Fisheries and Oceans Canada | Pêches et Océans Canada

INVITATION TO TENDER

Sealed Tenders, addressed to:

Fisheries and Oceans, Canada
TENDER SUBMISSION
c/o Natural Resources Canada
1350 Regent Street
Fredericton NB E3C 2G6

and marked: **Tender F5211-130294**
Roof Top A/C Replacement and Controls Upgrades, St John's International Airport, Newfoundland

will be received up to: **THURSDAY, 19 DECEMBER 2013**
2:00 p.m. Atlantic time

Nature of Work:
The Department of Fisheries and Oceans Canada general scope of work for this project would be the removal and replacement of an existing roof-top heat pump unit including disposal of the unit and R-22 refrigerant, new electrical feed, and upgrading of the existing electronic control system for the air-conditioning system to a new direct digital controls system. A Detailed specification, complete with drawings is provided in the attached document package. Bidders must attend a site visit in order to submit their bids. It is essential that contractors view the site and surroundings to understand the work involved.

Bidders are instructed to consult the appended tender package for further details and specific requirements.

Site Locations: General Service Building, Royal Canadian Air Force Road, St. John's International Airport, St. John's, Newfoundland, A1A 5B2.

Start Date: Upon Award.

Completion Date: All work to be completed by 26 March 2014

Mandatory Site Visit: is to be held on **Wednesday, December 11rd, 2013 at 10:00am local time** at the General Service Building, Royal Canadian Air Force Road, St. John's International Airport, St. John's, Newfoundland, A1A 5B2. It is a requirement for all

persons wishing to tender on this project to attend this meeting at the site to familiarize themselves fully with the scope of work and the tendering requirements.

Security Requirements: Escorts will be provided.

Inquiries: Direct all technical and contractual inquiries to the contracting authority Kimberly Walker by email at DFOtenders-soumissionsMPO@dfo-mpo.gc.ca.

Fisheries and Oceans Canada will not necessarily accept the lowest or any of the tenders received and reserves the right to reject any and all tenders received which shall be final and at the sole discretion of the Department.

Canada

Fisheries and Oceans Canada | Pêches et Océans Canada

APPEL D'OFFRES

Faire parvenir les soumissions cachetées à :

Pêches et Océans Canada
SOUMISSION CONSÉCUTIVE À UN APPEL D'OFFRES
a/s de Ressources naturelles Canada
1350, rue Regent
Fredericton (N.-B.) E3C 2G6

et indiquer : **Soumission F5211-130294**
Remplacement du climatiseur sur le toit et mises à niveau des commandes, Aéroport international de St. John's (Terre-Neuve-et-Labrador)

Les soumissions seront acceptées jusqu'à : JEUDI, 19 DECEMBRE 2013
14 h, heure de l"Atlantique

Nature des travaux :
La portée générale des travaux de Pêches et Océans Canada pour ce projet comprend l'enlèvement et le remplacement de la pompe thermodynamique installée sur le toit, y compris l'élimination de cette pompe et du réfrigérant R-22; un nouveau système de régulation électrique et le remplacement du système de régulation électronique pour le système de conditionnement de l'air par un nouveau système de commande numérique directe. Un cahier des charges détaillé accompagné des dessins est fourni dans la trousse de documents ci-jointe. Les soumissionnaires doivent visiter le site afin de pouvoir présenter leur soumission. Il est essentiel que les entrepreneurs voient le site et les environs pour bien comprendre les travaux à exécuter.

On rappelle aux soumissionnaires de consulter le dossier d'appel d'offres pour obtenir de plus amples renseignements et les exigences particulières.

Emplacement : Bâtiment des services généraux, chemin Royal Canadian Air Force, Aéroport international de St. John's, St. John's (Terre-Neuve-et-Labrador) A1A 5B2.

Date de début : Dès l'attribution.

Date d'achèvement : Tous les travaux doivent se terminer avant le 26 mars 2014.

Visite obligatoire du site: La visite aura lieu **le mercredi 11 décembre 2013 à 10 h, heure locale**, au Bâtiment des services généraux, chemin Royal Canadian Air Force, Aéroport international de St. John's, St. John's (Terre-Neuve-et-Labrador) A1A 5B2. Cette réunion sur le site est obligatoire pour toutes les personnes qui souhaitent présenter une soumission afin qu'elles se familiarisent entièrement avec la portée des travaux et les exigences de la soumission.

Exigences de sécurité: Un service d'escorte sera fourni.

Demandes de renseignements : Toutes les demandes de nature techniques et contractuelles doivent être transmises par courriel à l'autorité contractante Kimberly Walker à l'adresse : DFOtenders-soumissionsMPO@dfo-mpo.gc.ca.

Pêches et Océans Canada n'acceptera pas nécessairement la soumission la moins coûteuse ni l'une des soumissions reçues, et il se réserve le droit de refuser l'une ou l'autre ou l'ensemble des soumissions reçues, cette décision est sans appel et à la seule discrétion du Ministère.

Canada

Fisheries and Oceans Canada | Pêches et Océans Canada

December 4, 2013

CONTRACT SERVICES
Fisheries and Oceans Canada
C/O Natural Resources Canada
1350 Regent St
Fredericton, NB E3C 2G6

Re: Invitation to Tender F5211-130294
Roof Top A/C Replacement and Controls Upgrades, St John's International Airport, Newfoundland

Sealed, signed tenders will be received up to **2:00 p.m. Atlantic Time: Thursday, December 19 2nd**, for the said service in accordance with the documents enclosed.

Bidders have the option to submit via email to the Contracting Officer processing this tender at DFOtenders-soumissionsMPO@dfo-mpo.gc.ca or bids may be submitted and addressed as per sample below. Your bid submission must include:

two (2) signed copies of the Form of Tender;

Do not address the bid to any individual, it may delay the receipt of the tender submission and could be considered late and therefore non-compliant. Make sure any outside envelope (i.e. courier envelopes) are addressed as per the sample below.

The onus is on the bidder to ensure that the bid is delivered on time to the location designated

Upon acceptance the successful bidder will be required to supply:

proof of insurance;
proof of WCB coverage;

Any tender received after the above noted time will be considered late and will be returned to the sender unopened. Tenders may be revised by email, letter or fax (506) 452-3676, provided the tender and revision(s) are both received prior to Tender Closing Time.

Mandatory Site Visit: is to be held on **Wednesday, December 11rd, 2013 at 10:00am local time** at the General Service Building, Royal Canadian Air Force Road, St. John's International Airport, St. John's, Newfoundland, A1A 5B2. It is a requirement for all persons wishing to tender on this project to attend this meeting at the site to familiarize themselves fully with the scope of work and the tendering requirements.

Canada

Fisheries and Oceans | Pêches et Océans

For further project or contract information, please contact Kim Walker by email at DFOtenders-soumissionsMPO@dfo-mpo.gc.ca

Regards,

Kim Walker
Contracts Officer
Enclosures

SAMPLE ENVELOPE

Your company name and address

Fisheries and Oceans Canada
TENDER SUBMISSION

Fisheries and Oceans Canada
c/o Natural Resources Canada
1350 Regent Street
Fredericton NB
E3B 5P7

Tender	**F5211-130294** **Roof Top A/C Replacement and Controls Upgrades**
Date Due:	**Thursday, December 19th, 2013** 2:00 PM Atlantic Time

Canada

Fisheries and Oceans Canada / Pêches et Océans Canada

CONSTRUCTION TENDER FORM

Closing Date/Time	Thurs. December 19, 2013 @ 2PM Atlantic time	Solicitation No. F5211-130294
Closing Location	Fisheries and Oceans Canada C/O Natural Resources Canada 1350 Regent Street, Fredericton, NB E3B 5P7	
Fax No.	506-452-3676	
Project Title	Roof Top A/C Replacement and Controls Upgrades	
Project Location	General Service Building, Royal Canadian Air Force Rd, St. John's Intern'l Airport, St. John's, NL A1A 5B2	

1. TENDER DOCUMENTS

1.1. Construction Tender Form - FP-5155E

1.2. DFO Instructions to Bidders - Construction at http://www.dfo-mpo.gc.ca/contract-contrat/instructions-instructions-eng.htm

1.3. DFO General Conditions - Construction at http://www.dfo-mpo.gc.ca/contract-contrat/general-generale-eng.htm

1.4. Labour Conditions at 1.1. http://www.labour.gc.ca/eng/standards_equity/contracts/conditions/conditions.shtml

1.5. Schedules of Wages Rates for Federal Construction Contracts.
The appropriate Schedule of Wage rates for the contract are the ones for the location where the work will be performed. Please refer to: http://www.labour.gc.ca/eng/standards_equity/contracts/schedules/index.shtml

1.6. Insurance Conditions at http://www.dfo-mpo.gc.ca/contract-contrat/insurance-assurances-eng.htm

1.7. Insurer's Certificate of Insurance - FP-5140E at http://www.dfo-mpo.gc.ca/forms-formulaires/FP_5140_E.pdf

1.8. Plans and Specifications

2. We, having informed ourselves fully of the conditions relating to the work to be performed, having full knowledge of site conditions and having carefully examined the plans and specifications and all the terms and covenants of the Tender Documents, including any amendments (IT BEING UNDERSTOOD AND AGREED THAT FAILURE TO HAVE DONE SO WILL NOT RELIEVE US OF OUR OBLIGATION TO ENTER INTO A CONTRACT AND CARRY OUT THE WORK FOR THE CONSIDERATION SET OUT HEREAFTER) do tender and offer to perform the said work in strict accordance with the said documents and such further details, plans and instructions as may be supplied from time to time and to furnish to Her Majesty the Queen in Right of Canada, all materials, plant, machinery, tools, labour and things necessary for the construction or carrying out and proper completion of the said work for the sums stated in the Combined Price Schedule of this tender form.

3. We understand and agree that all applicable taxes, duties, permits and fees are our responsibility and are included in our Tendered Price. The exceptions to the foregoing are the Goods and Services Tax (GST) / the Harmonized Sales Tax (HST). GST / HST will be paid to the contractor by Fisheries and Oceans Canada in addition to any amounts due under the contract.

4. We certify that Bid Security, if required, in one of the forms outlined in GI09 of the "DFO Instruction to Bidders - Construction", accompanies this Tender.

5. It is understood and agreed that in the event of this Tender being accepted within 30 (thirty) calendar days of the date and time stated for closing of tenders and our failing or refusing to carry out the contract in accordance with the terms of our Tender, our bid security, if required by the tender, (i) if in the form of a certified cheque, bank draft, or bonds of, or bonds unconditionally guaranteed as to principal and interest by, the Government of Canada, or (ii) if in the form of a Bid Bond, shall be forfeited to Her Majesty the Queen in Right of Canada and the Bonding Company shall be liable in accordance with the terms of the Bond.

6. It is further understood and agreed that notwithstanding (i) the forfeiture of the certified cheque or bonds of (ii) the liability of the Bonding Company, Her Majesty shall be entitled to the payment of any additional amounts that may be required to meet the cost of all loss and damage suffered by Her Majesty by reason of our default in carrying out the contract.

7. We understand this project must be completed by March 26, 2014 . If our Tender is accepted, we agree to start work immediately upon notification of contract award and once all required insurances, permits, Letter of Good Standing and Clearance from applicable provincial compensation authority, etc., are in place. We will attend start-up meeting and will work vigorously and continuously to complete the project within this prescribed time.

8. Bidders shall take note that the performance of the Contractor during and upon completion of the work shall be evaluated by Her Majesty. The evaluation shall be based on the quality of workmanship; timeliness of completion of the work; project management, contract management and management of health and safety.

   Should the Contractor's performance be considered unsatisfactory, the Contractor's bidding privileges for future work may be suspended.

   The form Contractor Performance Evaluation Report Form (FP 5135E) at http://www.dfo-mpo.gc.ca/forms-formulaires/FP_5135_E.pdf will be used to record the performance.

9. By signing below we certify that we are authorized to sign this tender on behalf of the Corporation, Partnership, Joint Venture or Sole Proprietorship and bind the company to it.

10. We certify that we are in possession of all the tender documents listed in this tender form.

11. Special tender form inserts/additional instructions (For DFO use only)

12. We certify that our tender is inclusive of all obligations as required by the preceding pages of this tender form, without change.

Our Goods and Services Tax/Harmonized Sales Tax (GST/HST) Registration number is: _____

Please indicate type of business and check one of the following :

Corporation ☐ Partnership ☐ Sole Proprietorship ☐ Joint Venture ☐

Tenderer Name (Print)	Title	Company Name
Tenderer Signature	Date	Address:
Duly Authorized Representative* *As per Paragraph 10 of this Tender Form		Fax: Phone: Email:

IF APPLICABLE

Witness Name (Print)

Witness Signature

CORPORATE SEAL

13. COMBINED PRICE SCHEDULE

- The prices per unit shall govern in establishing the Total Extended Amount. Any arithmetical errors in this Appendix will be corrected by Her Majesty
- Her Majesty may reject the bid if any of the prices submitted do not reasonably reflect the cost of performing the part of the work to which that price applies.

Tenderer Name _____

LUMP SUM

The Lump Sum Amount designates Work to which a Lump Sum Arrangement applies.

(a) Work included in the Lump Sum Amount represents all work not included in the unit price table.

LUMP SUM AMOUNT (LSA) Excluding GST/HST	

Tenderer Name _____

UNIT PRICE TABLE

The Unit Price Table designates Work to which a Unit Price Arrangement applies.

(a) Work included in each item is as described in the referenced specification section.

(b) The Price per Unit shall not include any amounts for Work that is not included in that unit price item.

Item	Specification Reference	Class of Labour, Plant or Material	Unit of Measurement	Estimated Quantity (EQ)	Price per Unit (PU) (GST/HST extra)	Extended Amount (EQ x PU) (GST/HST extra)
TOTAL EXTENDED AMOUNT (TEA) Excluding GST/HST						

TOTAL BID AMOUNT

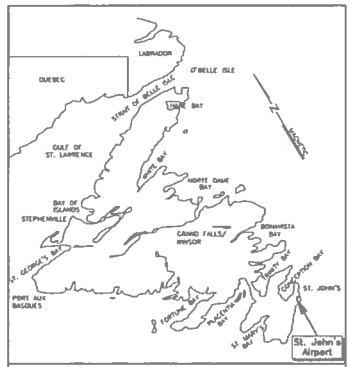
TOTAL BID AMOUNT (LSA + TEA) Excluding GST/HST	

FISHERIES AND OCEANS

Canada

PROJECT TITLE

GENERAL SERVICE BUILDING
ROOF-TOP A/C REPLACEMENT
& CONTROLS UPGRADES



KEY LOCATION PLAN

LOCATION ST. JOHN'S

PROJECT NO.: F6879-131148
ISSUED FOR TENDER

DATE: NOVEMBER 04, 2013

CLIENT/OWNER:
DEPARTMENT OF FISHERIES & OCEANS,
REAL PROPERTY, SAFETY AND SECURITY

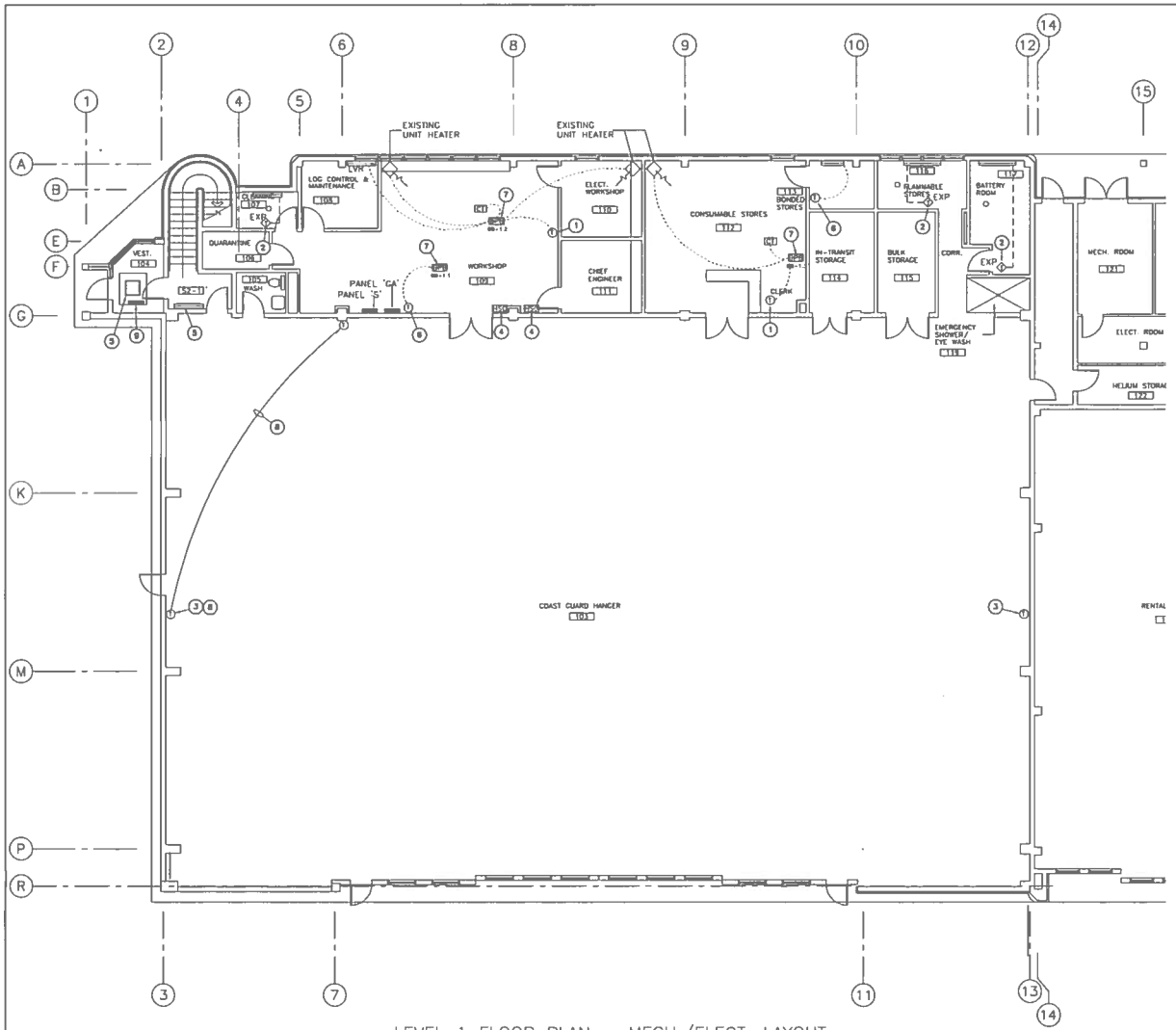
PRIME CONSULTANT:

CORE ENGINEERING INC.
MECHANICAL & ELECTRICAL CONSULTANT

DRAWING LIST:

MECHANICAL

01N1001H020ME-1	FIRST LEVEL PLAN – MECH /ELECT LAYOUT
01N1001H020ME-2	SECOND LEVEL PLAN – MECH /ELECT LAYOUT
01N1001H020ME-3	CONTROL SCHEMATICS & SCHEDULES



LEVEL 1 FLOOR PLAN – MECH./ELECT. LAYOUT

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

PLAN NOTES:

1. EXISTING LOW VOLTAGE HEATING AND COOLING THERMOSTAT TO BE REMOVED AND NEW DDC 4 BUTTON THERMOSTAT INSTALLED. CONTRACTOR TO UTILIZE EXISTING WIRING WHERE POSSIBLE.
2. EXISTING EXPLOSION PROOF LINE VOLTAGE THERMOSTAT TO REMAIN.
3. EXISTING L.V. PROGRAMMABLE THERMOSTAT CONTROLLING HANGER FORCE FLOW UNIT HEATERS TO BE REMOVED AND NEW DDC 4-BUTTON THERMOSTATS TO BE INSTALLED. UTILIZE EXISTING WIRING WHERE POSSIBLE.
4. EXISTING HANGER DESTRATIFICATION FAN SPEED CONTROLLERS TO REMAIN.
5. EXISTING FORCE FLOW HEATERS WITH BUILT-IN THERMOSTATS TO REMAIN.
6. EXISTING LINE VOLTAGE THERMOSTAT TO BE REMOVED AND A NEW DDC 4 BUTTON THERMOSTAT TO BE INSTALLED. SEE CONTROLS SCHEMATICS. PROVIDE NEW LV RELAY.
7. EXISTING PRICE LPB BY-PASS BOXES. CONTRACTOR TO REMOVE EXISTING CONTROLLER AND INSTALL NEW DDC BOX CONTROLLER. SEE BOX CONTROL SCHEMATIC. EXTEND ALL WIRING AS NECESSARY.
8. NEW DDC THERMOSTAT FOR UNIT HEATERS TO BE LOCATED AS SHOWN. EXTEND WIRE & CONDUIT TO NEW LOCATION. CONDUIT TO RUN ALONG EXISTING PIPING ON WALL.
9. EXISTING FIRE ALARM PANEL LOCATION. PROVIDE ALL HARDWARE AND SOFTWARE MODIFICATIONS TO EXISTING FIRE ALARM CONTROL PANEL TO ACCOMMODATE SHUT DOWN OF NEW HEAT PUMP UNIT UP ON ALARM. RUN 2C#14 FIRE ALARM CABLE IN EMT FROM FIRE ALARM CONTROL PANEL TO NEW HEAT PUMP AND CONNECT ALL WIRING/CONDUIT TO BE RUN CONCEALED AT ALL TIMES. IDENTIFY FIRE ALARM CONDUIT WITH RED TAPE AT 15M INTERVALS AND AT WALL PENETRATIONS. HAVE MODIFICATIONS VERIFIED BY MANUFACTURER'S SERVICE REPRESENTATIVE AND SUBMIT CERTIFICATE IN O & M MANUAL.

Fisheries and Oceans Pêches et Océans
Real Property Management
Gestion des biens immobiliers

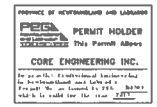
KEY LOCATION PLAN

Prime Consultant

CORE ENGINEERING INC.
MECHANICAL & ELECTRICAL CONSULTANT
57 PIPPY PLACE
ST. JOHN'S, NL, CANADA A1B 4H8
TEL (709)722-8513
FAX (709)722-8516

Professional Stamps

Professional Permit



RO	ISSUED FOR TENDER	04/11/13	R.F.	B.E.
no	revision	date	by	approved
no	revision	date	par	approuvé

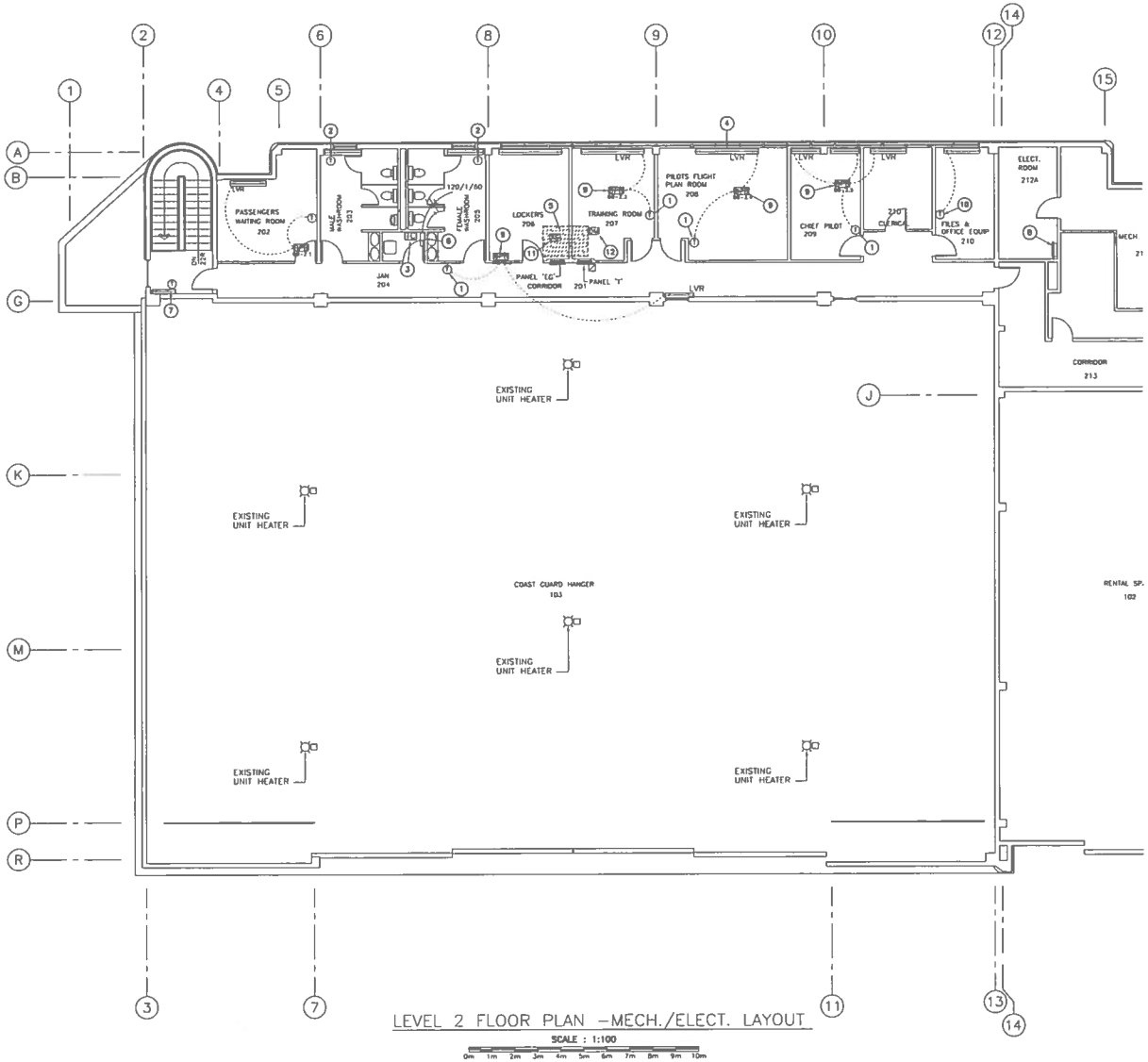
Project – projet

GENERAL SERVICE BUILDING
ROOF-TOP A/C REPLACEMENT
& CONTROLS UPGRADES

Drawing – dessin

FIRST LEVEL PLAN –
MECH./ELECT. LAYOUT

drawn – dessiné S.D.	designed – dessiné par W.E.
date – date SEPT., 2013	checked – vérifié A.S.
scale – échelle AS NOTED	approved for tender – approuvé pour l'appel
project no – projet no F6879-131148	drawing no – no du dessin 01N1001H020ME1
	sheet – feuille 1/3



LEVEL 2 FLOOR PLAN –MECH./ELECT. LAYOUT

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

PLAN NOTES

1. EXISTING LOW VOLTAGE HEATING AND COOLING THERMOSTAT TO BE REMOVED AND NEW DDC 4 BUTTON THERMOSTAT INSTALLED. CONTRACTOR TO UTILIZE EXISTING WIRING WHERE POSSIBLE.
2. EXISTING LINE VOLTAGE BUILT-IN THERMOSTAT TO REMAIN.
3. EXISTING ROOF-TOP HEAT PUMP UNIT PROGRAMMABLE CONTROLLER TO BE REMOVED AND NEW DDC PANEL INSTALLED. SUPPLY AND INSTALL A 120/1/60, 15 AMP CCT. FROM PANEL EG TO POWER DDC PANEL. PROVIDE NEW 15 AMP 1 POLE BREAKERS TO SUIT PANEL. PROVIDE LOCK ON DEVICE ON BREAKER.
4. EXISTING BASE BOARD HEATER WITH LOW VOLTAGE RELAY.
5. EXISTING ROOF-TOP HEAT PUMP TO BE REMOVED AND NEW INSTALLED. PROVIDE A NEW CURB ADAPTER TO SUIT. EXTEND ALL CONTROL WIRING AS NECESSARY TO FACILITATE THE NEW UNIT.
6. MOUNT NEW DDC PANEL CP-1 ON WALL BEHIND DOOR OF JANITORS ROOM.
7. EXISTING FORCE FLOW HEATER C/W BUILT-IN THERMOSTAT TO REMAIN.
8. EXISTING 600/3/60 PANEL BOARD. REMOVE EXISTING 30 AMP BREAKER AND ALL WIRE AND CONDUIT SERVING EXISTING ROOF-TOP HEAT PUMP BEING REMOVED. INSTALL NEW 60 AMP 3 POLE BREAKER AND RUN NEW FEEDER TO NEW ROOF-TOP HEAT PUMP. NEW FEEDER TO BE 3#6 RW90 & 1#8 TW GND IN 27mm DIA. EMT CONDUIT. MAKE CONNECTION TO UNIT WITH LIQUID TIGHT FLEXIBLE METAL CONDUIT.
9. EXISTING PRICE L88 BY-PASS BOXES. CONTRACTOR TO REMOVE EXISTING CONTROLLER AND INSTALL NEW DDC BOX CONTROLLER. SEE BOX CONTROL SCHEMATIC. EXTEND ALL WIRING AS NECESSARY.
10. EXISTING LINE VOLTAGE THERMOSTAT TO BE REMOVED AND A NEW DDC 4 BUTTON THERMOSTAT TO BE INSTALLED. SEE CONTROLS SCHEMATICS. PROVIDE NEW LV RELAY.
11. NEW AIR CONTAMINANT SENSOR. MOUNT IN SUPPLY AIR DUCT. (BY CONTROLS TRADE)
12. NEW FRESH AIR DAMPER ACTUATOR. (BY CONTROLS TRADE)

Fisheries and Oceans Pêches et Océans
Real Property Management
Gestion des biens immobiliers

KEY LOCATION PLAN

Prime Consultant

CORE ENGINEERING INC.
MECHANICAL & ELECTRICAL CONSULTANT
57 PIPPY PLACE
ST. JOHN'S, NL, CANADA A1B 4H9
TEL (709)722-0613
FAX (709)722-0710

Professional Stamps

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF NEWFOUNDLAND ANDREW M. SMITH

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF NEWFOUNDLAND KEITH J. CADOGAN

Professional Permit

PROVINCE OF NEWFOUNDLAND AND LABRADOR
PEGL
PERMIT HOLDER
This Permit Allows
CORE ENGINEERING INC.

R0	ISSUED FOR TENDER	04/11/13	R.F	B.E.
no.	revision	date	by par	approved approuvé
no	revision	date		

Project – projet

GENERAL SERVICE BUILDING
ROOF-TOP A/C REPLACEMENT
& CONTROLS UPGRADES

Drawing – dessin

SECOND LEVEL PLAN –
MECH./ELECT. LAYOUT

drawn – dessiné S.D.	designed – dessiné par W.E.
date – date SEPT. 2013	checked – vérifié A.S.
scale – échelle AS NOTED	approved for tender – approuvé pour l'appro

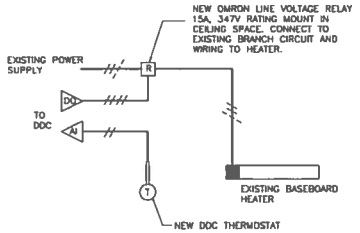
project no – projet no	drawing no. – no du dessin	sheet – feuille
F6879-131148	01N1001H020ME-2	2/3

CONTROLS LEGEND

- CP-1 — MAIN DDC CONTROLLER; SUPPORTING BACNET I/P, BACNET ETHERNET, MSTP AND FTP CONNECTIONS, ABILITY TO PERFORM GLOBAL PROGRAMMING STRATEGIES WITH 1000 AV & 1000 BV VALUES AVAILABLE ON BOARD ABILITY TO CONNECT UP TO 128 MSTP CONTROLLERS, FLASH MEMORY TO ENSURE NO DATA LOSS ON POWER FAILURE, EXPANDABLE UP TO 7 BACNET CONTROLLER MODULES FOR THIRD PARTY INTEGRATION ETC. MOUNT IN EINAC1 ENCLOSURE C/W CONTROL TRANSFORMER. SEE SPEC
- Tx — 120/24VAC CONTROL TRANSFORMER – NUMBER, AS REQUIRED. SIZE TO SUIT LOADS.
- Ts — ROOM TEMPERATURE SENSOR "GREYSTONE" TE200AS-7 OR EQUAL, C/W STAINLESS STEEL COVER PLATE AND 10,000 OHM THERMISTER. MOUNT 1400mm A.F.F.
- T — 4-BUTTON DIGITAL THERMOSTAT; ALERTON MS2000BT OR EQUAL C/W LCD DISPLAY AND FIELD SERVICE MODE FOR APPLICATION SPECIFIC VAV BOXES ETC..
- R — RELAY SIZED TO SUIT LOAD, 24VAC COIL.
- OAT — OUTDOOR TEMPERATURE SENSOR "GREYSTONE" TE200 F-7 10kΩ THERMISTOR OR APPROVED EQUAL.
- LOW VOLTAGE CONTROL WIRING, TWISTED PAIR, MAGNETICALLY SHIELDED SHOWN AND WHERE NECESSARY
- INDICATES # OF WIRES – CONTRACTOR TO VERIFY AND INCLUDE ADEQUATE WIRING IN TENDER PRICE TO SUIT DDC CONTRACTOR
- TS — DDC TEMPERATURE SENSOR – DUCT OR PIPE MOUNTED. "GREYSTONE" TE100 SERIES 10kΩ THERMISTOR OR EQUAL. PROVIDE IMMERSION WELL FOR PIPE MOUNTING.
- BPB — DDC BACNET BY-PASS BOX CONTROLLER C/W CROSS FLOW SENSOR, IO CONNECTIONS, NETWORK COMMUNICATIONS.
- DS — DISCONNECT SWITCH (BY ELECTRICAL TRADE UNLESS OTHERWISE NOTED)
- DM — DAMPER MOTOR: "BELIMO" AF-24 OR EQUAL.
- AS — AIR CONTAMINANT SENSOR, "GREYSTONE" AIR-300 OR EQUAL, MOUNT IN STRAIGHT SECTION OR SUPPLY AIR DUCT.
- DO — DIGITAL OUTPUT SIGNAL FROM THE DDC PANEL
- DI — DIGITAL INPUT SIGNAL TO THE DDC PANEL
- AO — ANALOG OUTPUT SIGNAL FROM THE DDC PANEL
- AI — ANALOG INPUT SIGNAL TO THE DDC PANEL

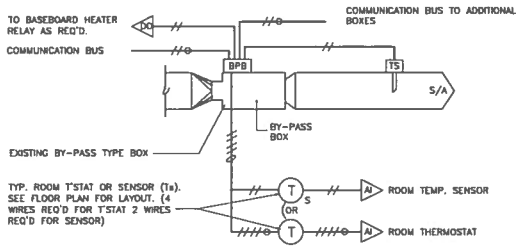
NOTES:

1. ALL CONTROL DEVICES SHALL BE SUPPLIED AND INSTALLED BY THE MECHANICAL TRADE WITH ALL CONTROL WIRING 50 VOLTS AND BELOW BY MECHANICAL CONTRACTOR. ALL WIRING TO BE AS PER ELECTRICAL SPECIFICATIONS AND RUN IN EMT CONDUIT.
2. PROVIDE LAMACOID LABELS FOR ALL STARTERS, EQUIPMENT AND DEVICES.
3. THIS CONTRACTOR TO BE RESPONSIBLE TO PROVIDE ALL CONTROL TRANSFORMERS AS REQUIRED TO COMPLETE THE CONTROLS SYSTEMS.



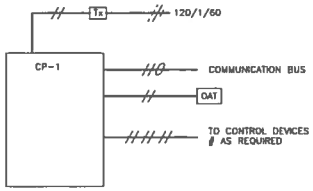
TYP. LINE VOLTAGE BSBD HEAT CONTROL

SCALE: N.T.S.



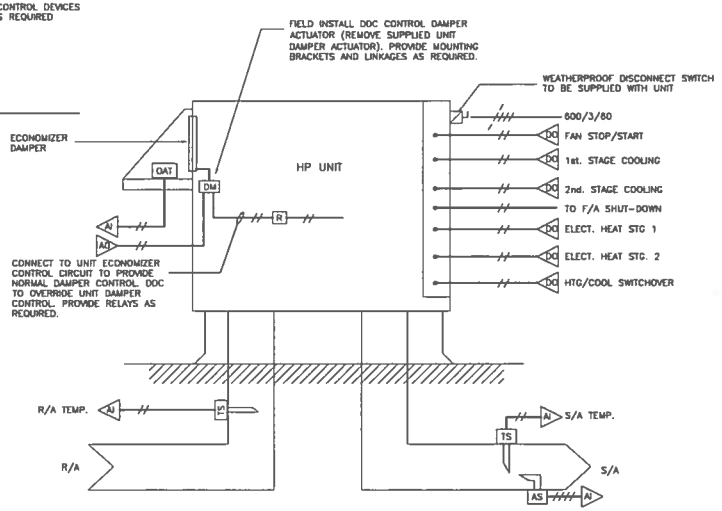
TYP. BY-PASS BOX CONTROL SCHEMATIC

SCALE: N.T.S.



DDC CONTROL PANEL SCHEMATIC

SCALE: N.T.S.



NEW HEAT PUMP CONTROL SCHEMATIC

SCALE: N.T.S.

EXISTING BY-PASS BOX SCHEDULE

BOX NUMBER	MODEL NO. E.H. PRICE SEV 8000	INLET SIZE MM DIA.	REQ'D CAPACITY L/S	TOTAL S.P. PA.	MIN. AIR VOLUME L/S	ELECTRIC HEATING COIL (KW)	REMARKS
EXISTING BB-1.1	UNIT #10	250	228	--	25	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-1.2	UNIT #10	250	217	--	25	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-1.3	UNIT #8	200	186	--	20	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-2.1	UNIT #8	200	178	--	20	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-2.2	UNIT #8	200	141	--	20	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-2.3	UNIT #10	250	222	--	25	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-2.4	UNIT #9	200	148	--	20	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED
EXISTING BB-2.5	UNIT #10	250	224	--	25	NO	PROVIDE NEW DDC CONTROLLER AND BALANCE AS INDICATED

ROOFTOP HEAT PUMP UNIT SCHEDULE

SYMBOL	SERVING	MANUFACTURER	MODEL No.	AHRI EER	COOLING CAPACITY (kW)		HEATING		FAN DATA					ELECTRIC HEAT (kW)	MAX. FRESH AIR (L/s)	POWER SUPPLY	MCA	MOCP	FILTERS	REMARKS
					TOTAL COOLING	SENSIBLE	COP	CAPACITY (kW)	CAP (L/S)	EXT. SP. (Pa.)	BHP.	R.P.M.	MOTOR (KW)							
HP-1	OFFICES	CARRIER OR EQUAL	50TCD012	12	34.10	17.62	3	17.78	1651	446	3.05	1135	3.73	17.0	250	600/3/60	50A	60	CHARCOAL	C/W INSULATED ROOF CURB ADAPTOR, W.P. DISC. SWITCH, ECONOMIZER, POWER EXHAUSTER, CHARCOAL FILTERS, "AAF", AMAIR/CE, 500 X 500 X 50mm MERV 8, UL CLASS 900, CAN-S-111 OR EQUAL AND PROVIDE OPTIONAL VERTICAL ECONOMIZER HOOD ON UNIT.

NOTES:
1. ALL UNITS TO HAVE BACNET CONTROL INTERFACE.
2. HEAT PUMP HEATING CAPACITY BASED ON -12.2°C OAT AND 21°C RAT.
3. SET MIN. F/A AT 10%.

Fisheries and Oceans / Pêches et Océans
Real Property Management / Gestion des biens immobiliers

KEY LOCATION PLAN

Prime Consultant

CORE ENGINEERING INC.
MECHANICAL & ELECTRICAL CONSULTANT
37 PIPPY PLACE
ST. JOHN'S, NL, CANADA A1B 4H8
TEL (709)722-0013
FAX (709)722-0910

Professional Stamps

Professional Permit

no.	revision	date	by	approved
R0	ISSUED FOR TENDER	04/11/13	R.F	B.E.
no	revision	date	par	approuvé

Project – projet

GENERAL SERVICE BUILDING
ROOF-TOP A/C REPLACEMENT
& CONTROLS UPGRADES

Drawing – dessin

CONTROL SCHEMATICS
& SCHEDULES

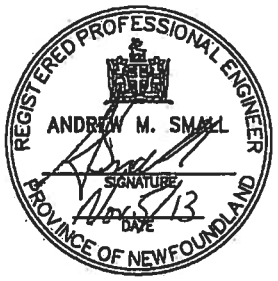
drawn – dessiné R.F	designed – dessiné par W.E.
date – date SEPT., 2013	checked – vérifié A.S.
scale – échelle AS NOTED	approved for tender – approuvé pour l'appel d'offres

project no – projet no.	drawing no. – no du dessin	sheet – feuille
F6879-131148	01N1001H020ME3	3/3

Department of Fisheries and Oceans
Specification for
Roof Top Air Conditioning Replacement
And Control Upgrades

Project No. F6879-131148

ISSUED FOR TENDER



CLIENT

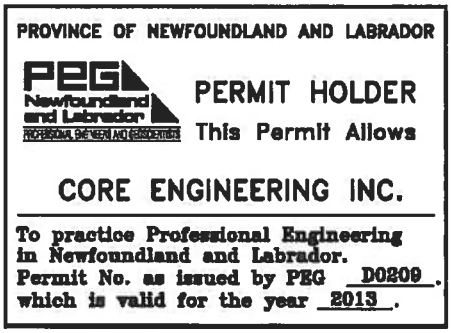
Department of Fisheries and Oceans
John Cabot Building
10 Barters Hills
St. John's, NL A1C 5X1

MECHANICAL/ELECTRICAL CONSULTANTS

CORE Engineering Inc.
57 Pippy Place
St. John's, NL A1B 4H8

DATE

November 5, 2013



DIVISION 26 - ELECTRICAL

DRAWING NUMBER	DRAWING TITLE
01N1001H020ME-1	First Level Plan – Mech./Elec. Layout
01N1001H020ME-2	Second Level Plan – Mech./Elec. Layout
01N1001HO20ME-3	Control Schematics & Schedules

PART 1 GENERAL

1.1 References

.1 National Building Code of Canada (NBC) latest edition including all amendments up to tender closing date.

.2 National Plumbing Code of Canada (NPCC) 2010.

1.2 Description of Work

.1 Work under this contract covers the removal and replacement of an existing roof-top heat pump unit including disposal of the unit and R-22 refrigerant, new electrical feed, and upgrading of the existing electronic control system for the air-conditioning system to a new direct digital controls system. Work location is at the General Service Building, St. John's Airport, Torbay side.

1.3 Codes

.1 Perform work in accordance with National Building Code of Canada (NBC) and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Meet or exceed requirements of:

.1 contract documents,

.2 specified standards, codes and referenced documents.

1.4 Documents Required

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

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 Change orders.

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved work schedule.

.9 Manufacturers' installation and application instructions.

1.5 Work Schedule

.1 Provide within 10 working days after Contract award, schedule showing anticipated progress stages and final completion of work within time period required by Contract documents.

.2 Interim reviews of work progress based on work schedule will be conducted as decided by Engineer/Project Manager and schedule updated by Contractor in conjunction with and to approval of Engineer/Project Manager.

1.6 Cost Breakdown

.1 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Engineer/Project manager and aggregating contract price. After approval by Engineer/Project Manager cost breakdown will be used as basis for progress payment.

1.7 Contractor's Use of Site

.1 Use of site: to be co-ordinated with the project manager.

.2 Use following areas for work and storage: available areas within site boundary.

.3 Obtain and pay for use of additional storage or work areas.

1.8 Project Meetings

.1 Project meetings to be held at times and locations as determined by Engineer and Project Manager.

.2 Engineer and Project Manager will arrange project meetings and record and distribute minutes.

1.9 Location of Equipment and 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 usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Engineer/Project Manager of impending installation and obtain his approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Engineer/Project Manager.

1.11 Concealment

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

1.12 Cutting and Patching

.1 Obtain Engineer/Project Managers approval before cutting, boring or sleeving load-bearing members other than those indicated on the drawings.

.2 Cut and patch as required to make work fit.

.3 Make cuts with clean, true, smooth edges.

.4 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.

.5 Refinish surfaces to match adjacent finishes: for continuous surfaces refinish to nearest wall/ceiling intersections.

.6 Core drill floor slabs for penetrations of mechanical and electrical work.

.7 Cut concrete using concrete saw or multiple core drilling. Pneumatic or impact tools are not allowed without prior approval.

1.13 Existing Services

.1 Where Work involves breaking into or connecting to existing services, carry out work at times directed with minimum of service interruption.

.2 Before commencing work, establish location and extent of service lines in area of Work and notify Engineer/Project Manager of findings.

.3 Submit schedule to and obtain approval from Engineer/Project Manager for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Engineer/Project Manager and confirm findings in writing.

.5 Remove abandoned service lines. Cap or otherwise seal lines at cut-off points as directed by Engineer/Project Manager.

.6 Record locations of maintained, re-routed and abandoned service lines.

1.14 Additional Drawings

.1 Engineer/Project Manager may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

1.15 Building Smoking Environment

.1 There is no smoking permitted on the project work site.

1.16 Equipment Disposal

.1 Contractor to provide a certificate of disposal or recycling of the roof-top heat pump and its R-22 refrigerant.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Title and description of Work.

.2 Contract Method.

.3 Work sequence.

.4 Contractor use of premises.

.5 Owner occupancy.

1.2 Work Covered by Contract Documents

.1 Work of this contract comprises of all architectural, mechanical and electrical work for the replacement of a roof-top heat pump and building DDC control system. Refer to Section 01 00 50 – General Instruction for further description of work.

1.3 Contract Method

.1 Construct the Work under a single lump sum contract.

1.4 Work Sequence

.1 Construct Work to accommodate Owner's continued use of premises during construction.

.2 Maintain fire access/control.

1.5 Contractor Use of Premises

.1 Contractor has restricted use of site and shall co-ordinate with the project manager.

.2 Contractor shall have limited use of premises for storage and access.

.3 Coordinate use of premises under direction of the project manager.

.4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.6 Owner Occupancy

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Cooperate with the project manager in scheduling operations to minimize conflict and to facilitate Owner usage.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 Related Sections

.1 Section 01770 – Closeout Procedures.

.2 Section 01780 - Closeout Submittals.

1.3 Administrative

.1 Submit to Engineer 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 Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of 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 Engineer, 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 errors and omissions in submission is not relieved by Engineer's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.

.10 Keep one reviewed copy of each submission on site.

1.4 Shop Drawings and Product Data

.1 Refer to DFO Contract documents.

.2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.3 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.

.4 Allow 7 days for Engineer's review of each submission.

.5 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.

.6 Make changes in shop drawings as Engineer may require, consistent with Contract Documents. When resubmitting, notify Engineer in writing of any revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate, 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.

.8 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.

.9 After Engineer's review, distribute copies.

.10 Submit 6 prints of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.

.11 Submit 6 electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Engineer where shop drawings will not be prepared due to standardized manufacture of product.

.12 Delete information not applicable to project.

.13 Supplement standard information to provide details applicable to project.

.14 If upon review by Engineer, 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.

.15 The review of shop drawings by Consultant for sole purpose of ascertaining conformance with general concept. This review shall not mean that DFO or the consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

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 Engineer's business address.

.3 Notify Engineer 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 Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.

.6 Make changes in samples which Engineer 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.

1.6 Mock-ups

.1 N/A

1.7 Progress Photographs

.1 Provide photos to the consultant at 25% completion.

1.8 Certificates and Transcripts

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 33 00 - Submittal procedures.

1.2 References

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Province of Newfoundland and Labrador

.1 Occupational Health and Safety Act, R.S.N. Latest Edition.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 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 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Engineer and authority having jurisdiction, weekly.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit Material Safety Data Sheets (MSDS) to Engineer.

.7 Engineer will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 after receipt of plan. Revise plan as appropriate and resubmit plan to Engineer] within 3 days after receipt of comments from Engineer.

.8 Engineer's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Engineer.

.10 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.

1.4 Filing of Notice

.1 File Notice of Project with Provincial authorities prior to commencement of Work.

1.5 Safety Assessment

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

1.6 Meetings

.1 Schedule and administer Health and Safety meeting with Engineer prior to commencement of Work.

1.7 Project/Site Conditions

.1 Work at site will involve contact with:

.1 Building occupants.

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 Engineer may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 Responsibility

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to 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, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 Compliance Requirements

.1 Comply with Occupational Health and Safety Act, Occupational Health and Safety Regulations, C. Nfld. Reg., Latest Edition.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 Unforseen Hazards

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Engineer verbally and in writing.

1.12 Health and Safety Co-ordinator

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have minimum 2 years' site-related working experience specific to activities associated with building renovations.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.13 Posting of Documents

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Engineer.

1.14 Correction of Non-Compliance

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Engineer.

.2 Provide Engineer with written report of action taken to correct non-compliance of health and safety issues identified.

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

1.15 Blasting

.1 N/A

1.16 Powder Actuated Devices

.1 N/A

1.17 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.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Fires

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

1.2 Disposal of Wastes

.1 All waste materials must be disposed of at an approved landfill site. The Contractor is responsible for obtaining permission from the operator of the landfill prior to disposing of wastes. The Contractor shall provide the DFO Project Manager with written permission from the operator of the landfill prior to the final disposal of wastes.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers. All wastes must be disposed of in an approved landfill.

END OF SECTION

PART 1 GENERAL

1.1 Fire Extinguishers

.1 Supply fire extinguishers necessary to protect the work in progress and the Owner's physical plant on site.

1.2 Rubbish and Waste Materials

.1 Rubbish and waste materials are to be kept to a minimum.

.2 The burning of rubbish is prohibited.

.3 Removal:
- .1 Remove all rubbish from the work site as directed by the Site Engineer.

.4 Storage:
- .1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
- .2 Deposit greasy or oily rags and materials subject to spontaneous combustion in an approved receptacles and remove from site.

1.3 Flammable and Combustible Liquids

.1 The handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.

.2 Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes, requires the permission of the Fire Chief.

.3 Transfer of flammable and combustible liquids is prohibited within the building.

.4 Transfer of flammable and combustible liquids will not be carried out in the vicinity of open flames or any type of heat-producing devices.

.5 Flammable liquids having a flash point below 38°C such as naphtha or gasoline will not be used as solvents or cleaning agents.

.6 Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and the Fire Department is to be notified when disposal is required.

1.4 Hazardous Substances

.1 Work entailing the use of toxic or hazardous materials, chemicals and/or explosives, otherwise creates a hazard to life, safety or health, will be in accordance with the National Fire Code of Canada.

1.5 Fire Inspection

.1 Site inspections by the DFO Project Manager may be undertaken.

.2 Co-operate with the DFO Project Manager during routine fire safety inspection of the work site.

.3 Immediately remedy all unsafe fire situations observed by the DFO Project Manager.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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 facilities.

1.2 Precedence

.1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 Reference Standards

.1 Within text of each specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether any product or system is in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be born 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 Tenders, except where specific date or issue is specifically noted.

1.4 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 the 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.

1.5 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 the Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Consultant

reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 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 wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, 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 the Consultant.

.9 Touch-up damaged factory finished surfaces to the Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 Transportation

.1 Pay costs of transportation of products required in performance of Work.

1.8 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 the Consultant] in writing, of conflicts between specifications and manufacturer's instructions, so that the Consultant may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 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 the 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. The Consultant and Project Manager 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 the Consultant, whose decision is final.

1.10 Co-Ordination

.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.

1.11 Concealment

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform the Consultant if there is interference. Install as directed by the Consultant.

1.12 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.

1.13 Location of Fixtures

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform the Consultant of conflicting installation. Install as directed.

1.14 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.

1.15 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.

1.16 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 the Consultant.

.2 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, and/or building occupants.

.3 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 service.

1.17 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, building occupants and pedestrian and vehicular traffic.

.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 service.

PART 2 GENERAL

2.1 Not Used

.1 Not used.

PART 3 GENERAL

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Requirements and limitations for cutting and patching the Work.

1.2 Related Sections

.1 Section 01 11 00 - Summary of Work.

.2 Section 01 33 00 - Submittal Procedures.

1.3 Submittals

.1 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of any element of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.2 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.4 Preparation

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Obtain Owner's Representative's approval before cutting, boring or sleeving load-bearing members.

1.5 Execution

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

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

.14 Make cuts with clean, true, smooth edges.

.15 Where new work connects with existing, and where existing work is altered, cut, patch and make good to match existing work.

1.6 Waste Management and Disposal

.1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Progressive cleaning.

.2 Final cleaning.

1.2 Related Section

.1 Section 01 74 21 - Waste Management and Disposal.

.2 Section 01 77 00 - Closeout Procedures.

1.3 Project Cleanliness

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site, unless approved by Engineer.

.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 21 - Waste Management and Disposal.

.6 Remove waste material and debris from site and deposit in waste container at end of each working day.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.4 Final Cleaning

.1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site, unless approved by Engineer.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 List significant generic types of products, work, or requirements specified. Do not include procedure, process, preparatory work, or final adjusting and cleaning. Include Waste Audit, Waste Reduction Workplan, Materials Source Separation Program, and Cost/Revenue Analysis Workplan.

1.2 Definitions

.1 Waste Audit (WA): Relates to projected waste generation. Involves measuring and estimating quantity and composition of waste, reasons for waste generation, and operational factors which contribute to waste.

.2 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA (Schedule A).

.3 Demolition Waste Audit (DWA): Relates to actual waste generated from project.

.4 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.5 Cost/Revenue Analysis Workplan (CRAW): Based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.6 Waste Management Coordinator (WMC): Designate individual who is in attendance on-site, full-time. Designate, or have designated, individuals from each Subcontractor to be responsible for waste management related to their trade and for coordinating activities with WMC.

.7 Separate Condition: Refers to waste sorted into individual types.

1.3 Site Visit

.1 Pre-tender site visit: Walk-through of project site prior to completion of tender submittal is mandatory. Date, time and location to be arranged by the project manager.

1.4 Documents

.1 Maintain at job site, one copy of following documents:

.1 Waste Audit

.2 Waste Reduction Workplan

.3 Material Source Separation Plan

.4 Schedules A B C D E completed for project.

1.5 Use of Site and Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility.

1.6 Submittal

.1 Submit requested submittals in accordance with Section 01330 - Submittal Procedures.

.2 Prepare and submit the following submittals prior to project start-up:

.1 Submit 2 copies of completed Waste Audit (WA): Schedule A.

.2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.

.3 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.

.4 Submit 2 copies of Cost/Revenue Analysis Workplan (CRAW): Schedule D.

.5 Submit 2 copies of Materials Source Separation Program description.

1.7 Waste Audit

.1 Conduct WA prior to project start-up.

.2 Prepare Waste Audit: Schedule A.

.3 Record, on Waste Audit - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.8 Waste Reduction Workplan

.1 Prepare WRW prior to project start-up.

.2 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.3 Describes management of waste.

.4 Identify opportunities for reduction, reuse, and/or recycling (3Rs) of materials. Based on information acquired from WA.

.5 Post workplan or summary where workers at site are able to review its content.

1.9 Demolition Waste Audit

.1 Prepare Demolition Waste Audit (DWA) prior to project start-up.

.2 Complete Demolition Waste Audit (DWA): Schedule C.

1.10 Cost/Revenue Analysis Workplan

.1 Prepare CRAW: Schedule D.

1.11 Materials Source Separation Program

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Engineer.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.

.4 Provide containers to deposit reusable and/or recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition. Ship materials to site operating under Certificate of Approval. Materials must be immediately separated into required categories for reuse of recycling.

1.12 Waste Processing Sites

.1 For approved sites, contact Provincial Department of Environment.

1.13 Disposal of Wastes

.1 Burying of rubbish and waste materials is prohibited unless approved by Engineer.

.2 Disposal of waste, volatile materials, mineral spirits, oil, paint thinner, into waterways, storm, or sanitary sewers is prohibited.

1.14 Storage, Handling and Protection

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Engineer.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Engineer.

.7 Protect surface drainage, mechanical and electrical from damage and blockage.

1.15 Scheduling

.1 Coordinate work with other activities at site to ensure timely and orderly progress of the work.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Application

.1 Do work in compliance with WRW.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 Cleaning

.1 Remove tools and waste materials on completion of work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.3 Diversion of Materials

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, to approval of Engineer, and consistent with applicable fire regulations. Mark containers or stockpile areas. Provide instruction on disposal practices.

.2 On-site sale of salvaged, recovered, reusable, recyclable materials is not permitted.

.3 Demolition Waste

Material Type	Recommended Diversion %	Actual Diversion %

Material Type	Recommended Diversion %	Actual Diversion %
Acoustic Tile	50	[]
Acoustical Insulation	100	[]
Carpet	100	[]
De-mountable Partitions	80	[]
Doors and Frames	100	[]
Electrical Equipment	80	[]
Furnishings	80	[]
Marble Base	100	[]
Mechanical Equipment	100	[]
Metals	100	[]
Rubble	100	[]
Wood (uncontaminated)	100	[]
Other		[]

.4 Construction Waste

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	[]
Plastic Packaging	100	[]
Rubble	100	[]
Steel	100	[]
Wood (uncontaminated)	100	[]
Other		[]

3.4 Waste Audit

.1 Schedule A

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Descrip.						
Off-cuts						
Warped						
Pallet Forms						
Plastic Packaging						
CardboardPackaging						
Other						

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Doors and WindowsMaterial Descrip. Painted Frames Glass Wood Metal Other						

3.5 Waste Reduction Workplan

.1 Schedule B

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Wood and Plastics MaterialDescrip. Chutes Warped Pallet Forms Plastic Packaging Cardboard Packaging Other							
Doors and Windows MaterialDescrip. Painted Frames Glass Wood Metal							

(1) Material Category	(2) Person(s) Respon-sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material (s) Destina-tion
Other							

3.6 Demolition Waste Audit

.1 Demolition Waste Audit

(1) Material Descrip.	(2) Quantity	(3) Unit	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks and Assump-tions
Wood						
Wood Stud						
Plywood						
Baseboard-Wood						
Door Trim - Wood						
Cabinet Doors and Windows						
Panel Regular						
Slab Regular Wood Laminate						
Byfold - Closet						
Glazing						

3.7 Cost/Revenue Analysis Workplan

.1 Schedule D

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/ Credit $(+/-)	(6) Category Sub-Total $(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard – Wood					
Door Trim – Wood					

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/ Credit $(+/-)	(6) Category Sub-Total $(+/-)
Cabinet					$
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate					
Byfold - Closet					
Glazing					$
		(7) Cost (-) / Revenue (+)			$

3.8 Canadian Governmental Departments Chief Responsibility for the Environment

.1 Schedule E

Province	Address	General Inquires	Fax
Newfoundland	Department of Environment Confederation Building Box 8700 St. John's, NF A1B 4J6	(709) 729-2664	(709) 729-1930

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 Related Sections

.1 Section 01 78 00 - Closeout Submittals.

.2 Section 01 91 13 - Commissioning.

1.3 Inspection and Declaration

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Engineer's Inspection.

.2 Engineer's Inspection: Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Operation of systems have been demonstrated to Owner's personnel.

.5 Work is complete and ready for Final Inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Engineer and Contractor. If Work is deemed incomplete by Owner and Engineer, complete outstanding items and request reinspection.

.5 Declaration of Substantial Performance: when Owner and Engineer consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty

period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment: When Owner and Engineer consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Owner and Engineer, complete outstanding items and request reinspection.

.8 Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

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.

1.2 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 91 13 - Commissioning.

.4 Division 22, 23 and 26.

1.3 Submissions

.1 Submit two (2) copies of 'As-Built' drawings and Maintenance Manuals for approval by the engineer.

.2 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after final inspection, with Engineer's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Engineer, two final copies of operating and maintenance manuals in English.

.6 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.

.7 If requested, furnish evidence as to type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.9 Pay costs of transportation.

1.4 Format

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 Contents - Each Volume

.1 Table of Contents: provide title of project;

.1 date of submission; names,

.2 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 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in.

1.6 As-builts and Samples

.1 In addition to requirements in General Conditions, maintain at the site for Engineer 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 Engineer.

1.7 Recording Actual Site Conditions

.1 Record information on set of blue line opaque drawings, and in copy of Project Manual, provided by Engineer.

.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 Final Survey

.1 N/A

1.9 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 trouble-shooting; 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 by controls manufacturer.

.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 as specified in Section 01 91 13 - Commissioning.

.15 Additional requirements: As specified in individual specification sections.

1.10 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.

1.11 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 Engineer. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 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 in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.13 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; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

1.14 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 Engineer.

1.15 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.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Commissioning of all new mechanical and electrical systems and components including:
- .1 Testing and adjustment
- .2 Demonstrations
- .3 Instructions of all procedures for Owner's personnel
- .4 Updating as-built data
- .5 Co-ordination of Operation and Maintenance material.

1.2 References

.1 National Fire Code.

.2 CSA (Canadian Standards Association).

.3 Canadian Electrical Code.

1.3 Quality Assurance

.1 Personnel to be employed in the Commissioning activities shall be qualified trades persons, certified testing agencies and factory approved by the Commissioning Team Leader or the Owner's representative.

1.4 Pre-commissioning

.1 The purpose of the pre-commissioning process is to ensure the project is completed to permit the execution of the Commissioning process for this project.

.2 The Pre-commissioning process must be fully completed to the satisfaction of the Commissioning Team prior to conducting the Commissioning process.

.3 The Pre-commissioning Team shall consist of:
- .1 General Contractor.
- .2 Owner (or the designated Owner representative)
- .3 Project Manager.
- .4 Applicable sub-trade representative.
- .5 Equipment Manufacturer's representative.
- .6 Others as identified by the Engineer.

.4 The Pre-commissioning process shall include the site verification that all systems are operable and performed to the intent of the Specification.

1.5 Commissioning

.1 The Commissioning process shall be conducted once all pre-commissioning activities are completed.

.2 The purpose of the Commissioning process is to fully test all systems including mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.

.3 The Commissioning activities shall be co-ordinated by the General Contractor.

.4 The Commissioning exercise shall be conducted over period deemed necessary by the Owner for the mechanical section of the specifications.

.5 Commissioning activities for the mechanical systems shall have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

.6 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification and bear all associated cost.

.7 The Commissioning Team shall be comprised of the individuals or groups as identified in Section 1.2 Pre-commissioning, including the Engineer.

1.6 Procedures

.1 Ensure all required personnel are present at the scheduled activities.

.2 Provide all documentation and drawings as defined in the specifications.

1.7 Preparation

.1 Provide test instruments required for all activities as defined by the Engineer.

.2 Verify all systems were Pre-commissioned.

.3 Confirm all scheduled activities will have identified personnel available.

1.8 System Demonstration

.1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined by the Engineer.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

.3 Prepare and insert additional data in operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the Commissioning exercise.

.4 Where instruction is required, instruct personnel in all phases of operation and maintenance using Operation and Maintenance Manuals as the basis of instruction.

.5 Review all contents of the manuals in detail to explain all aspects of operation and maintenance.

1.9 Schedule of Activities

.1 The events concerning the Pre-commissioning and Commissioning activities shall be conducted based on a pre-established schedule with all members of the Commissioning Team.

.2 For Contract purposes, the schedule of activities will be as follows:

.1 Pre-commissioning - to be completed prior to commissioning by the Contractor.

.2 Commissioning:

- one (1) day – all trades.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 23 and 26 respectively.

.2 Coordinate work of this section with other sections as required to properly execute the work and as necessary maintain satisfactory progress of the work of other sections.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00 – Quality Control.

1.3 References

.1 Underwriter's Laboratories of Canada (ULC)

.1 CAN-S115, Fire Tests of Firestop Systems.

1.4 Definitions

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.5 Submittals

.1 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

.2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.3 Submit manufacturer's engineering judgement identification number and drawing details when no ULC or cUL system is available. Engineering judgement must include both project name and contractor's name who will install firestop system as described in drawing.

.4 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation. Include manufacturer's specifications, training letter, and technical data for each material including the composition and limitations, documentation of ULC or CUL firestop systems to be used.

.5 Submit material safety data sheets provided with product delivered to job site.

1.6 Mock-up

.1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Construct mock-up showing service penetrations, fire separation and floor assemblies. Mock-up may be part of finished work.

.3 Allow 48h for inspection of mock-up by Owner's Representative before proceeding with membrane work.

1.7 Manufacturer's Representative

.1 A manufacturer's representative is to be on site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures and at commissioning stage to certify acceptance completed installation. Training will be done as per manufacturer's written recommendations published in their literature and drawing details.

1.8 Quality Assurance

.1 Qualifications:

.1 Installer: person specializing in fire stopping installations with minimum five (5) years documented experience approved by the fire stopping manufacturer.

.2 Manufacturer: company with minimum five (5) years experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.

.2 All fire stopping materials for this project to be supplied by a single manufacturer.

PART 2 PRODUCTS

2.1 Materials

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-rating involved for each separate instance.

.2 Fire stopping and smoke seal systems: in accordance with CAN-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN-S115 and not to exceed opening sizes for which they are intended.

.2 Firestop system rating: as indicated on drawings.

.3 Service penetration assemblies: certified and tested by ULC or cUL in accordance with CAN-S115.

.4 Service penetration firestop components: certified and tested by ULC or cUL in accordance with CAN-S115.

.5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.6 Non-curing, re-penetrable intumescent sealants, caulking or putty material for use with flexible cables or cable bundles.

.7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal. Consult with Owner's Representative and damper manufacturer prior to installation ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

.8 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe. No silicone based firestop are allowed to be applied on plastic pipes.

.9 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.10 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.11 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.12 Sealants for vertical joints: non-sagging.

PART 3 EXECUTION

3.1 Preparation

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 Installation

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification or UL Products Certified for Canada (CUL) and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 Inspection

.1 Notify Owner's Representative when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 Schedule

.1 Firestop and smoke seal at:

- .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
- .2 Top of fire-resistance rated masonry and gypsum board partitions.
- .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
- .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
- .6 Around mechanical and electrical assemblies penetrating fire separations.

3.5 Clean-up

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.

.3 Section 01 78 00 - Closeout Submittals.

1.2 Submittals

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Owner's Representative.

.2 Make changes as required and re-submit as directed by Owner's Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Owner's Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner's Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 Quality Assurance

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 Maintenance

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 Delivery, Storage, and Handling

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

PART 3 EXECUTION

3.1 Painting, Repairs, and Restoration

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 Cleaning

.1 Clean interior and exterior of all systems including strainers. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts. If dust or dirt is detected prior to startup, vacuum interior of all ducts and air handling units. Prior to vacuuming use video camera to record condition of ductwork. Also use video camera to record condition of ducts after cleaning.

3.3 Field Quality Control

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Submit tests as specified in other sections of this specification.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 Demolition

.1 Owner's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Owner's Representative may record these demonstrations on video tape for future reference.

3.5 Protection

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system

END OF SECTION

PART 1 GENERAL

1.1 System Description

.1 Unit to be an outdoor roof mounted, electrically controlled heat pump unit utilizing scroll compressors with crankcase heaters. Supply air shall be discharged vertically, as shown on the drawings. Unit shall be of ultra-high cooling efficiency and utilize environmental friendly Puron (R-410A) refrigerant. Roof-top unit to be complete with a curb adaptor to suit existing curb.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 01 78 00 – Closeout Submittals.

.4 Section 23 33 00 – Air Duct Accessories.

1.3 Quality Assurance

.1 Unit shall well exceed ASHRAE 90.1-2001 Energy Efficiency Standards.

.2 Unit shall be rated in accordance with ARI Standards 210. The unit shall be designed in accordance with UL Standard 1995. The unit shall be rated in accordance with ARI sound standards, 270 and 370.

.3 The unit shall be designed to conform to ASHRAE 15.

.4 The unit shall be UL and UL, Canada, tested and certified in accordance with ANSI Z21.47 Standards as a total package.

.5 Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

.6 The unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).

.7 The unit shall be manufactured in a facility registered to ISO 9001:2000.

.8 The unit shall be subjected to a completely automated run testing on the assembly line.

1.4 References

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 430, Central Station Air Handling Units.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association (CSA)

.1 CSA B52 Mechanical Refrigeration Code.

.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.6 American Bearing Manufacturer's Association (ABMA)

.1 ANSI/ABMA 9 Load Ratings and Fatique Life for Ball Bearings

.2 ANSI/ABMA 11 Load Ratings and Fatique Life for Roller Bearings.

.7 Air Movement and Control Association (AMCA)

.1 AMCA 210, Laboratory Method of Testing Fans for Aerodynamic Performance Rating (ASHRAE)

.2 AMCA 300 Reverberaut Room Method for Sound Testing of Fans.

.8 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).

.1 ASHRAE 68, Laboratory Method of Testing to Determine the Sound Power in a Duct.

.9 National Electrical Manufacturer's Association (NEMA)

.1 NEMA MG1 Motors and Generators

.2 NEMA ICS 7-1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

.10 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.5 Delivery, Storage and Handling

.1 The unit shall be stored and handled per manufactures recommendations.

1.6 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 Submittal Procedures.

.2 Indicate:

.1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.

.2 Piping, valves, fitting shipped loose by packaged equipment supplier, showing their final location in field assembly.

.3 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.

.4 Complete internal panel wiring and any external panel and wiring, both as schematics and as actually assembled.

.5 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

.6 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.

.7 For fans submit performance curves.

.8 Provide estimate of sound levels to be expected across each individual octave band in dB referred to A rating for further evaluation by the Engineer.

1.7 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.8 Closeout Submittals

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.9 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Engineer/Architect.

.4 Divert unused paint material from landfill to official hazardous material collections site approved by Engineer/Architect.

.5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.10 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide one spare set of fan belts and filters.

.3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

.4 Spare filters: in addition to filters installed for startup and commissioning. Immediately prior to acceptance by Engineer/Architect, supply 1 complete set of filters for each filter unit or filter bank.

PART 2 PRODUCTS

2.1 Equipment

.1 General:

.1 The unit shall be a factory assembled, single-piece heat pump. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

.2 Unit Cabinet:

.1 To be constructed of galvanized steel, bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.

.2 All airsteam interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, foil-faced, cleanable, insulation. Insulation shall be bonded with a thermosetting resin (8 to 12% by weight nominal, phenol formaldehyde typical). retardance requirements and has an R value of 3.70.

.3 Cabinet panels shall be hinged access panels with multiple quarter-turn latches and handles, for the filter, compressors, evaporator fan, control box and heat section areas. Each major external hinged access panel shall be double-wall construction and permanently attached to the unit. Panels shall also include tiebacks.

.4 Return air filters shall be accessible through a hinged access panel standard size filters.

.5 Holes shall be provided in the base rails (minimum 14 gage) for rigging shackles and level travel and movement during overhead rigging operations.

.6 Fork lift slots shall be available from three sides of the unit (end and 2 sides).

.7 Unit shall have a factory-installed internally sloped drain pan, providing a minimum 3/4-in. NPT connection with horizontal drain, to prevent standing water from accumulating. Pan shall be fabricated of high impact polycarbonate

material and shall slide out for cleaning and or maintenance. The drain pan shall conform to ASHRAE 62 self-draining provisions.

.8 The unit shall have standard thru-the-bottom power and control wiring connection capability.

.3 Fans:

.1 Indoor blower (evaporator fan):

.1 Centrifugal supply air blower shall have rubber-isolated, cartridge type, ball bearings and adjustable belt drive.

.2 Fan wheel shall be made from steel with a corrosion resistant finish. It shall be a dynamically balanced, double-inlet type with forward-curved blades.

.3 The indoor fan system (blower wheels, motors, belts, and both bearings) shall slide out for easy access.

.4 Evaporator fan motors shall be continuous operation, open drip-proof. Bearings shall be sealed, permanently lubricated ball-bearing type for long life and lower maintenance.

.2 Condenser fans shall be of the direct-driven propeller type, with corrosion-resistant aluminum blades riveted to corrosion-resistant steel supports. They shall be dynamically balanced and discharge air upwards. Condenser-fan motors shall be totally enclosed thermally plated and be of a shaft down design.

.4 Compressor(s):

.1 Fully hermetic, scroll type with crankcase heaters, internal high-pressure and temperature protection.

.2 Factory mounted on rubber grommets and internally spring mounted for vibration isolation.

.3 On dual electrically and mechanically independent refrigerant circuits.

.5 Coils:

.1 Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanical bonded to seamless internally grooved copper tubes with all joints brazed.

.2 Dual-circuit shall have face-split type evaporator coil (circuit no. 1 on bottom).

.3 Condenser coils shall be continuous slab design to facilitate easy coil cleaning.

.4 Coils shall be leak tested at 1170 kPa and pressure tested at 12900 kPa.

.6 Refrigerant Components:

.1 Each refrigerant circuit shall include:

.1 thermostatic expansion valve (TXV) with removable power element.

.2 Refrigerant filter driers.

.3 Gage port and connections on suction, discharge, and liquid lines.

.7 Filter Section:

.1 Standard filter section shall consist of factory-installed 50mm thick throwaway fiberglass filters and shall be on a dedicated slide out track to easily facilitate access and replacement.

.2 Filter section shall use standard size filters and be a common size with cabinet sizes.

.8 Controls and Safeties:

.1 Controls shall be accomplished through the use of a factory installed, electrical/mechanical control system and associated electronic and electrical hardware. Stop/start and control of the supply fan shall be done through the building's DDC system. Provide all relays as required.

.2 Safeties:

.1 Unit components shall be equipped with the following protections:

.1 Overtemperature shuts down individual compressor.

.2 Overcurrent protection compressor.

.3 Crankcase heaters.

.4 High-pressure switch.

.5 Low-of-charge switch.

.6 Compressor shall be prevented from restarting for a minimum of 5 minutes after shutdown. Compressor must run for at least 10 seconds after start-up.

.7 Freeze protection thermostat (FPT) shall shut down unit operation based on coil temperature.

.9 Operating Characteristics:

.1 Unit shall be capable of starting and running at 52°C ambient outdoor temperature per maximum load criteria of ARI Standard 210.

.2 Unit shall be provided with fan time delay to prevent cold air delivery in heating mode.

.10 Electrical Requirements:

.1 All unit power wiring shall enter unit cabinet at a single location.

.11 Motors:

.1 Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.

.2 Evaporator-fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers.

.3 All evaporator fan motors 3.73 kW and larger shall meet the minimum efficiency requirements as established by the Energy Policy Act of 1992 (EPACT).

.4 Totally enclosed condenser-fan motor shall have permanently lubricated, sealed bearings, and inherent automatic-reset thermal overload protection.

.13 Phase Loss Protection:

.1 Shall provide unit shutdown when an electrical phase loss is detected.

.14 Special Features:
- .1 Hail guard on condenser.
- .2 Condenser coil corrosion protection.
- .4 Weather-proof disconnect switch.
- .5 Crankcase heaters.
- .6 Economizer with min. fresh air setting.
- .7 Power exhauster.
- .8 Field installed DDC fresh air damper actuator with connection to unit ecomizer control.

.15 Capacity and Performance:
- .1 Refer to Schedule on the Drawings.

.16 Warranty:
- .1 Provide a one (1) year complete warranty with an additional four (4) year compressor warranty.

PART 3 EXECUTION

3.1 Installation

.1 Install units in accordance with manufacturer's instructions and as indicated.

.2 Ensure adequate clearance for servicing and maintenance.

3.2 Fans

.1 Install fan sheaves required for final air balance.

3.3 Commissioning

.1 Commission in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements one day per unit for startup and one day for commissioning.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes.

.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems

.2 Check-out demonstration or proper operation of components.

.3 On-site operational tests

1.2 Related Sections

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 91 13 - General Commissioning (Cx) Requirements.

.5 Section 01 91 41 - Commissioning (Cx) Training.

.6 Section 25 05 01 - EMCS: General Requirements.

1.3 Definitions

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 Design Requirements

.1 Confirm with Owner's Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Final Report: submit report to Owner's Representative.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Owner's Representative before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 Closeout Submittals

.1 Provide documentation, O&M Manuals, and training materials of O&M personnel for review by Owner's Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

1.7 Commissioning

.1 Do commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

.2 Carry out commissioning under direction of Owner's Representative and in presence of Owner's Representative and Commissioning Co-ordinator.

.3 Inform, and obtain approval from, Owner's Representative in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of Owner's Representative until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software. Install software for access to EMCS via dial up modem at Owner's designated site and at Transportation and Works Office in St. John's for use during commissioning and for their use afterwards. Where high speed internet is available, use web browser software, compatible with Windows Vista with access via Internet Explorer (latest edition).

.7 Perform tests as required.

1.8 Completion of Commissioning

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner's Representative and Commissioning Co-ordinator.

1.9 Issuance of Final Certification of Completion

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 PRODUCTS

2.1 Equipment

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

PART 3 EXECUTION

3.1 Procedures

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Co-ordinator and/or Owner's Representative.

.3 Commission integrated systems using procedures prescribed by Commissioning Co-ordinator and/or Owner's Representative.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

3.2 Field Quality Control

.1 Pre-Installation Testing.

- .1 General: consists of field tests of equipment just prior to installation.
- .2 Testing may be on site or at Contractor's premises as approved by Owner's Representative.
- .3 Configure major components to be tested in same architecture as designed system. Include all required network and control components.
- .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
- .5 Additional instruments to include:
  - .1 DP transmitters.
  - .2 By-pass box supply duct SP transmitters.
  - .3 DP switches used for dirty filter indication and fan status.
- .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.
- .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

.8 Owner's Representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".

.9 Transmitters above 0.5 % error will be rejected.

.10 DP switches to open and close within 2% of setpoint.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner's Representative and Commissioning Co-ordinator and provide:

.1 2 technical personnel capable of re-calibrating field hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Owner's Representative's acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final startup testing.

.5 O&M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Owner's Representative.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.

.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

.2 Test to last at least 30 consecutive 24 hour days.

.3 Tests to include:

.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

.4 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Commissioning Co-ordinator and/or Owner's Representative to verify reported results.

3.3 Adjusting

.1 Final adjusting: upon completion of commissioning as reviewed by Owner's Representative set and lock devices in final position and permanently mark settings.

3.4 Demonstration

.1 Demonstrate to Commissioning Manager and/or Owner's Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 25 05 01 - EMCS: General Requirements.

1.3 Definitions

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Owner's Representative 30 days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

1.5 Quality Assurance

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Owner's Representative reserves right to approve instructors.

1.6 Instructions

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.7 Time for Instruction

.1 Number of days of instruction to be as specified in this section (1 day = 7 hours including two 15 minute breaks and excluding lunch time).

1.8 Training Materials

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.9 Training Program

.1 To be in 2 phases over 6 month period.

.2 Phase 1: 1/2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Owner's Representative and Commissioning Co-ordinator.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during 30 day test period.

.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.

.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.5 Introduction to Direct Digital Controls and BACnet protocol.

.6 Identification of Control Components.

.7 Review of DDC Network Diagram for building.

.8 Review of shop drawings for building.

.9 Detailed discussion of sequences of operation

.10 Walk through of mechanical systems.

.3 Phase 2: 1/2 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.

.1 Provide multiple instructors on pre-arranged schedule. Include at least

.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

.2 Equipment maintenance training: provide personnel with 1/2 days training in maintenance of EMCS components, maintenance and calibration of sensors and controls.

.3 Programmers: provide personnel with 1/2 days training in following subjects in approximate percentages of total course shown:

.1 Software and architecture: 10%

.2 Application programs: 15%

.3 Controller programming: 50%

.4 Trouble shooting and debugging:10%

.5 Colour graphic generation: 15%

.6 Display and interpret summaries

.7 Command points

.8 Modify points and point groups

.9 Define trend logs

.10 Schedule and print reports

1.10 Additional Training

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.11 Monitoring and Training

.1 Engineer/ Architect to monitor training program and may modify schedule and content.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

1.2 Related Sections

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between other Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.1 Section 01 33 00 – Submittal Procedures.
.2 Section 01 35 29.06 – Health and Safety Requirements.
.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
.4 Section 01 91 13 – General Commissioning (Cx) Requirements.
.5 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
.6 Section 25 01 12 - EMCS: Training.
.7 Section 25 05 02 - EMCS: Submittals and Review Process.
.8 Section 25 05 03 - EMCS: Project Record Documents.
.9 Section 25 05 54 - EMCS: Identification.
.10 Section 25 05 60 - EMCS: Field Installation.
.11 Section 25 08 20 - EMCS: Warranty and Maintenance.
.12 Section 25 10 01 - EMCS: Local Area Network (LAN).
.13 Section 25 10 02 - EMCS: Operator Work Station (OWS).
.14 Section 25 30 01 - EMCS: Building Controllers
.15 Section 25 30 02 - EMCS: Field Control Devices.
.16 Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 References

.1 American National Standards Institute (ANSI)

.1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of

Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).

.1 CEA-709.1-B, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA).

.2 Canadian Environmental Protection Act (CEPA).

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.8 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA).

.9 National Electrical Manufacturers Association (NEMA)

1.4 Acronyms, Abbreviations and Definitions

.1 Acronyms used in EMCS.

.1 AEL - Average Effectiveness Level
.2 AI - Analog Input
.3 AO - Analog Output
.4 BACnet - Building Automation and Control Network
.5 BC(s) - Building Controller(s)
.6 BECC - Building Environmental Control Centre
.7 CAB - Canadian Automated Building (CAB) Protocol
.8 CAD - Computer Aided Design
.9 CDL - Control Description Logic
.10 CDS - Control Design Schematic
.11 COSV - Change of State or Value
.12 CPU - Central Processing Unit
.13 DI - Digital Input
.14 DO - Digital Output
.15 DP - Differential Pressure

.16 ECU - Equipment Control Unit
.17 EMCS - Energy Monitoring and Control System
.18 HVAC - Heating, Ventilation, Air Conditioning
.19 IDE - Interface Device Equipment
.20 I/O - Input/Output
.21 ISA - Industry Standard Architecture
.22 LAN - Local Area Network
.23 LCU - Local Control Unit
.24 MCU - Master Control Unit
.25 NC - Normally Closed
.26 NO - Normally Open
.27 OS - Operating System
.28 O&M - Operation and Maintenance
.29 OWS - Operator Work Station
.30 PC - Personal Computer
.31 PCI - Peripheral Control Interface
.32 PCMCIA - Personal Computer Micro-Card Interface Adapter
.33 PID - Proportional, Integral and Derivative.
.34 RAM - Random Access Memory
.35 ROM - Read Only Memory
.36 SP - Static Pressure
.37 TCU - Terminal Control Unit
.38 USB - Universal Serial Bus
.39 UPS - Uninterruptible Power Supply
.40 WAN- Wide Area Network

1.5 Definitions

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction which related equipment (stop, start) and value or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system", and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.

.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:

.1 AI (analog input)
.2 AO (analog output)
.3 DI (digital input)
.4 DO (digital output)
.5 Pulse inputs

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.
.2 Refer also to Section 25 05 54 - EMCS: Identification.

1.6 System Description

.1 Refer to control schematics, sequences of operation and related Divisions of specifications for system architecture.

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.
.2 Control devices as listed in I/O point summaries and/or shown on the control drawings.
.3 Data communications equipment necessary to affect EMCS data transmission system.
.4 Field control devices.
.5 Software/Hardware complete with full documentation.
.6 Complete operating and maintenance manuals.

.7 Training of personnel.

.8 Acceptance tests, technical support during commissioning, full documentation.

.9 Wiring interface co-ordination of equipment supplied by others.

.10 Miscellaneous work as specified in these sections and as indicated.

.3 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed prior to installation.

.3 Location of controllers as reviewed by Owner's Representative prior to installation.

.4 Provide utility and emergency power to EMCS.

.5 Metric references: in accordance with CAN/CSA Z234.1.

.4 Language Operating Requirements:

.1 Provide English interface to system through operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.

.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).

.2 Reporting function such as trend log, alarm report logs, energy report logs, maintenance generated logs.

.6 The network design to be a fully distributed network, with each primary system having its own locally mounted dedicated controller. Any failure in the network shall **not** in any way affect the control of these primary systems. Connecting hardware points from one system to more than one controller is not acceptable. Any points associated with a system are to be connected to one dedicated controller. Each dedicated controller to have a locally mounted control and display device to allow the operator to view and adjust any point on the controller.

.7 All wiring associated with the EMCS communication network as well as all control wiring and conduit associated with the EMCS at 50 volts or less. Wire and conduit

above 50 volts by Electrical Division.

.8 BACnet compliance: full compliance to the BACnet standard (ANSA/ASHRAE) 135, BACnet – A Data communication Protocol for Building Automation and Control Networks is mandatory. Down to the field device level, the EMCS system must meet BACnet standards for system architecture and administration, and use open communication protocols and user friendly programming and graphics. Install the EMCS installed to communicate at the supervisory layer to the WAN using the BACnet TCP/IP protocol implemented on Ethernet.

.9 The EMCS system for this facility to be accessible by designated personnel via the WAN for monitoring and programming purposes. The EMCS contractor to provide all the required hardware, software, gateways, etc. needed to permit connection of the EMCS to the WAN. This shall include all hardware, software, programming, start-up and commissioning required. The contractor to supply and install all the required hardware and software on the WAN file server to allow for this remote operation monitoring and programming to take place.

1.7 Submittals

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Submittals and Review Process.

.2 Submit for review:

.1 Equipment list and systems manufacturers within 10 days after award of contract.

.3 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 – EMCS: Submittals and Review Process. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by third party Engineer registered in Canada, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/ specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Existing devices intended for re-use: submit test report.

1.8 Quality Assurance

.1 Have local office for at least 5 years staffed by factory trained personnel capable of installing and providing instruction, routine maintenance and emergency service on systems.

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.4 Ensure factory qualified supervisory personnel continuously direct and monitor work and attend site meetings.

.5 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.6 Be able to provide factory trained personnel on site within 24 hours notice or provide instructions on maintenance and emergency service on system.

.7 BACnet devices to bear BACnet testing laboratories BTL mark and listed on BACnet manufacturers association web site.

1.9 Delivery, Storage and Handling

.1 Material Delivery Schedule: provide Owner's Representative with "Materials Delivery Schedule" within 2 weeks after award of contract.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional, Municipal, and Provincial regulations.

.7 Label location of salvaged material's storage areas and provide barriers and security devices.

.8 Ensure emptied containers are sealed and stored safely.

.9 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative Owner's Representative.

.10 Fold up metal and plastic banding, flatten and place in designated area for recycling

1.10 Existing Conditions – Control Components

.1 Utilize existing control wiring and piping as indicated.

.2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards and specifications.

.1 Do not modify original design of existing devices without written permission from Owner's Representative.

.2 Provide for new, properly designed device where re-usability of components is uncertain.

.3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.

.1 Furnish test report to Owner's Representative within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Owner.

.2 Failure to produce test report will constitute acceptance of existing devices by owner.

.4 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.2 Owner will repair or replace existing items judged defective yet deemed necessary for EMCS.

.5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.6 Assume responsibility for existing controls to be incorporated into EMCS after written receipt of approval from Owner's Representative.

.1 Be responsible for items repaired or replaced by Owner.

.2 Be responsible for repair costs due to negligence or abuse of equipment repaired or replaced by Owner.

.3 Responsibility for existing devices terminates upon final acceptance of EMCS or applicable portions of EMCS as approved by Owner's Representative.

.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed

PART 2 PRODUCTS

2.1 Acceptable Systems, manufacturers

.1 Alerton, Delta, Automated Logic, Honeywell, Johnson Controls, Tridium/Distech.

.2 Proposed system to have communication capability utilizing BACnet Protocol.

.3 Panel to be NEMA rated to suit environmental requirements.

.4 Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.

.5 Wiring within panels to be contained within properly sized rigid PVC slotted wall wire duct. All wiring within the wire duct to be concealed with a non-slip cover.

.6 Terminations for the connection of power wiring, communication wiring and field mounted devices to be at properly identified terminal blocks mounted within the control panel.

.7 All control panels to be provided with an internally mounted 120 volt duplex power receptacle.

.8 All control panels to be identified with permanently mounted Lamecoid tags to identify the control panel and the systems served by the control panel. Submit schedule of labels with shop drawing submission.

.9 Provide low voltage transformers in panels or elsewhere as required.

.10 Provide adaptors between metric and imperial components.

PART 3 EXECUTION

3.1 Manufacturer's Recommendations

.1 Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

3.2 Painting

.1 Painting to be in accordance with NEMA, supplemented as follows:

.2 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.3 Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.

.4 Clean and prime exposed hangers, racks, fastenings, and other support components.

.5 Paint all unfinished equipment installed indoors to NEMA.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes.

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process include review meetings for building Energy Monitoring and Control System (EMCS).

1.2 Related Sections

.1 The contractor is to ensure that all related work is co-ordinated among all specification sections as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.3 Section 25 05 01 - EMCS: General Requirements.

1.3 Definitions

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 Design Requirements

.1 Preliminary Design Review: to contain following contractor and systems information.

.1 Location of local office.

.2 Description and location of installing and servicing technical staff.

.3 Location and qualifications of programming design and programming support staff.

.4 List of spare parts.

.5 Location of spare parts stock.

.6 Names of sub-contractors and site-specific key personnel.

.7 Sketch of site-specific system architecture.

.8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.

.9 Descriptive brochures.

.10 Sample CDL and graphics (systems schematics).

.11 Response time for each type of command and report.

.12 Item-by-item statement of compliance.

.13 Proof of demonstrated ability of system to communicate utilizing BACnet protocol.

1.5 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within 30 working days after contract award for review by Owner's Representative.

.3 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

.5 Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format, or PDF structured using menu format for easy loading and retrieval on OWS.

.6 Submittals shall consist of:

- .1 Data sheets of all products.
- .2 Wiring and piping interconnection diagrams including panel and device power, and sources.
- .3 List of materials of all proposed devices and equipment.
- .4 Software documentation:
- .5 Sequence of operation, in text form.
- .6 Application programs.
- .7 Point Schedules
- .8 Controls schematics and system diagrams.
- .9 Project installation schedule.
- .10 Names of subtrades working for EMCS contractor.
- .11 Mounting support details for components installed in airflow, waterflow and steam systems.

.7 Submit shop drawings in a package which contains the various schedules and drawings which completely describe the control system installed. At a minimum the shop drawing package to contain the following items described in Section 1.4.8 to 1.4.28 as follows:

.8 Network drawing showing the network connection of all network control units, programmable control units, terminal control units and operator workstations to indicate the location of each of these elements.

.9 Schematic control diagram for each system being controlled. Where there are typical systems a drawing to be provided for each system. This drawing to be on a AB size sheet (11 x 17) and shall include a title block which includes as a minimum the drawing title, drawing number, project title, contractor's name, contractor's address, contractor's phone and fax numbers, contractor's project number and a section to provide a record for

revision information.

.10 The schematic control diagram to include a bill of materials which provides a list of all part numbers and descriptions for the control components on the drawing list to include field equipment as well as panel mounted components.

.11 The schematic control diagram to include a complete wiring diagram for all electrical connections, including motor starters, heating coils, coiling coils etc.

.12 The schematic control diagram to include a layout of the control panels for each system. This layout to show the mounting of all panel equipment, including transformers, power supplies, controllers, transducers, sensors, relays, contactors and any other panel mounted equipment.

.13 The contractor to include with the shop drawing submittal drawings, showing all wiring details for the connections of sensors, transducers, relays and contactors these details to show terminal numbers and be referenced to the appropriate schedules and drawings.

.14 The contractor to supply with the shop drawing package a complete point schedule to show every point connected to the system. This schedule to be in tabular format and provide the point identification, point type, wire tag, termination details reference, referenced drawings, device mounting location and device code numbers.

.15 The point schedule to provide at a minimum the following information on the software attributes of the point:

.1 Tag name – ex. EPT-1

.2 Point type – ex. AO-3

.3 System name – ex. A/C-1

.4 Object name – H-VLV.

.5 Expanded ID- Heating control valve

.6 Units of measurement - %.

.16 The point schedule to provide at a minimum the following information on the digital controller to which the point is connected:

.1 Controller type – ex. Unitary controller

.2 Controller address ex. 256.

.3 Cable destination – the termination at the controller, ex. AO-1.

.4 Terminal numbers – the termination at the controller.

.17 The point schedule to provide at minimum the following information on the control panel:

.1 Panel identification

.2 Panel location

.3 Reference drawing

.18 The point schedule to provide at a minimum the following information on any intermediate device which may be associated with the point:

.1 Type of wiring or tubing used

.2 Device part number

.3 Location of the device.

.4 Reference details.

.19 The point schedule to provide at a minimum the following information on any field device which may be associated with the point;

.1 Type of wiring or tubing used

.2 Device part number

.3 Location of the devices

.4 Reference details

.20 The contractor to supply with the shop drawing package a complete room schedule, to show the equipment associated with the room controls. Schedule to be in tabular format and provide the room number and location, terminal unit number, part numbers for the terminal unit controller, sensors and actuators. Included on this schedule terminal unit type, size, minimum flow and maximum flow.

.21 Sequence of operation for each system controlled. Sequence to be in complete conformance with the sequence of operations included with this specification. Any changes require the approval of the Owner's Representative in writing. Sequence to include all modes of operation including fail safe, emergency and fire modes.

.22 Catalogue cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, dampers, control air system components, etc.

1.6 Preliminary Shop Drawing Review

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:

.1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.

.3 Spare point capacity of each controller by number and type.

.4 Controller locations.

.5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

.7 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

1.7 Detail Shop Drawing Review

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:

.1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.

.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules and terminations.

.4 Pneumatic schematics and schedules.

.5 Complete Point Name Lists.

.6 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.

.7 Software and programming details associated with each point.

.8 Manufacturer's recommended installation instructions and procedures.

.9 Input and output signal levels or pressures where new systems ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.7 Graphic system schematic displays of air systems with point identifiers and textual description of system, and typical floor plans as specified.

.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.9 Listing of and example of specified reports.

.10 Listing of time of day schedules.

.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

.15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

1.8 Quality Assurance

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's factory trained programmer to attend meeting.

.3 Owner's Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes.

.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 Related Sections

.1 Section 01 78 00 - Closeout Submittals.

.2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.3 Section 25 05 01 - EMCS: General Requirements.

.4 Section 25 05 02 - EMCS: Submittals and Review Process.

1.3 Definitions

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acryonyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 Submittals

.1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.

.2 Submit Record Documents, As-built drawings, Operation and Maintenance Manual to Owner's Representative in English.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.5 As-Builts

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Owner's Representative.

.3 Provide before acceptance 4 hard and 1 soft copy incorporating changes made during final review.

1.6 O&M Manuals

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests.

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.4 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.5 System operation to include:

.1 Complete step-by-step procedures for operation of system.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring, tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates, materials, colours and lettering sizes.

1.2 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 25 05 01 - EMCS: General Requirements.

1.3 References

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.4 Definitions

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 System Description

.1 Language Operating Requirements: provide identification for control items in English.

1.6 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process supplemented and modified by requirements of this Section.

.2 Submit to Owner's Representative for approval samples of nameplates, identification tags and list of proposed wording.

PART 2 PRODUCTS

2.1 Nameplates for Panels

.1 Identify by plastic laminate, 3 mm thick melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 Nameplate for Field Devices

.1 Identify by plastic encased cards attached by plastic tie.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name and point address, make, model number.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 Nameplates for Room Sensors

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Owner's Representative.

.3 Letter size: to suit, clearly legible.

2.4 Warning Signs

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Owner's Representative.

2.5 Wiring

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 Conduit

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Owner's Representative during "Preliminary Design Review".

PART 3 EXECUTION

3.1 Nameplates and Labels

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 11 00 – Summary of Work.

.2 Section 25 05 01 – EMCS: General Requirements.

.3 Section 26 05 00 – Common Work Results-Electrical.

1.2 References

.1 American National Standards Institute (ANSI)

.1 ANSI C2, National Electrical Safety Code.

.2 ANSI/NFPA 70, National Electrical Code.

.2 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

1.3 System Description

.1 Electrical:

.1 Provide power wiring from emergency power panels where emergency power is provided to EMCS field panels. If no emergency power provided, install UPS Device. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.

.2 Hard wiring between field control devices and EMCS field panels.

.3 Communication wiring between EMCS field panels and OWS's including main control centre BECC.

.4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.5 Refer to wiring diagrams included as part of flow diagrams. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval by Owner's Representative before commencing work.

.6 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.

.7

.2 Mechanical:

.1 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Mechanical. Costs to be carried by designated trade.

.3 By-pass Terminal Units.

.1 Air flow probe for BP boxes to be supplied and installed under Mechanical Division. Air flow dp sensor, actuator and associated BP controls to be supplied and installed by EMCS contractor. Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators to be the responsibility of EMCS contractor. Coordinate air flow adjustments with balancing trade.

.4 Structural:

.1 Special steelwork as required for installation of work.

1.4 Personnel Qualifications

.1 Qualified factory trained supervisory personnel to:

.1 Continuously direct and monitor all work.

.2 Attend site meetings.

1.5 Existing Conditions

.1 Cutting and Patching: refer to Section 01 73 00 – Execution Requirements supplemented as specified herein.

.2 Repair all surfaces damaged during execution of work.

.3 Turn over to Owner's Representative existing materials removed from work not identified for re-use.

PART 2 PRODUCTS

2.1 Special Supports

.1 Structural grade steel, primed and painted after construction and before installation.

2.2 Wiring

.1 As per requirements of Electrical Divisions.

.2 For 50V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.

.3 For wiring under 50 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.

.4 Sizes:

.1 120V Power supply: to match or exceed breaker, size #12 minimum.

.2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.

.3 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.

.4 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair. Wiring must be continuous without joints.

.5 More than 4 conductors: #22 minimum solid copper.

.5 Terminations:

.1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.3 Conduit

.1 As per requirements of Electrical Division.

.2 Electrical metallic tubing to CSA C22.2 No. 03. Flexible and liquid tight flexible metal conduit to CSA C22.2 No.56. Rigid steel threaded conduit to CSA C22.2 No. 45.

.3 Junction and pull boxes: welded steel.

.1 Surface mounting cast FS: screw-on flat covers.

.2 Flush mounting: covers with 25 mm minimum extension all round.

.4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.

.5 Outlet boxes: 100 mm minimum, square.

.6 Conduit boxes, fittings:

.1 Bushings and connectors: with nylon insulated throats.

.2 With push pennies to prevent entry of foreign materials.

.7 Fittings for rigid conduit:

.1 Couplings and fittings: threaded type steel.

.2 Double locknuts and insulated bushings: use on sheet metal boxes.

.3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.

.8 Fittings for thin wall conduit:

.1 Connectors and couplings: steel, set screw type.

2.4 Wiring Devices, Cover Plates

.1 Conform to CSA.

.2 Receptacles:

.1 Duplex: CSA type 5-15R.

.2 Single: CSA type 5-15R.

.3 Cover plates and blank plates: finish to match other plates in area.

2.5 Supports for Conduit, Fastenings, Equipment

.1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.

.1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.

.2 Exposed conduits or cables:

.1 50 mm diameter and smaller: one-hole steel straps.

.2 Larger than 50 mm diameter: two-hole steel straps.

.3 Suspended support systems:

.1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.

.2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

PART 3 EXECUTION

3.1 Installation

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 Mechanical Piping

.1 Install piping in accordance with Section 23 05 05 – Installation of Pipework.

3.3 Electrical General

.1 Do complete installation in accordance with requirements of:

.1 Electrical Divisions, this specification.

.2 CSA 22.1 Canadian Electrical Code, latest edition.

.3 ANSI/NFPA 70.

.4 ANSI C2.

.2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage (above 50 V) contacts and mark to prevent accidental injury.

.3 Do underground installation to CAN/CSA C22.3 No.7, except where otherwise specified.

.4 Conform to manufacturer's recommendations for storage, handling and installation.

.5 Check factory connections and joints. Tighten where necessary to ensure continuity.

.6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.

.8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.

.9 Install conduits, and sleeves prior to pouring of concrete.

.10 Holes through exterior wall and roofs: flash and make weatherproof.

.11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.

.12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.4 Conduit System

.1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to

allow for future expansion capabilities specified for systems. Maximum conduit fills not to exceed 40%. Design drawings do not show conduit layout.

.2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.

.3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Owner's Representative before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.

.4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.

.5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.

.6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.

.7 Limit conduit length between pull boxes to less than 30 m.

.8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.

.9 Fastenings and supports for conduits, cables, and equipment:

.1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.

.2 Provide adequate support for raceways and cables, sloped vertically to equipment.

.3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Owner's Representative.

.10 Install polypropylene fish cord in empty conduits for future use.

.11 Where conduits become blocked, remove and replace blocked sections.

.12 Pass conduits through structural members only after receipt of Owner's Representative's written approval.

.13 Conduits may be run in flanged portion of structural steel.

.14 Group conduits wherever possible on suspended or surface channels.

.15 Pull boxes:

.1 Install in inconspicuous but accessible locations.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper or foam to prevent entry of construction material.

.4 Provide correct size of openings. Reducing washers not permitted.

.5 Mark location of pull boxes on record drawings.

.6 Identify AC power junction boxes, by panel and circuit breaker.

.16 Install terminal blocks or strips indicated in cabinets to Electrical Division.

.17 Install bonding conductor for 120 volt and above in conduit.

3.5 Wiring

.1 Install multiple wiring in ducts simultaneously.

.2 Do not pull spliced wiring inside conduits or ducts.

.3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.

.4 Tests: use only qualified personnel. Demonstrate that:

.1 Circuits are continuous, free from shorts, unspecified grounds.

.2 Resistance to ground of all circuits is greater than 50 Megohms.

.5 Provide Owner's Representative with test results showing locations, circuits, results of tests.

.6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

.7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

.8 Do not allow wiring to come into direct physical contact with compression screw.

.9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.6 Wiring Devices, Cover Plates

.1 Receptacles:

.1 Install vertically in gang type outlet box when more than one receptacle is required in one location.

.2 Cover plates:

.1 Install suitable common cover plate where wiring devices are grouped.

.2 Use flush type cover plates only on flush type outlet boxes.

3.7 Starters, Control Devices

.1 Install and make control connections as indicated. Power connections above 50V by Electrical Division.

.2 Install correct over-current devices.

.3 Identify each control wire, terminal for external connections with permanent number marking identical to diagram.

.4 Performance Verification:

.1 Operate switches and controls to verify functioning.

.2 Perform start and stop sequences of contactors and relays.

.3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.8 Grounding

.1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.

.2 Install separate grounding conductors in conduit within building.

.3 Install ground wire in all PVC ducts and in tunnel conduit systems.

.4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.9 Tests

.1 General:

.1 Perform following tests in addition to tests specified Section 25 08 20 - EMCS: Warranty and Maintenance.

.2 Give 14 days written notice of intention to test.

.3 Conduct in presence of Owner's Representative and authority having jurisdiction.

.4 Conceal work only after tests satisfactorily completed.

.5 Report results of tests to Owner's Representative in writing.

.6 Preliminary tests:

.1 Conduct as directed to verify compliance with specified requirements.

.2 Make needed changes, adjustments, replacements.

.3 Insulation resistance tests:

.1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.

.2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Owner's Representative and authority having jurisdiction.

3.10 Identification

.1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes.

.1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

1.2 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 25 05 01 - EMCS: General Requirements.

1.3 References

.1 Canada Labour Code (R.S., c. L-2)/Part I - Industrial Relations.

.2 Canadian Standards Association (CSA)

.1 CSA Z204 – Guidelines for Managing Indoor Quality in Buildings

1.4 Definitions

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit detailed preventative maintenance schedule for system components to Owner's Representative.

.3 Submit detailed inspection reports Owner's Representative.

.4 Submit dated, maintenance task lists to Owner's Representative and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.
.2 Device type and range.
.3 Measured value.
.4 System displayed value.
.5 Calibration detail

.6 Indication if adjustment required,

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Owner's Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.6 Maintenance Service During Warranty Period

.1 Provide services, materials, and equipment to maintain EMCS for warranty period of one year after date of substantial completion. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:

.1 Initiate service calls when EMCS is not functioning correctly.

.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.3 Furnish Owner's Representative with telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS after receiving request for service.

.5 Perform work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.5 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Owner's Representative.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

.2 Related Sections:

.1 Section 25 05 01 – EMCS: General Requirements.

1.2 References

.1 Canadian Standards Association (CSA International).

.1 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications.

.2 CSA T530, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA – 569-A with modifications.

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information Technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements.

.1 IEEE Std 802.3TM, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA).

.1 TIA/EIA-568, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements, Part 2 Balanced Twisted- Pair Cabling Components, Part 3 Optical Fiber Cabling Components Standard.

.2 TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).

.1 TBITS 6.9, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings-Technical Specifications.

1.3 Definitions

.1 Acronyms and definitions: refer to Section 25 05 01 – EMCS: General Requirements.

1.4 System Description

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530 and TIA/EIA-569-A.

.1 Provide reliable and secure connectivity of adequate performance between different sections segments of network.

.2 Allow for future expansion of network, with selection of networking technology

and communication protocols.

.2 Data communication network to included, but not limited to:

.1 EMCS-LAN.

.2 Modems.

.3 Network interface cards.

.4 Network management hardware and software.

.5 Network components necessary for complete network.

1.5 Design Requirements

.1 EMCS Local Area Network (EMCS-LAN).

.1 High Speed, high performance, local area network over MS/TP with MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.

.2 EMCS-LAN to be: BACnet Protocol

.3 Each EMCS-LAN to be capable of supporting at least 50 devices.

.4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.

.5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.

.6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.

.7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.

.1 LAN to provide capabilities for OWSs, either network resident or connected remotely to access point status and application report data or execute control functions for other devices via LAN.

.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.

.1 Network medium: twisted cable, shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 Materials and installation for building automation controllers including:

.1 Master Control Unit (MCU).

.2 Local Control Unit (LCU)

.3 Equipment Control Unit (ECU).

.4 Terminal Control Unit (TCU).

1.2 Related Sections

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 05 02 - EMCS: Submittals and Review Process.

.3 Section 25 05 03 - EMCS: Project Records Documents.

.4 Section 25 30 02 - EMCS: Field Control Devices.

.5 Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 References

.1 American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE, Applications Handbook, SI Edition.

.2 ASHRAE Standard 135 – BAC net – A Data Communications Protocol for Building Automation and Control Networks.

.3 ASHRAE Standard 135.1 Method of Test Conformance to BAC net.

.2 Canadian Standards Association (CSA)

.1 C22.2 No.205, Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE)

.1 IEEE C37.90.1, Surge Withstand Capabilities Test for Protective Relays and Relays Systems.

1.4 Definitions

.1 Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

1.5 System Description

.1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controllers quantity, and point contents to be approved by Owner's Representative at time of preliminary design review.

.2 Controllers: stand-alone intelligent Control Units:

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.6 Design Requirements

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing the detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including the resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices.

.1 To conform to CSA C22.2 No. 205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logic devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring .

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input/Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 12 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 0-10V DC

.3 10 K ohm.

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 12 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20 mA.

.2 0 - 10 V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.4 Controller's and associated hardware and software: operate in conditions of 0°C to 44°C and 20 % to 90 % non-condensing RH.

.5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Owner's Representative for ceiling mounting.

.6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.7 Provide surge and low voltage protection for interconnecting wiring connections.

1.7 Submittals

.1 Make Submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

1.8 Maintenance Procedures

.1 Provided manufacturers recommended maintenance procedures for insertion in Section 25 05 03 – EMCS: Project Record Documents.

PART 2 PRODUCTS

2.1 Master Control Unit (MCU)

.1 Primary function of MCU is to provide co-ordination and supervision of subordinate devices. Supervisory role shall include coordination of subordinate devices in the execution of optimization routines such as demand limiting or enthalpy control.

.2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices. Include support for Open System Protocols, BACnet.

.3 MCU shall have local I/O capacity as follows;

.1 To have at least 16 I/O points of which minimum to be 2AO, 6AI, 4DI, 4DO.

.2 LCU's to be added to support system functions as indicated in I/O Summary List.

.4 Central Processor Unit (CPU)

.1 Processor to consist of at minimum a 16 bit microprocessor capable of supporting software to meet specified requirements.

.2 CPU idle time to be more than 30 % when system configured to maximum input and output with worst case program use.

.3 Minimum addressable memory to be at manufacturer's discretion but to support at least all performance and technical specifications. Memory to include:

.1 Non-volatile EEPROM to contain operating system, executive,

application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hr minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) RAM to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS, CAB-Gateway, or locally installed floppy disk.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving month/day/hour/minute/second, with rechargeable batteries for minimum 72 hr operation in event of power failure.

.5 Local Operator Terminal (OT)

.1 OT to:

.1 Have integral access/display panel where immediate access to OWS is not available.

.2 Support operator's terminal for local command entry, instantaneous and historical data display, programs additions and modifications.

.3 Simultaneously display minimum of 16 points with full English identification to allow operator to view single screen dynamic displays depicting entire mechanical systems.

.2 Functions to include, but not be limited to, following:

.1 Start and stop points.

.2 Modify setpoints.

.3 Modify PID loop setpoints.

.4 Override PID control.

.5 Change time/date.

.6 Add/modify/start/stop weekly scheduling.

.7 Add/modify setpoint weekly scheduling.

.8 Enter temporary override schedules.

.9 Define holiday schedules.

.10 View analog limits.

.11 Enter/modify analog warning limits.

.12 Enter/modify analog alarm limits.

.13 Enter/modify analog differentials.

.3 OT to provide access to real and calculated points in controller to which it is connected or to any other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and any other controller in network.

.4 Operator access to OTs to the same as OWS user password. Password changes to automatically be downloaded to controllers on network.

.5 OT to provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.

.6 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

2.2 Local Control Unit (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC, hydronic and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points of one Building System to be connected to one controller as listed in I/O Summary designations.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements. As per MCU requirements (section 2.3.4) above with the following additions:

.1 Include as minimum 2 interface ports for connection to local computer terminal.

.2 Design so that shorts, opens or grounds on any input or output will not interfere with other input or output signals.

.3 Physically separate line voltage (50V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.

.4 Include power supplies for operation of LCU and associated field equipment.

.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

.6 Provide conveniently located screw type or spade lug terminals for field wiring.

.7 LCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.

2.3 Terminal/Equipment Control Unit (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

.1 The TCU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

.3 By-Pass Box Terminal Controller

.1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.

.2 Controller to support point definition; in accordance with section 25 05 01 – EMCS: General Requirements.

.3 Controller to operate independent of network in case of communication failure.

.4 Controller to include damper actuator and terminations for input and output sensors and devices.

2.4 Software

.1 General:

.1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

.2 To include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.

.3 Include initial programming of all Controllers, for entire system.

.2 Program and data storage:

.1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.

.2 Maintain CDL and operating data such as setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages:

.1 Control Description Logic software to be programmed using English like or graphical, high level, general control language.

.2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed.

.4 Pseudo or calculated points:

.1 Software to have access to any value or status in controller or other networked controller so as to define and calculate pseudo point from other values/status of controller. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.

.2 Inputs and outputs for any process to be able to include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to any number of other processes (eg. cascading).

.5 Control Description Logic (CDL):

.1 Capable of generating on-line project-specific control loop algorithms (CDLs). CDLs to be software based, programmed into RAM or EEPROM. Owner must

have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.

.2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (eg. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS or BC(s) and to tune control loops.

.3 Perform changes to CDL on-line.

.4 Control logic to have access to values or status of all points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Energy optimization routines such as enthalpy control, supply temperature reset, etc. to be LCU or MCU resident functions and form part of CDL.

.6 MCU to be able to perform following pre-tested control algorithms:

.1 Two position control.

.2 Proportional Integral and Derivative (PID) control.

.3 Automatic control loop tuning.

.7 Control software to provide the ability to define the time between successive starts for each piece of equipment to reduce cycling of motors.

.8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.9 Power Fail Restart: Upon detection of power failure system to verify availability of emergency power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.6 Event and Alarm management: The system to use a management by exception concept for Alarm Reporting. This is a system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as a direct result of the primary event to be suppressed by the system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. The exception is, when an air handler which is supposed to stop or start fails to do so under the event condition.

.7 Energy management programs: The following programs shall include specific summarizing reports, to include the date stamp indicating sensor details which activated and or terminated the feature.

.1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:

.1 Time of day scheduling.

.2 Calendar based scheduling.

.3 Holiday scheduling.

.4 Temporary schedule overrides.

.5 Optimal start stop.

.6 Night setback control.

.7 Enthalpy (economizer) switchover.

.8 Peak demand limiting.

.9 Temperature compensated load rolling.

.2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.

.3 Apply programs to equipment and systems as specified or requested by the Owner's Representative.

.8 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 MCUs to accumulate and store automatically run-time for binary input and output points.

.2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.

.3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.

.4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.

.5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWH, litres, tonnes, etc.).

.6 Store event totalization records with minimum of 9,999,999 events before reset.

.7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 Levels of Address

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 Point Name Support

.1 Controllers (MCU, LCU) to support point naming convention as defined in Section 25 05 01 – EMCS: General Requirements.

PART 3 EXECUTION

3.1 Location

.1 Location of Controllers to be approved by Owner's Representative.

3.2 Installation

.1 Install Controllers in secure enclosures as indicated.

.2 Provide necessary power from local 120 V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use Uninterruptible Power Supply (UPS) and emergency power when equipment must operate in an emergency and co-ordinating mode.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 25 05 02 - EMCS: Submittals and Review Process.

.2 Section 25 05 03 - EMCS: Project Records Documents.

1.2 References

.1 American National Standards Institute (ANSI)

.1 ANSI C12.7, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13, Requirements for Instrument Transformers.

.2 Canadian Standards Association

.1 CSA Type 1 Enclosure

.2 CSA Type 4X Enclosures

.3 CSA Type 12 Enclosures

1.3 Submittals

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

.2 Include:

.1 Information as specified for each device.

.2 Manufacturer's detailed installation instructions.

.3 Pre-Installation Tests

.1 Submit samples at random from equipment shipped, as requested by Owner's Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.4 Manufacturer's Instructions

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 Closeout Submittals

.1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 25 05 03 - EMCS: Project Records Documents.

PART 2 PRODUCTS

2.1 General

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in CSA 4X enclosures.

.8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 Temperature Sensors

.1 General: except for VAV box control to be resistance or thermocouple type to following requirements:

.1 Thermisters 10 K ohm, $\pm$ 0.2° C accuracy, less than 0.1° C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac..

.2 RTD's: 1000 ohm at 0 °C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm°C.

.3 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.

.2 Sensors:

.1 Room type: wall mounting, in slotted type covers, LCD display °C or °F, with guard as indicated. Dual set point momentary push button, override switch.

.2 Room type for by-pass boxes: as for room type, above. Include setpoint adjustment, local indication, push button override for night set back function.

.3 General purpose duct type: suitable for insertion into ducts at any angle, insertion length 460 mm.

.4 Averaging duct type: continuous filament with minimum immersion length 6000 mm. Bend probe at field installation time to 100 mm radius at any point along probe without degradation of performance.

.5 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in CSA 4X enclosure.

.6 Immersion type: spring loaded probe, NPT ½ fitting insertion to suit pipe size.

2.3 Temperature Transmitters

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detector type sensors.

.2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg C per volt change.

.3 Output signal: 4 - 20 mA into 500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.

.7 Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 °C.

.10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.

.11 Transmitter ranges: Select narrowest range to suit application from following:

.1 Minus 50 °C to plus 50 C°, plus or minus 0.5 °C.

.2 0 to 100 °C, plus or minus 0.5 °C.

.3 0 to 50 °C, plus or minus 0.25 °C.

.4 0 to 25 °C, plus or minus 0.1 °C.

.5 10 to 35 °C, plus or minus 0.25°C.

2.4 Electrical Relays

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.

.2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.

.3 Contacts: rated at 5 amps at 120 V AC.

.4 Relay to have visual status indication

2.5 Solid State Relays

.1 Requirements:

.1 CSA approved.

.2 Suitable to the application as recommended by manufacturer.

.3 Voltage range: 75-265 VAC

.4 Panel mounting.

.5 Suitable for AC or DC loads.

.6 Output surge absorbing element for inductive on/off loads.

.7 Input capacitor/resistor circuit for pulse noise absorption.

.8 For input inductive noise use twisted-pair wires for electromagnetic noise and shielded cable for static noise.

2.6 Current Transducers

.1 Requirements:

.1 Range: in accordance with Equipment Schedules.

.2 Purpose: measure line current and produce proportional signal in one of following ranges:

.1 4-20 mA DC.

.2 0-5 volt DC.

.3 0-10 volts DC.

.4 2-10 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside the MCC or starter enclosure.

2.7 Electronic Control Damper Operators

.1 Requirements

.1 Push-pull proportional type as indicated.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

.4 Power requirements: 5 VA maximum at 24 V AC.

.5 Operating range: 4-20 mA. 0-10 V DC, 2-10 V DC..

2.8 Panels

.1 Either free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door.

.2 To be modular multiple panels as required to handle requirements with additional space to accommodate future capacity as required by Owner's Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

PART 3 EXECUTION.

3.1 Installation

.1 Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.

.2 Temperature transmitters, controllers, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.

.3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.

.4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 Temperature Sensors

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

- .1 Protect from solar radiation and wind effects by stainless steel shields.
- .2 Install in CSA 4X enclosures.

.4 Duct installations

- .1 Do not mount in dead air space.
- .2 Location to be within sensor vibration and velocity limits.
- .3 Securely mount extended surface sensor used to sense average temperature.
- .4 Thermally isolate elements from brackets and supports so as to respond to air temperature only.
- .5 Support sensor element separately from coils, filter racks.

3.3 Panels

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).

.3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.4 Identify wiring and conduit clearly.

3.4 Identification

.1 Identify field devices properly.

.2 Refer to Section 25 05 54 - EMCS: Identification.

3.5 Testing

.1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to Owner's Representative for approval. Owner's Representative will verify results at random. Provide testing equipment and manpower necessary for this verification.

3.6 Commissioning

.1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

PART 1 GENERAL

1.1 Design Documentation

.1 Design documentation for each system to include, as a minimum:

- .1 Narrative type of Sequence of Operation.
- .2 Control Description Logic (CDL).
- .3 Input/Output Summary Schedules.
- .4 Schematics.

1.2 EMCS Language Design Criteria

.1 Language: refer to Section 25 05 01 EMCS: General Requirements.

.2 Levels of EMCS Language

- .1 Level 1: alarm and operational messages to convey alarm conditions or operational messages.
- .2 Level 2: full names of equipment and control points. The various systems, their equipment and components and all control points are named in accordance with this section.
- .3 Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.
- .4 Level 4: commands: represent various computer functions and routines.
  - .1 Operational commands - relate to building operations and building system controls.
  - .2 Computer system commands - relate to computer maintenance, upgrading or development software used to improve and maintain the application software for the building site.
- .5 Level 5: machine language. Languages specific to each manufacturer's product, used internally to perform its functions and routines.

.3 Additional Equipment, Components and/or Control Points. Where additional equipment, components and/or control points are required on specific projects, the following procedures shall be adopted:

- .1 Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.
- .2 SYSTEM descriptors shall be not more than 10 alphanumeric characters. INPUT and OUTPUT descriptors shall be not more than 10 alphanumeric characters. The letters shall be based upon the English/French language full name, and should, where possible, be the first letter of each word of the full name.

.4 The descriptor shall be unique.

.5 Descriptors and expansions: table lists standardized system identifiers and point identifiers.

.1 Table:

Identifiers and Expansions

English Identifier (10 characters max)	English Expansion (40 characters max)
OAD	Outside air damper
OAT	Outside air temperature
OAH	Outside air humidity
OAV	Outside air volume
RAD	Return air damper
RAT	Return air temperature
RAH	Return air humidity
RASP	Return air static pressure
SF#-C	Supply fan # control
SF#-S	Supply fan # status
SAV	Supply air volume
SAVC	Supply air volume control
SAT	Supply air temperature
SAH	Supply air humidity
SAVP	Supply air velocity pressure
SASP	Supply air static pressure
RAV	Return air volume
RAVC	Return air volume control
RAT	Return air temperature
RAH	Return air humidity
RAVP	Return air velocity pressure
RASP	Return air static pressure
AFS	Air Flow Switch
AFM	Air Flow Monitor
F	Flow
P	Pressure
ST	Supply temperature
RT	Return temperature

1.3 I/O Summary Schedules

.1 General:

.1 The EMCS contractor shall provide a complete I/O summary schedule similar to the one listed below, listing and describing all I/O's in detail. Contractor's standard schedule may be used provided all relevant information is provided.

.2 PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.

.3 Building/Area: unique label given to each building forming part of a multi-building facility.

.4 Area/System Label: unique label given to each area of the building or to each system.

.1 Column 1: Point no: I/O Summary Schedule reference number.

.2 Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.

.3 Column 3: Description: describes the point label in expanded terms.

.4 Column 4: Type: (eg. AI, AO, DI, DO).

.5 Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).

.6 Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).

.7 Column 7: Sensor type: describes in 2 or 3words.

.8 Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.

.9 Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).

.10 Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).

.11 Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).

.12 Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.

.13 Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.

.14 Column 14: Set Point: Defines the design set-point of the control loop.

.15 Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.

.16 Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").

.17 Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA:

defines the form of action. DA = direct acting. RA = REVERSE ACTING.

.18 Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.

.19 Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.

.20 Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.

.21 Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.

.22 Column 22: Programs:

.1 Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).

.2 Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.

.3 Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).

.4 Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.

.5 Run time totals: for calculation of operation of digital points.

.6 Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

.1 Schedule:

INPUT/OUTPUT			SCHEDULE PCU NO.					(see 1.3.2)		
PROJECT NO.			BLDG/AREA			NAME		(see 1.3.3)		
PROJECT NAME			AREA/SYSTEM			NAME		(see 1.3.3)		
POINT IDENTIFICATION								ALARMS		
1	2	3	4	5	6	7	8	9	10	11
Point. No	Point Label	Descrip	Type	Eng. Unit	Access Level	Sensor type	Assoc Point	Type (M,CR)	DI/D0 NO/NC	Limits

MESSAGES								DI/DO		
12	13	14	15	16	17	18	19	20	21	22
Alarm Limit	Maint	Set-Point MO/MA	Dead band start	Dev. alarm delay	NO/NC DA/RA	Cont's NO/NC	Delay succ.	Heavy Motor	Auto reset	Prog

1.4 Control Narrative Sequence of Operations

Sequence of Operation

.1 HVAC System

.1 The direct digital control system (DDC) shall control all aspects of the HVAC system.

.2 The DDC main controller shall determine the demand for heating or cooling based on the number of zones calling or the greatest demand for a particular mode.

.3 The main controller shall communicate with the zone controllers on a communications bus network.

.4 When any thermostat senses a temperature deviation of 1.5°F or more from its current setpoint, it becomes a zone heating or cooling caller. When a zone becomes a caller, the main controller registers its demand and its heating or cooling caller status. When the main controller registers the minimum required number of zone callers, as determined by the system mode demand, a mode shall be selected, and the specific mode energized.

.5 On a rise to 2°F the DDC controller shall energize a second stage of cooling. When demand falls to 1.0°F the second stage shall be released. When cooling demand falls to 0.5°F, the first staged shall be released.

.6 The units fresh air damper shall be positioned at minimum of 10% and when combustion fumes are sensed by the supply air ducts sensor the fresh air damper shall close fully. The damper shall revert to it's minimum position once the supply air is clean of contaminants. Combustor fume setpoint shall be minimum ppm level practical for sensing device.

.7 The roof-top heat pump shall be scheduled to run on time of day as per the owner's schedule.

.2 Hangar Heating

.1 The hanger forced flow electric heaters shall be controlled through the DDC system. During occupied periods the space temperature shall be maintained at 21°C, and re-set down to 18° during un-occupied periods.

1.5 Input/Output Point Summary Table

.1 The input/output table summarizes the Input/Output (I/O) points for the various systems as outlined within the EMCS specifications and control schematic drawings. However,

the tables are not all inclusive as they do not list the typical room temperature sensors, unit heater/force flow valves, terminal unit control assemblies, etc. The number and location of these devices can be found on the floor plans and/or listed in relevant schedules. All points and field devices required to accomplish the specified sequence of operation shall be provided. Any discrepancies in I/O counts between the points list, specs and drawings shall be reported to the Owner's Representative.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 Additional Programming

.1 The EMCS contractor to make allowance during bidding process for 4hrs of additional programming as directed by the engineer to make any requested changes and adjustments to the EMCS programming.

END OF SECTION

PART 1 GENERAL

1.1 General

.1 This Section covers items common to sections of this division. This section supplements requirements of Division 1.

1.2 Codes and Standards

.1 Do complete installation in accordance with CSA C22.1-12.

.2 Abbreviations for electrical terms: to CSA Z85-1983.

1.3 Care, Operation and Start-up

.1 Instruct operating personnel in the operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 Voltage Ratings

.1 Operating voltages: to CAN3-C235-83.

.2 Equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 Permits, Fees and Inspection

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Engineer will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

.4 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Engineer.

1.6 Materials and Equipment

.1 Provide materials and equipment in accordance with Section 01 61 00 – Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

1.7 Finishes

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

1.8 Wiring Identification

.1 Identify branch circuit wiring with permanent numbered tapes at both ends.

.2 Maintain phase sequence and color coding throughout.

.3 Color code: to CSA C22.1-12.

.4 Use color coded wires in communication cables, matched throughout system.

1.9 Wiring Terminations

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.10 Manufacturers and CSA Labels

.1 Visible and legible after equipment is installed.

1.11 Warning Signs

.1 As specified and to meet requirements of Electrical Inspection Department and Engineer.

.2 Porcelain enamel or 1 mm thick plastic signs, minimum size 175 x 250 mm.

1.12 Mounting Heights

.1 Mounting height of equipment is from finished grade to centre line of equipment unless specified or indicated otherwise.

1.13 Field Quality Control

.1 Conduct the following tests:
- .1 Circuits originating from branch distribution panels.

.2 Insulation resistance testing.
- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
- .2 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Engineer.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Submit test results for Engineer's review.

.3 Carry out tests in presence of engineer and have engineer sign and verify test results on site at time of test.

1.14 Coordination of Protective Devices

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

1.15 Coordination

.1 Coordinate work with work of other Divisions to avoid conflict.

.2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

.3 Where interference occurs, owner must approve relocation of equipment and materials regardless of installation order.

.4 Notwithstanding the review of shop drawings, this Division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The owner shall decide the extent of relocation required.

1.16 Cutting and Patching

.1 This contractor is to bear the cost of all cutting and patching required to facilitate installation of electrical equipment. Obtain written approval of Structural Engineer before drilling any beams or floors.

1.17 Cleaning

.1 Do final cleaning in accordance with Division 1.

1.18 Protection

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark all live parts "LIVE 600 VOLTS", or with appropriate voltage in English.

1.19 Record Drawings

.1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

.2 Submit record drawings within 30 days prior to start of commissioning.

1.20 Inspection of Work

.1 The owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.21 Scheduling of Work

.1 Work shall be scheduled in phases as per other divisions of the specifications.

.2 Become familiar with the phasing requirements for the work and comply with these conditions.

.3 No additional monies will be paid for contractors requirement to comply with work phasing conditions.

1.22 Fire Rating Penetrations

.1 Maintain fire ratings around conduits passing through fire rated assemblies.

.2 Use 3M brand, or equal fire barrier products at each penetration.

.3 Standard of acceptance for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS195 wrap and #CS195 sheet.

.4 Alternate manufacturers: Nelson.

1.23 Standard of Acceptance

.1 The items named meet in all respect performance, quality and workmanship and are acceptable to the owner without qualification.

.2 Equipment proposed shall meet the same standards of performance, quality and workmanship.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSA C22.2 No. 65-1956(R1965) Wire Connectors.

PART 2 PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

PART 3 EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors as recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSA C22.2 No. 0.3-M1985, Test Methods for Electrical Wires and Cables.

1.2 Product Data

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 8 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TW rated at 600V, for bonding conductors only.

PART 3 EXECUTION

3.1 Use of Wiring Methods

.1 General ac power wiring is to be accomplished using RW90 wire in EMT unless otherwise required by code. All wiring and conduit to be concealed where possible.

3.2 Installation of Building Wires

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34.

END OF SECTION

PART 1 GENERAL

Not applicable

PART 2 PRODUCTS

2.1 Equipment

.1 Insulated bonding conductors: green, type TW.

.2 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Bonding jumpers, straps.
- .5 Pressure wire connectors.

PART 3 EXECUTION

3.1 Installation - General

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Install dedicated bonding conductor in all conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 26 05 01 - Electrical General Requirements.

END OF SECTION

PART 1 GENERAL

Not applicable.

PART 2 PRODUCTS

2.1 Support Channels

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 EXECUTION

3.1 Installation

.1 Secure equipment to poured concrete with expandable inserts.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5 m oc spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.12 Do not use plastic ty-raps for securing conduits or cables.

END OF SECTION

PART 1 GENERAL

Not applicable.

PART 2 PRODUCTS

2.1 Junction and Pull Boxes

.1 Welded steel construction with screw-on flat covers for surface mounting for use with EMT.

.2 Boxes to be sized in accordance with the CEC Part 1 without use of box extensions.

PART 3 EXECUTION

3.1 Junction and Pull Box Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.2 Installation

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Install size 2 identification labels indicating system name.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSA C22.1-12, Canadian Electrical Code, Part 1.

PART 2 PRODUCTS

2.1 Outlet and Conduit Boxes - General

.1 Size boxes in accordance with CSA C22.1.

.2 Size boxes to avoid use of box extensions.

2.2 Conduit Boxes

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for connection to surface mounted conduit.

2.4 Fittings General

.1 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

PART 3 EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

END OF SECTION

PART 1 GENERAL

1.1 Location of Conduit

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

PART 2 PRODUCTS

2.1 Conduits

.1 Electrical metallic tubing (EMT).

2.2 Conduit Fastenings

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Channel type supports for two or more conduits at 1.5 m oc.

.3 Six mm dia threaded rods to support suspended channels.

2.3 Conduit Fittings

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Steel couplings for EMT.

.4 Steel connectors with insulated throats.

2.4 Fish Cord

.1 Polypropylene.

PART 3 EXECUTION

3.1 Installation

.1 Use EMT conduit for interior branch circuit wiring, except where specified otherwise or required by code.

.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.3 Minimum conduit size: 21 mm.

.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.5 Mechanically bend steel conduits over 21 mm dia.

.6 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.7 Dry conduits out before installing wire.

.8 Install conduit concealed where possible.

END OF SECTION

PART 1 GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures

PART 2 PRODUCTS

2.1 Breakers General

.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

2.2 Thermal Magnetic Breakers

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping and instantaneous tripping for short circuit protection.

.2 Breakers complete with mounting hardware to suit existing panels.

PART 3 EXECUTION

3.1 Installation

.1 Install circuit breakers in existing panels as indicated.

.2 Update panel directories.

END OF SECTION