DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Pot Feeder & Cleaning Chemical
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	

Type	by-pass feeder				
Size	7.6 L (2 USgal)				
Pressure	172 kPa (25 psi)				

Notes: chemical to circulate at 1-2% solution	Standard of Acceptance: Neptune DBF – 2 Ferroquest FQ 7103

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Return Grill
Project	Water Works and Water Supply, WTP	Device location	Office Washroom
Project Number	02-0602	Tag No	EG

Type	Egg Crate Face Return				
Finish	Standard White Powder Coat				
Border	T-Bar Border				

Notes:	Standard of Acceptance: Price 80 / TB / / / B12

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Floor Drain w/ round strainer
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	FD-1

Floor	On-grade				
Finish	Epoxy coated				
Strainer	¼" (6 mm) thick 127 mm diameter nickel bronze				
Pipe Size	100 mm				
	w/ anchor flange and weepholes				
	no hub outlet				

Notes:	Standard of Acceptance: Watts FD-200-A

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Floor Drain w/ oval funnel
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	FD-2

Floor	On-grade				
Finish	Epoxy coated				
Strainer	¼" (6 mm) thick 127 mm diameter nickel bronze				
Funnel	100 x 225 mm				
Pipe Size	100 mm				
	w/ anchor flange and weepholes				
	no hub outlet				

Notes:	Standard of Acceptance: Watts FD-200-EG

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Sump Pump and Pit
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	SP1

Pump			Pit		
Capacity	16 gpm (60 L/min)		Diameter	457 mm	
Head	7 ft		Height	762 mm	
Discharge	¾" NPT				
Mode	automatic				
Motor	1/6 Hp				
	CSA Approved				

Notes: Supply with 9 ft power cord.	Standard of Acceptance: Monarch Submersible Utility Pump UP16M Equinox Sump Pit ESP30

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Heat Recovery Ventilator
Project	Water Works and Water Supply, WTP	Device location	Process Room – Mezzanine Level
Project Number	02-0602	Tag No	HRV1

Net supply airflow	80 L/s				
Static Pressure	125 Pa				
Defrost Type	Electric				
Fan motor	1/10 Hp				
	120 volts 1 phase				
	CSA certified				

Notes: Supply with two (2) outside weatherhoods - duct connection diameter 152 mm.	Standard of Acceptance: Lennox HRV2-200SEP

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Louver / Damper Combination
Project	Water Works and Water Supply, WTP	Device location	Generator Room
Project Number	02-0602	Tag No	L3, L4

Size	762 mmx 762 mm	Damper	Opposed Blade	
Static pres drop (louver)	17.4 Pa (0.07 in. water)		Insulated	
Air Velocity	3.6 m/s (700 fpm)			
Water Penetration	0 at 3.6 m/s			
Material	Aluminum			

Notes:	Standard of Acceptance: Westvent XT-435V Louver Westvent OBX-6H6 Damper

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Pressure Tank
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	PT1

Dimensions	Height: 29.25" (743 mm)		Pump Size	½ Hp	
	Diameter: 16 ¾" (43 mm)		Pre-charge	38 psig	
Inlet Pipe	1 ¼" (32 mm)				
Outlet Pipe	1" (25 mm)				
Boost Pressure	40 psig				
Pressure Switch Setting	40 - 60 psig				

Notes:	Standard of Acceptance: Amtrol RP-10

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Diffuser
Project	Water Works and Water Supply, WTP	Device location	Tank and Process Rooms and Office
Project Number	02-0602	Tag No	SCD

Type	Square Cone				
Finish	Standard white powder coat				
No. of cones	3				

Notes:	Standard of Acceptance: Price SCD / 31 / 3C / B12

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Glycol Make-Up Package
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	

Make-up Capacity	6.8 L/m @ 482 Kpa				
Motor	0.2 kw				
Pressure Range	69 - 482 Kpa				
Solution Container	189 L				
System Connection	½" NPT				

Notes: Package includes pump, built in pressure relief valve, pressure tank, priming valve, PRV, shut-off valve, pressure gauge, and tank with level indicator.	Standard of Acceptance: Expanflex GMP2-50 (HG Specialties Inc.)

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Polyethylene Sump Tank
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	ST1

Capacity	1387 L (305 Imp. gal.)		Tank Size	Length	1854 mm
Burial Depth	above ground			Width	1450 mm
Manhole access	760 mm diam.			Height	635 mm
McPhee access	400 mm diam.				
	CSA certified				

Notes:	Standard of Acceptance: Equinox E 305 LP

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Electric Water Heater
Project	Water Works and Water Supply, WTP	Device location	Office Washroom
Project Number	02-0602	Tag No	HWT-1

Capacity	22.7 L (5 USgal)
Type	Electric
Elements	1.5 kW
	120 volts
	CSA certification

Notes:	Standard of Acceptance:
	Rheem RE6

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Unit Heater
Project	Water Works and Water Supply, WTP	Device location	Generator Room and Underneath Mezzanine Office
Project Number	02-0602	Tag No	UH3, UH8

Type	Horizontal Unit Heater		Motor	1/20 Hp	
Capacity	3.8 kW (w/ water)				
Flow	0.09 L/s				
Pressure Drop	3.0 kPa				
Entering Water Temperature	82 °C				
Entering Air Temperature	16 °C				
Fluid	Propylene Glycol				

Notes:	Standard of Acceptance: Engineered Air H1L

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Wall Radiator
Project	Water Works and Water Supply, WTP	Device location	Office/Washroom
Project Number	02-0602	Tag No	WF-1 / WF-2

Rows	1				
Enclosure Height	305 mm				
Average Water Temperature	77 °C				
Air Temp.	18 °C				
Element	32 mm Copper Tube				
fins	Aluminum 164 fins/m				
Capacity	1.15 kW/m				

Notes: WF-1 length 1.5 m WF-2 length 0.6 m	Standard of Acceptance: Engineered Air WF-1A

DILLON CONSULTING LIMITED Equipment Specification Sheet					
Client	Government of Nunavut		Device Name	Unit Heater	
Project	Water Works and Water Supply, WTP		Device location	Process and Tank Rooms	
Project Number	02-0602		Tag No	UH1, UH2, UH4, UH5, UH6, UH7	
Type	Horizontal Unit Heater		Motor	1/20 Hp	
Capacity	8.6 kW (w/ water)				
Flow	0.19 L/s				
Pressure Drop	3.3 kPa				
Entering Water Temperature	82 °C				
Entering Air Temperature	16 °C				
Fluid	Propylene Glycol				
Notes:			Standard of Acceptance: Engineered Air H1		

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Expansion Tank
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	XT1

Model Number	OT20		Air Precharge	15 psi	
Tank Volume	41 L				
Acceptance Volume	18 L				
System Connection	¾" NPT				
Max. Oper. Pressure	150 psi				
System Media	50% Propylene Glycol				

Notes:	Standard of Acceptance: Expanflex OT20

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	In-Line Circulating Pump
Project	Water Works and Water Supply, WTP	Device location	Process Room (Primary Boiler Loop)
Project Number	02-0602	Tag No	HSP1 / HSP 2

Flow	1.5 L/s				
Total Head	3.0 m (10 ft)				
Flange Pipe Size	38 mm (1½")				
Motor	1/6 Hp				
RPM	1750				
Liquid	50% Propylene Glycol				
Construction	Bronze-Fitted				

Notes:	Standard of Acceptance: Armstrong S35

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Boiler
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	B1 / B2

Type	Water		Max Working Pressure	30 psi	
IBR Net Rating	49.8kW				
AFUE %	84 %				
Fuel	No. 2 Fuel Oil				
Burner Capacity	1.65 GPH (6.25 L/hr)				
Voltage	120 V – 1 phase 60 Hz				
System Solution	50% Propylene glycol				
	ULC Approved				

Notes:

Supply with:

A) control package A350 Temperature
include: - one (1) control module with supply sensor and well.
- two (2) S350 stage modules
- one (1) Y350 power module
- one (1) D350 display module

B) Burnham V8 Inlet Air Accessory Kit (Part #61128003)

Standard of Acceptance:

Burnham V85W

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	In-Line Circulating Pump
Project	Water Works and Water Supply, WTP	Device location	Process Room (Secondary Unit Heater Loop)
Project Number	02-0602	Tag No	HSP4 / HSP5

Flow	1.5 L/s				
Total Head	4.3 m (14 ft)				
Flange Pipe Size	64 mm (2½")				
Motor	1/4 Hp				
RPM	1750				
Liquid	50% Propylene Glycol				
Construction	Bronze-Fitted				

Notes:	Standard of Acceptance: Armstrong S45

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Duct Heater
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	DH1

Duct Size	200 mm		Motor	210 v – 1 phase	
Energy	3.5 kW				
Flow	80 L/s				

Notes:	Standard of Acceptance:
w/ air proving switch and automatic reset thermal cut-out.	Thermolec

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Return Grill
Project	Water Works and Water Supply, WTP	Device location	Office Washroom
Project Number	02-0602	Tag No	EG

Type	Egg Crate Face Return				
Finish	Standard White Powder Coat				
Border	T-Bar Border				

Notes:	Standard of Acceptance: Price 80 / TB / / / B12

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client	Government of Nunavut	Device Name	Floor Drain w/ round strainer
Project	Water Works and Water Supply, WTP	Device location	Process Room
Project Number	02-0602	Tag No	FD-1

Floor	On-grade	
Finish	Epoxy coated	
Strainer	¼" (6 mm) thick 127 mm diameter nickel bronze	
Pipe Size	100 mm	
	w/ anchor flange and weepholes	
	no hub outlet	

Notes:	Standard of Acceptance: Watts FD-200-A

Contents

1.0 General

1.1 GENERAL

.1 The Contractor shall read and be governed by the General Conditions, General Instructions, Instructions to Bidders, Addenda, Form of Tender and Agreement of the complete Specifications for this project.

.2 The complete work under this trade shall be governed by the dictates of good practice in all details of materials and methods even if not minutely specified. The work shall be properly co-ordinated with the requirements of other units of work specified in other sections.

2.0 Scope of Work

2.1 GENERAL

.1 The Contractor shall furnish all labour, materials and necessary equipment to provide complete and operating electrical systems as set forth on the plans and in these Specifications, and as called for elsewhere in the Contract documents. Any work, even if not shown or specified, which is obviously necessary or reasonably implied to complete the work, shall be carried out as if it was both shown and specified.

.2 The responsibility as to which Division provides required articles or materials rest solely with the Contractor. Extras will not be considered based on grounds of difference in interpretation of specifications as to which trade was involved to provide certain specialties or materials.

2.2 UTILITIES

.1 The Contractor shall co-ordinate work of all utility companies for modifications and connection of services. All costs for arrangements and connections of the services shall be borne by the Contractor.

2.3 CODES AND STANDARDS

.1 Where references are made to Standard Specifications such as Electrical and Electronic Manufacturers Association of Canada (EEMAC), National Electrical Manufacturers Association (NEMA), Canadian Standards Association (CSA), Institute of Electrical and Electronic Engineers (IEEE), Insulated Power Cable Engineers Association (IPCEA), Instrument Society of America (ISA), etc., the latest edition and revisions of such Standard Specifications shall apply.

.2 The electrical installation shall comply with the latest edition of the Canadian Electrical Code, and all applicable municipal and local codes and the regulations of local inspection authorities.

.3 CSA Electrical Bulletins in force at time of Tender submission, while not identified and specified by number in these Specifications, are to be considered as forming part of related CSA Part II Standard and must be complied with.

2.4 USE OF PRODUCTS DURING CONSTRUCTION

.1 Any equipment used for temporary or construction purposes shall be acceptable to the Engineer. Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

2.5 TESTS

.1 Before the electrical installation is placed in operation, the Contractor shall make suitable tests to establish that all equipment, devices, and wiring have been correctly installed, are in satisfactory working condition, and will operate as intended.

.2 Before energizing any portion of the electrical systems, perform megger tests on all feeders. Results to conform to IPCEA Standards, to the satisfaction of the authorized inspection authority and to the Engineer.

.3 Upon completion of the installation and immediately prior to final inspection and takeover, check the load balance on all feeders at distribution centres, motor starters and panelboards. Tests to be carried out by turning on all possible loads and checking load current balance. If load imbalance exceeds 10 percent, reconnect circuits to balance load.

.4 All tests to be performed in the presence of the Engineer, suitably logged, tabulated, signed and included in the Operation and Maintenance Manuals.

.5 Where specific tests are required for specific systems or equipment, they shall be so indicated in appropriate sections of the specifications, furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Insulation resistance of each circuit shall be measured before energizing (with neutral ground disconnected) as follows:

.1 Line(s) to neutral.

.2 Line(s) to ground.

.3 Neutral to ground.

.4 Line to line(s).

.8 Circuit testing shall be as follows:

.1 Motor feeders are tested with motors disconnected and controller open.

.2 Motor control circuits are tested with control stations and over-current devices connected, from phase to ground only.

.3 Lighting feeders are tested with feeder breaker open and panelboard connected.

.4 Lighting branch circuits are tested after all lamp holders, receptacles, fixtures, and similar items are connected, with switches turned on but before lamping. If circuits feed auto-transformer type ballasts, the only reading possible will be from line or neutral, to ground. If fixtures with power factor correcting capacitors connected line-to-line are involved, it may be necessary to disconnect them to avoid capacitor over-voltage.

.9 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 1000 V instrument.

.2 Check resistance to ground before energizing.

2.6 OPERATIONS AND MAINTENANCE DATA

.1 Operations and Maintenance Data shall be submitted in accordance with Section 01730 - Operations and Maintenance Manual.

3.0 Workmanship and Material

3.1 GENERAL

.1 All work shall be performed by competent tradesmen, be executed in a workmanlike manner and present a neat, mechanical appearance when completed.

.2 For work involving specialties such as medium voltage electrical distribution, instrumentation, etc., the Contractor shall employ only tradesmen or Sub-contractors fully qualified and experienced in such work.

.3 All materials to be new, meeting the quality specified and conform to the standards of the Canadian Standards Association. Where equipment or materials are specified by technical description only, they are to be of the best commercial quality obtainable for the purpose.

.4 Electrical equipment that is shown on the plans or called for in the specifications that is not CSA approved to be treated by Division 16 in one of the following ways:

.1 Make known to the Engineer in writing not less than ten (10) days prior to closing date of tender, and

.2 Make allowance in tender for having said equipment approved by local Electrical Inspection Authorities.

.5 Wall and building penetrations to be located so as not to affect the wall system. All holes to be made with a hole saw, cleaved and caulked.

3.2 UNIFORMITY OF EQUIPMENT

.1 Unless otherwise specifically called for in the specifications, uniformity of manufacturer to be maintained throughout the building for any particular item or type of equipment.

3.3 DRAWINGS AND SPECIFICATIONS

.1 Electrical drawings indicate general location and route to be followed by conduits and/or wire and do not show all structural and mechanical details. In some cases, conduit or wiring is not shown on the plans or shown diagrammatically in schematic or riser diagrams. Conduit and wiring to be installed physically to conserve headroom, furring spaces, etc.

.2 Follow structural and mechanical drawings for details of this work and install electrical conduits, boxes and fittings to co-ordinate with structural and mechanical work and details. Refer to architectural and structural drawings for accurate building dimensions.

.3 In order to provide sufficient detail and maximum degree of clarity on drawings, symbols used for various electrical devices, particularly wall mounted devices, take up more space on the drawings than the device does on the wall. In these instances, locate device on wall with primary regard for convenience of operation and usage of wall space, rather than stringing devices out along wall so as to comply with scale locations of electrical symbols.

4.0 Execution

4.1 EXAMINATION OF OTHER DRAWINGS

.1 The Contractor shall examine carefully the structural, architectural and mechanical drawings and work of other trades, to satisfy himself that the work under this Contract can be satisfactorily carried out without changes to the buildings and layouts as shown on the plans.

.2 Should any item arise indicating conflict with equipment of other trades or requiring additional work beyond the intent as described in the specifications and shown on the drawings, the Contractor shall immediately bring the matter to the attention of the Engineer before submitting his Tender. Failure to do so constitutes acceptance of responsibility for any necessary work.

4.2 PERMIT, INSPECTION, FEES

.1 The Contractor shall obtain all permits required, (paying all fees levied) and after completion of the work, shall furnish to the Engineer, prior to final completion certificate issuance, a Certificate of Final Inspection and Approval from the Electrical Inspection Authorities. Permits shall be taken out at the beginning of the work.

4.3 SETTING OUT THE WORK

.1 The Contractor shall thoroughly examine the drawings and specifications and especially figured dimensions immediately after the Contract is awarded and report any discrepancy, error, or omission to the Engineer. The Contractor shall lay out his own work and do all necessary levelling and measuring. Figures, full size and dimensioned drawings shall take precedence over scale measurements of drawings.

.2 The Contractor shall be responsible for correcting all work completed contrary to the intent of the drawings and specifications and shall bear all costs for same. Where the intent of the drawings and specifications is not clear, he should obtain a clarification from the Engineer before proceeding with the work, otherwise no compensation will be forthcoming for any necessary adjustments.

.3 Where any equipment supplied by this Contractor must be built in with the work of other Contractors, this Contractor shall be responsible for the supply of the equipment to be built in or measurements to allow necessary opening to be left so as not to delay the work.

4.4 ALTERATIONS

.1 Alterations entailing additional work or deletions shall be carried out only upon written request by the Engineer.

4.5 LOCATION OF OUTLETS AND DEVICES

.1 The Engineer reserves the right to change location of equipment to within 3 m of points indicated on plans without extra charge providing the Contractor is advised prior to installation.

4.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not indicated, verify before proceeding with installation.

.3 Install electrical equipment at the following heights unless indicated otherwise:

.1 Panelboards: 1800 mm to top or as required by Code.

.2 Disconnect switches, thermostats: 1350 mm.

4.7 PROTECTION

.1 Protect the work of others from damage resulting from the work of this Division.

.2 Protect the work of this Division from that of others, make good any damage, remove all debris and rubbish and leave the project site in a clean and tidy condition to the approval of the Engineer.

.3 Protect exposed electrical live equipment during construction for personnel safety.

.4 Shield and mark live parts "LIVE 120 VOLTS" or with appropriate voltage in English.

5.0 Products

5.1 MECHANICAL EQUIPMENT WIRING

.1 Provide all labour and materials required to complete electrical power, control and instrumentation wiring for plumbing, heat tracing and control equipment as called for in these specifications and/or shown on the drawings.

.2 Provide all motor circuit protection, combination starters and disconnects as required for mechanical equipment unless otherwise specifically noted in these specifications or on the drawings.

.3 Motors will be supplied and set in place for mechanical equipment by Division 15 & 13.

6.0 Identifications

6.1 EQUIPMENT IDENTIFICATION

.1 Provide engraved nameplate identification on all distribution switchboards and components, panelboards, motor control and protection equipment, miscellaneous system cabinets, terminal boxes, local and remote mechanical and process equipment switches. Identify all relays in control panels.

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically secured to the equipment with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Nameplate sizes and wording on nameplates to be supplied by Engineer prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be in English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

6.2 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings with heat embossed slip-on sleeves on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout the system.

6.3 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling or floor and at 15 m intervals.

.3 Colour to be 25 mm wide prime colour and 20 mm wide auxiliary colour.

6.4 WIRING TERMINATIONS

.1 Lugs, terminals and screws used for termination of wiring to be suitable for either copper or aluminum conductors.

6.5 MANUFACTURER'S AND CSA LABELS

.1 Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

6.6 WARNING SIGNS

.1 Provide warning signs, as specified or to meet requirements of Inspection Authorities and Engineer.

.2 Use porcelain enamel signs, minimum 175 x 250 mm size.

END OF SECTION

PART 1 - GENERAL - Not applicable

PART 2 - PRODUCTS

2.1 Equipment

.1 Clamps for grounding of conductor, size as required to electrically conductive underground water pipe.

.2 Plate electrodes: copper surface are 0.2m², 1.6 mm thick.

.3 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, type TW 90, size as indicated.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 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 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, conductors, connectors, accessories, as indicated, to conform to requirements of Engineer and local authority having jurisdiction over installation. Where EMT or PVC is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment

.9 Connect building structural steel and metal siding to ground by welding copper to steel.

.10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 Electrodes

.1 Install plate electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use size 2/0 AWG copper conductors for connections to electrodes.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 Equipment Grounding

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, distribution panels, PLC panel.

3.4 Communication Systems

.1 Install grounding connections for Telephone and PLC communication.

3.5 Grounding Bus

.1 Install copper grounding bus mounted on insulated supports on wall as indicated.

.2 Ground non-current carrying metal parts to ground bus with individual insulated copper connections minimum size #6 AWG.

3.6 Permafrost

.1 Bond non-current carrying metal parts together with size #6 AWG copper equipotential conductor. Run conductor from ground bus or service neutral bar to, but not necessarily limited to, following indoor systems and equipment:

.1 Hot water heating system.
.2 Main water pipe.
.3 Main building drain.
.4 Oil line.
.5 Telephone lead-in or service conduits, near panels.
.6 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

.2 Install four plate electrodes in original undisturbed ground.

.3 Install ground wire from service neutral bar to and where buried use bare copper not smaller than size 2 AWG strand, and at least 460 mm below ground. Bond ground conductor, or short tap from it, to outside metal sheathing of building close to power service conduit. Use lug or cast clamp, with bronze or plated bolt, nut and washers (not sheet metal screw or wood screw). Remove paint from sheathing for good contact. Conduit is required only on outside wall of building. Indoors, run bare and fasten as specified for equipotential bonding wire.

.4 Install electrode interconnections where metal parts, circuits or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

3.7 Field Quality Control

.1 Perform tests in accordance with Section 01735 and 16010.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

1.0 General

.1 Supply and installation of all hangers, supports and inserts for the installation of conduits and all other electrical equipment, as shown on the drawings and specified herein.

2.0 Products

2.1 COMPONENTS

.1 Single Conduit Run Supports: Galvanized single hole conduit straps up to 50 mm diameter, two hole above 50 mm diameter or ringbolt type hangers.

.2 Multiple Conduit Run Supports: Preformed galvanized steel channel conduit rack with 25 percent spare capacity, and one piece conduit clamps. Unistrut, Electrovert or approved equal.

.3 Sleeves in Concrete: 16 gauge pipe, sand filled, diameter as required.

3.0 Execution

3.1 INSTALLATION

.1 Install all supporting devices to maintain headroom, neat mechanical appearance and to support equipment loads as required.

.2 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes.

.3 Do not cut or drill beams, joists or structural steel unless written permission of the Engineer is obtained.

.4 Distance between conduit cable supports not to exceed code requirements.

.5 Supports to be suitable for the real loads imposed by equipment.

.6 Supports to be securely fastened, free from vibration and excessive deflection or rotation.

.7 Use metal anchors for all loads.

.8 Shot driven pins may only be used with the approval of the Engineer.

.9 Threaded rod hangers where used are to be adequately sized.

.10 Supporting methods for major equipment and lighting fixtures are to be approved by Engineer.

.11 Allow for future addition of equipment.

.12 Use approved inserts in concrete or masonry material, co-ordinate methods of fastening electrical equipment supports with other sections of work.

.13 Avoid penetrating building vapour barrier.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1 Section 16151.

1.2 References

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

1.3 Product Data

.1 Submit product data in accordance with Section 01340.

PART 2 - PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size for branch circuits: 12 AWG.

.2 Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 Armoured Cables

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC901.

.3 Armour: interlocking type fabricated from aluminum strip.

2.3 Control Cables

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: stranded annealed copper conductors, sized as indicated, with PVC insulation with shielding of aluminum polyester shield and overall covering of PVC jackets.

.3 600 V type: stranded annealed copper conductors, sizes as indicated with insulation type RW90 x-link insulation

PART 3 - EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:
  .1 In conduit systems in accordance with Section 16133.

3.2 Installation of Armoured Cables

.1 Group cables wherever possible.

.2 Install cable in ceiling space for drops to lighting fixture only. Maximum cable length shall not exceed 3 metres.

.3 Terminate cables with cable clamps or connectors.

3.3 Installation of Control Cables

.1 Install control cables in conduit.

.2 Ground control cable shield.

PART 1 - GENERAL

Not Used

PART 2 - MATERIALS

2.1 Pull and Junction Boxes

.1 Pull and junction boxes shall conform to the following general requirements.
- .1 NEMA 12 for general use.
- .2 NEMA 4x in areas where the possibility of exposure to moisture (e.g. wetted areas) and/or corrosive vapours exists.
- .3 NEMA 4x in all exterior areas.

.2 NEMA 12 construction shall conform to the following minimum requirements:
- .1 12GA galvanized steel with seams continuously welded, ground smooth, no knockouts;
- .2 Zinc-rich coating on all seams;
- .3 stainless steel captivated cover screws threaded into sealed wells;
- .4 NEMA 12 classification;
- .5 UL listed.

.3 NEMA 4x construction shall conform to the following minimum requirements:
- .1 14GA steel with polyester powder coating inside and out over phosphatized surfaces;
- .2 Seams continuously welded, ground smooth, no knockouts;
- .3 Stainless steel clamps on four sides;
- .4 Stainless steel hinges;
- .5 Flat cover with oil resistant gasket;
- .6 NEMA 4x classification;
- .7 UL listed.

PART 3 - EXECUTION

3.1 Installation of Outlet Boxes

.1 Use locknut and bushing for boxes in non-hazardous areas.

.2 Use cast metal boxes with threaded conduit hubs.

.3 Use Type FS and FD boxes in exterior and wet areas and where exposed rigid steel conduit is required.

.4 Fill unused punched-out, tapped, or threaded hub openings with insert plugs.

.5 Use outlet boxes sized to accommodate quantity of conductors enclosed.

.6 Use outlet boxes sized to accommodate conduit tying into box.

.7 Install pull boxes or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.

.8 Make covers of boxes accessible.

.9 Install pull boxes or junction boxes rated for the area classification.

.10 Install rigid conduit squarely into boxes that do not have hubs or are drilled and tapped.

.11 Install with locknut on the outside and bushing on inside.

3.2 Installation of Junction and/or Pull Boxes

.1 Install junction boxes and pull boxes plumb and square to building lines and as required due to number of bends, distance, or pulling conditions.

.2 Securely anchor junction boxes and pull boxes, and make readily accessible.

.3 Do not total more than 180 degrees, including entrance and exit to the boxes, for conduit bends.

END OF SECTION