

MECHANICAL MOTORLIST																							
UNIT #	UNIT DESCRIPTION	UNIT LOCATION	LOAD			VOLT	PH	EQUIPMENT			STARTER			DISCONNECT			CONTROL			REMARKS			
			MCA	KW	HP			S	I	C	S	I	C	S	I	C	S	I	C		S	I	C
UNIT HEATER																							
UH-1	SCL STRUCTURE LIBRARY	SCL STRUCTURE LIBRARY			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	1	
UH-2	SCL STRUCTURE LIBRARY	SCL STRUCTURE LIBRARY			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	1	
UH-3	SURVEY TOOLS LOCKER	SURVEY TOOLS LOCKER			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	1	
UH-4	SURVEY TOOLS LOCKER	SURVEY TOOLS LOCKER			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	1	
UH-5	RPSS WORKSHOP	RPSS WORKSHOP			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	1	
UH-6	RPSS WORKSHOP	RPSS WORKSHOP			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	1	
AIR COMPRESSOR																							
AC-1	SCL STRUCTURE STORAGE	BUILDING				20	230	1	M	M	E	E	E	INT	E	E	E	M	M	M	INT	3	
UNIT HEATER																							
P-1	BOILER CIRCULATOR	MECHANICAL ROOM			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	M	M	M	BC		
EXHAUST FAN																							
EF-1	SCL STRUCTURE LIBRARY	SCL STRUCTURE LIBRARY ROOF			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	E	E	E	SW		
EF-2	SURVEY TOOLS LOCKER	SURVEY TOOLS LOCKER ROOF			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	E	E	E	SW		
EF-3	RPSS WORKSHOP	RPSS WORKSHOP ROOF			1/4	120	1	M	M	E	M	M	M	INT	E	E	E	E	E	E	SW		
EF-4	SCL STRUCTURE WASHDOWN	SURVEY TOOLS LOCKER			FRAC	120	1	M	M	E	M	M	M	INT	E	E	E	E	E	E	SW		
HEAT PUMP																							
HP-1/CU-1	SCL STRUCTURE LIBRARY	SCL STRUCTURE LIBRARY	12.5				208	1	O	M	E	M	M	M	INT	E	E	E	M	M	M	TSTAT	2

DEFINITIONS:
S SUPPLIED BY M DENOTES "BY MECHANICAL CONTRACTOR"
I INSTALLED BY E DENOTES "BY ELECTRICAL CONTRACTOR"
C CONNECTED BY O DENOTES "BY OTHERS NOT LISTED ABOVE"

NOTES:
1) THERMOSTAT OPERATES BOTH UNIT HEATERS FOR SPACE
2) WIRED TO SPACE THERMOSTAT
3) PROVIDE OUTLET FOR AIR COMPRESSOR

INT INTEGRAL PART OF UNIT
TSTAT CONTROLLED BY THERMOSTAT, SUPPLIED BY MECH CONTRACTOR, WIRED BY ELEC CONTRACTOR
ASTAT CONTROLLED BY AQUASTAT, SUPPLIED BY EQUIPMENT MANUFACTURER
TC TIME CLOCK SWITCH
BC BOILER CONTROL PANEL
SW WALL SWITCH

HEAT PUMP - FURNISHED BY DFO

EQUIPMENT TAG	INDOOR LOCATION	OUTDOOR LOCATION	UNIT TYPE	MANUFACTURER	MODEL	COOLING NOMINAL TON	SEER	HEATING CAPACITY (MBH)	AIRFLOW (CFM)	E.S.P. (IN H2O)	SIZE (LXWXH) (IN)	WEIGHT (LB)	POWER (V/PH/Hz)	MCA	INDOOR/OUTDOOR	NOTES
HP-1/CU-1	SCL STRUCTURE LIBRARY	SCL STRUCTURE LOADING	WALL	SAMSUNG	AC024MNADCH/AA	2.0	18.3	31	551	-	47"X10"X28"	90	208/1/60	12.5		1,2,3,4,5,6

NOTES:
1. UNIT TO BE SINGLE POINT POWER CONNECTION WITH OUTLET
2. PROVIDE 7 DAY PROGRAMMABLE THERMOSTAT TO CONNECT TO UNITS
3. PROVIDE FILTERS WITH UNIT
4. PROVIDE ISOLATION VALVES ON SUPPLY/RETURN
5. USE R-410A REFRIGERANT
6. PROVIDE PACKAGED CONDENSATE PUMP AND EXTENDED DRAIN PANS
7. UNIT TO BE COMPLETE WITH DISCONNECT SWITCH

FAN SCHEDULE - BASIS OF DESIGN

EQUIPMENT TAG	SERVICE	LOCATION	TYPE	MANUFACTURER	MODEL	AIR FLOW (CFM)	E.S.P. (IN WC)	FAN (RPM)	DRIVE TYPE	MOTOR (HP)	POWER (V/Phase/Hz)	SOUND LEVEL (SONES)	REMARKS
EF-1	SCL STRUCTURE LIBRARY	SCL STRUCTURE LIBRARY ROOF	ROOF	GREENHECK	G-070-VG	225	0.3	1511	DIRECT	FRAC	120/1/60	4.1	1
EF-2	SURVEY TOOLS LOCKER	SURVEY TOOLS LOCKER ROOF	ROOF	GREENHECK	G-070-VG	225	0.3	1511	DIRECT	FRAC	120/1/60	4.1	1
EF-3	RPSS WORKSHOP	RPSS WORKSHOP ROOF	ROOF	GREENHECK	G-099-VG	225/1225	0.3	1511	DIRECT	1/4	120/1/60	4.1	1,2
EF-4	SCL STRUCTURE WASHDOWN	SURVEY WORKSHOP ROOF	ROOF	GREENHECK	G-070-VG	225	0.3	1511	DIRECT	FRAC	120/1/60	4.1	1

NOTES:
1. BACKDRAFT DAMPER (<300CFM); MOTORIZED DAMPER (>300 CFM)
2. 2 SPEED OPERATION FAN WITH WALL SWITCH FOR HIGH OPERATION

DIFFUSERS AND GRILLES - BASIS OF DESIGN

UNIT TAG	MANUFACTURER	MODEL	DESCRIPTION/TYPE	SERVICE	NOTES
L-1	E.H.PRICE	DE439	EXTERIOR LOUVER, ALUMINUM CONSTRUCTION	EXTERIOR AIR TERMINATIONS	1,2,3,4,5

NOTES:
1. PROVIDE DIFFUSERS AND GRILLES WITH BORDER STYLES THAT ARE COMPATIBLE WITH ADJACENT WALLS AND CEILING SYSTEMS. REFER TO DFO REPRESENTATIVE
2. NC LEVELS ARE BASED ON OCTAVE BANDS 2-7 SOUND POWER LEVELS MINUS A ROOM ABSORPTION OF 10 DB. MEASURED AS PER ASHRAE 70-91
3. PROVIDE OPPOSED BLADE DAMPERS FOR RETURN AND EXHAUST GRILLES LOCATED ABOVE GYPSUM BOARD CEILING WHERE VOLUME DAMPERS ARE NOT ACCESSIBLE
4. COLOUR TO SUIT DFO REPRESENTATIVE AND TO BE SELECTED DURING SHOP DRAWING REVIEW
5. LOUVER TO BE COMPLETE WITH 100MM FORMED MOUNTING FLANGE

AIR COMPRESSOR SCHEDULE - BASIS OF DESIGN

EQUIPMENT TAG	LOCATION/SERVICE	MANUFACTURER	MODEL	TANK SIZE GAL	DUTY CYCLE	FREE AIR CFM @ 135 PSI	NOMINAL HP	POWER (VOLT/PHASE/Hz)
CA-1	SCL STRUCTURE STORAGE	INGERSOLL RAND	RS151-A138-TAS	120	100%	77	20	230/1/60

NOTES:
1). INTEGRAL AIR DRYER

SYMBOL LEGEND AND ABBREVIATIONS											
PIPING						DUCTWORK					
EXISTING			NEW			EXISTING			NEW		

PUMP SCHEDULE - BASIS OF DESIGN

EQUIPMENT TAG	DESCRIPTION	LOCATION	SERIES	MANUFACTURER	MODEL	FLOW (GPM)	LIQUID TEMP. (F)	HEAD (FT)	(PSI)	MOTOR (HP)	POWER (V/Ph)	VFD	NOTES
P-1	BOILER CIRCULATOR	MECHANICAL ROOM	MAGN3	GRUNDFOS	MAGN3 40-120	35	150	32	14	1	120/1/60	Y	

NOTES:

HYDRONIC UNIT HEATER SCHEDULE - BASIS OF DESIGN

EQUIPMENT TAG	LOCATION/SERVICE	MANUFACTURER	MODEL	TYPE	MOUNTING TYPE	CAPACITY MBH	EWT F	LWT F	FLOW GPM	POWER (VOLT/PHASE/Hz)
UH-1	SCL STRUCTURE LIBRARY	SIGMA	084H	HYDRONIC	CEILING	62.8	160	140	6.4	120/1/60
UH-2	SCL STRUCTURE LIBRARY	SIGMA	084H	HYDRONIC	CEILING	62.8	160	140	6.4	120/1/60
UH-3	SURVEY TOOLS LOCKER	SIGMA	058H	HYDRONIC	CEILING	44.6	160	140	4.6	120/1/60
UH-4	SURVEY TOOLS LOCKER	SIGMA	058H	HYDRONIC	CEILING	44.6	160	140	4.6	120/1/60
UH-5	RPSS WORKSHOP	SIGMA	084H	HYDRONIC	CEILING	62.8	160	140	6.4	120/1/60
UH-6	RPSS WORKSHOP	SIGMA	084H	HYDRONIC	CEILING	62.8	160	140	6.4	120/1/60

NOTES:
1. ALL UNIT HEATERS TO BE CONTROLLED BY 7 DAY PROGRAMMABLE THERMOSTAT FOR EACH UNIT
2. SUPPLY WITH FACTORY INSTALLED DISCONNECT SWITCH
3. CONFIRM THERMOSTAT PROGRAMMING WITH DFO REPRESENTATIVE

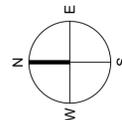
MECHANICAL DRAWING LIST

DWG. NO	DESCRIPTION	SCALE	BUILDING PERMIT	TENDER	CONSTRUCTION
M0.01	MECHANICAL COVERSHEET	NTS	X	X	
M0.02	MECHANICAL SPECIFICATION	NTS	X	X	
M0.03	MECHANICAL SPECIFICATION	NTS	X	X	
M1.01	MECHANICAL ROOF PLAN	1:100	X	X	
M2.01	PLUMBING PLAN	1:100	X	X	
M3.01	MECHANICAL PLAN	1:100	X	X	
M4.01	MECHANICAL DETAILS	NTS	X	X	

**PACIFIC BIOLOGICAL STATION
TECHNICAL SERVICES BUILDING
MECHANICAL UPGRADE
MECHANICAL SCHEDULES**

SCALE AS NOTED
DATE NOV 19, 2019
DRAWING NUMBER **MO.01**
REVISION 1

DWG. NO.	DRAWING REFERENCES	NOTES	NO.	DATE	REVISIONS
			1	2019-11-20	ISSUED FOR TENDER



DIVISION 23 HVAC

1. GENERAL

1.1 RELATED REQUIREMENTS

- 1 THIS SECTION OF THE SPECIFICATION FORMS PART OF THE CONTRACT DOCUMENTS AND IS TO BE READ, INTERPRETED, AND COORDINATED WITH ALL OTHER PARTS.
- 1.1 **GENERAL SECTION**
- 1.2 **THIS SECTION**
- 1.3 **PROVIDE SHALL MEAN SUPPLY AND INSTALL:**
- 2 CONSULTANT SHALL MEAN CONSULTING PROFESSIONAL ENGINEERS
- 3 PROVIDE COMPLETELY TESTED AND OPERATIONAL SYSTEMS TO MEET THE REQUIREMENTS DESCRIBED HEREIN AND IN COMPLETE ACCORD WITH APPLICABLE CODES AND ORDINANCES.
- 4 CONTRACT DOCUMENTS DRAWINGS OF THIS DIVISION ARE DIAGRAMMATIC AND APPROXIMATELY TO SCALE UNLESS DETAILED OTHERWISE. THEY ESTABLISH SCOPE, MATERIAL, AND INSTALLATION QUALITY BUT NOT DETAILED INSTALLATION INSTRUCTIONS.
- 5 FOLLOW MANUFACTURER'S RECOMMENDED INSTALLATION INSTRUCTIONS, DETAILS, AND PROCEDURES FOR EQUIPMENT, SUPPLEMENTED BY REQUIREMENTS OF THE CONTRACT DOCUMENTS.
- 6 BEFORE SUBMITTING TENDERS, VISIT AND EXAMINE THE SITE AND NOTE ALL CHARACTERISTICS AND FEATURES AFFECTING THE WORK. NO ALLOWANCES WILL BE MADE FOR ANY DIFFICULTIES ENCOUNTERED OR ANY EXPENSES INCURRED BECAUSE OF ANY CONDITIONS OF THE SITE OR ITEMS EXISTING THEREON, WHICH IS VISIBLE OR KNOWN TO EXIST AT THE TIME OF TENDER.
- 7 CLARIFICATIONS OR REQUESTS FOR ALTERNATE MATERIALS OR EQUIPMENT MUST BE SUBMITTED IN WRITING TO THE CONSULTANT NO LATER THAN SEVEN (7) WORKING DAYS PRIOR TO THE MECHANICAL TRADES' CLOSING TENDER DATE. APPROVAL OF REQUESTS SHALL BE GIVEN BY THE CONSULTANT.
- 8 MAKE REFERENCE TO ELECTRICAL, MECHANICAL, STRUCTURAL, AND ARCHITECTURAL DRAWINGS, WHERE AVAILABLE, WHEN SETTING OUT WORK. CONSULT WITH RESPECTIVE DIVISIONS IN SETTING OUT LOCATIONS FOR EQUIPMENT, WORK, AND PIPING, SO THAT CONTACTS ARE AVOIDED AND SYMMETRICAL, EVEN SPACING IS MAINTAINED. JOINTLY WORK OUT ALL CONTACTS ON SITE BEFORE FABRICATING OR INSTALLING ANY MATERIALS OR DUCTWORK.

1.3 CODE COMPLIANCE, PERMITS AND FEES

- 1 ALL WORK SHALL COMPLY WITH CURRENT EDITIONS OF THE NATIONAL, PROVINCIAL, AND MUNICIPAL CODES, STANDARDS, ACTS AND BYLAWS AND WILL MEET THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
- 2 OBTAIN ALL PERMITS AND PAY ALL FEES APPLICABLE TO THE SCOPE OF WORK. CONTRACTOR SHALL ARRANGE FOR INSPECTIONS OF THE WORK BY THE AUTHORITIES HAVING JURISDICTION AND SHALL PROVIDE CERTIFICATES INDICATING FINAL APPROVAL.

1.4 TENDER PRICE BREAKDOWN

- 1 SUBMIT A TENDER PRICE BREAKDOWN, AS A MINIMUM, INCLUDE THE FOLLOWING IN THE TENDER PRICE BREAKDOWN:
 - 1 MECHANICAL EQUIPMENT, MATERIALS, LABOUR
 - 2 SHOW WORK AS ACTUALLY INSTALLED. DRAWINGS SHALL BE AVAILABLE ON A WEBSITE BASED FOR REVIEW BY DFO REPRESENTATIVE.
 - 3 CONTROLS, EQUIPMENT, MATERIALS, LABOUR

1.5 SUBMITTALS

- 1 CONTRACTOR SHALL PROVIDE AND SUBMIT TO THE DFO REPRESENTATIVE AN ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD SCHEDULE B AND ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE SCHEDULE C-8 FOR SERVICING ENGINEERING.
- 2 SHOP DRAWINGS: SUBMIT SHOP DRAWINGS FOR ALL EQUIPMENT AS ELECTRONIC FILES (FILE FORMAT: PDF), WHEN MANUFACTURERS CUT SHEETS APPLY TO A PRODUCT SERIES RATHER THAN A SPECIFIC PRODUCT. THE DATA SPECIFICALLY APPLICABLE TO THE PRODUCT SHALL BE CLEARLY INDICATED BY OTHER MEANS. EACH SUBMITTED PIECE OF LITERATURE AND DRAWINGS SHALL CLEARLY REFERENCE THE SPECIFICATION AND/OR DRAWING THAT THE SUBMITTAL IS BEING REFERENCED TO. THE SUBMITTALS SHALL BE ACCEPTED AS CUT SHEETS TO FULFILL SUBMITTAL REQUIREMENTS. SUBMITTALS SHALL INCLUDE A COMPLETE BILL OF MATERIALS OF EQUIPMENT TO BE USED INCLUDING QUANTITY, MANUFACTURER, MODEL NUMBER, AND OTHER RELEVANT TECHNICAL DATA.
- 3 CLOSEOUT SUBMITTALS: PROVIDE A DIGITAL COPY, PREPARED BY THE MECHANICAL CONTRACTOR.
 - 1 OPERATION AND MAINTENANCE MANUAL, APPROVED BY DFO, AND FINAL COPIES DEPOSITED WITH THE DFO REPRESENTATIVE A MINIMUM OF 14 DAYS PRIOR TO THE COMMENCEMENT OF WORK.
 - 2 OPERATION AND MAINTENANCE MANUAL TO INCLUDE BUT NOT LIMITED TO:
 - 1 LAYMAN'S DESCRIPTION OF THE SYSTEMS AND ASSOCIATED CONTROLS.
 - 2 OPERATIONAL INSTRUCTIONS, SERVICING, MAINTENANCE, OPERATION, AND TROUBLE-SHOOTING INSTRUCTIONS FOR EACH ITEM OF EQUIPMENT.
 - 3 WARRANTIES.
 - 4 EQUIPMENT MANUFACTURER'S PERFORMANCE DATASETS INDICATING POINT OF OPERATION AS LEFT AFTER COMMISSIONING IS COMPLETE.
 - 5 TESTING, ADJUSTING, AND BALANCING REPORTS.
 - 6 LIST OF SUPPLIERS AND CONTACT INFORMATION.

1.6 RECORD DRAWINGS

- 1 CONTRACTOR SHALL MARK CHANGES AS WORK PROGRESSES AND AS CHANGES OCCUR. USE DIFFERENT COLOUR WATERPROOF INK FOR EACH CHANGE. DO NOT USE RED OR BLACK INK. TRANSFER INFORMATION WEEKLY TO THE CONSULTANT AS ACTUALLY INSTALLED. DRAWINGS SHALL BE AVAILABLE ON A WEBSITE BASED FOR REVIEW BY DFO REPRESENTATIVE.
- 2 IDENTIFY EACH DRAWING IN LOWER RIGHT CORNER OF 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 OR DATE).
- 3 SUBMIT TO DFO REPRESENTATIVE FOR APPROVAL, AND MAKE CORRECTIONS AS DIRECTED.
- 4 SUBMIT COMPLETED CAD AND PDF RECORD DRAWINGS WITH FINAL OPERATING AND MAINTENANCE MANUALS WITHIN TWO (2) WEEKS OF SUBSTANTIAL COMPLETION IN ELECTRONIC FORMAT. FAILURE TO SUBMIT DRAWINGS WILL BE CONSIDERED AS THE WORK BEING UNDESIRABLE BY THE OWNER AND DEDUCTED FROM THE CONTRACTOR'S HOUR BACK AMOUNT.
- 5 GO TO TRANSFER RECORD INFORMATION ONTO DRAWINGS A USB DRIVE AS THESE CONTRACTORS RESPONSIBILITY. CONSULTANT WILL RELEASE DRAWINGS TO CONTRACTOR AFTER SIGNING A COPYRIGHT FORM. COMPLETE THE CONTRACTOR'S FORM TO UTILISE THIS CONSULTANT FOR TRANSFERRING AS BUILT INFORMATION. ALLOW 5400 SHEET FOR ALL DRAWINGS IN THE CONSTRUCTION SET. THIS WILL COVER COSTS FOR DRAFTING TIME (MATERIALS NOT REQUIRED).

1.7 QUALITY OF WORK

- 1 ALL WORK SHALL BE BY QUALIFIED TRADESMEN WITH VALID PROVINCIAL TRADE QUALIFICATION CERTIFICATES. SPOT CHECKS WILL BE MADE BY THE CONSULTANT. WORK WHICH DOES NOT CONFORM TO STANDARDS SPECIFIED BY THE CONSULTANT AND THE TRADE, MAY BE REJECTED BY THE CONSULTANT. THE CONTRACTOR SHALL REJECT REJECTED WORK TO THE ACCEPTED STANDARD AT NO COST TO THE OWNER.

1.8 METRIC CONVERSION

- 1 ALL UNITS IN THIS DIVISION ARE EXPRESSED IN SI UNITS.
- 2 ON ALL SUBMITTALS (SHOP DRAWINGS ETC.) USE THE SAME SI UNITS AS STATED IN THE SPECIFICATION. EQUIPMENT NOMINAL DIAMETERS OF PIPES, METRIC AND IMPERIAL.
- 3 WHEN PIPES ARE SPECIFIED WITH METRIC DIMENSIONS AND IMPERIAL SIZE PIPES ARE AVAILABLE, PROVIDE EQUIPMENT NOMINAL IMPERIAL SIZE PIPE AS INDICATED IN THE TABLE, AND PROVIDE AT NO EXTRA COST ADAPTERS TO ENSURE COMPATIBLE CONNECTIONS TO ALL METRIC SIZE FITTINGS, EQUIPMENT, AND PIPING.
- 2 WHEN CSA APPROVED SI METRIC PIPES ARE PROVIDED, THE CONTRACTOR SHALL PROVIDE AT NO EXTRA COST ADAPTERS TO ENSURE COMPATIBLE CONNECTIONS BETWEEN THE SI METRIC PIPES AND ALL NEW AND EXISTING EQUIPMENT.

Metric		Imperial	
mm	inches	mm	inches
Nominal Outside Diameter of Pipe		Nominal Outside Diameter of Pipe	
3	1/8	1/2	2
6	1/4	3/4	3
12	3/8	1 1/2	6
15	1/2	2	8
20	3/4	100	4
25	1	125	5
32	1 1/4	150	6

1.9 CUTTING, PATCHING AND CORING

- 1 PROVIDE HOLES AND SLEEVES, CUTTING AND FITTING REQUIRED FOR MECHANICAL WORK. RELOCATE IMPROPERLY LOCATED HOLES AND SLEEVES. ALL WORK SHALL BE COORDINATED WITH OTHER TRADES.

1.10 COMPLIANCE WITH ENERGY BY-LAW

- 1 ALL EQUIPMENT INSTALLED ON THIS PROJECT SHALL COMPLY WITH:
 - 1 NATIONAL ENERGY CODE OF CANADA FOR BUILDINGS - 2015
 - 2 ASHRAE STANDARD 90.1 - 2016

1.11 INSTALLATION OF EQUIPMENT

- 1 PIPE ALL EQUIPMENT DRAINS TO BUILDING DRAINS EXCEPT SYSTEMS CONTAINING GLYCOL.
- 2 UNIONS AND FLANGES SHALL BE PROVIDED IN PIPING OR DUCTWORK TO PERMIT EASY REMOVAL OF EQUIPMENT.
- 3 MAINTAIN PERMANENT ACCESS TO EQUIPMENT FOR MAINTENANCE.

1.12 CONNECTIONS TO EXISTING SERVICES

- 1 MAINTAIN UNION WITH THE DFO REPRESENTATIVE FOR SPECIAL PROTECTIVE AND DISPOSAL. REMOVE DATES WHEN ALL ASBESTOS MATERIALS ARE LOCATED DURING THE WORK IN THIS SECTION.
- 2 ALL MATERIAL REMOVED FROM THE BUILDING UNDER THIS CONTRACT SHALL BE REMOVED FROM THIS SITE AND DISPOSED OF AS REQUIRED BY ANY APPLICABLE DISPOSAL REGULATIONS.

1.14 EQUIPMENT AND MATERIALS

- 1 ALL EQUIPMENT INSTALLED ON THIS PROJECT SHALL COMPLY WITH ALL APPLICABLE REQUIREMENTS INCLUDING:
 - 1 CSA STANDARDS
 - 2 LOCAL STANDARDS AND BYLAWS
 - 3 MANUFACTURER REQUIREMENTS AND RECOMMENDATIONS
 - 4 NATIONAL BUILDING CODE AND ALL REFERENCED CODES AND STANDARDS
 - 5 NATIONAL FIRE CODE
 - 6 NATIONAL PLUMBING CODE
 - 7 NFPA STANDARDS
 - 8 NATIONAL ENERGY CODE OF CANADA FOR BUILDINGS (NECB)
 - 9 ASHRAE STANDARD 90.1
 - 10 ASHRAE STANDARDS, GUIDELINES, HANDBOOKS AND DESIGN GUIDES
- 1.15 **DELIVERY, STORAGE AND HANDLING**
 - 1 STORAGE AND HANDLING REQUIREMENTS:
 - 1 STORE MATERIALS AND EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS; IN A CLEAN, DRY, WELL-VENTILATED AREA. COORDINATE LOCATION OF STORAGE WITH THE OWNER.

- 2 STORE AND PROTECT EQUIPMENT FROM NICKS, SCRATCHES, AND BLEMISHES.
- 3 REPLACE DEFECTIVE OR DAMAGED MATERIALS WITH NEW.
- 2 PROTECT EQUIPMENT AND OPEN END DUCT WITH POLYETHYLENE COVERS AND MAINTAIN EQUIPMENT ON CRATES UNTIL INSTALLATION.
- 3 ENSURE THAT EXISTING EQUIPMENT IS CAREFULLY DISMANTLED AND NOT DAMAGED OR LOST. DO NOT REUSE EXISTING MATERIALS AND EQUIPMENT UNLESS SPECIFICALLY INDICATED.

1.16 FIRESTOPPING AND SEISMIC SEALS

- 1 PROVIDE FIRESTOPPING SYSTEMS TO PROTECT AND MAINTAIN A FIRE RESISTANCE RATING, AS INDICATED ON DRAWINGS AND IN ACCORDANCE WITH UL, UL-L, UL-C, OR FM DESIGN RATINGS FOR ALL MECHANICAL WORK IN DIVISIONS 21, 22, 23 AND 25.
- 2 FOR RENOVATION PROJECTS, IN ADDITION TO THE NECESSARY NEW PENETRATIONS, PROVIDE THE FIRESTOPPING FOR ALL EXISTING PENETRATIONS AND ASSEMBLIES WHERE FIRESTOPPING IS DAMAGED, DISCONTINUED OR ABSENT.
- 3 ALL FIRESTOP SYSTEM INSTALLATIONS MUST MEET THE REQUIREMENTS OF CAN-S115M OR UL-C 3, 115M TESTED INSTALLATION INSTRUCTIONS THAT PROVIDE A FIRE RATING.

1.17 ACCESS DOORS

- 1 PROVIDE ACCESS DOORS FOR MAINTENANCE OR ADJUSTMENT OF ALL PARTS OF THE MECHANICAL SYSTEM.
- 2 PROVIDE 300 MM X 300 MM MINIMUM SIZE FOR INSPECTION AND HAND ACCESS.
- 3 600 MM X 600 MM MINIMUM SIZE, LARGER IF INDICATED ON DRAWINGS, WHERE ENTRY IS REQUIRED AND ACCESS IS DIFFICULT TO OBTAIN.

1.18 ESCUTCHEONS AND PLATES

- 1 PROVIDE ESCUTCHEONS AND PLATES ON ALL PIPING AND DUCTWORK PASSING THROUGH FINISHED WALLS, FLOORS, AND CEILINGS.

1.19 GUARANTEE/WARRANTY

- 1 FURNISH A WRITTEN GUARANTEE STATING THAT ALL WORK EXECUTED IN THIS CONTRACT WILL BE FREE FROM DEFECTIVE WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF SUBSTANTIAL PERFORMANCE.

1.20 BALANCING

- 1 THE APPROVED BALANCING AGENCIES ARE: BLUE COLLAR GROUP, FLUTECH MECHANICAL, WESTERN MECHANICAL, I.D. ENGINEERING.
- 2 BALANCE EQUIPMENT, EXHAUST FANS AND AIR OUTLETS TO AIR QUANTITIES INDICATED ON THE DRAWINGS AND IN THIS SPECIFICATION, WHERE SUCH QUANTITIES ARE NOT INDICATED, DIVIDE CAPACITY EQUALLY AMONG ALL OUTLETS.
- 3 THE BALANCER SHALL USE APPROPRIATE AIR FLOW SETTINGS AND CONTROL METHODS FOR SINGLE FLOW AND SYSTEMS. BALANCING FOR THE CENTRAL SYSTEM AIR VOLUME UNDESIRABLE.
- 4 SUBMIT A PDF COPY OF THE REPORT TO THE DFO REPRESENTATIVE WITHIN TWO (2) WEEKS AFTER SUBSTANTIAL COMPLETION. FAILURE TO SUBMIT THE REPORT WITHIN THE SPECIFIED TIME WILL RESULT IN THE WORK BEING DONE BY THE OWNER AND THE COSTS DEDUCTED FROM THE CONTRACTOR'S HOUR BACK AMOUNT.
- 5 BALANCING SHALL BE PERFORMED TO THE FOLLOWING:
 - 1 AIR-TERMINAL OUTLETS, ±10%
 - 2 AIR-CENTRAL EQUIPMENT, ±5%
 - 3 HYDRONIC PUMPS AND CENTRAL EQUIPMENT, ±5%
- 6 PROVIDE A DROP TEST OF ALL FAN DAMPERS AND A LETTER/CERTIFICATE CONFIRMING THIS WORK.
- 7 COOPERATE WITH THE BALANCING AGENCY AS FOLLOWS:
 - 1 PROVIDE ACCESS TO ALL WORK AREAS AND UNOCCUPIED AREAS.
 - 2 ALLOW BALANCING AGENCY FREE ACCESS TO SITE DURING CONSTRUCTION PHASE. INFORM BALANCING AGENCY OF ANY MAJOR CHANGES MADE TO SYSTEMS DURING CONSTRUCTION AND PROVIDE A COMPLETE SET OF RECORD DRAWINGS AND SPECIFICATIONS FOR THE BALANCING AGENCY.
 - 3 OPERATE AUTOMATIC CONTROL SYSTEM AND VERIFY SET POINTS DURING BALANCING.
 - 4 PROVIDE AND INSTALL BALANCING VALVES, DAMPERS, AND OTHER MATERIALS REQUESTED BY THE BALANCING AGENCY AND NECESSARY TO PROPERLY ADJUST OR CORRECT THE SYSTEMS TO DESIGN FLOWS, WITHOUT ADDITIONAL COST TO OWNER.
 - 5 PROVIDE AND INSTALL RELIEFS AND SHIMMES FOR ROTATING EQUIPMENT, AS REQUIRED TO PROPERLY BALANCE THE SYSTEMS TO DESIGN FLOWS, WITHOUT ADDITIONAL COST TO OWNER.
 - 6 ALLOW IN THE DESIGN FLOW, WITHOUT ADDITIONAL COST TO OWNER.
 - 7 SUBMIT TO THE DESIGN FLOW, WITHOUT ADDITIONAL COST TO OWNER.

1.21 COMMISSIONING AND DEMONSTRATION

- 1 BE RESPONSIBLE FOR THE PERFORMANCE AND COMMISSIONING OF ALL EQUIPMENT SUPPLIED AND RE-USED UNDER DIVISIONS 23.
- 2 CONDUCT OPERATION AND REVIEW NOTING OF ALL EXISTING EQUIPMENT AND ASSOCIATED CONTROL DEVICES IN THE RENOVATED AREA. SUBMIT REPORT CONTAINING ANY REMEDIAL WORK REQUIRED.
- 3 AT THE COMPLETION, DEMONSTRATE THE OPERATION OF THE SYSTEMS TO THE CONSULTANT, THE DFO REPRESENTATIVE, AND THE OPERATING STAFF.
- 4 AT THE COMPLETION OF THE COMMISSIONING, TESTING, BALANCING AND DEMONSTRATION SUBMIT TO THE DFO REPRESENTATIVE AND THE OPERATING STAFF A WRITTEN REPORT, INCLUDING THIS CONTRACT, A COMPLETE CLEAN AND OPERATIONAL IN ACCORDANCE WITH THE SPECIFICATION AND DRAWINGS.

1.22 SYSTEM CLEANING AND CHEMICAL TREATMENT

- 1 EMPLOY SERVICES OF THE EXISTING BUILDING'S WATER TREATMENT FIRM OR, IF THERE IS NOT ONE, A FIRM SPECIALIZING IN HYDRONIC SYSTEM CHEMICAL TREATMENT. THIS FIRM SHALL SUBMIT A SCHEDULE OF WORK TO THE CONSULTANT, INCLUDING TYPES, AND QUANTITY TO BE USED, AT THE COMPLETION OF THE CHEMICAL TREATMENT. A FIRM SPECIALIZING IN HYDRONIC SYSTEM CHEMICAL TREATMENT SHALL BE PROVIDED TO THE CONSULTANT FOR REVIEW AND AFTER THE CHEMICAL TREATMENT, ANALYSIS AND TYPES OF CHEMICALS USED. THE REPORT SHALL ALSO INCLUDE THE DETAILS OF PROCEDURES TO BE USED TO REMOVE ALL EXCESS CHEMICALS FROM THE SYSTEMS.
- 2 PROVIDE TEST KITS AS REQUIRED ALONG WITH ADEQUATE CHEMICALS AND REAGENTS FOR ONE YEAR OF TESTING. APPROPRIATE TEST KITS WILL BE PROVIDED TO PROPERLY TEST EACH SYSTEM INSTALLED UNDER THIS CONTRACT.
- 3 HANDLE AND FLUSH ALL DOMESTIC COOLD, HOT AND RECYCLATION WATER SYSTEMS, PROVIDE A CERTIFICATE OF WORK.

1.23 FLASHING AND ROOF CURBS

- 1 PROVIDE CURBS, FLASHES AND COUNTER FLASH AS REQUIRED WHERE MECHANICAL EQUIPMENT PASSES THROUGH EXISTING ROOF OR THROUGH EXISTING WALLS. FLASHES AND COUNTER FLASHES SHALL BE INSTALLED TO PROTECT THE ROOF OR WALL.
- 2 PROVIDE FACTORY ROOF CURBS FOR ALL ROOF MOUNTED EQUIPMENT UNLESS NOTED OTHERWISE.

1.24 SEISMIC CERTIFICATION

- 1 PROVIDE SEISMIC RESTRAINTS FOR ALL REQUIRED EQUIPMENT, PIPING, AND DUCTWORK.
- 2 THE CONTRACTOR SHALL RETAIN THE SERVICES OF A QUALIFIED PROFESSIONAL SEISMIC ENGINEER (SEISMIC ENGINEER) REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA. THE SEISMIC ENGINEER SHALL DESIGN AND REVIEW THE INSTALLATION OF ALL SEISMIC RESTRAINTS AS WELL AS MECHANICAL/ELECTRICAL AND MECHANICAL SYSTEMS. THE SEISMIC ENGINEER SHALL SUBMIT A WRITTEN REPORT, INCLUDING THIS CONTRACT, TO THE CONSULTANT, INDICATING IN THE CONTRACT DOCUMENTS AND INSTALLED IN THE FIELD. THE COMPLETE DESIGN FOR THESE SYSTEMS SHALL COMPLY WITH ALL APPLICABLE BUILDING REGULATIONS.
- 3 SEISMIC ENGINEER SHALL PROVIDE AND SUBMIT TO THE DFO REPRESENTATIVE AN ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD SCHEDULE B AND ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE SCHEDULE C-8 FOR SERVICING ENGINEERING.
- 4 PIPING, DUCTWORK AND EQUIPMENT SHALL BE RESTRAINED IN ACCORDANCE WITH THE LATEST EDITION OF THE SEISMIC RESTRAINTS MANUAL FOR BEST PRACTICES FOR SEISMIC RESTRAINTS.
- 5 SUBMIT SHOP DRAWINGS OF ALL SEISMIC RESTRAINTS PREPARED AND SEALED BY THE SEISMIC ENGINEER. PRIOR TO SUBSTANTIAL COMPLETION, THE SEISMIC ENGINEER SHALL VISIT THE SITE AND VERIFY THE SEISMIC RESTRAINTS INSTALLATION IN REGARDS TO THE ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE SCHEDULE C-8 OF THE BUILDING CODE.
- 6 THE CONTRACTOR SHALL OBTAIN APPROVAL FOR THE LOCATION OF ALL RESTRAINT FIXING POINTS FROM THE STRUCTURAL ENGINEER ON SITE, PRIOR TO INSTALLATION.
- 7 WHERE EQUIPMENT IS MOUNTED ON SPRINGS OR RESILIENT MOUNTS FOR VIBRATION ISOLATION, IT SHALL BE THE RESPONSIBILITY OF THE MANUFACTURER OF THE MOUNT TO INCORPORATE SEISMIC RESTRAINTS. THESE RESTRAINTS SHALL BE MULTI-DIRECTIONAL, AS DESCRIBED IN THE GUIDELINES SPECIFIED ABOVE. PROVIDE CLEAR FRAMING BARS WHERE NECESSARY TO ACHIEVE THIS AND ALSO AVOID OVERTURNING. THE MANUFACTURER SHALL SUPPLY CERTIFICATES, SIGNED BY A PROFESSIONAL ENGINEER REGISTERED WITH THE JURISDICTION, VERIFYING THE DESIGN OF THE SEISMIC RESTRAINTS IN ACCORDANCE WITH THE SECTION.

1.25 VIBRATION ISOLATION

- 1 PROVIDE NEOPRENE ISOLATORS FOR DEFLECTIONS 6MM (1/4") AND UNDER.
- 2 PROVIDE EITHER NEOPRENE OR STEEL SPRING ISOLATORS FOR DEFLECTIONS BETWEEN 6MM AND 12MM (1/2").
- 3 PROVIDE STEEL SPRING ISOLATORS FOR DEFLECTIONS OF 12MM (1/2") AND OVER.
- 4 PROVIDE ADJUSTABLE LIMIT STOPS FOR SPRING ISOLATION MOUNTS ON EQUIPMENT WITH OPERATING WEIGHTS EXCEEDING 100 KG (220 LBS) FROM THE ISOLATION POINT.
- 5 ALL SPRING ISOLATORS SHALL BE "OPEN SPRING" UNLESS OTHERWISE STATED. SEISMICALLY RATED HOUSED SPRING ISOLATORS MAY BE USED WHERE THEY ARE SUITABLE IN ALL RESPECTS FOR SERVICE USED.
- 6 SELECT ISOLATORS IN ACCORDANCE WITH EQUIPMENT WEIGHT DISTRIBUTION TO ALLOW FOR AN AVERAGE DEFLECTION (BETWEEN) OR EXCEEDING THE SPECIFIED DEFLECTION REQUIREMENTS AND SO THAT NO ISOLATOR HAS A DEFLECTION LESS THAN 10% OF THE STATIC DEFLECTION SPECIFIED. A MINIMUM OF 4 ISOLATORS ARE REQUIRED FOR EACH PIECE OF EQUIPMENT, UNLESS SPECIFIED OTHERWISE. REFER TO THE MINIMUM STATIC DEFLECTION TABLE CONTAINED IN THIS SECTION.

1.26 SUBSTANTIAL AND TOTAL PERFORMANCE

- 1 PRIOR TO RECEIVING AN INSPECTION FOR SUBSTANTIAL PERFORMANCE, PROVIDE A COMPLETE LIST OF ITEMS, WHICH ARE DEFICIENT.
- 2 A CERTIFICATE OF SUBSTANTIAL PERFORMANCE WILL NOT BE GRANTED UNLESS THE FOLLOWING ITEMS ARE COMPLETED AND AVAILABLE TO THE OWNERS CONSULTANT:
 - 1 SCHEDULE C-8 FOR SERVICING ENGINEERING.
 - 2 FINAL BACKFLOW PREVENTION TEST REPORTS FOR ALL BACKFLOW DEVICES.
 - 3 FIRE STOPPING AND FIRE DAMPER TEST LETTER.
 - 4 DRAFT OPERATING/MAINTENANCE MANUALS HAVEN BEEN SUBMITTED FOR REVIEW.
 - 5 ALL MECHANICAL SYSTEMS HAVE BEEN COMMISSIONED AND ARE CAPABLE OF OPERATION WITH ALARM CONTROLS FUNCTIONAL AND AUTOMATIC CONTROL IN OPERATION.
 - 6 AIR AND WATER SYSTEMS HAVE BEEN BALANCED WITH DRAFT REPORT SUBMITTED TO THE CONSULTANT.
 - 7 OPERATING AND MAINTENANCE DEMONSTRATIONS HAVE BEEN PROVIDED TO THE OWNER.
 - 8 RECORD DRAWINGS HAVE BEEN SUBMITTED.
 - 9 ALL PREVIOUSLY IDENTIFIED DEFICIENCIES HAVE BEEN CORRECTED AND ACCEPTED.
- 3 PRIOR TO A TOTAL PERFORMANCE INSPECTION, PROVIDE DECLARATION IN WRITING THAT DEFICIENCIES NOTED AT TIME OF SUBSTANTIAL PERFORMANCE INSPECTION HAVE BEEN CORRECTED AND THE FOLLOWING ITEMS COMPLETED PRIOR TO THE TOTAL PERFORMANCE INSPECTION.
 - 1 SUBMIT FINAL AIR AND WATER BALANCE REPORTS.
 - 2 SUBMIT FINAL OPERATING AND MAINTENANCE MANUALS.
- 4 THE CONSULTANT SHALL PROVIDE ONE (1) VISITATION FOR THE PURPOSE OF TOTAL PERFORMANCE INSPECTION. SUBSEQUENT VISITATIONS IF REQUIRED SHALL BE AT THE EXPENSE OF THE CONTRACTOR.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- 1 LISTED MANUFACTURERS ARE ACCEPTABLE FOR THEIR ABILITY TO MEET THE GENERAL DESIGN INTENT, QUALITY AND PERFORMANCE CHARACTERISTICS OF THE PRODUCTS AS SPECIFIED IN THE SECTION. THE QUALITY OF ALL PRODUCTS AVAILABLE FROM THE LISTED MANUFACTURERS/SUPPLIERS.
- 2 IT REMAINS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THE PRODUCTS SUPPLIED ARE EQUAL TO THE SPECIFIED PRODUCTS IN ALL RESPECTS FOR SERVICE USED, AND MEET THE PERFORMANCE SPECIFICATIONS AND PHYSICAL DIMENSIONS OF THE SPECIFIED PRODUCT.
- 3 THE CONTRACTOR SHALL FURNISH ANY ADDITIONAL WORK OR MATERIALS, TO ACCOMMODATE THE USE OF EQUIPMENT FROM THE ACCEPTABLE MANUFACTURERS AND SUPPLIERS LISTED.

2.2 ASBESTOS

- 1 THE INTENT FOR A HAZMAT CONTRACTOR TO REMOVE ALL ASBESTOS CONTAINING MATERIAL PRIOR TO THE COMMENCEMENT OF WORK TAKING PLACE. NOTIFY THE CONSULTANT IF ASBESTOS CONTAINING MATERIAL IS SUSPECTED TO REMAIN ON SITE.
- 2 IDENTIFYING ISOLER ROOMS CONTAINING ASBESTOS IN WALLS AND CEILINGS AND IS NOT TO BE DISTURBED OR TOUCHED AS PART OF THIS SCOPE.
- 1 TOYVED & WHITE 425 OR EQUAL.

2.3 FIRESTOPPING AND SEISMIC SEALS

- 1 USE THE SAME MANUFACTURER THROUGHOUT THE PROJECT AND COMPATIBLE MATERIALS FOR RESTORATION WORK.

- 2 PROVIDE FILL MATERIAL COMPONENTS FOR EACH FIRESTOPPING SYSTEM AS NEEDED. USE ONLY COMPONENTS SPECIFIED BY THE FIRESTOPPING MANUFACTURER FOR THE DESIGNATED FIRE-RESISTANCE RATED SYSTEMS.

2.4 ELECTRICAL MOTORS

- 1 SUPPLY MECHANICAL EQUIPMENT COMPLETE WITH ELECTRICAL MOTORS.
- 2 PROVIDE MOTORS DESIGNED, MANUFACTURED, AND TESTED IN ACCORDANCE WITH THE LATEST EDITION OF THE FOLLOWING CODES AND STANDARDS: NEMA DESIGN CLASS, IEC PART 1, ISEE AND IEC. ALL MOTORS TO BE CSA LABELED. ALL MOTORS TO BE APPROVED FOR USE IN THE DESIGNATED AREA CLASSIFICATION BY THE PROVINCIAL ELECTRICAL PROTECTION BRANCH. ALL MOTORS INTENDED FOR USE WITH A VARIABLE FREQUENCY DRIVE (VFD) SHALL BE INVERTER ONLY RATED.
- 3 UNLESS SPECIFIED OTHERWISE, PROVIDE MOTORS DESIGNED FOR FULL VOLTAGE STARTING, ESMAC DESIGN B. MOTORS DRIVING PUMPS OR HIGH INERTIA LOADS MAY BE ESMAC DESIGN C OR D.
- 4 PROVIDE MOTORS RATED FOR CONTINUOUS DUTY WITH 115 SERVICE FACTOR UNLESS SPECIFIED OTHERWISE IN THE SPECIFICATION.
- 5 MOTORS LESS THAN 3/4 HP SHALL BE 120 V, 60 HZ, 1-PHASE. MOTORS 3/4 HP AND LARGER SHALL BE 3-PHASE AT THE INDICATED VOLTAGE.
- 6 ALL MOTORS SHALL BE 100% NEMA UNLESS OTHERWISE NOTED.
- 7 PROVIDE MOTORS COMPLETE WITH EQUIPMENT EXCEPT WHERE INDICATED.
- 8 PROVIDE MOTORS WITH GREASE OR LUBRICATED ANTI-FRICTION TYPE BALL OR ROLLER BEARINGS.
- 9 PROVIDE MOTORS DESIGNED WITH CLASS B INSULATION. CLASS F INSULATION FOR FULLY ENCLOSED MOTORS.
- 10 REFER TO ELECTRICAL SPECIFICATIONS FOR VOLTAGE, FREQUENCY, AND PHASE DATA. THIS SHALL TAKE PRECEDENCE OVER ANY REFERENCE IN MECHANICAL SPECIFICATION.
- 11 WHERE MOTOR POWER IS STATED IN KW OR HP, NOMINAL MOTOR HORSEPOWER MULTIPLIED BY 746 OR 0.746 RESPECTIVELY, HAS BEEN USED AS THE CONVERSION FACTOR.
- 12 MINIMUM CERTIFIED MOTOR EFFICIENCY SHALL BE AS OUTLINED IN ASHRAE 90.1.

2.5 DUCTWORK AND ACCESSORIES

- 1 EQUIPPED RECTANGULAR DUCTS: EXTERNAL RIGID INSULATION, SERVICE TEMPERATURE 5°C TO 23°C (41°F TO 40°F). MINIMAL FIBER BOARD FOR LOW AND MEDIUM TEMPERATURE APPLICATIONS. ALL SERVICE ALUMINUM FOL-SORM 10M7 FIBER VAPOR BARRIER JACKET WITH CLASS FIBRE REINFORCEMENT, FACTORY APPLIED.
 - 1 DENSITY 390KG/M³ (24 PCF), MINIMUM RSI 0.7025M (R 4.376)
- 2 ROUND DUCTS AND CONCEALED RECTANGULAR DUCTS: EXTERNAL FLEXIBLE INSULATION, SERVICE TEMPERATURE 5°C TO 23°C (41°F TO 40°F). CLASS FIBRE OR MINERAL FIBRE FLEXIBLE BARRIER FOR LOW AND MEDIUM TEMPERATURE APPLICATIONS. ALL SERVICE ALUMINUM FOL-SORM 10M7 FIBER VAPOR BARRIER JACKET WITH CLASS FIBRE REINFORCEMENT, FACTORY APPLIED.
 - 1 DENSITY 1250KG/M³ (78 PCF), MINIMUM RSI 0.4025M (R 2.281) (INSTALLED)
- 3 ADJUSTIVE LIVING DUCTS: INTERNAL FLEXIBLE DUCT LINER, FLEXIBLE MINERAL FIBRE BARRIER, FOR LOW AND MEDIUM TEMPERATURE. ACoustICAL APPLICATIONS. AIRSTREAM SURFACE FINISHED WITH A BLACK MAT BONDED TO THE FIBREGLASS SUBSTRATE. AIR FLOW VELOCITY RATING 25 M/S (5000 FT/MIN)
 - 1 DENSITY 1250KG/M³ (78 PCF), MINIMUM RSI 0.4025M (R 2.281)
- 4 FINISH JACKETS:
 - 1 THERMOCAVANS JACKET: FIRE RATED, 1700 (R 0.02) FIRE RETARDANT CANVAS JACKET FOR COVERING MECHANICAL PIPING THROUGH EXISTING WALLS, FLOORS AND CEILING.
 - 2 UTILITY SHIELD: OVER RIGID INSULATION FOR RECTANGULAR DUCTWORK AND FLEXIBLE INSULATION FOR ROUND DUCTWORK. APPLY CONTINUOUS METAL CORNER READ TO ALL CORNERS. ADHERE VAPOR RETARDER TAPE OVER CORNERS AND BREAKS IN VAPOR BARRIER, AND AT ALL CORNERS.
 - 3 ALUMINUM JACKET: 51 MIL (2.0 GA) HEAVY BRUSH-ON HIGH PRESSURE SEALANT. APPLY SEAMANT APPLICATION AFTER THE FIRST APPLICATION HAS COMPLETELY DRIED OUT. WHERE METAL CLEARANCE EXCEEDS 1.5 MM (1/16") USE HEAVY MASTIC TYPE SEALANT.
 - 2 FLANGED JOINTS: SOFT ELASTOMER BUTYL OR EXTRUDED FORM OF SEALANT BETWEEN FLANGES FOLLOWED BY AN APPLICATION OF HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT.
 - 3 OTHER JOINTS: HEAVY MASTIC TYPE SEALANT.
 - 2 DUCT TAPES AS SEALING METHOD ARE NOT PERMITTED, EXCEPT ON RESIDENTIAL DUCTWORK - MINIMUM 3 WRAPS OF 2" (1/2") 50MM FOL DUCT TAPE IS ACCEPTABLE.
 - 3 SURFACES TO RECEIVE SEALANT SHOULD BE FREE FROM OIL, DUST, DIRT, MORTURE, RUST AND OTHER SUBSTANCES THAT INHIBIT OR PREVENT BONDING.
 - 4 DO NOT INSULATE ANY SECTION OF THE DUCTWORK UNTIL IT HAS BEEN INSPECTED AND APPROVED OF DUCT SEALANT APPLICATION BY THE CONSULTANT.

2.6 ACCESS DOORS

- 1 DRYWALL SURFACE: EXTRUDED ALUMINUM FRAME WITH EPS/ROCK WOOL INLAY AND STRUCTURAL CORNER ELEMENTS. PRIME TO BE CONCRETE 2-PART JOINT HINGE, NON-CORRODING WITH ALLEN HEAD CAM LATCH.
- 2 TIE SURFACE: UNIVERSAL DESIGN, STAINLESS STEEL DOOR (16GA) AND STAINLESS STEEL FRAME (16GA). DOOR FLUSH TO FRAME. ROUNDED SAFETY CORNERS, CONTINUOUS CONCEALED HINGE, ALLEN HEAD CAM LATCH, #4 SATIN FINISH.
- 3 PLASTER WALLS AND CEILING: STEEL DOOR (16GA) AND STEEL FRAME (16GA). DOOR FLUSH TO FRAME EDGE. EXPANSION RESISTANT. ALL LETTERS GALVANIZED LATH SURROUNDING DOOR. 15 MM TO RECEIVE PLASTER. CONTINUOUS CONCEALED HINGE, ALLEN HEAD CAM LATCH, PRIME COAT GREY PANTONE FINISH.
- 4 FIRE RATED WALLS:
 - 1 NON-COMBUSTIBLE CONSTRUCTION UNLINED STEEL DOOR (16GA) AND STEEL FRAME (16GA). DOOR FLUSH TO FRAME. 25MM MOUNTING FRAME WITH MANSORY ANCHOR STRAPS. CONCEALED SELF-CLOSING HINGE, FLUSH KEY LATCH, PRIME COAT GREY PANTONE FINISH. LATCH RATED 2 HOUR UL LABEL.
 - 2 INTERMEDIATE TEMPERATURE: 5°C TO 31°C (41°F TO 89°F)
 - 1 FIBRE FIBROUS GLASS OR MINERAL FIBRE INSULATION. MAXIMUM "K" VALUE AT 30°C (100°F)

2.7 EQUIPMENT ISOLATION

- 1 LOW TEMPERATURE, PIPING SERVICE TEMPERATURE -40°C TO 15°C (-40°F TO 41°F)
- 1 FLEXIBLE FOAMED ELASTOMER OR CLOSED CELL INSULATION WITH SELF-ADHESIVE SEAL OR LAP SEAL. SELF-ADHESIVE SEAL: MAXIMUM "K" VALUE AT 24°C (75°F) = 0.039 W/M² (0.27 BTU/IN.HR.FT²)
- 2 LOW TO INTERMEDIATE TEMPERATURE: 5°C TO 31°C (41°F TO 89°F)
- 1 PREFORMED INSULATION, FIBRE FIBROUS GLASS OR FORMED MINERAL FIBRE PIPE INSULATION WITH ALL SERVICE JACKET VAPOR BARRIER (AS). ASU SHALL BE EN-ENFORCED WITH CLASS FIBRE, FACTORY APPLIED WITH SELF-ADHESIVE LAP-CLOSURE. MAXIMUM "K" VALUE AT 30°C (100°F) = 0.035 W/M² (0.24 BTU/IN.HR.FT²)
- 3 FINISH JACKETS:
 - 1 THERMOCAVANS JACKET: FIRE RATED, 1700 (R 0.02) FIRE RETARDANT CANVAS JACKET FOR COVERING MECHANICAL PIPING THROUGH EXISTING WALLS, FLOORS AND CEILING.
 - 2 PVC FINISHING JACKET: WHITE, UV RESISTANT, FOR INDOOR OR OUTDOOR APPLICATIONS, 2550 FIRE CLASS, MINIMUM 0.0 MM (0.07") THICK.
 - 3 THERMOCAVANS JACKET: 1.5MM (0.06") THICK DOUBLE OR SMOOTH ALUMINUM JACKETS WITH LONGITUDINAL SLP JOINTS AND 50MM (2") END LAPS WITH FACTORY APPLIED PROTECTIVE LINER ON INTERIOR SURFACE.

2.8 SEISMIC CABLE RESTRAINTS

- 1 GALVANIZED STEEL, AIRCRAFT CABLES SIZED TO RESIST SEISMIC LOADS WITH A MINIMUM SAFETY FACTOR OF TWO AND ARRANGED TO PROVIDE ALL-DIRECTIONAL RESTRAINT.
- 2 CABLE END CONNECTIONS SHALL BE MADE TO THE EXISTING MINIMUM MODULUS OF ELASTICITY. CABLE END CONNECTIONS SHALL BE STEEL ASSEMBLIES THAT SWIVEL TO FINAL INSTALLATION ANGLE AND UTILIZE TWO CLAMPING BOLTS TO PROVIDE FULL ENGAGEMENT.

2.9 VIBRATION ISOLATION

- 1 NEOPRENE WASHERS/SHIMMING
- 1 ONE PIECE MOLDED BRIDGE BEARING NEOPRENE WASHERS/SHIMMING. THE BUSHING SHALL SURROUND THE ANCHOR BOLT AND HAVE LATCH WASHERS FACE TO AVOID METAL TO METAL CONTACT. USE WASHERS/SHIMMING ONLY ON LIGHT WEIGHT EQUIPMENT.
 - 1 BASIS OF DESIGN IS: MASON H/4 NEM GRAMMET OR EQUAL
- 2 NEOPRENE PAD ISOLATORS
 - 1 NEOPRENE OR NEOPRENE/ STEEL NEOPRENE PAD ISOLATORS. MINIMUM STATIC DEFLECTION 2.5 MM (0.1") OR GREATER.
 - 1 BASIS OF DESIGN IS: MASON W/4M OR EQUAL
- 3 RUBBER FLOOR MOUNTS
 - 1 BRIDGE BEARING NEOPRENE MOUNTINGS. MINIMUM STATIC DEFLECTION OF 5MM (0

Duty	Rectangular Duct	Round Duct	Thick Code	Thin Code	TKC Code
Indoor concealed	None	None	None	None	None
Indoor exposed in mechanical room and elsewhere except utility areas	Canvas Jacket	Canvas Jacket	Canvas Jacket	Canvas Jacket	CRD1
Indoor exposed in utility areas	Utility Finish	CRF2	Utility Finish	Utility Finish	CRD2
Outdoor exposed to precipitation	Aluminum Jacket	CRF3	Aluminum Jacket	Aluminum Jacket	CRD3

1.5 PIPING INSULATION MINIMUM THICKNESS SCHEDULE

Type of System	Design Operating Temperature Range °C (°F)	Thermal Conductivity of Insulation Coefficient Range W/m·K (ft·lb/Btu·in·°F)	Mean Rating Temperature °C (°F)	Minimum Thickness of Piping Insulation (mm)	Nominal Pipe Diameter (NPS)	Series 1	Series 2	Series 3	Series 4
Steam & Cond.	122-177 (251-350)	0.042-0.045	63 (149)	40	40	60	75	75	110
	84-121 (201-250)	0.038-0.043	65 (149)	40	40	60	75	75	110
Heating	81-103 (142-220)	0.034-0.042	52 (126)	25	40	50	50	50	50
	41-60 (105-142)	0.033-0.040	38 (100)	25	25	40	40	40	40
Cooling	5-16 (41-61)	0.030-0.039	24 (75)	25	25	25	25	25	25
	-5 (-41)	0.030-0.039	24 (75)	25	25	40	40	40	40

NOTE: WHERE THE THERMAL CONDUCTIVITY OF INSULATION IS GREATER THAN THE RANGE SPECIFIED ABOVE, INCREASE THE THICKNESS BY THE RATIO OF U2/U1.

U2 = PROPOSED INSULATION "K" VALUE AT THE TABLE MEAN RATING TEMPERATURE.

U1 = UPPER RANGE LIMIT "K" VALUE FROM THE TABLE ABOVE.

NOTE: WHERE THERMAL CONDUCTIVITY OF INSULATION IS LESS THAN THE RANGE SPECIFIED ABOVE, THE THICKNESS MAY BE DECREASED BY THE RATIO OF U2/U1.

U2 = PROPOSED INSULATION "K" VALUE AT THE TABLE MEAN RATING TEMPERATURE.

U1 = LOWER RANGE LIMIT "K" VALUE FROM THE TABLE ABOVE.

1.6 PIPING FINISH SCHEDULE

- INDOORS CONCEALED; FACTORY FINISH
- INDOORS EXPOSED IN MECHANICAL ROOM AND ELSEWHERE; CANVAS JACKET
- INDOORS EXPOSED IN UTILITY AREAS, PARADE, ETC.; PVC JACKET
- OUTDOORS; ALUMINUM JACKET

1.7 SEISMIC CABLE RESTRAINTS

- CABLES MUST NOT BE ALLOWED TO BEND ACROSS SHARP EDGES.
- CABLE ASSEMBLIES SHALL SUIT INSTALLATION TYPE
 - CEILING AND AT THE CLEVIS BOLT
 - BETWEEN THE HANGER ROD NUT AND THE CLEVIS
 - CLAMPED TO A BEAM

1.8 VIBRATION ISOLATION

- NEOPRENE WASHER/BUSHING
 - ISOLATE VARIABLE FREQUENCY DRIVE CONTROLLER USING NEOPRENE WASHER/BUSHING ISOLATORS OR SOFT GROMMETS SUCH THAT STRUCTURE BORNE NOISE TRANSMISSION TO OCCUPIED SPACE IS LESS THAN AMBIENT NOISE TRANSMISSION.
- RUBBER FLOOR MOUNTS
 - MOUNT VALVE PUMPS ON TWO (2) RUBBER FLOOR MOUNT ISOLATORS UNDER EACH SUPPORT FOOT.
 - FOR EQUIPMENT MOUNTED ON A SLAB ON GRADE MOUNT ON RUBBER FLOOR MOUNT ISOLATORS UNLESS OTHERWISE SPECIFIED.
 - PROVIDE PROTECTION OF THE RUBBER ELEMENT FROM CONTACT WITH OIL IN THE MECHANICAL ROOM.
- SPRING FLOOR MOUNTS
 - ISOLATE ALL FLOOR OR PER MOUNTED EQUIPMENT ON SPRING FLOOR MOUNT ISOLATORS, UNLESS OTHERWISE SPECIFIED.
 - SPRING HANGERS
 - LOCATE ISOLATION HANGERS AS NEAR TO THE OVERHEAD SUPPORT STRUCTURE AS POSSIBLE.
 - INSTALLATION SHALL PERMIT HANGER BOX OR ROD TO MOVE THROUGH A 30 DEGREE ARC WITHOUT METAL TO METAL CONTACT.
 - ALL DISCHARGE DUCTWORK RUNS FOR A DISTANCE OF 15M (50') FROM THE CONNECTED EQUIPMENT SHALL BE ISOLATED FROM THE BUILDING STRUCTURE BY MEANS OF SPRING HANGERS. SPRING DEFLECTION SHALL BE A MINIMUM OF 15MM (5/8").
- MINIMUM STATIC DEFLECTION SCHEDULE

Equipment	Equipment Supported By	Static Deflection	Dynamic Deflection
Hot Water Drains	None	3mm (1/8")	3mm (1/8")
Hot Water Pumps over 1000 G	Steel (15)	3mm (1/8")	3mm (1/8")
Pumps			
In-line under 1500 (240) HP	Steel (15)	3mm (1/8")	3mm (1/8")
In-line 1500 (240) HP to 11300 (15) HP	Steel (15)	3mm (1/8")	3mm (1/8")
In-line 11300 (15) HP to 15000 (15) HP	Steel (15)	3mm (1/8")	3mm (1/8")
Base mounted under 5500 (7.5) HP	Steel (15)	15mm (5/8")	15mm (5/8")
Base mounted 5500 (7.5) HP and up	Steel (15)	15mm (5/8")	15mm (5/8")
Fans, Blowers & Packages 6 V Units:			
Under 2.5 HP	Steel (15)	3mm (1/8")	3mm (1/8")
2.5 HP to 5 HP	Steel (15)	3mm (1/8")	3mm (1/8")
7.5 HP to 40 HP - up to 400 gpm	Steel (15)	3mm (1/8")	3mm (1/8")
7.5 HP to 40 HP - over 400 gpm	Steel (15)	3mm (1/8")	3mm (1/8")

6. NOTES:

- TABLE INDICATES REQUIRED STATIC DEFLECTION OF ISOLATORS FOR ALL FANS REGARDLESS OF POWER RATING AND FOR ALL OTHER MOTOR DRIVEN EQUIPMENT OVER 0.375 KW (0.5 HP).
- ADVISE CONSULTANT OF EQUIPMENT NOT CONTAINED IN THE TABLE AND OBTAIN CLARIFICATION AS TO THE ISOLATION PERFORMANCE REQUIREMENTS.
- STEEL SPRING ISOLATORS SHALL BE USED FOR ALL DEFLECTIONS 15MM (5/8") AND OVER.
- NEOPRENE ISOLATORS SHALL BE USED FOR DEFLECTIONS 6MM (5/16") AND UNDER.
- USE HOUSED SPRING ISOLATORS FOR HEAT PUMP.

END OF SECTION

DIVISION 22 PLUMBING

1. GENERAL

1.1 SECTION SCOPE

- PIPING, VALVES AND SPECIALTIES SERVING TENANT WATER DISTRIBUTION SYSTEMS AND SANITARY AND STORM DRAIN WASTE AND VENT PIPING, EQUIPMENT AND ACCESSORIES BETWEEN PLUMBING FIXTURES, AND CONNECTIONS TO EXISTING PIPING SERVICES.

1.2 CLEANOUTS

- PROVIDE SANITARY AND STORM PIPING CLEANOUTS AT ALL CHANGES IN DIRECTION, AT THE ENDS OF ALL HORIZONTAL RUNS, AT THE BASE OF EVERY STACK, WHERE DRAINS LEAVE THE BUILDING, WHERE SHOWN ON THE DRAWINGS AND IN COMPLIANCE WITH THE LOCAL PLUMBING CODE, BYLAW AND ORDINANCES.
- PROVIDE CAULKED OR TREADED TYPE CLEANOUTS EXTENDED TO FINISHED FLOOR OR WALL SURFACE.
- PROVIDE HOTTED COVER PLATE CLEAN OUTS ON VERTICAL RANWATER LEADERS ONLY. ENSURE AMPLE CLEARANCE AT CLEAN OUT FOR RIDGING OF DRAINAGE SYSTEM.

2. PRODUCTS

2.1 PIPE AND FITTINGS

- SANITARY AND STORM DRAINAGE, AND VENT SHALL BE CAST IRON CLASS 4000, TO MATCH EXISTING.
- DOMESTIC WATER (ABOVE GRADE INSIDE BUILDING) SHALL BE TYPE "L" HARD COPPER FOR HOT AND COLD WATER.
- NATURAL GAS SHALL BE STEEL SCHEDULE 40, A53 GRADE B.

2.2 VALVES

- WHEREVER POSSIBLE ALL VALVES SHALL BE OF ONE MANUFACTURER.
- GLOBE VALVES SHALL BE OF THE SAME MANUFACTURER AS THE ADJOINING COUPLINGS.
- PROVIDE VALVES WITH MANUFACTURER'S NAME AND PRESSURE RATING CLEARLY MARKED ON OUTSIDE OF BODY. ALL VALVES MUST BE SUITABLE IN ALL RESPECTS FOR SERVICE USED.
- ALL VALVES SHALL HAVE A PROVINCIAL OR NUMBER THAT IS CURRENT.
- BALL VALVES 2 NPS AND UNDER SHALL BE LOW LEAD FORGED BRASS BODY, 2 PIECE BODY, FULL PORT, CHROME PLATED BALL, PIPE SEATS, BLOW OUT PROOF STEM, ADJUSTABLE PACKING NUT, FOR DOMESTIC WATER SERVICE, CLASS 4140 (20, 600 PSI) W.O.G.
- GLOBE VALVES 2 NPS AND UNDER SHALL BE LEAD FREE BRONZE BODY, SWIVEL TYPE STAINLESS STEEL DISC, UNION BONNET, FOR DOMESTIC WATER SERVICE, CLASS 1300 KPA (200 PSI) W.O.G.
- CHECK VALVES 2 NPS AND SMALLER SHALL BE LEAD FREE BRONZE SWING CHECK WITH BRONZE DISC CAPABLE OF BEING REGRINDING, Y PATTERN, SUITABLE FOR DOMESTIC WATER USE, CLASS 1300 KPA (200 PSI) W.O.G.
- PRESSURE REDUCING VALVE NPS 1 AND SMALLER SHALL BE LEAD FREE COPPER SILICON ALLOY BODY OR LOW LEAD BRONZE BODY, SS INTEGRAL STRAINER, RENEWABLE SS SEAT, SERVICEABLE IN LINE, BUILT IN BYPASS CHECK VALVE, SUITABLE FOR HOT AND COLD WATER POTABLE WATER, RATED AT MAXIMUM INLET PRESSURE OF 2100 KPA (300 PSI) AND 82°C (180°F) TEMPERATURE.
- PRESSURE REDUCING VALVE NPS 1-1/4 TO NPS 2 SHALL BE PILOT OPERATED WITH LOW FLOW BYPASS, DAMPRAM ACTUATED GLOBE VALVE, LEAD FREE, BRONZE BODY OR DUCTILE IRON TO ASTM A356, LEAD FREE BRONZE, STAINLESS STEEL OR DUCTILE IRON INTERNALS. ALL DUCTILE IRON COMPONENTS INCLUDING BODY AND COVER SHALL BE LINED AND COATED WITH EPOXY COATING.
- BACKFLOW PREVENTERS DOUBLE CHECK VALVE ASSEMBLY (DCVA) SHALL BE 2 NPS AND SMALLER, LEAD FREE CAST COPPER SILICON ALLOY BODY, PRESSURE DIFFERENTIAL RELIEF VALVE, REPLACEABLE CHECK MODULE SEATS AND DISCS, TWO ISOLATION VALVES, TEST COOKS AND A BRONZE STRAINER, COMPLY WITH CSA B64.5 AND AWWA C510.
- REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) SHALL BE 2 NPS AND SMALLER, LEAD FREE CAST COPPER SILICON ALLOY BODY, PRESSURE DIFFERENTIAL RELIEF VALVE, REPLACEABLE CHECK MODULE SEATS AND DISCS, TWO ISOLATION VALVES, TEST COOKS AND A STRAINER, COMPLY WITH CSA B64.4 AND AWWA C511.
- STRAINERS SHALL BE 1/2" - 2 NPS THREADED ENDS, BRONZE BODY, 100# KPA (150 PSI) RATING.
- WATER HAMMER ARRESTORS SHALL BE BELLOWS TYPE WITH WELDED STAINLESS STEEL NESTING BELLOWS OR PISTON STYLE AND STAINLESS STEEL CASING. AIR CHAMBERS ARE UNACCEPTABLE.

2.3 PREFORMED PIPE INSULATION

- PREFORMED INSULATION, FINE FIBROUS GLASS OR FORMED MINERAL FIBRE PIPE INSULATION WITH ALL SERVICE JACKET VARIOUS TYPES (AUG) AND SHALL BE REINFORCED WITH GLASS FIBRE, FACTORY APPLIED WITH PRESSURE SENSITIVE LAP CLOSURE, MAXIMUM "K" VALUE AT 38°C (100°F) = 0.035 W/M·K (0.24 BTU/IN·HR·FT²·°F) ACCEPTABLE MANUFACTURERS: MANDON INSULATION, KNAUF, KODOL, JOHNS MANVILLE, FIBREK.
- THERMOCANVAS FINISHING JACKET, FIRE RATED, 1700, 10 (2) FIRE RETARDANT CANVAS JACKET FOR COVERING MECHANICAL INSULATION INDOORS, 2550 FIRE CLASS, PLAIN WAVE COTTON, NO DYES.
- PVC FINISHING JACKET, WHITE, UV RESISTANT, FOR INDOOR OR OUTDOOR APPLICATIONS, 2550 FIRE CLASS, MINIMUM 0.50 MM (1/64") THICK.

2.4 CLEANOUTS

- FLOOR - UNFINISHED AREA, CAST IRON FLOOR LEVEL, CLEANOUT ASSEMBLY WITH EXTRA HEAVY DUTY, ROUND, ADJUSTABLE, SCORATED, SECURED CAST IRON TOP AND NO-HUB OUTLET, SUITABLE FOR HEAVY TRAFFIC.
- FLOOR - FINISHED AREA (GENERAL AREA) SHALL BE CAST IRON CLEANOUT WITH EXTRA HEAVY DUTY ROUND, ADJUSTABLE, SCORATED, SECURED NICKEL BRONZE TOP, AND NO-HUB OUTLET. FOOT TRAFFIC AREAS WITH SHEET GOODS FLOORING SHALL BE CAST IRON FLOOR LEVEL CLEANOUT ASSEMBLY WITH A SQUARE ANCHOR, NICKEL BRONZE TOP WITH (6MM (1/8") TYLE RECESS, AND NO-HUB OUTLET, CARPETED FLOOR AREA SUBJECT TO FOOT TRAFFIC SHALL BE CAST IRON FLOOR LEVEL CLEANOUT ASSEMBLY WITH ROUND, ADJUSTABLE, SCORATED, NICKEL BRONZE TOP AND CARPET CLAMPING FRAME.
- WALL - FINISHED AREA SHALL BE CONCEALED DRAINAGE LINE IN A FINISHED WALL, CAST IRON CLEANOUT TEE AND CAST IRON COUNTERSINK FLUSH WITH STAINLESS STEEL ROUND COVER AND SCREW.

2.5 SALES, FLASHING AND VENT TERMINALS

- METAL FLASHING-26 GAUGE GALVANIZED STEEL, METAL COUNTER FLASHING-22 GAUGE GALVANIZED STEEL.
- LEAD FLASHING-WATERPROOFING: 1.5L/30 FT SHEET LEAD.
- FLEXIBLE FLASHING-4" ML THICK SHEET BUTYL, COMPATIBLE WITH ROOFING.
- FLOOR DRAIN FLASHING-40 ML THICK CHLORANATED POLYETHYLENE (CPE) EQUIVALENT TO CHLORALLOY.
- CAPS-STEEL, 22 GAUGE MINIMUM, 16 GAUGE AT FIRE RESISTANT ELEMENTS.

2.6 PLUMBING FIXTURES

- ALL SINKS ARE TO BE DFO-SUPPLIED EQUIPMENT.
- HOSE BIBBS TO BE FROST FREE HOSE BIBBS COMPLETE WITH LOCKABLE COVER.

3. EXECUTION

3.1 PIPING

- PIPE CONNECTIONS NPS 1/2 AND LESS SHALL BE SOLDERED OR SCREWED JOINT UNLESS NOTED OTHERWISE.
- PIPE CONNECTIONS NPS 3/4 SHALL BE SCREWED JOINT FOR LIQUID SYSTEMS UNLESS NOTED OTHERWISE.
- PIPE CONNECTIONS NPS 21/2 AND LARGER SHALL BE WELDED OR FLANGED UNLESS NOTED OTHERWISE.

3.2 PIPE SUPPORT SPACING

- PROVIDE HANGERS AND SUPPORTS TO SECURE EQUIPMENT IN PLACE, PREVENT VIBRATION, PROTECT AGAINST DAMAGE FROM EARTHQUAKE, MAINTAIN GRADE, PROVIDE FOR EXPANSION AND CONTRACTION, AND ACCOMMODATE ISOLATION.
- PROVIDE GALVANIZED HANGERS AND SUPPORTS FOR ALL PIPING EXCEPT HANGERS AND SUPPORTS SHALL BE COPPER PLATED OR ENPOY COATED FOR COPPER PIPING.
- USE OF PERFORATED STRIPS IS NOT PERMITTED FOR PIPE HANGERS.
- POWER ACTUATED FASTENERS AND "DROP-IN" ANCHORS SHALL NOT BE USED.
- PROVIDE RING TYPE HANGERS FOR PIPING UP TO NPS 1/2 AND CLEVIS TYPE HANGERS FOR PIPING OVER NPS 1/2.

Pipe Size (NPS)	Red Diameter mm (in)	Spacing m (ft)
1/2	5 (3/8)	1.8 (6)
3/4	6 (3/8)	2.4 (8)
1	8 (3/8)	3.1 (10)
1 1/4	10 (3/8)	3.6 (12)

3.3 EXPANSION COMPENSATION

- PROVIDE STRUCTURAL WORK AND EQUIPMENT REQUIRED FOR EXPANSION AND CONTRACTION OF ALL PIPING. PROVIDE ANCHORS, GUIDES, AND EXPANSION JOINTS AS REQUIRED TO ADEQUATELY PROTECT THE PIPING SYSTEMS.
- PROVIDE EXPANSION COMPENSATION FOR ALL CLOSED PIPING SYSTEMS INCLUDING BUT NOT LIMITED TO HEATING WATER, CHILLED WATER, STEAM AND CONDENSATE, CLOSED CONDENSER WATER SYSTEMS, AND ALL OTHER CLOSED PIPING SYSTEMS THAT OPERATE AT VARYING TEMPERATURES. EXPANSION COMPENSATION MAY BE ELIMINATED FROM OPEN SYSTEMS SUCH AS DOMESTIC COLD, DOMESTIC HOT, DOMESTIC HOT REGICULATING SYSTEMS EXCEPT WHERE LOCATED IN VERTICAL SERVICE SHIFTS.
- ALL PIPING SHALL BE ANCHORED AND SUPPORTED IN SUCH A MANNER THAT STRAIN AND/OR WEIGHT DOES NOT COME UPON ANY APPARATUS AND PIPE BRANCH CONNECTIONS. EXPANSION JOINTS AND COMPENSATORS SHALL BE INSTALLED AND GUIDED AS PER MANUFACTURER'S RECOMMENDATIONS. ALL EQUIPMENT SHALL BE CONNECTED WITH UNIONS OR FLANGES TO PROVIDE FOR EASY REMOVAL. WHERE PIPING PASSES THROUGH WALLS OR FLOOR SLABS, THE SLEEVES SHALL BE OF SUFFICIENT SIZE TO ACCOMMODATE THE EXPANSION AND THE PIPE INSULATION, WITHOUT BINDING OR DRIPPING THE INSULATION OR PREVENTING THE EXPANSION OF THE PIPING.
- INSTALL ALL VALVES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
- INSTALL VALVES IN ACCESSIBLE LOCATIONS WITH STEMS UPRIGHT OR ANGLED 45° ABOVE HORIZONTAL UNLESS APPROVED OTHERWISE. VALVES MUST BE ACCESSIBLE WITHOUT REMOVING ADJACENT PIPING.
- INSTALL CONTROL VALVES WITH THEIR STEMS UPRIGHT UNLESS APPROVED OTHERWISE AND WITH ADEQUATE CLEARANCE FOR REMOVAL OF ACTUATORS.
- PROVIDE STEM EXTENDING ON ALL INSULATED VALVES.
- PROVIDE FULL PORT BALL VALVES IN PIPING 50 MM (2") AND SMALLER AND BUTTERFLY VALVES IN PIPING 65 MM (2-1/2") AND LARGER FOR SHUT-OFF, EQUIPMENT ISOLATION, THROTTLING, BYPASS OR MANUAL FLOW CONTROL SERVICES.
- THROTTLING VALVES ARE NOT TO BE USED FOR SHUT-OFF; ADDITIONAL VALVES SHALL BE INSTALLED FOR ISOLATION PURPOSES.
- PROVIDE ISOLATION VALVES AT BRANCH TAKE-OFFS, TO ISOLATE EACH PIECE OF EQUIPMENT, UPSTREAM OF ALL METERS, GAUGES, AUTOMATIC AIR VENTS, AND AS INDICATED.
- USE SILENT CHECK VALVES ON DISCHARGE OF PUMPS AND IN VERTICAL PIPES WITH DOWNWARD FLOW, AND AS INDICATED.
- USE CIRCUIT SETTING GLOBE VALVES COMPLETE WITH LOCK SHIELD TO CONTROL FLOW IN CIRCUITS, EXCEPT WHERE BALANCING COOKS ARE SPECIFICALLY SPECIFIED.
- INSTALL AUTOMATIC FLOW LIMITING BALANCING VALVES IN DOMESTIC HOT WATER RECIRCULATION PIPING.
- INSTALL BALANCING VALVES IN RETURN PIPING CONNECTIONS TO EACH TERMINAL HEATING AND COOLING UNIT - E.G. FAN COIL UNITS.

3.4 PIPING INSULATION MINIMUM THICKNESS SCHEDULE

Type of System	Design Operating Temperature Range °C (°F)	Thermal Conductivity of Insulation Coefficient Range W/m·K (ft·lb/Btu·in·°F)	Mean Rating Temperature °C (°F)	Minimum Thickness of Piping Insulation (mm)	Series 1	Series 2	Series 3	Series 4
Above Grade		0.042-0.045	63 (149)	40	40	60	75	90
Hot Water Drains	51-93 (124-200)	0.036-0.042	52 (126)	25	40	50	50	50
Hot Water Systems	41-60 (105-142)	0.035-0.040	38 (100)	25	25	40	40	40
Cool Water & Refrigeration	5-16 (41-61)	0.030-0.039	24 (75)	25	25	25	25	25
	-5 (-41)	0.030-0.039	24 (75)	25	25	40	40	40

NOTE: WHERE THE THERMAL CONDUCTIVITY OF A PROPOSED INSULATION IS GREATER THAN THE RANGE SPECIFIED ABOVE, THE THICKNESS WILL BE INCREASED BY THE RATIO OF U2/U1.

U2 = PROPOSED INSULATION "K" VALUE AT THE TABLE MEAN RATING TEMPERATURE.

U1 = UPPER RANGE LIMIT "K" VALUE FROM THE TABLE ABOVE.

NOTE: WHERE THERMAL CONDUCTIVITY OF PROPOSED INSULATION IS LESS THAN THE RANGE SPECIFIED ABOVE, THE THICKNESS MAY BE DECREASED BY THE RATIO OF U2/U1.

U2 = PROPOSED INSULATION "K" VALUE AT THE TABLE MEAN RATING TEMPERATURE.

U1 = LOWER RANGE LIMIT "K" VALUE FROM THE TABLE ABOVE.

3.5 PIPING FINISH SCHEDULE

- INDOORS CONCEALED; FACTORY FINISH
- INDOORS EXPOSED IN MECHANICAL ROOM AND ELSEWHERE; CANVAS JACKET
- INDOORS EXPOSED IN UTILITY AREAS, PARADE, ETC.; PVC JACKET

3.6 SALES, FLASHING AND VENT TERMINALS

- PROVIDE FLEXIBLE FLASHING AND METAL COUNTER FLASHING WHERE PIPING PENETRATES WEATHER OR WATERPROOFED WALLS AND FLOORS.
- CPE, CHLORANATED POLYETHYLENE OR LEAD MATERIAL MAY BE USED AT FLOOR DRAINS AND CLEANOUTS. CHLORANATED SHALL BE SOLVENT WELDED TO MANUFACTURER'S INSTALLATION INSTRUCTIONS. LEAD SHALL NOT BE USED ON ROOFS WHERE THE ROOFING MATERIAL IS APPLIED BY A TORCH-ON METHOD.
- FLASH FLOOR DRAINS IN FLOORS WITH TOPPING OVER OCCUPIED AREAS WITH LEAD OR CPE MEMBRANE, A MINIMUM OF 300MM (12") CLEAR ON SIDES WITH MINIMUM 900MM X 900MM (36" X 36") SHEET SIZE. FASTEN FLASHING TO DRAIN CLAMP DEVICE.

DIVISION 25 INTEGRATED AUTOMATION

2. CONTROLS GENERAL

2.1 SECTION SCOPE

- PROVIDE A COMPLETE SYSTEM OF AUTOMATIC CONTROLS INCLUDING CONTROL DEVICES, COMPONENTS, WIRING AND MATERIALS. ALL CONTROL WORK ASSOCIATED WITH THE WORK OF DIVISIONS 25.2 AND 23.

2.2 RELATED REQUIREMENTS

- THIS SECTION OF THE SPECIFICATION FORMS PART OF THE CONTRACT DOCUMENTS AND IS TO BE READ, INTERPRETED, AND COORDINATED WITH ALL OTHER PARTS. FOR GENERAL CONDITIONS, REFER TO SECTION 25.02 HEATING, VENTILATION, AND AIR CONDITIONING.

2.3 CODE COMPLIANCE

- ALL WORK SHALL COMPLY WITH CURRENT EDITIONS OF THE NATIONAL BUILDING CODES, STANDARDS AND ACTS AND WILL MEET THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.

2.4 EXAMINATION OF EXISTING SYSTEM

- THIS PROJECT INVOLVES RENOVATION TO AN EXISTING BUILDING, THOUGH MOST OF THE EXISTING CONTROLS HAVE BEEN REMOVED OR SHALL BE. THE CONTRACTOR SHALL INSPECT THE BUILDING PRIOR TO TENDER CLOSE AND INCLUDE IN HIS BID ALL CONTROL COMPONENTS REQUIRED TO PROVIDE A FULLY OPERATIONAL SYSTEM INCLUDING REPLACEMENT OF EXISTING DEFECTIVE COMPONENTS WHERE NOTED IN THE PROJECT DOCUMENTS.

2.5 DESIGN REQUIREMENTS

- DESIGN AND PROVIDE CONDUIT AND WIRING LINKING ELEMENTS OF SYSTEM. SUPPLY SUFFICIENT PROGRAMMABLE CONTROLLERS OF TYPES TO MEET PROJECT REQUIREMENTS. QUANTITY AND POINTS CONTENTS AS REVIEWED BY CONSULTANT PRIOR TO INSTALLATION.
- PROVIDE ALL CONTROL SYSTEM COMPONENTS TO MAKE A COMPLETE AND OPERABLE SYSTEM, EXCEPT THOSE SUPPLIED AS PART OF PACKAGED EQUIPMENT CONTROLS, BUT INCLUDING ALL AUTO-SEQUENCING DEVICES AND ELECTRICAL INTERLOCKS REQUIRED TO ACCOMPLISH THE SEQUENCES SPECIFIED HEREINAFTER. REFER TO THE ELECTRICAL EQUIPMENT SCHEDULE, THE ELECTRICAL DRAWINGS, AND THE ELECTRICAL SPECIFICATION WHICH DESCRIBES THE LIMITS OF THE EXTENT TO THE WORK IN DIVISION 25 SERVING MECHANICAL SYSTEMS. MATERIALS, EQUIPMENT, CONNECTIONS, AND POWER SHALL BE PROVIDED BY DIVISION 25 BUT REQUIRED FOR THE CONTROL SYSTEM SHALL BE PROVIDED UNDER THIS SECTION.

3. PRODUCTS

3.1 THERMOSTATS

- PROVIDE NEW 7-DAY PROGRAMMABLE THERMOSTATS WHERE INDICATED OF BUILDING STANDARD TYPE. ENSURE OPERATING CHARACTERISTICS ARE COMPATIBLE WITH CONTROL COMPONENTS (I.E. DIRECT/REVERSE ACTING).
- ALL THERMOSTATS TO BE WALL OR COLUMN MOUNTED AT 1500MM ABOVE FINISHED FLOOR UNLESS SPECIFICALLY NOTED OTHERWISE.
- ALL THERMOSTATS ARE TO BE CALIBRATED PRIOR TO AIR BALANCING. CONTACT BUILDING OWNER IF AN EXISTING THERMOSTAT NEEDS REPLACING.

3.2 CONTROL COMPONENTS

- PROVIDE CONTROL VALVES AND DAMPER ACTUATORS AS REQUIRED TO MEET THE SEQUENCE OF OPERATION AND MEET THE DESIGN INTENT. VALVES AND ACTUATORS SHALL BE MADE BY BELIMO, APPROPRIATE FOR SERVICE AND ENVIRONMENT.
- CONTROL VALVES FOR NEW MECHANICAL EQUIPMENT SHALL BE PROVIDED BY CONTROLS CONTRACTOR FOR INSTALLATION BY THE MECHANICAL CONTRACTOR.
- VERIFY CORRECT OPERATION OF CONTROLLED DEVICES INCLUDING CONTROL VALVES, DAMPERS, SWITCHES, ETC. WITHIN THE AREA OF RENOVATION.

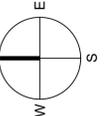
4. EXECUTION

4.1 SEQUENCE OF OPERATION

- UNIT HEATERS - CONTROLLED MANUALLY VIA PROGRAMMABLE T-STAT OR TEMPORARY TEMPERATURE OVERRIDE.
- EF-1, EF-2 - CONTROLLED VIA WALL SWITCH.
- EF-3 - WALL SWITCH WITH OVERRIDE TO HIGH SPEED.
- EF-4 - CONTROL VIA WALL SWITCH.
- MOTORIZED DAMPERS TO PROVE OPEN PRIOR TO FAN STARTING. FAN TO TURN OFF PRIOR TO MOTORIZED DAMPERS CLOSING. DAMPERS TO FAIL CLOSED. DAMPER ASSOCIATED WITH FAN SERVING SAME SPACE.
- EXISTING DUCTLESS SPLIT SYSTEM PROVIDED BY OPA, CONTROL VIA PACKAGED CONTROLS AND VIA PROGRAMMABLE T-STAT. T-STAT TO PREVENT SIMULTANEOUS OPERATION OF HEAT PUMP IN COOLING MODE AND UNIT HEATERS IN HEATING MODE. T-STAT TO OPERATE HEAT PUMP IN COOLING MODE WHEN ROOM TEMPERATURE RISES ABOVE SETPOINT.
- PUMP #1 - PUMP TO CIRCULATE HEATING WATER WHENEVER A UNIT HEATER CALLS FOR HEAT, ADJUSTING SPEED AS REQUIRED TO MEET SETPOINT.

END OF SECTION

FISHERIES AND OCEANS CANADA REAL PROPERTY, SAFETY AND SECURITY	
PACIFIC BIOLOGICAL STATION TECHNICAL SERVICES BUILDING MECHANICAL UPGRADE	SCALE AS NOTED
MECHANICAL SPECIFICATION	DATE NOV 19, 2019
MO.03	DRAWING NUMBER
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NO.	REVISIONS
1	REVISION

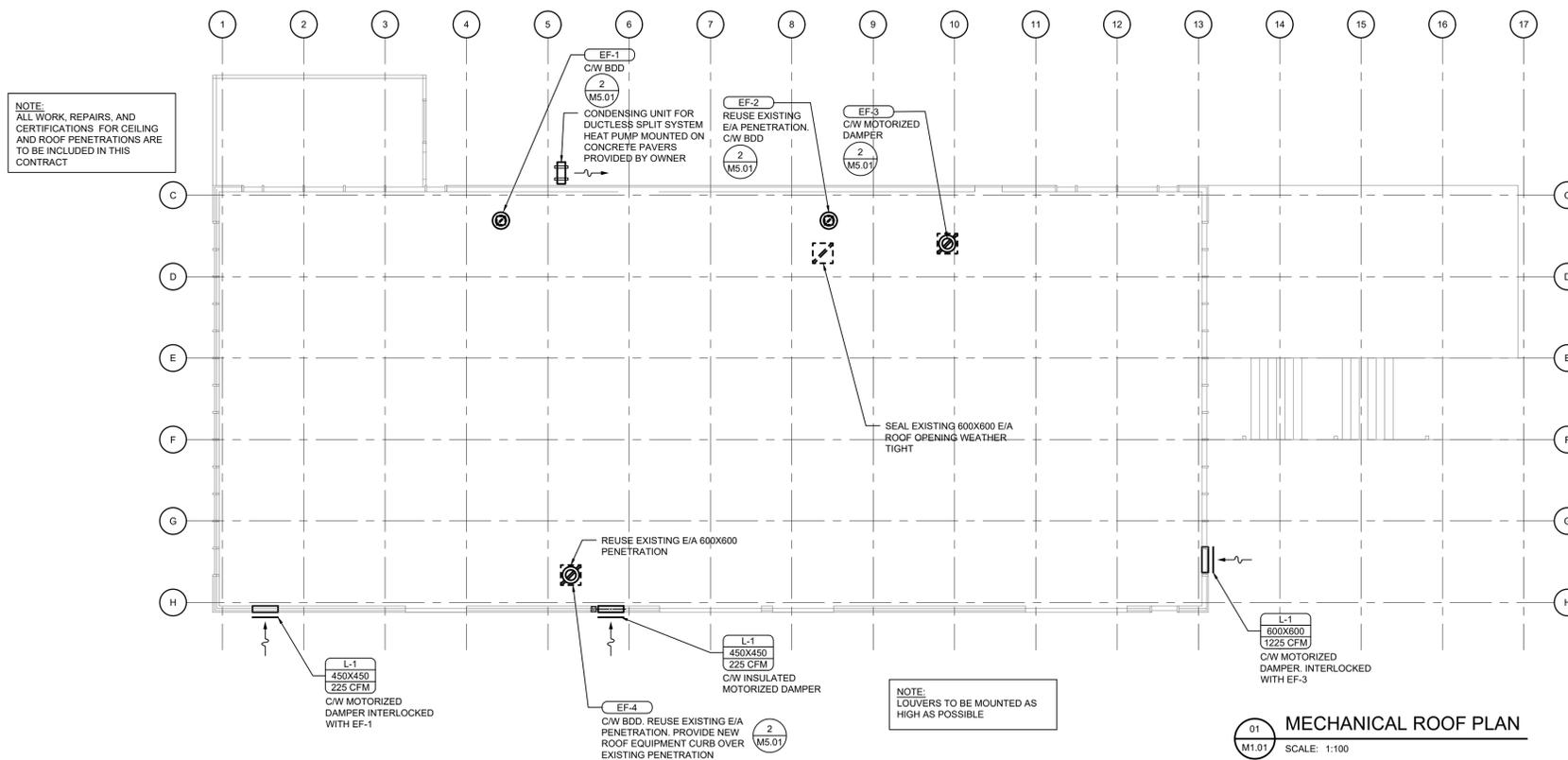


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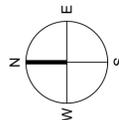


PACIFIC BIOLOGICAL STATION
TECHNICAL SERVICES BUILDING
MECHANICAL UPGRADE
MECHANICAL ROOF PLAN

SCALE AS NOTED
DATE NOV 19, 2019
DRAWING NUMBER M1.01
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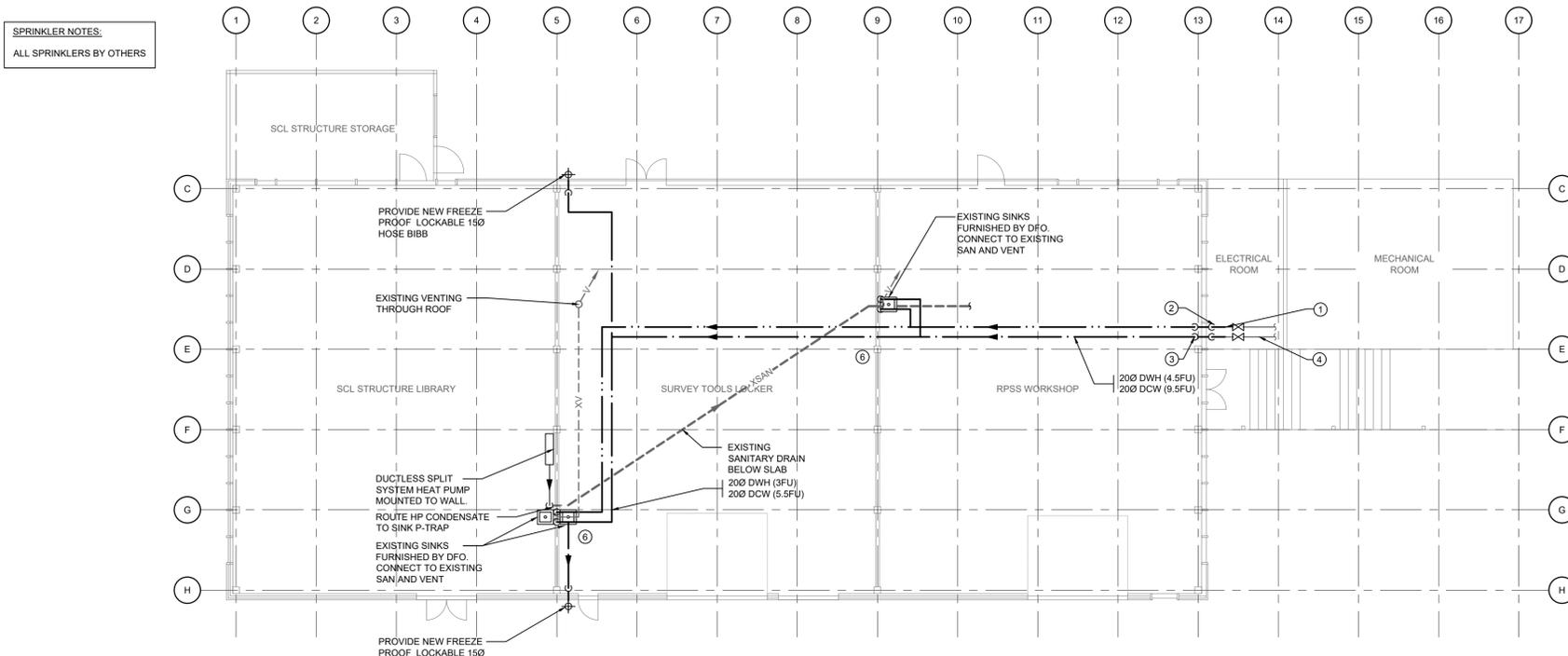
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1	2019-11-20	ISSUED FOR TENDER
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DWG. NO. DRAWING REFERENCES

NOTES



SPRINKLER NOTES:
ALL SPRINKLERS BY OTHERS

- NOTES:**
- ① CONNECT TO EXISTING 200 DCW AND DHW WATER CAP OFFS IN ELECTRICAL ROOM
 - ② ROUTE DHW/DCW PIPING THROUGH EXISTING OPENINGS. PROVIDE FIRE STOPPING TO MAINTAIN REQUIRED FIRE RATINGS
 - ③ DHW/DCW PIPING ENTER WORKSHOP AT LOW LEVEL AND RUN UP WALL TO BELOW CEILING
 - ④ PROVIDE DRIP PAN UNDER DOMESTIC WATER RUNNING THROUGH ELECTRICAL ROOM
 - ⑤ REPLACE THE ROOF DRAIN PIPING INSULATION THAT WAS REMOVED ON APPROXIMATELY 3 PIPING JOINTS DURING ASBESTOS ABATEMENT
 - ⑥ PROVIDE FIRE STOPPING ON ALL PENETRATIONS THROUGH THE TWO INTERIOR WALLS IN SURVEY TOOLS LOCKER

PLUMBING PLAN
SCALE: 1:100

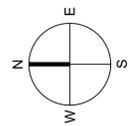
**PACIFIC BIOLOGICAL STATION
TECHNICAL SERVICES BUILDING
MECHANICAL UPGRADE**

PLUMBING PLAN

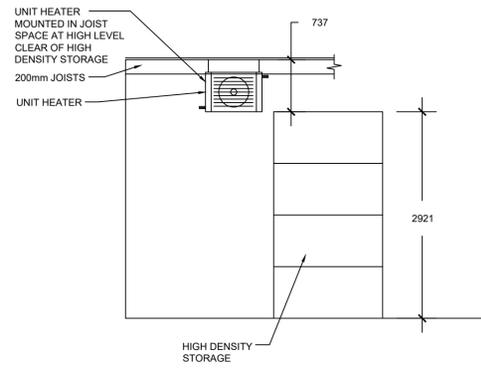
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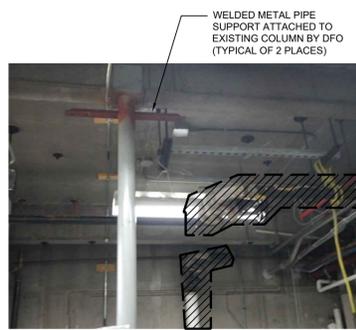
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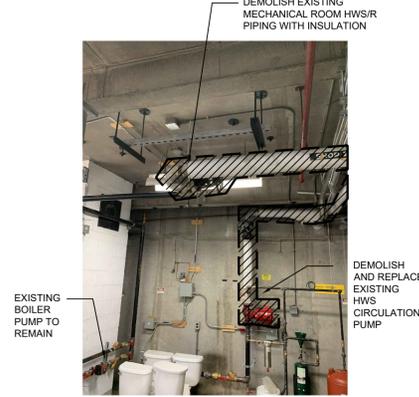
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06 UNIT HEATER MOUNTING
M2.01 SCALE: 1:50



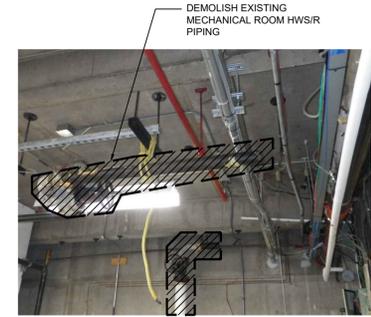
05 HWS/R PIPE SUPPORT
M2.01 SCALE: NTS



04 EXISTING BOILER PUMP
M2.01 SCALE: NTS

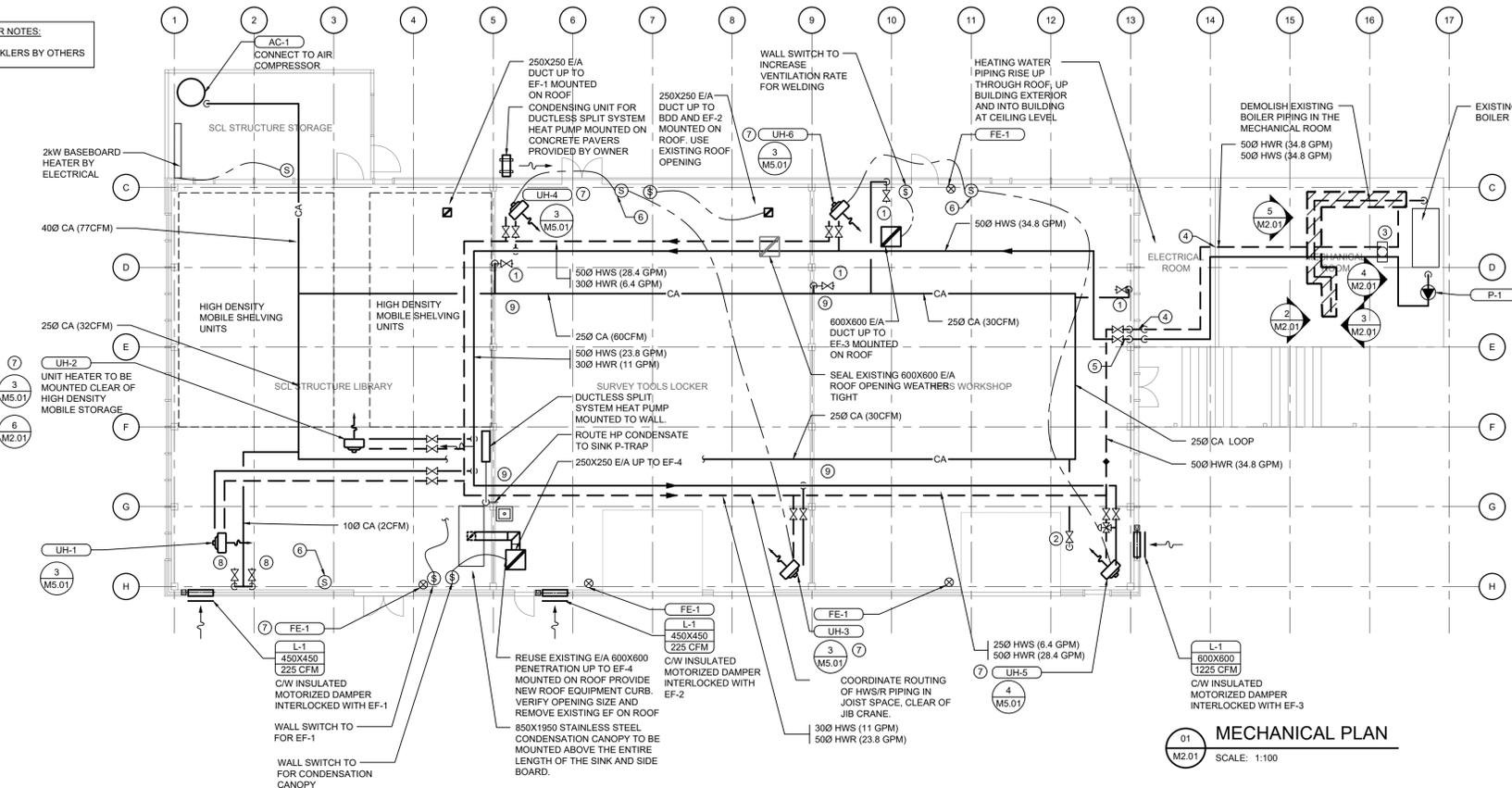


03 EXISTING HWS PIPING
M2.01 SCALE: NTS



02 EXISTING HWS PIPING
M2.01 SCALE: NTS

SPRINKLER NOTES:
ALL SPRINKLERS BY OTHERS



MECHANICAL ROOM NOTES:
EXISTING BOILER HAS BEEN DRAINED AND SHUT DOWN
NO PIPING TO BE MOUNTED TO CEILING OR WALL DUE TO ASBESTOS ON MECHANICAL ROOM CEILING
PIPING TO BE MOUNTED ON A HORIZONTAL SUPPORT WELDED ON EXISTING COLUMN AND USE EXISTING WALL OPENINGS INTO THE ELECTRICAL ROOM FOR HWS/R PIPING.

- NOTES:**
- 100 COMPRESSED AIR CONNECTION COMPLETE WITH REGULATOR AND QUICK CONNECT. ALLOWANCE FOR 15 CFM @ 120 PSI.
 - 100 COMPRESSED AIR CONNECTION ON PULL DOWN HOSE REEL COMPLETE WITH REGULATOR AND QUICK CONNECTION ALLOWANCE FOR 15 CFM @ 120 PSI.
 - WELDED METAL PIPE SUPPORT ATTACHED TO EXISTING COLUMN BY DFO
 - ROUTE HWS/R PIPING THROUGH EXISTING OPENINGS. PROVIDE FIRESTOPPING TO MAINTAIN REQUIRED FIRE RATINGS
 - HWS/R PIPING ENTER WORKSHOP AT LOW LEVEL AND RUN UP WALL TO BELOW CEILING
 - 7 DAY PROGRAMMABLE THERMOSTAT CONTROLLING UNIT HEATERS COMPLETE WITH TEMPORARY TEMPERATURE OVERRIDE. MOUNT ON THERMAL ISOLATION BASE
 - UNIT HEATERS TO BE MOUNTED AS HIGH AS POSSIBLE
 - 60 COMPRESSED AIR CONNECTION COMPLETE WITH REGULATOR AND QUICK CONNECT. ALLOWANCE FOR 1 CFM @ 120 PSI.
 - PROVIDE FIRE STOPPING ON ALL PENETRATIONS THROUGH THE TWO INTERIOR WALLS IN SURVEY TOOLS LOCKER

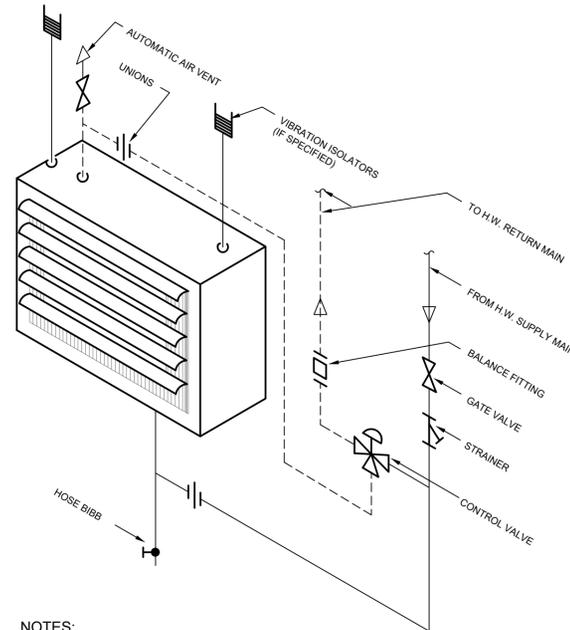
PACIFIC BIOLOGICAL STATION
TECHNICAL SERVICES BUILDING
MECHANICAL UPGRADE

MECHANICAL PLAN

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REVISION	1

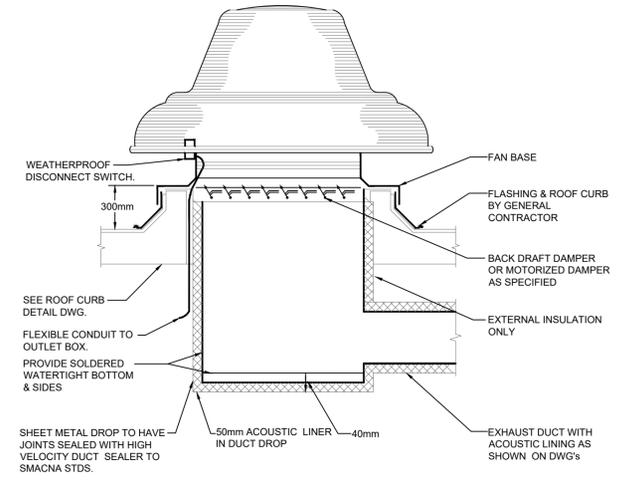
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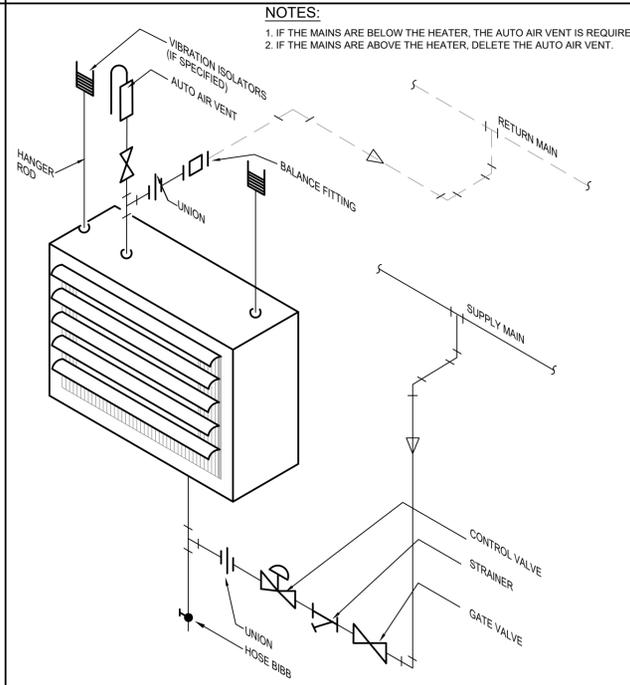
NOTES:
 1. IF THE PIPING MAINS ARE BELOW THE HEATER, THE AUTO AIR VENT IS REQUIRED.
 2. IF THE PIPING MAINS ARE ABOVE THE HEATER, DELETE THE AUTO AIR VENT.

4 3-WAY COIL DETAIL
 M4.01 SCALE: NTS



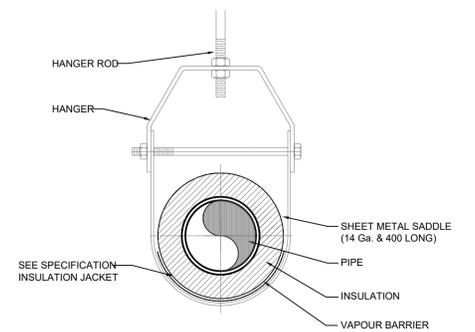
DETAIL NOTES
 1. SEE DRAWINGS FOR DIMENSIONS OF ROOF OPENING

2 ROOF MOUNTED EXHAUST FAN DETAIL
 M4.01 SCALE: NTS

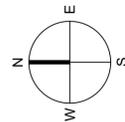


NOTES:
 1. IF THE MAINS ARE BELOW THE HEATER, THE AUTO AIR VENT IS REQUIRED.
 2. IF THE MAINS ARE ABOVE THE HEATER, DELETE THE AUTO AIR VENT.

3 2-WAY CONTROL VALVE PIPING
 M4.01 SCALE: NTS



03 INSULATED PIPE HANGER DETAIL
 M4.01 SCALE: NTS



FISHERIES AND OCEANS CANADA
 REAL PROPERTY, SAFETY AND SECURITY

**PACIFIC BIOLOGICAL STATION
 TECHNICAL SERVICES BUILDING
 MECHANICAL UPGRADE
 MECHANICAL DETAILS**

SCALE	AS NOTED
DATE	NOV 19, 2019
DRAWING NUMBER	M4.01
REVISION	1

DESIGNED	AJM
DRAWN	AJM
CHECKED	CCT
RECOMMENDED	
APPROVED	
APPROVED	

NO.	DATE	REVISIONS
1	2019-11-20	ISSUED FOR TENDER

DWG. NO.	DRAWING REFERENCES	NOTES
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