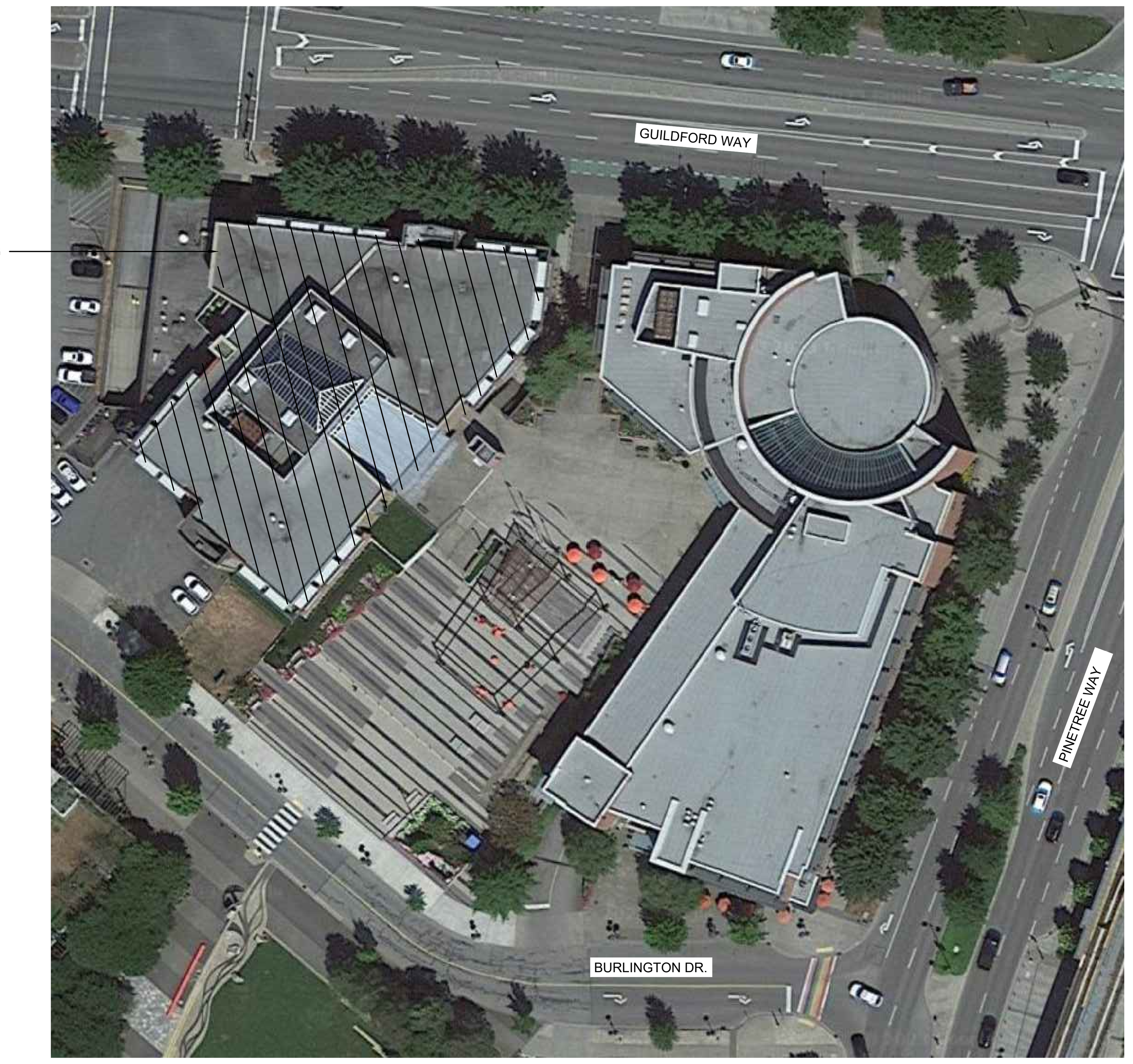

SCOPE OF WORK BUILDING

NORTH

1 / M0.01 SITE PLAN

SCALE: NTS

MECHANICAL ABBREVIATIONS

AD	AREA DRAIN	KW	KILOWATT
AFF	ABOVE FINISHED FLOOR	KS	KITCHEN SINK
AHU	AIR HANDLING UNIT	LV	LAVATORY
ARCH	ARCHITECTURAL	LAT	LEAVING AIR TEMPERATURE
BB	BASEBOARD HEATER	LWT	LEAVING WATER TEMPERATURE
BDD	BACKDRAFT DAMPER	MAU	MAKE-UP AIR UNIT
BF	BOTTLE FILLER	MAX	MAXIMUM
BFP	BACKFLOW PREVENTER	MH	MANHOLE
BHP	BREAK HORSEPOWER	MBH	1000 BRITISH THERMAL UNITS/HOUR
BMS	BUILDING MANAGEMENT SYSTEM	MD	MOTORIZED DAMPER
BT	BATH TUB	MECH	MECHANICAL
CB	CATCH BASIN	MIN	MINIMUM
CFM	CUBIC FEET PER MINUTE	NFHB	NON FREEZE HOSE BIB
CLG	CEILING	NIC	NOT IN CONTRACT
CO	CLEANOUT	NC	NOISE CRITERIA/NORMALLY CLOSED
CONN	CONNECTION	NO	NORMALLY OPEN
C/W	COMPLETE WITH	NTS	NOT TO SCALE
CONT	CONTINUATION	O/A	OUTDOOR AIR
CTE	CONNECT TO EXISTING	OBD	OPPOSED BLADE DAMPER
DB	DRY BULB	OED	OPEN ENDED DUCT
DCVA	DOUBLE CHECK VALVE ASSEMBLY	OD	OUTSIDE DIAMETER
DDC	DIRECT DIGITAL CONTROL	POC	POINT OF CONNECTION
DEG	DEGREE	PRV	PRESSURE REDUCING VALVE
DF	DRINKING FOUNTAIN	PSI	POUNDS PER SQUARE INCH
DIA	DIAMETER	R/A	RETURN AIR
DN	DOWN	RF	RETURN FAN
DUC	DUAL CHECK VALVE	RM	ROOM
DW	DISH WASHER	RPM	REVOLUTIONS PER MINUTE
DWG	DRAWING	RWL	RAIN WATER LEADER
E/A	EXHAUST AIR	S/A	SUPPLY AIR
EAT	ENTERING AIR TEMPERATURE	SF	SUPPLY FAN
EF	EXHAUST FAN	SH	SHOWER
EFF	EFFICIENCY	SK	SINK
ELEC	ELECTRICAL	SS	STAINLESS STEEL
ENT	ENTERING	SP	STATIC PRESSURE
ESP	EXTERNAL STATIC PRESSURE	SPEC	SPECIFICATION
EWT	ENTERING WATER TEMPERATURE	ST	STORM
EXH	EXHAUST	T/A	TRANSFER AIR
FA	FROM ABOVE	TA	TO ABOVE
FB	FROM BELOW	TB	TO BELOW
FD	FLOOR DRAIN	TBC	TO BE CONFIRMED
FE	FIRE EXTINGUISHER	TBD	TO BE DETERMINED
FFD	FUNNEL FLOOR DRAIN	TD	TRENCH DRAIN
FLA	FULL LOAD AMPS	THRU	THROUGH
FLR	FLOOR	TS	TAMPER SWITCH
FPM	FEET PER MINUTE	TSP	TOTAL STATIC PRESSURE
GPM	GALLONS PER MINUTE	TYP	TYPICAL
GWB	GYPSUM WALL BOARD	UR	URINAL
HD	HUB DRAIN	VFD	VARIABLE FREQUENCY DRIVE
HB	HOSE BIBB	VTR	VENT THROUGH ROOF
HP	HORSEPOWER	W	WATER MAIN
ID	INSIDE DIAMETER	WB	WET BULB
INV	INVERT	WC	WATER CLOSET
JS	JANITOR SINK	WG	WATER GAUGE

SYMBOL SCHEDULE

PIPING SYSTEMS

- DOMESTIC COLD WATER (DCW)
- DOMESTIC HOT WATER (DHW)
- DOMESTIC HOT WATER RECIRC. (DHWR)
- V — SANITARY VENT
- SAN — SANITARY SEWER ABOVE GRADE
- SAN — SANITARY SEWER BELOW GRADE
- ST — STORM SEWER ABOVE GRADE
- ST — STORM SEWER BELOW GRADE
- X — DRAIN TILE
- IR — IRRIGATION
- G — GAS
- C — CONDENSATE DRAIN
- HWS — HEATING WATER SUPPLY
- HWR — HEATING WATER RETURN
- CHWS — CHILLED WATER SUPPLY
- CHWR — CHILLED WATER RETURN
- CONDS — CONDENSER WATER SUPPLY
- CONDR — CONDENSER WATER RETURN
- RS — REFRIGERANT SUCTION(GAS)
- RL — REFRIGERANT LIQUID

FITTINGS AND VALVES

- DIRECTION OF FLOW
- PIPE DROP
- PIPE RISE
- PIPE TEE UP
- PIPE TEE DOWN
- PIPE UNION
- PIPE CLEAN-OUT
- PIPE CLEAN-OUT TO GRADE
- PIPE CAP-OFF
- ISOLATION VALVE
- ISOLATION VALVE (NORMALLY CLOSED)
- CHECK VALVE
- 2-WAY CONTROL VALVE
- 3-WAY CONTROL VALVE
- S — SOLENOID VALVE
- BALANCING VALVE
- CIRCUIT SETTER VALVE
- PRESSURE REDUCING VALVE
- PRESSURE INDEPENDENT VALVE
- STRAINER
- RELIEF VALVE
- BACKFLOW PREVENTOR
- AUTOMATIC AIR VENT
- SEISMIC GAS SHUT-OFF VALVE
- PIPE ANCHOR
- EXPANSION JOINT
- FLEX COUPLING
- PIPE SLEEVE
- HEAT TRACING

OUTLETS AND DRAINS

- OPEN DRAIN
- HOSE-BIBB
- FLOOR DRAIN
- FUNNEL FLOOR DRAIN
- ROOF DRAIN
- AREA DRAIN
- P-TRAP
- VENT TO ABOVE

MECHANICAL EQUIPMENT

- PUMP
- CABINET FAN
- PROPELLER FAN
- UNIT HEATER
- FORCE FLOW HEATER
- REHEAT COIL

SYSTEM MONITORING AND CONTROLS

- T — ROOM TEMPERATURE SENSOR
- RT — REVERSE ACTING TEMPERATURE SENSOR
- S — TEMPERATURE SENSOR
- H — HUMIDITY SENSOR
- CO_2 — CO_2 SENSOR
- T — PIPE TEMPERATURE SENSOR
- P — PRESSURE GUAGE
- THERMOMETER
- F/S — FLOW SWITCH
- GM — GAS METER
- WM — WATER METER
- CONTROL WIRING

DUCTWORK

- SUPPLY OR OUTDOOR AIR DUCT UP
- SUPPLY OR OUTDOOR AIR DUCT DOWN
- RETURN AIR DUCT UP
- RETURN AIR DUCT DOWN
- EXHAUST AIR DUCT UP
- EXHAUST AIR DUCT DOWN
- TURNING VANES
- ACOUSTIC INSULATION
- BALANCING DAMPER
- BDD — BACKDRAFT DAMPER
- M — MOTORIZED DAMPER
- FIRE DAMPER - VERTICAL
- FIRE DAMPER - HORIZONTAL
- FIRE/SMOKE DAMPER
- DUCT CAP-OFF
- RETURN OR EXHAUST AIR GRILLE
- UC — UNDER-CUT DOOR

FIRE PROTECTION

- FIRE EXTINGUISHER
- FIRE DEPARTMENT SIAMESE CONNECTION
- PENDANT SPRINKLER HEAD
- EXT. COVERAGE PENDANT SPRINKLER HEAD
- UPRIGHT SPRINKLER HEAD
- EXT. COVERAGE UPRIGHT SPRINKLER HEAD
- UP AND DOWN SPRINKLER HEAD
- UP AND DOWN EXTENDED COVERAGE HEAD
- SIDEWALL SPRINKLER HEAD
- EXTENDED COVERAGE SIDEWALL HEAD
- DRY SPRINKLER ALARM VALVE
- SP — WET SPRINKLER SUPPLY LINE
- DRY — DRY SPRINKLER SUPPLY LINE
- PRE — PRE-ACTION SPRINKLER LINE
- F — FIRE LINE TO STANDPIPE

EQUIPMENT TAGS & CALLOUTS

- GRILLE TYPE / NECK/GRILLE SIZE / AIR VOLUME
- EQUIPMENT/FIXTURE TYPE
- GENERAL NOTE
- DRAWING REVISION
- - / M- — DETAIL NUMBER / DRAWING NUMBER
- - / M- — SECTION NUMBER / DRAWING NUMBER

MECHANICAL GENERAL NOTES

1. THE MECHANICAL SYSTEM SHALL CONSIST OF ALL WORK SHOWN ON THE DRAWINGS, DIAGRAMS, SCHEMATICS AND AS DESCRIBED IN THE SPECIFICATIONS.
2. THE MECHANICAL PLANS ARE DIAGRAMMATIC IN NATURE AND DO NOT ATTEMPT TO SHOW ALL REQUIRED OFFSETS. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ADDITIONAL CONSTRUCTION DETAILS.
3. COORDINATE THE DRAWINGS WITH THE SPECIFICATIONS AND IN CASES WHERE CONFLICTS OCCUR THE MOST STRINGENT REQUIREMENT SHALL APPLY.
4. CONTRACTOR TO COORDINATE ALL MECHANICAL WORK WITH THAT OF OTHER TRADES TO ENSURE PROPER AND ADEQUATE INTERFACE WITH THE WORK OUTLINED FOR THIS PROJECT.
5. CONTRACTOR TO PROVIDE HORIZONTAL AND VERTICAL CLEARANCE REQUIREMENTS AS PER CEC (CANADIAN ELECTRICAL CODE) FOR ALL INSTALLED EQUIPMENT. OFFSET MECHANICAL WORK AS REQUIRED TO MEET THIS REQUIREMENT.
6. MECHANICAL EQUIPMENT SHALL NOT BE USED FOR TEMPORARY HEATING DURING THE CONSTRUCTION PROCESS. A WRITTEN LETTER FROM THE OWNER IS REQUIRED TO DO SO.
7. ALL DUCTWORK SIZES ARE SHOWN AS INSIDE CLEAR. ADD APPROPRIATE DIMENSION FOR INSULATION OR DUCT LINER TO OBTAIN "TOTAL DUCT SIZE".
8. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS AND ELEVATIONS FOR THE EXACT LOCATION AND ELEVATION OF GRILLES AND DIFFUSERS.
9. CONTRACTOR TO ALLOW AND PROVIDE FOR METAL DUCTWORK TRANSITIONS BETWEEN ALL EQUIPMENT AND DUCT CONNECTIONS.
10. PROVIDE DIFFUSERS AND GRILLE COMPATIBLE WITH ARCHITECTURAL CEILING TYPES. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
11. COORDINATE EXACT LOCATIONS OF ALL ROOM THERMOSTATS AND/OR ROOM TEMPERATURE SENSORS WITH THE DESIGN ARCHITECT BEFORE FINAL INSTALLATION.

MECHANICAL RENOVATION NOTES

1. THE CONTRACTOR SHALL BE REQUIRED TO ATTEND A PRE-BID WALK THROUGH TO ENSURE A PROPER UNDERSTANDING OF THE MECHANICAL SCOPE OF WORK.
2. CONTRACTOR IS RESPONSIBLE FOR REVIEWING AND VERIFYING ACTUAL ON-SITE CONDITIONS AND EQUIPMENT LOCATIONS PRIOR TO ANY AND ALL DEMOLITION WORK AND/OR EQUIPMENT REMOVAL.
3. CONTRACTOR TO INCLUDE AS A PART OF THE BID ALL COSTS ASSOCIATED WITH CUTTING AND PATCHING THAT IS REQUIRED TO INSTALL ALL NEW MECHANICAL SYSTEMS AS REQUIRED TO MEET THE SITE CONDITIONS AS SHOWN ON THE DRAWINGS. PATCHING SHALL MEET THE AESTHETIC CONDITIONS WHICH WAS THE CONDITION PRIOR TO ANY CUTTING BEING PREFORMED.
4. CONTRACTOR TO PROPERLY SEAL AND REPAIR ANY AND ALL DAMAGE THAT IS A RESULT OF REMOVAL OR DEMOLITION OF MECHANICAL EQUIPMENT. THIS INCLUDES BUT IS NOT LIMITED TO WALL, DOOR, CEILINGS, ETC.
5. THE EXISTING FACILITIES MECHANICAL SYSTEMS SHALL REMAIN OPERATIONAL DURING THE CONSTRUCTION AND RENOVATION PERIOD. CONTRACTOR TO COORDINATE CONSTRUCTION ACTIVITIES AND PHASING WITH OWNER TO MINIMIZE DISRUPTIONS TO OWNERS OPERATIONS AND ACCESS, AND TO ENSURE SAFETY OF THE USERS. PROVIDE ALL MEASURES REQUIRED TO PREVENT HAZARDS TO PEOPLE AND DAMAGE TO ITEMS REMAINING INCLUDING BUT NOT LIMITED TO DAMAGE FROM DUST AND HEAT.
6. THE EXISTING DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY OTHERS. AS A RESULT, THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT.
7. DURING REMOVAL OF ITEMS SO INDICATED, CAUTION SHOULD BE USED TO PREVENT DAMAGE TO ANY EQUIPMENT HAVING SALVAGE VALUE. ALL REUSABLE SALVAGED MATERIAL SHALL REMAIN THE PROPERTY OF THE OWNER AND BE RETAINED FOR THEIR INSPECTION. ONLY ITEMS AGREED BY THE OWNER SHALL BE DISPOSED OF BY THE CONTRACTOR.
8. CONTRACTOR SHALL COORDINATE AND SCHEDULE WORK WITH FACILITY TO LIMIT INTERFERENCE WITH OPERATIONS.
9. CONTRACTOR TO RE-BALANCE EXISTING AIR TERMINALS TO INDICATED AIR VOLUMES.

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THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE CONSULTANT PRIOR TO COMMENCING THE WORK.

THESE DRAWINGS ARE NOT TO BE SCALED.

REV.	DATE	DESCRIPTION
1.	2023.10.12	ISSUED FOR CLIENT REVIEW
2.	2024.01.18	ISSUED FOR CLIENT REVIEW
3.	2024.03.14	ISSUED FOR TENDER
4.	2024.03.20	ISSUED FOR TENDER ADDENDUM 001
5.	2024.05.01	ISSUED FOR RFP

CONSULTANT:

SEAL:

Permit to Practice: 1000236
Association of Professional Engineers and Geoscientists of the Province of British Columbia
M. J. T. KASUYA
PROFESSIONAL LICENSEE ENGINEERING
Licence 58622
2024-05-02

PROJECT TITLE:

CITY OF COQUITLAM, PSB - AHU-1 REFURBISHMENT

PROJECT ADDRESS:
2986 GUILDFORD WAY
COQUITLAM
BC

DRAWN BY	PK
CHECKED BY	MK
SCALE	NOT TO SCALE
DATE	MAY 1ST, 2024

DRAWING TITLE:

COVER PAGE

PROJECT NO.	DRAWING NO.
025b-007-23	M0.01

HEATING COIL (HYDRONIC)

EQUIPMENT TAG	LOCATION	SERVICE	COIL LOAD (MBH)	FLUID FLOW (GPM)	EWT (DEG F)	LWT (DEG F)	MAX PRESS. DROP (FT. WG)	AIR FLOW (CFM)	EAT (DEG F)	LAT (DEG F)	AIR VEL (FPM)	SIZE (WxH) IN	NOTES
HC-1	AHU-1	AHU-1	362.98	25.00	170.0	141.0	0.94	9800	16	50.15	387	76x48	ALL

NOTES:
1 MAX HEATING WATER FLOW RATE TO BE 25GPM.

FANS

EQUIPMENT TAG	QTY	LOCATION	SERVICE	TYPE	MANUFACTURER	MODEL	AIR FLOW (CFM)	TSP (IN.WG)	FAN (RPM)	MOTOR SIZE	DRIVE TYPE	WEIGHT (LBS)	NOTES
F-1	2	AHU-1	AHU-1	FAN ARRAY	XNRGY	P500-20	9,800	3.5	1,838	5 HP	VFD	-	ALL

NOTES:
1 TWO FAN ARRAY W/ 5HP FAN EACH.
2 TOTAL AIRFLOW 9800 CFM, 4900 CFM EACH.
3 BOTH FANS TO BE CONTROLLED BY VFD.
4 ALLOW FOR MODIFICATION OF AHU TO FIT NEW FAN ARRAY.

SWITCHOVER COIL (HYDRONIC)

EQUIPMENT TAG	LOCATION	SERVICE	COIL LOAD (MBH)	FLUID FLOW (GPM)	EWT (DEG F)	LWT (DEG F)	MAX PRESS DROP (FT. WG)	AIR FLOW (CFM)	EAT DB (DEG F)	EAT WB (DEG F)	LAT DB (DEG F)	LAT WB (DEG F)	APD (IN H2O)	SIZE (WxH) IN	NOTES
CC-1 (COOLING)	AHU-1	AHU-1	400.3	60.0	42.0	58.3	4.7	9,800.0	82.0	68.0	55.0	54.9	0.4	76x48	ALL
CC-1 (HEATING)	AHU-1	AHU-1	354.0	12.0	170.0	111.0	0.6	9,800.0	45.0	-	78.0	-	0.3	76x48	ALL

NOTES:
1 COOLING COIL TO SERVE AS SWITCHOVER HEATING AND COOLING COIL.
2 MODULATE HEATING GPM TO PROVIDE MAX LAT DB OF 78F.

MECHANICAL MOTORLIST

UNIT NUMBER	QTY	UNIT DESCRIPTION	UNIT LOCATION	ELECTRICAL LOAD				VOLT	PH	EQUIPMENT			STARTER				DISCONNECT			CONTROL				NOTES
				MCA	FLA	KW	HP			S	I	C	S	I	C	TYPE	S	I	C	S	I	C	TYPE	
F-1	2	FAN (EACH)	AHU-1		5.1		5	575		M	M	M	M	M	M	VFD	E	E	E	M	M	M	DDC	ALL
PSB-AHU1-P1	1	PUMP	AHU-1 MECH ROOM	-	-	-	1	120	1	M	M	M	M	M	M	ECM	E	E	E	M	M	M	DDC	-

SUPPLIER / INSTALL / WIRE CODES:
MECH = MECHANICAL
ELEC = ELECTRICAL
G = GENERAL CONTRACTOR
S = SUPPLIED BY
I = INSTALLED BY
C = CONNECTED BY

STARTER CODES:
MAN = MANUAL STARTER
HOA = MAGNETIC STARTER W/ HAND/OFF/AUTO
SWITCH W/ AUX. CONTACTS
MAG = MAGNETIC STARTER C/W AUX STATUS CONTACTS
MRR = MOTOR RATED RELAY, 24 VAC COIL
& MOTOR PROTECTION SWITCH
PCS = PACKAGED CONTROL SYSTEM
VFD = VARIABLE FREQUENCY DRIVE
RVS = REDUCED VOLTAGE STARTER
WS = WALL SWITCH
CP = CONTROL PANEL

CONTROL DEVICE CODES:
AQUA = PUMP CONTROLLED BY AQUASTAT
BMS = BLDG MANAGEMENT SYSTEM
ES = END SWITCH
ET = LINE VOLTAGE T'STAT
FA = FIRE ALARM
FAP = FIRE ALARM PANEL
FS = FLOW SWITCH
GS = GAS SENSOR
H = HUMIDITY SENSOR
I = INTERLOCK, SEE NOTES
LIGHT = WIRED TO LIGHT SWITCH
LS = LEVEL SWITCH
OS = OCCUPANT SENSOR
PS = PRESSURE SWITCH
R. STAT = REVERSE ACTING THERMOSTAT
TC = TIME CLOCK
T = LOW VOLTAGE T'STAT OR SENSOR
TS = TAMPER SWITCH
VS = VARIABLE SPEED SWITCH
WS = WALL SWITCH

ELECTRICAL LOAD CODES:
BHP = BRAKE HORSEPOWER
FLA = UNIT FULL LOAD AMPS
HP = UNIT OR MOTOR HORSE POWER
PH = POWER PHASE
MCA = MINIMUM CIRCUIT AMPS
VOLT = REQUIRED SUPPLY VOLTAGE

MISCELLANEOUS CODES:
FFCP = FIRE FIGHTERS CONTROL PANEL
FRAC = FRACTIONAL HORSEPOWER
INT = INTEGRAL PART OF UNIT

GENERAL NOTES:
A. ALL FIRE ALARM DEVICES WIRED BY ELECTRICAL
B. CONTROL PANELS ARE SHIPPED LOSS & REQUIRE FIELD WIRING
C. PCS EQUIPMENT REQUIRES SINGLE SOURCE POWER CONNECTION, UNLESS NOTED OTHERWISE
D. CP, VFD EQUIPMENT REQUIRES POWER WIRING TO AND FROM CONTROL PANEL TO CONTROLLED EQUIPMENT

NOTES:
1. 2 FAN ARRAY FOR EXISTING AHU-1
2. 2 VFDS FOR REDUNDANCY.
3. LOAD VALUES ARE FOR SINGLE FAN IN AN ARRAY OF 2.

PUMP SCHEDULE

EQUIPMENT TAG	DESCRIPTION	LOCATION	TYPE	MANUFACTURER	MODEL	FLUID TEMP. (DEG F)	FLUID TYPE	FLOW (EA) (GPM)	HEAD (EA) (FT)	IMPELLER SIZE (INCH)	MOTOR (HP)	MOTOR (RPM)	AT DESIGN (RPM)	MIN. FLOW (LPS)	POWER (V/PH/HZ)	NOTES
PSB-AHU1-P1	CIRCULATOR PUMP	AHU-1 MECH ROOM	INLINE	GRUNDFOS	MAGNA3 32-120 GF	170	WATER	25.0	7.5	-	1.0	2,566	2,566	-	120/1/60	ALL

NOTES:
1 WET-ROTOR PUMP WITH ECM MOTOR
2 PROVIDE FACTORY INSULATING SHELL
3 WITH MODULE FOR BACNET MSTP INTERFACE.

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4.	2024.03.20	ISSUED FOR TENDER ADDENDUM 001
5.	2024.05.01	ISSUED FOR RFP

CONSULTANT:

SEAL:

2024-05-02

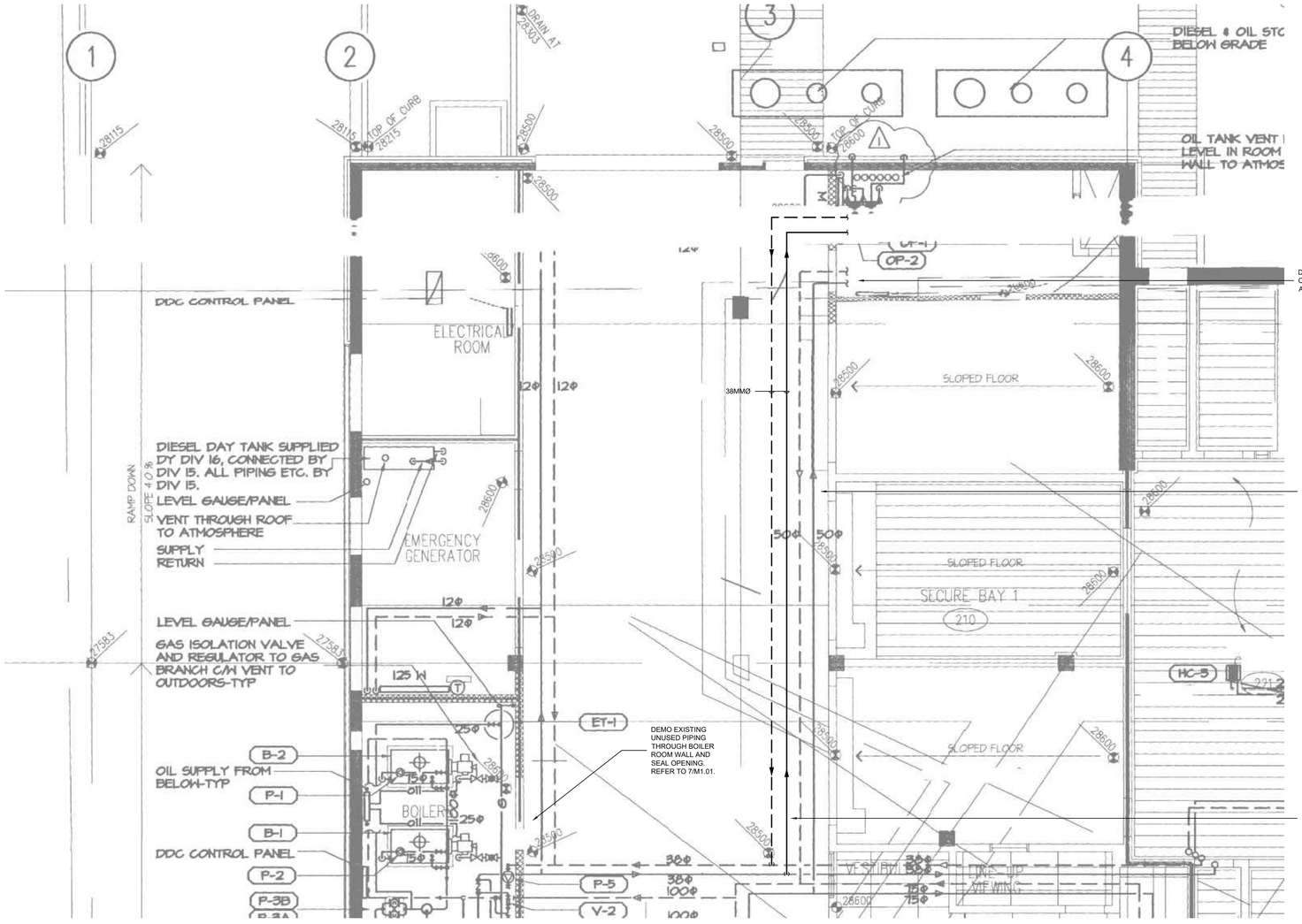
PROJECT TITLE:
CITY OF COQUITLAM, PSB - AHU-1 REFURBISHMENT

PROJECT ADDRESS:
2986 GUILDFORD WAY
COQUITLAM
BC

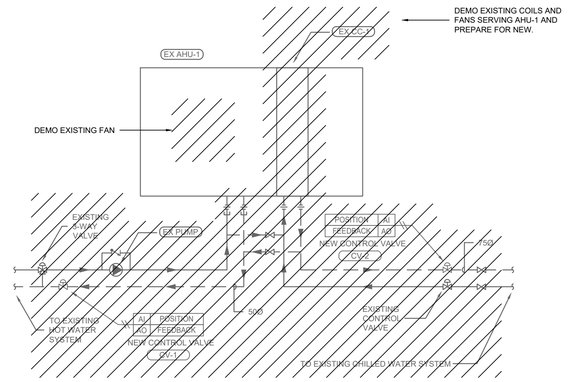
DRAWN BY	PK
CHECKED BY	MK
SCALE	----
DATE	MAY 1ST, 2024

DRAWING TITLE:
MECHANICAL SCHEDULES

PROJECT NO. 025b-007-23
DRAWING NO. **M0.02**



1 M1.01 PSB P1 PLAN
SCALE: 1:50



2 M1.01 AHU-1 DEMO PLAN
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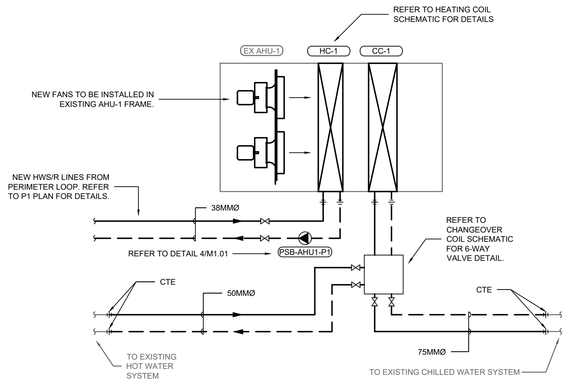

3 M1.01 AHU-1 NEW PLAN
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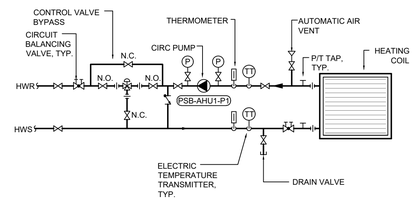

4 M1.01 PUMPED HEATING COIL SCHEMATIC
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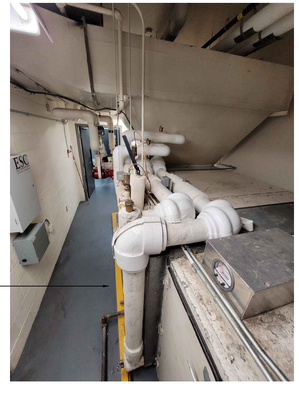

6 M1.01 P1 AHU-1 DEMO
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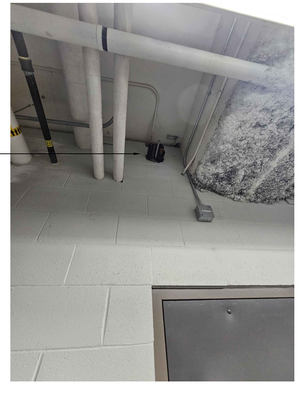

7 M1.01 P1 BOILER ROOM DEMO
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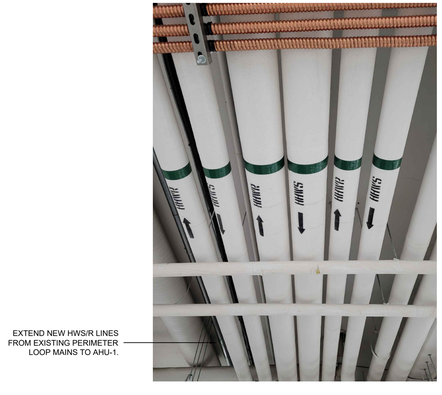

6 M1.01 P1 CONNECTION POINT TO HWS/R
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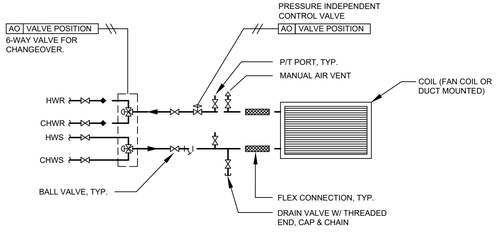

5 M1.01 CHANGEOVER COIL SCHEMATIC
SCALE: NOT TO SCALE

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CONSULTANT:

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PSB P1 PLAN

PROJECT NO.
025b-007-23

DRAWING NO.
M1.01

COMMON WORKS

1.1 GENERAL SCOPE

'PROVIDE' SHALL MEAN SUPPLY AND INSTALL.

'CONSULTANT' SHALL MEAN AME GROUP CONSULTING PROFESSIONAL ENGINEERS

PROVIDE COMPLETE, FULLY TESTED AND OPERATIONAL SYSTEMS TO MEET THE REQUIREMENTS DESCRIBED HEREIN AND IN COMPLETE ACCORD WITH APPLICABLE CODES AND ORDINANCES.

CONTRACT DOCUMENTS AND DRAWINGS ARE DIAGRAMMATIC. THEY ESTABLISH SCOPE, MATERIAL AND INSTALLATION QUALITY BUT ARE NOT DETAILED INSTALLATION INSTRUCTIONS.

FOLLOW MANUFACTURERS' RECOMMENDED INSTALLATION INSTRUCTIONS, DETAILS AND PROCEDURES FOR EQUIPMENT, SUPPLEMENTED BY REQUIREMENTS OF THE CONTRACT DOCUMENTS.

BEFORE SUBMITTING TENDER, 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 ITEM EXISTING THEREON, WHICH IS VISIBLE OR KNOWN TO EXIST AT THE TIME OF TENDER.

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 ONLY BE GIVEN BY ADDENDUM.

MAKE REFERENCE TO ELECTRICAL, MECHANICAL, STRUCTURAL AND ARCHITECTURAL DRAWINGS WHEN SETTING OUT WORK. CONSULT WITH RESPECTIVE DIVISIONS IN SETTING OUT LOCATIONS FOR DUCTWORK, EQUIPMENT, AND PIPING, SO THAT CONFLICTS ARE AVOIDED AND SYMMETRICAL EVEN SPACING IS MAINTAINED. JOINTLY WORK OUT ALL CONFLICTS ON SITE BEFORE FABRICATING OR INSTALLING ANY MATERIALS OR EQUIPMENT.

1.2 CODE COMPLIANCE, PERMITS AND FEES

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.

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.

1.3 TENDER PRICE BREAKDOWN

SUBMIT A TENDER PRICE BREAKDOWN WITHIN THIRTY (30) DAYS OF TENDER CLOSING AND BEFORE FIRST PROGRESS CLAIM, IN A FORMAT AGREED TO WITH THE CONSULTANT. AS A MINIMUM INCLUDE EQUIPMENT, MATERIALS AND LABOUR FOR MECHANICAL, PLUMBING, SHEET METAL, FIRE PROTECTION AND CONTROLS.

1.4 SUBMITTALS

COMPLY WITH DIVISION 1 - SUBMISSION AND CLOSEOUT PROCEDURES AND IN ADDITION THE FOLLOWING:

SHOP DRAWINGS: PROVIDE SHOP DRAWINGS FOR ALL EQUIPMENT AS ELECTRONIC FILES (FILE FORMAT: .DWG, .DXF, PDF, OR COMPARABLE). WHEN MANUFACTURER'S CUT SHEETS APPLY TO A PRODUCT SERIES RATHER THAN A SPECIFIC PRODUCT, THE DATA SPECIFICALLY APPLICABLE TO THE PROJECT SHALL BE HIGHLIGHTED OR CLEARLY INDICATED BY OTHER MEANS. EACH SUBMITTED PIECE OF LITERATURE AND DRAWINGS SHALL CLEARLY REFERENCE THE SPECIFICATION AND/OR DRAWING THAT THE SUBMITTAL IS TO COVER. GENERAL CATALOGS SHALL NOT BE ACCEPTED AS CUT SHEETS TO FULFILL SUBMITTAL REQUIREMENTS.

CLOSEOUT SUBMITTALS: PROVIDE A MINIMUM OF TWO (2) MECHANICAL OPERATION AND MAINTENANCE MANUALS AND ONE DIGITAL COPY, PREPARED BY THE TAB CONTRACTOR.

OPERATION AND MAINTENANCE MANUAL APPROVED BY, AND FINAL COPIES DEPOSITED WITH THE CONSULTANT A MINIMUM OF 7-DAYS BEFORE FINAL INSPECTION.

OPERATION AND MAINTENANCE MANUAL TO INCLUDE BUT NOT LIMITED TO: LAYMAN'S DESCRIPTION OF THE SYSTEMS AND ASSOCIATED CONTROLS; OPERATIONAL INSTRUCTIONS, SERVICING, MAINTENANCE, OPERATION AND TROUBLE-SHOOTING INSTRUCTIONS FOR EACH ITEM OF EQUIPMENT; WARRANTIES; EQUIPMENT MANUFACTURER'S PERFORMANCE DATASHEETS INDICATING POINT OF OPERATION AS LEFT AFTER COMMISSIONING IS COMPLETE; TESTING, ADJUSTING AND BALANCING REPORTS.

SITE RECORDS: CONTRACTOR SHALL MAINTAIN 1 SET OF WHITE PRINTS AT CONTRACTORS COST TO MARK CHANGES AS WORK PROGRESSES AND AS CHANGES OCCUR. USE DIFFERENT COLOUR WATERPROOF INK FOR EACH SERVICE. DO NOT USE PENCIL OR BLACK INK. TRANSFER INFORMATION WEEKLY TO SHOW WORK AS ACTUALLY INSTALLED. DRAWINGS SHALL BE AVAILABLE FOR REFERENCE PURPOSES AND REVIEW.

RECORD DRAWINGS: PRIOR TO START OF TESTING, ADJUSTING AND BALANCING FOR MECHANICAL FINALIZE PRODUCTION OF RECORD DRAWINGS

RECORD DRAWINGS: USE FINAL SITE RECORD TO ELECTRONICALLY PRODUCE CAD AND PDF FILES THUS FORMING A "RECORD DRAWING" SET. IDENTIFY EACH DRAWING IN LOWER RIGHT HAND CORNER IN LETTERS AT LEAST 12 MM HIGH AS FOLLOWS: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (SIGNATURE OF CONTRACTOR) (DATE). PERFORM TESTING, ADJUSTING AND BALANCING FOR HVAC USING RECORD DRAWINGS. SUBMIT RECORD DRAWINGS TO CONSULTANT FOR APPROVAL AND MAKE CORRECTIONS AS DIRECTED. PERFORM TESTING, ADJUSTING, AND BALANCING FOR HVAC USING RECORD DRAWINGS. PROVIDE COMPLETED REPRODUCIBLE RECORD DRAWINGS WITH FINAL OPERATING AND MAINTENANCE MANUALS WITHIN TWO (2) WEEKS OF SUBSTANTIAL COMPLETION. FAILURE TO SUBMIT DRAWINGS WILL RESULT IN THE WORK BEING UNDERTAKEN BY THE OWNER AND DEDUCTED FROM THE CONTRACTOR'S HOLD BACK AMOUNT. COST TO TRANSFER RECORD INFORMATION ONTO REPRODUCIBLE MEDIA & AUTO-CAD OR REVIT ARE THIS CONTRACTOR'S RESPONSIBILITY. CONSULTANT WILL RELEASE CAD DRAWINGS TO CONTRACTOR AFTER SIGNING A COPYRIGHT FORM. SHOULD THE CONTRACTOR CHOOSE TO UTILIZE THIS CONSULTANT FOR TRANSFERRING AS BUILT INFORMATION TO RECORD DRAWINGS, ALLOW $400 / SHEET FOR ALL DRAWINGS IN THE CONSTRUCTION SET. THIS WILL COVER COSTS FOR DRAFTING TIME & PRINTING COSTS.

1.5 QUALITY OF WORK

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 MAY BE REJECTED BY THE CONSULTANT. THE CONTRACTOR SHALL REDO REJECTED WORK TO THE ACCEPTED STANDARD AT NO COST TO THE OWNER.

1.6 METRIC CONVERSION

ALL UNITS ARE EXPRESSED IN SI UNITS. ON ALL SUBMITTALS (SHOP DRAWINGS ETC.) USE THE SAME SI UNITS AS STATED IN THE SPECIFICATION.

WHERE PIPES ARE SPECIFIED WITH METRIC DIMENSIONS AND IMPERIAL SIZED PIPES ARE AVAILABLE, PROVIDE EQUIVALENT NOMINAL IMPERIAL SIZED PIPE AS INDICATED IN THE TABLE, AND PROVIDE AT NO EXTRA COST ADAPTERS TO ENSURE COMPATIBLE CONNECTIONS TO ALL METRIC SIZED FITTINGS, EQUIPMENT AND PIPING.

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 PIPES, FITTINGS, AND EQUIPMENT.

EQUIVALENT NOMINAL DIAMETER OF PIPES

15MM = NPS ½

20MM = NPS ¾

25MM = NPS 1

30MM = NPS 1-1/4

40MM = NPS 1-1/2

50MM = NPS 2

65MM = NPS 2-1/2

75MM = NPS 3

THE METRIC DUCT SIZES ARE EXPRESSED AS 25 MM = 1 INCH.

1.7 DRAWINGS AND SPECIFICATIONS

SHOULD ANY DISCREPANCY APPEAR BETWEEN DRAWINGS AND SPECIFICATIONS OBTAIN WRITTEN CLARIFICATION FROM THE CONSULTANT DURING THE TENDER PERIOD. WITHOUT A WRITTEN CLARIFICATION THE BETTER QUALITY AND/OR GREATER QUANTITY OF WORK OR MATERIALS SHALL BE ESTIMATED, PERFORMED AND FURNISHED WITHIN THE TENDERED PRICE.

1.8 CUTTING, PATCHING AND CORING

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.

OBTAIN WRITTEN APPROVAL FROM THE STRUCTURAL CONSULTANT BEFORE CUTTING OR BURNING STRUCTURAL MEMBERS.

1.9 COMPLIANCE WITH ENERGY BY-LAW

ALL EQUIPMENT INSTALLED ON THIS PROJECT SHALL COMPLY WITH THE NATIONAL ENERGY CODE OF CANADA FOR BUILDINGS - 2015, ASHRAE STANDARD 90.1 - 2016 AND THE CITY OF VANCOUVER BUILDING BY-LAW ENERGY UTILIZATION REQUIREMENTS.

1.10 INSTALLATION OF EQUIPMENT

PIPE ALL EQUIPMENT DRAINS TO BUILDING DRAINS EXCEPT SYSTEMS CONTAINING GLYCOL.

UNIONS AND FLANGES SHALL BE PROVIDED IN PIPING OR DUCTWORK TO PERMIT EASY REMOVAL OF EQUIPMENT.

MAINTAIN PERMANENT ACCESS TO EQUIPMENT FOR MAINTENANCE.

1.11 CONNECTIONS TO EXISTING SERVICES

MAINTAIN LIAISON WITH THE OWNER AND PROVIDE A MUTUALLY ACCEPTABLE SCHEDULE TO INTERRUPT, REROUTE, OR CONNECT TO EXISTING BUILDING SERVICES WITH THE MINIMUM OF INTERRUPTION OF THOSE SERVICES.

1.12 SELECTIVE DEMOLITION

REMOVE FROM SITE ALL EQUIPMENT, DUCTING OR PIPING WHICH IS NO LONGER REQUIRED BECAUSE OF WORK UNDER THIS CONTRACT. EXCEPT AS OTHERWISE STATED, SALVAGEABLE MATERIALS FROM AREA OF DEMOLITION SHALL BECOME THE PROPERTY OF THE OWNER AT HIS DISCRETION.

THE INTENT IS FOR A HAZ-MAT CONTRACTOR TO REMOVE ALL ASBESTOS CONTAINING MATERIAL PRIOR TO THE PROPOSED PROJECT WORK TAKING PLACE. NOTIFY THE CONSULTANT IF ASBESTOS CONTAINING MATERIAL IS SUSPECTED TO REMAIN ON SITE.

1.13 EQUIPMENT AND MATERIALS

WHERE TWO OR MORE PRODUCTS OF THE SAME TYPE ARE REQUIRED, PRODUCTS SHALL BE OF THE SAME MANUFACTURER.

NOTIFY THE CONSULTANT IN WRITING TEN (10) DAYS PRIOR TO THE TENDER CLOSE, ANY MATERIALS OR EQUIPMENT SPECIFIED WHICH IS NOT CURRENTLY AVAILABLE OR WILL NOT BE AVAILABLE FOR USE AS CALLED FOR HEREIN. FAILING THIS, THE CONTRACT WILL ASSUME THAT THE MOST EXPENSIVE ALTERNATE HAS BEEN INCLUDED IN THE TENDER PRICE.

APPROVED EQUIVALENTS AND/OR ALTERNATIVES TO SPECIFIED PRODUCTS SHALL BE EQUAL TO THE SPECIFIED PRODUCT IN EVERY RESPECT, OPERATE AS INTENDED, AND MEET THE SPACE, CAPACITY, AND NOISE REQUIREMENTS OUTLINED.

THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY ADDITIONAL LABOUR AND MATERIALS REQUIRED BY ANY TRADES OR OTHER CONTRACTORS TO ACCOMMODATE THE USE OF OTHER THAN SPECIFIED MATERIALS OR EQUIPMENT. THE CONTRACTOR SHALL BEAR ANY AND ALL COSTS FOR DESIGN/SYSTEM MODIFICATIONS TO ACCOMMODATE THE "ALTERNATE" EQUIPMENT. EXTRAS WILL NOT BE APPROVED TO COVER SUCH WORK.

1.14 DELIVERY, STORAGE AND HANDLING

STORE MATERIALS AND EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS IN A CLEAN, DRY, WELL-VENTILATED AREA.

REPLACE DEFECTIVE OR DAMAGED MATERIALS WITH NEW.

1.15 FIRESTOPPING AND SMOKE SEALS

PROVIDE FIRESTOPPING SYSTEM(S) TO PROVIDE AND MAINTAIN A FIRE RESISTANCE RATING, AS INDICATED ON DRAWINGS AND IN ACCORDANCE WITH UL, WH, ULC, CUL OR FM DESIGN DETAILS FOR ALL MECHANICAL WORK IN DIVISIONS 21, 22, 23 AND 25

FOR RENOVATION PROJECTS, IN ADDITION TO THE NECESSARY NEW PENETRATIONS, PROVIDE THE FIRESTOPPING FOR ALL EXISTING MECHANICAL ASSEMBLIES WHERE FIRESTOPPING IS DAMAGED, DISCONTINUED OR ABSENT WITHIN THE CONSTRUCTION AREA.

SOUND TRANSMISSION COEFFICIENT (STC) RATINGS TESTED TO ASTM E90-09 TO ACHIEVE STC RATINGS AS REQUIRED BY ARCHITECTURAL DRAWINGS.

ALL FIRESTOP SYSTEM INSTALLATIONS MUST MEET THE REQUIREMENTS OF CAN4-S115-M OR ULC S-115-M TESTED ASSEMBLIES THAT PROVIDE A FIRE RATING

1.16 ACCESS DOORS

PROVIDE ACCESS DOORS FOR MAINTENANCE OR ADJUSTMENT OF ALL PARTS OF THE MECHANICAL SYSTEM.

PROVIDE 300 MM X 300 MM MINIMUM SIZE FOR INSPECTION AND HAND ACCESS.

600 MM X 600 MM MINIMUM SIZE, LARGER IF INDICATED ON DRAWINGS, WHERE ENTRY IS REQUIRED AND ACCESS IS DIFFICULT.

1.17 ESCUTCHEONS AND PLATES

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

1.18 GUARANTEE / WARRANTY

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.

1.19 BALANCING

THE APPROVED BALANCING AGENCIES ARE: WESTERN MECHANICAL; K.D. ENGINEERING, FLOTECH MECHANICAL, BLUE COLLAR GROUP.

BALANCE FANS AND AIR OUTLETS TO AIR QUANTITIES INDICATED ON THE DRAWINGS AND IN THIS SPECIFICATION. WHERE OUTLET QUANTITIES ARE NOT INDICATED, DIVIDE CAPACITY EQUALLY AMONG ALL OUTLETS.

SUBMIT THE REPORT TO THE CONSULTANT 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 FINAL PAYMENT.

BALANCING SHALL BE PERFORMED TO THE FOLLOWING:

HYDRONIC-PUMPS AND CENTRAL EQUIPMENT ±5%

PROVIDE A DROP TEST OF ALL FIRE DAMPERS AND A LETTER/CERTIFICATE CONFIRMING THIS WORK.

COOPERATE WITH THE BALANCING AGENCY AND MAKE ANY CORRECTIONS AS REQUIRED BY BALANCING AGENCY.

PROVIDE BALANCING VALVES AND DAMPERS, PULLEYS, SHEAVES ETC. AS REQUESTED BY THE BALANCING AGENCY AND/OR NECESSARY TO PROPERLY ADJUST OR CORRECT THE SYSTEMS TO DESIGN FLOWS, WITHOUT ADDITIONAL COST TO OWNER.

1.20 COMMISSIONING AND DEMONSTRATION

BE RESPONSIBLE FOR THE PERFORMANCE AND COMMISSIONING OF ALL EQUIPMENT SUPPLIED AND RE-USED UNDER DIVISIONS 22 AND 23.

CONFIRM OPERATION AND REVIEW CONDITION OF ALL EXISTING EQUIPMENT AND ASSOCIATED CONTROL DEVICES IN THE RENOVATED AREA. SUBMIT REPORT NOTING ANY REMEDIAL WORK REQUIRED.

AT THE CONCLUSION OF COMMISSIONING, DEMONSTRATE THE OPERATION OF THE SYSTEMS TO THE CONSULTANT AND THEN TO THE OWNER'S OPERATING STAFF.

AT THE COMPLETION OF THE COMMISSIONING, TESTING, BALANCING AND DEMONSTRATION SUBMIT TO THE CONSULTANT A LETTER CERTIFYING THAT ALL WORK SPECIFIED UNDER THIS CONTRACT IS COMPLETE, CLEAN AND OPERATIONAL IN ACCORDANCE WITH THE SPECIFICATION AND DRAWINGS.

1.21 FLASHING AND ROOF CURBS

PROVIDE CURBS, FLASH AND COUNTER FLASH AS REQUIRED WHERE MECHANICAL EQUIPMENT PASSES THROUGH WEATHER OR WATERPROOFED WALLS, FLOORS AND ROOFS.

PROVIDE FACTORY ROOF CURBS FOR ALL ROOF MOUNTED EQUIPMENT UNLESS NOTED OTHERWISE.

1.22 SEISMIC CONTROL

PROVIDE SEISMIC RESTRAINTS FOR ALL REQUIRED EQUIPMENT, PIPING, AND DUCTWORK IN ACCORDANCE WITH THE LATEST EDITION OF THE SEISMIC RESTRAINTS MANUAL FOR MECHANICAL SYSTEMS PRODUCED BY SMACNA, AND THE LATEST EDITION OF THE ASHRAE APPLICATION HANDBOOK CHAPTER 49, SEISMIC RESTRAINTS.

SEISMIC ENGINEER SHALL PROVIDE AND SUBMIT TO THE OWNER'S CONSULTANT ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW SCHEDULE S-B AND ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE SCHEDULE S-C FOR SEISMIC ENGINEERING.

SUBMIT SHOP DRAWINGS OF ALL SEISMIC RESTRAINT DETAILS PREPARED AND SEALED BY THE SEISMIC ENGINEER. PRIOR TO SUBSTANTIAL COMPLETION, THE SEISMIC ENGINEER SHALL VISIT THE SITE AND VERIFY THE SEISMIC RESTRAINT INSTALLATION AS REQUIRED TO SATISFY THE ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE SCHEDULE [C-B] [C-2] OF THE BUILDING CODE.

THE CONTRACTOR SHALL OBTAIN APPROVAL FOR THE LOCATION OF ALL RESTRAINT FIXING POINTS FROM THE STRUCTURAL ENGINEER, ON SITE, PRIOR TO INSTALLATION.

WHERE EQUIPMENT IS MOUNTED ON SPRING OR RESILIENT MOUNTS FOR VIBRATION ISOLATION IT SHALL BE THE RESPONSIBILITY OF THE MANUFACTURER OF THE MOUNT TO INCORPORATE SEISMIC RESTRAINT. PROVIDE STEEL FRAME BASES WHERE NECESSARY TO ACHIEVE THIS AND ALSO AVOID OVERTURNING. THE MANUFACTURER SHALL SUPPLY CERTIFICATES, SIGNED BY A PROFESSIONAL ENGINEER REGISTERED WITHIN THE JURISDICTION, VERIFYING THE DESIGN OF THE SEISMIC RESTRAINTS IS IN ACCORDANCE WITH THIS SECTION.

1.23 VIBRATION ISOLATION

PROVIDE NEOPRENE ISOLATORS FOR DEFLECTIONS 6MM (1/4") AND UNDER.

PROVIDE EITHER NEOPRENE OR STEEL SPRING ISOLATORS FOR DEFLECTIONS BETWEEN 6MM AND 12MM (½").

PROVIDE STEEL SPRING ISOLATORS FOR DEFLECTIONS OF 12MM (½") AND OVER.

PROVIDE ADJUSTABLE LIMIT STOPS FOR SPRING ISOLATION MOUNTS ON EQUIPMENT WITH OPERATING WEIGHTS SUBSTANTIALLY DIFFERENT FROM THE INSTALLED WEIGHTS

ALL SPRING ISOLATORS SHALL BE "OPEN SPRING" UNLESS OTHERWISE STATED. SEISMICALLY RATED HOUSED SPRING ISOLATORS MAY BE USED IN LIEU PROVIDED THAT THEY MEET THIS PROJECT'S REQUIREMENTS FOR SEISMIC RESTRAINT.

SELECT ISOLATORS IN ACCORDANCE WITH EQUIPMENT WEIGHT DISTRIBUTION TO ALLOW FOR AN AVERAGE DEFLECTION MEETING OR EXCEEDING THE SPECIFIED DEFLECTION REQUIREMENTS AND SO THAT NO ISOLATOR HAS A DEFLECTION LESS THAN 80% OF THE STATIC DEFLECTION SPECIFIED. A MINIMUM OF 4 ISOLATORS ARE REQUIRED FOR EACH PIECE OF EQUIPMENT, UNLESS SPECIFIED OTHERWISE.

1.24 SUBSTANTIAL AND TOTAL PERFORMANCE

PRIOR TO REQUESTING AN INSPECTION FOR SUBSTANTIAL PERFORMANCE, PROVIDE A COMPLETE LIST OF ITEMS, WHICH ARE DEFICIENT.

A CERTIFICATE OF SUBSTANTIAL PERFORMANCE WILL NOT BE GRANTED UNLESS THE FOLLOWING ITEMS ARE COMPLETED AND AVAILABLE TO THE OWNER'S CONSULTANT:

FINAL PLUMBING INSPECTION CERTIFICATE FROM THE AUTHORITY HAVING JURISDICTION.

FIRE STOPPING AND FIRE DAMPER TEST LETTER

DRAFT OPERATING/MAINTENANCE MANUALS HAVE BEEN SUBMITTED FOR REVIEW.

ALL MECHANICAL SYSTEMS HAVE BEEN COMMISSIONED AND ARE CAPABLE OF OPERATION WITH ALARM CONTROLS FUNCTIONAL AND AUTOMATIC CONTROLS IN OPERATION.

AIR AND WATER SYSTEMS HAVE BEEN BALANCED WITH DRAFT REPORT SUBMITTED TO THE CONSULTANT.

OPERATING AND MAINTENANCE DEMONSTRATIONS HAVE BEEN PROVIDED TO THE OWNER.

RECORD DRAWINGS HAVE BEEN SUBMITTED.

ALL PREVIOUSLY IDENTIFIED DEFICIENCIES HAVE BEEN CORRECTED AND ACCEPTED.

PRIOR TO A TOTAL PERFORMANCE INSPECTION PROVIDE DECLARATION IN WRITING THAT SUBSTANTIAL PERFORMANCE DEFICIENCIES HAVE BEEN CORRECTED AND FINAL TAB REPORTS AND O&M MANUALS HAVE BEEN SUBMITTED.

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

LISTED MANUFACTURERS ARE ACCEPTABLE FOR THEIR ABILITY TO MEET THE GENERAL DESIGN INTENT, QUALITY AND PERFORMANCE CHARACTERISTICS OF THE SPECIFIED PRODUCT. THE LIST DOES NOT ENDORSE THE ACCEPTABILITY OF ALL PRODUCTS AVAILABLE FROM THE LISTED MANUFACTURERS/SUPPLIERS.

IT REMAINS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THE PRODUCTS SUPPLIED ARE EQUAL TO THE SPECIFIED PRODUCTS IN EVERY RESPECT, OPERATE AS INTENDED, AND MEET THE PERFORMANCE SPECIFICATIONS AND PHYSICAL DIMENSIONS OF THE SPECIFIED PRODUCT.

THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY ADDITIONAL WORK OR MATERIALS, TO ACCOMMODATE THE USE OF EQUIPMENT FROM THE ACCEPTABLE MANUFACTURERS AND SUPPLIERS LISTED.

2.2 FIRESTOPPING AND SMOKE SEALS

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

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.

ACCEPTABLE MANUFACTURERS: 3M, HILTI, AD FIREBARRIER, TREMCO

2.3 PIPE HANGERS AND SUPPORTS

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 INSULATION.

PROVIDE GALVANIZED HANGERS AND SUPPORTS FOR ALL PIPING EXCEPT HANGERS AND SUPPORTS SHALL BE COPPER PLATED OR EPOXY COATED FOR COPPER PIPING.

TOGGLE HANGERS AND/OR STRAP HANGERS SHALL NOT BE USED FOR PIPE HANGERS.

POWER ACTUATED FASTENERS AND "DROP-IN" ANCHORS SHALL NOT BE USED.

PROVIDE RING TYPE HANGERS FOR PIPING UP TO NPS 1½ AND CLEVIS TYPE HANGERS FOR PIPING OVER NPS 1½.

2.4 ACCESS DOORS

DRYWALL SURFACE: EXTRUDED ALUMINUM FRAME WITH GYPSUM BOARD INLAY AND STRUCTURAL CORNER ELEMENTS. HINGE TO BE CONCEALED 2-POINT HINGE, NON-CORRODING WITH SCREWDRIVER OPERATED CAM LATCH.

TILE SURFACE: UNIVERSAL DESIGN, STAINLESS STEEL DOOR (16GA) AND STAINLESS STEEL FRAME (18GA), DOOR FLUSH TO FRAME, ROUNDED SAFETY CORNERS, CONTINUOUS CONCEALED HINGE, SCREWDRIVER OPERATED CAM LATCH, #4 SATIN STAINLESS STEEL FINISH.

PLASTER WALLS AND CEILING: STEEL DOOR (14GA) AND STEEL FRAME (14GA), DOOR FLUSH TO FRAME EDGE, EXPANSION CASING BEAD AND 75 MM WIDE GALVANIZED LATH SURROUND RECESSED 18 MM TO RECEIVE PLASTER, CONTINUOUS CONCEALED HINGE, SCREWDRIVER OPERATED CAM LATCH, PRIME COAT GREY PAINTED FINISH.

FIRE RATED WALLS NON-COMBUSTIBLE CONSTRUCTION: UNINSULATED STEEL DOOR (16GA) AND STEEL FRAME (16GA), DOOR FLUSH TO FRAME EDGE, 25MM MOUNTING FRAME WITH MASONRY ANCHOR STRAPS, CONCEALED SELF-CLOSING HINGE, FLUSH KEY LATCH, PRIME COAT GREY PAINTED FINISH, ULC RATED 2 HOUR 'B' LABEL.

FIRE RATED WALLS COMBUSTIBLE CONSTRUCTION: INSULATED STEEL DOOR (20GA) FOR MAXIMUM 250°C RISE AFTER 30 MINUTES AND STEEL FRAME (16GA), DOOR FLUSH TO FRAME EDGE, 25MM MOUNTING FRAME WITH MASONRY ANCHOR STRAPS, CONCEALED SELF-CLOSING HINGE, FLUSH KEY LATCH, PRIME COAT GREY PAINTED FINISH, ULC RATED 1-1/2 HOUR 'B' LABEL.

FIRE RATED CEILINGS: 50MM INSULATED STEEL DOOR (16GA) AND STEEL FRAME (16GA), DOOR FLUSH TO FRAME EDGE, 25MM MOUNTING FRAME WITH MASONRY ANCHOR STRAPS, CONCEALED UPSWING SELF-CLOSING HINGE, L HANDLE LATCH, WHITE BAKED ENAMEL FINISH, SIZE 600MM X 600MM (24" X 24") ULC RATED 2 HOUR 'B' LABEL.

DUCTWORK: ULTRA LOW LEAKAGE TYPE, FLAT OVAL DESIGN, GALVANIZED STEEL FRAME (22GA), DOUBLE SKIN GALVANIZED STEEL DOOR (22 GA) WITH 25MM INSULATION FULLY ENCLOSED IN PANEL, BULB TYPE SEAL INTEGRALLY FASTENED TO DOOR, LEVER CAM LOCKS. PROVIDE STAINLESS STEEL IN LIEU OF GALVANIZED STEEL IN STAINLESS STEEL DUCTWORK.

ACCEPTABLE MANUFACTURERS: MAXAM, ACUDOR, MILCOR, CAN.AQUA, MIFAB, BILCO, BAUCOPLUS

2.5 IDENTIFICATION

IDENTIFY PIPING WITH LABELS AND FLOW ARROWS. PROVIDE IDENTIFICATION AT 15M (50FT) MAXIMUM INTERVALS, BEFORE AND AFTER PIPES PASSING THROUGH WALLS, AT ALL SIDES OF TEES, BEHIND ACCESS DOORS. USE BRADY B-500 VINYL CLOTH LABELS FOR NON INSULATED PIPES AND B-350 FOR INSULATED PIPES.

PROVIDE 20MM (3/4") DIAMETER BRASS TAGS, SECURE TO VALVE STEMS WITH KEY CHAIN. PROVIDE A VALVE DIRECTORY AT ALL MECHANICAL ROOMS, IN THE O&M MANUALS AND A DIGITAL COPY CROSS REFERENCED WITH ANY ASSOCIATED CONTROLS NOMENCLATURE.

EACH PIECE OF EQUIPMENT SHALL BE IDENTIFIED WITH ITS EQUIPMENT SCHEDULE IDENTIFICATION, E.G. SUPPLY FAN SF-1, COOLING COIL CC-1, PUMP P-1 WITH LAMACOID PLATES HAVING 6MM (1/4") MINIMUM LETTER SIZE.

ACCEPTABLE MANUFACTURERS: BRADY

2.6 VIBRATION ISOLATION

NEOPRENE WASHER/BUSHING: A ONE PIECE MOLDED BRIDGE BEARING NEOPRENE WASHER/BUSHING. THE BUSHING SHALL SURROUND THE ANCHOR BOLT AND HAVE A FLAT WASHER FACE TO AVOID METAL TO METAL CONTACT. USE WASHER/BUSHING ONLY ON LIGHT-WEIGHT EQUIPMENT.

ACCEPTABLE MANUFACTURER: MASON HG HEMI GROMMET OR EQUAL

NEOPRENE PAD ISOLATORS: NEOPRENE OR NEOPRENE / STEEL / NEOPRENE PAD ISOLATORS. MINIMUM STATIC DEFLECTION 2.5 MM (0.1") OR GREATER.

ACCEPTABLE MANUFACTURER: MASON WMSW OR EQUAL

RUBBER FLOOR MOUNTS: BRIDGE BEARING NEOPRENE MOUNTINGS. MINIMUM STATIC DEFLECTION OF 5MM (0.2") OR GREATER AND ALL DIRECTIONAL SEISMIC CAPABILITY.

ACCEPTABLE MANUFACTURER: MASON RAA OR ND OR EQUAL

SPRING FLOOR MOUNTS: SPRING ISOLATORS BUILT INTO A DUCTILE IRON OR STEEL HOUSING TO PROVIDE ALL DIRECTIONAL SEISMIC SNUBBING. THE SNUBBER SHALL BE ADJUSTABLE VERTICALLY AND ALLOW A MAXIMUM OF 6MM (1/4") TRAVEL IN ALL DIRECTIONS BEFORE CONTACTING THE RESILIENT SNUBBING COLLARS. MOLDED NEOPRENE CUP OR 1/4" (6MM) NEOPRENE ACOUSTICAL FRICTION PAD BETWEEN THE BASEPLATE AND THE SUPPORT. SPRING DIAMETERS SHALL BE NO LESS THAN 0.8 OF THE COMPRESSED HEIGHT OF THE SPRING AT RATED LOAD. SPRINGS SHALL HAVE A MINIMUM ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF THE RATED DEFLECTION.

ACCEPTABLE MANUFACTURER: MASON SSLFH OR EQUAL

SPRING HANGERS: HANGERS SHALL CONSIST OF RIGID STEEL FRAMES CONTAINING MINIMUM 32MM (1 1/4") THICK NEOPRENE ELEMENTS AT THE TOP AND A STEEL SPRING SEATED IN A STEEL WASHER REINFORCED NEOPRENE CUP ON THE BOTTOM. PROVIDE A COMBINATION RUBBER AND STEEL REBOUND WASHER AS THE SEISMIC UPSTOP FOR SUSPENDED PIPING, DUCTWORK AND EQUIPMENT. RUBBER THICKNESS SHALL BE A MINIMUM OF 6MM (1/4"). COLOUR CODED SPRINGS, RUST RESISTANT, PAINTED BOX TYPE HANGERS. TO MAINTAIN STABILITY THE BOXES SHALL NOT BE ARTICULATED AS CLEVIS HANGERS NOR THE NEOPRENE ELEMENT STACKED ON TOP OF THE SPRING.

ACCEPTABLE MANUFACTURER: MASON HD, HS OR EQUAL

ALTERNATE VIBRATION ISOLATION ACCEPTABLE MANUFACTURERS, KORFUND, VIBRO-ACOUSTICS

3. EXECUTION

3.1 PAINTING REPAIRS AND RESTORATION

DO PAINTING IN ACCORDANCE WITH DIVISION 09 - INTERIOR PAINTING. PRIME AND TOUCH UP MARRED FINISHED PAINTWORK TO MATCH ORIGINAL. RESTORE TO NEW CONDITION, FINISHES WHICH HAVE BEEN DAMAGED.

CLEAN EXPOSED BARE METAL SURFACES SUPPLIED UNDER DIVISIONS 21, 22, 23 AND 25. APPLY AT LEAST ONE COAT OF CORROSION RESISTANT PRIMER PAINT TO ALL SUPPORTS AND EQUIPMENT FABRICATED FROM FERROUS METAL.

3.2 DEMONSTRATION

SUPPLY TOOLS, EQUIPMENT, PERSONNEL TO DEMONSTRATE AND INSTRUCT THE OPERATING, AND MAINTENANCE PERSONNEL IN OPERATING, CONTROLLING, ADJUSTING, TROUBLE-SHOOTING, AND SERVICING OF ALL SYSTEMS AND EQUIPMENT DURING REGULAR WORK HOURS, PRIOR TO ACCEPTANCE.

3.3 FIRESTOPPING AND SMOKE SEALS

THE OWNER'S CONSULTANT SHALL CONDUCT MANDATORY DESTRUCTIVE REVIEWS FOR EACH TYPE OF INSTALLATION. DESTRUCTIVE TESTING SHALL BE AT THE DISCRETION OF THE OWNER'S CONSULTANT AND AUTHORITY HAVING JURISDICTION

ALLOW FOR DESTRUCTIVE TESTING OF 5% OF FIRE STOPPING APPLICATIONS. SHOULD INSTALLATIONS NOT CONFORM TO MANUFACTURER'S LISTED ASSEMBLY, AN ADDITIONAL 25% OF INSTALLATIONS MAY BE DESTRUCTIVELY TESTED AND SHOULD THERE BE MORE FAILURES, THE CONTRACTOR WILL BE RESPONSIBLE TO REMOVE ALL FIRE STOPPING PRODUCTS AND REINSTALL PRODUCTS CORRECTLY, AT NO ADDITIONAL COST TO THE PROJECT..

TAG ALL PENETRATIONS AND EVERY 3 METERS OF JOINT SEAL WITH PRINTED TAGS. TAGS SHALL INDICATE PRODUCT, SYSTEM #, DATE INSTALLED, INSTALLED BY: (NAME AND PHONE NUMBER OF SUBCONTRACTOR) AND RE-PENETRATED BY & DATE.

TAGS SHALL STATE: CAUTION! FIRESTOP - DO NOT REMOVE, PUNCTURE OR DISCONTINUE UNLESS PREPARED TO RE-SEAL IMMEDIATELY WITH SPECIFIED PRODUCT

COMPLY WITH MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION OF THROUGH-PENETRATION JOINT MATERIALS. WHERE POSSIBLE, USE METAL SLEEVES FOR FLOOR PENETRATIONS TO PREVENT/MITIGATE THE CONSEQUENCES OF LEAKAGE OR FLOODING.

PERFORM UNDER THIS SECTION PATCHING AND REPAIRING OF FIRESTOP CAUSED BY CUTTING OR PENETRATING OF EXISTING FIRESTOP SYSTEMS ALREADY INSTALLED BY OTHER TRADES.

3.4 PIPE HANGERS AND SUPPORTS

PIPE SUPPORT SPACING AND HANGER ROD DIAMETER SHALL BE:

PIPE SIZE: NPS 3/4 TO 1½ ROD DIAMETER 9MM (3/8"), SPACING 2.4M (8')

PIPE SIZE: NPS 2 TO 2½ ROD DIAMETER 9MM (3/8"), SPACING 3M (10')

PIPE SIZE: NPS 3 TO 4 ROD DIAMETER 16MM (5/8"), SPACING 3.6M (12')

3.5 PIPE PRESSURE TESTING

ADVISE CONSULTANT OR PROJECT MANAGER 48 HOURS MINIMUM PRIOR TO PERFORMANCE OF PRESSURE TESTS.

HYDROSTATIC TEST: 150% OF WORKING PRESSURE, BUT NOT LESS THAN 860 KPA (125 PSIG). FOR PP-R PIPING, DO NOT EXCEED 1034 KPA (150 PSI). FOR PEX PIPING, DO NOT EXCEED 690 KPA (100 PSI). MAINTAIN TEST PRESSURE WITHOUT LOSS FOR 4 HOURS MINIMUM UNLESS SPECIFIED FOR LONGER PERIOD OF TIME IN RELEVANT MECHANICAL SECTIONS.

PRIOR TO TESTS, ISOLATE EQUIPMENT AND OTHER PARTS WHICH ARE NOT DESIGNED TO WITHSTAND TEST PRESSURE OR MEDIA.

CONDUCT TESTS IN PRESENCE OF CONSTRUCTION MANAGER OR PROJECT MANAGER.

EXAMINE ALL JOINTS FOR LEAKS AND REMAKE ALL LEAKING JOINTS WITH NEW MATERIALS. PAY COSTS FOR REPAIRS OR REPLACEMENT, RETESTING, AND MAKING GOOD. CONSULTANT TO DETERMINE WHETHER REPAIR OR REPLACEMENT IS APPROPRIATE.

INSULATE OR CONCEAL WORK ONLY AFTER APPROVAL AND CERTIFICATION OF TESTS BY AUTHORITIES.

PRESSURE TEST ALL GAS PIPING IN ACCORDANCE WITH CSA B149.1. PURGE ALL PIPING AFTER PRESSURE TESTS IN ACCORDANCE WITH CSA B149.1.

SUBMIT COPIES OF PRESSURE TEST REPORTS FOR ALL SECTIONS OF PIPING.

3.6 ACCESS DOORS

PROVIDE ALL ACCESS DOORS REQUIRED TO ACCESS WORK INSTALLED BY DIVISIONS 21, 22, 23 AND 25. BE RESPONSIBLE FOR COORDINATING LOCATIONS, CUTTING OPENING AND INSTALLING PANELS. ANY SECONDARY SUPPORTS, BLOCKING ETC. WILL BE BY THE CEILING OR WALL CONTRACTOR. ENSURE THAT EQUIPMENT IS WITHIN VIEW AND ACCESSIBLE FOR OPERATING, INSPECTING, ADJUSTING, SERVICING WITHOUT USING SPECIAL TOOLS.

3.7 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 AIRBORNE NOISE TRANSMISSION.

RUBBER FLOOR MOUNTS: MOUNT IN-LINE 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 PIER 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 DEGREES 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 19MM (0.75").

DIVISION 23 HVAC

1. GENERAL

1.1 SYSTEM CLEANING AND CHEMICAL TREATMENT

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 BE PERFORMED, CHEMICAL TYPES AND QUANTITY TO BE USED. AT THE COMPLETION OF THE CHEMICAL TREATMENT A REPORT SHALL BE SUBMITTED TO OUTLINE THE WORK PERFORMED AND DETAILS OF PROCEDURES TO BE USED BY THE BUILDING OPERATOR FOR CONTINUED WATER QUALITY TESTING AND CHEMICAL TREATMENT.

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.

CLEAN AND FLUSH ALL NEW HOT AND COLD CLOSED LOOP WATER SYSTEM PIPING. PROVIDE A CERTIFICATE FOR THIS WORK.

1.2 GRILLES, LOUVERS AND DIFFUSERS

AIRFLOW TESTS AND SOUND LEVEL MEASUREMENT SHALL BE MADE IN ACCORDANCE WITH APPLICABLE ADC EQUIPMENT TEST CODES, ASHRAE STANDARDS AND AMCA STANDARDS.

MANUFACTURER SHALL CERTIFY CATALOGUED PERFORMANCE AND ENSURE CORRECT APPLICATION OF AIR OUTLET TYPES.

OUTSIDE LOUVERS SHALL BEAR AMCA SEAL FOR FREE AREA AND WATER PENETRATION.

PROJECT CONDITIONS: REVIEW REQUIREMENTS OF OUTLETS AS TO SIZE, FINISH AND TYPE OF MOUNTING PRIOR TO SUBMITTING SHOP DRAWINGS AND SCHEDULES OF OUTLETS. POSITIONS INDICATED ARE APPROXIMATE ONLY. CHECK LOCATIONS OF OUTLETS AND MAKE NECESSARY ADJUSTMENTS IN POSITION TO CONFORM WITH ARCHITECTURAL FEATURES, SYMMETRY, AND LIGHTING ARRANGEMENT.

2. PRODUCTS

2.1 DUCTWORK AND ACCESSORIES

PROVIDE DUCTWORK CONSTRUCTED, REINFORCED, SEALED, AND INSTALLED TO WITHSTAND 1-½ TIMES THE WORKING STATIC PRESSURE.

PROVIDE LOW PRESSURE DUCTWORK 500 PA (2" W.G.) FOR SUPPLY DUCTWORK AND PLENUMS ON SYSTEMS WITHOUT TERMINAL MIXING BOXES OR AIR VALVES, SUPPLY DUCTWORK DOWNSTREAM FROM TERMINAL MIXING BOXES OR AIR VALVES, OUTDOOR AIR DUCTWORK AND PLENUMS, RETURN AIR DUCTWORK AND PLENUMS, EXHAUST AND RELIEF AIR DUCTWORK AND PLENUMS, UNLESS NOTED OTHERWISE.

LOW PRESSURE INSULATED FLEXIBLE DUCTWORK SHALL BE EQUAL TO THERMAFLEX TYPE M-KC.

PROVIDE MEDIUM PRESSURE DUCTWORK TO 1000 PA (4"W.G.) FOR SUPPLY AIR DUCTWORK DOWNSTREAM FROM SUPPLY AIR HANDLING UNITS DISCHARGE, TO TERMINAL MIXING BOXES OR AIR VALVES, EXHAUST AND RETURN AIR DUCTWORK DOWNSTREAM OF RETURN/EXHAUST AIR VALVES TO THE RETURN/EXHAUST FANS AND DISCHARGE DUCTWORK FROM THE RETURN/EXHAUST FANS TO THE AIR HANDLING UNITS AND/OR RELIEF OPENING.

WHERE FLEXIBLE AIR DUCTS ARE USED TO CONNECT TERMINAL MIXING BOXES OR AIR VALVES TO METAL DUCTS, THE FLEXIBLE AIR DUCTS SHALL BE RATED FOR 30.5 M/S (6000 FPM) VELOCITY AND 2500 PA (10" W.G.). MAXIMUM STRETCHED LENGTH OF FLEXIBLE AIR DUCT SHALL BE 300 MM (12"). DO NOT USE FLEXIBLE DUCT TO CHANGE DIRECTION. WHERE FLEXIBLE AIR DUCTS ARE ATTACHED TO METAL INSULATED DUCT, FURNISH FLEXIBLE AIR DUCTS WITH FIBERGLASS WOOL INSULATION AND METALIZED JACKET. THERMAFLEX M-KC OR EQUAL.

2.2 DUCT SEALING

DUCT SEALING LOW PRESSURE DUCTWORK 500 PA (2" W.G.) AND UNDER SHALL BE SMACNA SEAL CLASS A. SEAL ALL SUPPLY, RETURN AND EXHAUST DUCT JOINTS, LONGITUDINAL AS WELL AS TRANSVERSE JOINTS AS FOLLOWS:

SLIP JOINTS: APPLY HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT. APPLY SECOND APPLICATION AFTER THE FIRST APPLICATION HAS COMPLETELY DRIED OUT. WHERE METAL CLEARANCE EXCEEDS 1.5 MM (1/16") USE HEAVY MASTIC TYPE SEALANT.

FLANGED JOINTS: SOFT ELASTOMER BUTYL OR EXTRUDED FORM OF SEALANT BETWEEN FLANGES FOLLOWED BY AN APPLICATION OF HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT.

OTHER JOINTS: HEAVY MASTIC TYPE SEALANT.

DUCT SEALING MEDIUM PRESSURE DUCTWORK TO 1000 PA (4"W.G.) SHALL BE THE SAME AS 500 PA DUCTWORK EXCEPT PROVIDE A COMBINATION OF WOVEN FABRICS AND SEALING COMPOUND FOLLOWED BY AN APPLICATION OF HIGH PRESSURE DUCT SEALANT.

DUCT TAPES AS A SEALING METHOD ARE NOT PERMITTED, EXCEPT ON RESIDENTIAL DUCTWORK - MINIMUM 2 WRAPS OF 2" WIDE (50MM) FOIL DUCT TAPE IS ACCEPTABLE.

DO NOT INSULATE ANY SECTION OF THE DUCTWORK UNTIL IT HAS BEEN INSPECTED AND APPROVED OF DUCT SEALANT APPLICATION, BY THE CONSULTANT.

2.3 DUCT HANGERS AND SUPPORTS

HANGERS AND SUPPORTS TO SMACNA STANDARDS.

STRAP HANGERS: OF SAME MATERIAL AS DUCT BUT NEXT SHEET METAL THICKNESS HEAVIER THAN DUCT.

MAXIMUM SIZE DUCT SUPPORTED BY STRAP HANGER: 500 MM.

HANGERS: GALVANIZED STEEL ANGLE WITH GALVANIZED STEEL RODS TO SMACNA.

TOGGLE HANGERS AND/OR STRAP HANGERS SHALL NOT BE USED.

POWER ACTUATED FASTENERS AND "DROP-IN" ANCHORS SHALL NOT BE USED.

2.4 PIPING

HOT WATER HEATING; CHILLED WATER SHALL BE STEEL SCHEDULE 40, A53 GRADE B, TYPE "L" HARD COPPER OR TYPE "K" SOFT COPPER IF BURIED.

REFRIGERANT PIPING SHALL BE ACR COPPER.

PIPE CONNECTIONS UNLESS NOTED OTHERWISE SHALL BE: NPS 1½ AND LESS: SCREWED JOINT STEEL PIPING, NPS 2: SCREWED JOINT FOR LIQUID SYSTEMS, WELD JOINT FOR AIR OR GAS SYSTEMS, NPS 2½ AND LARGER: WELD OR FLANGED PIPING INCLUDING BRANCH CONNECTIONS.

USE DIELECTRIC TYPE COUPLINGS WHEN JOINING DISSIMILAR METAL PIPES.

USE LEAD FREE SOLDER FOR SOLDERING DOMESTIC WATER COPPER PIPE.

2.5 VALVES

WHEREVER POSSIBLE ALL VALVES SHALL BE OF ONE MANUFACTURER.

GROOVED 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 CRN NUMBER WHICH IS CURRENT.

USE NON-RISING STEM VALVES ONLY WHERE THERE IS INSUFFICIENT CLEARANCE FOR STEM TO RISE.

BALL VALVES 2 NPS AND UNDER SHALL BE FORGED BRASS BODY, SCREWED ENDS, THREADED CAP, CHROME PLATED BALL, PTFE SEATS, BLOW OUT PROOF STEM, ADJUSTABLE PACKING NUT. BALL VALVES FOR ISOLATION SERVICE SHALL HAVE A LARGE/FULL PORT. BALL VALVES FOR BALANCING SERVICE SHALL HAVE A REDUCED PORT AND VALVE HANDLE SHALL HAVE A MEMORY STOP, SCREWED ENDS, CLASS 4140 KPA (600 PSI) W.O.G. TOYO/RED & WHITE 5044AB OR EQUAL.

GATE VALVES NPS 2 AND UNDER SHALL BE BRONZE BODY, RISING STEM, SOLID WEDGE DISC, UNION OR SCREWED BONNET, SCREWED ENDS, CLASS 2070 KPA (300 PSI) W.O.G. TOYO/RED & WHITE 298 OR EQUAL.

GATE VALVES NPS 2-½ AND OVER SHALL BE CAST IRON BODY, RISING STEM, O.S. & Y, SOLID WEDGE DISC, BRONZE TRIM, BOLTED BONNET, FLANGED ENDS, CLASS 1033 KPA (150 PSI) W.O.G. TOYO/RED & WHITE 421 OR EQUAL.

GLOBE VALVES NPS 2 AND UNDER SHALL BE BRONZE BODY, STAINLESS STEEL DISC, UNION BONNET, SCREWED ENDS, CLASS 2760 KPA (400 PSI) W.O.G. TOYO/RED & WHITE 214 OR EQUAL.

GLOBE VALVES NPS 2-½ AND OVER SHALL BE CAST IRON BODY, RISING STEM, O.S. & Y CAST IRON DISC, BRASS SEAT, FLANGED ENDS, CLASS 1380 KPA (200 PSI) W.O.G. TOYO/RED & WHITE 400 OR EQUAL.

CHECK VALVES NPS 2 AND SMALLER SHALL BE BRONZE SWING CHECK WITH BRONZE DISC CAPABLE OF BEING REGROUND, SCREWED ENDS, CLASS 13880 KPA (300 PSI) W.O.G. TOYO/RED & WHITE 238 OR EQUAL.

CHECK VALVES NPS 2-½ AND OVER SHALL BE CAST IRON BODY, BOLTED COVER, BRONZE SEAT, CAST IRON DISC, FLANGED ENDS, CLASS 1380 KPA (200 PSI) W.O.G. TOYO/RED & WHITE 435 OR EQUAL.

2.6 HYDRONIC PIPING SPECIALTIES

MANUAL AIR VENT: PROVIDE MANUAL AIR VENTS FROM SHORT VERTICAL SECTION OF LINE DIAMETER PIPE TO FORM AIR CHAMBER. PROVIDE 3MM (1/8") BRASS NEEDLE VALVE AT TOP OF CHAMBER.

AIR SEPARATOR: PROVIDE CENTRIFUGAL TYPE, CONNECTIONS TO SUIT LINE PIPE DIAMETER, 861 KPA (125 PSI) ASME RATED STEEL TANK, REMOVABLE STAINLESS STEEL 5 MM PERFORATED STRAINER, BLOW DOWN DRAIN CONNECTION. THE MANUFACTURER TO FURNISH DATA SHEET SPECIFYING AIR COLLECTION EFFICIENCY AND PRESSURE DROP AT RATED FLOW.

RELIEF VALVES NPS 2 AND SMALLER SHALL BE PRESSURE ONLY RELIEF VALVES, BRONZE BODY, DIRECT SPRING LOADED TYPE, ASME RATED, LEVER OPERATED NON-ADJUSTABLE FACTORY SET, THREADED CONNECTIONS, DISCHARGE PRESSURE AS SCHEDULED. PROVIDE A DISCHARGE LINE THE SAME SIZE AS THE VALVE OUTLET AND PITCHED DOWNWARD FROM THE VALVE TO DRAIN.

RADIATOR VALVE: HEAVY PATTERN BRASS BODY VALVE, WHEEL HANDLE, RISING STEM, INSIDE SCREW, RENEWABLE COMPOSITION SWIVEL, STRAIGHT OR ANGLE GLOBE, THREADED OR UNION ENDS, POSITIVE BACK SEATING. DAHL SERIES 11040 OR EQUAL.

MEMORY RADIATOR BALANCING VALVE: REMOVABLE CAP-KEY, SCREW SET MEMORY BONNET FOR BALANCING, BRASS BODY, RISING STEM, INSIDE SCREW, RENEWABLE COMPOSITION SWIVEL DISC, STRAIGHT OR ANGLE GLOBE, THREADED OR UNION ENDS, POSITIVE BACK SEATING. DAHL SERIES 13000 OR EQUAL

CIRCUIT SETTER VALVE: SCREWED ENDS, BRASS BODY REGULATING VALVE, COMBINATION P/T TEST POINTS WITH EPT INSERTS/CHECK VALVES, DRAIN PORT, MEMORY STOP HANDLE WITH GRADUATED MARKINGS, POSITIVE SHUT OFF, 1035 KPA @ 93°C (150 PSI @ 200°F) RATING.

PRESSURE REDUCING VALVE: ½ TO ¾ NPS, SCREWED ENDS, BRASS BODY PRESSURE REDUCING VALVE WITH LOW INLET PRESSURE CHECK VALVE, REMOVABLE STRAINER. ADJUSTABLE PRESSURE OF 172 KPA TO 414 KPA (25 PSI TO 60 PSI), MAXIMUM OPERATING TEMPERATURE 107°C (225°F), MAXIMUM WORKING PRESSURE 862 KPA (125 PSI). BELL AND GOSSETT A-430H OR EQUAL.

2.7 DUCT AND BREECHING INSULATION

EXPOSED RECTANGULAR DUCTS: EXTERNAL RIGID INSULATION, SERVICE TEMPERATURE 5°C TO 232°C (41°F TO 450°F), MINERAL FIBER BOARD FOR LOW AND MEDIUM TEMPERATURE APPLICATIONS, ALL SERVICE ALUMINUM FOIL-SCRIM KRAFT (FSK) VAPOUR BARRIER JACKET WITH GLASS FIBRE REINFORCEMENT, FACTORY APPLIED. DENSITY 36KG/M3 (2.25 PCF), MINIMUM RSI 0.76/25MM (R 4.3/IN)

ROUND DUCTS AND CONCEALED RECTANGULAR DUCTS: EXTERNAL FLEXIBLE INSULATION, SERVICE TEMPERATURE 5°C TO 232°C (41°F TO 450°F), GLASS FIBER OR MINERAL FIBER FLEXIBLE BLANKET FOR LOW AND MEDIUM TEMPERATURE APPLICATIONS, ALL SERVICE ALUMINUM FOIL-SCRIM KRAFT (FSK) VAPOUR BARRIER JACKET WITH GLASS FIBRE REINFORCEMENT, FACTORY APPLIED. DENSITY 12KG/M3 (0.75PCF), MINIMUM RSI 0.49/25MM (R 2.8/IN) (INSTALLED)

ACOUSTIC LINING DUCTS: INTERNAL FLEXIBLE DUCT LINER, FLEXIBLE MINERAL FIBER BLANKET, FOR LOW AND MEDIUM TEMPERATURE ACOUSTICAL APPLICATIONS, AIRSTREAM SURFACE FACED WITH A BLACK MAT BONDED TO THE FIBREGLASS SUBSTRATE, AIR VELOCITY RATING 25.4 M/S (5,000 FT/MIN). DENSITY 24KG/M3 (1.5 PCF), MINIMUM RSI 0.74/25MM (R 4.2/IN)

ACOUSTIC LINING PLENUMS: INTERNAL RIGID DUCT LINER, RIGID MINERAL FIBER BOARD, FOR LOW AND MEDIUM TEMPERATURE ACOUSTICAL APPLICATIONS, AIRSTREAM SURFACE FACED WITH A BLACK MAT BONDED TO THE FIBREGLASS SUBSTRATE, AIR VELOCITY RATING 25.4 M/S (5,000 FT/MIN). DENSITY 48KG/M3 (3 PCF), MINIMUM RSI 0.76/25MM (R 4.3/IN)

BREECHING INSULATION: EXTERNAL SEMI-RIGID INSULATION, SERVICE TEMPERATURE UP TO 538°C (1000°F), GLASS FIBER OR MINERAL FIBER FLEXIBLE BLANKET FOR HIGH TEMPERATURE APPLICATIONS. DENSITY 25KG/M3 (1.6PCF), MINIMUM RSI 0.25/25MM (R 1.4/IN)

2.8 DUCTWORK FINISH JACKETS

THERMOCANVAS JACKET: FIRE RATED, 170G (6 OZ) FIRE RETARDANT CANVAS JACKET FOR COVERING MECHANICAL INSULATION INDOORS, 25/50 FIRE CLASS, PLAIN WAVE COTTON, NO DYES.

UTILITY FINISH: OVER RIGID INSULATION FOR RECTANGULAR DUCTWORK AND FLEXIBLE INSULATION FOR ROUND DUCTWORK. APPLY CONTINUOUS METAL CORNER BEAD TO ALL CORNERS. ADHERE VAPOR RETARDER TAPE OVER ALL JOINTS AND BREAKS IN VAPOR RETARDER, AND AT ALL CORNERS.

ALUMINUM JACKET: 51 MIL (22 GA.) THICK STUCCO OR SMOOTH ALUMINUM JACKETING WITH LONGITUDINAL SLIP JOINTS AND 50MM (2") END LAPS WITH FACTORY APPLIED PROTECTIVE LINER ON INTERIOR SURFACE.

2.9 PREFORMED PIPE INSULATION

CHILLED WATER PIPING WITH A SERVICE TEMPERATURE OF -40°C TO 5°C (-40°F TO 41°F) SHALL BE PRE-FORMED AND PRE-SLIT FLEXIBLE FOAMED ELASTOMERIC OR CLOSED CELL INSULATION WITH SELF-ADHESIVE SELF SEAL OR LAP SEAL JOINTS, MAXIMUM "K" VALUE AT 24°C (75°F) = 0.039 W/M.°C (0.27 BTU.IN/HR.FT2.°F)

CHILLED WATER AND HEATING WATER PIPING WITH A SERVICE TEMPERATURE OF 5°C TO 315°C (41°F TO 599°F) SHALL BE PREFORMED INSULATION, FINE FIBROUS GLASS OR FORMED MINERAL FIBRE PIPE INSULATION WITH ALL SERVICE JACKET VAPOUR RETARDER (ASJ). ASJ SHALL BE RE-ENFORCED WITH GLASS FIBRE, FACTORY APPLIED WITH PRESSURE SENSITIVE LAP CLOSURE. MAXIMUM "K" VALUE AT 38°C (100°F) = 0.035 W/M.°C (0.24 BTU.IN/HR.FT2.°F)

2.10 PIPING FINISH JACKETS

THERMOCANVAS JACKET: FIRE RATED, 170G (6 OZ) FIRE RETARDANT CANVAS JACKET FOR COVERING MECHANICAL INSULATION INDOORS, 25/50 FIRE CLASS, PLAIN WAVE COTTON, NO DYES.

PVC FINISHING JACKET: WHITE, UV RESISTANT, FOR INDOOR OR OUTDOOR APPLICATIONS, 25/50 FIRE CLASS, MINIMUM 0.50 MM (0.02") THICK.

ALUMINUM JACKET: 0.51 MM (22 GA.) THICK STUCCO OR SMOOTH ALUMINUM JACKETING WITH LONGITUDINAL SLIP JOINTS AND 50MM (2") END LAPS WITH FACTORY APPLIED PROTECTIVE LINER ON INTERIOR SURFACE.

2.11 GRILLES, LOUVERS AND DIFFUSERS

ACCEPTABLE MANUFACTURES FOR AIR TERMINALS: E.H. PRICE, TITUS, ANEMOSTAT, NAILOR.

ACCEPTABLE MANUFACTURERS FOR LOUVERS: AIROLITE, PENN, AIRSTREAM, WEST VENT, NAILOR, RUSKIN.

PROVIDE BAFFLES TO DIRECT AIR AWAY FROM WALLS, COLUMNS OR OTHER OBSTRUCTIONS WITHIN THE RADIUS OF DIFFUSER OPERATION.

PROVIDE PLASTER FRAME FOR DIFFUSERS LOCATED IN PLASTER SURFACES AND ANTI-SMUDGE FRAMES OR PLAQUES ON DIFFUSERS LOCATED IN ROUGH TEXTURED SURFACES SUCH AS ACOUSTICAL PLASTER.

PROVIDE 30 MM MARGIN FRAME ON GRILLES WITH [COUNTERSUNK SCREW HOLES] [CONCEALED FASTENING].

PROVIDE OPPOSED BLADE BALANCE DAMPER, ACCESSIBLE FROM GRILLE FACE ON ALL GRILLES LOCATED IN DRYWALL CEILINGS OR BULKHEADS.

ALL GRILLES AND DAMPERS SHALL BE ALUMINUM IN WET AREAS (I.E. SHOWERS, AQUATIC AREAS, DISHWASHING ETC.)

IN GYMNASIUM, AQUATIC CENTRES, FRONT BLADES SHALL BE FRONT PIVOTED, WELDED IN PLACE OR SECURELY FASTENED TO BE IMMOBILE.

FABRICATE GOOSENECKS OF MINIMUM 1.3 MM (18 GA.) GALVANIZED STEEL. MOUNT ON MINIMUM 300 MM (12 IN.) HIGH CURB BASE WHERE SIZE EXCEEDS 225 MM X 225 MM (9 IN. X 9 IN).

REFER TO GRILLES AND DIFFUSER SCHEDULE FOR TYPES AND CAPACITIES.

2.12 EQUIPMENT

ALL EQUIPMENT SHALL BE CSA APPROVED FOR ITS INTENDED USE.

INLINE BELT DRIVEN EXHAUST FAN: WHEEL STATICALLY AND DYNAMICALLY BALANCED TO AMCA STANDARD, TEFC MOTORS, PERMANENTLY LUBRICATED, HEAVY DUTY BEARINGS OR PILLOW BLOCK BALL BEARINGS. BEARING SHALL BE SELECTED FOR A MINIMUM L10 LIFE IN EXCESS OF 100,000 HOURS. (EQUIVALENT TO L50 AVERAGE LIFE OF 500,000 HOURS). HEAVY GAUGE GALVANIZED STEEL HOUSING. RECTANGULAR CONSTRUCTION INCLUDING RECTANGULAR DUCT MOUNTING COLLARS. DRIVE FRAME ASSEMBLIES SHALL BE CONSTRUCTED OF HEAVY GAUGE STEEL AND MOUNTED ON VIBRATION ISOLATORS. ADJUSTABLE BELT DRIVE, PULLEYS, AND KEYS OVERSIZED FOR A MINIMUM OF 150 PERCENT OF DRIVEN HORSEPOWER. PROVIDE A MOTORIZED DAMPER TO PREVENT OUTSIDE AIR FROM ENTERING BACK INTO THE BUILDING WHEN FAN IS OFF. PROVIDE A NEMA 4 DISCONNECT SWITCH WIRED FROM FAN MOTOR TO JUNCTION BOX.

ACCEPTABLE MANUFACTURERS: COOK, GREENHECK

CAPACITY AS SCHEDULED.

EXHAUST FAN: CEILING MOUNT, ENERGY STAR® RATED WITH BUILT-IN SPEED SELECTOR. THE MOTOR SHALL BE TOTALLY ENCLOSED, FOUR POLE CONDENSER TYPE ENGINEERED TO RUN CONTINUOUSLY. POWER RATING SHALL BE 120V/60HZ. HOUSING MATERIAL SHALL BE NO LESS THAN 26 GAUGE GALVANIZED STEEL WITH RUST PROOF EPOXY AND

FORWARD CURVED CENTRIFUGAL WHEEL, GALVANIZED STEEL OR CALCIUM CARBONATE FILLED POLYPROPYLENE, STATICALLY AND DYNAMICALLY BALANCED TO AMCA STANDARDS.

ACCEPTABLE MANUFACTURERS: PANASONIC

CAPACITY AS SCHEDULED.

3. EXECUTION

3.1 DUCTWORK AND ACCESSORIES

FABRICATE DUCTWORK IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE, NFPA 90A STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS, AND NFPA 90B STANDARD FOR THE INSTALLATION OF WARM AIR HEATING AND AIR-CONDITIONING SYSTEMS

PRIOR TO FABRICATION OF DUCTWORK, CHECK ALL CEILING SPACES AND HEIGHTS AND CONFLICTS WITH OTHER TRADES.

DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS. FOR ACOUSTICALLY LINED OR INTERNALLY INSULATED DUCTS ALLOW FOR INSULATION THICKNESS AND MAINTAIN INTERIOR CLEAR DIMENSIONS INDICATED.

CONNECT OUTLET TERMINALS TO LOW PRESSURE DUCTS WITH 900MM (36") MAXIMUM LENGTH OF STRETCHED FLEXIBLE DUCT. HOLD IN PLACE WITH STRAP OR CLAMP, CAULK SEALED. DO NOT USE FLEXIBLE DUCT TO CHANGE DIRECTIONS.

PROVIDE A FLEXIBLE CONNECTION WHERE LOW PRESSURE DUCTS ARE CONNECTED TO FAN EQUIPMENT, TERMINAL BOXES OR ANY OTHER APPARATUS. JOINT SHALL BE SCREWED OR BOLTED FLEXIBLE GASKETED JOINT, MINIMUM 50MM (2") WIDE.

PROVIDE FIRE DAMPERS WHERE DUCTS CROSS FIRE SEPARATIONS. FIRE DAMPERS SHALL BE ULC LISTED AND "DYNAMIC"; RATED TO CLOSE UNDER AIRFLOW. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE SEPARATION RATINGS AND LOCATIONS.

PROVIDE BALANCING DAMPERS WHERE INDICATED ON DRAWINGS AND AT POINTS ON LOW PRESSURE SUPPLY, RETURN AND EXHAUST DUCTS WHERE BRANCHES ARE TAKEN FROM LARGER DUCTS.

MODIFY CEILING SYSTEM WHERE REQUIRED TO ACCOMMODATE GRILLES AND DIFFUSERS.

SIZE ROUND DUCTS, INSTALLED IN PLACE OF RECTANGULAR DUCTS, FROM ASHRAE TABLE OF EQUIVALENT RECTANGULAR AND ROUND DUCTS. NO VARIATION OF DUCT CONFIGURATION OR SIZES PERMITTED EXCEPT BY PERMISSION FROM THE CONSULTANT.

EXPOSED ROUND DUCTWORK TO BE SPIRAL LOCK SEAM TYPE ONLY.

PROVIDE DUCT HANGERS AND SUPPORTS IN ACCORDANCE WITH SMACNA MANUALS.

CONFIRM THE EXISTING BASE BUILDING STANDARDS PRIOR TO SUBMITTING TENDER.

DUCTWORK SHALL BE GALVANIZED STEEL UNLESS NOTED OTHERWISE.

3.2 DUCT HANGERS AND SUPPORTS

DUCT SUPPORT SHALL BE:

UP TO 750MM DUCT SIZE: ANGLE SIZE 25X25X3 MM WITH 6MM ROD SIZE

751 TO 1050MM DUCT SIZE: ANGLE SIZE 40X40X3 MM WITH 6MM ROD SIZE

1051 TO 1500MM DUCT SIZE: ANGLE SIZE 40X40X3 MM WITH 10MM ROD SIZE

1501 TO 2100MM DUCT SIZE: ANGLE SIZE 50X50X3 MM WITH 10MM ROD SIZE

2101 TO 2400MM DUCT SIZE: ANGLE SIZE 50X50X5 MM WITH 10MM ROD SIZE

2401 AND OVER DUCT SIZE: ANGLE SIZE 50X50X6 MM WITH 10MM ROD SIZE

UPPER HANGER ATTACHMENTS SHALL BE:

FOR CONCRETE: MANUFACTURED CONCRETE INSERTS.

FOR STEEL JOIST: MANUFACTURED JOIST CLAMP.

FOR STEEL BEAMS: MANUFACTURED BEAM CLAMPS.

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 PIPING SYSTEMS INCLUDING BUT NOT LIMITED TO: HEATING WATER, CHILLED WATER, STEAM AND CONDENSATE, CLOSED CONDENSER WATER SYSTEMS, AND ALL OTHER PIPING SYSTEMS THAT OPERATE AT VARYING TEMPERATURES.

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 CRUSHING THE INSULATION OR PREVENTING THE EXPANSION OF THE PIPING.

IT IS THE CONTRACTOR`S RESPONSIBILITY TO RETAIN THE SERVICES OF A QUALIFIED PROFESSIONAL ENGINEER (REGISTERED IN THE PROJECT AREA) TO DESIGN THE PIPE EXPANSION SYSTEM FOR THE ACTUAL INSTALLED LAYOUT OF ALL PIPING SYSTEMS COVERED BY THIS SPECIFICATION SECTION (INCLUDING REFRIGERANT PIPING). THE EXPANSION SYSTEM MUST INCLUDE EXPANSION FITTINGS, COMPENSATORS, JOINTS, OR PIPING BENDS, PIPE GUIDES, AND PIPING ANCHORS. ANCHOR FORCES MUST BE COORDINATED WITH THE PROJECT STRUCTURAL ENGINEER.

THE INSTALLATION OF ALL PIPING SYSTEMS MUST FOLLOW THE DESIGN REQUIREMENTS OF THE CONTRACTOR'S QUALIFIED PROFESSIONAL ENGINEER THAT HAS DESIGNED THE ENTIRE PIPING SYSTEM TO ALLOW EXPANSION COMPENSATION.

SPECIAL ATTENTION SHOULD BE GIVEN TO STRAIGHT PIPE RUNS, PIPE RISER INSTALLATIONS AND NON-METALLIC PIPE INSTALLATIONS. AS A MINIMUM ON HOT PIPING, PROVIDE EXPANSION COMPENSATION ON EVERY OTHER FLOOR OF A NON-METALLIC PIPE RISER IN A SHAFT AND EVERY THIRD FLOOR FOR METALLIC PIPE RISERS. ALL PIPE TAKE-OFFS FROM THE RISER MUST ALSO BE DESIGNED TO ALLOW VERTICAL MOVEMENT OF THE RISER CONNECTION IF NEEDED. TAKE-OFFS WITH SPECIFICALLY DESIGNED SWING JOINTS WITH APPROPRIATE PIPING SUPPORT CAN BE USED TO ALLOW MOVEMENT.

UNLESS REQUIRED OTHERWISE BY THE CONTRACTOR'S ENGINEER, METALLIC PIPING EXPANSION COMPENSATION IS GENERALLY NOT REQUIRED FOR: PIPING RISERS LESS THAN 12M (39 FEET) IN VERTICAL HEIGHT, OR HORIZONTAL RUNS WITH STRAIGHT LENGTHS LESS THAN 11M (36 FEET) AND A TOTAL FLOATING PIPING SYSTEM LENGTH LESS THAN 30M (98 FEET). FLOATING SYSTEMS CONSIST OF PIPING SUPPORTS ALLOWING MOVEMENT IN AT LEAST 2 DIRECTIONS (PIPE HANGERS) AND EQUIPMENT CONNECTIONS WITH FLEXIBLE HOSES.

3.4 VALVES

INSTALL VALVES IN ACCESSIBLE LOCATIONS WITH STEMS UPRIGHT OR ANGLED 45° ABOVE HORIZONTAL UNLESS APPROVED OTHERWISE. VALVES MUST BE ACCESSIBLE WITHOUT REMOVING ADJACENT PIPING.

PROVIDE STEM EXTENSIONS ON ALL INSULATED VALVES.

PROVIDE BALL VALVES IN PIPING NPS 2 AND SMALLER AND BUTTERFLY VALVES OR GATE VALVES IN PIPING NPS 2-½ AND LARGER FOR SHUT-OFF, EQUIPMENT ISOLATION, THROTTLING, BYPASS OR MANUAL FLOW CONTROL SERVICES. BALL VALVES USED FOR SHUT-OFF / ISOLATION SHALL BE FULL PORT.

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.

PROVIDE ISOLATION VALVES IN ALL SYSTEMS SUCH THAT FLOOR BY FLOOR FOR HORIZONTAL SYSTEMS, ALL RISERS IN VERTICAL SYSTEMS AND ZONE AREAS ON A LARGE HORIZONTAL SYSTEM CAN BE ISOLATED.

USE SWING OR SOFT SEATED SPRING LOADED CHECK VALVES IN HORIZONTAL AND VERTICAL UP-FLOW PIPES AND ON THE DISCHARGE OF PUMPS. SPRING LOADED WATER CHECK VALVES SHALL BE LOCATED EIGHT (8) PIPE DIAMETERS DOWNSTREAM OF PUMPS OR ELBOWS. USE SILENT CHECK VALVES ON DISCHARGE OF PUMPS AND IN VERTICAL PIPES WITH DOWNWARD FLOW, AND AS INDICATED.

DO NOT INSTALL BALANCING OR THROTTLING VALVE ON DISCHARGE OF PUMPS EQUIPPED WITH VFD. INSTALL PRESSURE PORTS FOR FLOW MEASUREMENT.

3.5 DUCT AND BREECHING INSULATION

INSTALL ALL DUCTWORK INSULATION TO THE THERMAL INSULATION ASSOCIATION OF CANADA BEST PRACTICES GUIDE.

DUCT INSULATION MINIMUM THICKNESS TABLE (CLIMATIC ZONE 5)

Rigid Exterior Duct Insulation				
Duty	Plenum (4)	Duct Location		
		Interior		Exterior
		Conditioned Space	Unconditioned Space	
	Minimum Insulation Thickness in mm (in.)			
Cooling Only Air Supply	25 (1")	25 (1")	25 (1")	125 (5")
Heating or H/C Air Supply	38 (1-1/2")	38 (1-1/2")	38 (1-1/2")	125 (5")
Outdoor Air Supply	38 (1-1/2")	38 (1-1/2")	38 (1-1/2")	0
Combustion Air	38 (1-1/2")	38 (1-1/2")	38 (1-1/2")	0
Return Air	25 (1")	0	25 (1")	125 (5")
Exhaust Air (1)(2)	25 (1")	0	25 (1")	25 (1")
Grease Hood Exhaust (5)	N/A	38 (1-1/2")	38 (1-1/2")	0
Tempered Air Supply or Makeup Air	0	0	25 (1")	125 (5")
Mixed Air (3)	20 (3/4")	20 (3/4")	20 (3/4")	125 (5")
See note (6) for factory installed duct and plenums				

Flexible Exterior Duct Insulation				
Duty	Plenum (4)	Duct Location		
		Interior		Exterior
		Conditioned Space	Unconditioned Space	
	Minimum Insulation Thickness mm (in.)			
Cooling Only Air Supply	38 (1-1/2")	38 (1-1/2")	38 (1-1/2")	188 (7-1/2")
Heating or H/C Air Supply	50 (2")	50 (2")	50 (2")	188 (7-1/2")
Outdoor Air Supply	50 (2")	50 (2")	50 (2")	0
Combustion Air	50 (2")	50 (2")	50 (2")	0
Return Air	38 (1-1/2")	0	38 (1-1/2")	188 (7-1/2")
Exhaust Air (1)(2)	38 (1-1/2")	0	38 (1-1/2")	38 (1-1/2")
Grease Hood Exhaust (5)	N/A	38 (1-1/2")	38 (1-1/2")	0
Tempered Air Supply or Makeup Air	0	0	38 (1-1/2")	188 (7-1/2")
Mixed Air (3)	38 (1-1/2")	38 (1-1/2")	38 (1-1/2")	188 (7-1/2")
See note (6) for factory installed duct and plenums				

NOTE (1): AIR TEMPERATURES 15°C TO 49°C (60°F TO 120°F).

NOTE (2): PROVIDE 38MM (1-½") FLEXIBLE DUCT INSULATION ON ALL EXHAUST AIR DUCTWORK FROM OUTSIDE WALL OR ROOF TO DAMPER BUT A MINIMUM OF 1.5 M (5 FT.) INSIDE BUILDING.

NOTE (3): MIXED AIR INCLUDES TEMPERED AIR DOWNSTREAM OF HEAT RECOVERY UNITS.

NOTE (4): PLENUMS LOCATED OUTSIDE THE BUILDING SHALL BE INSULATED TO THE VALUES LISTED IN THE EXTERIOR COLUMN.

NOTE (5): PROVIDES 1 HOUR FIRE RATING. THICKNESS SHALL BE DOUBLED FOR 2 HOUR APPLICATIONS.

NOTE (6): FACTORY INSTALLED DUCTWORK AND PLENUMS PROVIDED WITH EQUIPMENT NEED NOT COMPLY WITH THIS TABLE PROVIDED THEY MEET THE REQUIREMENTS OF THE RELEVANT CSA STANDARD FOR THAT EQUIPMENT AND IS INSULATED TO RSI 0.58 (R3.3) OR GREATER. REFER TO NECB ARTICLE 5.2.12.1 FOR RELEVANT CSA STANDARDS.

3.6 DUCT FINISHES TABLE

INDOORS CONCEALED; FACTORY FINISH

INDOORS EXPOSED IN MECHANICAL ROOM AND ELSEWHERE; CANVAS JACKET AS PER TIAC STANDARD CRF/1 - CRD/1

INDOORS, EXPOSED IN UTILITY AREAS, PARKADE, ETC.; UTILITY FINISH AS PER TIAC CODE CRF/2 - CRD/2

INDOOR EXPOSED IN UTILITY AREAS, PARKADE, ETC. PROVIDE A UTILITY FINISH AS PER TIAC CODE CRF/2 AND CRD/2

OUTDOORS; ALUMINUM JACKET AS PER TIAC CODE CRF/3 - CRD/3

3.7 PIPING INSULATION MINIMUM THICKNESS SCHEDULE (ASHRAE 90.1)

CHILLED WATER AND REFRIGERANT PIPING IN A CONDITIONED SPACE:

SIZES NPS 1 TO NPS 6 - 25MM THICK.

SIZE NPS 8 - 40MM THICK

CHILLED WATER AND REFRIGERANT PIPING IN AN UNCONDITIONED SPACE OR EXTERIOR TO THE BUILDING:

SIZES NPS 1 TO NPS 1-¼ - 25MM THICK.

SIZES NPS 1-½ TO 8 - 40MM THICK.

LOW TEMPERATURE WATER PIPING 41-60°C (106-141°F) IN A CONDITIONED SPACE:

SIZES NPS 1 TO NPS 1-¼ - 25MM THICK.

SIZES NPS 1-½ TO 8 - 40MM THICK.

LOW TEMPERATURE WATER PIPING 41-60°C (106-141°F) IN AN UNCONDITIONED SPACE OR EXTERIOR TO THE BUILDING:

SIZES NPS 1 TO NPS 1-¼ - 40MM THICK.

SIZES NPS 1-½ TO 8 - 50MM THICK.

HEATING WATER PIPING 61-93°C (142-200°F) IN A CONDITIONED SPACE:

SIZES NPS 1 TO NPS 1-¼ - 40MM THICK.

SIZES NPS 1-½ TO 8 - 50MM THICK.

HEATING WATER PIPING 61-93°C (142-200°F) IN AN UNCONDITIONED SPACE OR EXTERIOR TO THE BUILDING:

SIZES NPS 1 TO NPS 1-¼ - 65MM THICK.

SIZES NPS 1-½ TO 8 - 75MM THICK.

3.8 PIPING FINISH SCHEDULE

INDOORS CONCEALED; FACTORY FINISH

INDOORS EXPOSED IN MECHANICAL ROOM AND ELSEWHERE; CANVAS JACKET

INDOORS, EXPOSED IN UTILITY AREAS, PARKADE, ETC.; PVC JACKET

OUTDOORS; ALUMINUM JACKET

SEQUENCE OF OPERATIONS (SOO)

AIR HANDLING UNIT (AHU-1, PSB-AHU1-P1):

1. GENERAL:
   1.1. THE NEW COILS HAVE BEEN DESIGNED TO PROVIDE HEATING AND COOLING FOR THE DISTRIBUTION FROM AHU-1.
   1.2. THERE ARE TWO (2) COILS. THE FIRST COIL WILL ACT AS A PRE-HEAT AND WILL BE PROVIDED WITH HIGH-TEMPERATURE WATER, AND THE SECOND COIL WILL ACT AS A SWITCH-OVER COIL, PROVIDING EITHER HEATING OR COOLING DEPENDING ON THE SPACE DEMANDS.
2. SEQUENCES:
   2.1. THE EXISTING AHU-1 SEQUENCES SHALL REMAIN, WITH THE MODIFICATION TO THE CONTROL OF THE PRE-HEATING OR SWITCH OVER COIL.
   2.2. PRE-HEATING COIL:
      2.2.1. PUMP (PSB-AHU1-P1), SHALL RUN WHEN OAT IS BELOW 5°C (ADJ.) OR WHEN SYSTEM IS IN HEATING MODE.
      2.2.2. THREE-WAY CONTROL VALVE SHALL MODULATE/MIX TO MAINTAIN HEATING WATER TEMPERATURE TO THE PRE-HEAT COIL TO BE AT 5°C (ADJ.).
      2.2.3. ALARMS:
         2.2.3.1. PUMP FAULT
         2.2.3.2. PUMP IN HAND
         2.2.3.3. LOW HEATING WATER SUPPLY TEMP.
      2.2.4. CONTROLS TO PROVIDE PUMP FEEDBACK (STATUS), AND RUNTIME.
   2.3. SWITCH-OVER COIL:
      2.3.1. THE SWITCH-OVER COIL WILL BE IN EITHER HEATING OR COOLING MODE, DEPENDING ON EXISTING THERMOSTAT AND SYSTEM DEMAND.
      2.3.2. THE FULLY MODULATING 6-WAY CONTROL VALVE SHALL CONTROL HEATING OR CHILLED WATER SUPPLY TO THE COIL TO SATISFY THE SPACE TEMPERATURE DEMANDS.
      2.3.3. CONTROLS TO PROVIDE FEEDBACK ON CONTROL VALVE POSITION.

CONTROL VALVES

1. GENERAL:
   1.1. CONTROL VALVES SHALL BE;
      1.1.1. THREE-WAY TYPE FOR MODULATING SERVICE AS SHOWN.
      1.1.2. SIX WAY, FOR CHANGE OVER FROM HEATING TO CHILLED WATER.
   1.2. CLOSE-OFF (DIFFERENTIAL) PRESSURE RATING: VALVE ACTUATOR AND TRIM SHALL BE FURNISHED TO PROVIDE THE FOLLOWING MINIMUM CLOSE-OFF PRESSURE RATINGS:
      1.2.1. WATER VALVES:
         1.2.1.1. THREE-WAY: 300% OF PRESSURE DIFFERENTIAL BETWEEN PORTS A AND B AT DESIGN FLOW OR 100% OF TOTAL SYSTEM (PUMP) HEAD.
   1.3. COIL CONNECTION KITS C/W CONTROL VALVES ARE ACCEPTABLE.
   1.4. PRESSURE INDEPENDENT CONTROL VALVES (PICV):
      1.4.1. TWO-WAY VALVES FOR MODULATING SERVICE INDEPENDENT OF PRESSURE.
         1.4.1.1. PROVIDE CALIBRATION CHARTS AND ADJUSTMENT TOOLS.
         1.4.1.2. PROVIDE A DIFFERENTIAL PRESSURE METER KIT SUITABLE FOR DIRECT READOUT C/W CONNECTION HOSES SUITABLE FOR THE SYSTEM PRESSURE.

2. WATER VALVES:
   2.1. BODY AND TRIM STYLE AND MATERIALS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS FOR DESIGN CONDITIONS AND SERVICE SHOWN, WITH EQUAL PERCENTAGE PORTS FOR MODULATING SERVICE.
   2.2. SIZING CRITERIA:
      2.2.1. THREE-WAY OR SIX-WAY MODULATING SERVICE: PRESSURE DROP EQUAL TO TWICE THE PRESSURE DROP THROUGH THE COIL EXCHANGER (LOAD), 35 KPA (5 PSI) MAXIMUM.
      2.2.2. VALVES ½ IN. THROUGH 2 IN. SHALL BE BRONZE BODY OR CAST BRASS ANSI CLASS 250, SPRING-LOADED, PTFE PACKING, QUICK OPENING FOR TWO-POSITION SERVICE. TWO-WAY VALVES TO HAVE REPLACEABLE COMPOSITION DISC OR STAINLESS STEEL BALL.
      2.2.3. VALVES 2½ IN. AND LARGER SHALL BE CAST IRON ANSI CLASS 125 WITH GUIDED PLUG AND PTFE PACKING.
      2.2.4. PRESSURE INDEPENDENT CONTROL VALVES.
         2.2.4.1. MINIMUM AND MAXIMUM DIFFERENTIAL PRESSURE SHALL BE SUITABLE FOR THE SYSTEM.
         2.2.4.2. BASE ON COIL FLOW RATES.
   2.3. WATER VALVES SHALL FAIL NORMALLY OPEN OR CLOSED, AS SCHEDULED ON PLANS, OR AS FOLLOWS:
      2.3.1. EATING AND SWITCHOVER COILS IN AIR HANDLERS--NORMALLY OPEN.

VALVE ACTUATORS

1. THE ACTUATOR SHALL HAVE MECHANICAL OR ELECTRONIC STALL PROTECTION TO PREVENT DAMAGE TO THE ACTUATOR THROUGHOUT THE ROTATION OF THE ACTUATOR.

2. WHERE SHOWN, FOR POWER-FAILURE/SAFETY APPLICATIONS, AN INTERNAL MECHANICAL, SPRING-RETURN MECHANISM SHALL BE BUILT INTO THE ACTUATOR HOUSING. ALTERNATIVELY, AN UNINTERRUPTIBLE POWER SUPPLY (UPS) MAY BE PROVIDED.

3. PROPORTIONAL ACTUATORS SHALL ACCEPT A 0 TO 10 VDC OR 0 TO 20 MA CONTROL SIGNAL AND PROVIDE A 2 TO 10 VDC OR 4 TO 20 MA OPERATING RANGE.

4. ALL 24 VAC/VDC ACTUATORS SHALL OPERATE ON CLASS 2 WIRING

5. ALL NON-SPRING-RETURN ACTUATORS SHALL HAVE AN EXTERNAL MANUAL GEAR RELEASE TO ALLOW MANUAL POSITIONING OF THE DAMPER WHEN THE ACTUATOR IS NOT POWERED. SPRING-RETURN ACTUATORS WITH MORE THAN 7 N·M (60 IN.-LB) TORQUE CAPACITY SHALL HAVE A MANUAL CRANK FOR THIS PURPOSE.

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THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE CONSULTANT PRIOR TO COMMENCING THE WORK.

THESE DRAWINGS ARE NOT TO BE SCALED.

REV.	DATE	DESCRIPTION
1.	2023.10.12	ISSUED FOR CLIENT REVIEW
2.	2024.01.18	ISSUED FOR CLIENT REVIEW
3.	2024.03.14	ISSUED FOR TENDER
4.	2024.03.20	ISSUED FOR TENDER ADDENDUM 001
5.	2024.05.01	ISSUED FOR RFP

CONSULTANT:

SEAL:

M. J. T. KASUYA
Licence 58621
2024-05-02

PROJECT TITLE:
CITY OF COQUITLAM, PSB - AHU-1 REFURBISHMENT

PROJECT ADDRESS:
2986 GUILDFORD WAY
COQUITLAM
BC

DRAWN BY	PK
CHECKED BY	MK
SCALE	NOT TO SCALE
DATE	MAY 1ST, 2024

DRAWING TITLE:
MECHANICAL SPECIFICATIONS

PROJECT NO.
025b-007-23

DRAWING NO.
M2.01