.4	PANEL SCHEDULES
E103.4	PANEL SCHEDULES
E201.4	PART GROUND FLOOR PLAN NORTH - LIGHTING AND FIRE ALARM
E202.4	PART GROUND FLOOR PLAN SOUTH - LIGHTING AND FIRE ALARM
E301.4	PART GROUND FLOOR PLAN NORTH - POWER AND SYSTEMS
E302.4	PART GROUND FLOOR PLAN SOUTH - POWER AND SYSTEMS
E401.4	ELECTRICAL RISERS
E501.4	ELECTRICAL DETAILS
E502.4	ELECTRICAL DETAILS
E601.4	PART GROUND FLOOR PLAN NORTH - LIGHTING AND FIRE ALARM DEMOLITION
E602.4	PART GROUND FLOOR PLAN SOUTH - LIGHTING AND FIRE ALARM DEMOLITION
E701.4	PART GROUND FLOOR PLAN NORTH - POWER AND SYSTEMS DEMOLITION
E702.4	PART GROUND FLOOR PLAN SOUTH - POWER AND SYSTEMS DEMOLITION



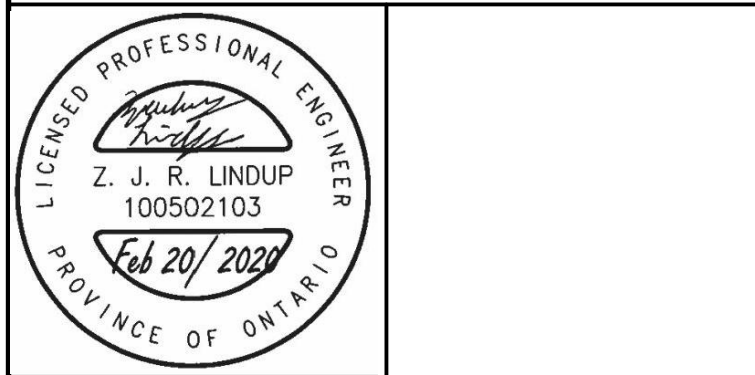
201 QUEENS AVE., UNIT 800 LONDON ON, N6A 1J1
250 CITY CENTRE AVE., SUITE 403 OTTAWA ON, K1R 6K7

KEY PLAN



NOTES

NO.	DATE	DESCRIPTION	BY
1	02/19/2020	ISSUED FOR TENDER	ZJRL
2	04/02/2020	REVISION	ZJRL



PROJECT TITLE	OUR LADY OF FATIMA		
DRAWING TITLE	ELECTRICAL LEGEND, DRAWING LIST, SCHEDULES, ABBREVIATIONS, AND GENERAL NOTES		

DATE	DRAWN BY	DRAWING No.
01/11/2020	AIS	E101.4
SCALE	CHECKED BY	
AS NOTED	ZJRL	
PROJECT No.	8906	

Panel ID: A

Location: Fed From: Mounting: Voltage: Mains: Number of CKT: 120/208 Wye, 3PH, 4W 225 A 78

Table with columns: CKT, Circuit Description, Trip, Poles, Poles, Trip, Circuit Description, CKT. Lists 78 electrical circuits including existing circuits, hand dryers, and counter/rec units.

* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:

1. NEW PANEL TO REPLACE EXISTING, TRACE OUT ALL EXISTING LOADS AND DO NOT PROVIDE NEW BREAKERS FOR LOADS THAT HAVE BEEN REMOVED.

Panel ID: B

Location: Fed From: Mounting: Voltage: Mains: Number of CKT: 120/208 Wye, 3PH, 4W 225 A 72

Table with columns: CKT, Circuit Description, Trip, Poles, Poles, Trip, Circuit Description, CKT. Lists 72 electrical circuits including range recs, dishwasher, fridge, counter recs, and microwave.

* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:

1. NEW PANEL TO REPLACE EXISTING, TRACE OUT ALL EXISTING LOADS AND DO NOT PROVIDE NEW BREAKERS FOR LOADS THAT HAVE BEEN REMOVED.

Panel ID: C

Location: Fed From: Mounting: Voltage: Mains: Number of CKT: MECH. 150B 120/208 Wye, 3PH, 4W 225 A 78

Table with columns: CKT, Circuit Description, Trip, Poles, Poles, Trip, Circuit Description, CKT. Lists 78 electrical circuits including existing circuits, microwave, range rec, and TV/laptop recs.

* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:

1. EXISTING SPARE BREAKERS UTILIZED IN THIS PHASE FOR NEW LOADS. TRACE OUT ALL LOADS AT COMPLETION OF THIS PHASE AND MARK REDUNDANT CIRCUITS AS SPARE. USAGE OF SPARE BREAKERS FOR NEW CIRCUITS IS INDICATED IN PARENTHESIS. 2. UTILIZE EXISTING SPARE BREAKER FOR NEW LOAD.

Panel ID: D

Location: Fed From: Mounting: Voltage: Mains: Number of CKT: CUST. 115 120/208 Wye, 3PH, 4W 225 A 66

Table with columns: CKT, Circuit Description, Trip, Poles, Poles, Trip, Circuit Description, CKT. Lists 66 electrical circuits including existing circuits, CCTs, and counter/rec units.

* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:

1. EXISTING PANEL 'D', PROVIDE NEW BREAKERS TO SUIT EXISTING SIEMENS ELECTRICAL PANEL. MARK ALL BREAKERS MADE REDUNDANT BY THIS PHASE AS SPARE. 2. UTILIZE EXISTING CIRCUIT MADE REDUNDANT BY THIS PHASE. 3. UTILIZE EXISTING SPARE BREAKER.

Panel ID: E

Location: Fed From: Mounting: Voltage: Mains: Number of CKT: STORAGE 159 120/208 Wye, 3PH, 4W 225 A 66

Table with columns: CKT, Circuit Description, Trip, Poles, Poles, Trip, Circuit Description, CKT. Lists 66 electrical circuits including CCTs, counter/rec units, and drinking fountain.

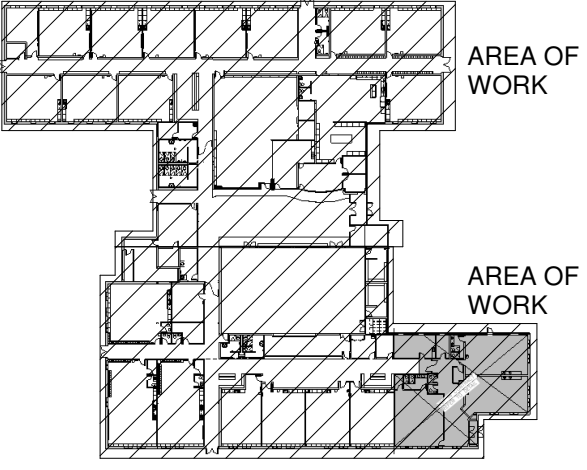
* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:

1. PREVIOUSLY PANEL 'H', PROVIDE NEW BREAKERS TO SUIT EXISTING SIEMENS ELECTRICAL PANEL. MARK ALL BREAKERS MADE REDUNDANT BY THIS PHASE AS SPARE. 2. UTILIZE EXISTING CIRCUIT MADE REDUNDANT BY THIS PHASE. 3. UTILIZE EXISTING SPARE BREAKER.



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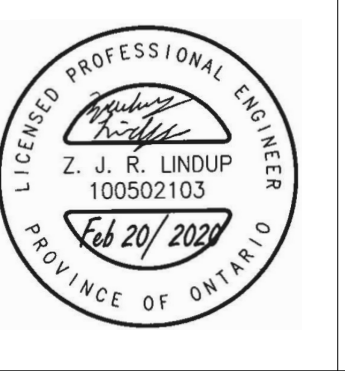


KEY PLAN

NOTES

LEGEND

Table with columns: No., DATE (MM/DD/YYYY), DESCRIPTION, REV. No.



PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

PANEL SCHEDULES

Table with columns: DATE PLOTTED, DRAWN BY, DRAWING No., SCALE, CHECKED BY, PROJECT No.

Panel ID: HPD

Location: CUST. 115 Voltage: 120/208 Wye, 3PH, 4W
 Fed From: Mains: 225 A
 Mounting: Surface Number of CKT: 66

CKT	Circuit Description	Trip	Poles	Poles	Trip	Circuit Description	CKT
1	SPARE	15 A	1	1	15 A	SPARE	2
3	SPARE	15 A	1	1	15 A	SPARE	4
5	SPARE	15 A	1	1	15 A	SPARE	6
7	SPARE	15 A	1	1	15 A	SPARE	8
9	SPARE	15 A	1	1	15 A	SPARE	10
11	SPARE	15 A	1	1	15 A	SPARE	12
13	SPARE	15 A	1	1	15 A	SPARE	14
15	SPARE	15 A	1	1	15 A	SPARE	16
17	SPARE	15 A	1	1	15 A	SPARE	18
19	SPARE	15 A	1	1	15 A	REWORKED (DC)	20
21	SPARE	15 A	1	1	15 A	REWORKED (DC)	22
23	REDUNDANT	20 A	1	1	20 A	REDUNDANT	24
25	REDUNDANT	15 A	1	1	20 A	REDUNDANT	26
27					1 15 A	REDUNDANT	28
29	REDUNDANT	20 A	3	1	20 A	REDUNDANT	30
31					1 20 A	REDUNDANT	32
33	SPARE	15 A	1	1	15 A	REDUNDANT	34
35	SPARE	15 A	1	1	20 A	REDUNDANT	36
37	SPARE	15 A	1	1	20 A	REDUNDANT	38
39	SPARE	15 A	1	1	15 A	REDUNDANT	40
41	SPARE	15 A	1	1	15 A	SPARE	42
43	SPARE	15 A	1	1	15 A	REDUNDANT	44
45	REWORKED (DC)	15 A	1	1	15 A	SPARE	46
47	REWORKED (DC)	15 A	1	1	15 A	SPARE	48
49	REWORKED (DC)	20 A	1	1	15 A	SPARE	50
51	REWORKED (DC)	20 A	1				52
53							54
55							56
57							58
59							60
61							62
63							64
65							66

* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:
 1. NEW PANEL TO REPLACE EXISTING. REWORK ALL EXISTING LIGHTING, FIRE ALARM, POWER AND SYSTEMS CIRCUITS TO PANEL 'D' IF THEY SERVE THE SCHOOL AND TO PANEL 'DC' IF THEY SERVE THE DAYCARE. EXISTING MECHANICAL CIRCUITS ARE TO REMAIN. DO NOT PROVIDE NEW BREAKERS FOR REWORKED OR REDUNDANT LOADS.

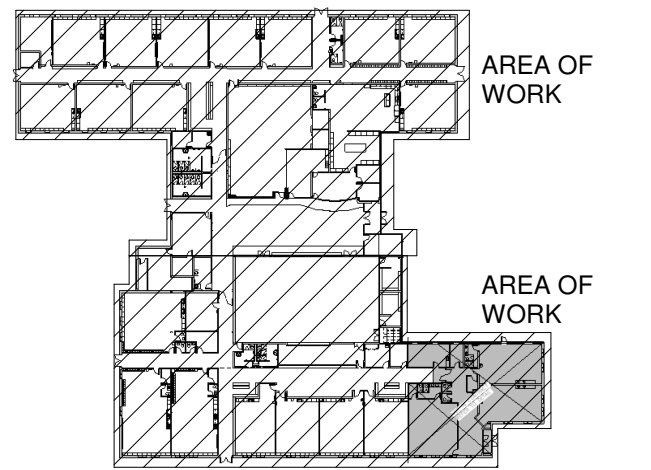
Panel ID: HPE

Location: STORAGE 159 Voltage: 120/208 Wye, 3PH, 4W
 Fed From: Mains: 225 A
 Mounting: Surface Number of CKT: 66

CKT	Circuit Description	Trip	Poles	Poles	Trip	Circuit Description	CKT
1	REDUNDANT	15 A	1	1	15 A	SPARE	2
3	SPARE	15 A	1	1	15 A	SPARE	4
5	REDUNDANT	15 A	1	1	15 A	SPARE	6
7	REDUNDANT	15 A	1	1	15 A	REDUNDANT	8
9	REDUNDANT	15 A	1	1	15 A	REDUNDANT	10
11	REDUNDANT	15 A	1	2	15 A	REDUNDANT	12
13	SPARE	20 A	1				14
15	REDUNDANT	15 A	1	2	15 A	REDUNDANT	16
17					2 15 A	REDUNDANT	18
19	SPARE	70 A	3	2	50 A	REDUNDANT	20
21					1 15 A	SPARE	22
23	REDUNDANT	40 A	3	1	15 A	SPARE	24
25	REDUNDANT				1 15 A	SPARE	26
27					1 15 A	SPARE	28
29	SPARE	15 A	2	1	15 A	SPARE	30
31					2 15 A	SPARE	32
33	SPARE	15 A	2	1	15 A	SPARE	34
35	SPARE	20 A	1	1	15 A	SPARE	36
37	SPARE	20 A	1	1	15 A	SPARE	38
39	SPARE	20 A	1	1	15 A	SPARE	40
41					1 15 A	SPARE	42
43							44
45							46
47							48
49							50
51							52
53							54
55							56
57							58
59							60
61							62
63							64
65							66

* GFCI BREAKER (5mA) ** GFCI BREAKER (30mA) + AFCI BREAKER

Notes:
 1. PREVIOUSLY PANEL 'G'. PROVIDE NEW BREAKERS TO SUIT EXISTING SIEMENS ELECTRICAL PANEL. USAGE OF SPARE, REWORKED OR REDUNDANT BREAKERS IS INDICATED IN PARENTHESIS. MARK ALL REWORKED AND REDUNDANT BREAKERS AS SPARE. REWORK EXISTING LIGHTING, FIRE ALARM, POWER AND SYSTEMS LOADS TO EXISTING PANEL 'H' RENAMED TO PANEL 'E'. REFER TO PANEL 'E' SCHEDULE FOR LIST OF CIRCUITS.



KEY PLAN

NOTES

LEGEND

No.	DATE MM/DD/YYYY	DESCRIPTION	REV. No.



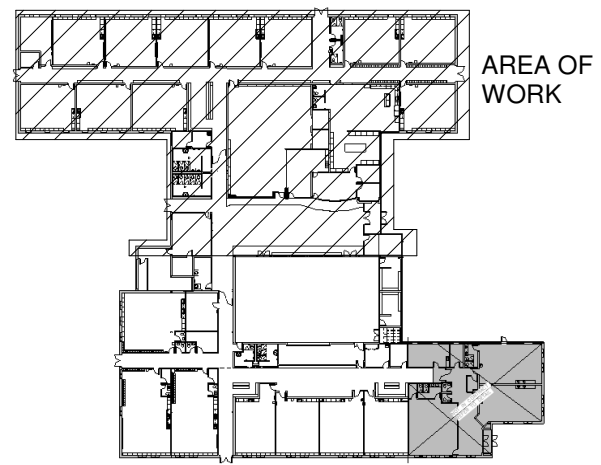
PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

PANEL SCHEDULES

DATE PLOTTED 2020-02-20 3:21:45 PM	DRAWN BY AIS	DRAWING No.
SCALE	CHECKED BY ZJRL	E103.4
PROJECT No. 8906		



KEY PLAN

NOTES

LEGEND

No.	DATE	DESCRIPTION	REV.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	
	MM/DD/YYYY		



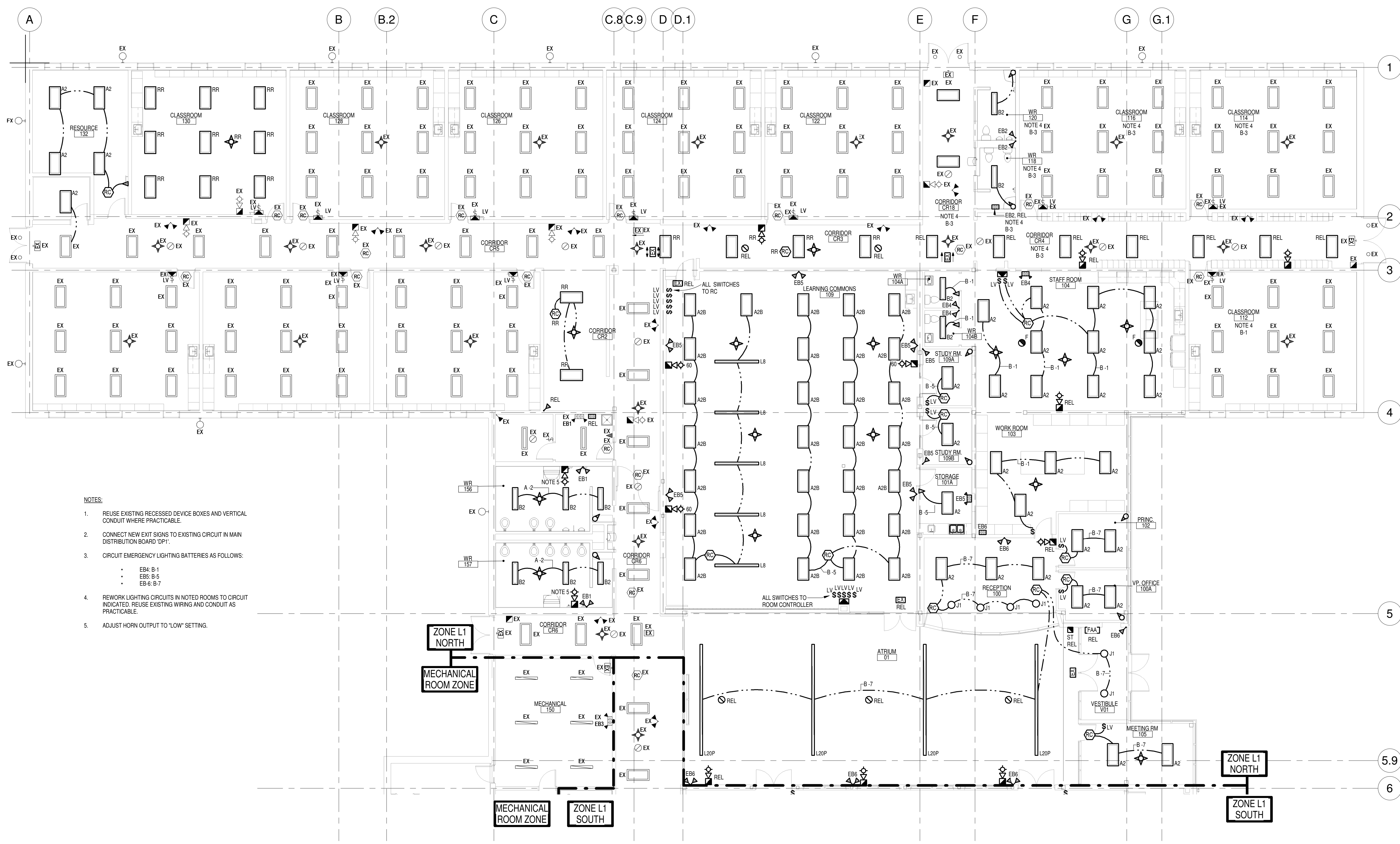
PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

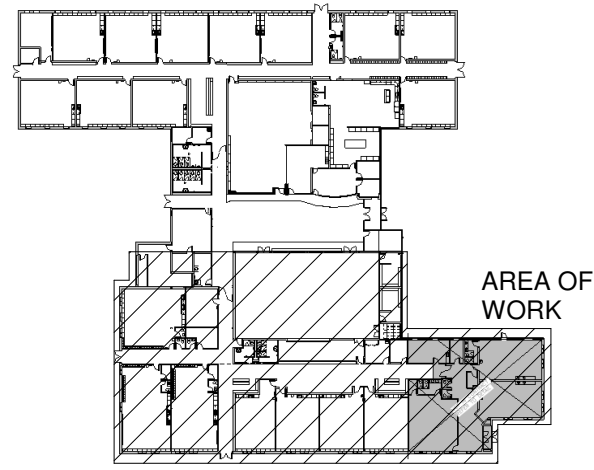
PART GROUND FLOOR PLAN - NORTH - LIGHTING AND FIRE ALARM

DATE PLOTTED 2020-02-20 3:21:51 PM	DRAWN BY AIS	DRAWING No.
SCALE 1 : 100	CHECKED BY ZJRL	E201.4
PROJECT No. 8906		



- NOTES:**
- REUSE EXISTING RECESSED DEVICE BOXES AND VERTICAL CONDUIT WHERE PRACTICABLE.
 - CONNECT NEW EXIT SIGNS TO EXISTING CIRCUIT IN MAIN DISTRIBUTION BOARD 'DP1'.
 - CIRCUIT EMERGENCY LIGHTING BATTERIES AS FOLLOWS:
 - EB4: B-1
 - EB5: B-5
 - EB6: B-7
 - REWORK LIGHTING CIRCUITS IN NOTED ROOMS TO CIRCUIT INDICATED. REUSE EXISTING WIRING AND CONDUIT AS PRACTICABLE.
 - ADJUST HORN OUTPUT TO "LOW" SETTING.

PART GROUND FLOOR PLAN - NORTH - LIGHTING AND FIRE ALARM
SCALE 1:100



KEY PLAN

NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV.
2	02/20/2020			
	MM/DD/YYYY			



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - SOUTH - LIGHTING AND FIRE ALARM

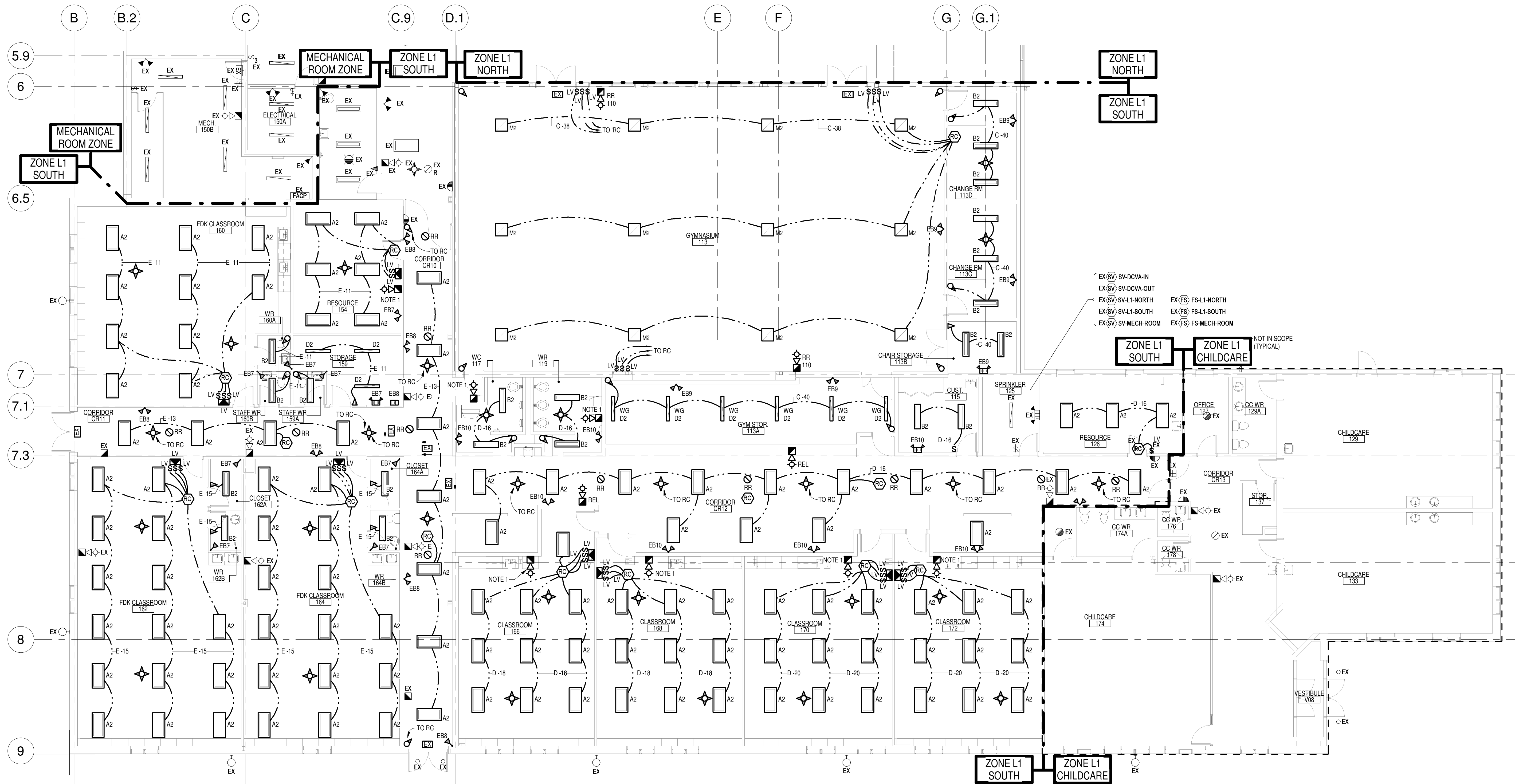
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PROJECT No. 8906		

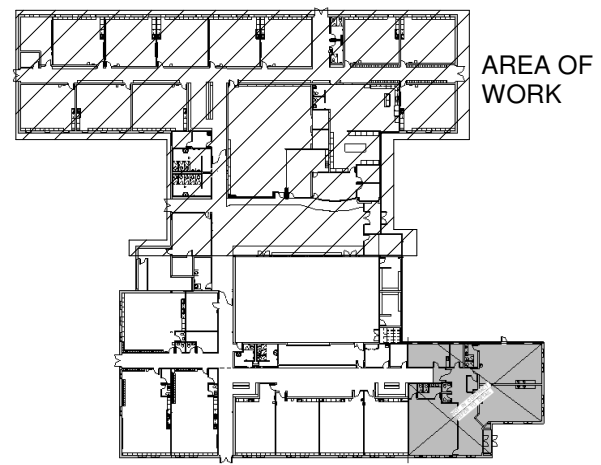
PART GROUND FLOOR PLAN - SOUTH - LIGHTING AND FIRE ALARM

SCALE 1 : 100

NOTES:

- ADJUST HORN OUTPUT TO "LOW" SETTING.
- REUSE EXISTING RECESSED DEVICE BOXES AND VERTICAL CONDUIT WHERE PRACTICABLE.
- CONNECT NEW EXIT SIGNS TO EXISTING CIRCUIT IN MAIN DISTRIBUTION BOARD 'DP1'.
- CIRCUIT EMERGENCY LIGHTING BATTERIES AS FOLLOWS:
 - EB7: E-11
 - EB8: E-13
 - EB9: C-38
 - EB10: D-16





KEY PLAN

NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV.
2	02/20/2020	ISSUED FOR TENDER & PERMIT		



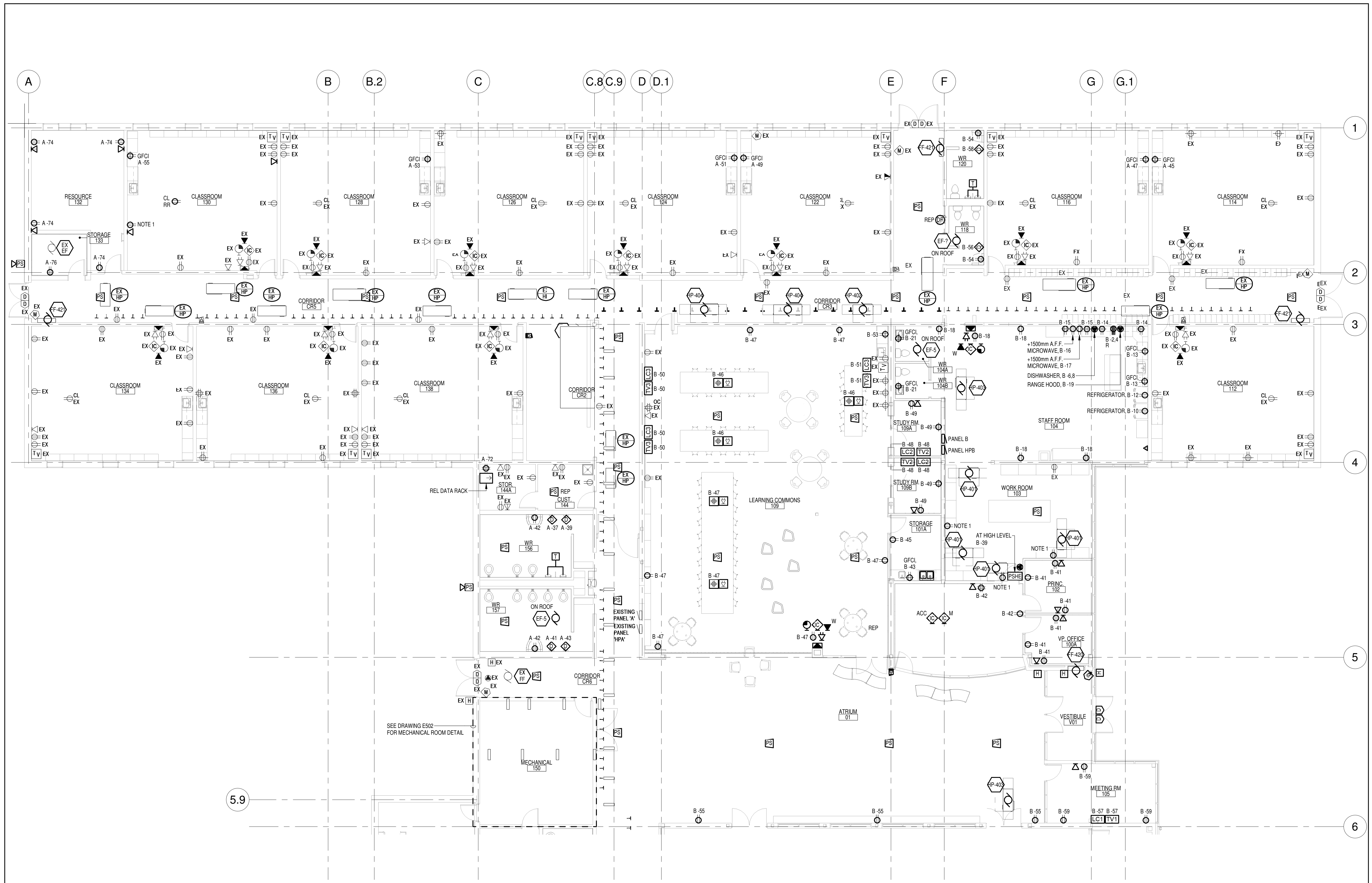
PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

PART GROUND FLOOR PLAN - NORTH - POWER AND SYSTEMS

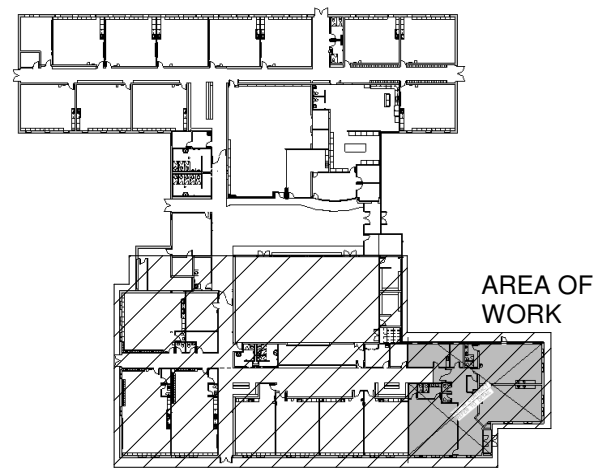
DATE PLOTTED 2020-02-20 3:22:05 PM	DRAWN BY AIS	DRAWING No.
SCALE 1 : 100	CHECKED BY ZJRL	E301.4
PROJECT No.	8906	



PART GROUND FLOOR PLAN - NORTH - POWER AND SYSTEMS
SCALE 1:100

- NOTES:
- CONNECT TO EXISTING CIRCUIT SERVING EXISTING RECEPTACLES IN THIS ROOM.
 - REUSE EXISTING VERTICAL CONDUIT AND RECESSED DEVICE BOXES WHERE PRACTICABLE.

5.9

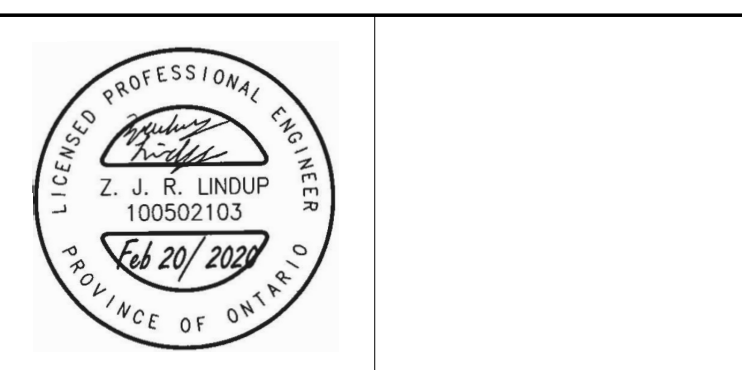


KEY PLAN

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LEGEND

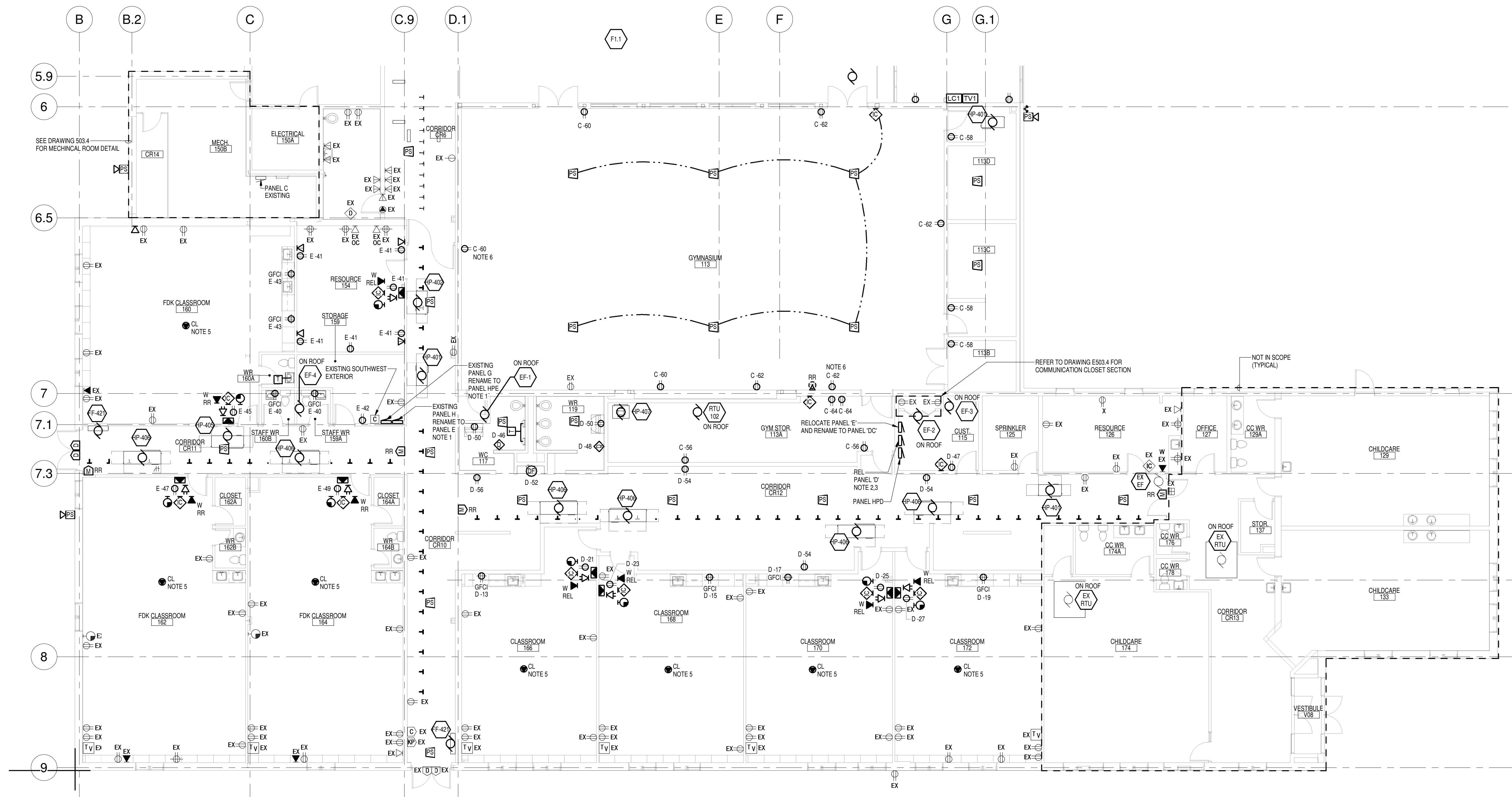
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2	02/20/2020	ISSUED FOR TENDER & PERMIT		
	MM/DD/YYYY			



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - SOUTH - POWER AND SYSTEMS

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PROJECT No. 8906		

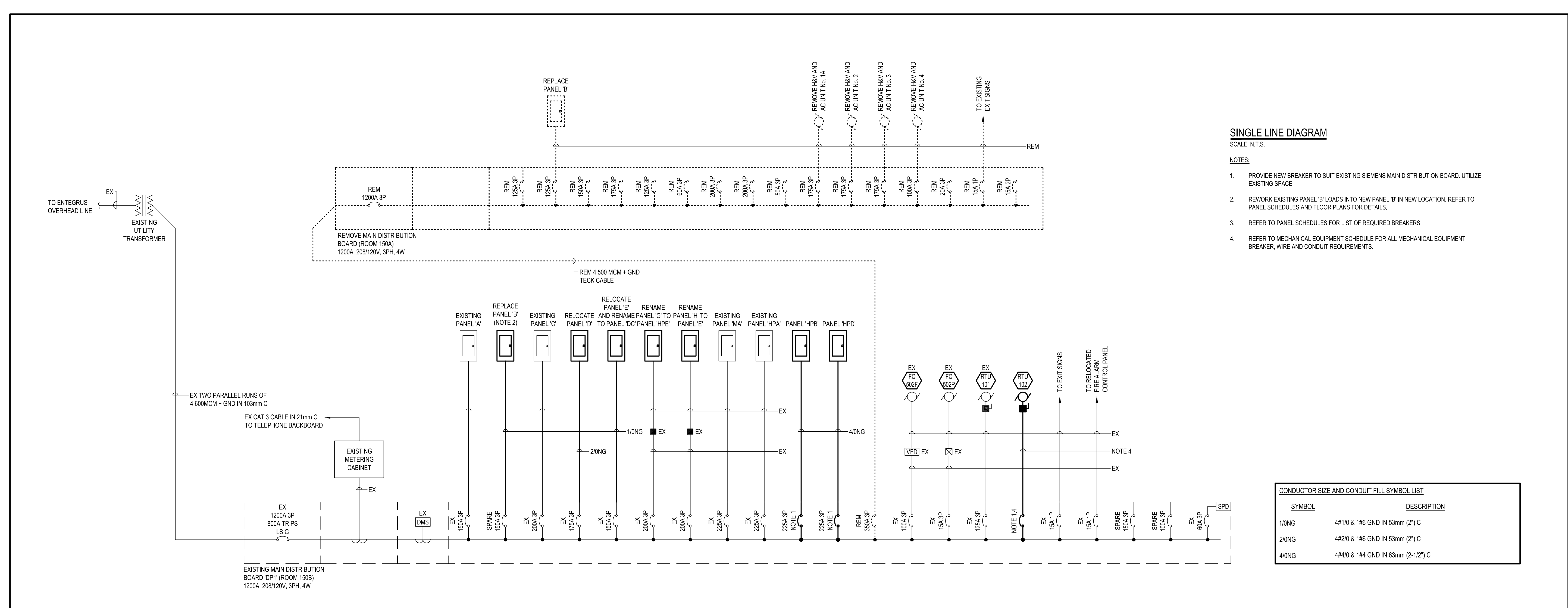


PART GROUND FLOOR PLAN SOUTH - POWER AND SYSTEMS

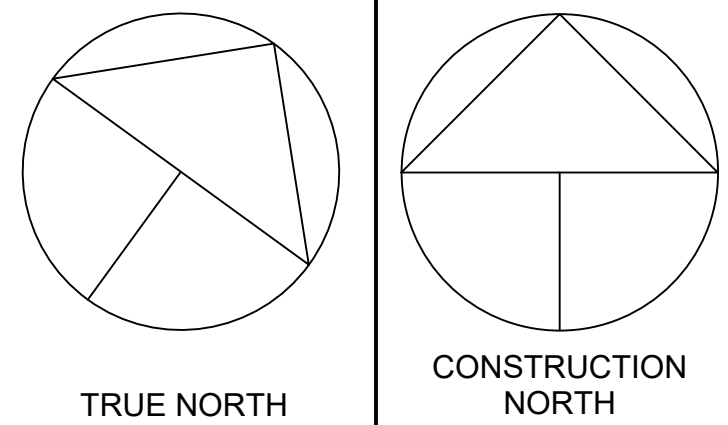
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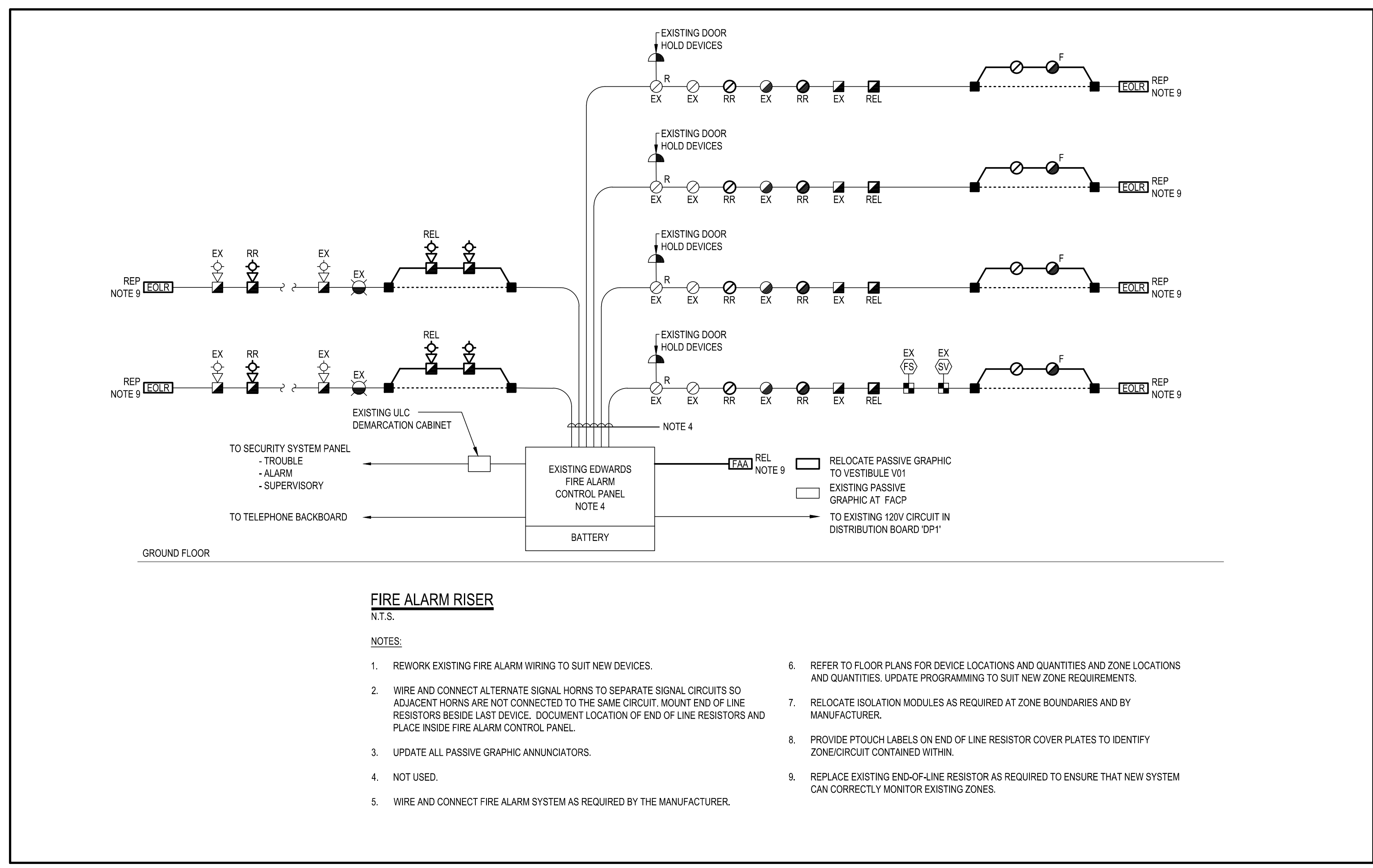
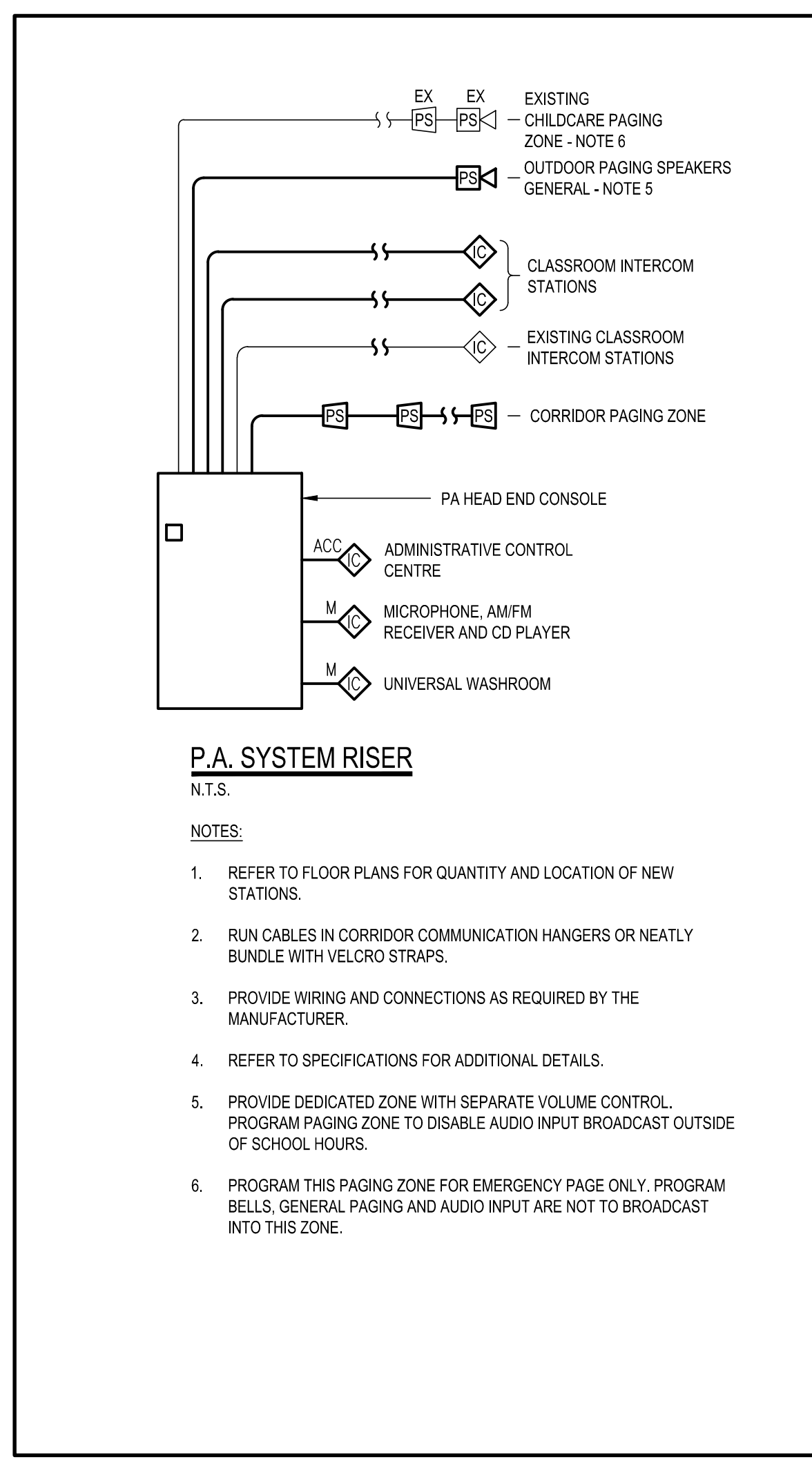
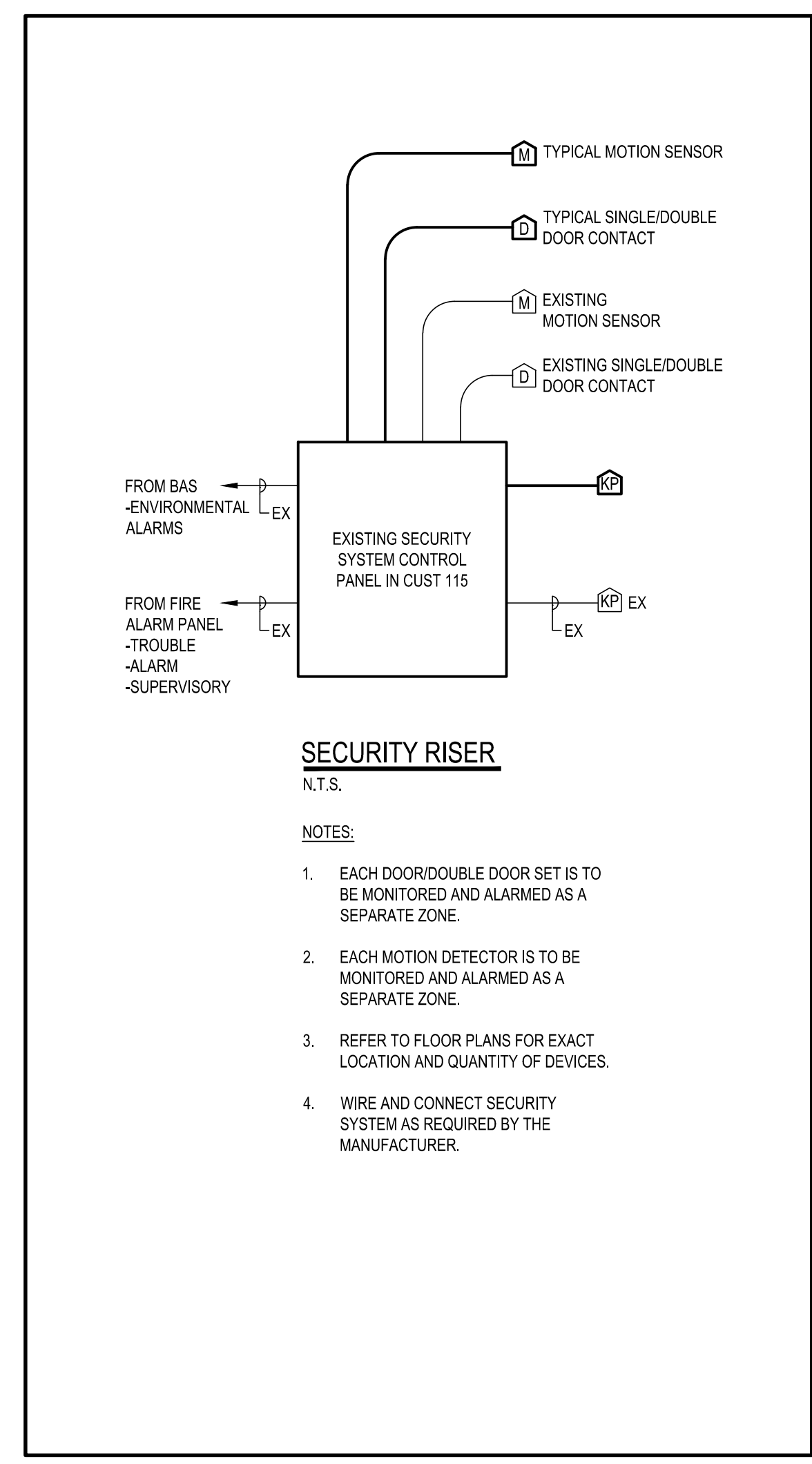
- REWORK EXISTING LOADS FED FROM EXISTING PANEL 'C' TO EXISTING PANEL 'H'. PROVIDE JUNCTION BOXES ABOVE CEILING AS REQUIRED. RENAME PANEL 'W' TO PANEL 'E' AND PANEL 'G' TO PANEL 'HPE'. TRACE OUT ALL EXISTING DEVICES AND PROVIDE LAMACOID LABELS AS PER SPECIFICATIONS FOR ALL EXISTING DEVICES.
- REWORK EXISTING LOADS ABOVE CEILING TO EXISTING PANEL IN NEW LOCATION. PROVIDE JUNCTION BOXES AS REQUIRED.
- REWORK EXISTING LOADS ABOVE CEILING FROM PANEL 'E' TO PANEL 'D' IN NEW LOCATION. PROVIDE JUNCTION BOXES AS REQUIRED.
- REUSE EXISTING VERTICAL CONDUIT AND RECESSED DEVICES BOXES WHERE PRACTICABLE.
- CONNECT TO EXISTING CIRCUIT SERVING RECEPTACLES IN THE AREA.
- CHIP OUT WALL AND RECESS NEW RECEPTACLE IN EXISTING BLOCK WALL. FISH WIRING AND CONDUIT IN EXISTING BLACKWALL.



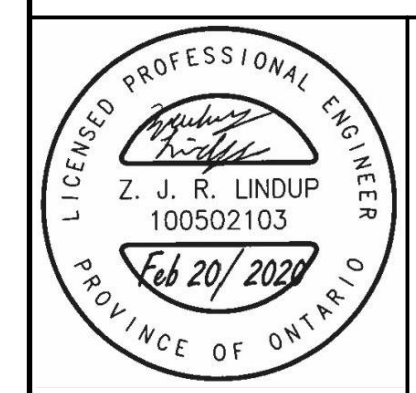
KEY PLAN



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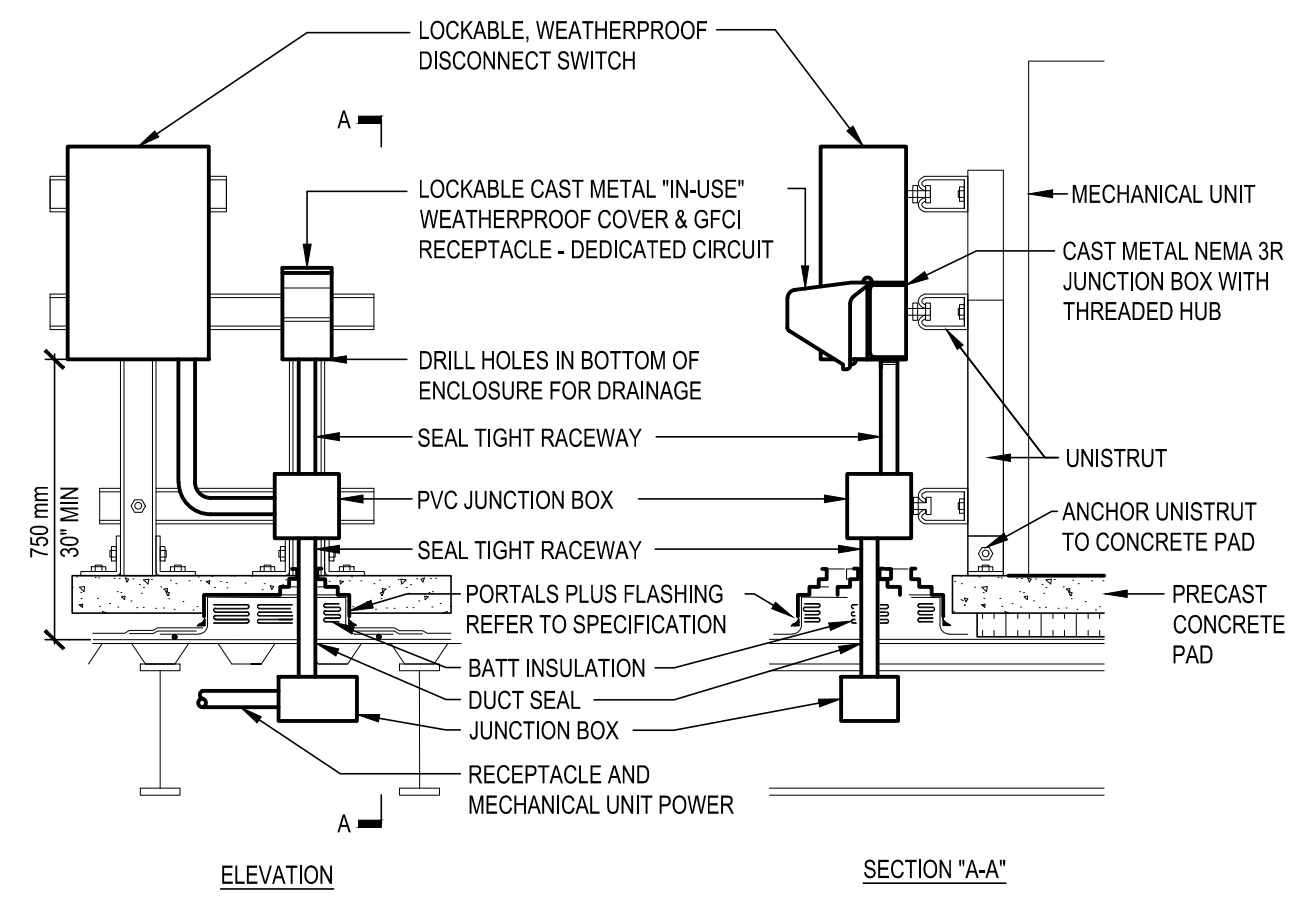
DATE	ISSUED FOR TENDER	REV. NO.
02/19/2020	REVISION	
04/05/2020		



PROJECT TITLE
OUR LADY OF FATIMA

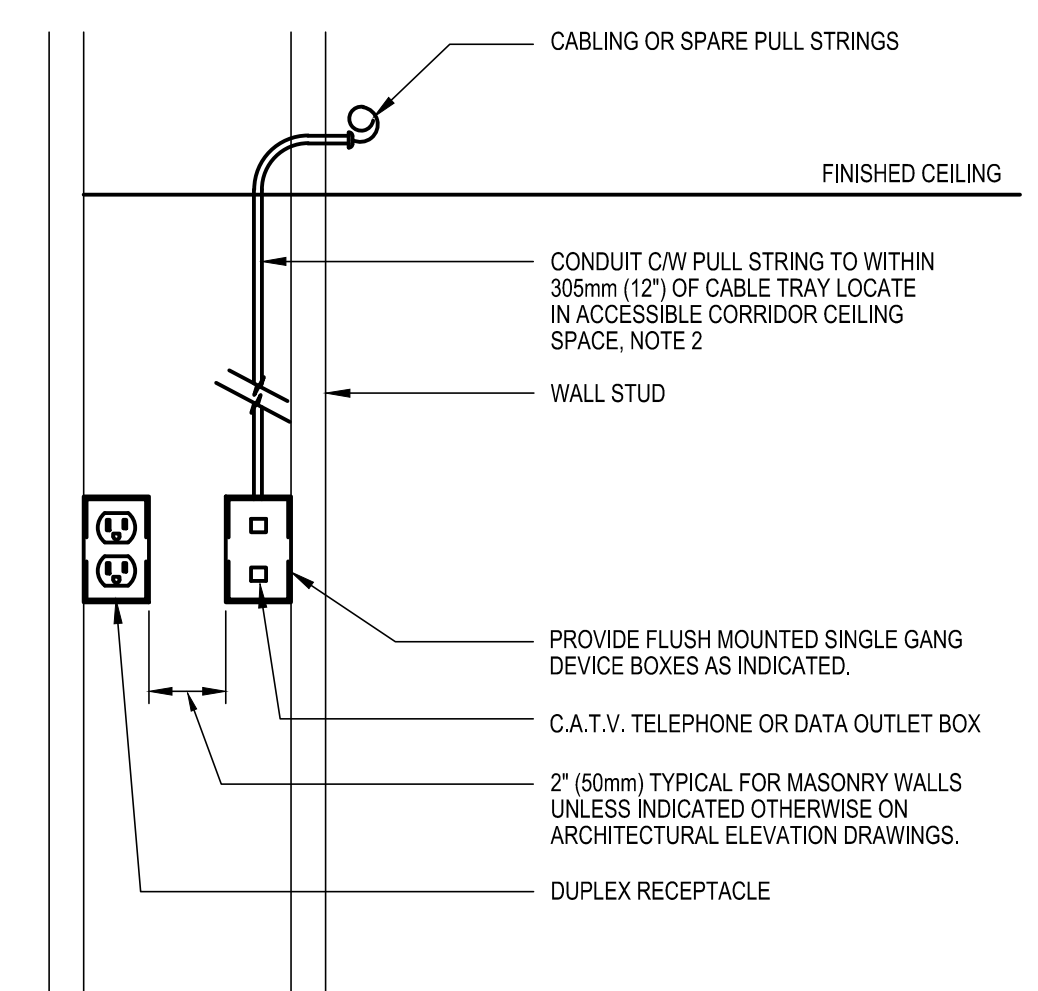
DRAWING TITLE
ELECTRICAL RISERS

DATE	DRAWN BY	DRAWING No.
01/11/2020	AS	E401.4
SCALE	CHECKED BY	
AS NOTED	ZJRL	
PROJECT No.		
8906		



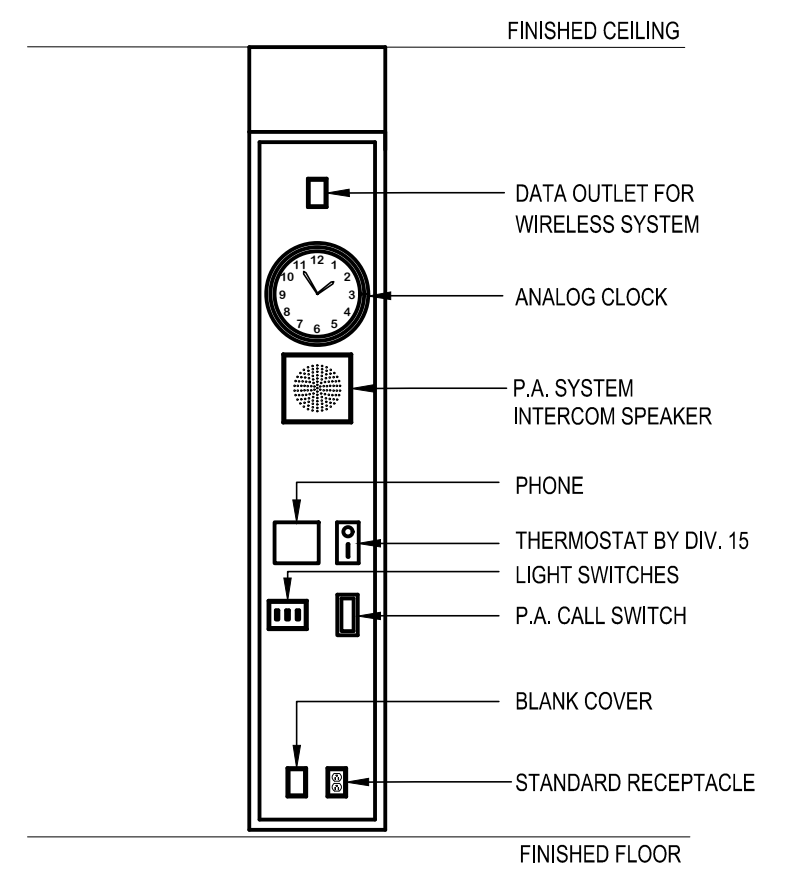
RECEPTACLE ROOF MOUNTING DETAIL

- N.T.S.
- NOTES:
1. MAINTAIN A MINIMUM CLEARANCE OF 308mm (12") ON ALL SIDES OF ROOF PENETRATION FROM WALLS, CURBS, AND OTHER PROJECTIONS TO FACILITATE PROPER FLASHING.
 2. FLANGES OF ADJACENT FLASHINGS SHALL NOT BE CUT OR OVERLAPPED.
 3. COORDINATE FLASHINGS INSTALLATION WITH GENERAL CONTRACTOR TO ENSURE PROPER METHODS AND MATERIALS ARE USED TO MAINTAIN ROOF WARRANTY.
 4. COORDINATE PRECAST CONCRETE BASE REQUIREMENTS WITH OTHER TRADES.
 5. ALL UNISTRUT AND ASSOCIATED MOUNTING HARDWARE TO BE ALUMINIUM.
 6. COORDINATE WITH DIVISION 15 FOR SHARED USE OF FLASHING WHERE SPECIFIED AND PRACTICABLE.



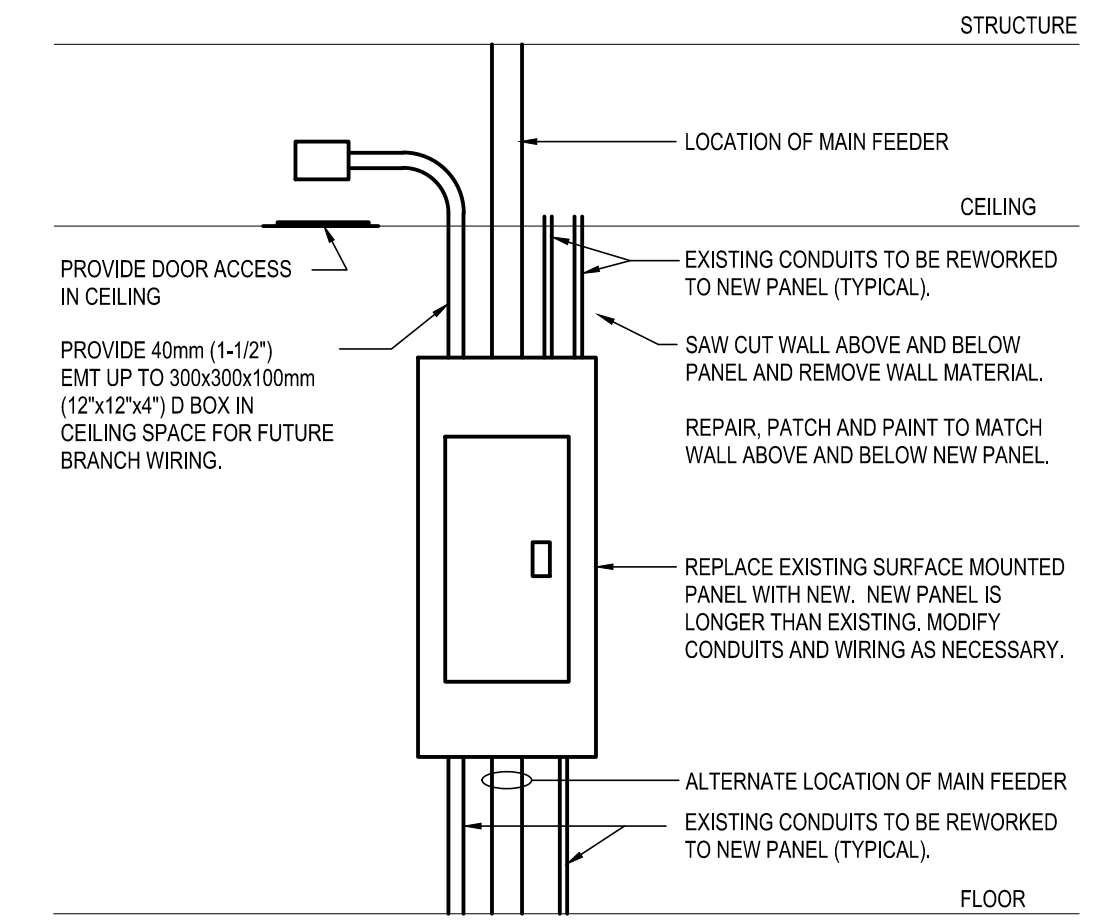
TYPICAL COMMUNICATION OUTLET AND RECEPTACLE MOUNTING

- N.T.S.
- NOTES:
1. REFER TO FLOOR PLANS FOR LOCATION, TYPE AND QUANTITY OF DEVICES.
 2. REFER TO SPECIFICATION FOR COMMUNICATION CONDUIT SIZES.



CLASSROOM MODULE

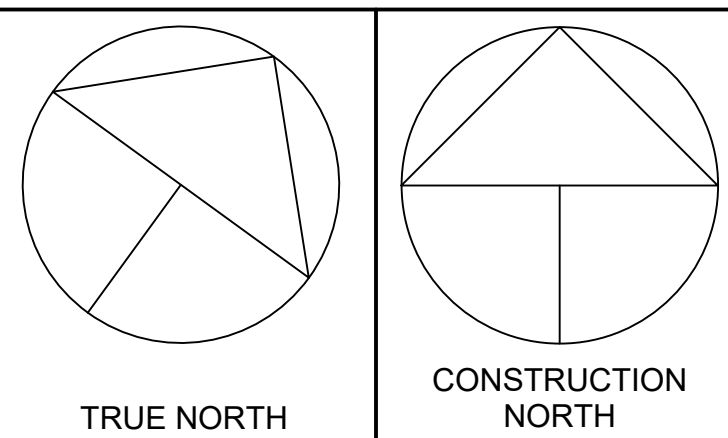
- N.T.S.
- NOTES:
1. MOUNT DEVICES AT HEIGHTS INDICATED ON ARCHITECTURAL DRAWINGS. REFER TO FLOOR PLANS FOR TYPES AND QUANTITY OF DEVICES.



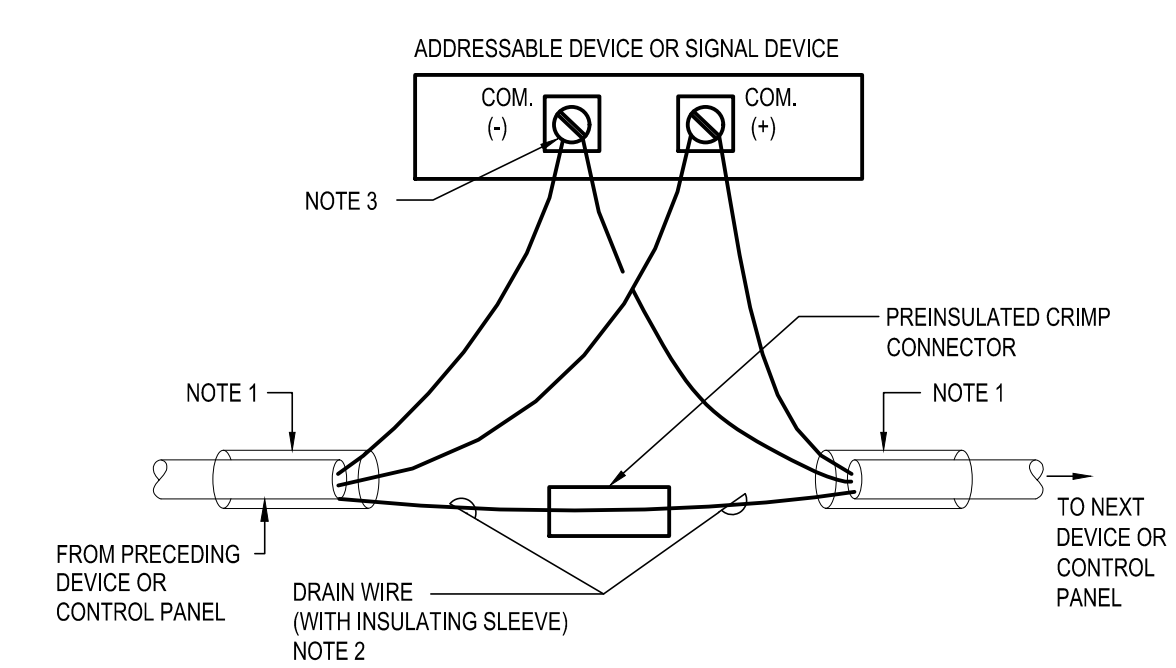
PANEL REPLACEMENT DETAIL

N.T.S.

KEY PLAN

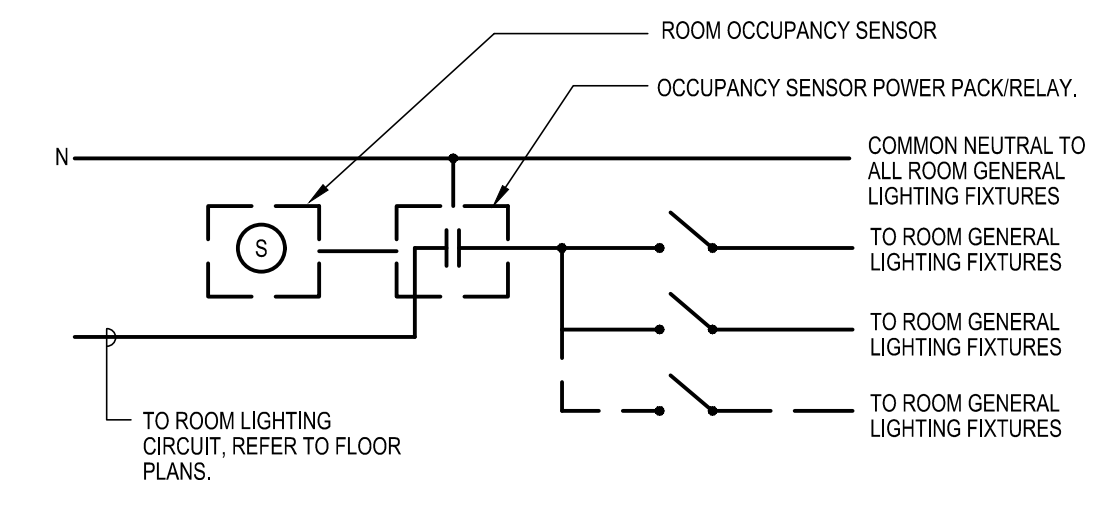


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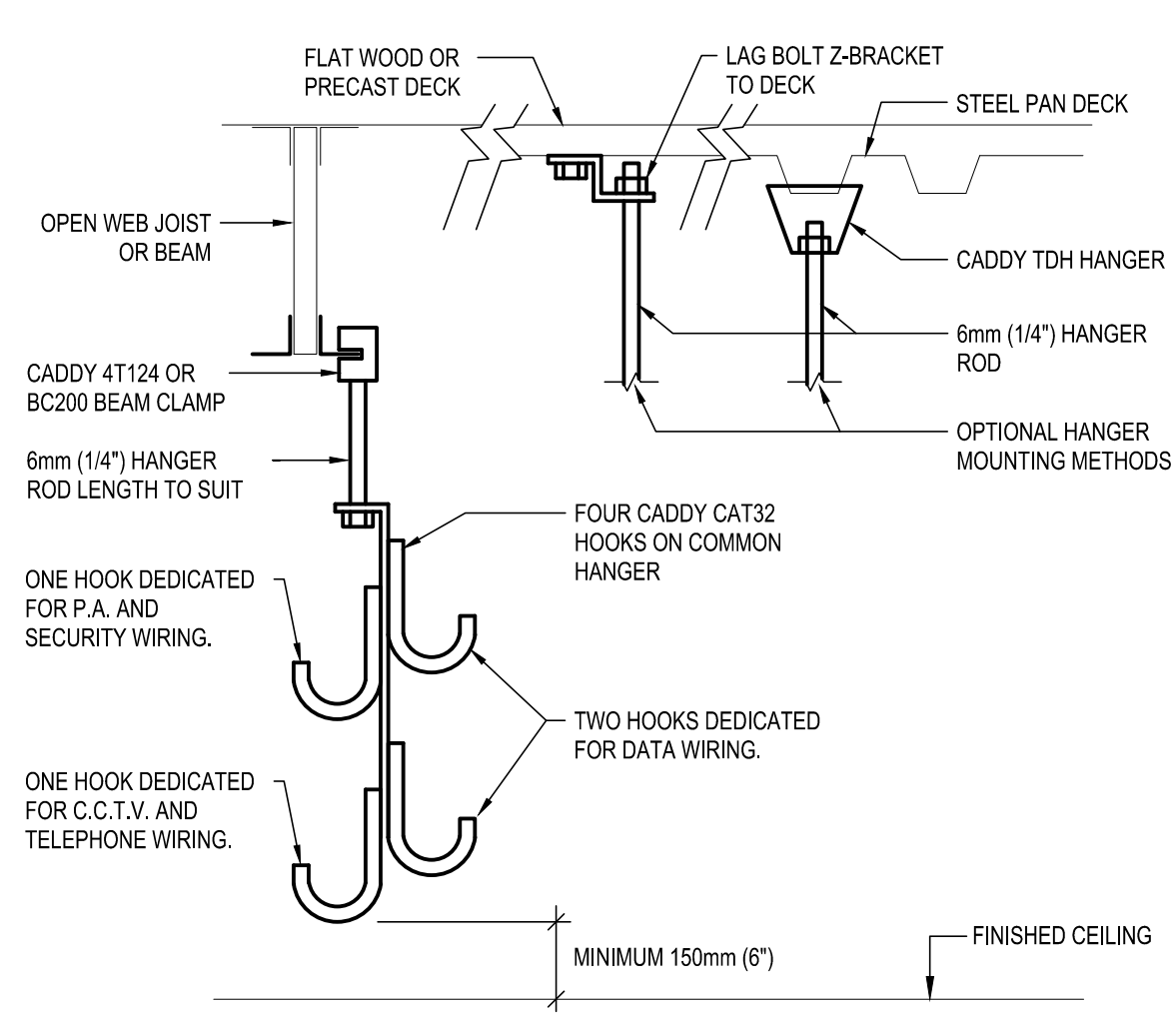
TYPICAL FIRE ALARM DEVICE WIRING DIAGRAM

- N.T.S.
- NOTES:
1. ASSEMBLE DRAIN WIRE AT BOTH ENDS OF SHIELD USING TYPICAL SHIELD/DRAIN INSULATION METHODS.
 2. SHIELDS ON CABLES MUST BE CONTINUOUS AND INSULATED FROM BOXES, CONDUITS ETC. ALL SHIELDS MUST BE ISOLATED FROM GROUND. APPROVED 'SHRINK' TUBING SHALL BE USED ON ALL DRAIN CONDUCTORS.
 3. DO NOT LOOP WIRE UNDER TERMINALS. BREAK WIRE RUNS TO PROVIDE SUPERVISION.



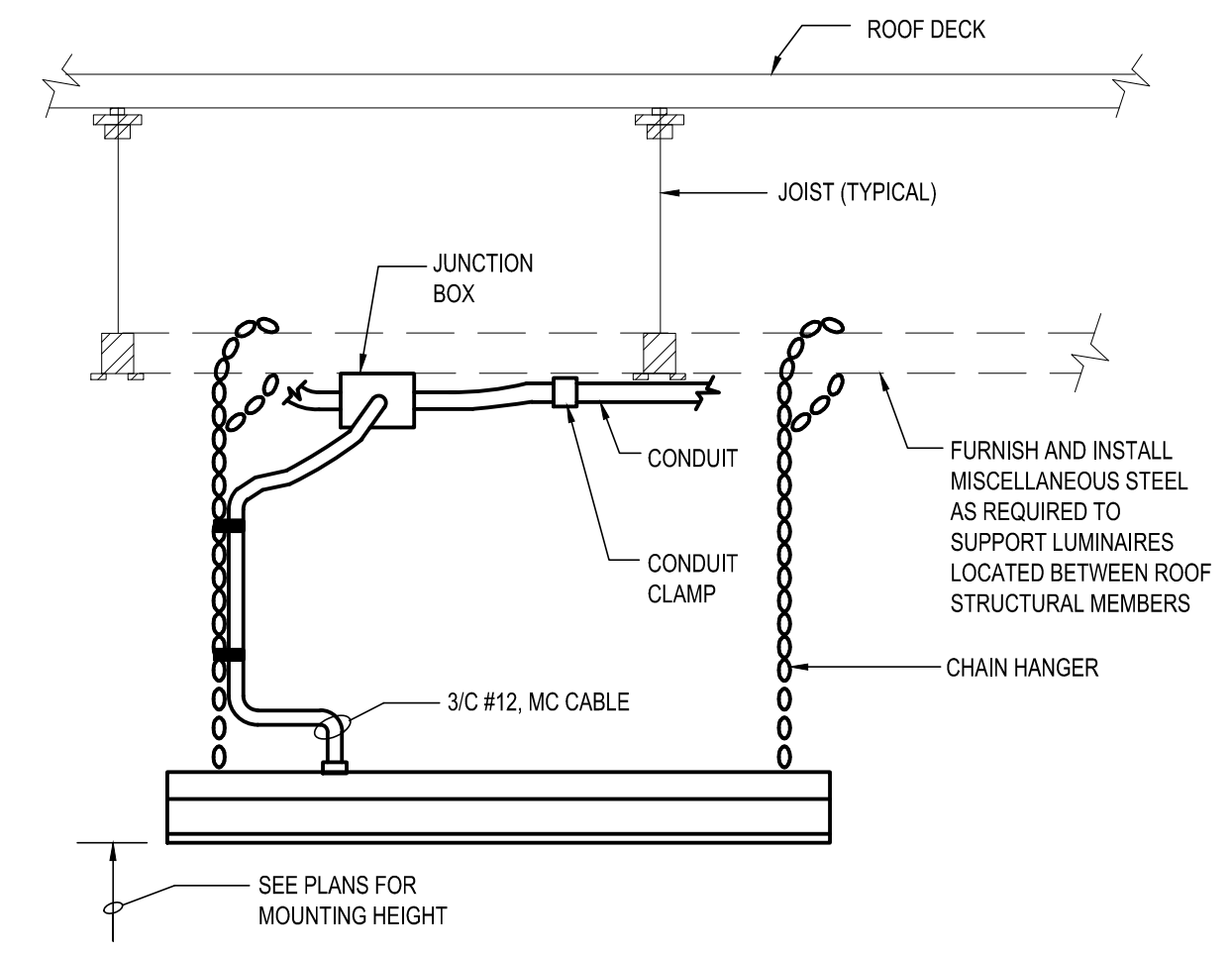
TYPICAL OCCUPANCY SENSOR SCHEMATIC

- N.T.S.
- NOTES:
1. ADJUST OCCUPANCY SENSORS TO TURN LIGHTS OFF WHEN ROOM UNOCCUPIED, FOR 5 MINUTES.
 2. WIRING BETWEEN OCCUPANCY SENSOR AND CONTROL UNIT TO BE IN CONDUIT.
 3. MOUNT POWER PACK IN ACCESSIBLE CEILING SPACE NEXT TO LIGHT FIXTURE OR SWITCH AT LOCATION ELECTRICAL FEED FROM LIGHTING PANEL TERMINATES.
 4. WIRE AND CONNECT OCCUPANCY SENSOR AND POWER PACK AS PER MANUFACTURER'S RECOMMENDATIONS.
 5. REFER TO ELECTRICAL SPECIFICATIONS FOR SPECIFIC INFORMATION ON SENSORS AND POWER PACKS.
 6. REFER TO FLOOR PLANS FOR LOCATION AND QUANTITY OF SENSORS AND LIGHT SWITCHES.
 7. DO NOT INSTALL OCCUPANCY SENSORS CLOSE TO DIFFUSERS. COORDINATE ON SITE. FOLLOW MANUFACTURER'S RECOMMENDATIONS.
 8. THIS DETAIL IS TO BE USED FOR ROOMS WITH OCCUPANCY SENSORS AND NO ROOM CONTROLLERS.



HANGER DETAILS

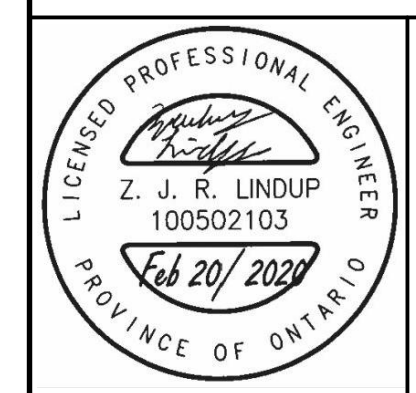
N.T.S.



TYPICAL MOUNTING DETAIL FOR CHAIN HUNG LUMINAIRES

N.T.S.

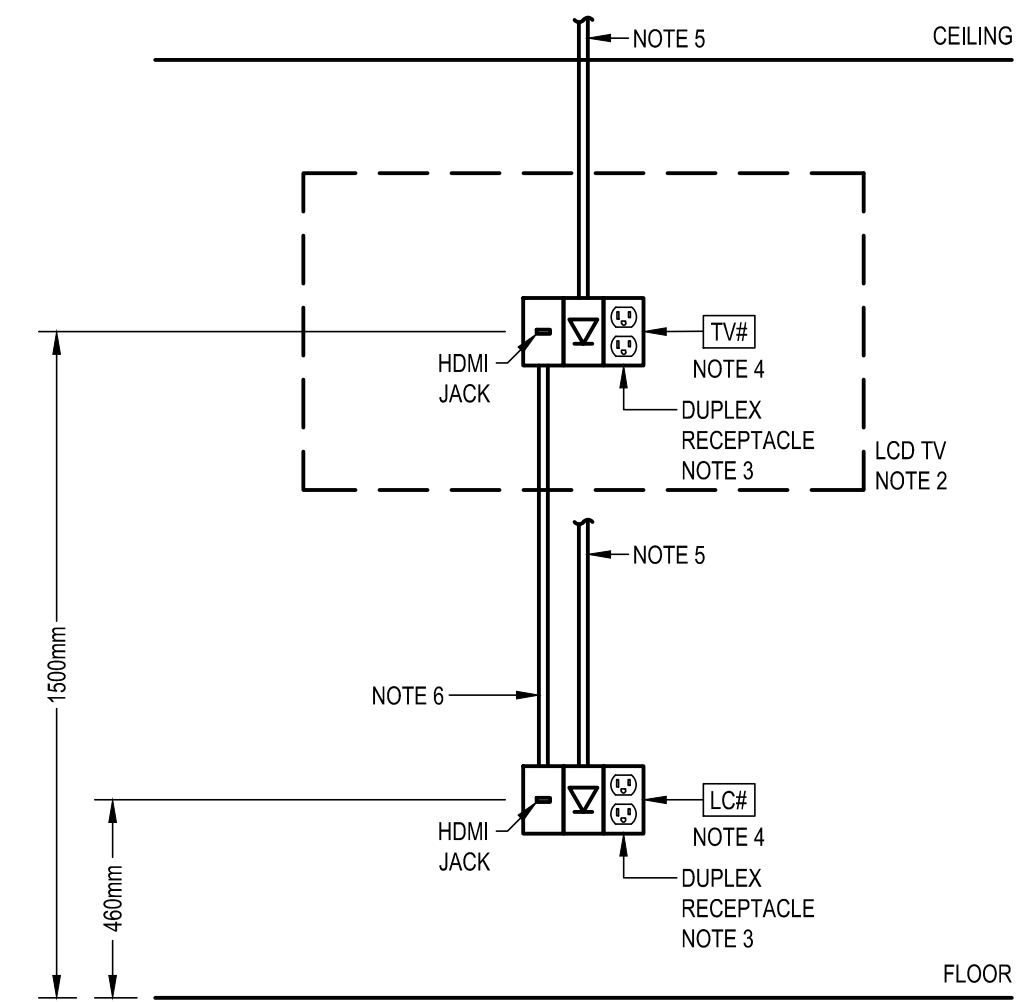
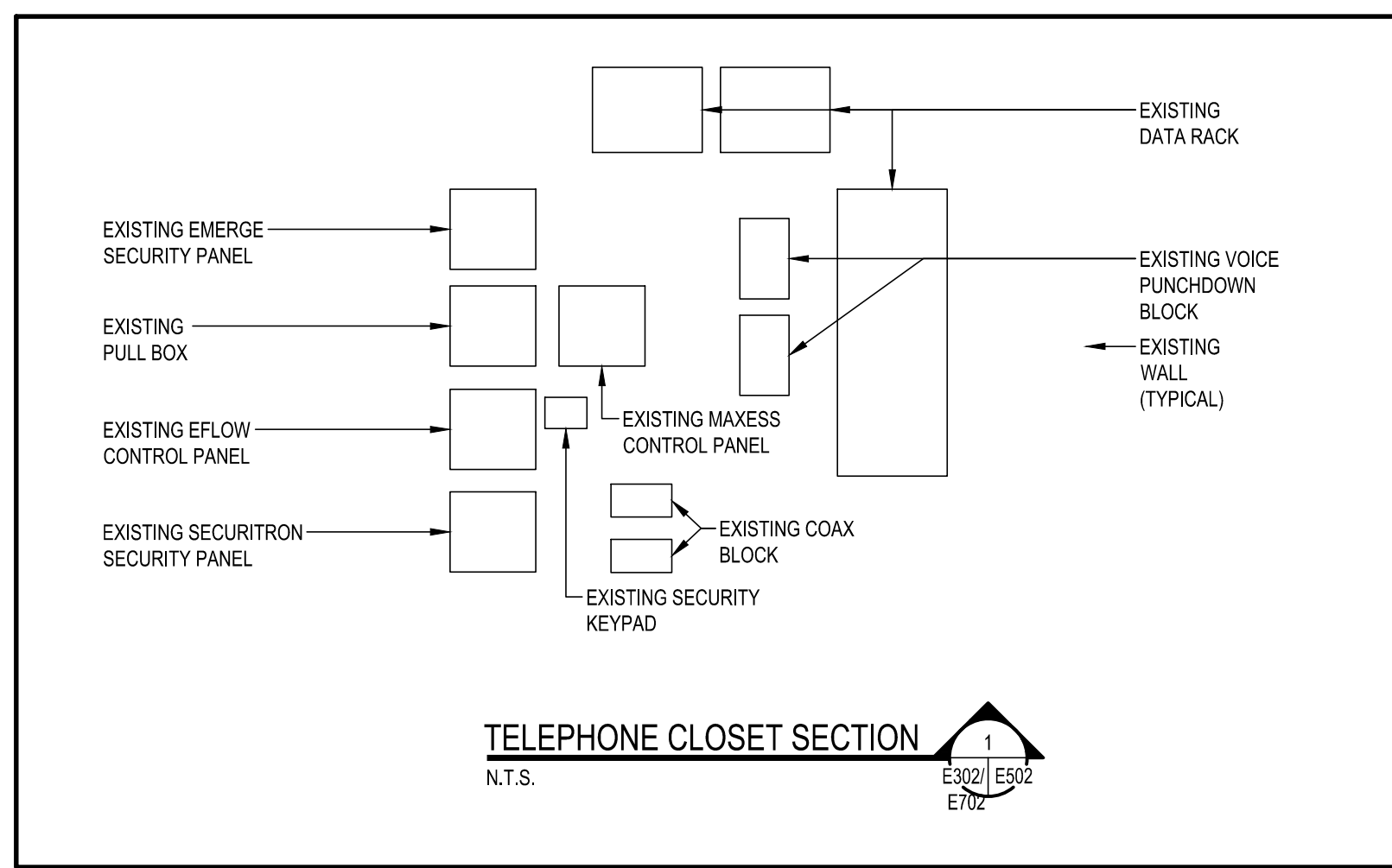
DATE	ISSUED FOR TENDER	REV. NO.
02/19/2020	REVISION	
DATE	ISSUED FOR TENDER	REV. NO.
04/05/2020	REVISION	



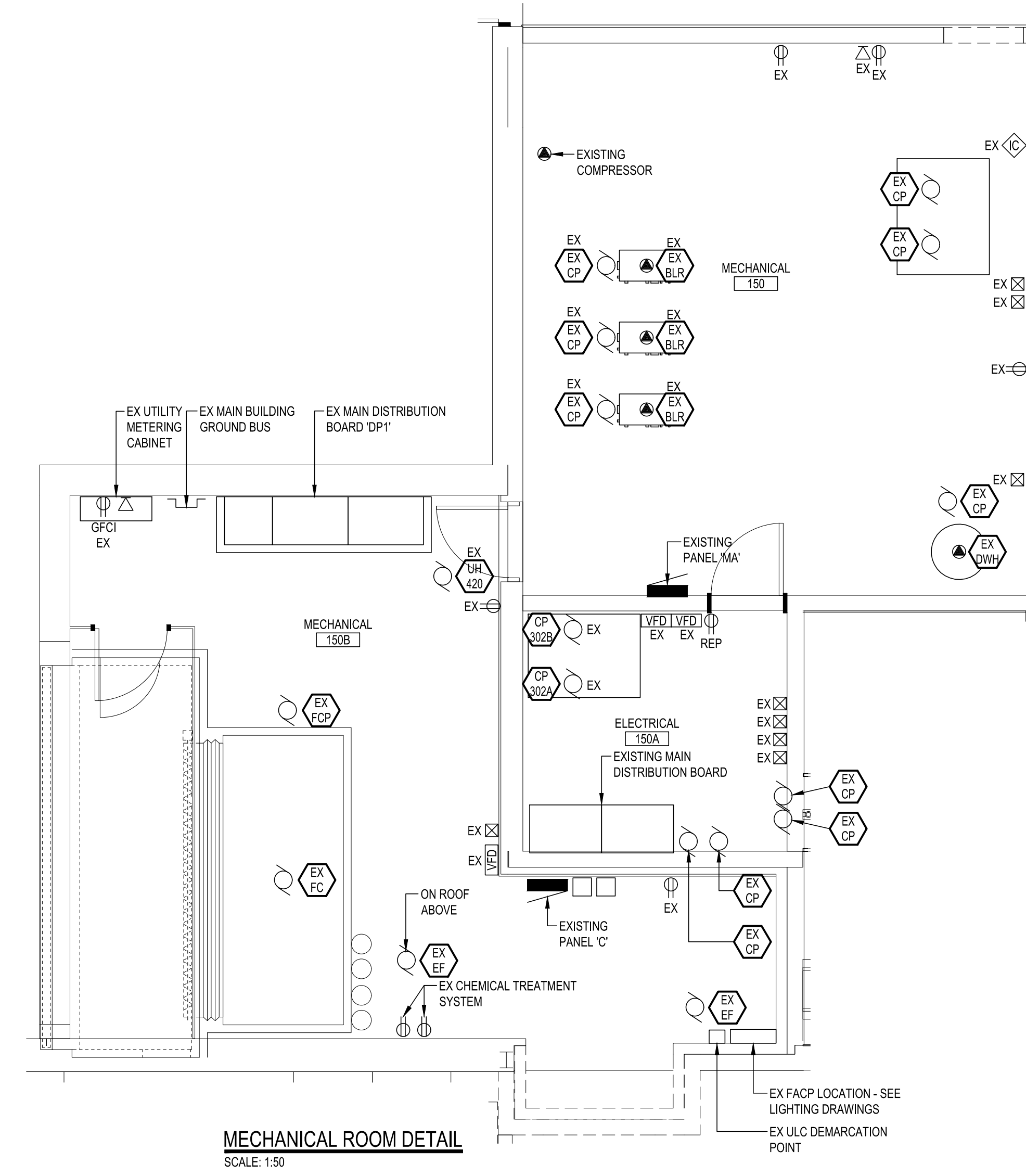
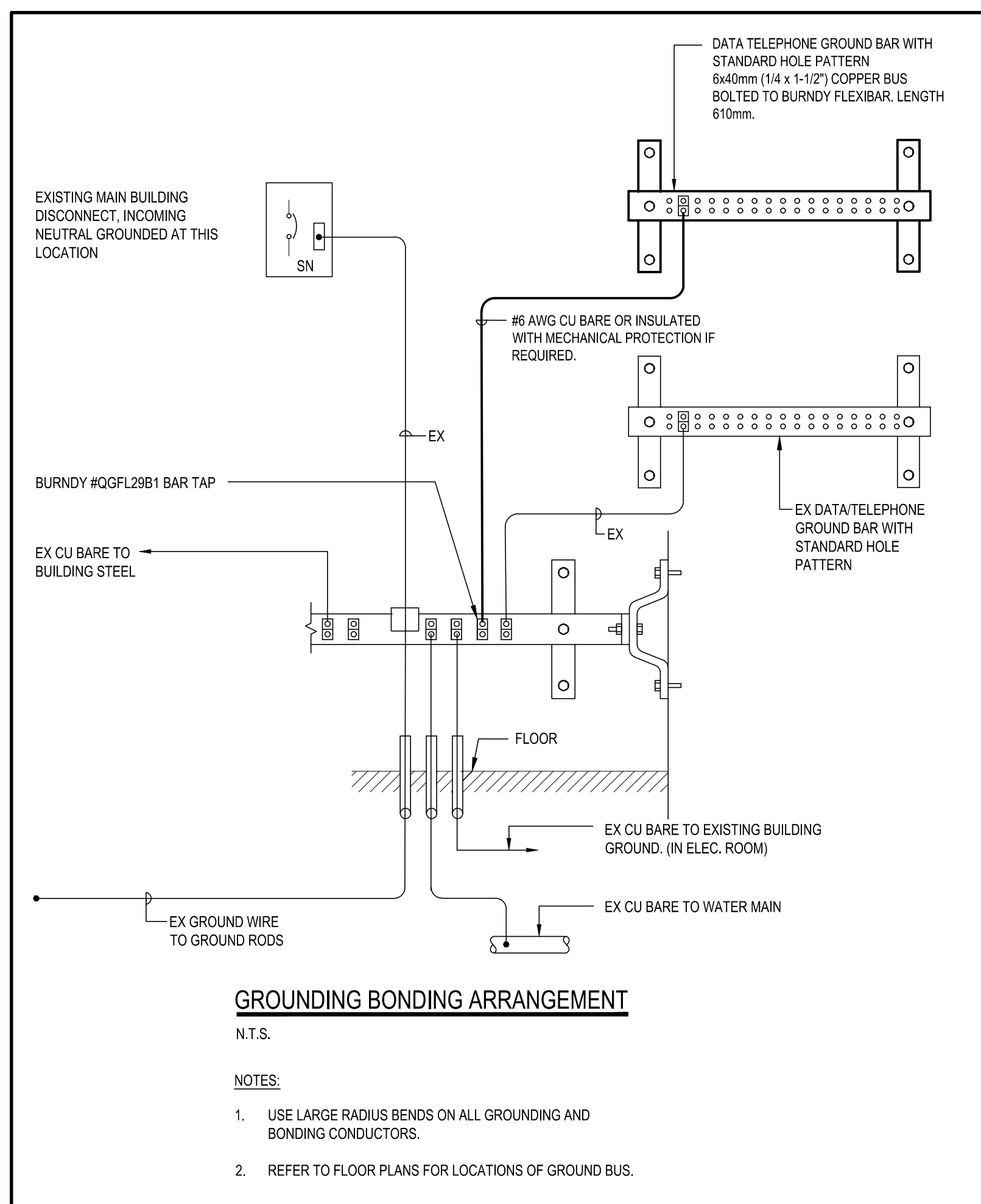
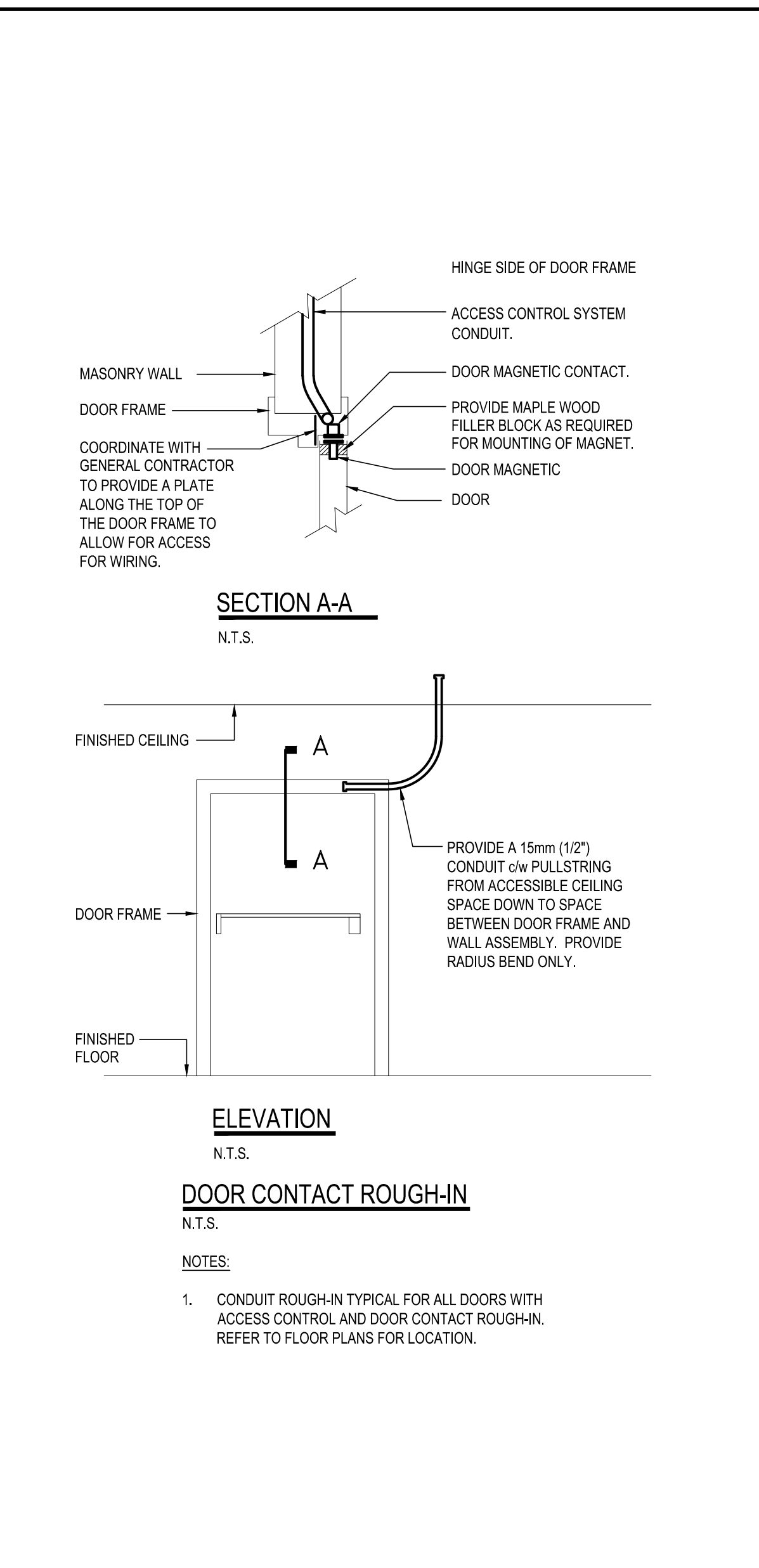
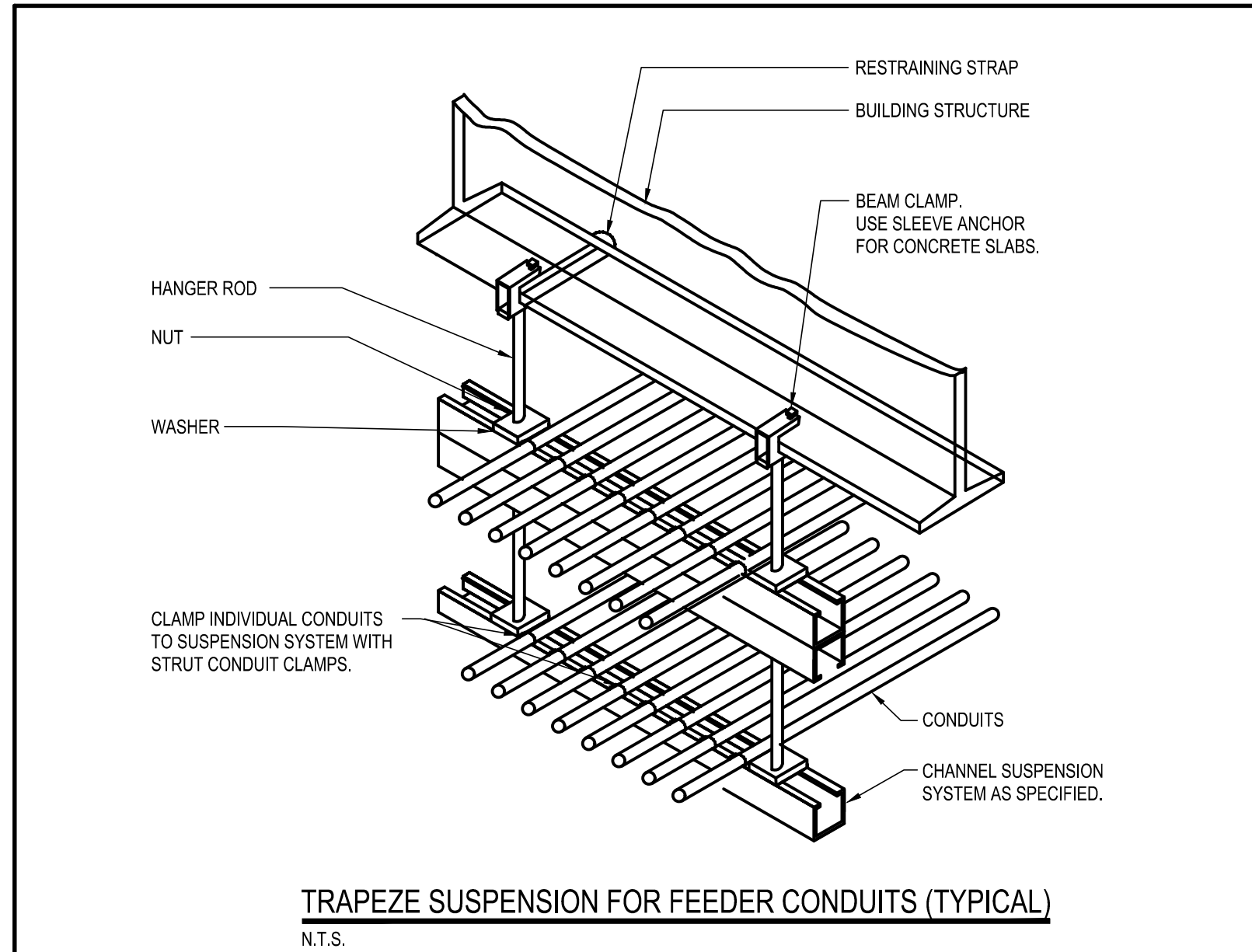
PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
ELECTRICAL DETAILS

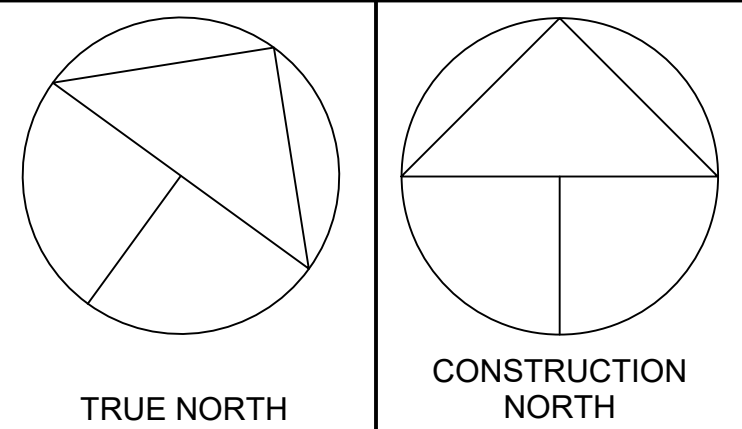
DATE	DRAWN BY	DRAWING No.
01/11/2020	AI5	
SCALE	CHECKED BY	E501.4
AS NOTED	ZJRL	
PROJECT No.	8906	



- NOTES:**
1. PROVIDE PULL STRINGS IN ALL EMPTY CONDUITS.
 2. LCD TV'S PROVIDED BY OWNER.
 3. REFER TO FLOOR PLANS FOR CIRCUIT.
 4. PROVIDE HUBBELL STATION BACKBOX c/w ASSOCIATED COVERPLATE AND DIVIDER BETWEEN POWER AND DATA/AV COMPARTMENTS.
 5. PROVIDE CONDUIT TO ACCESSIBLE CEILING SPACE FOR DATA AS SPECIFIED.
 6. PROVIDE 4mm C FOR HDMI CABLING.

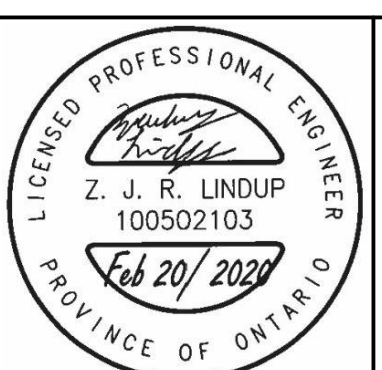


KEY PLAN



NOTES

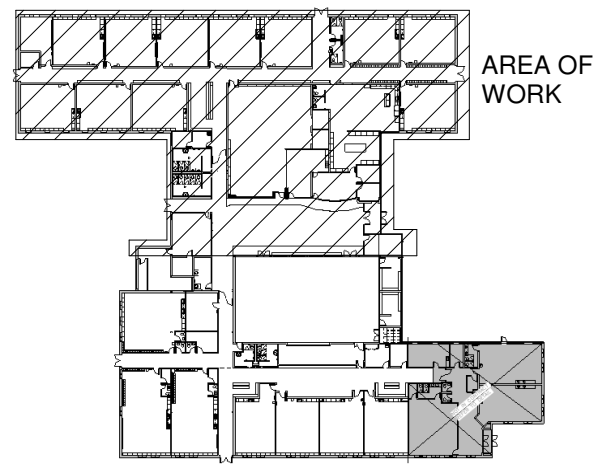
DATE	ISSUED FOR TENDER	REV
02/19/2020	REVISION	
04/05/2020		



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
ELECTRICAL DETAILS

DATE 01/11/2020	DRAWN BY AIS	DRAWING No.
SCALE AS NOTED	CHECKED BY ZJRL	E502.4
PROJECT No. 8906		

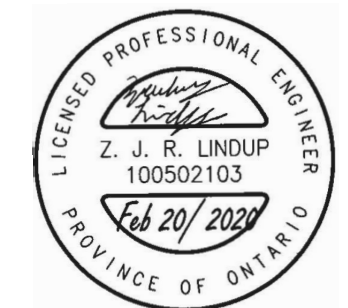


KEY PLAN

NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV.
2	02/20/2020			
	MM/DD/YYYY			



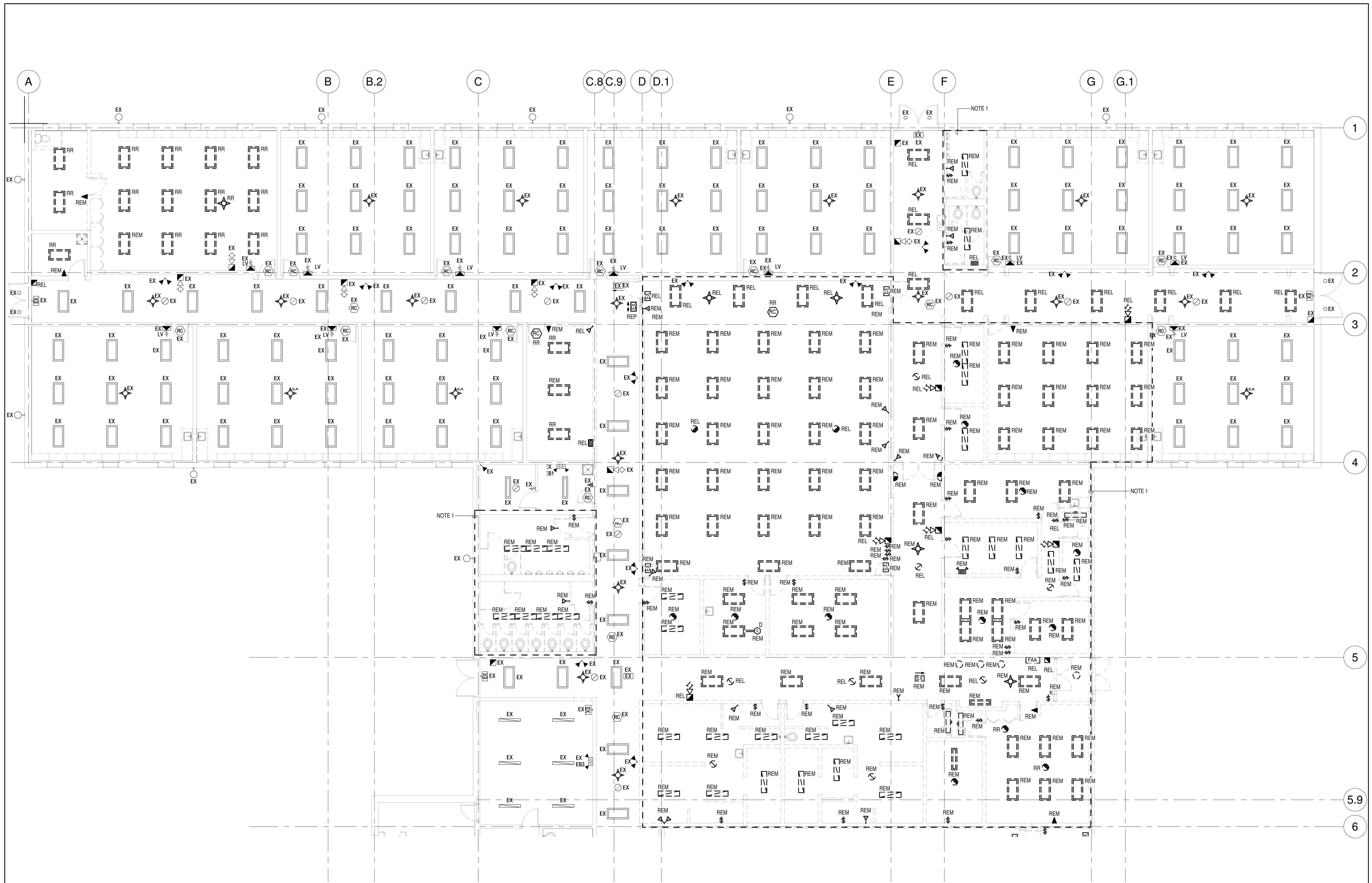
PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

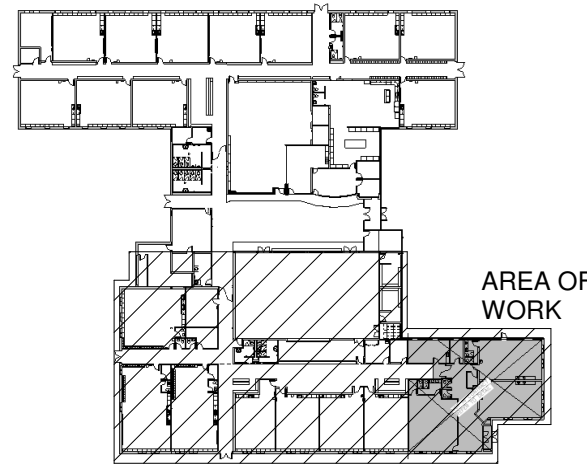
PART GROUND FLOOR PLAN - NORTH - LIGHTING AND FIRE ALARM DEMOLITION

DATE PLOTTED 2020-02-20 3:22:15 PM	DRAWN BY AIS	DRAWING No.
SCALE 1 : 100	CHECKED BY ZJRL	E601.4
PROJECT No. 8906		



PART GROUND FLOOR PLAN - NORTH - LIGHTING AND FIRE ALARM DEMOLITION
SCALE 1 : 100

- NOTES:
- EXISTING DEVICES ARE SHOWN FOR REFERENCE ONLY. COMPLETELY REMOVE ALL LIGHTING AND FIRE ALARM DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT CABLING AND CONDUIT BACK TO SOURCE. MAINTAIN SERVICE TO AREAS NOT UNDER CONSTRUCTION.



KEY PLAN

NOTES

LEGEND

No.	DATE	DESCRIPTION	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT	



PROJECT TITLE

OUR LADY OF FATIMA

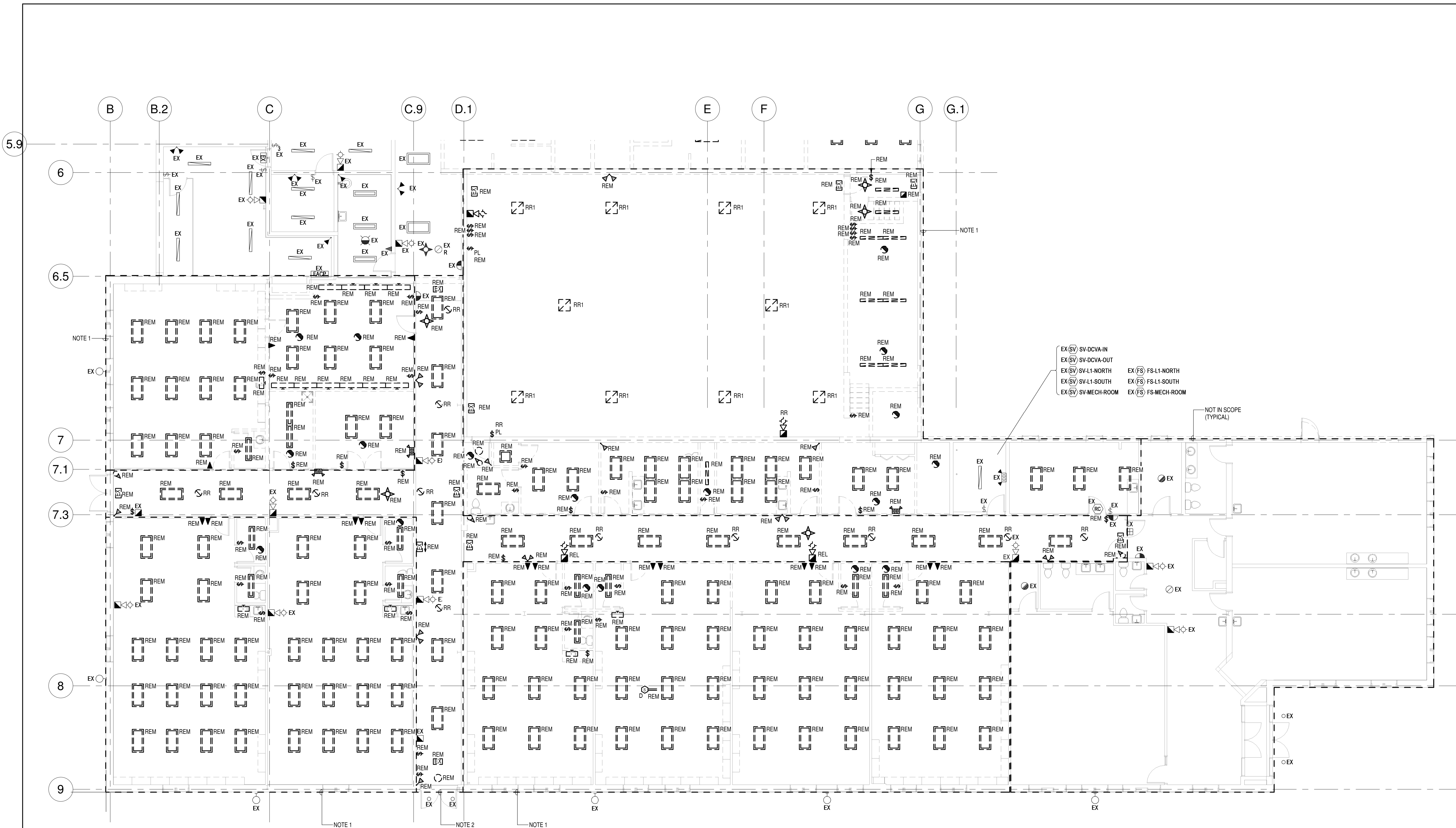
DRAWING TITLE

PART GROUND FLOOR PLAN - SOUTH - LIGHTING AND FIRE ALARM DEMOLITION

DATE PLOTTED 2020-02-20 3:22:19 PM DRAWN BY AIS DRAWING No.

SCALE 1:100 CHECKED BY ZJRL E602.4

PROJECT No. 8906

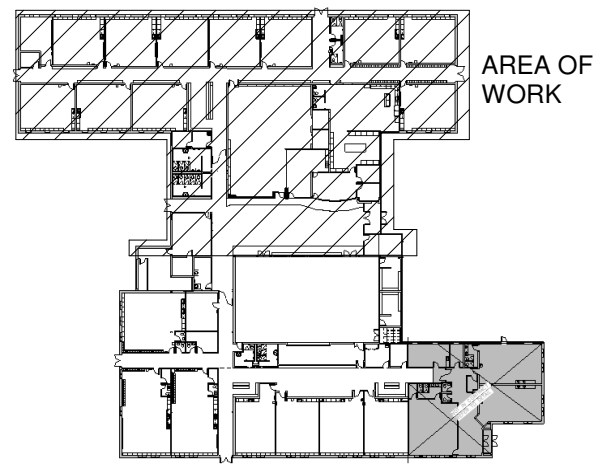


PART GROUND FLOOR PLAN - SOUTH - LIGHTING AND FIRE ALARM DEMOLITION

SCALE 1:100

NOTES:

- EXISTING DEVICES ARE SHOWN FOR REFERENCE ONLY. COMPLETELY REMOVE ALL LIGHTING AND FIRE ALARM DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT CABLING AND CONDUIT BACK TO SOURCE. MAINTAIN SERVICE TO AREAS NOT UNDER CONSTRUCTION.
- EXISTING DEVICES ARE SHOWN FOR REFERENCE ONLY. COMPLETELY REMOVE ALL CEILING MOUNTED LIGHTING AND FIRE ALARM DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT CABLING AND CONDUIT BACK TO SOURCE. MAINTAIN SERVICE TO AREAS NOT UNDER CONSTRUCTION.



KEY PLAN

NOTES

LEGEND

No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV. No.
2	02/20/2020	ISSUED FOR TENDER & PERMIT		



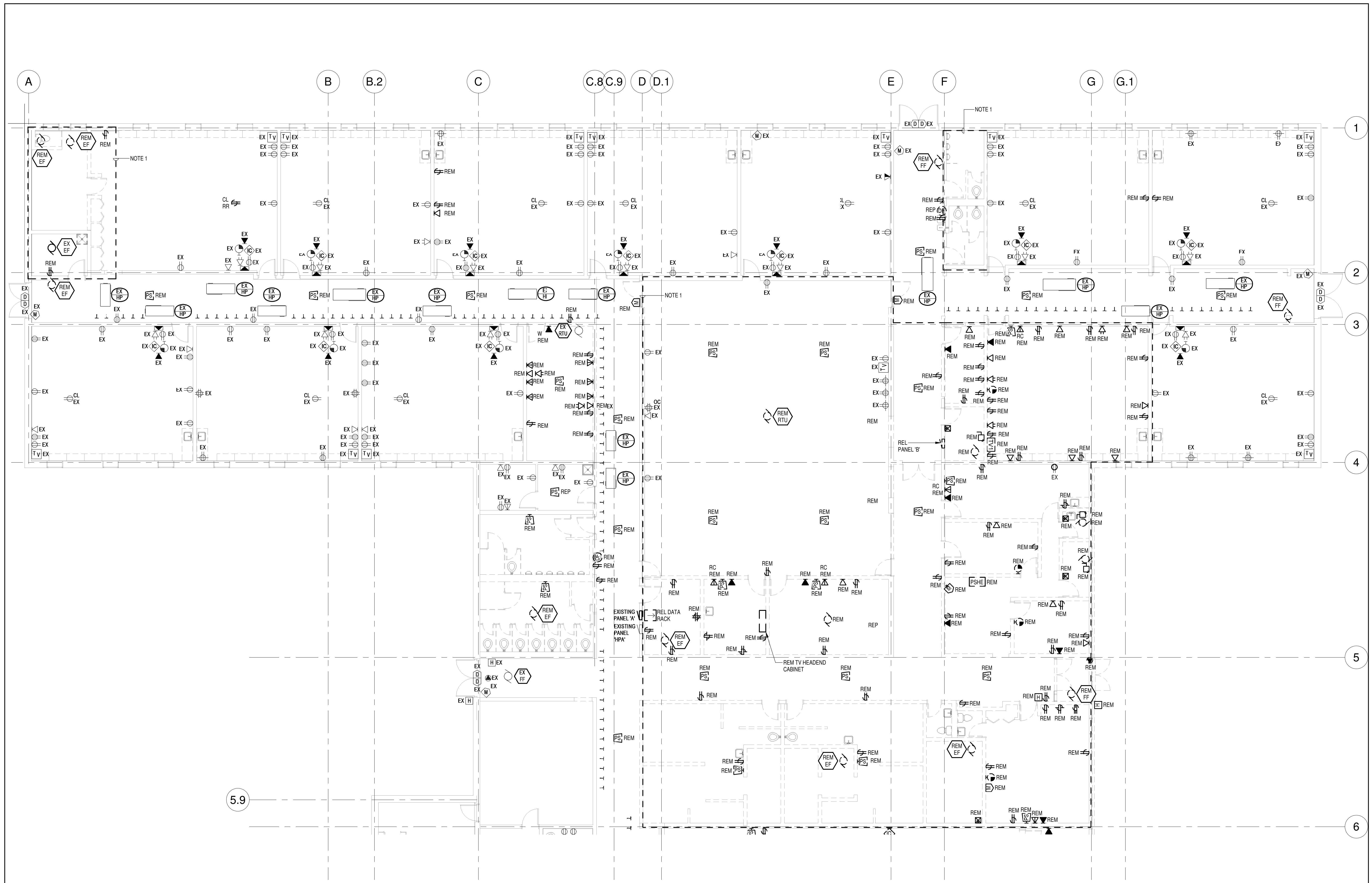
PROJECT TITLE

OUR LADY OF FATIMA

DRAWING TITLE

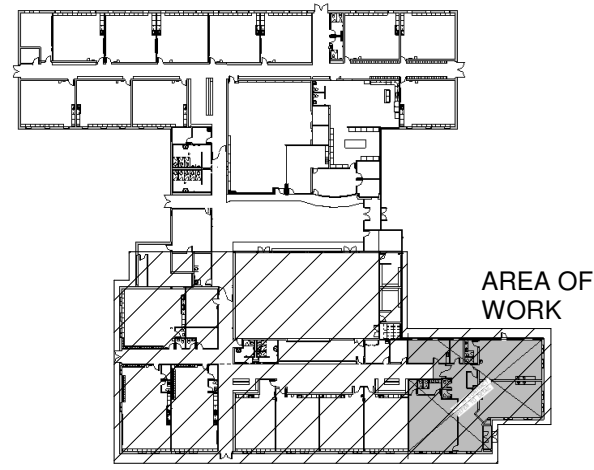
PART GROUND FLOOR PLAN - NORTH - POWER AND SYSTEMS DEMOLITION

DATE PLOTTED 2020-02-20 3:22:24 PM	DRAWN BY AIS	DRAWING No.
SCALE 1:100	CHECKED BY ZJRL	E701.4
PROJECT No.	8906	

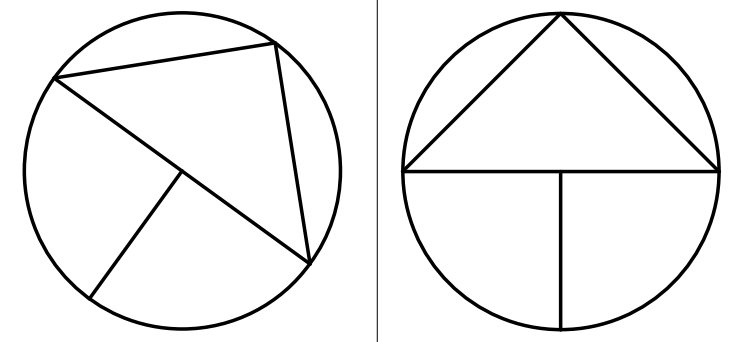


PART GROUND FLOOR PLAN - NORTH - POWER AND SYSTEMS DEMOLITION
SCALE 1:100

- NOTES:
- EXISTING DEVICES ARE SHOWN FOR REFERENCE ONLY. COMPLETELY REMOVE ALL POWER AND SYSTEMS DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT CABLING AND CONDUIT BACK TO SOURCE. MAINTAIN SERVICE TO AREAS NOT UNDER CONSTRUCTION.
 - COMPLETELY REMOVE ALL EXISTING PAGING SPEAKERS, INTERCOM STATIONS, CALL SWITCHES, PROGRAM BELLS, AND PULL CORDS UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT WIRING, CONDUIT, AND ACCESSORIES.



KEY PLAN

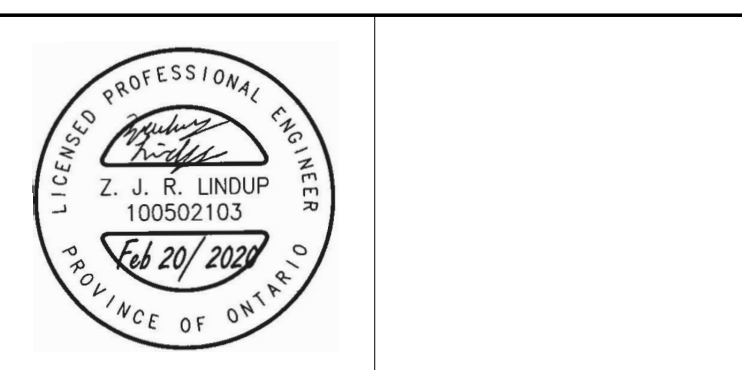


TRUE NORTH
CONSTRUCTION NORTH

NOTES

LEGEND

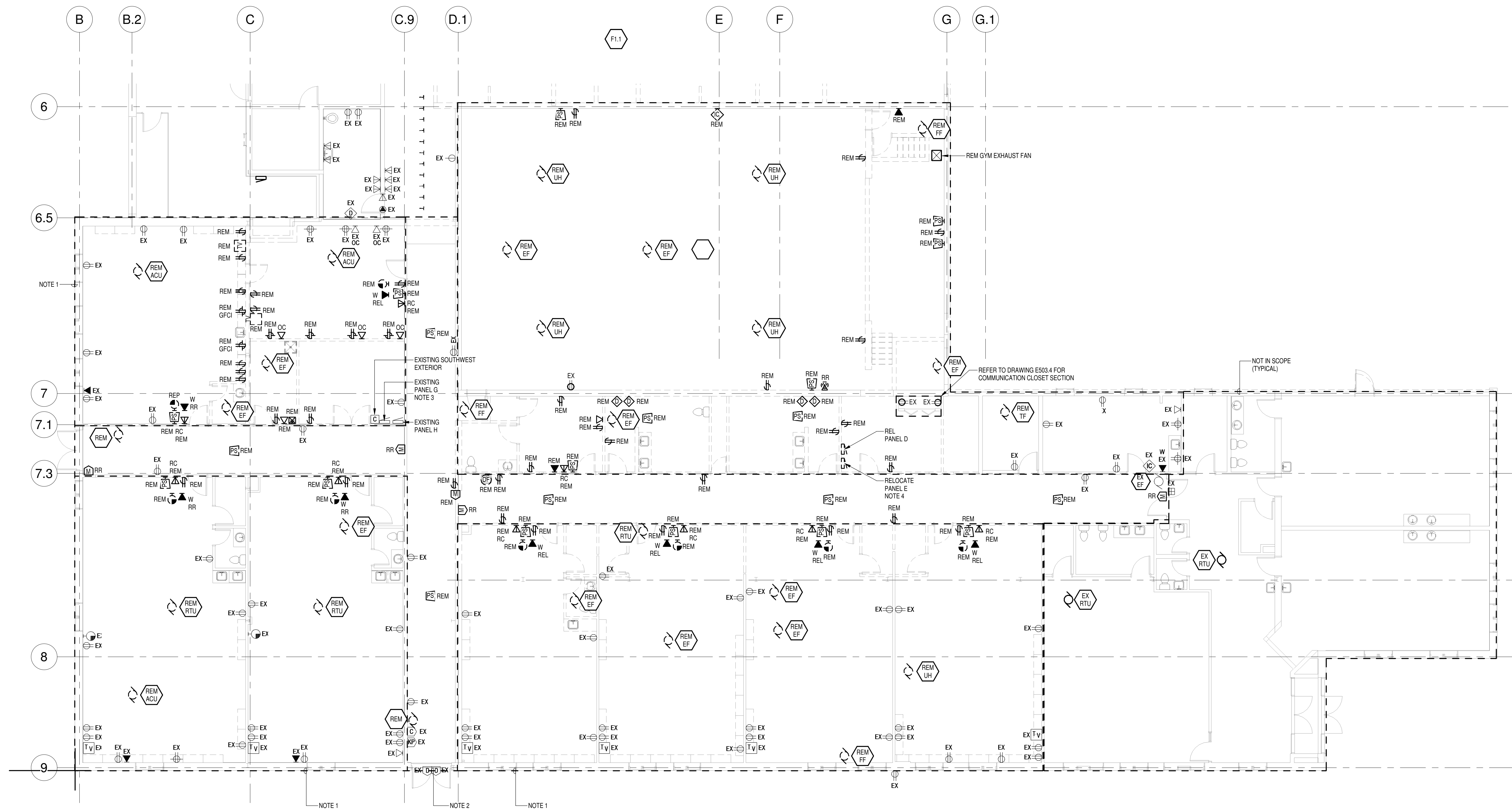
No.	DATE	ISSUED FOR TENDER & PERMIT	DESCRIPTION	REV. No.
2	02/20/2020			
	MM/DD/YYYY			



PROJECT TITLE
OUR LADY OF FATIMA

DRAWING TITLE
PART GROUND FLOOR PLAN - SOUTH - POWER AND SYSTEMS DEMOLITION

DATE PLOTTED 2020-02-20 3:22:28 PM	DRAWN BY AIS	DRAWING No. E702.4
SCALE 1 : 100	CHECKED BY ZJRL	
PROJECT No. 8906		



PART GROUND FLOOR PLAN SOUTH - POWER AND SYSTEMS DEMOLITION

SCALE 1 : 100

NOTES:

- EXISTING DEVICES ARE SHOWN FOR REFERENCE ONLY. COMPLETELY REMOVE ALL POWER AND SYSTEMS DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT CABLING AND CONDUIT BACK TO SOURCE. MAINTAIN SERVICE TO AREAS NOT UNDER CONSTRUCTION.
- EXISTING DEVICES ARE SHOWN FOR REFERENCE ONLY. COMPLETELY REMOVE ALL CEILING MOUNTED POWER AND SYSTEMS DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT CABLING AND CONDUIT BACK TO SOURCE. MAINTAIN SERVICE TO AREAS NOT UNDER CONSTRUCTION.
- EXISTING LOADS TO BE REWORKED TO EXISTING PANEL 'H'. REFER TO DRAWING E302.4 AND PANEL SCHEDULES FOR ADDITIONAL DETAILS.
- EXISTING LOADS NOT SERVING DAYCARE TO BE REWORKED INTO EXISTING PANEL 'D' IN NEW LOCATION. REFER TO DRAWING E302.4 AND PANEL SCHEDULES FOR ADDITIONAL DETAILS.
- COMPLETELY REMOVE ALL EXISTING PAGING SPEAKERS, INTERCOM STATIONS, CALL SWITCHES, PROGRAM BELLS, AND PULL CORDS UNLESS OTHERWISE NOTED. REMOVE ALL REDUNDANT WIRING, CONDUIT, AND ACCESSORIES.