Mechanical Addendum

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Project:	**UHNBC (University Hospital of Northern BC) Pharmacy Upgrade**
File:	144320228
Addendum No:	Addendum 7
Date:	February 9, 2024
Owner	**Northern Health Authority**

This addendum is to be read with and constitutes part of the tender document.

Instructions:

1. Amend your copy of the tender/quotation/proposal in accordance with the detail below
2. Retain one copy for your file; sign and return a second copy and attach to your submission as confirmation that the Addendum was taken into account in your bid submission.
3. Failure to sign and return this form may result in a non-compliant bid.

Details of the Addendum:

SPECIFICATIONS:

1. Section 22 05 00 – Common Work for Plumbing Systems

a) Revised Clause 1.2.12. to read: Provide seismic restraints for all required equipment, piping and ductwork. Please note all work in this project is considered post-disaster.
b) Revised Clause 3.3.7 to remove reference to Hand Hygiene Sink (HH-1)
c) Added Clause 1.16.3 to 1.16.7. as follows:

.3 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital and University areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in Patient, Staff, and Visitor occupied areas. In these areas, the work is to be performed during night time hours as follows:

.1 Monday through Fridays daily: 22:00 to 06:00

.2 Saturdays and Sundays daily: 06:00 to 06:00

.4 All work is to be performed within a protective environment. Provide and conform to Infection Control standards.

.5 The contractor shall ensure that on a daily basis, prior to turning work areas over for Hospital and University operation, the area is left clean and all systems are fully functioning. Allow for multiple shut-downs and re-starts/charges to accommodate the work/schedule and multiple phases.

.6 Contractor shall allow for, coordinate and arrange for all systems shut-downs and re-charges, as needed to realize the works, for multiple times, during night time hours as needed.

.7 In addition to all the above, all shut-downs shall be coordinated well in advance (weeks) with the Owner. The contractor's objective shall be to realize minimal the impact of shut-downs as much as possible. Methods such as working during night time hours, and/or existing pipe freezing, shall be considered, and allowed for. Prior to any shut-down, the contractor shall site verify and document the existing conditions related to the system being shut-down (pipe routings), and generate a schedule workplan. The shut-down impacts (including areas and rooms) shall be documented and included with the shut-down request. It shall be the contractor's responsibility to ensure that all work is executed in a planned, safe manner, with no negative impact to the overall hospital operations and/or patient care.

2. Section 22 40 00 – Common Work for Plumbing Systems

a) Revised Part 2 – Products to include wall mounted eye wash (EW-1)
b) Revised Part 2 – Products plumbing fixture tags to match drawings. (SK-1 & ES-1). Refer to attached updated spec section.

3. Section 23 05 00 – Common Work Results for HVAC

a) Added Clause 1.32.3 to 1.32.7 as follows:

.3 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital and University areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in Patient, Staff, and Visitor occupied areas. In these areas, the work is to be performed during night time hours as follows:

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.7 In addition to all the above, all shut-downs shall be coordinated well in advance (weeks) with the Owner. The contractor's objective shall minimize the impact of shut-downs as much as possible. Methods such as working during night time hours, and/or existing pipe freezing and hot-tapping, shall be considered, and allowed for. Prior to any shut-down, the contractor shall site verify and document

the existing conditions related to the system being shut-down (i.e. piping, ventilation, etc.). The shut-down impacts (including areas and rooms) shall be documented and included with the shut-down request. It shall be the contractor's responsibility to ensure that all work is executed in a planned, safe manner, with no negative impact to the overall hospital operations and/or patient care.

b) Added clause 1.33.11. to read: In order to maintain existing services operational, temporary relocations and/or bypasses of piping and ductwork will be required. Provide low point drains, air vents, and isolation valves for existing systems to allow isolation and operation of existing services, and connection and commissioning of new services (typical for all systems).

4. Section 23 05 14 – Variable Speed Drives

a) Revised Section 2.7 – Harmonic Filters, as follows:

.1 Harmonic filters are provided in addition to the drive built-in power conditioning input filters.

.2 VSD installations shall meet IEEE 519 harmonics guidelines for control of harmonics. Total harmonic voltage distortion shall be below 5% for normal applications and below 3% for special applications such as hospitals and airports, at point of common coupling with utility power supply. Calculation to demonstrate compliance shall be included in shop drawing submission. Failure to confirm compliance shall result in rejection of products.

.3 At a minimum, provide individual harmonic filters ahead of and coordinated with variable speed drive for every motor equal or greater than 7.46 kW [10 HP]. Provide harmonic filters for 7.5 HP and smaller motors if found necessary based on the results of the harmonic analysis for the existing and new power distribution systems of the hospital.

.4 For motors greater than 5.5 kW [7.5 HP], units shall be equipped with a line side harmonic filter or filter / reactor combination to prevent the back feeding of harmonics into the power system and a 5% load side reactor. Where the VFD is located more than 100ft from the motor, include a dv/dt filter.

.5 Filters must limit the current THD to less than 12% at all speeds and as specified by IEEE 519. Voltage THD must be limited to a maximum of 5% THD and 3% of the fundamental frequency. Filters must allow the motor to operate at low speeds without causing an over voltage condition.

.6 General:

- .1 type: passive inductor/capacitor network.
- .2 treat low frequency harmonics generated by VFD drives.
- .3 no resonance between harmonic filter with system impedances or attract harmonic currents from other harmonic sources.
- .4 wiring:
  - .1 all copper.
  - .2 Wiring insulation class: 220°C (428 F).
  - .3 Temperature rise: 130°C (266 F).
- .5 anti-vibration pad mounts for reactor and/or transformers.
- .6 enclosure: NEMA-3R.

.7 Performance:

- .1 power factor: 0.98 lagging to 0.95 leading in operating range form 50% to 100% full load.
- .2 maximum capacitive reactive power KVAR generated: 20% of kVA rating.
- .3 combined drive and harmonic filter mitigation:
  - .1 to IEEE standard 519, to Table 10.2 and Table 10.3,
  - .2 for the purpose of testing filters, the Point of Common Coupling (PCC) is measured at the input terminals of the harmonic filter,
  - .3 filter requirements to obtain the maximum Total Current Demand Distortion (TDD) at the PCC based on motor HP rating is as follows:

Motor Size		Filter Rating (1)	TDD Rating
Size	HP		
Small	≤ 25	Base filters only	35%
Medium	Between 30 and less than 60	10% passive	8%
Large	75≥	5% passive	5%

Notes:
(1) In addition to the Drive built-in line filters
(2) Drive built-in line filters only

.4 efficiency at full load

- .1 Harmonic filter only: minimum 99%

.2 Harmonic filter and Drive combined: minimum 96%.

.8 Harmonic Mitigation

.1 Passive Harmonic Filter

.1 will treat all of the characteristic low frequency harmonics generated by a 3-phase, diode bridge rectifier load (5th, 7th, 11th, 13th, etc.).

.2 will suppress the characteristic harmonics without the need for individual tuning or the requirement to phase shift against other harmonic sources.

.3 will achieve harmonic mitigation by passive inductor/capacitor network. Active electronic components will not be used.

.4 will never introduce a capacitive reactive power (KVAR) which is greater than 20% of its kVA rating to ensure compatibility with engine generators.

.5 will not resonate with system impedances in the power distribution system nor attract harmonic currents from other harmonic sources.

.9 Input line reactors and/or DC link chokes associated with VFDs will not be acceptable in-lieu of passive harmonic filters.

.10 Provide the ability to demonstrate to the Authority at any time that there are no potentially harmful power conditions present and that equipment intended to guard against such conditions is in proper working order.

b) Added Section 3.5 – Harmonic Filters

.1 Install harmonic filters in accordance with manufacturer's requirements.

.2 Commission filters units onsite. Provide test records of site condition performance at 0%, 50% and 100% motor load including measurements of:

.1 voltage and current harmonic distortion at input terminals of filter,

.2 obtain measurements with a recording type Fluke 41 or equivalent harmonics analyzer for individual and total harmonic currents and voltages.

5. Section 23 05 49 – Seismic Restraints for HVAC Systems

c) Remove Clause 1.4.1 and 1.4.2 and subsections and replaced with the following clauses:

1. Arrange and pay for the services of a B.C. registered professional engineer who specializes in the design and restraint of mechanical systems. This engineer, herein referred to as the seismic engineer shall provide all required engineering services related to support and seismic restraints of ductwork, piping and non-vibration isolated equipment as indicated below. For vibration isolated equipment the Engineer shall coordinate with vibration isolation supplier.

2. Support and restraint analysis shall include all incidental forces such as dead weight, thermal expansion load, thrust, wind, snow, and any vibratory loads. The analysis shall be derived from the service layout provided by the Mechanical Contractor, to accurately represent the conditions upon completion of the installation.

3. The seismic engineer shall aid the contractor as necessary during restraint of equipment, ductwork and piping.

4. The seismic engineer shall inspect the completed seismic installation and shall submit a statutory declaration to the consultant stating that the complete seismic installation is installed in accordance with his drawings and instructions and it complies with the regulatory requirements. Form MF174 in Section 23 06 02 should be used for this purpose. Prior to substantial performance, the seismic engineer shall provide letters of assurance for all mechanical, plumbing and fire protection systems.

d) Added Clause 1.5.10 to 1.5.14 as follows:

.10 Power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the HVAC, plumbing and fire suppression systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

.11 Provide support frame and seismic restraint for all mechanical services as per all applicable Codes and Standards. The Div. 23 contractor is responsible for the related design and implementation. The design and fabrication shop-drawings (showing all ductwork and piping and all supports/restraints) shall be by a registered structural/seismic engineer, coordinated and engaged by the Div. 23 contractor. Allow accordingly.

.12 All support frames and seismic restraints required for mechanical services shall be provided by this Contractor (Div. 23), in accordance with the Seismic P.Eng recommendation

.13 Submit shop drawings for all the pipe and duct support frames / racks. Shop drawings shall include the snow, thermal, gravity and lateral / seismic forces at the anchor points, steel specifications, detail of anchor / attachment to building structure, water proofing, and etc. Indicate resulting forces at all base building attachment points for review by the consultant.

.14 Coordinate the location, size, elevation and attachment point of each support frame with the building structure, and all new and existing services (i.e. mechanical, plumbing, electrical, etc.) to avoid any conflicts. All existing electrical services inside the building room are “live”, and cannot be shut-down or re-located.
Mechanical contractor shall allow for relocation of existing services mechanical services to suit the location of pipe / duct support frames. In addition, coordinate with the AHU manufacturer for the forces at the attachment points of steam and hydronic pipe supports inside the AHU service enclosure. These forces and drawings for the pipe supports shall be provided to the AHU manufacture prior to preparation of shop drawings to ensure necessary reinforcement will be provided in casing of the AHU service enclosure to suit pipe support system.

6. Section 23 05 20 – Thermometers and Gauges for HVAC

a) Revised Clause 3.2.4. to read: Install in locations as indicated and on inlet and outlet of: Heating and Cooling coils.
b) Revise Clause 3.3.1. to read: Install in following locations: Heating coils, upstream and downstream of PRV's, and other locations as indicated on the drawings.
c) Added Clause 3.3.4.1. to read: For differential pressure gauge, provide needle valve on each sensing line.

7. Section 23 05 53 – Identification for HVAC Systems

a) Added Clause 1.2.2. to read: Label all systems clearly, including painting and labelling of all pipes, ceiling identification dots, valve tagging, and emergency valve identification signage. Facility labeling system shall follow the same standard of the UHNBC labeling system. Submit proposed details for approval as part of shop drawing process.
b) Adde Clause 3.3.7. to read: Identify all hazardous exhaust ducts, e.g. fume hood, BioSafety Cabinet (BSC) exhaust, radioactive exhaust at not greater than 3 metre [10 ft.] and at least once in each partitioned space.
c) Added the following items to the pipe identification schedule under section 3.8.1.

Condensate - Med. Press.	M.P.Cond.	yellow	black
Condensate - Low Press.	L.P.Cond.	yellow	black

Sanitary	SAN	Green	white
Chilled Water Return	CH.W.R.	green	-
Chilled Water Supply	CH.W.S.	green	-

8. Section 23 25 00 – HVAC Water Treatment

a) Revised Clause 1.2.1. to read: Provide for cleaning and degreasing of all systems that use glycol or water as a heat transfer medium, such as:
Existing and new UHNBC chilled water and glycol systems.
Existing and new UHNBC hot water and glycol systems

b) Revise Clause 1.2.2. to read: Provide for cleaning and disinfection of domestic hot, cold and recirculation systems.

c) Revised Clause 1.2.7. to read: Provide for cleaning and disinfection of domestic hot, cold and recirculation systems.

d) Added Clause 1.2.7. 4 to read: Steam System

e) Added Clause 1.2.7.5. to read: Condensate System

f) Added Clause 1.2.7.6. to read: Domestic Water System

g) Added Clause 1.5.5. to read: Submit WHIMS data sheets for chemicals to be used for water conditioning and cleaning.

h) Added Clause 1.6.8. to read: Replenish existing systems where fluid is drained or system is expanded. Chemicals shall match existing.

i) Added Clause 2.1.6. to read: Open System Treatment (Humidifiers): Use a scale, alkalinity, and corrosion control agent containing Phosphonate. (PACE Chemicals Ltd. - SCALE PRO L-220 or approved equal.) Note: Products using Phosphates are not acceptable.

j) Added Clause 2.1.7. to read: Steam System Treatment (with Condensate Return): Use an anti-scaling corrosion inhibitor, neutralizing amine, sulphite oxygen scavenger, sludge conditioner and hydroxide to control alkalinity. (PACE Chemicals Ltd. - SCALEX LNC-17 or approved equal).

k) Added Clause 2.4.1.3. to read: Open System Test Kit: To determine proper levels of pH, Chloride, and Phosphonate in recirculating water. (PACE Chemicals Test Kit #106 or approved equal.)

l) Revised Clause 3.1.1. to read: All existing and new systems must be chemically cleaned and flushed before water treatment is added. This includes partial or complete filling for pressure testing.

m) Revised Clause 3.1.10. to read: Flushing and cleaning of steam and condensate systems:

1. After piping pressure test, flush steam and condensate lines to drain with clean water for minimum of four hours.
2. Make temporary piping cross-overs, blank-off equipment connections, bypass control valves, install drain and fill lines. Blank off at connections to existing treated systems and provide temporary pot feeder and circulating pump to maintain cleaning fluid minimum velocity through piping at 1.5 m/s (5 fps).
3. Refill with clean city water using temporary meter to establish system volume.
4. Isolate system from other piping systems and by-pass traps.
5. Drain and fill with solution of water and non-foaming, phosphate free detergent, 3% by weight.
6. Circulate solution for minimum of eight hours.
7. Flush to drain with clean water for four hours.
8. Remove and clean strainers.
9. Drain and refill system with clean water and circulate for two hours.
10. Inspect strainers, and repeat drain, fill and recirculation routine until strainers are free of debris.
11. Drain, remove temporary pumps, and cross-overs. Allow steam into system with condensate at traps and receivers diverted to drain. Inspect strainers and continue passing condensate to drain until strainers are free of debris.
12. Place traps in service and condensate pumping system in operation. Check traps for blow through and service faulty units.

13. Clean strainers and service traps before final acceptance of steam system.
14. Raise steam pressure to normal operating pressure. Hold pressure for four hours. Remove heat and allow to sit for 15 minutes. Flush steam system piping with clean water. Repeat flushing as necessary until wash water is clean and free of debris. Install corrosion coupons.
15. Use neutralizing agents upon recommendation of the Water Treatment Specialist and as pproved by Consultant.

n) Added Clause 3.1.14. to read: Heat trace all piping at the risk of exposure to freezing temperatures.
o) Added Clause 3.1.15. to read: For chilled water systems, circulate for 48 hours. After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until tests show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Install corrosion coupons, refill system and immediately add water treatment to proper level.
p) Added Clause 3.4.Equipment Bypass:
    1. Install temporary bypass connections around equipment before commencing chemical cleaning. Equipment required water quality standards shall be referred to within submittals, installation and operating manuals.
        1. Dynamic flush all pipework prior to chemical cleaning. Run water, with balanced fresh water feed using the designed flushing ports. Check for any pipework crosses and achieve minimum flow rates as per below:
        2. Dynamic flush is complete when discharge water runs clear.
        3. Remove, clean and re-install all strainer baskets.
        4. Only open isolation to bypassed equipment after flushing is completed and verified.

9. Section 23 31 00 – HVAC Ducts and Casings

a) Revised clause 2.9.1.1. to read: all new exhaust ductwork shall be stainless steel.
b) Deleted clause 2.9.1.2.
c) Revised clause 2.10.1.1. to read: all new exhaust ductwork shall be stainless steel.
d) Deleted clause 2.10.1.2.

10. Section 23 33 00 – Air Duct Accessories

e) Added Clause 3.5.1.2.3.3.: turning vanes
f) Added Clause 3.5.1.2.3.: silencers
g) Added Clause 3.5.1.2.4.7.: at locations having an internally mounted piece of equipment or device.
h) Added Clause 3.5.8.: Provide retaining chains on panels 2.1 m [7 ft] above floor, and higher.
i) Added Clause 3.5.9.: Provide “as-built” drawing noting location of all duct cleaning access doors.

11. Section 23 37 00 – Air Outlets and Inlets

a) Added Clause 2.3.7.7.: Filter status light shall be connected to BMS (typical). Provide FL+FBAS option.
b) Revised Clause 2.3.12.1. to read: An aerosol test system shall be provided for injecting aerosol challenge into the diffuser from the room side to allow the filter and housing to be scanned for integrity and leaks during commissioning or after filter replacement.

12. Section 23 41 00 – Particulate Air Filtration

a) Added Clause 2.1.8.Air filters in air handling units shall be provided with gaskets or seals, either as an integral part of the filter or as part of the housing or filter-holding frame, to prevent leakage between filter segments, adjacent filter frames, and the surrounding filter plenum enclosure.
b) Added Clause 2.4.4.: Provide with test ports before and after the filters and tested for integrity using a total penetration test or an equivalent test upon installation. Perform integrity test upon installation and submit the results.

c) Added Clause 2.4.5.: Provide means to indicate operating pressure drop via unit-mounted pressure transducer alarming on the building management system.
d) Revised Clause 3.8.3.1. to read: Dwyer Photohelic Series 3000 (indicating transmitter).
e) Deleted Clause 2.8.3.2.
f) Added Section 2.9 Non-Ionizing, Polarized Media Electronic Air cleaners as follows:

.1 Application

.1 Air handler final filtration and cleaning of air from air handling unit prior to distribution in the building

.2 Submittals

.1 Manufacturer's literature for Non-ionizing, polarized media electronic air cleaners

.2 Engineering data sheets.

.3 System efficiency.

.4 Documented installation references.

.5 System airflow and pressure drop

.6 Complete drawings of assemblies and racks.

.7 Unit dimensions, required clearances, construction details and field connection details. Installation details for mounting into racks and racks into air handling unit casings.

.8 Devices and control panel.

.9 System components and accessories.

.10 Catalog cuts.

.11 List of unit numbers.

.12 Operation and Maintenance Data:

.13 Instructions for media and component replacement.

.14 Installation, operation and maintenance manuals.

.3 General Product Information:

.1 The Air Cleaner shall have been tested and meet UL Standard 867 and CSA Standard C22.2 No. 187-M19986 for electrostatic Air Cleaners.

.2 The Air Cleaner shall have an active electrostatic field that polarizes a dielectric media. It shall not ionize airborne particles or produce ozone. Laboratory Testing Performance: Using the ASHRAE 52.2 protocol with carbon black in the test dust, the Air Cleaner shall test at MERV 13. Using the ASHRAE 52.2-NC protocol (with no carbon in the loading dust), the Air Cleaner shall test at MERV 15.

.3 As installed, it shall have a clean static pressure drop of less than 0.3" w.g. at 500 feet per minute and shall increase in resistance no more than 0.25" w.g. with a dust loading of 2,855 grams. It shall hold a total of 4,582 grams of dust at its final resistance of 1.4" w.g. per 24x24 module. Any substitute Air Cleaner must meet these MERV ratings, static pressures and loading characteristics. The Air Cleaner manufacturer must provide testing from an approved ASHRAE test lab to verify MERV rating, operational and loading performance.

.4 The Air Cleaner manufacturer shall produce at least two documented installation references, including client contact information with the following criteria:

.5 Air Cleaners shall have operated continuously for a minimum of 2.5 years with no pre-filtration and without media change and achieved an increase of less than .2 inches of static pressure at a face velocity of ~500fpm, in an urban environment. Air cleaner installations must be greater than 10,000 cfm and serving office and/or hospital space.

.6 In an urban environment, Air Cleaners must have demonstrated the ability to achieve indoor ultra-fine particle and black carbon levels that are up to 94% lower than the concentrations in the air outside the building. Outdoor air levels brought into in the building must be based on the ASHRAE Standard 62 Ventilation Rate Procedure.

.7 Air Cleaners shall have a documented ability to reduce TVOC levels by 50-60% in a single pass. Air Cleaners must have already been in service for over 90 days. Tests must be administered by an independent, third-party and readings must be taken immediately upstream and downstream of the Air Cleaning system over at least a 24-hour period.

.8 Construction: The Air Cleaner modules shall consist of four or six individual Air Cleaner Panels that are nominally 1” in depth, arranged in V’s within the module. The construction of the Air Cleaner frame and screens shall be aluminum, and the module side panels and attachment flanges shall be of galvanized steel. The Air Cleaner

.9 modules and each component thereof must have a positive seal where necessary to prevent bypass of unfiltered air.

.10 Electronics: The high voltage powerheads shall require 24 volts AC input and have a 9.5kV DC output. The powerheads must be fully potted and connected in parallel.

.11 Control Panel: The 24VAC power supply must be a UL or CSA certified transformer, class “2” type, which shall permit one side of the secondary output (24V) to be attached to electrical ground. A Filter Minihelic gauge shall be installed in the Unit Control Panel (and the signal tied into building automation).

.12 Filter Media: Each Air Cleaner shall have a disposable and recyclable media pad with a minimum of a class “2” fire rating. It shall have a positive seal in the overall filter assembly.

.13 Configuration: The Air Cleaners will be arranged in pre-fabricated module assemblies nominally 12” or 18” in height, of varying widths up to 48”, and either 24” or 29.5” deep in direction of airflow. The number of modules and width shall be such that the face velocity thru the filter bank shall be no more than 550 fpm. The V8 modules will be permanently mounted in the air handler and secured with vertical posts. The Air Cleaner module bank will be flashed and sealed. The air handler will be configured so as to allow front (or rear, but must be specific) access for media changes of the V8 assembly. There must be at least 24” of space for service and media change-out.

.14 Electrical Connection: The Air handler manufacturer shall provide a fully operational filter section for field connection and field electrical tie-in. All 24VAC electrical and control wiring integral to the Air Cleaner modules and Control Panel, including the access door interlocks, are to be provided by the Air Cleaner

manufacturer for connection in the field or factory. All line voltage connections and wiring are the responsibility of the contractor.

.15 Maximum Allowable Static Pressure: To minimize energy consumption, the AHU fan system has been designed for specific pressure drop through the Air Cleaning system. The fan system is designed for a maximum of 0.75" w.g when the filters are dirty.

.16 Construction and Start-up: If the AHU is operating during construction, the Air Cleaner bank shall be protected using roll or other media. These should be removed after 30 days from initial startup.

.17 The AHU manufacturer is responsible to purchase and store sufficient replacement filters so as not to exceed a total static pressure of 0.75" w.g (Matching #11 above) for a period of 4 years from final acceptance. Material responsibility not to exceed total media changes of 6 times per year.

.18 Air Cleaners will have been installed in at least three projects where the IAQ Procedure of ASHRAE Standard 62 was used successfully to reduce outdoor air requirements versus the Ventilation Rate Procedure of the same Standard. Air quality test reports must be submitted and show that the indoor air quality is acceptable and at least as good as would be expected using the Ventilation Rate Procedure.

.4 Quality Assurance

.1 System to be field assembled and tested for a minimum of 12 hours. Design, construction.

.5 Standard of Acceptance:

.1 Dynamic Air Quality Solutions.

g) Added Clause 3.4.3. to read:

.3 Non-ionizing, polarized media electronic air cleaners field performance and operating conditions

.1 Non-ionizing, polarized media electronic air cleaners are to be field tested by the manufacturer following the completion of the installation of the mechanical equipment. The test results shall confirm:

.2 Installation is in accordance with the manufacturer's installation requirements.

.3 Filter frames are sealed.

.4 Filter Airflow rates

.5 Filter panel media velocity

.6 Filter panel pressure drop

13. Section 23 73 11 – Air Handling Units – Custom

h) Revised Clause 1.2. as follows:

1.2 Warranty

.1 The 3 Year warrantee for the Air handling Units shall start at the Substantial Completion of the UHNBC Pharmacy Upgrade project.

i) Added Clause 2.1.1..6 to 11. As follows:

.6 AHU assembly shall include a heated and ventilated service enclosure. Electric heater, fan, back draft dampers, and thermostats shall be installed and wired by the AHU manufacturer.

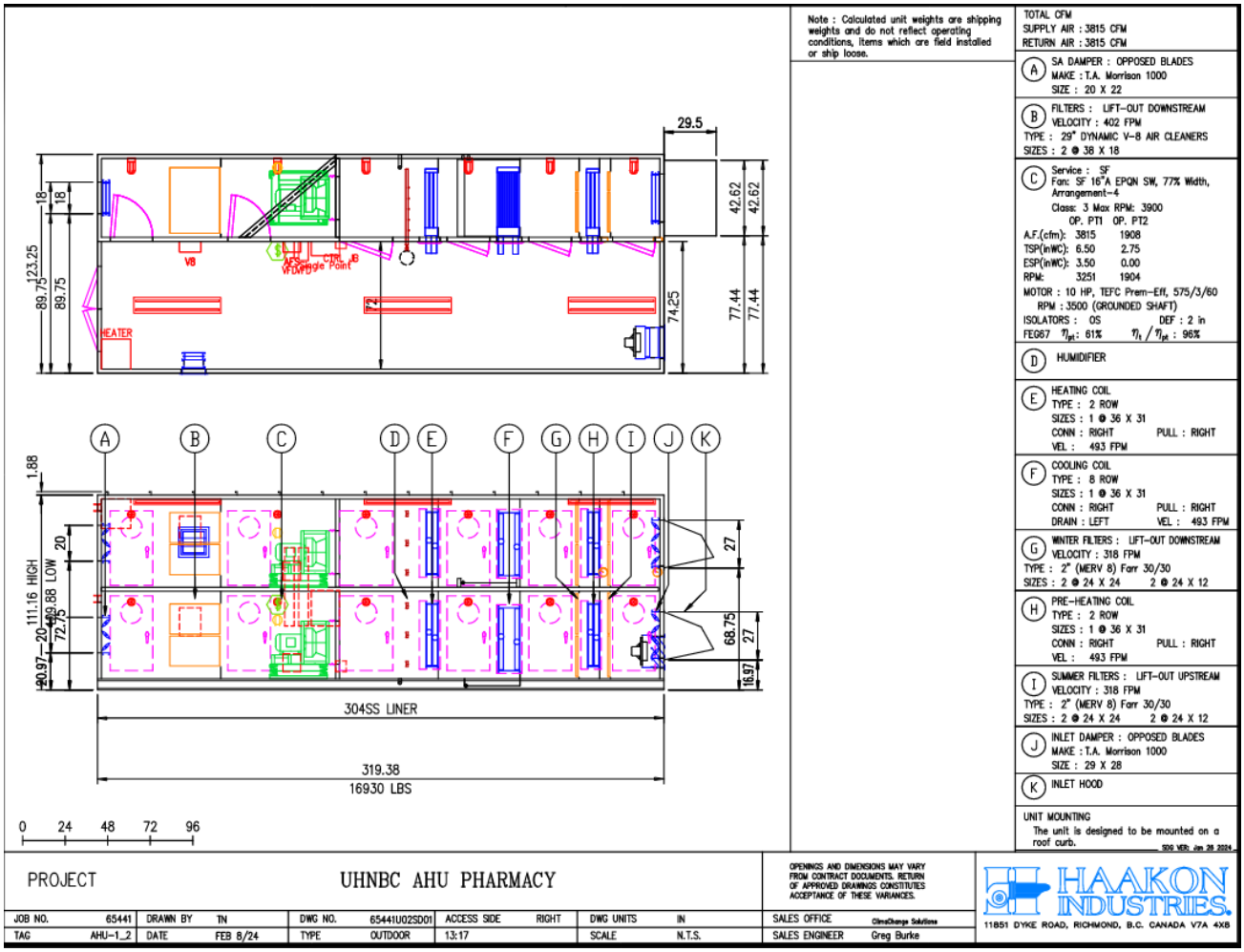
.7 Provide air intake and discharge louvers c/w back draft dampers to ventilate the service enclosure.

.8 Coordinate with the mechanical contractor for the location and size of pipe penetrations through the AHU service enclosure. All pipe penetrations shall be sealed in accordance with the AHU manufacture requirements.

.9 Provide two 50Ø floor drains inside the AHU service enclosure.

.10 The intent for the service enclosure is to protect maintenance staff against harsh weather conditions during servicing and maintenance of the AHU. The service enclosure will also house new pumps, hydronic and steam piping, and PRV station for the AHU. All new equipment and piping shall be supported from the AHU service enclosure. Coordinate with the mechanical contractor for the layout of the piping, pumps, PRV station, and the associated supports and seismic restraints. AHU casing shall be rated for the incidental forces at the connection points of pipe supports. Reinforce AHU floor, walls and roof as necessary.

.11 The basis of Design is the following configuration:



j) Revised Clause 2.1.2.4.: Provide breaker panel on exterior of unit for field connection of single point 575 V power connection. The AHU manufacturer shall provide disconnects, VSD's and all required wiring. The wiring from the main disconnect switch to each VFD, from VFDs to junction boxes, and from junction boxes to motors shall be by the AHU manufacturer. When disconnect is placed between a VSD and the motor, an auxiliary set of contacts is required to let the VSD know that it has been shut off. Provide factory installed power wiring in EMT from each fan motor to junction boxes located on the outside of the unit casing.

k) Revised Clause 2.1.2.4.9. as follows: Provide a 2kW electric heater c/w disconnect switch and thermostat to maintain the minimum temperature in the service corridor at 18°C [65°F]. Wire to 575 V breaker panel in EMT conduit.

l) Added Clause 2.1.2.14 to 16 as follows:

.14 Provide a 470 l/s fan c/w disconnect switch and thermostat. Wire to breaker panel in EMT conduit.

.15 The AHU electrical panel shall be designed such that each component (e.g. VFD, electric heater, fan, Dynamic V8 filter, etc.) can be isolated and replaced without the need to shut down the entire AHU. Provide disconnect switches for all devices to suit.

.16 Provide LED marine lights with protective metal cage and glass seals in all unit

compartments c/w extra-long-life krypton bulbs (60 W min.) or compact fluorescent lamps of equivalent wattage. Provide vapour proof fluorescent lights in all corridors. Light switches with indicator lights shall be installed outside next to each plenum door.

m) Added Clause 2.1.3.5.:Units shall be mounted on metal seismic insulated roof curbs provided with the units. Roof curbs shall be seismically secured to the roof (to Post Disaster Standards). When flashed to the mounting curb it shall provide a weatherproof whole (certified by a professional structural/ seismic engineer).
n) Revised Clause 2.1.4.2. to read: The underside of the base shall be insulated with 75mm (3") 64 kg/cu.m [4 lb/ft3] density fiberglass insulation and sheeted with a 22 gauge galvanized steel liner. Floors that "oil can" are not acceptable. Plenum floors shall be formed as a drain pan with a standing upturned angle.
o) Revised clause 2.1.5.1. to read: The manufacturer shall provide 25mm [1"] floor drain connections on the accessible side of each air tunnel for complete drainability of the base pan. Two Provide two 50 mm floor drains inside the service enclosure.
p) Added Clause 2.1.5.3.: Provide drains in all sections of the AHU.
q) Added Clause 2.1.6.7.:Drain pans shall be constructed to indoor air quality standard.
r) Revised Clause 2.1.7.6. to read: All required holes in casing for controls, electrical, piping etc. shall have grommets. Seal all factory utilized openings neatly and airtight. Site sealed openings shall be to the standard set by the manufacturer. Coordinate with the mechanical contractor for the location and size of openings for hot, chilled, steam and relief vent pipes.
s) Added Clause 2.1.7.9.: Provide a duplex receptacle in each plenum section.
t) Revised Clause 2.1.9.1. and 2 as follows:

.1 The interior face of all insulated walls and ceiling shall be covered with 0.70 mm [22 ga] 304 stainless steel solid liner. Arrange overlaps and joints to allow washdown. No insulation shall be exposed to the airstream.

.2 Provide 0.76 mm [22 ga] galvanized sheet metal covering on acoustically lined plenum walls for a distance of 1.2 m [4 ft] downstream from cooling and heat extract coils.

u) Added Clause 2.1.10.7.: Floor access doors to be water proof/ insulated marine type, suitable for man access into the void space below the units.
v) Revised Clause 2.1.11.12. to read: Fans shall be direct drive.
w) Deleted Clause 2.1.11.13, 14, 15 and 17.
x) Added Clause 2.1.11.19 to 22 as follows:

.19 Fan inlet safety screens.

.20 AIRFLOW MEASURING PROBES. Provide on each fan air flow measuring probes capable of continuously monitoring the air handling capacity of the respective plenum fan. Each airflow probe shall contain multiple, averaged velocity pressure taps located symmetrically around the throat of the fan inlet and a single static pressure tap located on the fan housing. The entire airflow monitoring probe must be located outside the inlet throat as to not obstruct airflow. The probes shall be capable of producing steady, non-pulsating signal of the velocity pressure, independent of the upstream static pressure without adversely affecting the performance of the fan. The sensing probes shall be accurate 3% of actual fan airflow.

.21 AIRFLOW DISPLAY. Provide digital read out panels for each fan, displaying digitally, in real time, the fans current air flow. The display shall be capable of showing the airflow of independent fans operating simultaneously. For interaction with a controller, the display shall output one (1) 0-10VDC signal for each fan being monitored. The output signal shall be accurate to 0.5% of Natural Span, including non-linearity, hysteresis and non-repeatability. The display must be water tight allowing for use in outdoor locations.

.22 Air flow measuring / monitoring device shall have the capability of re-calibration on site.

Coordinate with the balancing agent for the airflow verification and calibration of the AHU airflow sensors during commissioning.

y) Revised Clause 2.1.12.5. to read: Motors shall conform to ASHRAE 90.1-2016.
z) Revised Clause 2.1.16.1. to read: Refer to Section 23 82 05 for requirements.
aa) Added Clause 2.1.16.8.: Non-ferrous tubes and headers: brazed assembly.
bb) Deleted Clause 2.1.17.
cc) Added Clause 2.1.18.7.: Refer to spec section 23 84 13 for requirements.
dd) Deleted Section 2.1.18.2.
ee) Added Clause 2.1.20.12.: Air filters and associated systems shall be designed, installed, and located so as to avoid wetting from humidifiers, cooling coils, or other sources of moisture.
ff) Revised Clause 2.1.21.3.1. to read: Dwyer Photohelic Series 3000 (indicating transmitter).
gg) Deleted Clause 2.1.21..3.2.
hh) Deleted Clause 2.1.22.
ii) Added Clause 2.1.26 as follows:

.26 Louvres/Hoods

.1 Outside louvers and hoods with 25mm [1”] birdscreen.

jj) Added Clause 2.1.27 as follows:

.27 Implosion / Explosion Doors

.1 Doors shall be in accordance with W.C.B. Regulations, constructed as for hinged access doors.

.2 Latches shall be Brixon Safety Latches (Brixon Manufacturing Co., 859 North Prior Avenue, St. Paul, Minnesota, 55104. Available in Vancouver from Air Systems Supplies).

.3 Latches shall be complete with handles and shall have an adjustable release force as follows:

Latch Model	Release Force Range\
2H	2.3 to 15 kg [5 lbs. to 33 lbs.]
3H	9 to 82 kg [20 lbs. to 180 lbs.]
4H	20 to 118 kg [45 lbs. to 260 lbs.]

.4 Refer to drawings for locations of implosion / explosion doors and required number of latches.

.5 Provide heavy duty safety chains to limit door swings.

.5 Adjust tensions on implosion / explosion door latches so that doors open at a static pressure differential not greater than 500 Pa [2" w.g.] above / below the specified static pressure rating of the plenum.

.7 Perform tension tests on doors to verify that doors open at the settings on the latches.

.8 Adjust tensions on latches, if necessary and permanently mark the final setting of adjustment screws.

kk) Added Clause 2.2 as follows:

2.2. Air Flow Testing

.1 The unit manufacturer shall factory test each unit to ensure it meets the specified air flow requirements.

.2 The test shall be carried out in accordance with the guidelines set forth in the SMACNA HVAC AIR TEST MANUAL.

.3 An officer of the manufacturing company shall certify test results and forward copies of certified test results to the consultant. The consultant shall witness the air flow test on the first two units. The manufacturer shall provide transportation for the contractor and owner to the factory.

ll) Added Clause 2.3 as follows:

2.3 Air Leakage Testing

.1 The unit manufacturer shall factory pressure test each air handling unit to ensure the leakage rate of the casing does not exceed 1.0% of the unit air flow at 1.5 times the rated static pressure. A leakage test shall be performed with VSD and humidifier panels installed.

.2 The test shall be conducted in accordance with SMACNA duct construction manual. A calibrated orifice shall be used to measure leakage airflow.

.3 An officer of the manufacturing company shall certify test results and forward copies of the certified test results to the consultant. The consultant shall witness the pressure test on the first two units. The manufacturer shall provide transportation for the consultant and owner to the factory.

.4 “Double duct” or “side by side” units shall have each duct or side tested independently.

Positive pressure plenums shall be tested positively and negative pressure plenums shall be tested negatively.

mm) Added Clause 2.4 as follows:

2.4 Flood Testing

All unit bases shall be flooded to a level of 1.5” after manufacturing to assure there is no leakage through the floor and the perimeter water barrier. The results of the flood test shall be certified by the manufacturer.

nn) Added Clause 2.5 as follow:

2.5 Vibration Testing and Balancing

.1 Fans and motors shall be dynamically balanced to not exceed a BV-4 criterion as per AMCA 204-96. The test shall be conducted after the fan and motor base assembly has been completed. The entire fan assembly including fan wheels, shafts, bearings, drives, belts, motors, isolation bases shall be tested. During the test, the fan and motor base shall be supported by its isolators which are set in the freely floating operating position. (In cases where a concrete inertia base is provided, the factory poured concrete shall be installed at the time of the vibration test).

.2 The required measurement points are as follows: one horizontal measurement and one vertical measurement shall be taken for each fan and motor bearing and one axial measurement shall be taken for each shaft. (A total of 10 points for a typical belt

driven fan-motor assembly). The measurements shall be taken using calibrated, magnetically mounted accelerometers and a calibrated measuring instrument.

.3 Vibration measurement locations shall be as close as possible to the bearing or shaft centerlines. Measurements shall be taken from the bearing housings, bearing pedestals, or motor casings. Measurements shall not be taken from flexible covers or shields.

.4 Fans and motors shall be tested at the design RPM and the maximum overall filter-in vibration levels at each measurement point shall be less than or equal to 0.15 in/second peak velocity at the operating speed. If any measurements exceed the above criterion, the assembly shall be rebalanced and re-tested until the criterion is achieved.

.5 Certified measurements shall be provided to the consultant.

oo) Revised Clause 3.1.5. to read: Pipe from condensate and floor drains to [roof] drain complete with trap. Install unit so that the curb / housekeeping pad height is sufficient to accommodate depth of 'P' trap. The depth of p-traps shall comply with CSA Z317.2-2019 - Annex C.

pp) Added Clause 3.1.8 to 10 as follows:

.8 Where a separate disconnect is installed between the drive and the controlled equipment, provide interlock wiring between disconnect status contact switch, and VFD, to prevent drive from operating if disconnect switch is open.

.9 Equipment assembly is to be supervised by a direct employee of the AHU manufacturer or by a manufacturer certified service organization.

.10 Trap seal priming for drains from AHUs shall be provided for each drain and shall take into account winter operation. An air gap shall be present to provide an indirect drain between the air-handling unit and the building drainage system. Drains that are normally inactive and are capped or valved are exempted from this requirement.

14. Section 23 99 65 – HVAC Equipment Manufacturers

a) Added following items to the list:

ACCESS PANELS	Nailor, Greenheck	X
PRESSURE REDUCING VALVES	Armstrong, Fisher, Jordon, Leslie, Spirax/Sarco, Spence, Watson McDaniel	X

15. Section 23 99 66 – HVAC Subtrades

a) Added Chemical Treatment and Controls trades:

CHEMICAL TREATMENT:	BASE BUILDING WATER TREATMENT SPECIALIST
CONTROLS:	RELIABLE CONTROLS (BASE BUILDING CONTROLS CONTRACTOR – CONFIRM WITH NHA)

16. Section 25 05 00 – Common Work for Controls System

a) Added Clause 1.2.6.:The new system shall be fully integrated with the existing system and operator interface through the existing operator's work station located in the UHNBC Site.

17. Section 25 09 13 – Instrument and Control Devices

b) Deleted Clause 2.20.2.

c) Deleted Clause 2.20.5.

d) Added Clause 3.26 – Uninterruptible Power Supply (UPS)

.1 Under normal operating conditions power will be supplied from B.C. Hydro. In the event of failure of this supply, the standby generator(s) will start and provide power to the essential distribution system. All equipment supplied under this Division is to be connected to the essential distribution system.

.2 To allow for an extended delay which may be encountered getting the generator "on line" provide uninterruptible power for all AUTOMATION system and equipment required for MEMORY, PROCESSING, DATA ACQUISITION, and OPERATOR INTERFACE. The intent is that the automatic system must be aware of the length of time that the building systems are without power, and adjust the chain of events accordingly once power is restored.

.3 The automation system must be in full control of the building systems as soon as normal electrical power is restored. Delays for disk drive startup, and/or system "re-boot" are not acceptable.

.4 Provide uninterruptible power capable of supporting this performance for a MINIMUM period of at least twenty [20] minutes for all B.A.S. equipment.

.5 The uninterruptible power supply(ies) may be centrally located, or may be distributed as required throughout the building, and may take the form of individual battery/charger, and/or battery / charger / inverter combinations as required by the individual pieces of equipment.

.6 Provided supplies must meet the following criteria:

.1 Total harmonic distortion less than 5%.

.2 Single frequency harmonic distortion less than 3%.

.3 Output frequency regulation better than 1%.

.4 Static output voltage regulation better than +/-2% over battery voltage range of 105 to 140 VDC.

.5 Dynamic output voltage regulation better than

.6 +/- 15% with a 50% load change, and

.7 +/- 30% with a 100% load change.

.8 Recovery rate faster than 3 Hertz after 100% load change.

.9 Slew rate less than 2 Hertz per second.

.10 Battery recharge time with full normal operating load, 8 hours from fully discharged state (105 V.D.C.) to full charge

.11 Overload capability

.12 105% continuous.
.13 125% 10 minutes.
.14 200% 1 minute.
.15 Power factor better than 0.8.
.16 Acoustical noise radiation at 1 metre (4 ft.) less than 65 dBa for supplies up to 30 kva.
.17 Batteries to be maintenance free gel/cell type.
.18 Batteries to be warranteed for three (3) years.

.7 Provide the following monitoring features:
.1 D.C. voltmeter and ammeter.
.2 A.C. output voltmeter and ammeter.
.3 Audible and visible alarm indications on front panel.
.4 Common alarm output dry contacts for remote monitoring.
.5 Controls Contractor to wire from contacts to B.A.S..

.8 Provide the following over current protection breakers:
.1 A.C. input.
.2 A.C. output.
.3 D.C. battery output.
.4 A.C. alternate line input.

.9 Configure the power supply(ies) such that they can be removed for repair or maintenance without disrupting the memory or the operation of the automation system. Provide manual bypass switch to remove the supply from service.

.10 For supplies having a capacity in excess of 3 kva, provide a static transfer switch with manual lock-on feature to bypass supply for service. Provide for alternate source input which shall be connected to separate electrical panelboard. If primary input is connected to Essential panelboard, alternate input shall be connected to Normal panelboard.

.11 Commercial quality electrical distribution panel and all wiring to B.A.S. head end computer, CRTs, printers and DDC panels shall be the responsibility of the Controls Contractor.

.12 Acceptable Manufacturers: These are high end UPS systems and may be more than is required
.1 SAB NIFE Corporation.
.2 Liebert Corporation.
.3 Philtek Electronics Ltd.
.4 Power Inc. (PCI) Pulsector.

.13 UPS to be in interstitial plant rooms

18. Section 25 09 35 – Compounding Pharmacy Airflow Control

a) Revised Clause 2.3.11.8. to read: The CPACS shall be capable of digital integration with the existing Building Automation System.
b) Revised Clause 1.4.7. to read: The contractor shall review all contract documents and visit the site prior to the closing date of the tender and site confirm the requirements regarding the routing of interconnecting transmission network, etc.
c) Added Clause 1.4.11 to 13. as follows:

.11 All existing items which need to be removed, and which have a reasonable salvage value, such control devices, shall be carefully removed and handed over to the Owner. Coordinate with VCH FMO prior to removal of existing control devices, and the list of items that are required to be salvaged.

.12 Removal of control related equipment / devices must be done in collaboration with the control contractor. Handing over to the Owner includes moving to Owner's designated storage place on site. These items shall not become the property of the

Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.

.13 Remove all redundant material not required by the Owner from the site.

d) Added Clause 1.8.2.5. to 7. as follows:

.5 Terminal strips within the motor control centres (MCC) for control connections;

.6 Fire alarm equipment including fire smoke damper wiring and control, fire alarm devices and connections.

.7 All magnetic starters for equipment shall have the following features supplied under Division 26:

.1 Hand-off-automatic selector or on-off selector or start-stop buttons in cover with hand-automatic bridge if applicable.

.2 120-volt control transformers

.3 Four auxiliary dry contacts for interlocks; two normally open and two normally closed.

e) Revised Clause 1.8.3. to read: Note Division 26:

f) Revised Clause 1.8.4.4.1. to read: All wiring shall be run in conduit, and cable tray even in fully accessible ceiling areas. Non-continuous support systems such as J-hooks are not acceptable.

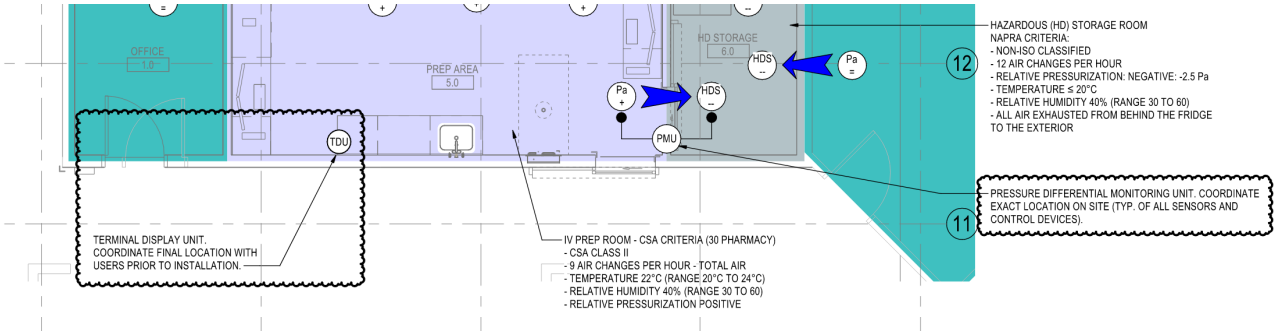
19. Added Section 23 05 05 – Demolition – Mechanical Services
20. Added Section 23 05 33 – Heat Tracing
21. Re-issued Section 23 05 93 – testing, adjusting and balancing for HVAC
22. Added Section 23 06 01 – Mechanical Detail
23. Added Section 23 06 02 – Mechanical Forms
24. Added Section 23 22 13 – Steam and Condensate Heating Piping
25. Added Section 23 22 14 – Steam Specialties
26. Added Section 23 84 13 – Humidifiers
27. Reissued Section 25 90 10 – Control Sequences of Operations. Note: revisions have been highlighted in Yellow for clarity.
28. Added Section 25 09 94 – Points List

DRAWINGS:

1. Refer to drawing M001 (sheet reissued).
a. Symbol legend updated for clarity.
b. Added General Notes

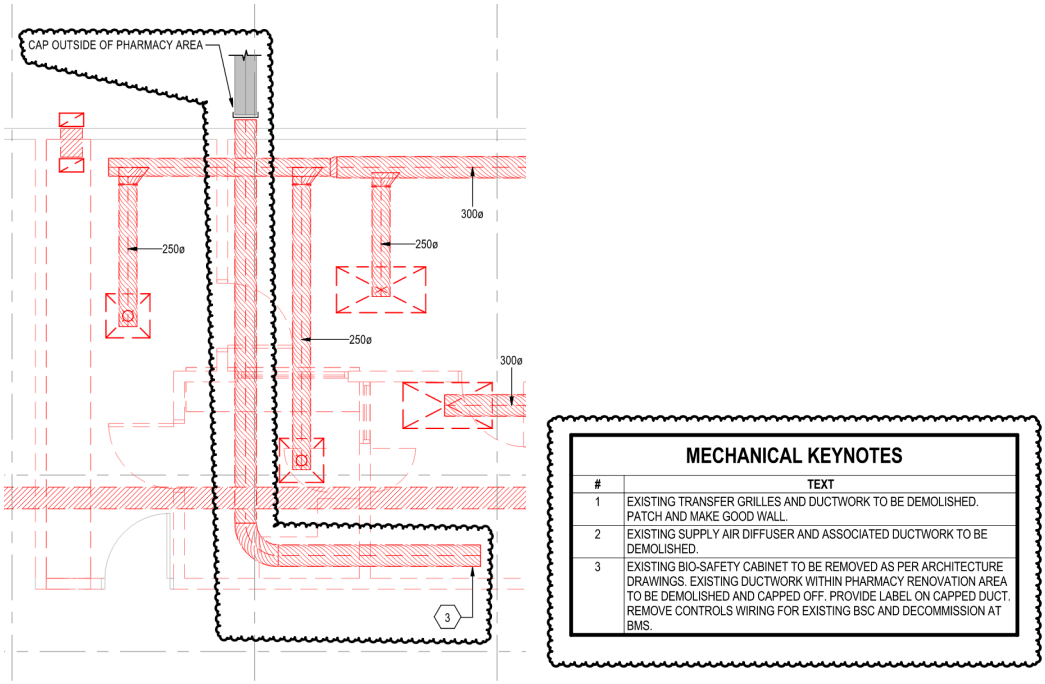
2. Refer to drawing M002 (sheet deleted).
a. Sheet removed – General Notes and Sheet List moved to M001.

3. Refer to drawing M100.
a. Added terminal display unit (TDU) location.
b. PMU noted for clarity.

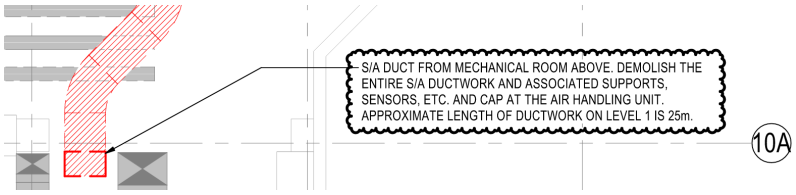


4. Refer to drawing M101.

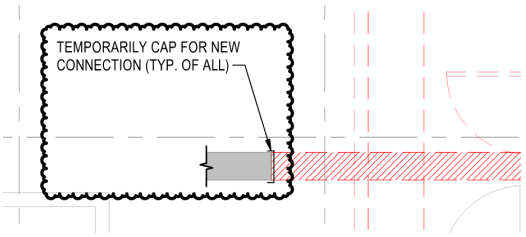
a. Added demolition of exhaust ductwork from existing biosafety cabinet.



b. Added note to demolish existing SA duct back to existing AHU.



c. Added note to provide temporary cap at existing ductwork.



5. Refer to drawing M102 (sheet reissued).

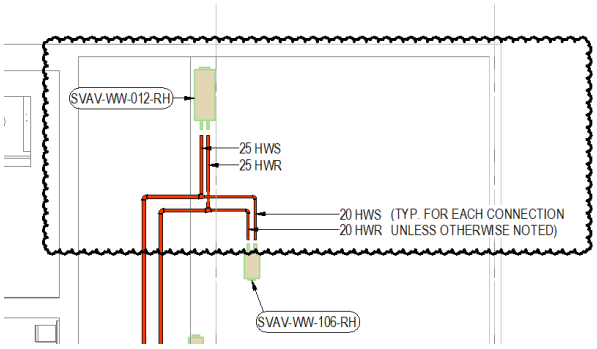
a. General Notes added regarding system shutdowns, coordination with FMO, and re-commissioning.
b. Steam and Condensate piping offsets shown for coordination purposes.
c. Added drawing notes on Steam and Condensate piping for coordination.

6. Refer to drawing M103 (sheet reissued).

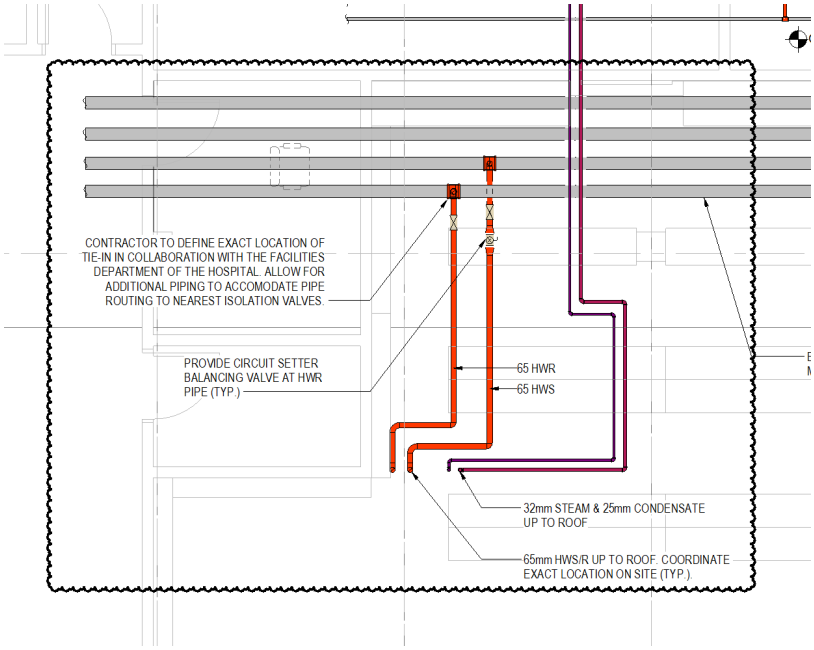
a. Added locations of balancing dampers on ductwork.
b. Duct dimensions added for clarity.
c. Diffuser in Shared Ante Rm 3.0 changed to S-4 type.
d. S-4 type diffusers updated to 300mm inlet size (typ.)
e. CO2 and Occupancy sensors added to Prep Area 5.0 and Library 6.2
f. Acoustic lining added to SA main duct from AHU.
g. Duct transition added at GL 10A

7. Refer to drawing M104.

a. HWS/R pipe sizes noted for clarity

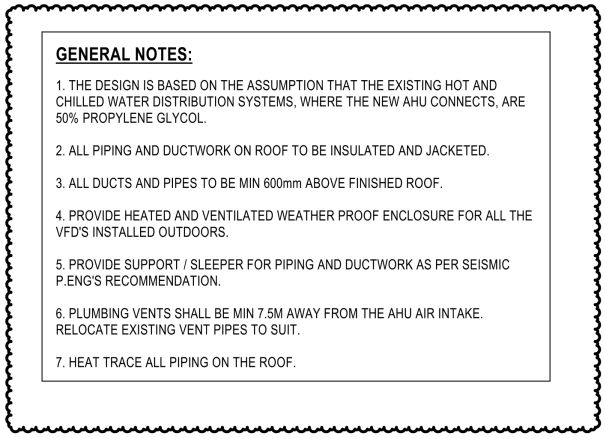


b. Revised pipe routing and notes.

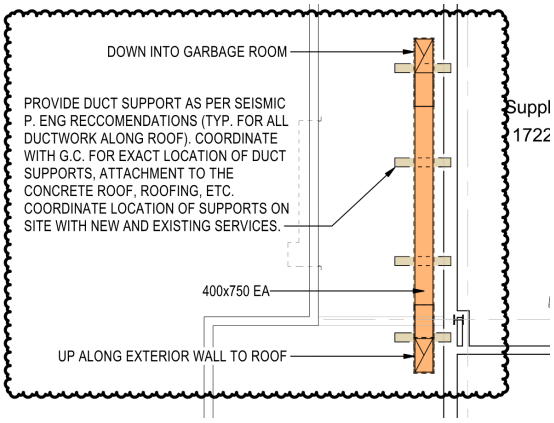


8. Refer to drawing M105.

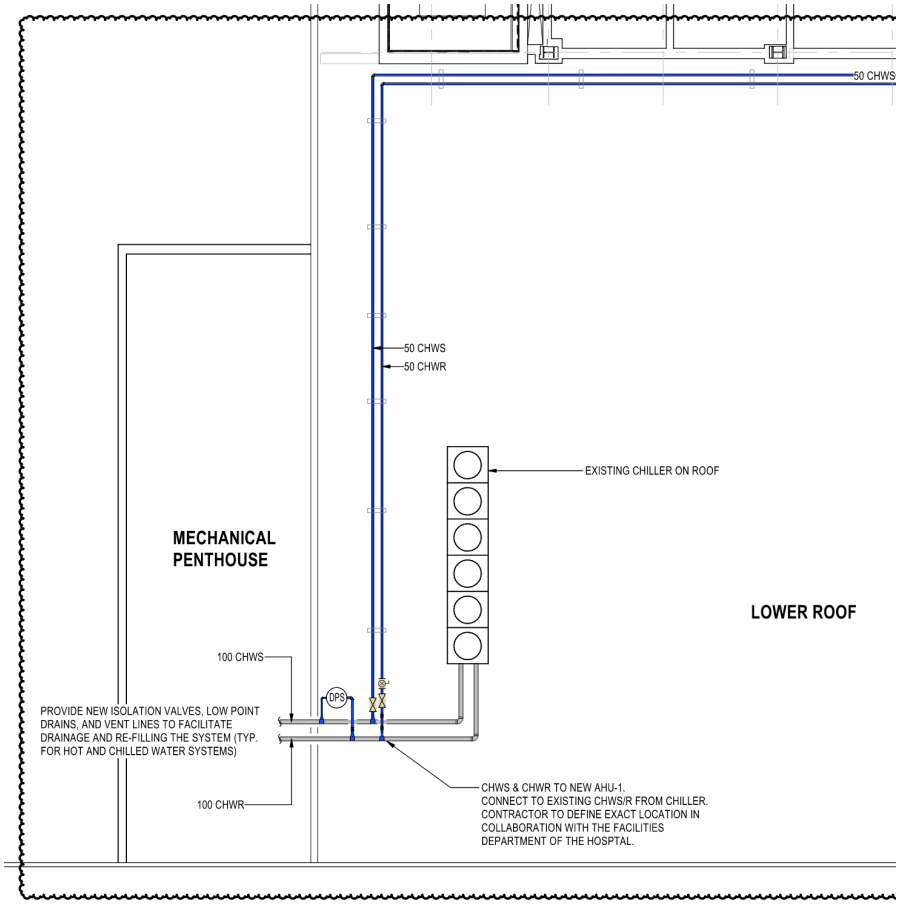
a. General Notes added



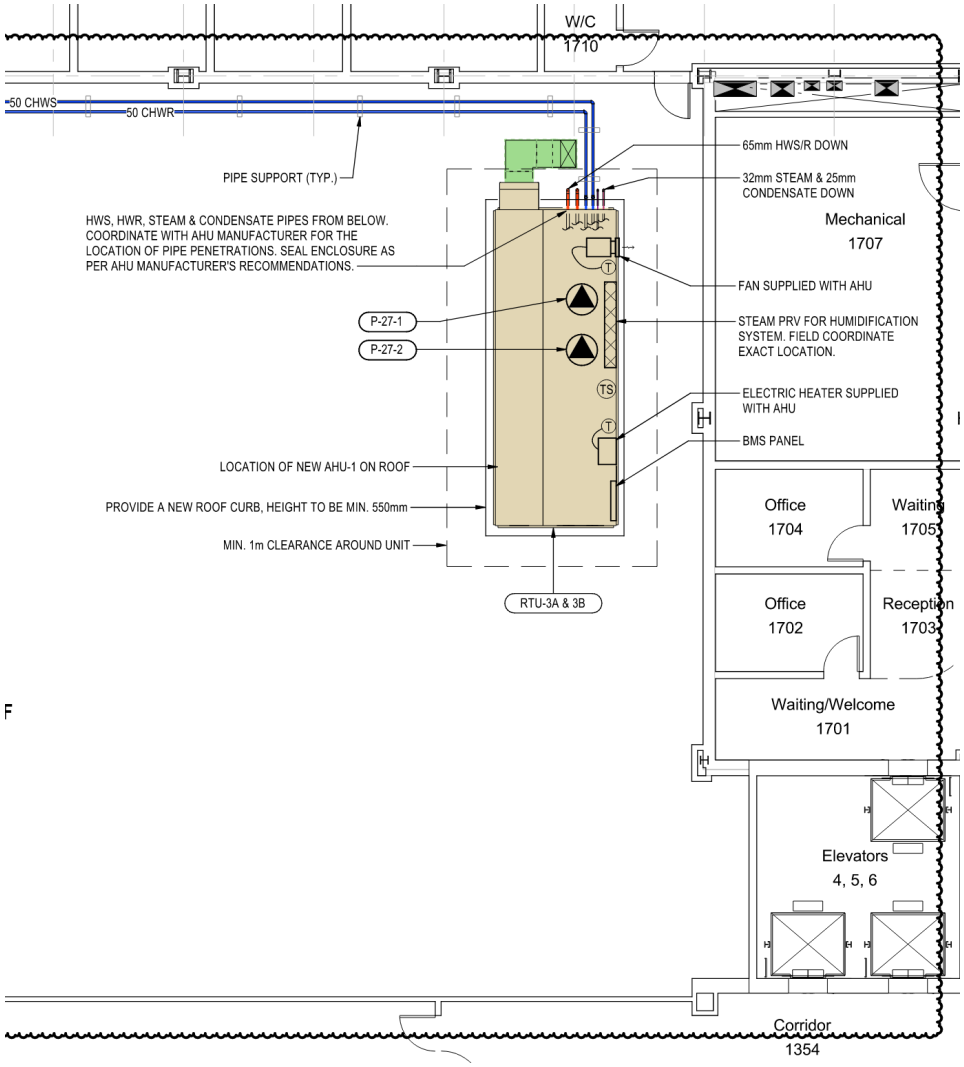
b. Duct supports and note added for clarity.



c. Valves and DP sensor added to CHW system. Notes added for clarity.



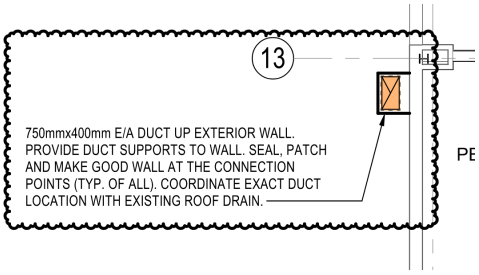
d. CHWS/R, HWS/R, and Steam and Condensate pipe routing updated.



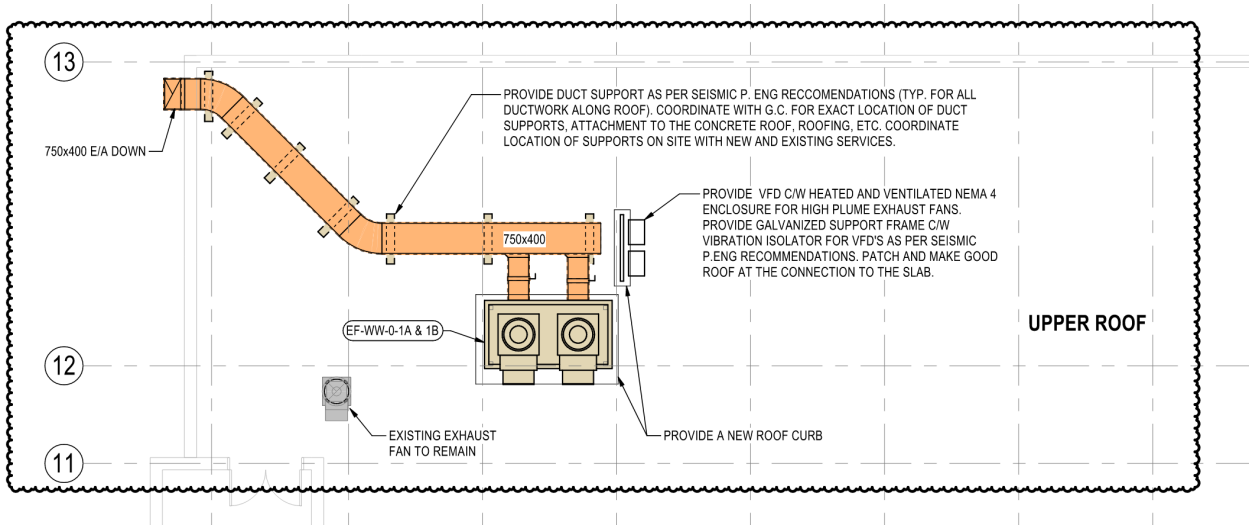
e. Equipment within AHU enclosure tagged and noted.

9. Refer to drawing M106.

a. Notes for duct supports to wall added for clarity.

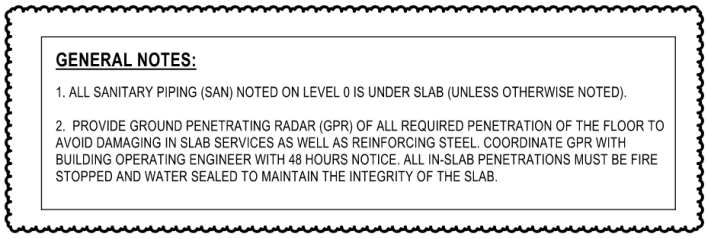


b. Ductwork routing updated. Added notes and location of VFD.



10. Refer to drawing M201.

a. Added General Notes for clarity.



11. Refer to drawing M400 (sheet reissued).

a. Sheet title updated to MECHANICAL SCHEMATICS
b. Details removed and are now located in specs.

12. Refer to drawing M401 (sheet reissued).

a. Sheet title updated to MECHANICAL SCHEMATICS
b. Details removed and are now located in specs.
c. Updates to Steam Schematic, Heating Coil Schematic.
d. Added VAV Connections Schematic

13. Refer to drawing M402 (sheet deleted).

a. Moved to M400

14. Refer to drawing M403 (sheet deleted).

a. Hydronic schematic removed
b. Steam schematic moved to M401

15. Refer to drawing M500.

a. Revised tagging of Air Handling Unit & added notes

UNIT IDENTIFICATION		AIRFLOW		PHYSICAL CHARACTERISTICS				
MARK	LOCATION	SUPPLY AIR (L/s)		UNIT OPERATING WEIGHT (kg)	MAXIMUM UNIT DIMENSIONS			Q
		AIR FLOW (l/s)	EXTERNAL STATIC PRESSURE (Pa)		HEIGHT (mm)	WIDTH (mm)	LENGTH (mm)	
RTU-3A	LEVEL 1 ROOF	1,800	875	7,000	2,540	3,110	8,130	
RTU-3B	LEVEL 1 ROOF	1,800	875	7,000	2,540	3,110	8,130	

NOTES:
1. ELECTRICAL FOR ALL MOTORS IS 575 / 3 / 60
2. MAXIMUM FACE VELOCITY FOR ALL FILTERS IS 2.5 M/S
3. SINGLE POINT POWER CONNECTION AT 575/3/60 AND SEPARATE 120/1/60 LIGHTING CONNECTION
4. INCLUDES ENCLOSURE FOR STEAM HUMIDIFIER.
5. ALL FANS TO BE INVERTER DUTY, COMPLETE WITH ISOLATOR, AUTOMATIC DAMPER FOR FAN ISOLATION, PIEZOMETER RING AIRFLOW MET
6. UNIT COMPLETE WITH STANDARD INSULATED ROOF CURB AND MOTOR LIFTING RAILS
7. REFER TO UNIT SECTIONS FOR MORE DETAILS
8. COILS SHALL BE RATED FOR 150 PSI (1,035 KPa)
9. SUPPLY, INSTALL, AND WIRE VARIABLE FREQUENCY DRIVES (VFD) COMPLETE WITH HARMONIC FILTERS/LINE REACTORS (FOR MOTORS OV
10. THE AHU SHALL INCLUDE A HEATED/VENTILATED ENCLOSURE FOR MOUNTING VSD, CONTROLS, AND ELECTRICAL DISCONNECTS ETC.
11. THE AHU SHALL HAVE TWO INDEPENDANT FAN TUNNELS SO THAT ONE FAN CAN BE TAKEN OFFLINE WITH THE UNIT STILL IN OPERATION. I
12. COIL CAPACITIES SHOWN ARE FOR 100% O/A
13. 550mm HIGH ROOF CURB
14. 1900 (W) x 2540 (H) x 8100 (L) SERVICE ENCLOSURE

b. Added notes on humidifier

AHU HUMIDIFIERS

UNIT NO.	SERVICE	TYPE	MANUF	MODEL	CAPACITY (Kg/HR)	STEAM PRESSURE (kPa)	AIR VOLUME (L/s)	ENTERING DB (C) / ENTERING RH (%)	D
RTU3-HUM-1	RTU-3A	STEAM	CAREL	SABCBLI2U0	66.7	103.4	1800	20 / 0	
RTU3-HUM-2	RTU-3B	STEAM	CAREL	SABCBLI2U0	66.7	103.4	1800	20 / 0	

NOTES
1. AIRFLOW PROVING SWITCH
2. HIGH-LIMIT HUMIDI-STAT, ON-OFF HIGH LIMIT
3. TEMPERATURE SWITCH
4. HIGH EFFICIENCY PVDF INSULATED MANIFOLDS AND TUBES
5. 304 S.S. ENCLOSURE AND TUBE
6. STEAM CONTROL VALVE, 24 VOLT ACTUATOR, STRAINER, STEAM SEPARATOR, F&T TRAP
7. CONDENSATE COOLER FOR DISPERSION MANIFOLD
8. 304 S.S. CONDENSATE DRAIN COOLER C/W TEMPERATURE ACTUATED VALVE AND FLOOR STAND
9. SUPPORT FRAME FOR INSTALLATION OF THE HUMIDIFIER
10. INSUALTED COPPER PIPE BETWEEN THE HUMIDIFIER AND DISPERSION TUBE PER MANUFACTURER'S REQUIREMENTS

c. Pump flow revised.

PUMP SCHEDULE

UNIT IDENTIFICATION		CONTROL	PERFORMANCE							ELECTRICAL					
MARK	SYSTEM SERVED		FLUID TYPE	FLUID TEMP (°C)	FLOW (l/s)	PUMP HEAD (kPa)	MIN EFFICIENCY (%)	HP	SPEED (RPM)	VOLTS	PHASE	OPERATING WEIGHT (kg)	MANUFACTURER	MODEL	NOTES
P-27-1	PREHEAT COIL 1	CONTINUOUS	50% GLYCOL	36	2.33	36	49.74	1	1,200	208	3	73.2	KSB	ETANORM	
P-27-2	PREHEAT COIL 2	CONTINUOUS	50% GLYCOL	36	2.33	36	49.74	1	1,200	208	3	73.2	KSB	ETANORM	

NOTES:
1.

16. Refer to drawing M501.

a. Min. Air Flows updated on VAV schedule

PHARMACY AIR VALVE SCHEDULE (AV)

MODEL	PHOENIX MODEL NUMBER	SIZE (in)	REHEAT COIL	OCCUPIED MODE		UNOCCUPIED MODE		NOTES
				MAX. (L/s)	MIN. (L/s)	MAX. (L/s)	MIN. (L/s)	
ACCEL II	EXVA112L	12	-	275	-	275	-	1,2,3,4,5,6,8,9
ACCEL II	EXVA108L	8	-	85	-	85	-	1,2,3,4,5,6,8,9
ACCEL II	EXVA112L	12	-	230	-	230	-	1,2,3,4,5,6,7,8,9
ACCEL II	EXVA112L	2x12	-	600	-	600	-	1,2,3,4,5,6,7,8,9,11
ACCEL II	EXVA108L	8	-	150	-	150	-	1,2,3,4,5,6,8,9
ACCEL II	EXVA108L	8	-	135	-	135	-	1,2,3,4,5,6,7,8,9
ACCEL II	MAVA212L	12	REFER TO HTG COIL SCHED.	295	295	295	295	1,2,3,4,5,6,8,9,10,12
ACCEL II	MAVA108L	8	REFER TO HTG COIL SCHED.	105	105	105	105	1,2,3,4,5,6,8,9,10,12
ACCEL II	MAVA212L	2x12	REFER TO HTG COIL SCHED.	810	200	810	200	1,2,3,4,5,6,8,9,10,12
ACCEL II	MAVA108L	8	REFER TO HTG COIL SCHED.	170	170	170	170	1,2,3,4,5,6,8,9,10,12
ACCEL II	MAVA108L	8	REFER TO HTG COIL SCHED.	115	115	115	115	1,2,3,4,5,6,8,9,10,12

b. Capacities and flows updated on duct mounted heater schedule

DUCT MOUNTED HOT WATER HEATING COIL SCHEDULE

UNIT IDENTIFICATION		COIL				AIR					FLUID		
REHEAT COIL NO.	ROOM(S) SERVED	TOTAL CAPACITY (kW)	HEIGHT (mm)	LENGTH (mm)	NUMBER OF ROWS	AIRFLOW (l/s)	EDB (°C)	LDB (°C)	FACE VELOCITY (m/s)	MAX APD (Pa)	FLUID TYPE	FLUID FLOW (l/s)	EV (°
RH-AV-S1	2.0 NON-HD CLEAN ROOM	5.4	394	425	1	295	11	26.2	2.7	12.51	50% PRO. GLYCOL	0.12	82
RH-AV-S2	3.0 SHARED ANTE ROOM	1.9	279	279	1	105	11	26.0	2.5	16.60	50% PRO. GLYCOL	0.04	82
RH-AV-S3	4.0 HD CLEAN ROOM	15.0	381	724	1	810	11	26.3	4.1	34.54	50% PRO. GLYCOL	0.32	82
RH-AV-S4	5.0 UNCLASSIFIED PREP / STORAGE SPACE	3.2	279	305	1	170	11	26.5	3.7	26.74	50% PRO. GLYCOL	0.07	82
RH-AV-S5	6.0 HD STORAGE	2.1	279	279	1	115	11	26.1	2.8	14.79	50% PRO. GLYCOL	0.05	82

NOTES:

c. Inlet sizes noted on diffuser schedule.

HVAC GRILLES, REGISTERS AND DIFFUSERS

TAG	MANUFACTURER	MODEL	DUTY	TYPE	MATERIAL	FACE SIZE	ACCESSORIES
S-1	E.H PRICE	SPD	SUPPLY	SQUARE PLAQUE DIFFUSER	STEEL	SEE DWGS	1,2,3
S-2	E.H PRICE	LFDC	SUPPLY	LAMINAR FLOW DIFFUSER HIGH EFFICIENCY FILTER	STAINLESS STEEL	600x600	1,2,3,4,5,6
S-3	E.H PRICE	LFDC	SUPPLY	LAMINAR FLOW DIFFUSER HIGH EFFICIENCY FILTER	STAINLESS STEEL	300x1200	1,2,3,4,5
S-4	E.H PRICE	LFDC	SUPPLY	LAMINAR FLOW DIFFUSER HIGH EFFICIENCY FILTER	STAINLESS STEEL	600x1200	1,2,3,4,5,7
E-1	E.H PRICE	730	EXHAUST	STAINLESS STEEL LOUVERED GRILLE	STAINLESS STEEL	SEE DWGS	1,2,3
E-2	E.H PRICE	630	EXHAUST	LOUVERED FACE EXHAUST GRILLE	ALUMINUM	SEE DWGS	1,2,3
E-3	E.H PRICE	80 SERIES	EXHAUST	EGG CRATE EXHAUST GRILLE	ALUMINUM	SEE DWGS	1,2,3

NOTES:
1. REFER TO ARCHITECTURAL DRAWINGS FOR TYPE OF CEILING AND/ OR SUSPENSION SYSTEM.
2. FINISH SHALL BE OF THE TYPE AND COLOR SELECTED BY THE ARCHITECT. SUBMIT CHART FOR SHOP DRAWINGS.
3. COORDINATE WITH ARCHITECT THE REQUIRED BORDER TYPE, END CAP, FRAME, MOUNTING, FINISH, AND COLOUR PRIOR TO ORDERING
4. COMPLETE WITH AEROSOL INJECTION PORT (INJ)
5. COMPLETE WITH HEPA FILTRATION.
6. 250mm INLET
7. 300mm INLET

d. Revised Fan Schedule.

FAN SCHEDULE

UNIT NO.	SERVICE	LOCATION	FAN TYPE	AIR FLOW (l/s)	FAN E.S.P. (Pa)	FAN DRAW (kW)	FAN MOTOR (kW)	FAN RPM	DRIVE TYPE	VOLTS/PH/Hz	MANUFACTURER	MODEL NO	SEE NOTE(s)
EF-WW-0-1A	PHARMACY DEPARTMENT EXHAUST	UPPER ROOF	PLENUM FAN	2,000	840	3.31	3.7	2100	DIRECT DRIVE	575/3/60	GREENHECK	VEKTOR-MH-18-4-85	ALL
EF-WW-0-1B	PHARMACY DEPARTMENT EXHAUST	UPPER ROOF	PLENUM FAN	2,000	840	3.31	3.7	2100	DIRECT DRIVE	575/3/60	GREENHECK	VEKTOR-MH-18-4-85	ALL

NOTES
1- ISOLATION DAMPER ACT. - ELECTRIC, 24 VAC, 2 POS., SR, W/END SWITCH, W/TRANSFORMER, MODEL: TFB24-S,ONE PER FAN
2- SURE-AIRE FLOW STATION (NO ELECTRONICS), QTY 2
3-CSA APPROVAL, UL/CUL-705 "POWER VENTILATORS".
4-BYPASS AIR PLENUM-SINGLE WALL, STEEL, SIDE EXHAUST INTAKES
5- COATED WITH LABCOAT, CONCRETE GRAY-RAL 7023, ENTIRE UNIT
6- NEMA-3R DISCONNECT, MOUNTED AND WIRED
7- MOTOR COVER
8- WEATHERHOOD OVER BYPASS DAMPER WITH INLET SCREEN
9- C/W NEMA PREMIUM EFFICIENT INVERTER MOTOR, TEFC, CLASS F OR GREATER INSULATION, SHAFT GROUNDING
10- 600 MM ROOF CURB GPFHD, 25 MM INSULATION, MILL FINISH
11- FACTORY VIBRATION TEST, 0.15 IN/S1129, PEAK, FILTER-IN AS MEASURED AT THE FAN RPM
12- HIGH WIND RATED (+/- 140 PSF RATING)
13- FLORIDA PRODUCT APPROVAL # FL17237 & MIAMI-DADE NOA# 14-0325.05
14- TEXAS DEPARTMENT OF INSURANCE PRODUCT EVALUATION RV-88.
15- OSHPD SEISMIC CERTIFIED, #OSP-0233-10
16- EXTENDED LUBE LINES-NYLON
17- BYPASS SHALL BE SIZED FOR 600 L/S, GALVANEAL, COATED.
18- BYPASS DAMPER ACT. -HCD-230-LE, MODULATING, W TRANSFORMER, 24 VAC, OPPOSED BLANDES, MODEL: TFB24-SR, NEMA 4 ENCLOSURE
19-ISOLATION DAMPER - HCD-230-LE, GALVANEAL, COATED, 850 MM X 800 MM, PARALLEL BLADES, MOUNTED IN BAP, ONE PER FAN, MODEL: TFB24-SR, NEMA 4 ENCLOSURE
20-VFD C/W NEMA 4 HEATED AND VENTILATED ENCLOSURE PER FAN
21-MOTOR WITH GREASEABLE BEARING
22-COATED STEEL FAN PANEL

Thanks,

Stantec Consulting Ltd.

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Senior Associate, Buildings Engineering

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Alireza.khaleghi@stantec.com

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 CODES AND STANDARDS

.1 All fixtures shall display CSA (Canadian Standards Association) approval where a CSA standard is available and in effect.

.2 Plumbing fittings shall be to CAN/CSA B125, Plumbing Fittings.

.3 Plumbing fixtures shall be to CAN/CSA B45, 'General Requirements for Plumbing Fixtures',

.4 Vitreous china plumbing fixtures shall be to CAN/CSA B45.1, 'Ceramic Plumbing Fixtures',

.5 Stainless steel plumbing fixtures shall be to CAN/CSA B45.4, 'Stainless Steel Plumbing Fixtures'.

1.3 COLOUR

.1 Vitreous china fixtures shall be white unless otherwise noted.

.2 Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.

.3 Exposed plumbing brass and metal work shall be heavy triple chromium plated.

1.4 QUALITY

.1 Plumbing fixture supply brass shall be of one manufacturer unless otherwise specified.

.2 Fixtures shall be free from flaws or blemishes. Surfaces shall be clear, smooth and bright and have dimensional stability.

.3 Plumbing fixtures and trim shall be brand new unless otherwise noted.

.4 All visible or exposed parts, trim, supplies, traps, tubing, nipples escutcheons, check valves on diverter supply lines and valves shall be chrome plated finish unless otherwise noted.

.5 All fittings shall have heavy duty stems.

Part 2 Products

2.1 SINKS – GENERAL

.1 Per CSA Z317.1 Overflows shall not be used for sinks as overflows “are difficult to clean and become contaminated very quickly, serving as reservoirs of bacteria.”

.2 All sinks shall be provided with offset drains to reduce the potential for aerosolization from the trap.

.3 All water supply outlets (faucets) shall be, per CSA 317.1, “equipped with non-aerated, splash free, laminar flow devices in all areas of the HCF. Devices with aerators or fine mesh screens shall not be used.”

2.2 THERMOSTATIC MIXING VALVES - GENERAL

.1 For all Fixtures: Per CSA Z317.1 set thermostatic mixing valve temperature so that hot water is supplied at a minimum temperature of 55°C within 1 min at outlets (i.e., the time needed to flush out the volume of water in the pipe run-out and heat-up the piping).

2.3 COUNTER MOUNT HAND SINK SK-2:

.1 **Sink:** Single compartment counter topmount medical hand wash sink – Franke HWS6810P-3. 18 gauge (1.2 mm), type 304 (CNS 18/10) stainless steel. Exposed surfaces are #4 satin finished. Sink compartment is angled. Undercoated to reduce condensation and resonance. Includes waste fitting, sound deadening pads, factory applied rim seal, cutout template, and factory installed EZ TORQUE™ fasteners. Certified to ASME A112.19.3-2008 / CSA B45.4-08. Right rear waste location. Includes 1 1/2" (38 mm) duplex waste assembly with rubber stopper and 1 1/2" (DN38) brass tailpiece. With Faucet ledge. Deck mounted faucet (see below).

.2 Model Options: HWS6810P-3/3, 3 faucet holes 1 1/2" diameter, 4" centres, 8" centreset. 546 x 508 mm Overall. 406 x 457 x 254 mm Bowl. (FB x LR x D).

.3 **Faucet: American Standard Monterrey #7500170.002 Two handles Faucet,** Polished Chrome finish, Brass, 1.9 LPM (0.5 GPM) pressure compensating aerator outlet, Rigid/limited swing gooseneck spout, 127 mm (5") projection reach, 4" (102 mm) long vandal resistant red and blue indexed wrist blade handles.

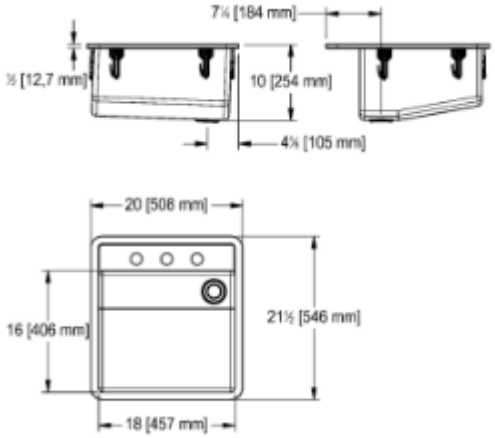
.4 **Thermostatic Mixing Valve:** Franke MIX-LF, thermostatic mixing valve, Point Of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, Integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F), housed in 356 mm x 356 mm x 152 mm (14" x 14" x 6") recessed box. Set valve temperature at 46 °C (114.8 °F). Note : Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.

.5 McGuire #LFH165LKN3RB Faucet Supplies (provide length(s) to suit), Chrome plated finish polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, Escutcheon and stainless steel braided flexible risers.

.6 McGuire #8912CBSAN P-Trap, SANIGUARD Antimicrobial Protection, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, Box flange and Seamless tubular wall bend.

.7 Provide escutcheons for all wall and floor penetrations. Provide commissioning services, thus ensuring operation as intended for the use. Coordinate and provide the required power for the faucet(s).

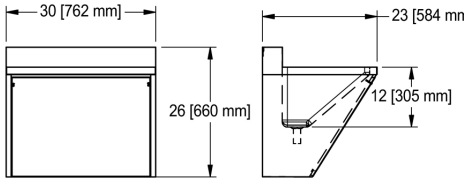
.8



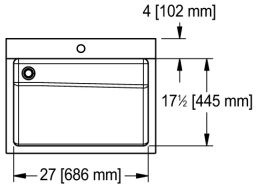
2.4 SURGEON SCRUB SINK SK-1:

.1 **Sink:** Single compartment premium surgical scrub station – Franke SSU1-00 Single compartment surgical scrub station. 18 gauge (1.2 mm), type 304 (CNS 18/10) stainless steel. Polished #4 satin finish. Radius coved bowl corners. Franke hygienic waste with integral talipiece. (No separate waste fitting required) Access panel for service and maintenance. Supplied with wall hanger brackets. Certified to ASME A112.19.3-2008 / CSA B45.4-08. Deck mounted faucet (see below).

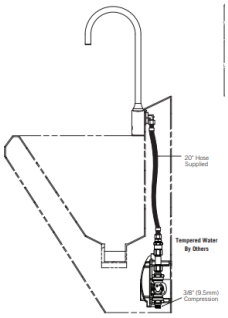
.2 Model Options: SSU1-00-1 1 faucet hole, 1-1/2" diameter, centred over bowl 23 x 30" Overall. 17 1/2 x 27 x 12" Bowl. (FB x LR x D). 584 x 762 mm Overall. 445 x 686 x 305 mm Bowl. (FB x LR x D).



.3 **Infection Control:** Surface treated with SANIGUARD® product protection. SANIGUARD® product protection is effective against most common bacteria, yeasts, molds and fungi that cause stains, odors and product deterioration. SANIGUARD® product protection is designed to protect the product itself and will not protect the user or others from food-borne illness or disease.



.4 **Faucet:** Back of sink deck-Mounted battery powered electronic faucet, Polished Chrome finish, Center hole only, Vandal resistant brass construction, Pressure compensating laminar flow device in spout base with plain spout end, Rigid gooseneck spout, 155 mm (6") projection reach, Self-adjusting sensor. Standard of Acceptance: Delta 1500T4670: Infrared electronic handwash system, chrome plated wallmount one piece cast main body with integral sensor, lead-free, adjustable sensing range and timeout, rigid smooth end gooseneck - 6.0" radius - 12.0" height, smooth spout end with laminar flow control in spout base 1.5 USGPM (5.7L/min).



.5 **Power:** Battery powered c/w 10-Year battery pack and holder.

.6 **Thermostatic Mixing Valve:** Franke MIX-LF, thermostatic mixing valve, Point Of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, Integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F), housed in 356 mm x 356 mm x 152 mm (14" x 14" x 6") recessed box. Set valve temperature at 46 °C (114.8 °F). Note : Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.

.7 McGuire #LFH165LKN3RB Faucet Supplies (provide length(s) to suit), Chrome plated finish polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, Escutcheon and stainless steel braided flexible risers.

.8 McGuire #8912CBSAN P-Trap, SANIGUARD Antimicrobial Protection, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, Box flange and Seamless tubular wall bend.

.9 Watts #CA-421 Fixture Carrier, universal steel hangar support plates with integral mounting brackets, heavy gauge epoxy coated steel uprights with welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

.10 Provide escutcheons for all wall and floor penetrations. Provide commissioning services, thus ensuring operation as intended for the use. Coordinate and provide the required power for the faucet(s).

2.5 EMERGENCY EYE WASH EW-1 (WALL MOUNTED):

.1 **Fixture:** Guardian #G5014 Wall mounted, hand-held eyewash/drench hose with ½" IPS U.S. made chrome-plated brass stay-open ball valve, nylon handle, powder-coated mounting bracket and flag handle, and 12ft. nylon coiled hose. Unit shall have (2) polypropylene GS-Plus™ spray heads with integral "flip-top" dust covers, filters and 1.6 GPM flow control orifices mounted on a chrome-plated brass eyewash assembly. Unit shall include ANSI compliant sign.

.2 **Performance:** Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 – 2014, and come with a full 2-year warranty.

.3 **Emergency Tempered Water Mixer:**

.1 Basis-of-Design Product: Guardian Equipment G6040 thermostatic mixing valve.

.2 Temperature Control. Valve shall have a precision thermal actuator to accurately blend hot and cold water. Valve is factory preset to deliver 85° F (29° C) tepid water with high temperature limit stop at 90° F (32° C). Temperature can be adjusted in field up to limit and locked.

.3 Capacity. Valve shall have a flow capacity of 50 GPM (189 L/min) at 30 PSI (2.1 bar) pressure drop.

.4 Failsafe Protection. In event the hot water supply fails, the valve shall deliver cold water only (i.e. bypass mode) at a flow rate of 38 GPM (144 L/min) at 30 PSI pressure drop. In the event the cold water supply fails, the valve shall close and not deliver any water at all.

.5 Supply Pressure. Maximum supply pressure is 125 PSI. Pressure of hot and cold water supplies can vary up to 25% and still deliver the flow and temperature required by ANSI/ASSE 1071.

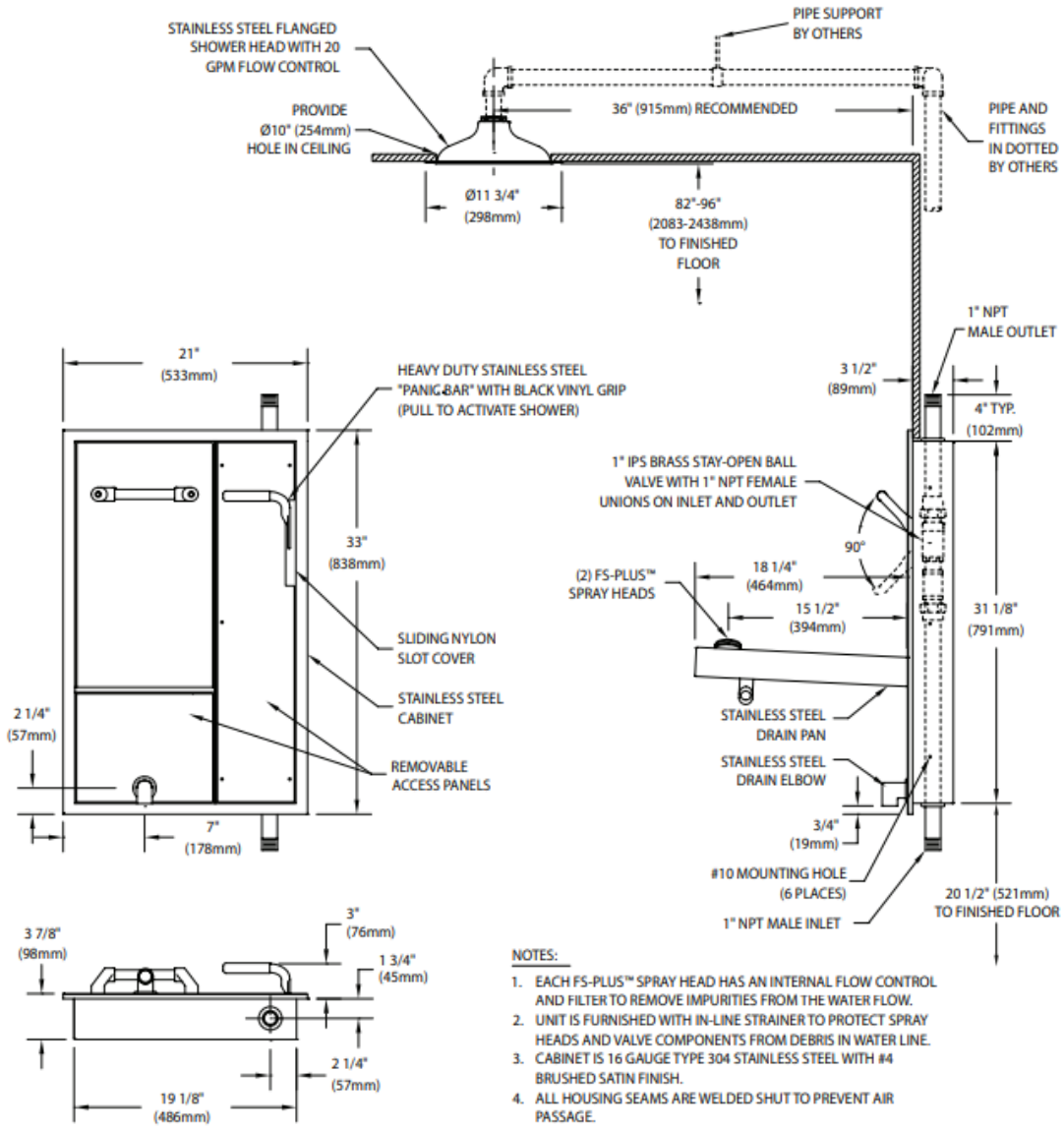
.6 Construction. Valve shall be furnished with lockable shutoff valves on the hot and cold water supplies, internal check valves to prevent cross-mixing of hot and cold water and stainless steel basket filters to remove debris from the water flow. Valve shall be furnished with outlet temperature gauge and stainless steel mounting bracket. Valve shall meet the requirements of the U.S. Safe Drinking Water Act as lead-free.

.7 Inlets/Outlet. Valve shall have 1" NPT female inlets and 1-1/4" NPT outlet. Inlets can be positioned in the field for top, back or bottom supply. Outlet can be positioned on top or bottom.

.8 Quality Control. Valve shall be third-party certified to comply with ANSI/ASSE 1071 and shall be fully assembled and factory tested prior to shipment.

2.6 COMBINATION SHOWER AND EYE/FACE WASH ES-1 (RECESSED MOUNTED):

☐ **GBF2562** Recessed Safety Station with Drain Pan and Daylight Drain, Recess Mounted Shower Head, Cleanroom Construction, Type 316 Stainless Steel



.1 **Fixture:** Guardian #GBF2562 Recessed Safety Station with Drain Pan and Daylight Drain, Recess Mounted Shower Head, Cleanroom Construction, Type 316 Stainless Steel. SSBF-61* – Barrier Free, recessed, cleanroom, wall mounted combination eye/face wash and shower safety station with ceiling mounted recessed shower head, patented stainless steel shower-actuating arm, swing-down stainless steel combination eye/face wash drain pan, and 1" IPS stainless

steel daylight drain. Unit construction shall be welded 16-gauge type 316 stainless steel with #4 brushed satin finish. Unit shall include stainless steel flanged shower head, internal 20 GPM flow control, chrome-plated brass eye/face wash supply fittings, brass unions, and U.S made full-port brass ball valve for shower. Eye/face wash valve shall be AutoFlow™, plug-type design with PTFE coated O-rings to seal valve orifices, polypropylene FS-Plus™ spray heads with individual 3.2 GPM flow controls and polyurethane filters. Supplied with in-line strainer to protect eye/face wash valve and spray heads from debris in water line. Activate eye/face wash valve by rotating 90° from stored position. Unit is completely sealed and airtight. Covers conceal all openings on front of unit. Supply nipples on inlet and outlet of shower valve are sealed with grommets. All seams in cabinet are fully welded and polished. Unit shall include ANSI compliant sign.

.2 **Performance:** Unit complies with ADA requirements for accessibility by handicapped persons. Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 – 2014, and come with a full 2-year warranty.

.3 **Emergency Tempered Water Mixer:**

.1 Basis-of-Design Product: Guardian Equipment G6040 thermostatic mixing valve.

.2 Temperature Control. Valve shall have a precision thermal actuator to accurately blend hot and cold water. Valve is factory preset to deliver 85° F (29° C) tepid water with high temperature limit stop at 90° F (32° C). Temperature can be adjusted in field up to limit and locked.

.3 Capacity. Valve shall have a flow capacity of 50 GPM (189 L/min) at 30 PSI (2.1 bar) pressure drop.

.4 Failsafe Protection. In event the hot water supply fails, the valve shall deliver cold water only (i.e. bypass mode) at a flow rate of 38 GPM (144 L/min) at 30 PSI pressure drop. In the event the cold water supply fails, the valve shall close and not deliver any water at all.

.5 Supply Pressure. Maximum supply pressure is 125 PSI. Pressure of hot and cold water supplies can vary up to 25% and still deliver the flow and temperature required by ANSI/ASSE 1071.

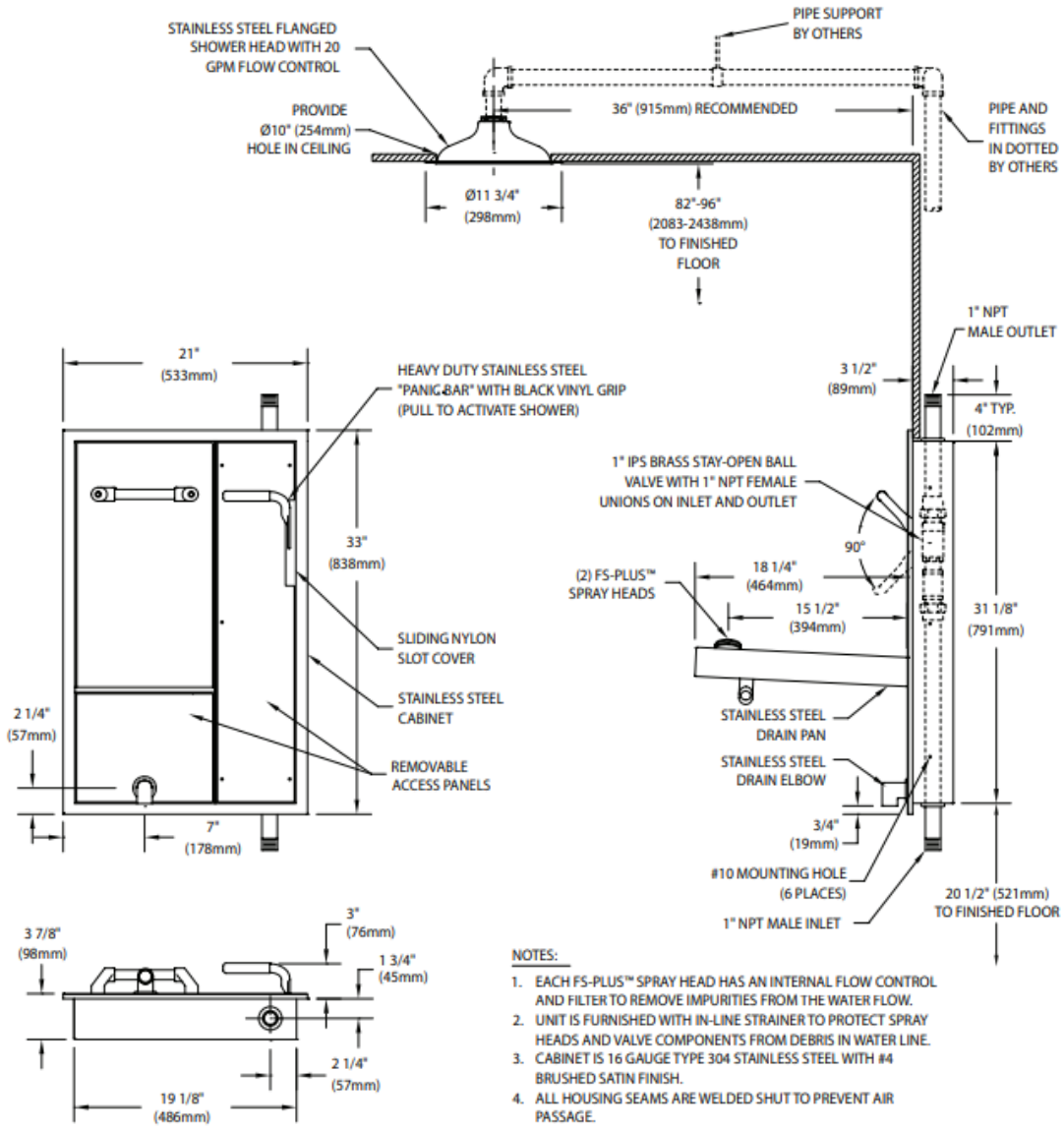
.6 Construction. Valve shall be furnished with lockable shutoff valves on the hot and cold water supplies, internal check valves to prevent cross-mixing of hot and cold water and stainless steel basket filters to remove debris from the water flow. Valve shall be furnished with outlet temperature gauge and stainless steel mounting bracket. Valve shall meet the requirements of the U.S. Safe Drinking Water Act as lead-free.

.7 Inlets/Outlet. Valve shall have 1” NPT female inlets and 1-1/4” NPT outlet. Inlets can be positioned in the field for top, back or bottom supply. Outlet can be positioned on top or bottom.

.8 Quality Control. Valve shall be third-party certified to comply with ANSI/ASSE 1071 and shall be fully assembled and factory tested prior to shipment.

2.7 MIXING VALVES

☐ **GBF2562** Recessed Safety Station with Drain Pan and Daylight Drain, Recess Mounted Shower Head, Cleanroom Construction, Type 316 Stainless Steel



.1 Mixing valves shall be thermostatic in operation, not mechanical mixing valves. This includes individual mixing valves at single fixtures or groups of fixtures including lavatories, sinks, showers, emergency fixtures etc.

.2 On both the up-stream hot and cold supplies, in an accessible location, provide isolation valves, positive swing check valves and strainers. This requirement does not apply when such components are supplied with or integral to the mixing valves itself. Where required, provide an access panel to the isolation valves, check valves and strainers.

Part 3 Execution

3.1 FIXTURE INSTALLATION

.1 Connect fixtures complete with specified trim, supplies, drains accessory piping, vented traps, stops or valves, reducers, escutcheons and fittings for the proper installation of all fixtures and their respective supply fittings.

.2 Provide necessary hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kilogram [200 pound] mass will not loosen or distort mounting.

.3 Provide chrome plated quarter turn mini ball valves for all lavatories, sinks and tank type water closets.

.4 ABS p-traps and waste arms are not permitted.

.5 Sinks:

.1 Provide braided stainless-steel flexible supplies for sinks

.1 Supplies for sinks shall incorporate 12 mm [1/2”] chrome plated quarter turn mini ball valve stop.

.2 PEX or other plastic supplies are **not** acceptable.

.3 Faucets shall be complete with nuts and tailpieces.

.4 Provide appropriate gaskets and/or sealing washers that will prevent the entry of water into fixture trim or faucet holes or punchings in millwork.

.5 Gooseneck spouts shall have a clearance of 200 mm [8"] from nozzle tip to countertop, unless otherwise specified.

.6 Plastic control handles and spouts are unacceptable.

.7 Sink P-traps shall be cast brass or tubular brass complete with either a cleanout or possess slip joint connections. Assembly shall be chrome plated where not concealed in millwork. Plastic drain and trap assemblies are **not** acceptable.

.8 Cleanouts serving fixtures in this Healthcare Facility shall be located at 1,830 mm above the finished floor level. At no point, shall a cleanout be less that a minimum of 150mm above the flood level rim of the fixture.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixture punchings for faucets or other trim shall not contain more punchings than necessary for the specified trim.

.2 Provide fixture and templates to the applicable trades for holes and cut outs required in all countertops.

3.3 WALLS AND FLOORS

.1 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

.2 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with Dow Corning anti-mildew 786 building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 WATER HAMMER ARRESTORS

.1 Provide water hammer arrestors or shock absorbers on fixtures with flush valves and/or quick closing valves.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 GENERAL

.1 All work shall comply with the BC Building Code and Kelowna General Hospital requirements regarding demolition work.

.2 Conform to Division 1, General Requirements.

.3 Comply with Workers Compensation Board regulations.

1.2 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for re-use, and re-install them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide the following in accordance with Section 01 33 00 – Submittal Procedures before starting work of this Section:

.1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Construction Waste Management and Disposal.

1.4 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

.1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.

.2 Notify Consultant and Owner and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

.3 Prevent debris from blocking drainage inlets.

.4 Protect mechanical systems that must remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Owner and users is minimized and as follows:

.1 Prevent debris from endangering the safe access to and egress from occupied buildings.

.2 Notify Consultant and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

1.5 SCOPE

.1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Consultant will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

.2 The work consists of the removal / demolition of existing mechanical systems and equipment, plumbing systems and equipment, and fire protection systems and equipment.

.3 In general the work consists of removal and disposing, relocation, and cap-off of, from the existing site, mechanical items in the building as listed below (take note that the list is by no means exhaustive). The piping systems must be drained first.

.1 Inside Building:

.1 All steam and condensate piping systems including pressure regulators, meters, valves, traps, ec. Take note of the items to be salvaged.

.2 All heating glycol and water piping system including but not limited to, heat exchangers, pumps, valves, expansion tank, convectors, radiant ceiling panels and unit heaters. Take note of the items to be salvaged.

.3 All Ventilation air systems, including but not limited to various supply, return and exhaust fans, air distribution ductwork with associated diffusers, grilles, dampers and louvers. Take note of the items to be salvaged.

.4 All plumbing systems, including but not limited to, the domestic hot and cold water piping, acid waste piping, valves, strainers, plumbing fixtures as well as sanitary sewer and vent piping. Take note of the items to be salvaged.

.5 All medical gas systems, including but not limited to, piping, valves. Take note of the items to be salvaged.

.6 Note: Ceilings, walls and furring may have to be removed by the general contractor before some mechanical services can be removed.

.7 Pneumatic and control systems as defined in Controls scope of work.

.8 Note: Ceilings, walls and furring may have to be removed by the general contractor before some mechanical services can be removed.

.2 Service Connections:

.1 Water service connection (to be capped as shown).

.2 Storm service shall be kept operational throughout.

.3 Sanitary service (to be capped as shown).

.4 Coordinate these service cap-offs, if applicable, with the Owner's Maintenance Dept. and, if applicable, the City of Prince George Engineering Department and pay all fees.

.5 Provide a water supply point of connection to be used during the demolition.

.3 Do not disrupt active or energized utilities without approval of the Owner.

.4 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.

.5 Demolish parts of existing building to accommodate new construction and remedial work as indicated.

.6 At end of each day's work, leave worksite in safe condition.

.7 Perform demolition work in a neat and workmanlike manner:

.1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

1.6 RESPONSIBILITIES

.1 Visit the site before tendering. Examine all local and existing conditions on which the work is dependent.

.2 No consideration will be granted for any misunderstanding, of work to be done, resulting from failure to visit the site.

1.7 COORDINATION

.1 Follow the sequence and program set by the hazardous material contractor, work in coordination with him.

.2 Coordinate removal of mechanical equipment with the electrical demolition contractor for disconnection of electrical services. Coordinate with the Owner for any required shutdowns.

1.8 SALVAGE

.1 All existing items which need to be removed, and which have a reasonable salvage value, such as fans and motors, air terminals, plumbing fixtures, and valves, and control devices shall be carefully removed and handed over to the Owner. Handing over to the Owner includes moving to Owner's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.

.2 Remove all redundant material not required by the Owner from the site.

.3 Please return all control devices part of demolition to FMO.

1.9 DEMOLITION

.1 The contract documents include some existing mechanical drawings but these drawings do not show all devices and fixtures to be demolished and removed; the drawings do not show as-built conditions. The contractor shall carefully examine the site and existing drawings where available to ascertain existing conditions and extent of work.

1.10 ASSOCIATED WORK

.1 All roof, walls and floors floor penetrations shall be patched after removal of mechanical equipment such as fans, piping, ductwork and pipe vents.

.2 All openings and penetrations in Level 1 fire separations (walls and floors) shall be sealed and fire stopped.

.3 The roof drainage system shall be maintained to be operational at all times.

1.11 ASBESTOS REMOVAL

.1 If the Contractor, during demolition, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and advise the General Contractor. The General Contractor shall take immediate appropriate action to verify presence of friable asbestos and be responsible for the removal of all friable asbestos.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE

.1 Electric heat tracing for freeze protection of piping system.

.2 All heat trace installation requirements shall comply with both the heat trace manufacturer's and pipe manufacturer's recommendations (specifically as related to plastic pipe with heat trace).

.3 Mechanical Contractor shall heat trace all piping exposed to outside (such as piping serving air handling units, steam and condensate, make-up water lines, drain cooler, etc.) for freeze protection.

.4 All heat-tracing is to be done by Mechanical Contractor, and final power connection by Electrical Contractor. Coordinate location of junction boxes with Electrical Contractor.

.5 The installation shall be megger tested. The installing contractor shall provide documented proof of the testing results

Part 2 Products

2.1 PIPE HEAT TRACING

.1 Provide complete, CSA approved system of heat tracing on piping exposed outdoors where indicated.

.2 The entire design and installation of the system shall comply with the Canadian Electrical Code and the requirements of the local inspection authority.

.3 Provide all necessary materials to provide a complete system.

.4 Use Raychem Chemelex Auto Trace self-regulating, shielded, jacketed cable type XL-TRACE (use XTV for hot water piping systems) or equal. System shall be thermostatically controlled using Chemelex Automatrix Thermostat #AMC-F5 with non-adjustable set point of 5ºC [40ºF] complete with 900 mm [36"] capillary.

Part 3 Execution

3.1 INSTALLATION

.1 Install heater system in accordance with manufacturer's instructions/recommendations and these specifications.

.2 All heat trace installation requirements shall comply with both the heat trace manufacturer's and pipe manufacturer's recommendations (specifically as related to plastic pipe with heat trace).

.3 Prior to installing heating cables, ensure the pipe systems are complete and have passed all necessary tests.

.4 Cables to be secured to pipes using Raychem Type G554 glass cloth tape at 300 mm [12"] intervals on pipe.

.5 Wrap all valves with a minimum of 1,320 mm [52"] of heater cable. Follow manufacturer's recommendations for installation of cable around valves and flanges.

.6 Install sensing bulb on side of pipe at least 1,000 mm [40"] away from valves, flanges, pumps, etc.

.7 After pipes are traced test all lengths prior to insulation of pipe insulation.

.8 Provide suitable identification for those pipe systems provided with heat tracing. At intervals of 6,000 mm [20 ft], provide on outside surface of insulation an adhesive backed nameplate “Caution - Heat Tracing.”

END OF SECTION

TABLE OF CONTENTS

1 MECHANICAL FORMS

1.1 MF 100 Checklist – Submissions to Consultant

ITEM	CHECKED BY	DATE
10 WORKING DAYS BEFORE CLOSE OF SUBTRADE TENDER – Request for addition of acceptable manufacturers		
10 DAYS AFTER AWARD OF THE CONTRACT – List of equipment suppliers and subtrades – Detailed price breakdown (MF 120, 121, 122)		
A.S.A.P. – Product & Fabrication samples (MF 131) – Shop Drawings		
WITH EACH APPLICATION FOR PROGRESS PAYMENT – Price breakdown (MF 120, 121, 122)		
PRIOR TO CLOSING IN CEILINGS & SHAFTS – Duct and pipe test data - Piping Test Data (MF 141)		
PRIOR TO STARTING SYSTEMS – Checklists for start-up (MF 151, 152, 153)		
PRIOR TO COMMISSIONING SYSTEMS – Checklists for operation (MF 151, 152, 153) – Commissioning schedule		
PRIOR TO DEMONSTRATION OF SYSTEMS – Demonstration agenda		
10 DAYS PRIOR TO SUBSTANTIAL PERFORMANCE INSPECTION – Submission of items listed on Form MF-188		
WHEN REQUESTING INSPECTION OF OUTSTANDING WORK – Certificate of total completion (MF 192) – Checklist of work remaining (MF 191) – Checklists of Demonstrations (MF 181, 182, 183)		

1.2 MF 120 Progress Claim Summary – Division 15 [21, 22, 23]

CLAIM NO: _____

FOR MONTH OF: _____

ITEM	PRICE	WORK TO DATE		PREVIOUS WORK		THIS MONTH	
	$	%	$	%	$	%	$
Base Contract Summary							
- HVAC							
- Plumbing							
- Cash Allowances							
Total Base Contract							
Change Order Summary							
Total Change Orders							
Total Contract:							
Amount due less 10% mechanics lien holdback							

NOTES:

- Submit this form as called for on MF 100 for tender price breakdown and for each progress claim.

1.3 MF 121 Detailed Price Breakdown – HVAC

CLAIM NO: _____

FOR MONTH OF: _____

ITEM		PRICE	WORK TO DATE		PREVIOUS WORK		THIS MONTH	
Mechanical		$	%	$	%	$	%	$
Mobilization & Permits								
Air Handing Equipment	Matl. Lab.							
HVAC Piping & Equipment:	Matl. Lab.							
Insulation – Piping & Equipment	Matl. Lab.							
SUBTOTAL								
Sheet Metal								
Air Terminal & Access.	Matl.							
Ductwork	Matl. Lab.							
Insulation – Ductwork	Matl. Lab.							
Duct Cleaning:	Lab.							
Testing & Balancing	Lab.							
SUBTOTAL								
Refrigeration	Matl. Lab.							
SUBTOTAL								
Controls	Matl. Lab.							
SUBTOTAL								

Finishing								
Comm. & Demonstration Maintenance Manuals								
SUBTOTAL								
TOTAL								

NOTES:

.1 Submit this form as called for on MF 100 for tender price breakdown and with each progress claim.

.2 Submit a separate form for each item listed on MF 120.

1.4 MF 122 Detailed Price Breakdown - Plumbing

CLAIM NO: _____

FOR MONTH OF: _____

ITEM		**PRICE**	**WORK TO DATE**		**PREVIOUS WORK**		**THIS MONTH**	
Plumbing		**$**	**%**	**$**	**%**	**$**	**%**	**$**
Sanitary & Storm Drainage	Matl. Lab.							
Domestic Water	Matl. Lab.							
Fixtures & Equipment	Matl. Lab.							
Plumbing Insulation	Matl. Lab.							
Medical Gas	Matl. Lab.							
Fire Protection	Matl. Lab.							
Wet & Dry Vacuum	Matl. Lab.							
Outside Services	Matl. Lab.							
TOTAL								

NOTES:

.1 Submit this form as called for on MF 100 for tender price breakdown and with each progress claim.

.2 Submit a separate form for each item listed on MF 120.

1.5 MF 141 Piping Test Data

SYSTEM: _____ (Heat pump loop water piping, Heating water piping, Chilled water piping, Condenser water piping, Steam piping, Boiler and boiler room piping, Domestic water piping main, Fire protection piping)		
Date:	**Time:**	**AM/PM:**
Section of System Tested:		
Pressure at start of Test: _____ kPa [psi] Pressure at end of Test: _____ kPa [psi]	**TEST:** Length: _____ hrs Medium: water /air / nitrogen	
Test Performed by:		
Name:	Signature:	Company:
Test witnessed at start:		
Name:	Signature:	Company:
Test witnessed at end:		
Name:	Signature:	Company:

Remedial Work / Comments:

1.6 MF 151 Checklist - Start-up and Operation Requirements - Air Systems

System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up Safety Controls Installed & Operational Control And Smoke Dampers Operational Permanent Electrical Connections Made Fan Drives Aligned By Millwright Fan Rooms & Plenums Vacuum Cleaned Equipment Lubricated Building Swept & Clear Of Dust All Filters Installed Operating & Maintenance Data Available		
During Start-Up Qualified Operator In Charge Supply Ducts Blown Out Using Fans R.A. & Exhaust Ducts Blown Out Using Fans		
During Subsequent Operation Qualified Operator In Charge Ensure That The Building Has Remained Clean Equipment Maintained Lubrication Maintained & Logged		

NOTES:

.1 This is a brief checklist and does not cover all procedures, which may be advisable in a particular case. Additional information is available from equipment suppliers.

.2 Prior to starting or operating each system complete the appropriate section of this form and submit it to the Consultant.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.7 MF 152 Checklist - Start-up and Operation Requirements – Water / Glycol Systems

System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up Safety Controls Installed & Operational Permanent Electrical Connections Made Equipment Lubricated System Flushed Out Operating & Maintenance Data Available Boiler Inspector Notified Chemical Treatment Agency Notified		
During Start-Up Qualified Operator In Charge Chiller Manufacturers Rep. Present		
Prior to Operation Boiler inspectors Approval Obtained Report from Chemical Treatment Agency Submitted		
During Operation Qualified Operator In Charge Equipment Maintained Lubrication Maintained & Logged Chemical Treatment Maintained And Logged		

NOTES:

.1 This is a brief checklist and does not cover all procedures, which may be advisable in a particular case. Additional information is available from equipment suppliers.

.2 Prior to starting or operating each system complete the appropriate section of this form and submit it to the Consultant.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.8 MF 153 Checklist - Start-up and Operation Requirements – Refrigeration Systems

System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up Safety Controls Installed & Operational Permanent Electrical Connections Made Equipment Lubricated System Charged and Tested Operating & Maintenance Data Available Boiler Inspector Notified & Start-up Approved		
During Start-Up Qualified Operator In Charge Manufacturers Rep. Present		
Prior to Operation Inspectors Approval Obtained		
During Operation Qualified Operator In Charge Equipment Maintained Lubrication Maintained & Logged		

NOTES:

.1 This is a brief checklist and does not cover all procedures, which may be advisable in a particular case.

.2 Prior to starting or operating each system complete the appropriate section of this form and submit it to the Consultant.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.9 MF 170 Certificate of Testing and Balancing

I hereby declare that I _____

I am an employee/a principal of _____

And certify that the testing and balancing procedures specified under Division 23 have been satisfactorily completed and I hereby certify that complete factual reports have been distributed.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.10 MF 171 Certificate of Duct Cleanliness

I hereby certify that I _____

I am an employee/a principal of _____

And have personally witnessed that the following duct systems have been vacuumed as necessary, are now clean and have been resealed with access panels in place at all cleaning openings in the ductwork.

FAN NO.	SYSTEM DESCRIPTION

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.11 MF 172 Certificate of Fire Damper Inspection

I hereby certify that I _____

am an employee/a principal of _____

And that all fire dampers have been tested by removing the fusible link and witnessing closure of the damper.

SIGNED _____ DATE _____

- Contract drawings supplied by:_____
- Latest addendum number or date of plans used:_____

NOTES:

1. This certificate must be submitted prior to substantial performance.

1.12 MF 173 Certificate of Penetrations Through Separations

I hereby certify that I _____

am an employee of _____

And have personally witnessed that all mechanical (HVAC & Plmb.) service penetrations through fire separations (rated & non-rated) and sound separations in the following areas have been properly sealed in accordance with the specified requirements.

AREA	SIGNED	DATE
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.13 MF 174 Certificate of Seismic Restraint Installation

I hereby declare that I _____

am an employee/a principal of _____

And certify that the seismic restraint of all mechanical equipment, piping and ductwork specified under Division 23 has been satisfactorily completed and that the installation meets the requirements of the B.C. Building Code as it relates to seismic restraint.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.14 MF 175 Certificate of Vibration Isolation

I hereby declare that I _____

am an employee/a principal of _____

And certify that the vibration isolation installation specified under Division 23 has been satisfactorily completed.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.15 MF 180 Checklist & Record – Items to be Handed to Owner

ITEM	RECEIVED	DATE
C.O. System Portable Calibration Kit		
Chemical Test Kit		
Control Drawings (Framed/Plasticized)		
Dip Stick For Oil Tank		
Electric Humidifier Replacement (Cylinder(s))		
Fan Belts – Spare Sets		
Filters - Spare Sets (Panel and Final)		
Glycol (enough to fill mixing tank when mixed)		
Hydrometer & Specific Gravity Chart		
Identification Schedule (Framed)		
Maintenance Program (Schedules & Cards)		
Master Key for B.A.S. Field Panels		
Rated Access Door Keys		
Salvaged Materials (Attach List)		
Spare Chemicals		
Sprinkler Heads & Cabinet		
Test Thermometer		
Thermostat Keys		
Valve List (Framed)		
Water Cooler Spare Filters		
Water flow meter for liquid flow measuring devices		
Differential Pressure Meter for Circuit Setting Balance Valves (15715)		
P/T Plug Master Test Kit (15715)		

NOTES:

.1 Copies of this form to be submitted to the consultant and the owner with all items signed off prior to substantial performance.

1.16 MF 181 Checklist – Demonstration of Air Handling Systems

System: _____

	CONTRACTOR		OWNER	
ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Troubleshooting				
Points of required Maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Humidity Control				
Air Pressure Control				
Air Volume Control				

NOTES:

.1 Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See MF 190).

.2 Owners representative to sign off each item during the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.17 MF 182 Checklist – Demonstration of Water / Glycol System

System: _____

	CONTRACTOR		OWNER	
ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Review of Chemical Treatment				
Troubleshooting				
Points of required Maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Pressure Control				
Volume Control				

NOTES:

.1 Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance (See MF 190).

.2 Owners representative to sign off each item during the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.18 MF 183 Checklist – Demonstration of Refrigeration System

System: _____

	CONTRACTOR		OWNER	
ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Troubleshooting				
Points of required Maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Pressure Control				

NOTES:

.1 Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See MF 190).

.2 Owners representative to sign off each item during the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.19 MF 188 Checklist – Substantial Completion Submissions - HVAC

SECTION	ITEM	CHECKED
23 05 00	Boiler Inspection Certificate	
23 05 00	Gas Inspection Certificate	
23 05 00	Equipment Extended Warranties Certificates	
25 05 13	Millwright Setting and Alignment Certificate	
23 05 00	Lubrication of Equipment Checklist	
23 05 00	Penetrations through Separations Certificate (MF-173)	
23 05 93	Air and Liquid Balancing Report	
23 06 02	Testing & Balancing Certificate (MF 170)	
23 06 02	Fire Damper Inspection Certificate (MF 172) and Checked Drawings	
23 08 00	Commissioning Report and Checklists	
23 05 00	Operating & Maintenance Manuals	
23 05 00	Record Drawings	
23 05 00	Maintenance Program	
23 05 00	Demonstration to Operating Staff agenda	
23 05 54	Identification Schedules	
23 06 02	Vibration Isolation Installation Certificate. (MF-175)	
23 06 02	Seismic Restraint Installation Certificate. (MF-174)	
23 25 00	Chemical Treatment and Cleaning Report for Piping Systems	
23 13 00	Fuel Oil Tank and Piping Pressure Test Report	
23 52 00	Boiler Start-up Test Reports	
23 23 00	Refrigeration System Start-up Test Reports	
23 64 00	Chiller Capacity and Efficiency Test Reports	
23 31 00	Duct Leakage Test Reports	
23 31 00	Duct Cleanliness Certificate (MF 171)	
23 06 02	Demonstrations Checklists (MF 181, 182, 183)	
23 06 02	Items handed to Owner Checklist (MF 180)	
23 06 02	Substantial Performance Certificate (MF(190)	
23 06 02	Checklist of work remaining after Substantial (MF 191).	

NOTES:

.1 This list is provided as a checklist and may not include all substantial completion requirements.

1.20 MF 189 Checklist – Substantial Completion Submissions- Plumbing

SECTION	SECTION	ITEM	CHECKED
15015		Operating & Maintenance Manuals. (Also 15400 & 15500)	
15015		Record Drawings. (Also 15400 & 15500)	
15400		Plumbing Inspection certificate	
15401		Buried drainage piping. Pipe leakage and bedding tests	
15420		Buried gas pipe covering report. (Also 02715 & 15400)	
15410		Water mains chlorination report. (Also 02713 & 15400)	
15410		Backflow prevention station test certificate	
15410		Hose Bibb operating keys. Signed receipt from Owner	
15410		Pipe test reports	
15410		Spare Water filters. (Also 15450, 15451 & 15452)	
15410		Backflow prevention (RPPD) test certificate	
15500		Fire protection system test certificate	

NOTES:

.1 This list is provided as a checklist and may not include all substantial completion requirements.

1.21 MF 190 Certificate of Substantial Performance Division 21, 22, 23

I hereby certify that I _____

am an employee / a principal /an agent

of _____

and have personally witnessed the following with regard to the mechanical systems work specified on the above project and that to the best of my knowledge except as noted on MF 191 (attached);

- The installation is complete and as specified.
- The systems have been commissioned and operate satisfactorily.
- Every control sequence and every control performs as specified.
- The systems are clean.
- All of the required submissions have been made to the consultant.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the consultant prior to substantial performance.

.2 If it is apparent during this inspection that the systems or their operation are seriously deficient then all reasonable costs of any subsequent inspections shall be deducted from the contract sum.

1.22 MF 191 Checklist – Work Remaining After Substantial Performance

		COMPLETION		
ITEM NO.	**DESCRIPTION**	**CLAIMED BY**	**DATE**	**VERIFIED DATE**

NOTES:

.1 This form must be filled in and submitted to the Consultant prior to substantial performance.

.2 Items arising out of this inspection will be added to the list by the Consultant. Copies of the complete list will be circulated to the Owner, the Architect and the Contractor.

.3 The Contractor may include estimated values against the outstanding work but determination of the actual amounts to be held will be made by the Consultant.

.4 The Contractor shall sign off each item as it is completed and submit the list monthly to the Consultant. When all items are signed off the completed list shall be submitted with the certificate of total performance MF 192.

1.23 MF 192 Certificate of Total Performance – Division 21, 22, 23

I hereby certify that I _____

am an employee / a principal / an agent

of _____

and have personally witnessed that each item of outstanding work on the checklist and record of work remaining after substantial completion MF 191 (attached) has been satisfactorily completed and I hereby certify that the

Mechanical systems work specified on the above project is complete.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the Consultant prior to substantial performance.

.2 If it is apparent during this inspection that the systems or their operation are seriously deficient then all reasonable costs of any subsequent inspections shall be deducted from the contract sum.

END OF SECTION

PART 1 - General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 REFERENCE STANDARDS

.1 Do all piping system work in accordance with ANSI/ASME B31.9 codes.

.2 Comply with ANSI/ASME B31.1 for high pressure applications.

1.3 REGULATORY REQUIREMENTS

.1 All components, products and fabrication techniques shall be provided in compliance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boilers and Pressure Vessel Safety Act and Regulations".

.2 Installation of, and repair or alterations to, pressure piping systems shall be performed only by licensed Contractors and licensed Welders, certified for the work being done in accordance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boilers and Pressure Vessel Safety Act and Regulations".

.3 Field welding to be in accordance with the procedures of CSA-W55.2 and CSA-W117.2 and the current edition of ASME/ANSI B31.1 or B31.9 Code

.4 Field welding for steam piping with pressure in excess of 100 kPa (15 psi) shall be in accordance with the current edition of ASME/ANSI B31.1.

.5 Make application and pay costs for registration and inspection of pressure piping systems with the BC Safety Authority in accordance with:

.1 CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code

1.4 SYSTEM PRESSURE RATINGS

.1 Steam and Condensate Pipe Fittings: Piping systems 1730 kPa [250 psig] or less operating pressure - 1730 kPa [250 psig] rating.

.2 Steam and Condensate Valves: Suitable for maximum system operating temperature and pressure.

1.5 APPLICABLE CODES AND STANDARDS

.1 Materials:

.1 ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.2 ASTM B43 Standard Specification for Seamless Red Brass Pipe, Standard Sizes

.3 ASTM A106 Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service

.4 ASTM A312 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

.5 ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings

.6 ANSI/ASME B16.3 Malleable Iron Threaded Fittings

.7 ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings: NPS ½ through 24

.8 ANSI/ASME B16.9 Factory Made Wrought Buttwelding Fittings

.9 ANSI/ASME B16.11Forged Fittings Socket Welding and Threaded

.10 ANSI/ASME B16.20 Metallic Gaskets for Pipe Flanges: Ring Joint Spiral Wound and Jacketed.

.11 ANSI/ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges.

.12 ANSI/ASME B31.1 Power Piping

.13 ANSI/ASME B18.2.1 Square and Hex Bolts and Screws,

.14 ANSI/ASME B18.2.2 Square and Hex Nuts

.2 Piping code:

.1 ANSI/ASME B31.9 Building Services Piping

.3 Make application and pay costs for registration and inspection of pressure piping systems with the BC Safety Authority in accordance with:

.1 CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code

1.6 SHOP DRAWINGS

.1 Submit detailed shop drawings of valves. Shop drawings shall clearly indicate valve make, model, location, type, size and pressure rating and Provincial CRN number.

.2 Submit shop drawings where headers and pipe assemblies with fittings, elbows and flanges are shop fabricated.

.3 Submit stress analysis, calculations and shop drawings, as required by BC Safety Authority for Pressure Piping Registration, that have been signed and sealed by a professional engineer licensed in British Columbia to the British Columbia Boiler Branch, Vancouver General Hospital FMO, and the mechanical consultant for review and approval prior to the start of construction."

.1 In addition to stress analysis and calculations for the new piping, calculations shall be provided for any existing lines (i.e. steam supply lines to the building, pressure reducing valve station, etc.) that are modified or connected to accommodate new lines to show:

.1 There are no additional interface loads introduced between the new and existing lines, or

.2 The existing lines are adapted to support any new loads as a result of the modification.

PART 2 - Products

2.1 GENERAL

.1 All products shall be registered with the regulatory authority in accordance with CSA B51.

2.2 PIPE

.1 Steel Pipe: to ASTM A53 Grade B as follows:

.1 To 250 mm [NPS 10], Schedule 40.

.2 To 300 mm [NPS 12] and over, 9.5 mm [0.375"] wall thickness.

.3 For the following systems:

.1 Steam

.2 Steam relief valve vents.

.2 Steel Pipe: To ASTM A53 Grade B as follows:

.1 To 200 mm [NPS 8], Schedule 80.

.2 For the following systems:

.1 Steam condensate.

2.3 PIPE JOINTS - STEEL PIPING

.1 50 mm [NPS 2] and under: screwed fittings, except where otherwise noted, with teflon tape or pulverized lead paste.

.2 65 mm [NPS 2-1/2] and over: welding fittings and flanges to CSA W47.1.

.3 Flanges: raised face, steel weld neck, lap or back-welded slip on type.

.4 Bolts and Nuts, carbon steel: to ANSI B18.2.1-1981 and ANSI B18.2.2.

.5 Flange gaskets:

.1 Stainless steel spiral wound non-asbestos gaskets.

2.4 PIPE FITTINGS - STEEL PIPE

.1 Pipe fittings, screwed, flanged or welded:

.1 Malleable iron extra heavy screwed fittings: Class 300 to ANSI B2.1 or cast iron extra heavy screwed fittings: Class 250 to ANSI B16.4.

.2 Steel pipe flanges and flanged fittings: to ANSI B16.5.

.3 Steel butt-welding fittings: to ANSI B16.9a.

.4 Unions, malleable iron ground joint type: Class 300 to ANSI B16.3.

2.5 VALVES GENERAL

.1 Wherever possible all valves shall be of one manufacturer.

.2 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.

.3 All valves shall have a Provincial CRN number which is current.

.4 Provide valves located more than 2100 mm [7 ft] from floor in equipment room areas with chain operated sheaves. Extend chains to 1800 mm [6 ft] above floor and hook to clips arranged to clear walking aisles.

.5 Include lock shield handles where shown or noted.

.6 Use non-rising stem valves where there is insufficient clearance for stem to rise.

2.6 GATE VALVES

.1 50 mm [NPS 2] and under, screwed:

.1 Cast or Forged Steel body, rising stem, non-rising handwheel, solid wedge disc, union or screwed bonnet.

.2 Acceptable Products:

.1 Class 150 [1034 kPa] - Crane 431, Grinnell 3080, Kitz 25, Newman Hattersley 607, Nibco T-131, Toyo 298.

.2 Class 200 [1380 kPa] - Crane 424, Grinnell 3130, Kitz 37, Newman Hattersley 608, Nibco T-174-SS, Toyo 314.

.2 50 mm [NPS 2] and under, socket weld:

.1 Application: Installed upstream of steam line drip traps on steam services of 890 kPa [130 psig] and higher.

.2 Forged steel, socket weld ends, bolted bonnet, O.S. & Y.

.3 Acceptable Products: Class 800 [5500 kPa] - Crane B-3604XU-W, Grinnell DSI 4121-A8-18, Newman Hattersley 1144, RP & C EF57D, Vogt SW12111.

.3 65 mm [NPS 2-1/2] and over, flanged:

.1 Cast or forged steel body, rising stem, non-rising handwheel, O.S. & Y., flanged, flexible disc, 13% chromium steel trim on disc, hard faced cobalt - chromium tungsten on body seat rings, bolted bonnet.

.2 Acceptable Products:

.1 Class 150 [1034 kPa] – Bonney Forge 1-11-RF, Crane 47XU-F, Grinnell DSI 37XUF, Kitz K150SCLS, Newman Hattersley 1481.

.2 Class 300 [2065 kPa] - Bonney Forge 3-11-RF, Crane 33XU-F, Grinnell DSI 23XUF, Kitz K300SCLS, Newman Hattersley 1482.

2.7 GLOBE VALVES

.1 50 MM [NPS 2] and under, screwed: (Steam throttling service)

.1 Cast or Forged Steel body, rising stem, non-rising handwheel, 450 brinell Hardened stainless steel trim plug type disc, union bonnet.

.2 Acceptable Products:

.1 Class 150 [1034 kPa] - Crane 14-1/2 P, Kitz 17S, Newman Hattersley 14, Nibco T-276-AP, Toyo 214.

.2 Class 200 [1380 kPa] - Crane 212P, Kitz 17S, Newman Hattersley 14, Toyo 214.

.2 50 MM [NPS 2] and under, screwed: (Steam, condensate isolating service)

.1 Cast or Forged Steel body, rising stem, non-rising handwheel, renewable composition or bronze disc, union bonnet.

.2 Acceptable Products:

.1 Class 150 [1034 kPa] - Crane 7, Grinnell 3240, Kitz 09, Newman Hattersley 14, Nibco T-235-Y, Toyo 221.

.2 Class 200 [1380 kPa] - Crane 212P, Grinnell 3370, Kitz 17, Newman Hattersley 14, Nibco T-276-AP, Toyo 214.

.3 65 mm [NPS 2-1/2] and over, flanged:

.1 Cast or Forged Steel body, plug-type disc with 13% chromium steel trim, hard faced cobalt-chromium-tungsten on seat, O.S.& Y.

.2 Acceptable Products:

.1 Class 150 [1034 kPa] - Bonney Forge 1-31-RF, Crane 143XU, Grinnell DSI 37XUF, Kitz 150SCJS, Newman Hattersley 1881.

.2 Class 300 [2065 kPa] - Bonney Forge 3-31-RF, Crane 151XU, Grinnell DSI 23XUF, Kitz 300SCJS, Newman Hattersley 1882.

2.8 SWING CHECK VALVES

.1 50 MM [NPS 2] and under, screwed:

.1 Bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Acceptable Products:

.1 Class 200 [1380 kPa] - Crane 36, Grinnell 3370, Kitz 19, Newman Hattersley 48, Nibco T-473-B, Toyo 360.

.2 65 MM [NPS 2-1/2] and over, flanged:

.1 Cast iron body, renewable or regrindable seat, bronze swing disc, bolted cap.

.2 Acceptable Products: Class 200 [1380 kPa] - Bonney Forge 3-61-RF, Crane 39E, Grinnell 6350A, Kitz K300SCO, Newman Hattersley 982, Nibco F-968-B.

2.9 SILENT CHECK VALVES (SPRING TYPE)

.1 50 MM [NPS 2] and under, screwed:

.1 Bronze or stainless steel body, bronze or stainless steel trim, stainless steel spring, (heavy duty spring in vertical down flow application).

.2 Acceptable Products: Class 125 [860 kPa] – Conbraco 61-500, Durabla, Muessco 203BP, Nova 700.

.2 65 MM [NPS 2-1/2] and over:

.1 Cast steel, wafer style, bronze trim, stainless steel spring (heavy duty spring in vertical down flow application).

.2 Acceptable Products: Class 125 [860 kPa] - Apco, Centerline, Durabla, Duo-ChekII, Grinnell CV817, Nibco W-920W, M & G.

2.10 STOP - CHECK VALVES

.1 Cast iron body with bronze trim, flanged connections.

.2 "Y" pattern, O.S.& Y.

.3 Acceptable Products: Class 250 [1725 kPa] Crane 28E or 30E, Grinnell 6869A angle.

2.11 BLOWDOWN VALVES

.1 Slow Opening:

.1 'Y'-type bronze globe, rising stem, renewable bronze seat ring, composition disc, threaded connections.

.2 Acceptable Products: Class 300 [2070 kPa].

.2 Quick Opening:

.1 Straight through pattern, sliding disc, packless seating, lever operated.

.2 Acceptable Products: Class 250 [1720 kPa] - Everlasting 4000 series.

.3 Surface Blowdown:

.1 Calibrated high-pressure orifice and plug valve.

.2 Acceptable Products: Class 300 [2070 kPa] - Hancock Flocontrol valve fig. 4596, 3/8" [10 mm] 2 V-port.

PART 3 - Execution

3.1 PIPING

.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly.

.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

.3 Install piping to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.4 Maintain a minimum of 25 mm [1"] space between adjacent flanges or pipe insulation, whichever has the larger diameter.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.6 Saddle type branch fittings may be used on mains, if branch line is at least one size smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Use long radius elbows.

.8 Screw or weld (unless otherwise specified) all piping systems up to NPS 2.

.9 Weld (unless otherwise specified) all piping systems 65 MM [NPS 2-1/2] and over.

.10 Weld all steam piping systems operating at 890 kPa [100 psig] or higher pressure except that connections to traps and small valves may be screwed (unless otherwise specified).

.11 The upstream gate valve in steam line drip traps on steam systems operating at 690 kPa [100 psig] or higher pressure shall be welded.

.12 Condensate piping for steam systems shall be considered to commence at the connection point to drip legs on steam piping and to commence at the connection point to steam coils, steam heat exchangers, steam radiation, etc.

.13 Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.

.14 Use eccentric reducers in steam and condensate piping at pipe size changes, flush on bottom side, to permit gravity drainage.

.15 Do not use thread protection couplings, close nipples, running nipples or street elbows.

.16 Install all thermometer wells and immersion sensor wells specified under the Controls Section. Where wells will restrict flow in small diameter pipes (NPS 1-1/2 and smaller) install a section of oversized pipe at least NPS 2.

.17 Steam drip pockets shall be line size.

.18 Cap ends during construction to prevent entry of foreign matter.

3.2 PIPE GRADING

.1 Grade all piping to provide positive drainage and venting. Slope as follows:

.1 Steam mains - down in direction of flow, minimum - 1:240 [1" in 20 ft.].

.2 Steam upfeed branches - up in direction of flow, minimum - 1:240 [1" in 20 ft.].

.3 Steam branches - down to drip, minimum 1:240 [1" in 20 ft.].

.1 install branches with greater slope,

.2 concentric reducers at pipe size changes in vertical runs,

.3 eccentric reducers at pipe size changes in horizontal runs, arranged flat on bottom,

.4 eccentric reducers arranged flat on bottom at valve inlet and flat on top at valve outlet, in horizontal runs at throttling or control valves where pipe connection size is greater than valve size.

.4 Condensate mains and branches - down in direction of flow, minimum - 1:240 [1" in 20 ft.].

.1 install return branches with greater slope,

.2 concentric reducers at pipe size changes in vertical runs,

.3 eccentric reducers at pipe size changes in horizontal runs, arranged flat on top,

.4 eccentric reducers arranged flat on bottom at valve inlet and flat on top at valve outlet, in horizontal runs at valves where pipe connection size is greater than valve size.

.5 Provide steam trap stations at bottom of all risers and all low points.

3.3 PIPE BRANCHES

.1 Up-Fed branches off mains:

.1 Steam and Condensate - upward either vertically or at a 45o angle to the vertical and then grade up to riser.

.2 Down-Fed branches off mains:

.1 Steam and Condensate - upward either vertically or at a 45o angle to the vertical and then grade downward to the vertical drop.

3.4 CONNECTIONS TO EQUIPMENT AND TO EXISTING PIPING

.1 Install unions or flanges at connections to all equipment and specialty components and at all connecting points to existing systems which, for reasons of separation for testing, will require to be blank flanged or capped.

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise noted.

.3 Arrange piping connections to allow ease of access and for removal of equipment.

.4 Align and independently support piping connections adjacent to equipment to prevent piping stresses being transferred.

.5 Do not reduce equipment connection sizes by bushing.

.6 Make connections to equipment relief connections and pipe to outside to a safe location above roof. Anchor piping and allow for possible expansion.

.7 Branch connections to existing steel piping may be made using double strap service saddles - Smith Blair #313 or Dresser #91.

.8 Where shut down of a service is not possible, a hot-tap process shall be used for the tie-in connection of the services. The hot-tap welding in-place requires special equipment and the services of a highly skilled journeyman welder. This work shall be carried out by Pacific Flow Control Ltd., 9886 - 134 St. Surrey, B.C. V3T 4B1, telephone 585-4799.

3.5 DRAIN CONNECTIONS

.1 Pipe the discharge from all steam drip pan elbows, equipment blowdowns and water columns to the nearest building drain.

.2 Drain piping shall be of the same material as the piping system to which it is connected, except where otherwise specified.

3.6 EXPANSION OF PIPING

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to equipment and building. Pay particular attention to piping running horizontal across building expansion joints and provide adequate expansion and contraction for all such piping.

.2 Only major expansion configuration and fittings have been shown on the drawings. Provide all required additional compensators, loops and swing connections

.3 Provide anchors, where shown. Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

.4 Expansion loops shall be of all welded construction with long radius elbows.

.5 Install expansion loops, cold sprung 50% of the calculated expansion.

.6 Install at least three [3] elbows in all branch connections. Where space does not permit 3 elbows, install braided flexible pipe connectors in accordance with manufacturers recommendations. Three [3] elbow branch connections shall have sufficient developed length to ensure that excessive stresses are not generated in the piping and in no case less than 900 mm [36"].

3.7 VALVES

.1 Install shut off valves at:

.1 branch take-offs, and

.2 to isolate piping to each piece of equipment.

.2 Install valves with stems upright or angled 45o above horizontal unless approved otherwise.

.3 Install control valves with their stems upright unless approved otherwise and with adequate clearance for removal of actuators.

.4 Use gate valves to shut off branch takeoffs and to isolate equipment.

.5 Use plug type globe valves in control valve bypass connections.

.6 Use swing check valves, in horizontal and vertical upflow pipes.

.7 Use silent check valves where specifically shown in vertical pipes with downward flow.

.8 Arrange valve hand wheels and operating levers to be accessible.

.9 Remove internal parts of valves before soldering, welding or brazing pipe to valve body.

.10 Provide drip assemblies above valves installed in vertical steam lines and ahead (upstream) of valves installed in horizontal steam lines, pressure steam headers, and where branches are vertical.

3.8 DRIP TRAP ASSEMBELIES

.1 Provide drip trap assemblies in accordance with Steam Specialties Section.

.2 Condensate discharge from drip trap assemblies to be piped to drain by gravity to the nearest flash tank or condensate receiver taking condensate from equipment or drip assemblies connected to steam supplies at same pressure.

3.9 PIPING TESTS

.1 Notify the Consultant and the Inspection Authority having jurisdiction, 48 hours in advance of intended test dates.

.2 Before testing piping, isolate all equipment, which cannot withstand the test pressure.

.3 Do not insulate, backfill or conceal until tests have been completed and approved by the inspection authorities.

.4 Examine all systems under test for leaks.

.5 Joints shall remain dry during the test. A general sweating around a weld shall be reason for rejection.

.6 Remake all leaking connections and joints.

.7 Tests shall be limited to new piping only.

.8 New connections to existing piping shall be warranted.

.9 Welded connections to existing high pressure steam lines shall be to the requirements of the Boiler and Pressure Vessel Safety Branch. Include for the cost of x-rays for welds.

.10 Initial Hydrostatic test: (Steam and Condensate): 200% of working pressure, but not less than 860 kPa [125 psig] for 1 working day.

.11 Final Hydrostatic test: (Steam and Condensate): 150% of working pressure, after piping connections to all equipment are complete, maintain until all parts of piping systems have been inspected.

3.10 WELDING TESTS

.1 Provide x-ray inspection of 10% of all welds.

.2 The welded joints in piping shall be gammaray radiographed by a specialized firm. Radiography shall be performed in accordance with Article 3 of Section 5 of the ASME Boiler and Pressure Vessel Code and CGSB-48-GP-2.

.3 Radiograph over full circumference.

.4 Radiographs shall be interpreted by the Consultant and representative of firm carrying out radiographing.

.5 Replace welds of poor or doubtful quality at Contractor's expense.

.6 In the event of weld rejection, the Owner has the right to insist on further testing at the Contractor's cost. Repairs will also be at the Contractor's cost.

.7 Leave welds uncovered until inspected and approved by the Consultant or Boiler Inspection Branch.

3.11 CLEANING AND FLUSING - STEAM AND CONDENSATE PIPING SYSTEMS

.1 Make temporary cross connections between steam and condensate piping and blow through with live steam until all dirt, scale, pipe dope, etc. have been removed. Discharge waste steam to drain. Cool waste steam before discharging to drain.

.2 Remove, clean and reinstall all strainer baskets.

.3 After pressure test, flush steam and condensate lines to drain with clean water for minimum of four hours.

.4 Isolate system from other piping systems and by-pass traps. Drain and fill with solution of water and non-foaming, phosphate free detergent, 3% by weight. Provide temporary pump and circulate solution for minimum of eight hours.

.5 Flush to drain with clean water for four hours. Remove and clean strainers.

.6 Drain and refill system with clean water and circulate for two hours. Inspect strainers, and repeat drain, fill and recirculate routine until strainers are free of debris.

.7 Drain and allow steam into system with condensate at receivers diverted to drain. Inspect strainers and continue passing condensate to drain until strainers are free of debris.

.8 Place traps in service and condensate pumping system in operation. Check traps for blow through and service faulty units.

3.12 CHEMICAL TREATMENT

.1 Refer to Section 23 25 00 for chemical treatment.

END OF SECTION

SECTION 23 22 14
STEAM SPECIALTIES

PART 1 - GENERAL

1.1 RELATED WORK

A. This section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCE STANDARDS

A. The provision of all specialty components shall be in accordance with ANSI/ASME B31 Codes for Building Services Piping.

1.3 REGULATORY REQUIREMENTS

A. All steam specialty components shall be provided in compliance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations.

PART 2 - PRODUCTS

2.1 GENERAL

A. Listings:

1. Fittings installed in a registered piping system: listed with Canadian Registration Number (CRN).

B. Materials:

1. To CSA B51 with;
    a. cast iron to ASTM A278, Class 30 or ASTM A126 Class B.
    b. bronze to ASTM B62
    c. stainless steel: to ASTM A351, ASTM A167, ASTM A276 or ASTM A564.

C. Bolting requirements:

1. to ASTM A307
2. studs, bolts and nuts to ASME B18.2.1, ASME B18.2.2 and ASTM A194, “high strength” type.

2.2 DRIP PAN ELBOWS

A. Cast iron or steel, screwed or flanged to suit relief valve outlet. Threaded riser nipple (300mm nipple rod) and threaded drain connections on elbow and drain pan.

B. Acceptable Products: Grinnell 1538 or 1538F, Consolidated 1665 or 1667, Spirax/Sarco Type 299.

2.3 PRESSURE REDUCING VALVES - STEAM

A. Design pressure: code stamped for 1035kPa (150psig)

B. Self-operating, external pilot, single seat, diaphragm type with enclosed spring chamber, main and pilot valves,

C. NPS 2 and smaller: threaded connections.

D. NPS 2½ and over: flanged connections.

E. Cast steel body for both main and pilot valves, stainless steel diaphragm, stainless steel seat rings, stainless steel disc, stainless steel stem, carbon steel spring

F. Inlet Y-pattern strainer.

G. The regulator shall be capable of dead-end shut-off.

H. Accuracy of regulation - 95%.

I. Air loader and regulator c/w filter and air gauge.

J. Muffling Orifice.

2.4 PRESSURE RELIEF VALVES - STEAM

A. 50 mm [NPS 2] and under: Bronze screwed body and bonnet, bronze or copper alloy trim.

B. 65 mm [NPS 2-1/2] and over: Cast iron flanged body and bonnet, stainless steel trim.

C. Suitable for maximum operating pressure.

D. ASME tested.

E. Lifting lever handle.

F. Selected for 90% of actual capacity at 10% accumulation.

2.5 STEAM FILTERS

A. Minimum Requirements:

1. Stainless steel housing.
2. Stainless steel condensate drain.
3. Bleeder valve.
4. Disposable micro-fibre filter tube rated at 98% efficiency for 0.1micron and larger particles.
5. One set of 10 replacement filter elements.

B. Acceptable Manufacturers:

1. Balston Type 23/75R.
2. Headline Type SF 189 - (Gas Analytical Systems).

2.6 STEAM SEPARATOR

A. Minimum Requirements:

1. design pressure: code stamped for 1035kPa (150psig)
2. baffle type with steel body
3. constructed in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1
4. NPS 2 and smaller inlet or outlet connections: threaded connections,
5. NPS 2 ½ and larger inlet or outlet connections: ANSI Class 150 flanged connections,
6. screwed bottom drain connection.

B. Standard of Acceptance: Wright Austin, Watson McDaniel WSEP.

2.7 STEAM TRAPS

A. General:

1. Select steam traps to pass 300% of the required condensate load except for thermodynamic type traps. For laundry equipment, select steam traps to pass 800% of the required condensate load.
2. All steam traps in each category shall be the product of a single manufacturer.

B. Float and Thermostatic Steam Traps - 0 to 1035 kPa [150 psig].

1. Application: For modulating service on heating coils, heat exchangers.
2. Cast iron or semi steel body, screwed connections.
3. Stainless steel float, lever mechanism and seat -replaceable.
4. Stainless steel or phosphor bronze balanced pressure thermostatic air vent.
5. Acceptable Products: Armstrong 'B', 'J' or 'L' series; Erwel 'F' series, Spirax/Sarco 'FT' series, Watson McDaniel 'FT' series.

C. Inverted Bucket Steam Traps - 0 to 1035 kPa [150 psig].

1. Application: For non-modulating steam services on end of line steam drips, humidifiers.
2. Cast iron or semi steel, screwed connections.
3. Stainless steel bucket, lever mechanism on replaceable seat.
4. Bimetal air vent.
5. Acceptable Products: Armstrong '800' series, Erwel 'C' series, Spirax/Sarco 'B' series, Watson McDaniel #1030-1040 series.

D. Thermostatic Steam Traps - 0 to 450 kPa [65 psig].

1. Application: Where large air venting capacity required and for modulating steam service on hospital equipment.
2. Bronze or stainless steel body and cap, screwed with male union connection.
3. Stainless steel or phosphor bronze bellows and replaceable stainless steel valve.
4. Acceptable Products: Erwel 'R' series, Spirax Sarco 'T' series, Watson McDaniel 'WT' series.

E. Thermodynamic Disc Steam Traps - 0 to 1035 kPa [150 psig].

1. Application: Steam tracing, process equipment.
2. Stainless steel body.
3. Hardened stainless steel disc.
4. Monel seat gasket.
5. Acceptable Products: Erwel D600 and CD600 series, Spirax/Sarco TD-52 and TD-42 series, Yarway 710, Watson McDaniel WD 600, WD 600S.

2.8 THERMOSTATIC CONDENSATE DRAIN VALVE

A. Liquid expansion steam traps shall have an oil-filled element set to operate at a fixed temperature.

B. Bronze bodies with screwed connections and stainless steel trim.

C. The device shall be easily adjusted to discharge condensate at any temperature between 140° and 212°F (60° and 100°C).

D. Initial setpoint shall be 140°F.

E. Standard of Acceptance: Spirax Sarco Thermotron

2.9 STRAINERS

A. “Y” pattern.

B. NPS 2 and under: Cast iron body, screwed connections.

C. NPS 2-1/2 and over: Cast iron body, flanged connections.

D. Steam and Condensate services - 1725 kPa [250 psig] rating.

E. Basket screen:

1. Bronze, stainless steel or monel perforated screen.
2. 35 holes/sq.cm [225 holes/sq.in], 1.2 mm [3/64"] dia. holes, 36% open area.

F. Acceptable Products: Armstrong, Erwel, Kitz, Muesco, Spirax/Sarco, Toyo

2.10 VACUUM BREAKERS - BALL TYPE

A. Application: On inlets to steam coils, heat exchangers and as indicated.

B. Stainless steel body.

C. Stellited seat and hardened stainless steel ball.

D. Cadmium plated retainer spring.

E. Set for operation at vacuum of 3.0 kPa [12" W.G.].

F. Acceptable Products: National Oilwell – Plenty.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers recommendations.

B. Maintain proper clearance around equipment to permit maintenance.

C. Bolt legs or cradle for tanks to floor or support structure.

3.2 DRIP PAN ELBOWS

A. Install on discharge of safety/relief valve outlets.

B. Install a 300 mm [12"] long riser nipple in exhaust outlet connection and centre nipple inside the vent pipe. Nipple to slide freely into vent pipe riser.

C. Pipe drip pan elbow drain connections full size to the nearest building drain.

3.3 STEAM SEPARATOR

A. Sized for better than 99% separation efficiency

B. Full size dirt pocket on bottom drain connection and float and thermostatic trap with components as specified for drip trap assembly, sized for 30% of separator steam flow

C. Installed in following locations;

1. at upstream side of each pressure reducing valve station,
2. not used.

3.4 PRESSURE REDUCING VALVES - STEAM

A. Install steam pressure reducing valves, complete with strainer, isolating valves, bypass and steam relief valve on all steam systems and where shown on the drawings in strict accordance with the manufacturers installation instructions. Take care to observe all manufacturer minimum dimension requirements upstream and downstream from valve.

B. Where space permits install straight upstream and downstream straight lengths as follows:

1. NPS ½ to NPS 1½ valve 900 mm [36”] upstream, 1420 mm [56”] downstream
2. NPS 2 to NPS 4 valve 1000 mm [40”] upstream, 1520 mm [60”] downstream

C. 120 mm (4½ in) pressure gauge with globe valve and syphon on low and high pressure sides, and code rated safety relief valve set for 55 kPa (8 lbs) above low pressure to be carried and sized for full capacity of pressure reducing valve.

D. Bypass globe valve and valves and fittings ahead of pressure relief valve of same pressure rating as for high pressure steam.

E. Inlet line into bypass globe valve sized for capacity of PRV at high pressure and globe valve to be one size smaller than inlet line.

F. Discharge line from bypass globe valve sized for same capacity at low side pressure.

G. The pressure sensing line shall be located in a straight section of downstream piping at least 10 pipe diameters from the nearest fitting to ensure true pressure.

H. Where design steam capacity of reducing station exceeds 700 kg/hr (1500 lb/hr) provide two independent pressure reducing assemblies in parallel, one sized at one third of specified capacity and other sized for remaining two thirds.

I. Where multiple PRV's are installed in a reducing station, size bypass for capacity of largest PRV in station.

3.5 PRESSURE RELIEF VALVES - STEAM

A. Install steam pressure relief valves, downstream from steam pressure reducing valves to protect the low pressure piping system.

B. Size, if shown, of safety relief vent piping on drawings is approximate only, unless identified as being based on a specific selection of pressure reducing valves and/or safety valves.

1. Include in contract price for actual size requirements of safety relief valves, which is dependent on contractor-selected manufacturer.

2. For unfired pressure vessels, and pressure reducing stations, size vents in accordance with ASME B31.1 and BPVC Section VIII, with an allowable maximum vent backpressure equal to 10% of valve release setpoint at full safety valve capacity.

3. For steam, and high-temperature heating boilers with operating water temperature greater than 100°C (212EF), size vents in accordance with ASME BPVC Section I, or as required by safety valve manufacturer.

4. Submit sizing calculations specific to the project with the safety valve shop drawing submission.

C. Relief valves shall discharge through drip pan elbows and fitted with NPS ¾ drain line run from base of elbow and from pan, to nearest drain.

D. Relief valve discharge lines shall be run to outdoors, as shown on the drawings, through weather-protected sleeves. Relief valve discharge piping shall be terminated a minimum of 3000 mm [118"] above the roof so that there is no personnel hazard. Provide a secure mesh cap to prevent foreign material entry.

E. When several relief valve vents connect to one header, the header cross sectional area shall equal the sum of individual outlet area.

F. Prove to the Consultant the operation of the pressure relief valves and show that adequate clearance has been provided and that there is sufficient flexibility in the piping.

G. Discharge from the pressure relief device shall be directed to a safe location in such a manner as to prevent any impingement of escaping fluid upon personnel, pressure equipment, or adjacent structures or surfaces (e.g., gravel, sand, etc.). Discharge piping shall meet applicable standards and regulations. When the location of a discharge outlet is being determined, consideration shall be given to the potential effects of prevailing winds or accumulated snow and the location of doors, operable windows, or ventilation intakes. The discharge outlet shall be located so that the discharge will not endanger passersby.

3.6 STEAM TRAPS GENERAL

A. Installation in accordance with the manufacturer's recommendations.

B. Install only traps which are capable of being subjected to the full steam pressure of the steam line feeding the respective trap.

C. Install ahead of each trap, a 300 mm [12"] minimum cooling leg, full size, a 150 mm [6"] scale pocket, an isolating gate valve, a strainer and a union.

D. Install after each trap, a union, a check valve and an isolating gate valve.

E. Install a bypass, complete with globe valve, where indicated.

F. Install a 10 mm [3/8"] test valve (globe) downstream of traps.

G. Install blow off valves on strainers NPS 1 and larger.

H. Install a second gate valve (socket weld) on mains steam traps on steam lines at pressures above 860 kPa [125 psig].

I. Do not install strainers in steam connections to non-freeze preheat coils.

J. Traps used for dripping steam mains and branches shall be minimum NPS ¾.

K. Steam Trap Application:

1. Install thermostatic steam trap to drain condensate from steam radiation units, convectors and other similar terminal heating units.
2. Install float and thermostatic steam traps to drain condensate from unit heaters, convectors, heating coils, heat exchangers, steam separators, flash tanks, steam jacketed equipment and direct steam injected equipment.
3. Install inverted bucket steam traps to drain condensate from humidifiers, steam main headers and branch lines.

3.7 STEAM TRAP ASSEMBELIES

A. Low pressure steam trap assemblies

1. Provided for equipment with modulating control of steam flow.
2. Float and thermostatic traps of appropriate pressure rating.
3. Sized for twice maximum condensing rate of apparatus served and three times maximum condensing rate for fresh air coils and preheat coils.
4. Capacities based on 3.5 kPa (½ psig) differential on trap.
5. Line size dirt pocket not less than 250 mm (10 in) long.
6. Socket weld blow-down connection, NPS 1 size with NPS 1 gate valve, nipple, and cap located at bottom of each dirt pocket.
7. Trap line made up with gate valve, strainer, union, steam trap, union and gate valve, socket weld from dirt pocket to first nipple after upstream isolation valve.
8. Test connection NPS ½ size with NPS ½ globe valve, nipple and cap, located after trap, and ahead of final gate valve in assembly.

B. Drip trap assemblies

1. Located in low pressure steam lines; at base of risers, at low points in system, before automatic control valves and after pressure reducing valves and installed at intervals of not more than 90 m (300 ft) in horizontal runs.
2. Traps used for dripping steam mains and branches shall be minimum NPS ¾.
3. Sized for condensate rates as shown below for high pressure drip traps.
4. Trap line made up as described above for low pressure trap assemblies with internals selected for inlet steam pressure.
5. Blow-down connection, NPS 1 size with NPS 1 gate valve, nipple, and cap located at bottom of each drip assembly dirt pocket.

C. High pressure steam trap assemblies

1. For dripping apparatus operating at steam pressures above 75 kPa (40 psig).
2. Inverted bucket traps of appropriate pressure rating with capacities based on pressure differential across trap of not more than 25% of nominal working pressure.
3. Sized for three times maximum condensing rate of apparatus served.
4. Made-up with socket weld fittings and connections for trap line, dirt pocket, and blow down.
5. Line size dirt pocket not less than 250 mm (10 in) long.
6. Blow-down connection, NPS 1 size with NPS 1 gate valve, nipple, and cap located at bottom of each dirt pocket.
7. Trap line made up with gate valve, strainer, union, steam trap, union and gate valve.
8. Test connection NPS½ size with NPS½ globe valve, nipple and cap, located after trap, and ahead of final gate valve in assembly.

D. High pressure drip assemblies:

1. Located in high pressure steam piping; at base of risers, before automatic control valves, before pressure reducing valves, at low points and at intervals of not more than 90 m (300 ft) in horizontal runs.
2. Made up with;
    a. socket weld fittings and connections for trap line, dirt pocket, and blow down,
    b. thermodynamic traps for steam inlet pressure of 100-1725 kPa (15-250 psig),
    c. thermostatic or thermodynamic traps where inlet steam pressures are 0-103 kPa (0-15 psig).
3. Line size dirt pockets on lines up to NPS 4 and on larger main sizes, at least half of main diameter, but not less than NPS 4.
4. Dirt pockets 1½ main diameters long, but not less than 250 mm (10 in).
5. Install a 300 mm [12"] long riser nipple in exhaust outlet connection and centre nipple inside the vent pipe. Nipple to slide freely into vent pipe riser. Pipe drip pan elbow drain connections full size to the nearest building drain.
6. Blow-down connection, NPS 1 size with NPS 1 gate valve, nipple, and cap located at bottom of each drip assembly dirt pocket.
7. Trap line made up with gate valve, strainer, union, steam trap, union and gate valve.

8. Lift check valve in condensate discharge line at locations where drip assembly return is lifted above top of gravity return main.

3.8 REDUNDANCY IN TRAPPING

A. Trap assemblies at snow coils, process heating apparatus, and heating convertors to be installed with redundancy in accordance with following;

1. minimum number of trap assemblies: 2
2. capacity of each assembly in group: equal to required capacity divided by N-1. Where N is number of assemblies, and required capacity is as given above; two times condensing rate, three times condensing rate, etc.
3. thus where two trap assemblies are installed each: sized for 100% of required trap capacity, and
4. where six trap assemblies are installed each: sized for 20% of required trap capacity.
5. each assembly to be made up with valves, strainer, unions, and test connection as specified above.
6. provide one line size by-pass and globe valve around group of assemblies.

3.9 STRAINERS

A. Installed in horizontal or downflow lines with clearance for removal of basket.

B. Install so that screen is in horizontal position.

C. Install strainers ahead of steam traps, pressure reducing valves, meters, control valves, and where shown on the drawings.

D. Install blow off globe valves, on strainers 25 mm [1"] and larger with inlet and outlet nipples. Install nipple and cap on smaller sizes.

3.10 VACUUM BREAKERS

A. Install vacuum breakers and check valves on steam coils and heat exchangers with modulated steam supply to control induced vacuum.

B. Location where shown on the drawings.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 The 3 Year warrantee for the Humidifier shall start at the Substantial Completion of the UHNBC Pharmacy Upgrade project.

1.2 SCOPE

.1 Provide humidifiers as required,

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit manufacturer's piping and wiring diagrams, and data sheets showing:

- .1 capacities,
- .2 absorption distances,
- .3 recommended installation methods.

.2 Submit manufacturers data substantiating absorption distances with air leaving humidifier at 24 C (75 F) and 40-55%RH (adjustable).

Part 2 Products

2.1 HUMIDIFIERS – AIR HANDLING UNITS - STEAM INJECTION

.1 For details and performance, refer to separate equipment lists.

.2 Provide stainless steel rods to support distribution manifolds in air handling unit.

.3 Provide support for steam separator.

.4 Stainless steel steam jacketed dispersing manifold with internal noise attenuating screen.

.5 Stainless steel separating chamber.

.6 Provide and install all required pipe connection extensions and fittings for remote and multiple steam dispersing manifolds.

.7 The first and last steam orifice in the distribution manifolds shall not be less than 100 mm [4"] from duct/plenum walls or acoustic insulation.

.8 All piping to be Stainless steel.

.9 Multiple manifold pipe connections to be insulated.

.10 Rapid Absorption Steam Humidifiers

- .1 Distribution panels with closely spaced steam dispersion tubes spanning between headers and mounted in stainless steel casing;
- .2 normally closed modulating steam control valve,
- .3 centrifugal type steam/water separator,
- .4 factory installed electric valve actuator,
- .5 Y type strainer and float and thermostatic steam trap.

.11 Humidifier supplier to be responsible to ensure the humidifier tube spacing and location are selected to ensure complete steam absorption before reaching a coil bank / filters.

.12 Electric temperature switch (field installed) to prevent cold startup of humidifier.

.13 Temperature switch shall be wired to prevent the humidifier valve from opening until the humidifier has heated up to operating temperature – By controls contractor.

Part 3 Execution

3.1 INSTALLATION

.1 Mount and fit units in accordance with manufacturer's instructions.

.2 Connect overflow with drain line sloped 1 in 25, terminating over open drain.

.3 Install steam trap assembly, strainers, isolating valves, and connect steam supply and condensate return.

.4 Where condensate is not returned to the UHNBC Steam Plan, provide condensate and drain water tempering device that mixes the hot condensate with domestic cold water prior to discharging to sewer at maximum 60˚C [140˚F].

.1 Standard of acceptance: DriSteem Drane-Kooler

.5 Pipe from condensate drains to drain complete with trap. Install unit so that the curb / housekeeping pad height is sufficient to accommodate depth of trap.

.6 Provide backflow preventer in inlet water line and air gap in drain line to each humidifier.

3.2 SEISMIC REQUIREMENTS

.1 Manufacturer to ensure that all components of humidifier unit meet seismic requirements for the facility and as prescribed by the seismic engineer.

3.3 SUPERVISION AND START-UP

.1 Arrange and pay for services of trained representative of equipment manufacturer to supervise installation, wiring, set up, and testing of humidifier systems.

.2 At completion, manufacturers' representative is to instruct Owners operating personnel in operation and maintenance of humidifier systems.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Sections 01 91 13 – Commissioning General Requirements and 23 08 00 – Commissioning of Mechanical for additional responsibilities.

1.2 CODES AND STANDARDS

.1 Procedures shall be in accordance with AABC'S National Standards for Field Measurement and Instrumentation and ASHRAE Standards.

1.3 CONTRACTOR QUALIFICATIONS

.1 Prior to finalizing contractual arrangements with the balancing agency, submit the names, qualifications and years of direct field testing and balancing experience in the testing and balancing field for all members of the balancing team that is scheduled to carry out the balancing work.

.1 The senior site technologist must have a minimum of five years testing and balancing experience of similar projects.

.2 Provide a list of a minimum of ten comparable projects successfully completed by all key members of the balancing team.

1.4 TESTS

.1 Give at least written 48 hour notice of date for tests or longer if possible (due to travel time required to get to site).

.2 Do not externally insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.3 Conduct tests in presence of Consultant. Arrange for the Owner's representative to be present.

.4 Bear costs including retesting and making good.

.5 Refer to Piping Sections for specific test requirements.

.6 Refer to Ducting Sections for specific test requirements.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.5 TESTING AND BALANCING

.1 General

.1 Employ an approved independent testing and balancing agency to test and balance the following systems.

.1 Heating hot water system;

.2 Antifreeze (glycol) system;

.3 Supply, return and exhaust air systems;

.4 Pharmacy Hazardous Exhaust air system;

.5 Pressure differential monitoring / systems for the compounding Pharmacy systems

.6 Domestic water recirc systems.

.7 Chilled water system;

.8 Other existing systems that will be affected by this project as indicated in the specifications or on the drawings such as:

.1 Hot water / glycol systems.

.2 Chiller water / glycol systems.

.3 Fumehood and BSC exhaust systems.

.4 Main air handling units and fans.

.5 All existing systems and equipment that will be stopped, and removed and re-installed.

.2 The Agency shall be responsible to the Contractor but report jointly to the Consultant and the Contractor. Report in writing to the Consultant any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.

.3 The balancing agency shall agree to perform spot checks, where requested, in the presence of the Consultant's designated representative.

.4 Work with the agency to:

.1 Ensure that all mechanical systems are complete and ready to be balanced and provide sufficient time for testing and balancing prior to substantial performance.

.2 Make corrections to achieve system balance without delay, include all corrections made during the balancing procedure on "As Built" Drawings. Mechanical Contractor to provide “As Built” information to the balancing agency before balancing commences.

.3 Adjust fan drives, change blade pitch angles and change sheaves and belts as directed by the agency.

.4 Maintain all systems in full operation during the complete testing and balancing period.

.5 Employ control technicians to adjust the control systems to facilitate the balancing process.

.6 Employ the journeyman millwright to check the alignment of any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process. Belt tension correctness to be verified.

.5 Consult with the Consultant to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.

.6 Complete air balance before commencing water balance where heating/cooling coils are installed in the air system. Balancing shall not commence until systems have been cleaned and treated and the air removed from within the piping systems.

.7 Accuracy: Balance to maximum flow deviation of 10% at terminal device and to 5% at equipment. Measurements to be accurate to within plus or minus 5% of actual values. Please note that the Pharmacy clean and ante rooms need to be balanced within the required differential pressures indicated in the NAPRA model standards.

.8 This agency shall remove and re-install ceiling tile to provide access to ductwork and piping. The balancing agency will make good any damage or soiling caused by his forces.

.9 Instrument calibration: At the Consultants request, the balancing agency shall submit a dated calibration chart for all instruments.

.10 Permanently mark final settings on valves, dampers and other adjustment devices. Set and lock all memory stop balancing devices.

.11 Seal all holes with snap plugs or approved alternate method, used for flow and pressure measurements.

.12 The controls contractor and balancing agency are to allow for checking and making adjustments during the 12-month warranty period, when weather conditions provide natural loads and in cases where complaints arise.

.13 Submit a draft balance report to the Consultant for approval and submit approved copies to the agency preparing the O & M manuals for inclusion in each operating and maintenance manual. Provide field notes in the balancing report to clearly identify unusual conditions, problem areas and report on any cases where the specified flow rates or conditions could not be achieved by adjustment. Identify outstanding problems that cannot be corrected by the balancing team or that will not be corrected by the installing trades (e.g. in cases where additional balancing dampers are required).

.14 Submit a statutory declaration to the Consultant, certifying that the testing and balancing procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and, finally, that follow-up testing, after correction of faults and omissions, has been completed and recorded. Reports to be signed by the senior member of the balancing team.

.15 Employ the testing and balancing agency to test all fire dampers as follows:

.1 Test all fire dampers (including combination smoke/fire dampers). The test shall be made by releasing the fusible link and witnessing closure of the damper. All fire dampers shall be left in the open position.

.2 A set of prints shall be marked up to show that each damper has checked for closure, accessibility and installation or provide schematic mechanical drawing showing all fire damper locations, label all fire dampers on drawing. The prints shall be certified correct by the agency and submitted to the consultant with completed test certificates.

.16 Due to the phased nature of the construction it will be necessary to balance one phase of work prior to commencing the next phase so that the hospital can relocate their departments and create working space for the next phase work to proceed. If the systems serving a phase of work cannot be totally balanced due to the overlapping of the phases, temporarily balance the systems to provide satisfactory conditions for occupancy. Provide final balance at the completion of all phases of work.

.2 Air Systems - Balancing

.1 **Prework:** Prior to demolition, in renovated areas, measure and record supply, return and exhaust airflow into existing areas that are not included in the renovations. After renovations are completed, rebalance existing branches to the conditions as found in the pre-construction measurements. Provide written report indicating all areas that have been pre-measured including Pitot tube traverse sheets.

.2 Note: prior to commencing the work take airflow measurements, record static pressure setpoints and speed of fan for:

.1 Supply, return, exhaust and outdoor for AHU-4, including all associated zones.

.2 Total supply, return, and exhaust air from Level 0. The intent is to verity the total airflow offset and pressurization for Level 0.

.3 Pressure setpoint and VFD setpoint for supply, return and exhaust fans and systems serving Level 0 (typical of all).

.3 Balance all return air systems and fans serving Level 0 (e.g. ductwork in the storage area by GL 14) to maintain the total airflow offset for Level 0 as found in pre-construction measurements.

.4 Adjust duct and terminal balance dampers and adjust or change drive sheaves and fan blade pitch angles to obtain design quantities (within +/-10%) at each outlet and inlet.

.5 Use terminal balance dampers to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. The sheet metal sub-contractor shall provide additional dampers where required by the balancing agency to achieve a satisfactory balance without creating objectionable sounds levels.

.6 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross-sectional area of duct. Provide a Pitot tube traverse test sheet for each major duct branch.

.7 Measure air quantities at each air terminal.

.8 Maintain the design relationship between the supply and exhaust air system quantities.

.9 Check to ensure that supply and return air quantities provide reasonable NAPRA room to room and building pressurization. Test building pressurization levels in variable volume systems throughout full range of fan delivery rates, under occupied, unoccupied, heating and cooling conditions. Exit doors and elevator shafts should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.10 Adjust the air terminals to obtain the optimum air distribution pattern. The total airflow through each air valve/mixing box should be adjusted and reported by the balancing agency for maximum and minimum flow conditions.

.11 Controllers on air valves/mixing boxes are to be checked by the controls contractor and the commissioning agent and they shall also verify that room thermostats / sensors are cycling valves/mixing boxes properly.

.12 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.

.13 Where variable air volume systems are installed, take measurements at maximum and minimum flows. Record the minimum operating duct static pressure setpoint for each air handling system.

.14 Balance of the rooms in the pharmacy to ensure that the air flow into or out of the rooms is in the correct direction. Balance to maintain the required pressures. Report to the Consultant where the desired pressure differential cannot be achieved within 10% of the design values for further direction. This may indicate a problem with how well the rooms are sealed or excessive leakage needs to be dealt with.

.15 The Balancing Agency shall include for return visits for readjustment of systems after the owner has moved in.

.16 Include in the air balance report:

- .1 Date of test, Name and address of building and balancing technician's name.
- .2 Range of outdoor air temperature during the balancing period.
- .3 System schematics indicating damper positions, design and measured air quantities at each inlet and outlet. Show room numbers and floors.
- .4 If installation permits, record both air terminals and fan discharge traverse air volumes to establish system leakage.
- .5 Main branch duct traverses. Maximum and minimum outdoor air quantities.

.6 Static pressure across each component in an air handling system at full flow.

.7 Face velocities across major components such as filter or coils.

.8 Static pressure across each fan.

.9 System static pressures at selected points throughout a VAV supply duct system and in main branch ducts in low velocity systems.

.10 Fan and motor speed.

.11 Motor size, starting time, amps and voltage.

.12 Coil air entering and leaving temperatures (D.B. and W.B.).

.13 Maximum and minimum zone supply air temperatures under prevailing conditions at time of test.

.14 Provide fan performance curve for each new air handling system.

.15 Air pressure map (i.e. positive, negative, neutral) and directional airflow for all spaces.

.3 Liquid Systems – Balancing

.1 Connections are being made to the existing chilled and hot water / glycol systems of the Building. Measure the flow rate to the existing systems prior to any changes taking place. Temporary command all control valves to 100% open to achieve full design flow. Re-balance the existing heating and chilled water systems on completion of the works to achieve the original water flow rates.

.1 Note: prior to commencing the work take flow measurements and record pressure setpoints of:

.1 Existing hot water / glycol pumps operating flow and pressure.

.2 Existing chilled water / glycol pumps operating flow and pressure.

.3 Hot water flow rate of existing re-heat coils that will be removed.

.4 Existing rooftop chiller flow rate.

.2 Re-balance the hot and chilled water loops for VAV's, AHU's, and chillers to maintain flow rates as found in pre-construction measurements. Coordinate with the Controls contractor for any required modifications to the hot and chilled water loops pressure setpoints. Balance hot and chilled water pumps based on the new hot and chilled water demand of the building.

.3 Set balance valves and balance fittings to provide required or design flow rates for each system component.

.4 Use installed flow measuring devices to determine flow rates for system balance. Where flow measuring devices are not installed, base flow balance on the air and liquid temperature difference across terminal heating/cooling elements and coils, acknowledging the different design temperature drops/rises used in the design of the systems.

.5 Effect system balance with automatic control valves fully open to heat transfer elements.

.6 Trim pump impellors to match pump performance to system characteristics rather than artificially increasing system pressure drops to match pump characteristics. Additional costs incurred in trimming the impellors will be considered as an extra.

.7 Check air vents to ensure that they are correctly installed and are operating properly. The mechanical contractor shall ensure that all air is removed from within the piping system and that there is flow throughout all piping systems before the balancing is started.

.8 Include in the liquid balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing procedure.

.3 Heating Coils: Tag, service & location. Specified and actual capacity, flow, liquid pressure drop, liquid entering and leaving temperatures, air-side entering and leaving temperatures.

.4 Flow measuring devices: Flow rates.

.5 Terminal heating elements: Entering and leaving liquid temperatures.

.6 System schematics: Specified and actual flow rates.

1.6 TYPE II B2 BIOSAFETY CABINENTS - BALANCING

.1 Certifying and balancing of all exhaust Biosafety Cabinets (BSC) systems shall be carried out as follows:

.1 Check room condition in front of the BSC using an anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20% of the specified average face velocity. Any cross drafts that exceed these values shall be eliminated before proceeding with the BCS tests.

.2 Determine specified average face velocity (required by NAPRA / Manufacturer) by averaging the velocity of at least nine readings taken at the BCS face. Readings shall be taken at the centres of a grid made up of three sections of equal area across the top one third, three across the centre and three across the bottom third of the fume hood face. Use of a thermal anemometer or equivalent is recommended for this test. Adjust exhaust fan as required to achieve specified average face velocities within minus 0% and plus10%.

.3 Smoke tests shall be conducted at BSC face openings. These tests are to be used as an evaluation of spillage or backdraft conditions at all levels and positions across face opening. Small smoke gun is recommended for these tests.

.4 Upon completion of these tests, a report analysis shall be prepared which will list the following final conditions:

.1 Exhaust fan operating characteristics including speed, static pressures, motor amperages and total exhaust flow.

.2 Position of hood sash.

.3 Face velocity readings taken at BSC opening.

.4 Results of smoke test spillage tests.

.5 Operating condition of surrounding area air conditioning or supply air system.

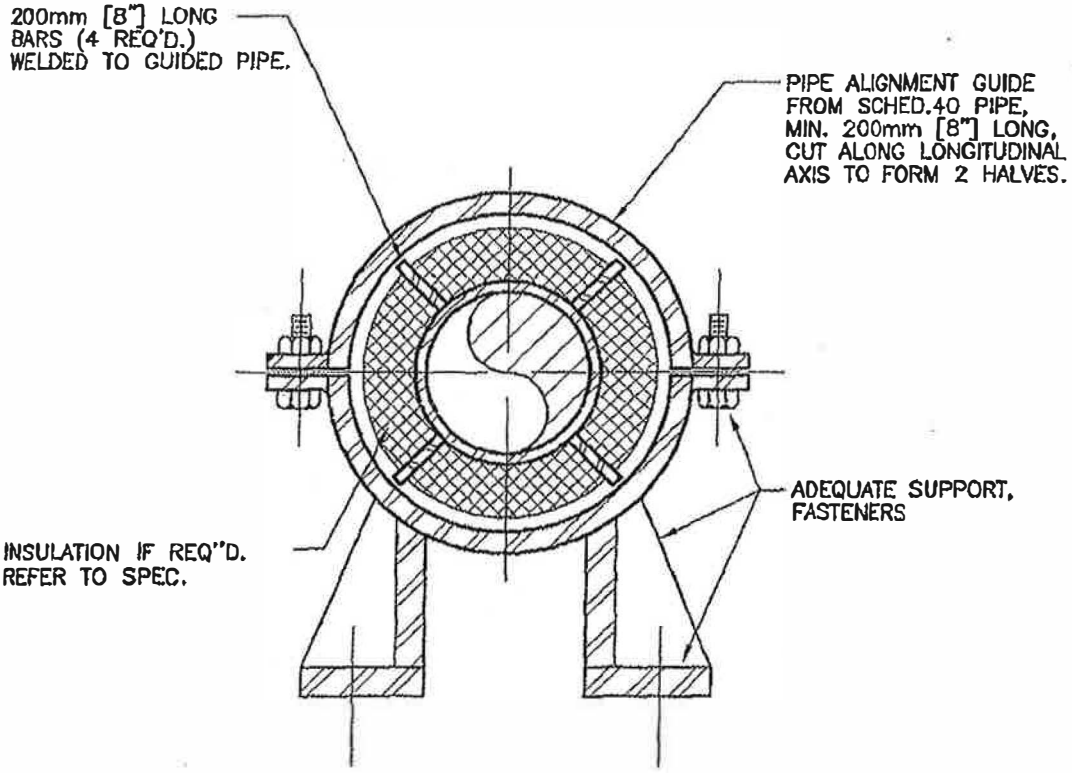
END OF SECTION

Detail Number	Detail Name
MD 01 000	
• MD 01 005	RADIATION WARNING SYMBOL
MD 02 000	**Pipe Hangers and Supports**
• MD 02 001	PIPE GUIDE
• MD 02 002	PIPE HANGERS
• MD 02 003	PIPE SUPPORT – ROLL HANGERS
• MD 02 005	PIPE GUIDE AT FLOOR SLAB
• MD 02 006	PIPE ANCHOR AT FLOOR SLAB
• MD 02 007	PIPE ANCHOR AND PIPE/DUCT SUPPORT on roof
MD 03 000	**Pipe Venting**
• MD 03 001	AUTOMATIC AIR VENT (HIGH CAPACITY)
• MD 03 002	LOW PRESSURE SYSTEM – MANUAL VENT
• MD 03 003	AIR VENT DRAIN DETAIL
MD 07 000	**Pipe Penetrations**
• MD 07 001	PIPE PENETRATION THROUGH ROOF
• MD 07 002	PIPE PENETRATIONS THROUGH ROOF
• MD 07 008	PIPE AND DUCT PENETRATION THROUGH INTERSTITIAL FLOOR
• MD 07 009	service penetrations through non-rated walls
• MD 07 010	PIPE PENETRATION THROUGH FIRE-RATED SEPARATION
MD 08 000	**Equipment Piping Connections**
• MD 08 003	PIPING to heat EXCHANGER (STEAM/LIQUID)
• MD 08 005	PRIMARY-SECONDARY PIPING FOR HEATING SYSTEM
• MD 08 006	PRIMARY-SECONDARY PIPING FOR COOLING SYSTEM
• MD 08 009	CHILLER PIPING ARRANGEMENT
• MD 08 011	EXPANSION LOOP DETAIL
MD 09 000	**Piping to Coils**
• MD 09 004	3-WAY VALVE STATION WITH UPFED CIRCULATING PUMP (N.O. TO COIL)
• MD 09 009	2-WAY VALVE STATION (COOLING COIL)
• MD 09 011	DUCT MOUNTED REHEAT COIL INSTALLATION

MD 10 000	**Piping to Terminal Units**
• MD 10 001	RADIATION PIPING SCHEMATIC (SINGLE ROW)
• MD 10 002	RADIATION PIPING SCHEMATIC (DOUBLE ROW)
• MD 10 009	PIPING CONNECTIONS TO UNIT HEATER WITH 2-WAY VALVE CONTROL
• MD 10 012	PIPING CONNECTIONS TO FAN COIL UNIT
• MD 10 013	PIPING CONNECTIONS TO CABINET UNIT HEATER
• MD 10 016	WATER-COOLED AIR CONDITIONING UNIT INSTALLATION
MD 11 000	**Steam & condensate Piping**
• MD 11 002	STEAM TRAP STATIONS SCHEMATICS
• MD 11 003	HIGH PRESSURE STEAM TEST STATION
• MD 11 004	F & T TRAP STATION
• MD 11 005	STEAM PRESSURE REDUCING STATION
• MD 11 006	STEAM PRESSURE REDUCING STATION
• MD 11 008	STEAM METER INSTALLATION
• MD 11 010	CONDENSATE COOLING POT
• MD 11 011	steam drip pan elbow
• MD 11 014	STEAM PRESSURE REDCING STATION
• MD 11 015	STEAM MAIN DRIP STATION
MD 17 000	**Expansion Tanks**
• MD 17 003	DIAPHRAGM EXPANSION TANK
MD 20 000	**Pumps**
• MD 20 001	VERTICAL IN-LINE PUMP INSTALLATION
• MD 20 003	CHEMICAL POT FEEDER
• MD 20 004	top suction-top discharge vertically mounted pumps
MD 21 000	**Sheet Metal / Ducting**
• MD 21 002	DUCT TAKE-OFF CONNECTION
• MD 21 034	PLENUM WALL CONSTRUCTION
• MD 21 035	TRANSFER DUCT
• MD 21 041	FAN / DUCT FLEXIBLE CONNECTION
• MD 21 043	GOOSENECK EXHAUST OR INTAKE

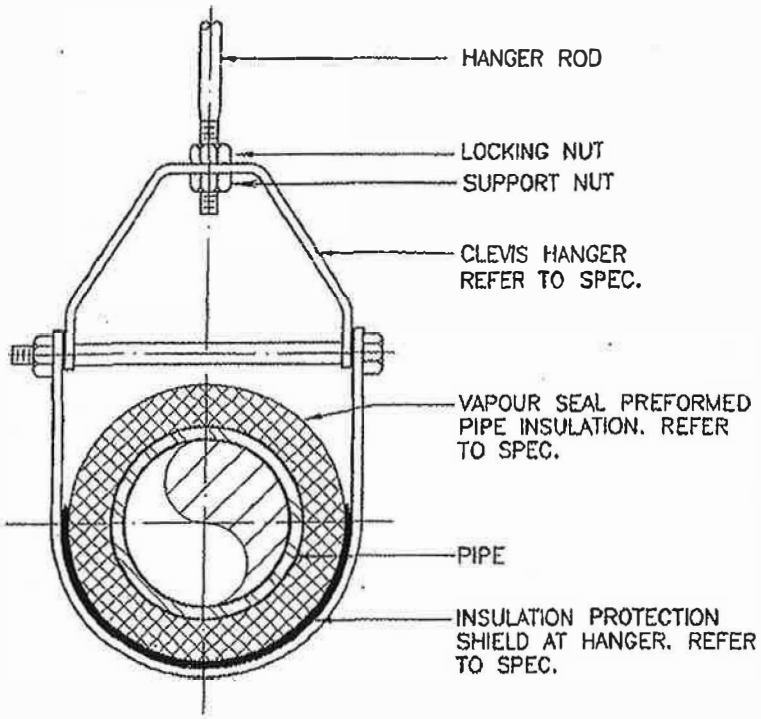
MD 22 000	**Duct Penetrations**
• MD 22 005	ducting through roof
• MD 22 008	DUCT PENETRATION THROUGH ROOF
• MD 22 012	ROOF CURB cap
• MD 22 013	duct penetrations through roof
MD 23 000	**Roof Mounted Equipment**
• MD 23 005	ROOF MOUNTED EXHAUST FAN
• MD 23 010	EQUIPMENT ROOF PADS/PIERS
• MD 23 011	ROOFTOP UNIT MOUNTING INSTALLATION
• MD 23 013	EQUIPMENT ROOF CURB
• MD 23 020	MOUNTING OF ROOFTOP EQUIPMENT
MD 28 000	**Fire / Smoke Dampers**
• MD 28 001	FIRE DAMPER (TYPE “B”)
• MD 28 003	ACCESS TO FIRE DAMPER (ROUND DUCT TO 300 MM [12”])
• MD 28 004	CEILING DAMPER / FIRE STOP INSTALLATION
• MD 28 006	FIRE DAMPER AND SUPPLY GRILLE INSTALLATION
MD 29 000	**Air Terminal Units**
• MD 29 002	AIR VALVE INSTALLATION (RE-HEAT COIL)
• MD 29 003	VENTURI AIR VALVE INSTALLATION - SINGLE
• MD 29 004	VENTURI AIR VALVE INSTALLATION - DUAL
MD 30 000	**Air Terminals**
• MD 30 002	RETURN/EXHAUST GRILLE WITH PLENUM
• MD 30 004	RETURN/EXHAUST DUCT IN STUD WALL
• MD 30 006	GRILLE MOUNTED ON EXPOSED RECTANGULAR DUCT
• MD 30 007	DUCT CONNECTIONS TO AIR TERMINALS
• MD 30 011	SUPPLY AIR DIFFUSER
• MD 30 013	EXHAUST/RETURN AIR PLENUM
• MD 30 014	REMOTE BALANCING DAMPER CONTROL
• MD 30 015	EXHAUST AIR OUTLET AT CEILING FOR LAB EQUIPMENT VENTING

MD 32 000	**Electrical**
• MD 32 003	HEAT TRACING

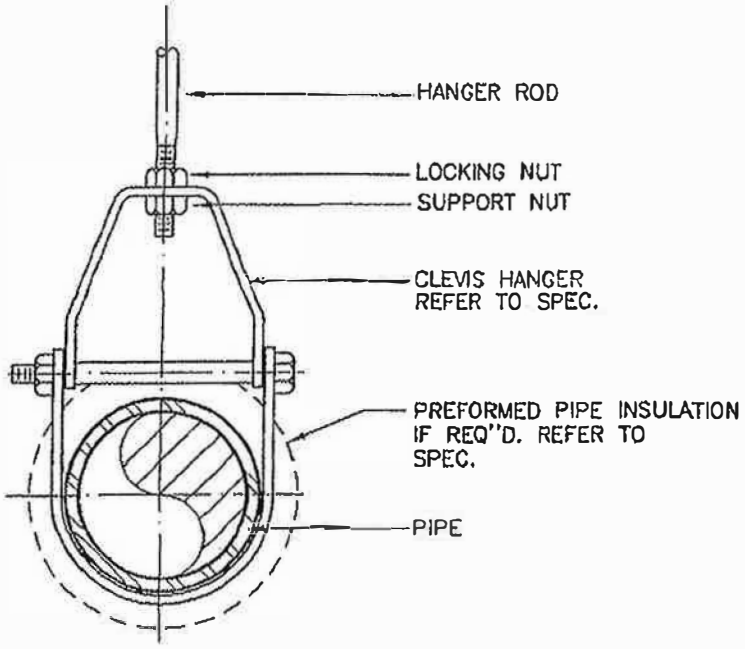

200mm [8"] LONG
BARS (4 REQ'D.)
WELDED TO GUIDED PIPE.
PIPE ALIGNMENT GUIDE
FROM SCHED.40 PIPE,
MIN. 200mm [8"] LONG,
CUT ALONG LONGITUDINAL
AXIS TO FORM 2 HALVES.
ADEQUATE SUPPORT,
FASTENERS
INSULATION IF REQ'D.
REFER TO SPEC.

FOR NPS 2-1/2 PIPE AND LARGER. REFER TO SPEC. FOR INSERTS OR HIGH DENSITY INSULATION AT INSULATION PROTECTION SHIELDS.

FOR COLD PIPING 10°C [50°F] OR LESS.

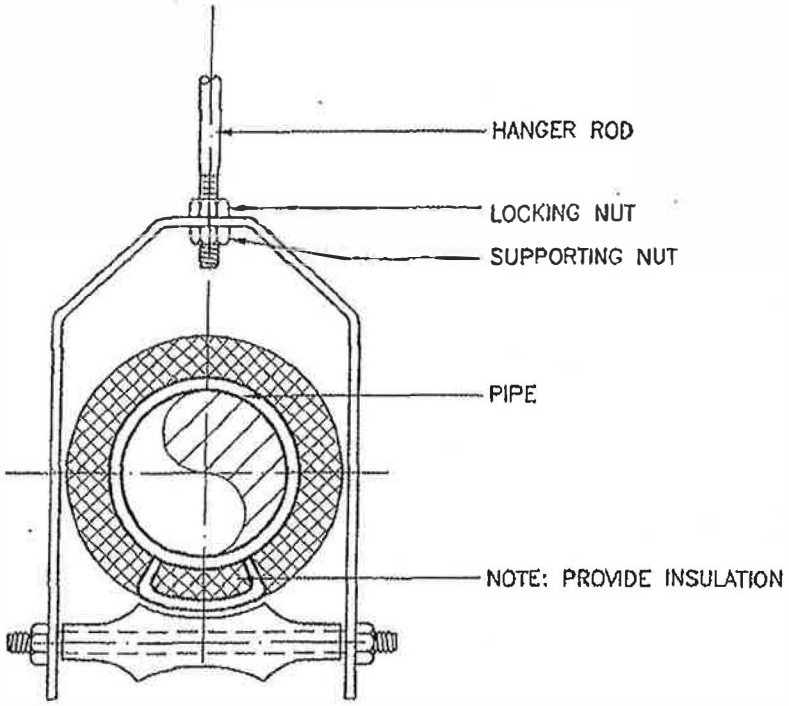


HANGER DETAIL FOR PIPING WITH VAPOUR SEALED INSULATION



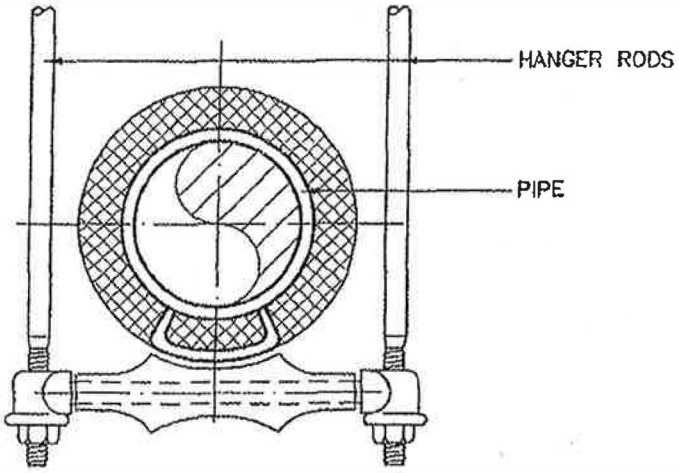
HANGER DETAIL FOR INSULATED HOT PIPING UP TO NPS 3 (75mm) OR ALL SIZES OF BARE PIPE

FOR INSULATED HOT PIPING NPS 4 & 6

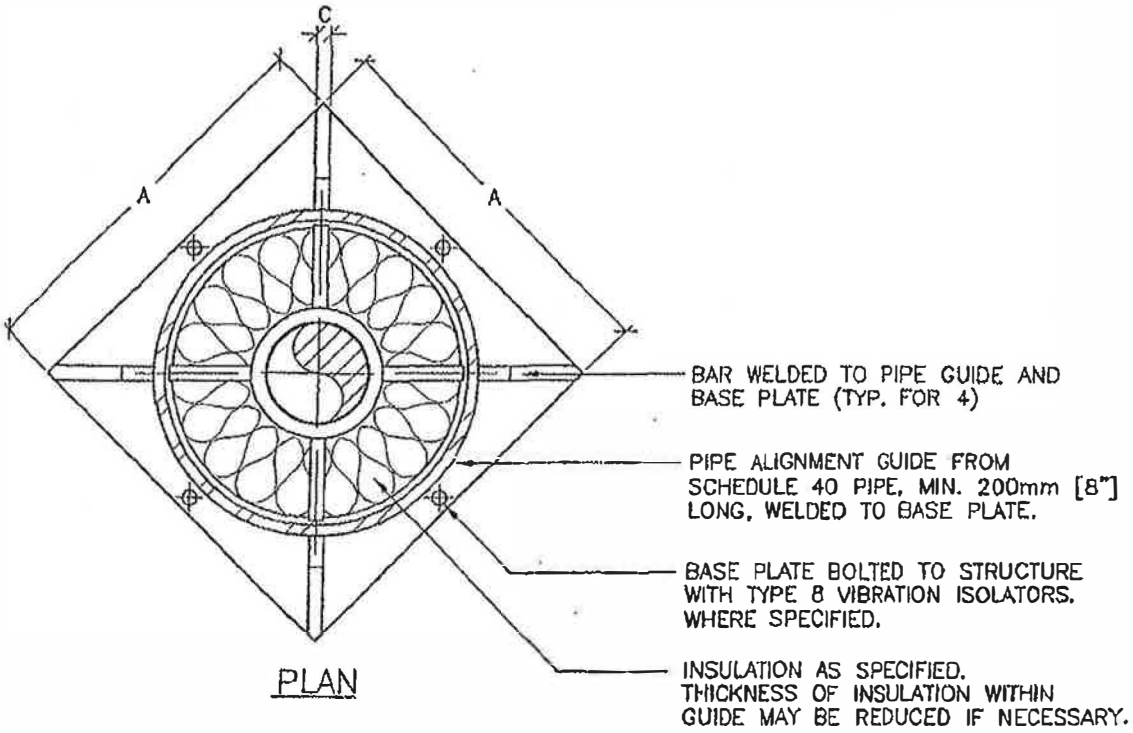


SINGLE ROD HANGER

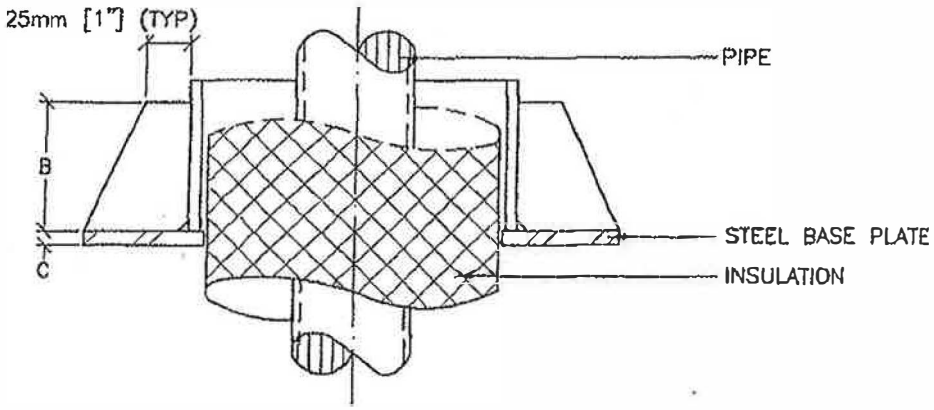
FOR INSULATED HOT PIPING NPS 8 AND LARGER



DOUBLE ROD HANGER

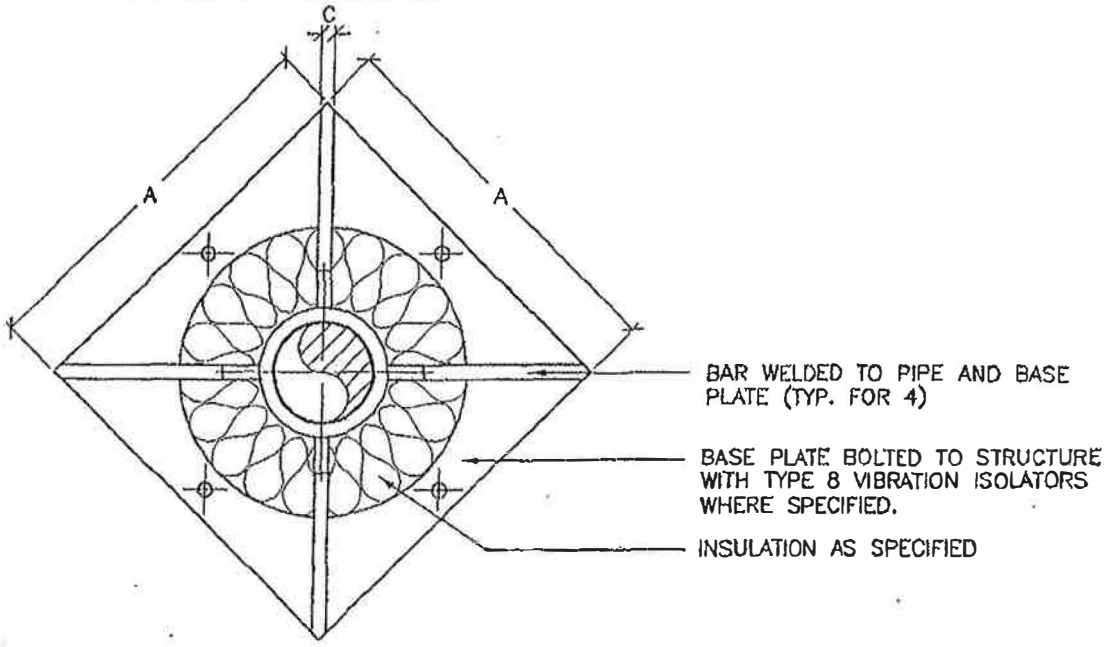


PLAN

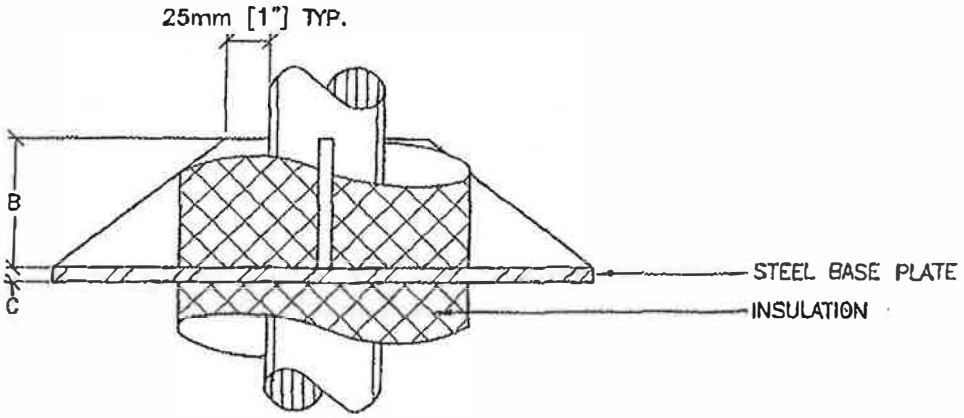


SECTION

PIPE SIZE	A	B	C
NPS 2	250mm [10"]	100mm [4"]	9.5mm [3/8"]
NPS 2-1/2	400mm [16"]	150mm [6"]	12.5mm [1/2"]
NPS 3	400mm [16"]	175mm [7"]	12.5mm [1/2"]
NPS 4	425mm [17"]	175mm [7"]	12.5mm [1/2"]
NPS 5	475mm [19"]	200mm [8"]	12.5mm [1/2"]
NPS 6	525mm [21"]	200mm [8"]	12.5mm [1/2"]
NPS 8	610mm [24"]	254mm [10"]	19.0mm [3/4"]
NPS 10	711mm [28"]	355mm [14"]	19.0mm [3/4"]



PLAN



SECTION

PIPE SIZE	A	B	C
NPS 2	250mm [10"]	100mm [4"]	9.5mm [3/8"]
NPS 2-1/2	400mm [16"]	150mm [6"]	12.5mm [1/2"]
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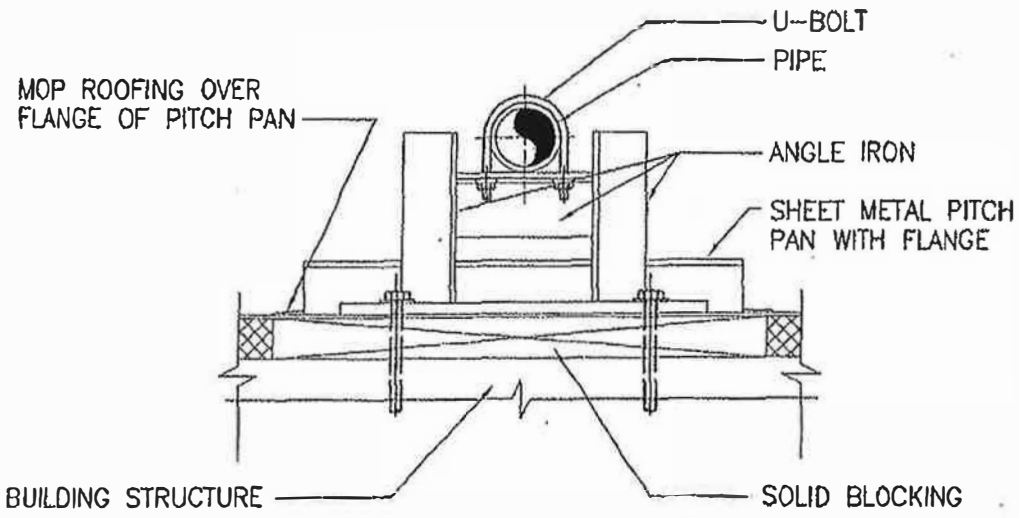
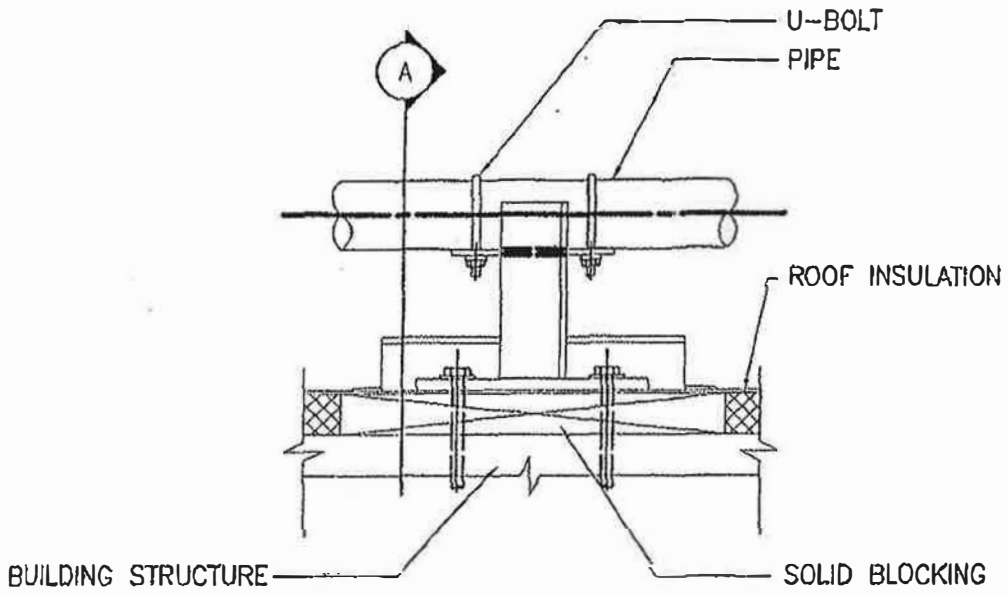
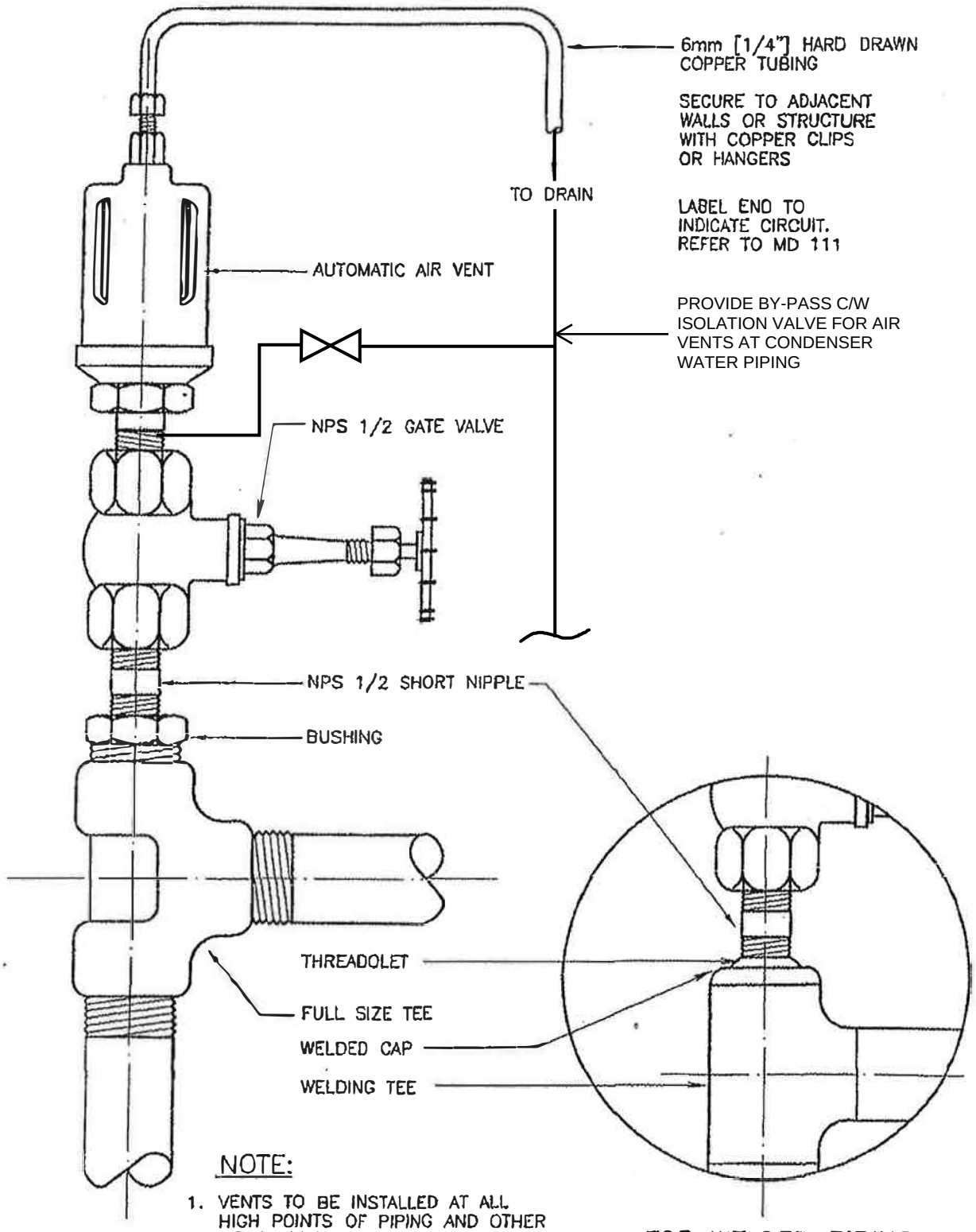

U-BOLT
PIPE
MOP ROOFING OVER FLANGE OF PITCH PAN
ANGLE IRON
SHEET METAL PITCH PAN WITH FLANGE
BUILDING STRUCTURE
SOLID BLOCKING

SECTION A-A

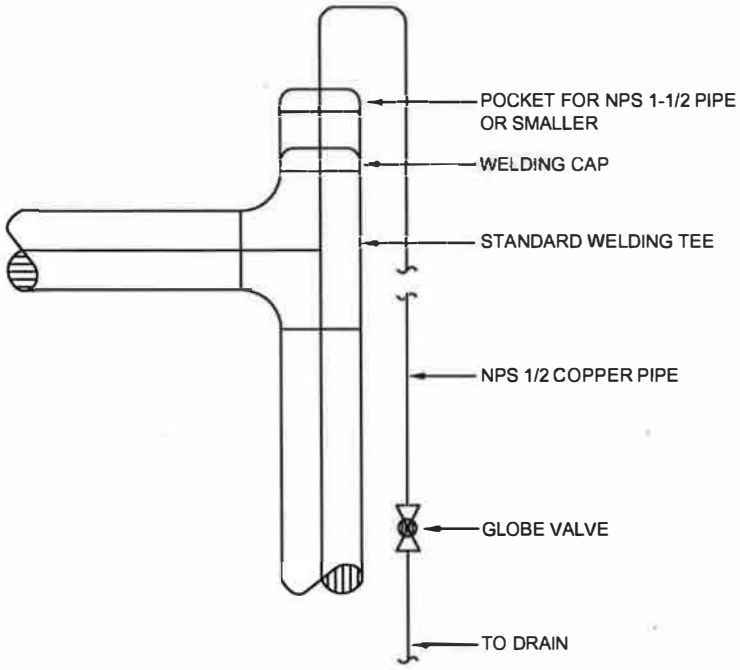

U-BOLT
PIPE
A
ROOF INSULATION
BUILDING STRUCTURE
SOLID BLOCKING



NOTE:

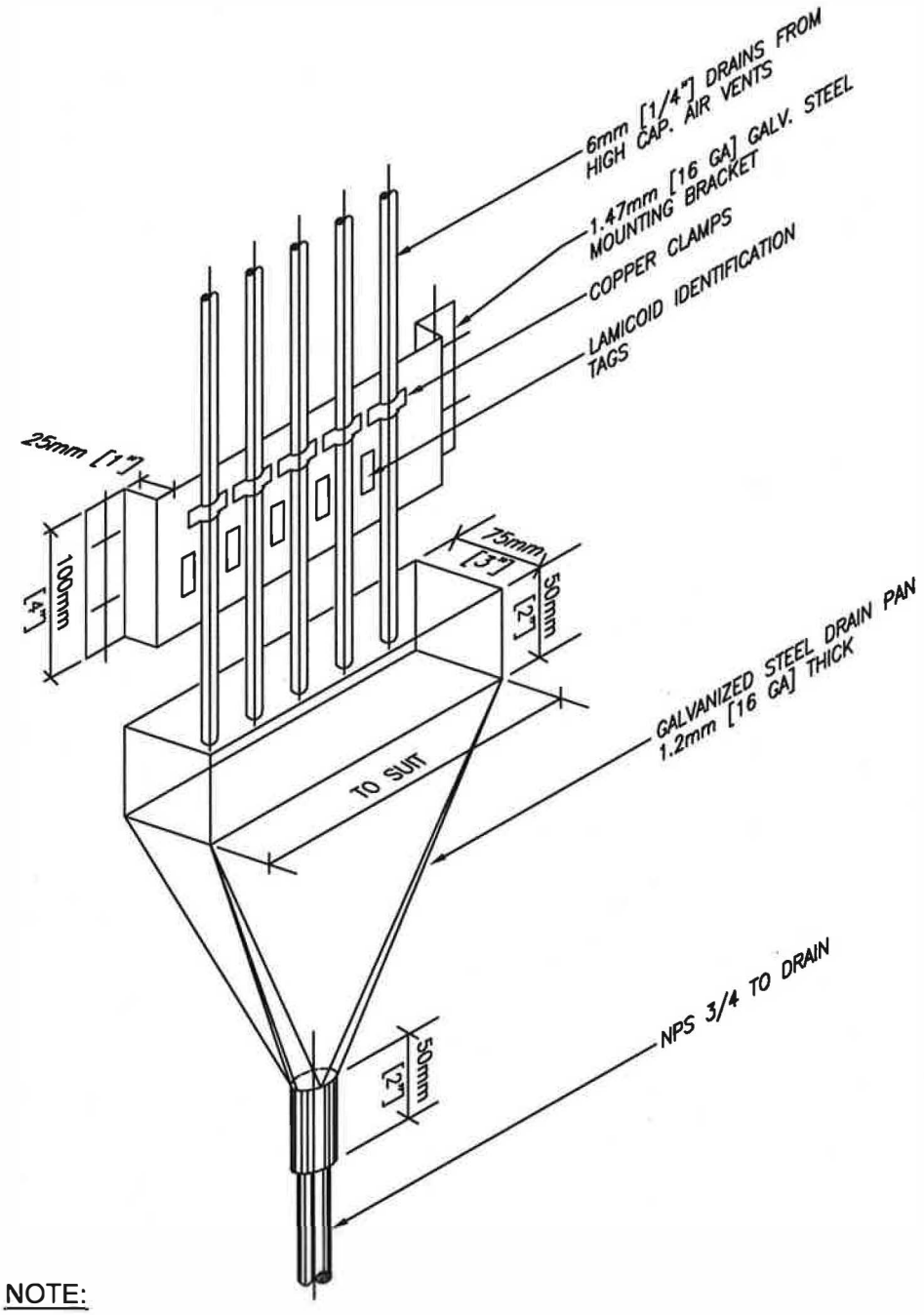
1. VENTS TO BE INSTALLED AT ALL HIGH POINTS OF PIPING AND OTHER AIR COLLECTING LOCATIONS.

FOR WELDED PIPING



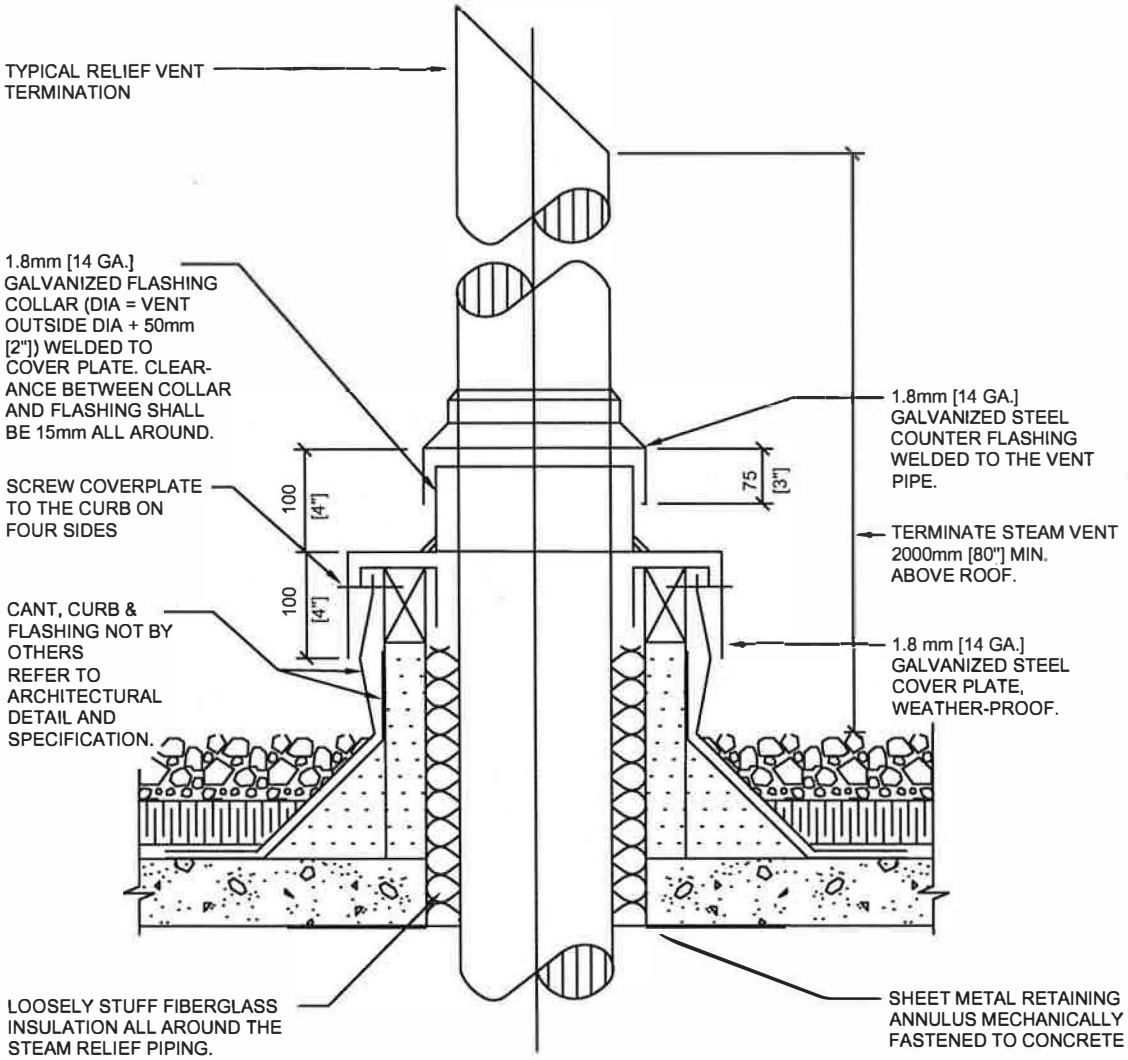
NOTES:

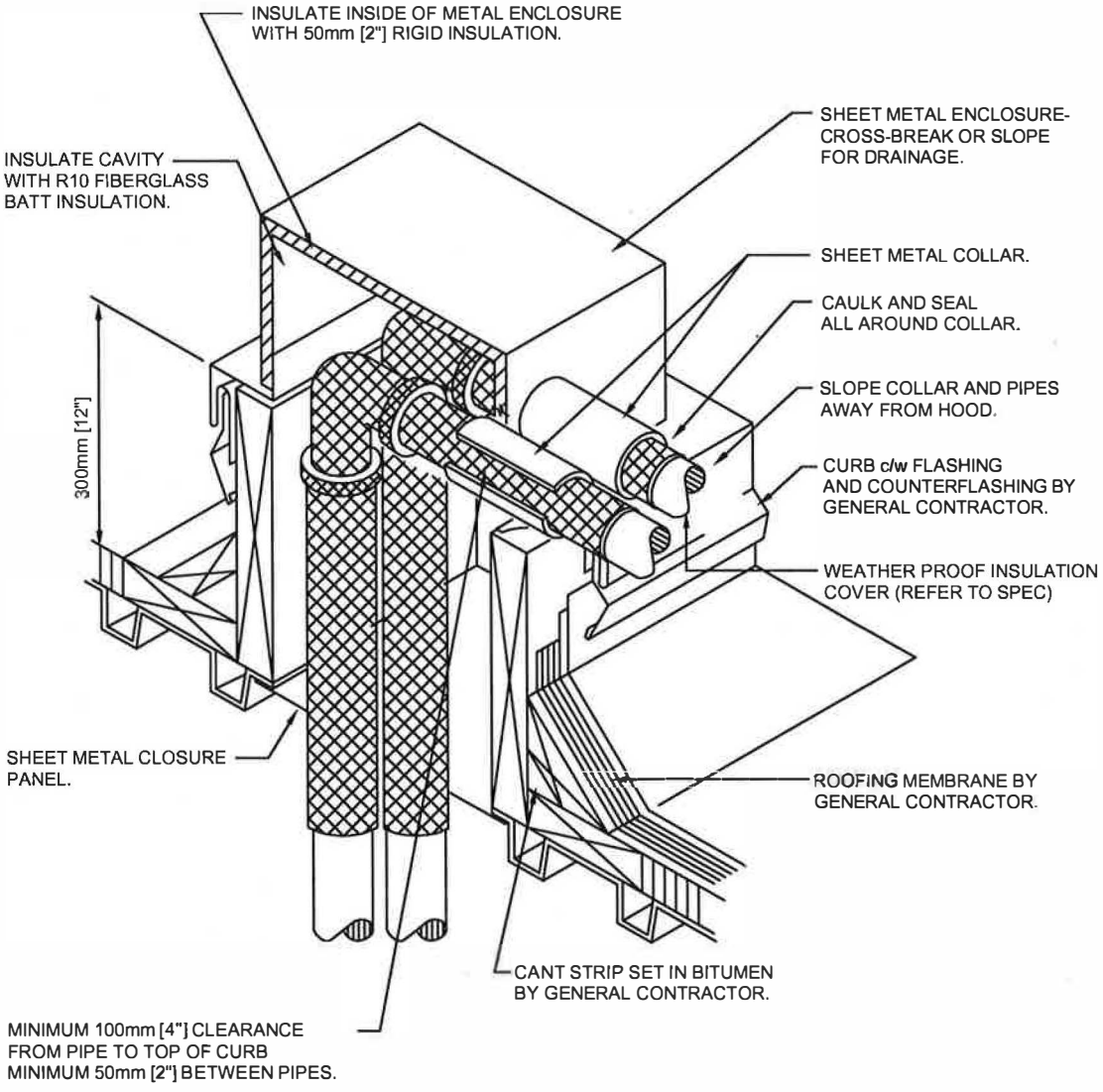
1. TYPICAL FOR NPS 2-1/2 & LARGER.
2. FOR NPS 2 & SMALLER AS ABOVE BUT POCKET SHALL BE MIN. 200mm [8"] LONG.



NOTE:

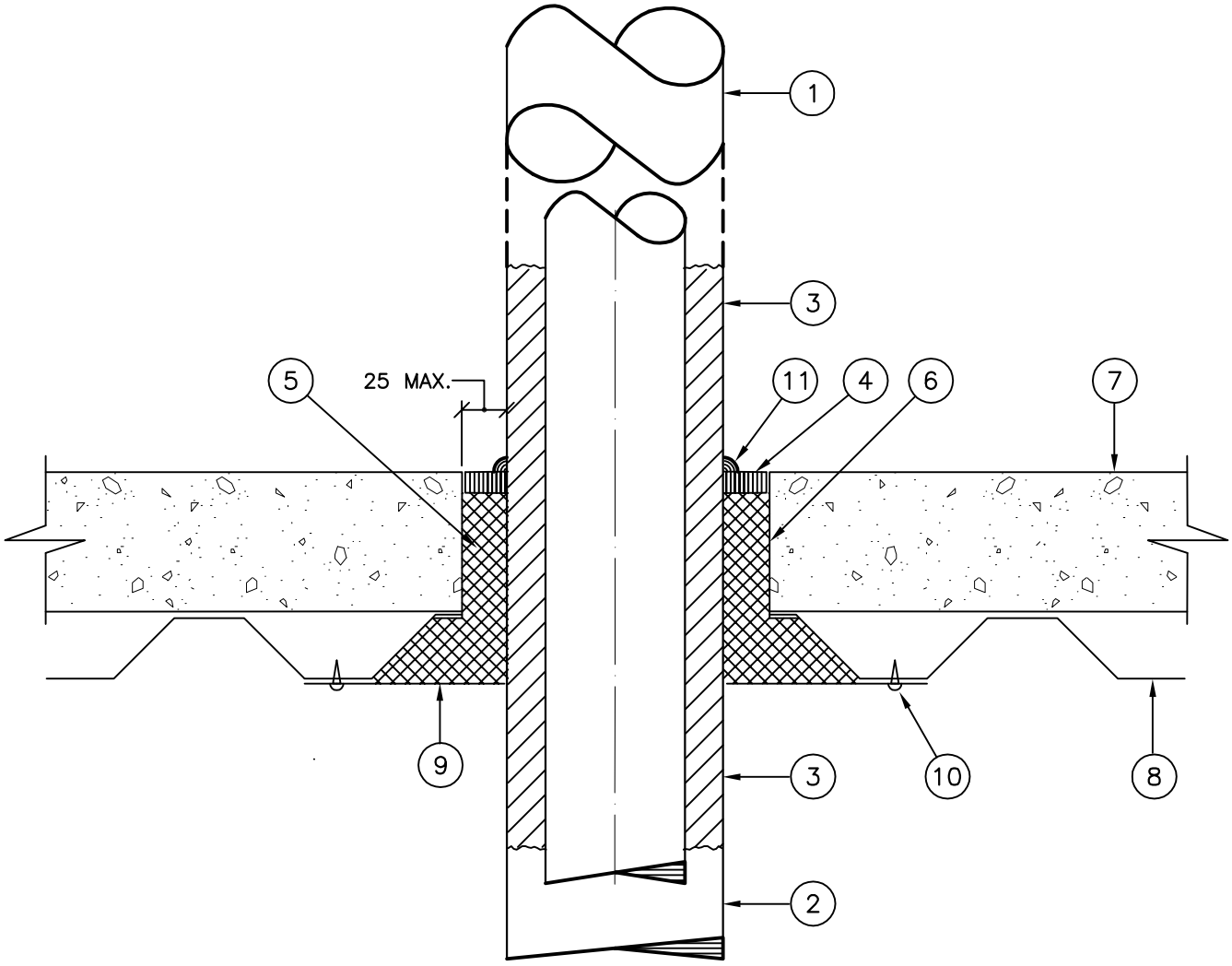
1. TYPICAL ARRANGEMENT SHOWN.
   LENGTH AND NO. OF VENT DRAINS TO SUIT INSTALLATION.
   FUNNEL SHOULD BE IN VISIBLE ACCESSIBLE LOCATION
   OR AS SHOWN ON DWGS.


TYPICAL RELIEF VENT TERMINATION
1.8mm [14 GA.] GALVANIZED FLASHING COLLAR (DIA = VENT OUTSIDE DIA + 50mm [2"]) WELDED TO COVER PLATE. CLEARANCE BETWEEN COLLAR AND FLASHING SHALL BE 15mm ALL AROUND.
SCREW COVERPLATE TO THE CURB ON FOUR SIDES
CANT, CURB & FLASHING NOT BY OTHERS REFER TO ARCHITECTURAL DETAIL AND SPECIFICATION.
LOOSELY STUFF FIBERGLASS INSULATION ALL AROUND THE STEAM RELIEF PIPING.
100 [4"]
100 [4"]
75 [3"]
1.8mm [14 GA.] GALVANIZED STEEL COUNTER FLASHING WELDED TO THE VENT PIPE.
TERMINATE STEAM VENT 2000mm [80"] MIN. ABOVE ROOF.
1.8 mm [14 GA.] GALVANIZED STEEL COVER PLATE, WEATHER-PROOF.
SHEET METAL RETAINING ANNULUS MECHANICALLY FASTENED TO CONCRETE



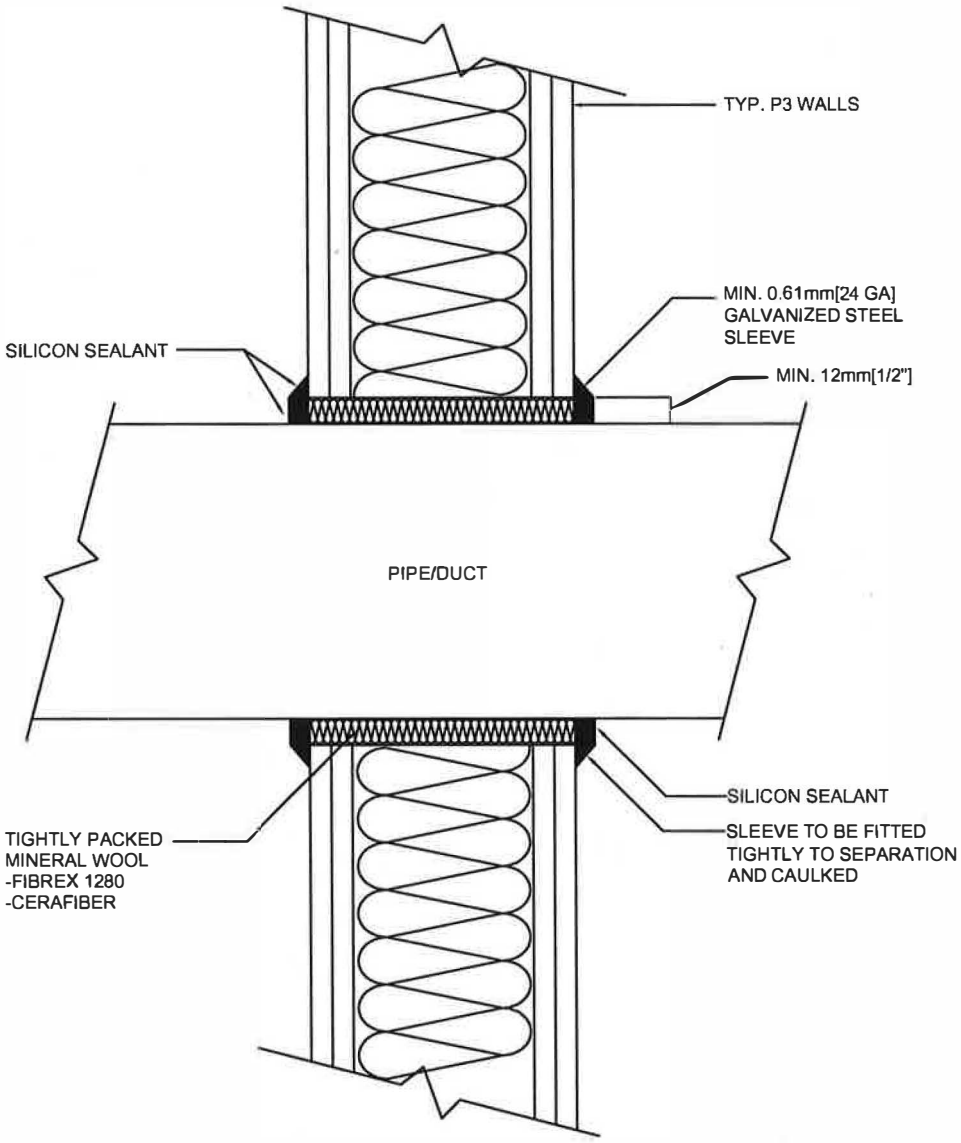
NOTES:

1. ALL WORK BY THIS DIVISION, UNLESS OTHERWISE NOTED.



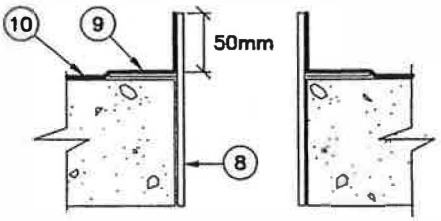
NOTES:

1. UNINSULATED PIPE
2. UNINSULATED DUCT
3. INSULATION (AS SPECIFIED)
4. MIN. 12mm [1/2"] THICK – U.L.C. APPROVED FIRE STOP SEALANT
5. MINERAL WOOL INSULATION – MANSON "CERAFIBER" OR CARBORUNDUM "FIBERFRAX" TIGHTLY PACKED
6. CORE OR FORMED HOLE IN CONCRETE FLOOR
7. 65mm DEEP CONCRETE FLOOR
8. 38mm DEEP STEEL DECK
9. SHEETMETAL RETAINING PLATE
10. SHEETMETAL SELF TAPPING SCREW
11. BEAD OF FIRE STOP SEALANT
12. PIPE INSTALLATION TO ENSURE THAT NO PIPE EXPANSION OCCURS AT FIRE STOP



NOTES:

1 FOR SERVICE PENETRATIONS THRU RATED SEPARATIONS REFER TO SPECIFICATION SECTION 15010-CLAUSE 1.35.



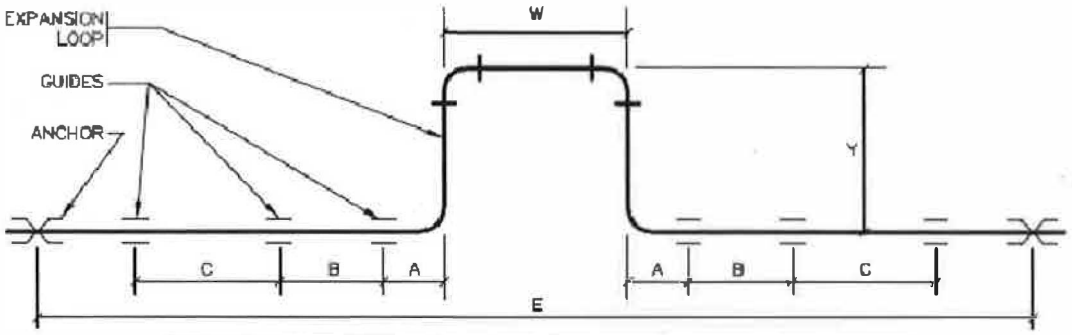
PIPE SLEEVE THROUGH FIRE-RATED FLOOR SLAB IN WET AREAS

NOTES:

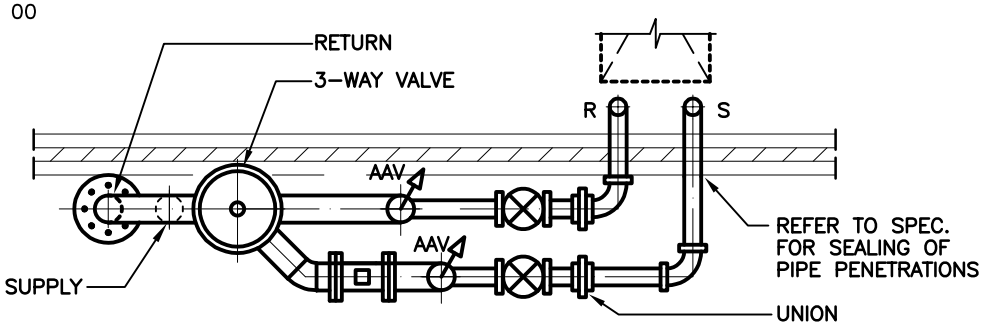
1. UNINSULATED PIPE.
2. INSULATION (AS SPECIFIED). TERMINATE INSULATION AT FIRE STOP.
3. 0.61mm [24 GA] GALVANIZED STEEL SLEEVE (NOT REQ'D. FOR CORE DRILLED CONCRETE OPENINGS). SEE NOTE 8 FOR WET AREAS.
4. MIN. 12mm [1/2"] THICK – U.L.C. APPROVED FIRE STOP SEALANT. SEAL BOTH SIDES (TO MAINTAIN RATING ON GYPROC WALLS; TO RETAIN MINERAL WOOL INSULATION; TO SEAL VAPOUR BARRIER ON COLD PIPES).
5. MINERAL WOOL INSULATION – MANSON "CERAFIBER" OR CARBORUNDUM "FIBERFRAX" TIGHTLY PACKED.
6. FIRE RATED GYPROC WALL.
7. FIRE RATED CONCRETE FLOOR OR WALL.
8. PIPE SLEEVE (SCHED. 40).
9. FLANGE WELDED TO SLEEVE.
10. WATERPROOF MEMBRANE.
11. OVERALL THICKNESS OF MINERAL FIBER PACKING (5) AND FIRE STOP SEALANT (4) TO ENSURE REQUIRED FIRE – RESISTANCE RATING OF SEPARATION.
12. BEAD OF FIRE STOP SEALANT.
13. PIPE INSTALLATION TO ENSURE THAT NO PIPE EXPANSION OCCURS AT FIRE STOP.
14. SUBMIT SHOP DRAWINGS

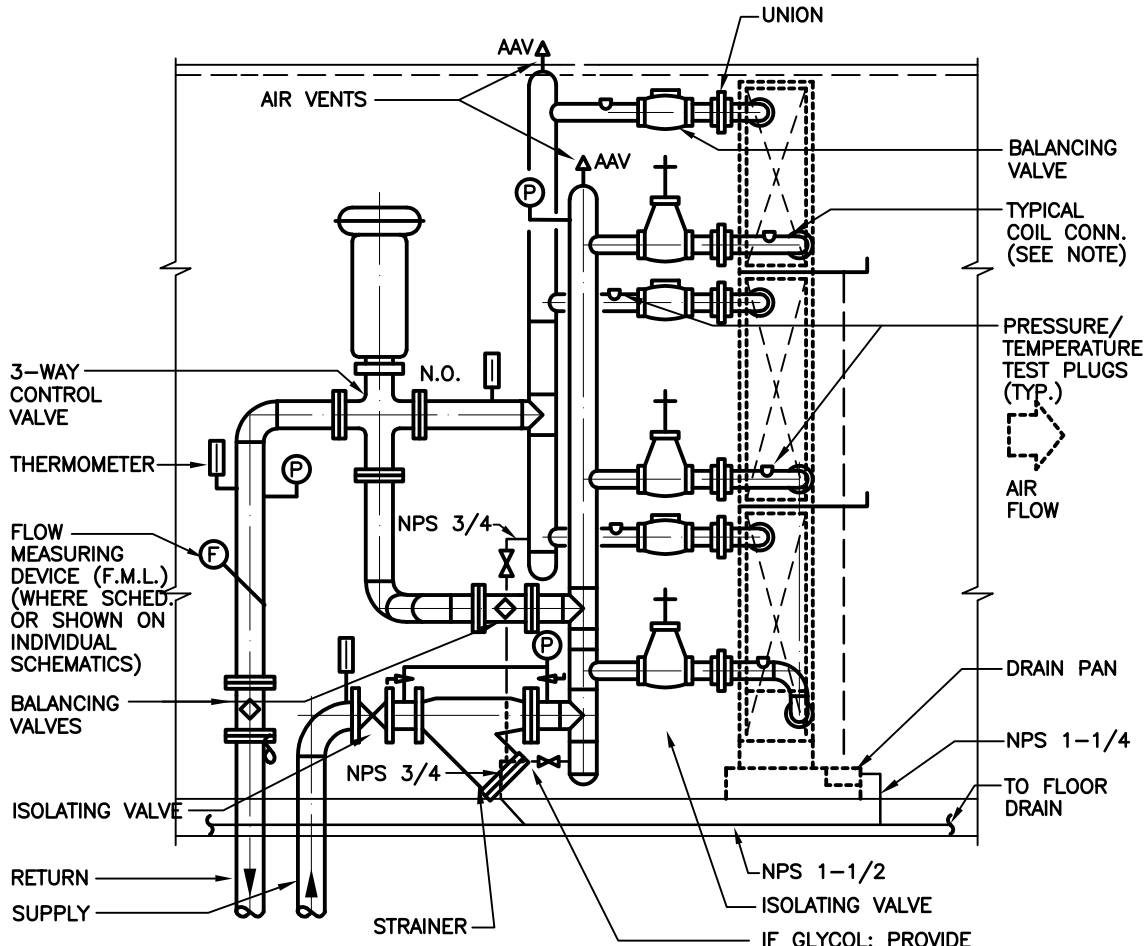
LOOP SIZING DATA:

1. USE THESE FORMULAS FOR TEMPERATURE DIFFERENCES NOT EXEEDING 110°C. FOR OTHER CONDITIONS USE THE ASHRAE GUIDE DATA BOOK.
2. LENGTH OF PIPE IN LOOP "L"mm = 2Y + W
3. FOR LENGTH "L" US THE FOLLOWING FORMULAS;
   a. STEEL PIPE $L = 2.67\sqrt{D \times E}$
   b. COPPER PIPE $L = 3.17\sqrt{D \times E}$
4. D = DIAMETER IN mm
5. E = DISTANCE BETWEEN ANCHORS IN mm



ACTUAL DIA. mm	PIPE SIZE mm	MAXIMUM DISTANCE		MAXIMUM SPACING BETWEEN GUIDES
D	NOMINAL	A	B	C
33	25	200	600	3000
42	30	200	600	3000
48	40	200	900	4500
60	50	200	900	4500
73	65	250	1200	6000
89	75	300	1200	6000
114	100	400	1500	9000
168	150	500	3000	10500
219	200	750	3000	13500
273	250	1000	3600	18000
324	300	1200	3600	21000
356	350	1400	3600	21000
406	400	1600	4500	24000
457	450	1800	4500	25500
508	500	2000	6000	27000
610	600	2400	6000	31500





NOTE:

1. COIL BALANCING & ISOLATING VALVES SHOWN ARE FOR SIZE NPS 2 AND SMALLER. VALVES NPS 2–1/2 AND LARGER ARE TO BE FLANGED AS PER SPEC.
2. DO NOT PIPE GLYCOL COIL TO DRAIN. CAP DRAIN VALVES.

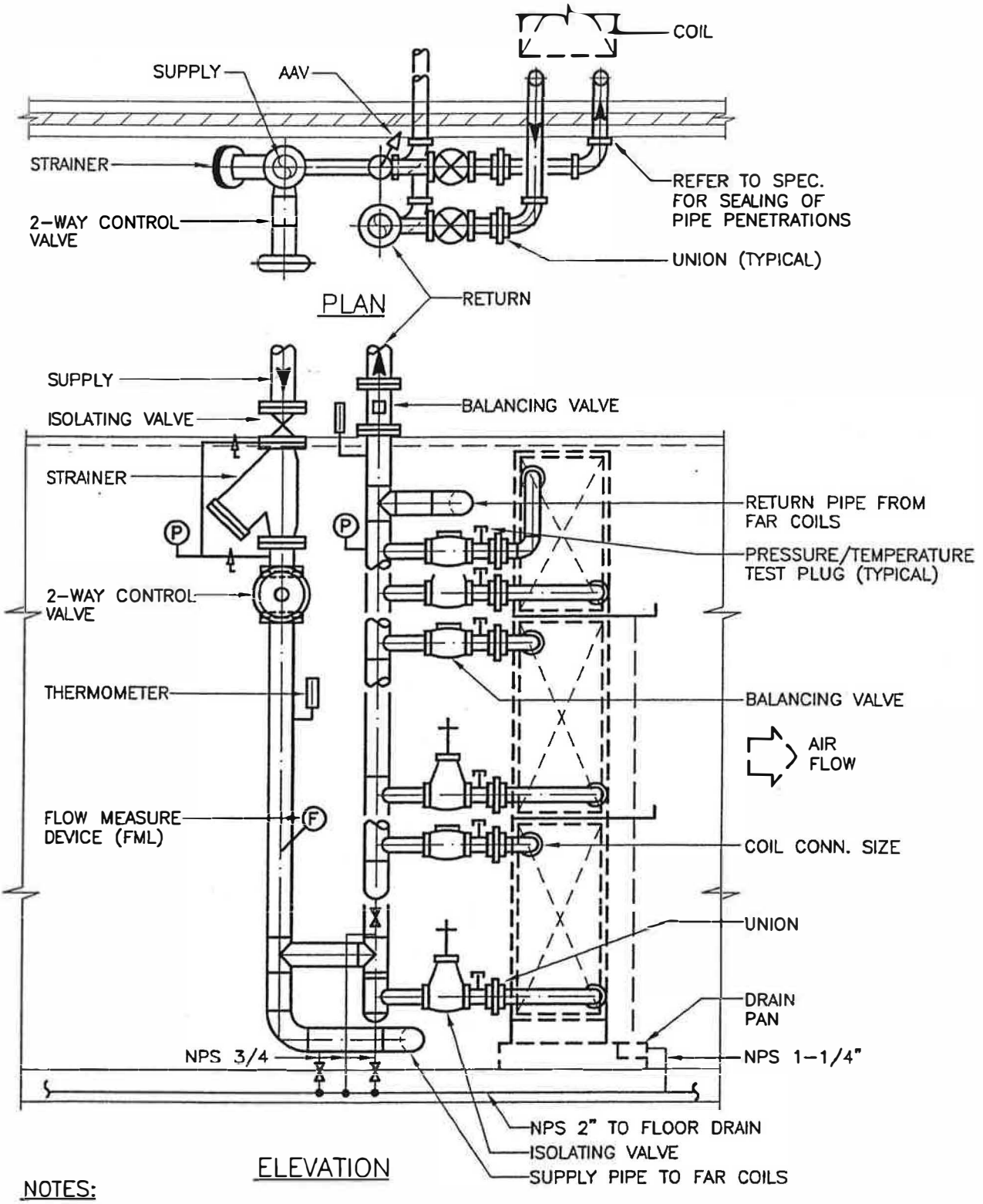
Stantec Consulting Ltd.
V:\1156\resource\Details–Mech Masters\MD 09 006.dwg
2007–01–25 11:03AM By: jgrande

UPFED 3-WAY VALVE STATION (N.C. TO COIL)

MD 753A

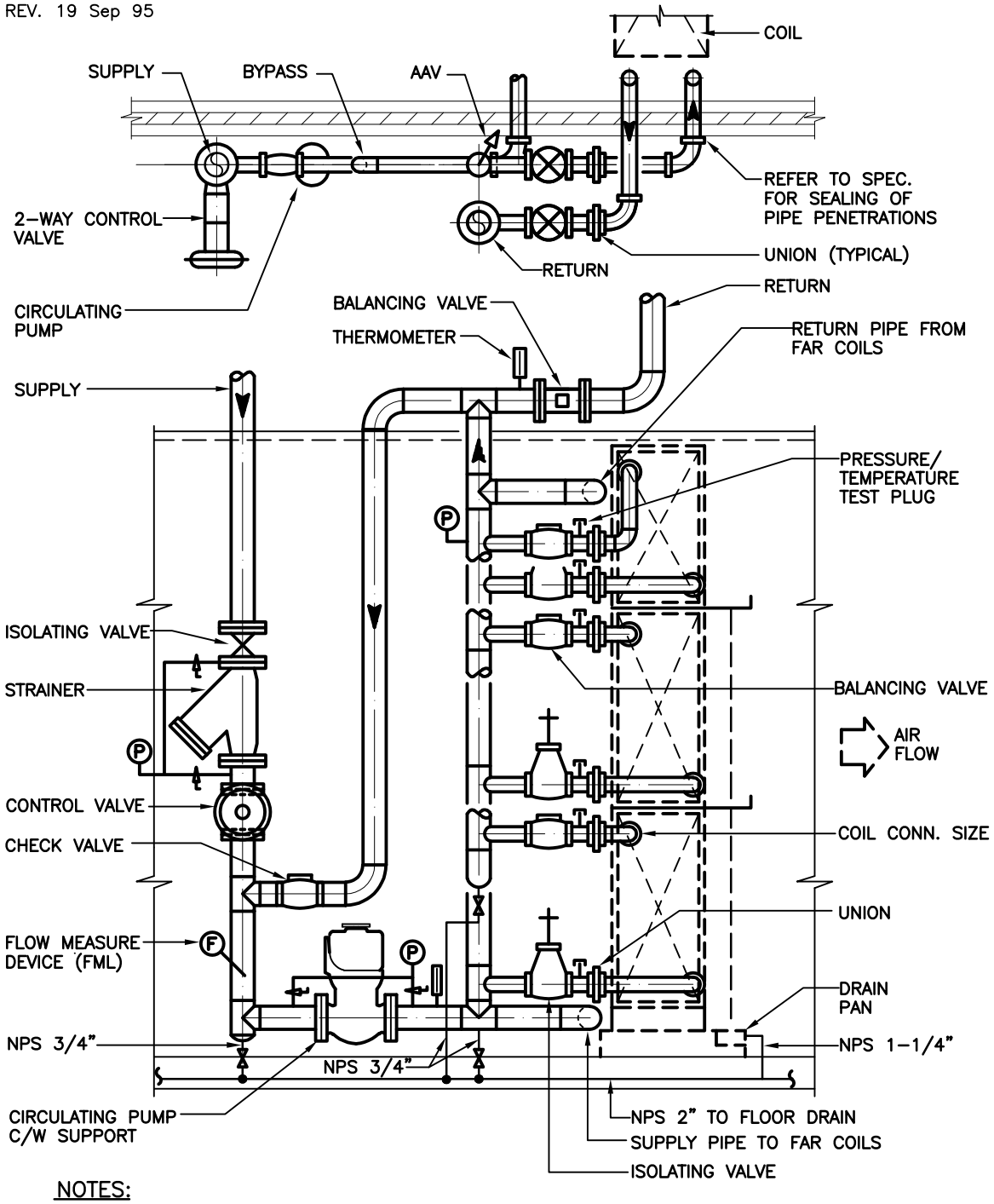
SCALE: N.T.S.

Edited By: BDT
File Name: MD–0753A
Files Dir: M:\ACAD\MechDtls\



NOTES:

1. COIL BALANCING & ISOLATING VALVES SHOWN ARE FOR NPS 2 AND SMALLER VALVES. NPS 2-1/2 AND LARGER ARE TO BE FLANGED AS PER SPEC.
2. DO NOT PIPE GLYCOL COILS TO DRAIN. CAP DRAIN VALVES.



NOTES:

1. COIL BALANCING & ISOLATING VALVES SHOWN ARE FOR NPS 2 AND SMALLER VALVES. NPS 2–1/2 AND LARGER ARE TO BE FLANGED AS PER SPEC.
2. DO NOT PIPE GLYCOL COILS TO DRAIN. CAP DRAIN VALVES.

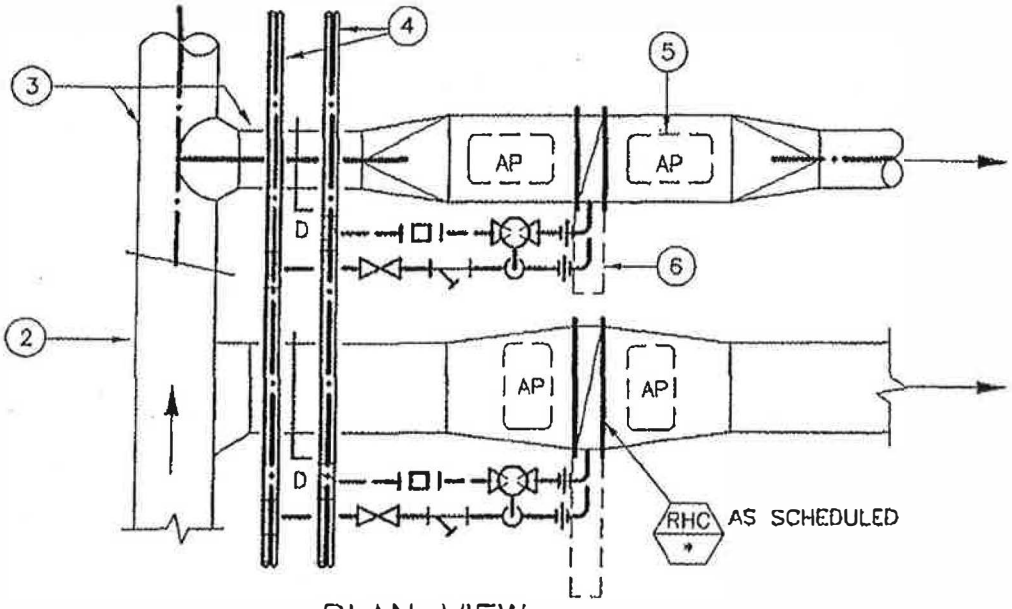
Stantec Consulting Ltd.
V:\1156\resource\Details–Mech Masters\MD 09 010.dwg
2007–01–02 01:21PM By: jgrande

TYPICAL 2-WAY VALVE STATION DETAIL (PUMPED HEATING COIL)

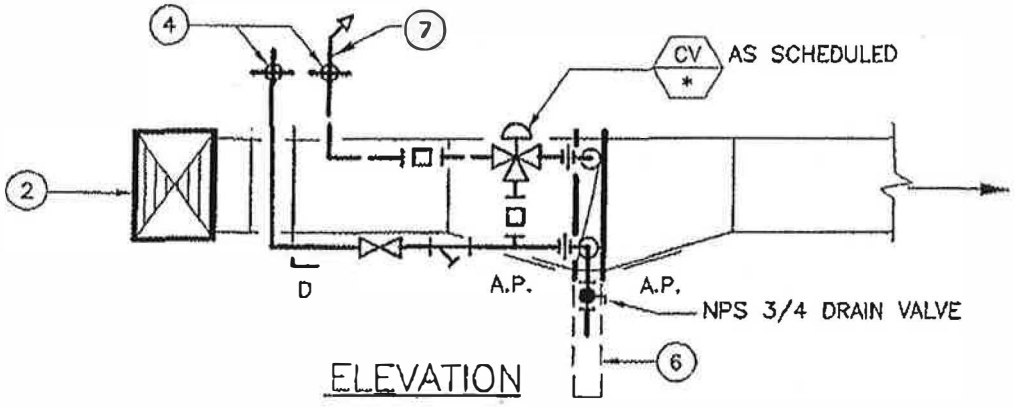
MD 754A

SCALE: N.T.S.

Edited By: BDT
File Name: MD–0700B
Files Dir: M:\ACAD\MechDtls\



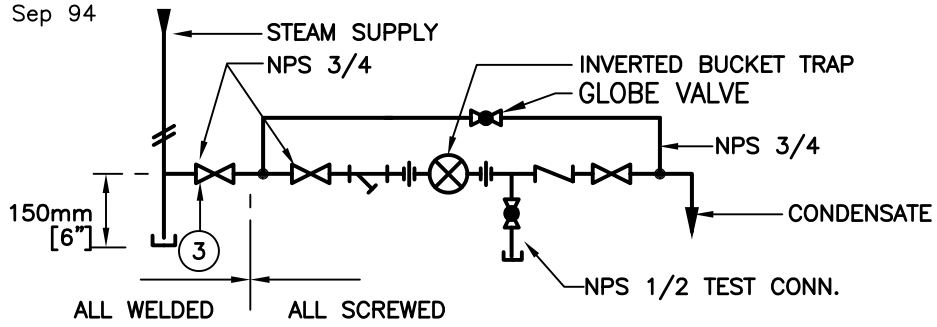
PLAN VIEW



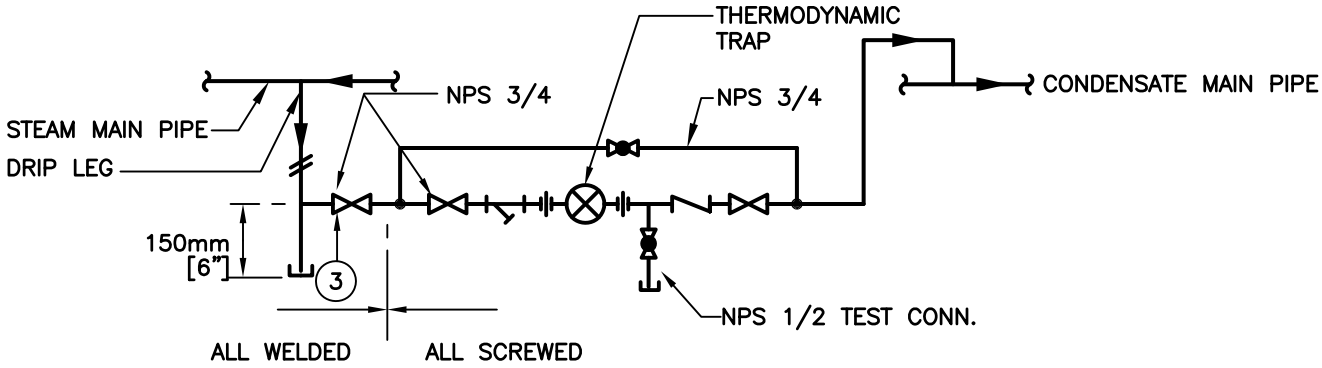
ELEVATION

NOTES:

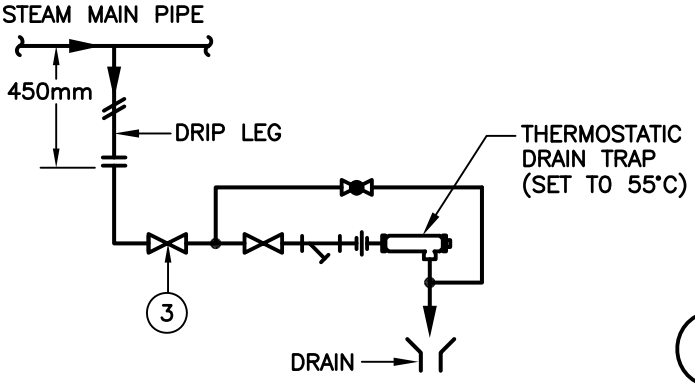
1. SEE MECHANICAL SCHEMATIC FOR PIPING ARRANGEMENT.
2. RECTANGULAR SUPPLY DUCT TYP.
3. ROUND SUPPLY DUCT TYP.
4. HWS & R PIPING.
5. ACCESS PANELS BOTH SIDES OF COIL.
6. CLEARANCE FOR COIL REMOVAL – SIDE OR BOTTOM AS REQ'D.
7. WHERE THE PIPING CONNECTIONS ARE FROM THE TOP OF THE HWS AND HWR MAINS, PROVIDE AUTOMATIC AIR VENT AT THE HIGH POINT ON THE RETURN PIPE FROM THE COIL.



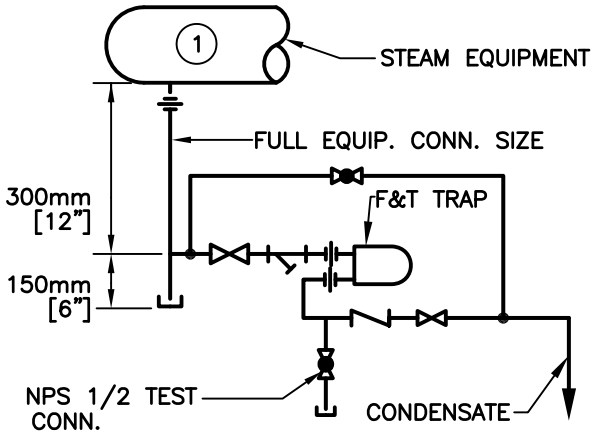
TRAP STATION – TYPE A



TRAP STATION – TYPE B



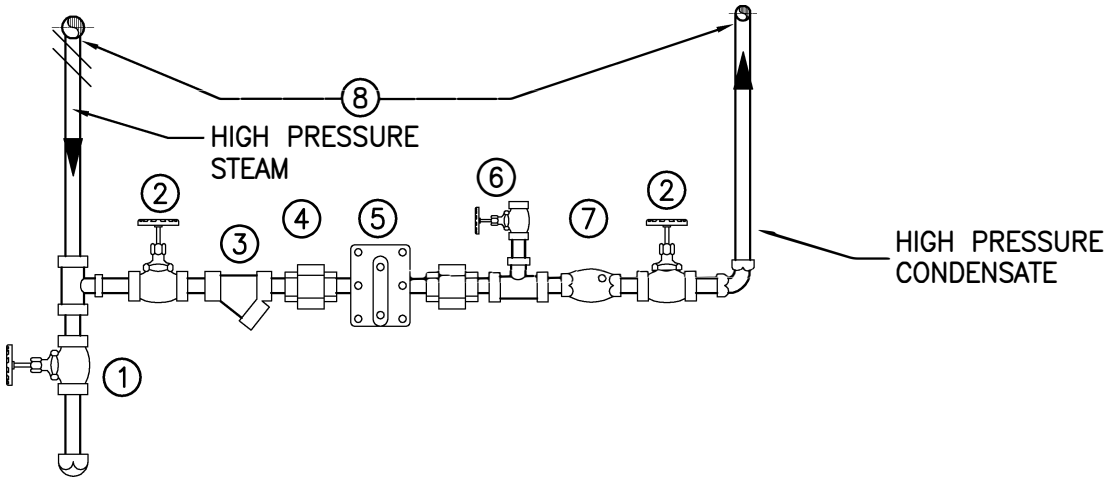
TRAP STATION – TYPE C



TRAP STATION – TYPE D

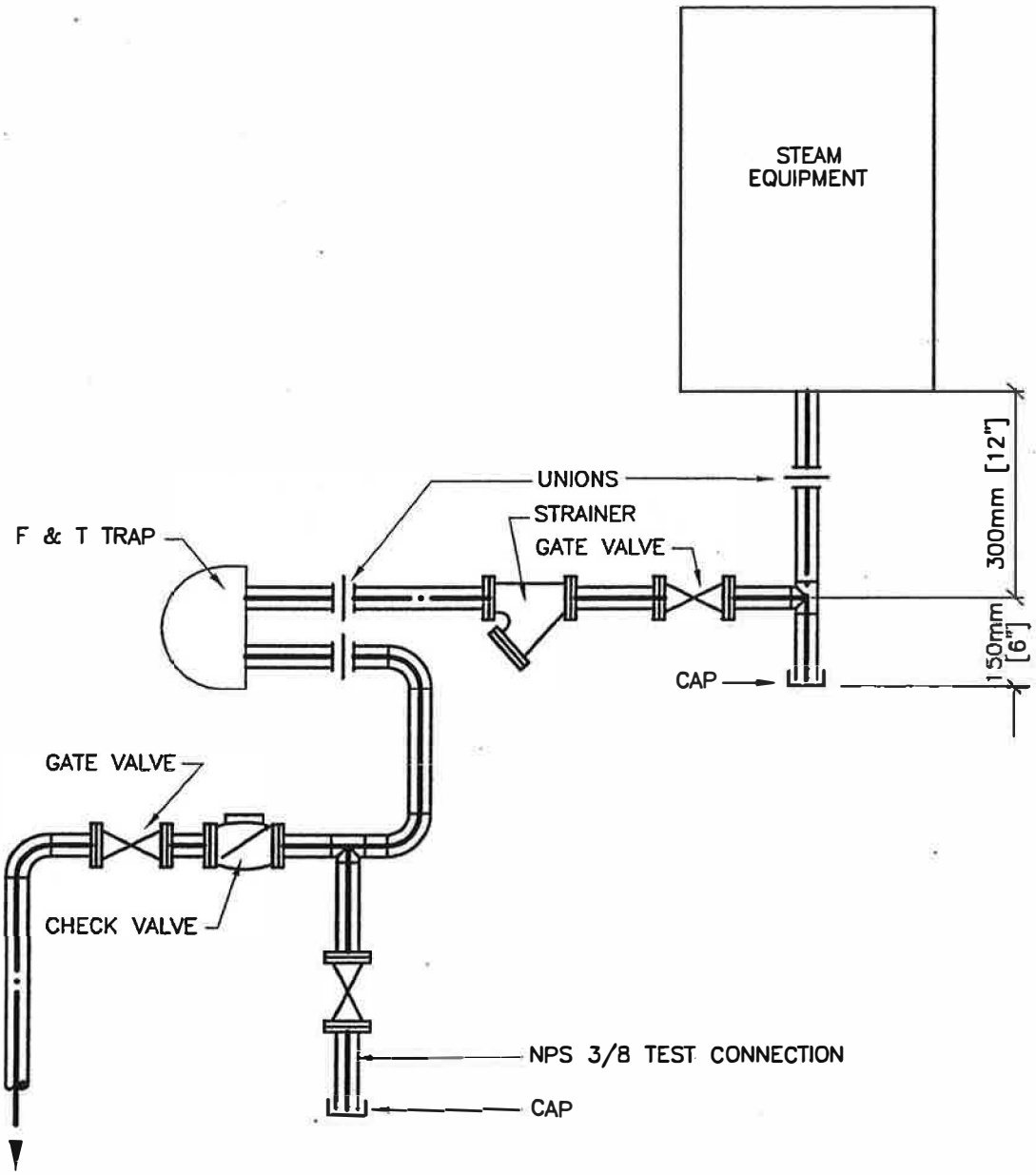
NOTES: (#)

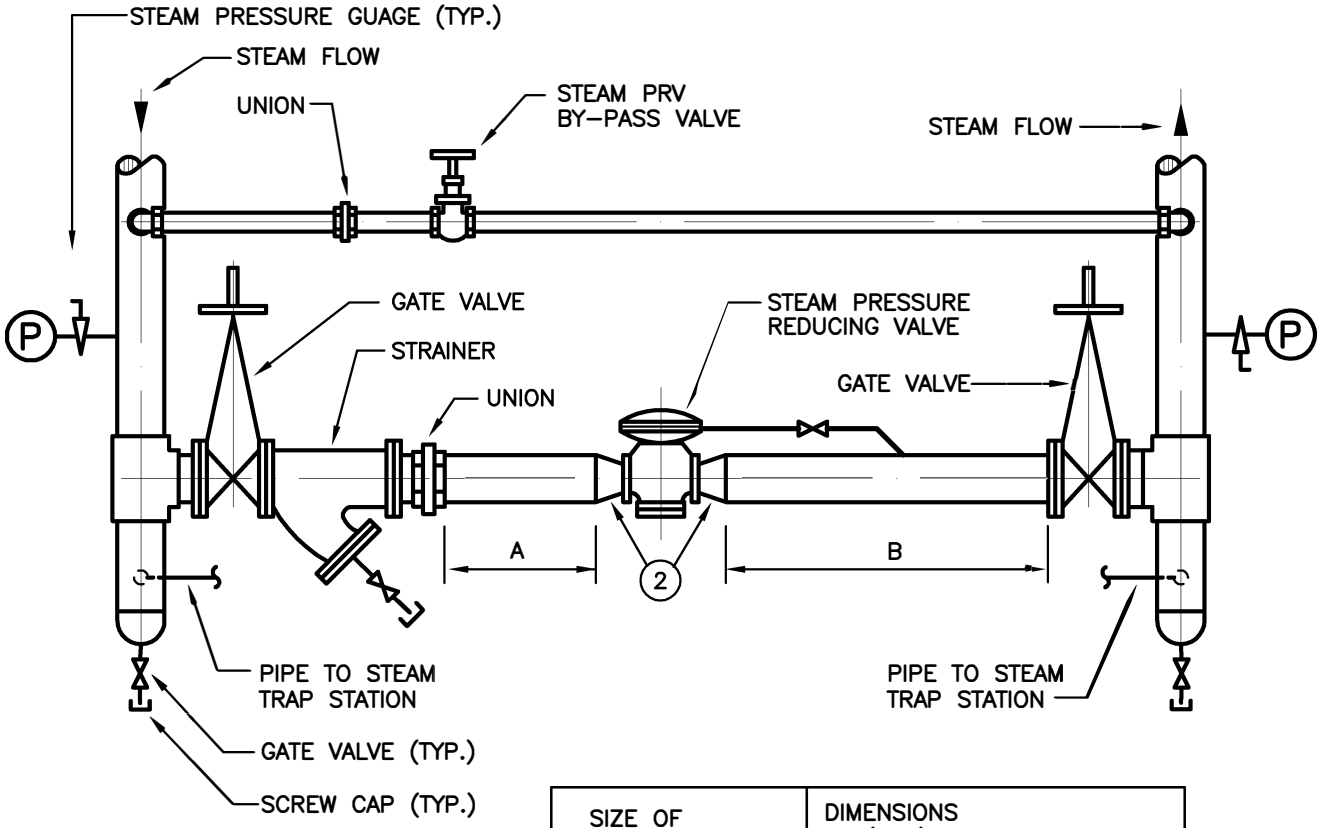
1. FOR TRAP SIZE SELECTION REFER TO EQUIP. SCHEDULES. TRAPS SHOULD BE SIZED FOR MINIMUM THREE TIMES THE CALCULATED CONDENSATE LOADING OF MAX. EQUIPMENT DESIGN CAPACITY.
2. INSTALL BLOW OFF VALVES ON STRAINERS NPS 1 AND LARGER. INSTALL NIPPLE & CAP ON SMALLER SIZES.
3. SOCKET WELD GATE VALVE REQUIRED ON STEAM LINES AT PRESSURES ABOVE 690 kPa [100 PSIG].
4. BYPASS SHALL BE INSTALLED IN THE SAME HORIZONTAL PLANE AS TRAP.



NOTES

1. BLOW DOWN VALVE AND PLUG
2. GATE VALVE
3. STRAINER –BLOW DOWN VALVE AND PLUG
4. UNION
5. STEAM TRAP
6. N.P.S. 1/2 TEST GLOBE VALVE
7. CHECK VALVE
8. FOR LINE SIZES REFER TO DRAWINGS

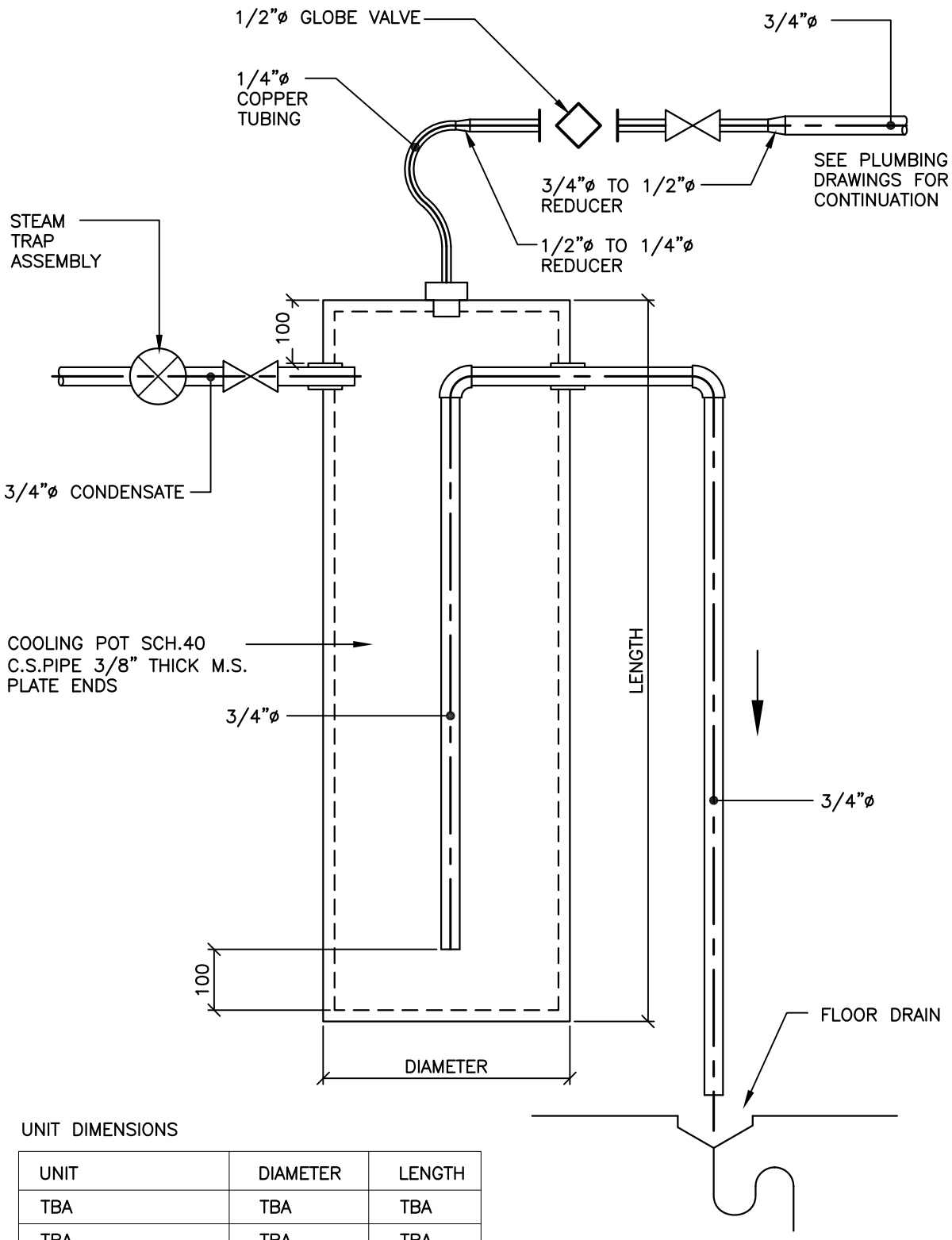

STEAM EQUIPMENT
UNIONS
STRAINER
GATE VALVE
F & T TRAP
300mm [12"]
150mm [6"]
CAP
GATE VALVE
CHECK VALVE
NPS 3/8 TEST CONNECTION
CAP



SIZE OF PRESSURE REDUCING VALVE (NPS)	DIMENSIONS (mm)	
	A	B
1/2 TO 1-1/2	450 [18"]	900 [36"]
2 TO 4	900 [36"]	1500 [60"]
5 TO 6	1200 [48"]	2400 [96"]

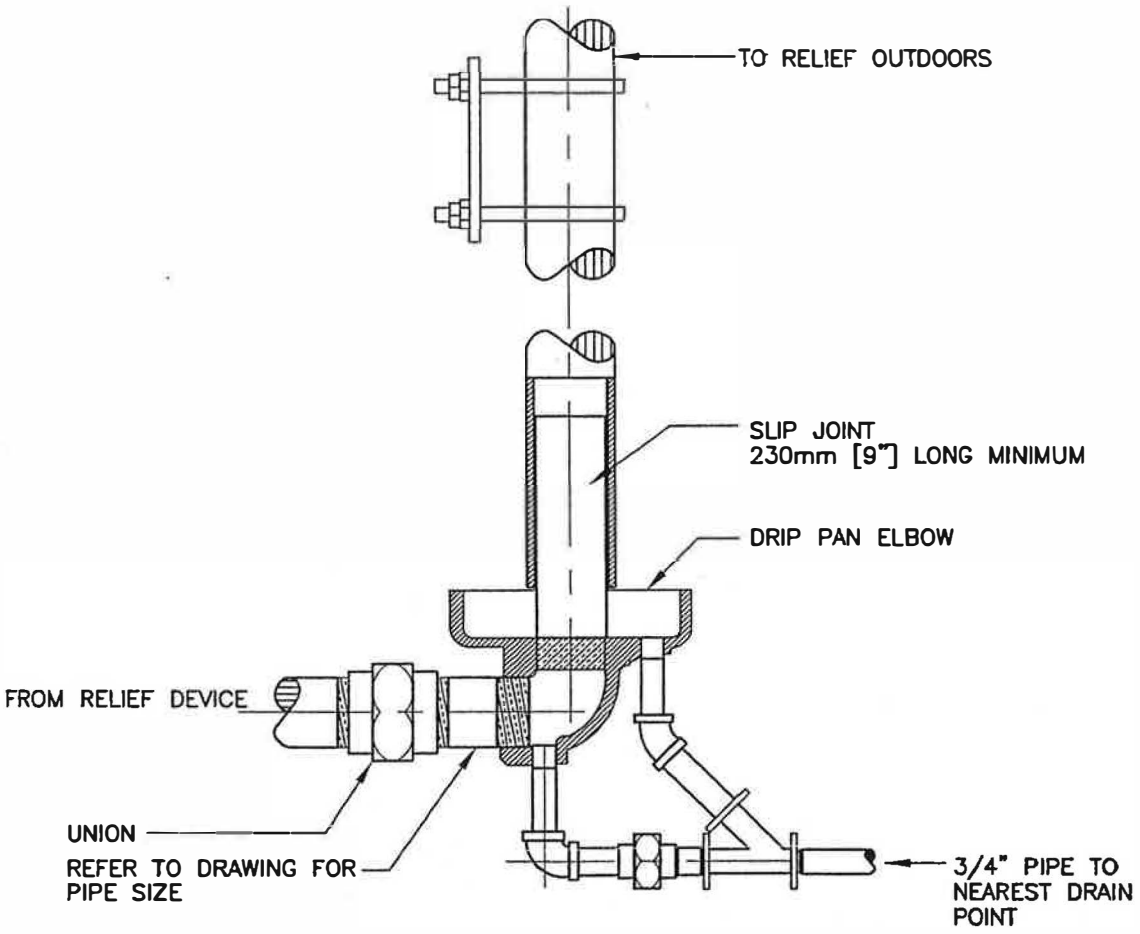
NOTES:

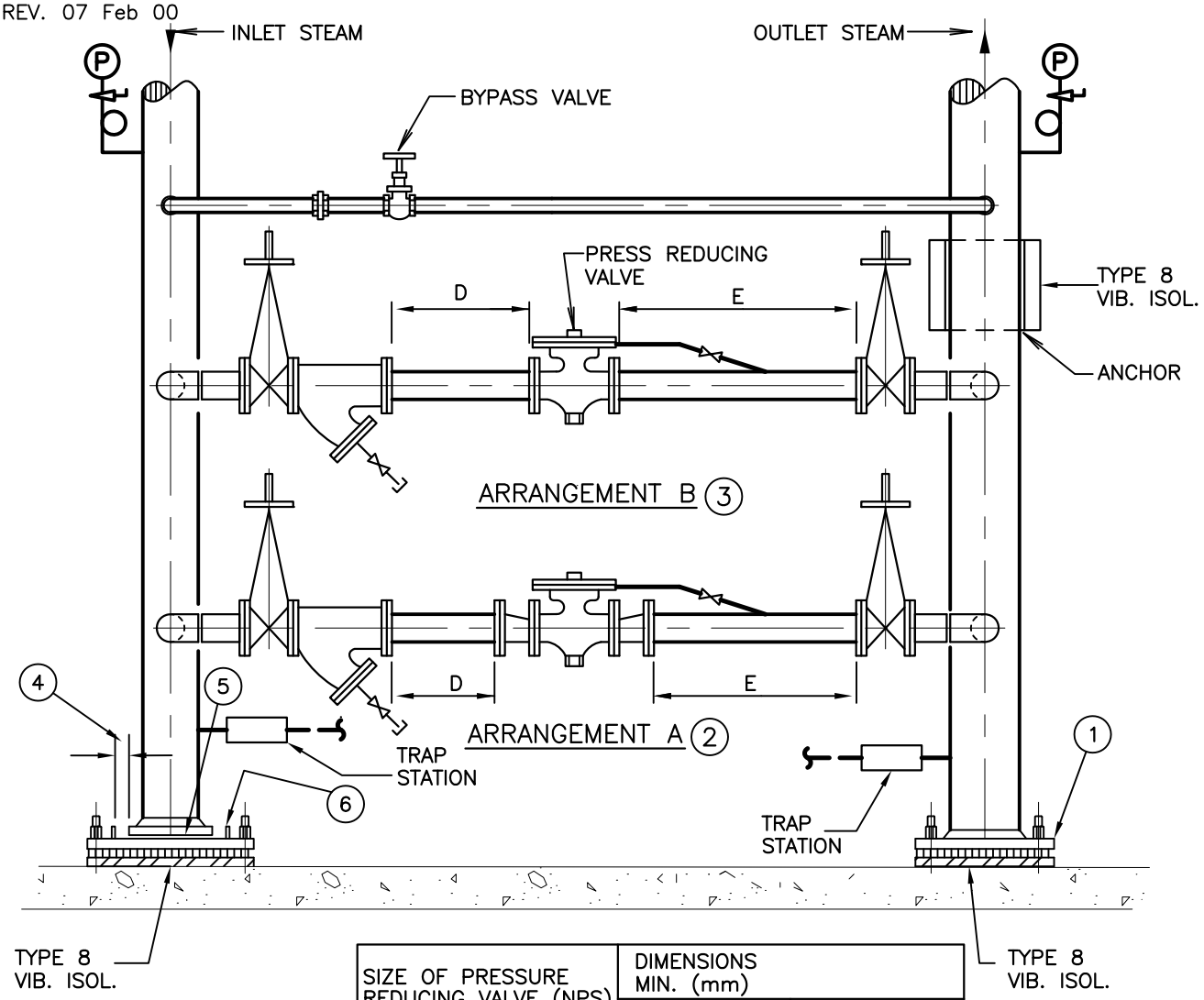
1. UNION NOT REQUIRED WHEN STEAM PRV OR PRV BY-PASS VALVE HAVE FLANGED CONNECTIONS.
2. USE CONCENTRIC REDUCERS (15°-20° INCLUDED ANGLE).



UNIT DIMENSIONS

UNIT	DIAMETER	LENGTH
TBA	TBA	TBA
TBA	TBA	TBA

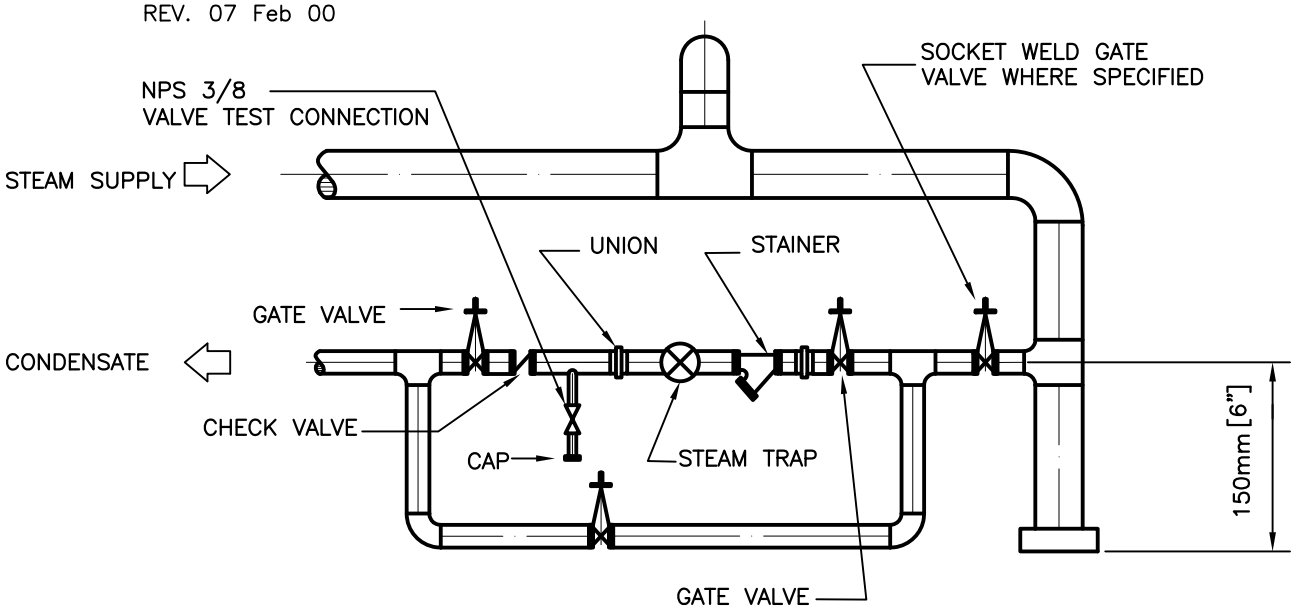

TO RELIEF OUTDOORS
SLIP JOINT
230mm [9"] LONG MINIMUM
DRIP PAN ELBOW
FROM RELIEF DEVICE
UNION
REFER TO DRAWING FOR
PIPE SIZE
3/4" PIPE TO
NEAREST DRAIN
POINT



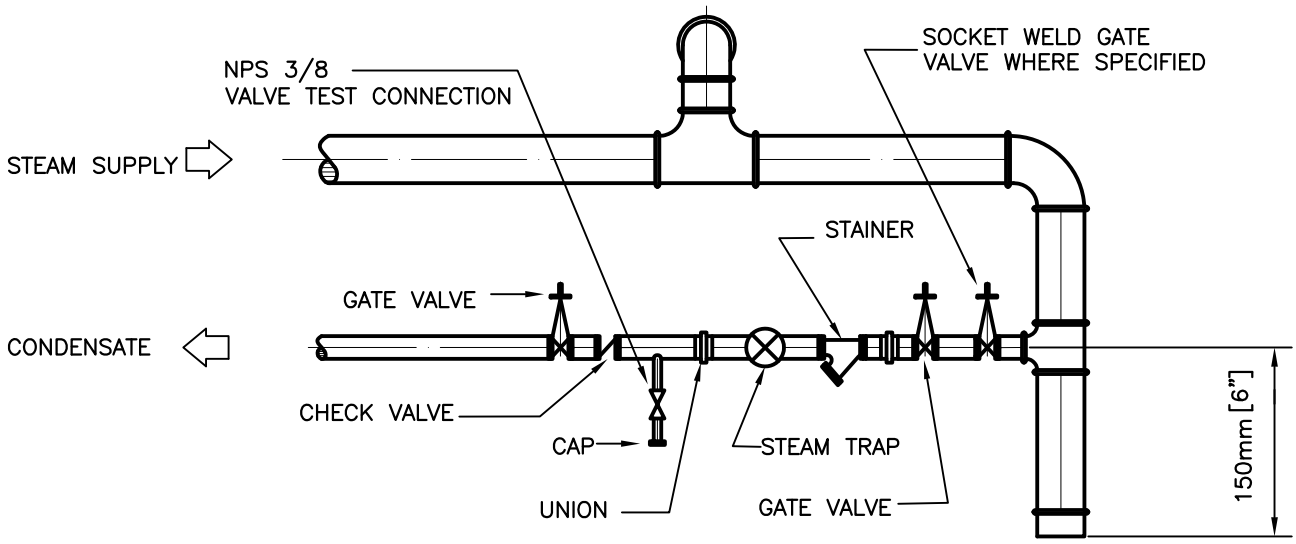
SIZE OF PRESSURE REDUCING VALVE (NPS)	DIMENSIONS MIN. (mm)	
	D	E
1/2 TO 1-1/2	600 [24"]	1200 [48"]
2 TO 4	1000 [40"]	1500 [60"]

NOTES:

1. 12mm [1/2"] STEEL PLATE.
2. USE ARRANGEMENT "A" FOR CONTROLLED PRESSURE OF 25% OR LESS OF INLET PRESSURE. ALSO, USE ARRANGEMENT "A" WHEN VALVE SIZE TO DISCHARGE HEADER DIAMETER RATIO IS 0.4 OR LESS; MAKE PIPE DIAMETER TWICE THE VALVE SIZE.
3. USE ARRANGEMENT "B" FOR CONTROLLED PRESSURE ABOVE 25% OF INLET PRESSURE.
4. PROVIDE 12mm [1/2"] CLEARANCE ON BOTH SIDES IN DIRECTION OF EXPANSION AND 6mm ON OTHER 2 SIDES.
5. PROVIDE GRAPHITE PASTE BETWEEN STEAM HEADER FOOT AND PLATE.
6. 12mm x 20mm [1/2"x3/4"] STEEL BAR STOP.
9. USE CONCENTRIC REDUCERS (15°-20° INCLUDED ANGLE).
10. LOCATE CONTROL SENSOR CONNECTION FOR PRV'S AT LEAST 600mm [24"] FROM PRV AND 450mm [18"] FROM ISOLATING VALVE.



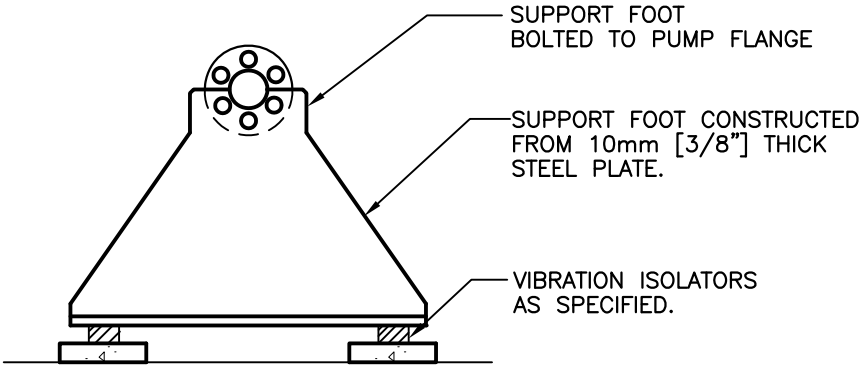
STEAM MAIN DRIP STATION WITH VALVED BYPASS



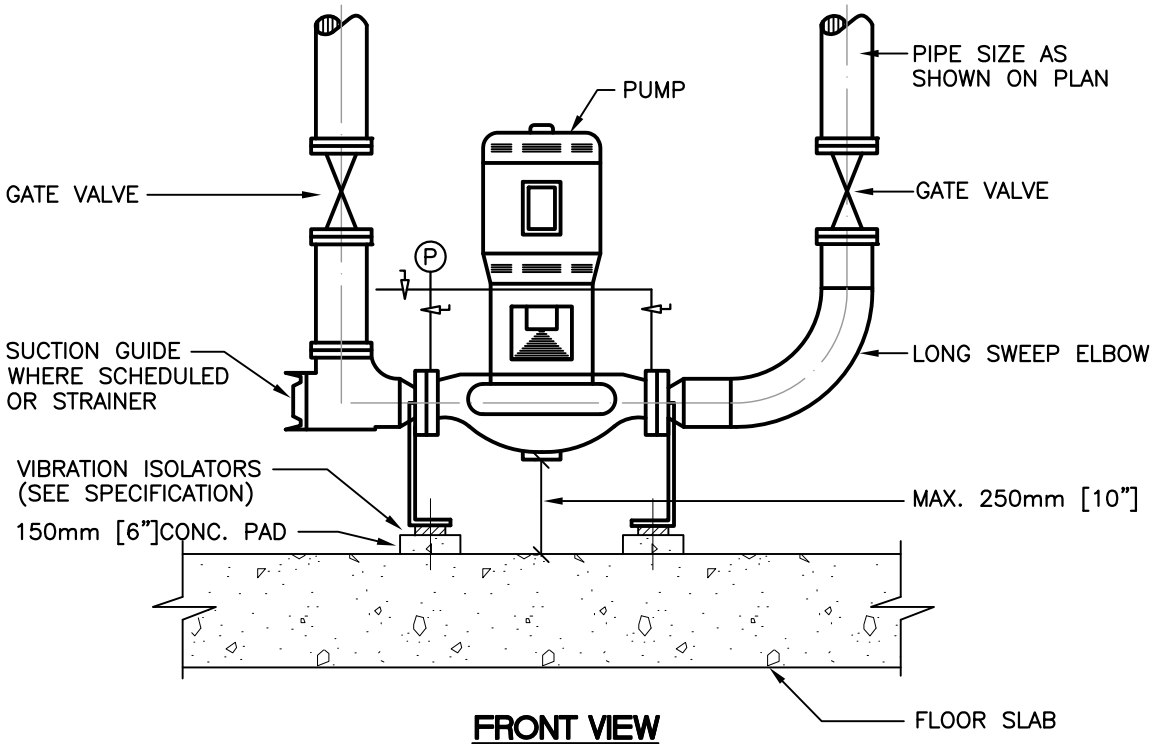
STEAM MAIN DRIP STATION WITHOUT VALVED BYPASS

NOTES:

1. PIPING SHALL BE WELDED OR SCREWED ACCORDING TO PIPE SPECIFICATION.
2. BYPASS SHALL BE INSTALLED IN SAME HORIZONTAL PLANE AS TRAP (BYPASS SHOWN BELOW TRAP FOR CLARITY ONLY)



END VIEW



FRONT VIEW

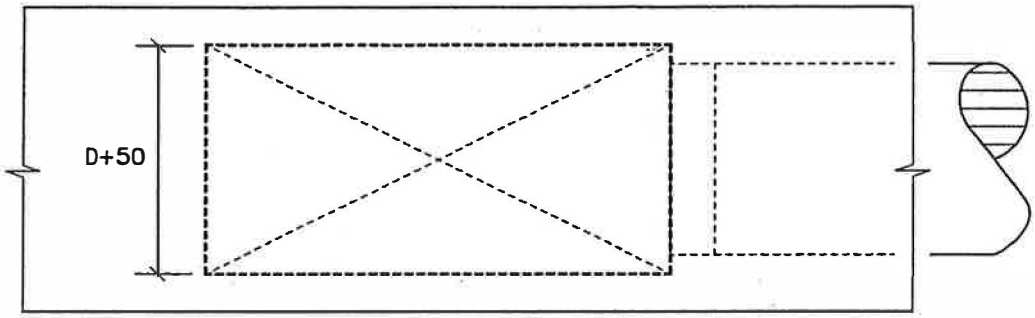
NOTES:

1. SUPPORT FOOT TO BE BOLTED TO THE FLOOR SLAB, THROUGH THE CONC. PAD USING NEOPRENE WASHERS AND BUSHINGS ON THE BOLTS (MIN. 2 BOLTS).

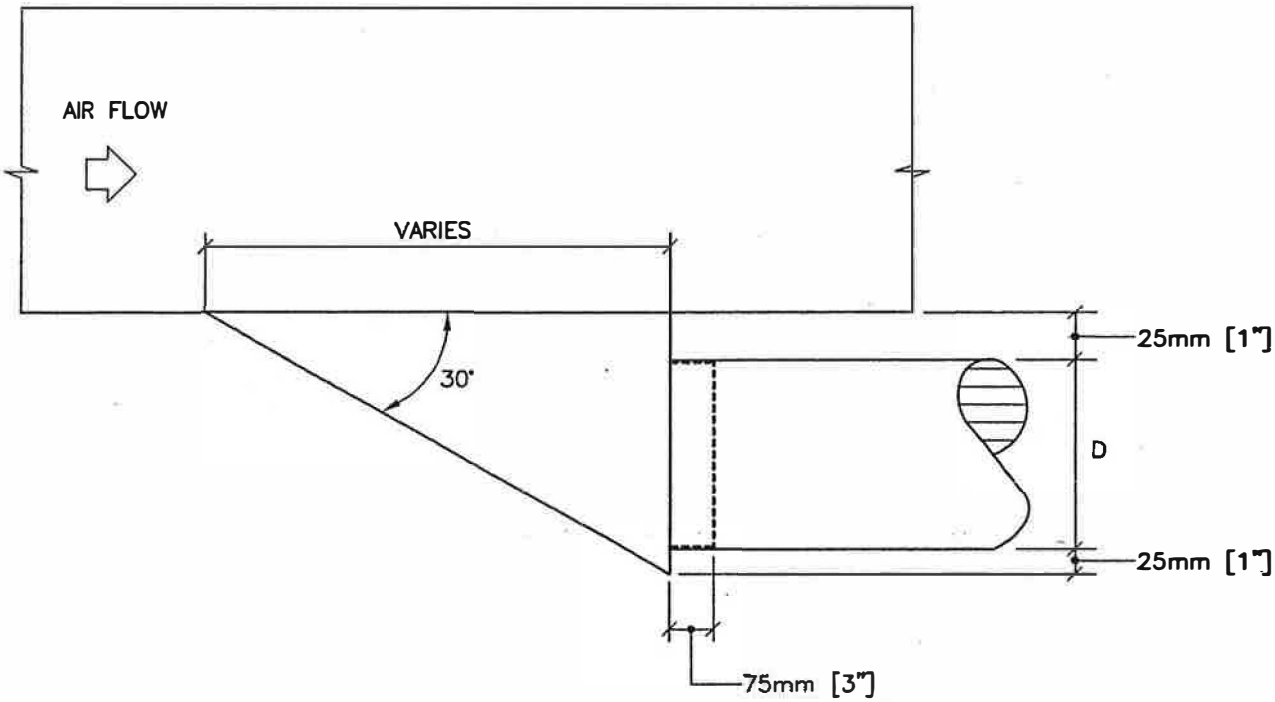
2. VALVES, STRAINERS, FITTINGS, ETC AT THE SUCTION AND DISCHARGE OF ALL PUMPS AND EQUIPMENT SHALL BE LINE SIZE, NOT PUMP OR EQUIPMENT FLANGE SIZE.

3. ALL PIPE SIZE CHANGES IN HORIZONTAL PLANE SHALL BE MADE BY USING ECCENTRIC FITTINGS TO PREVENT AIR ENTRAPMENT. PROVIDE POSITIVE DRAINAGE.

4. FOR PIPE CONNECTION TO PUMPS DECREASE FROM LINE SIZE, WITH LONG RADIUS REDUCING ELBOWS OR REDUCERS.



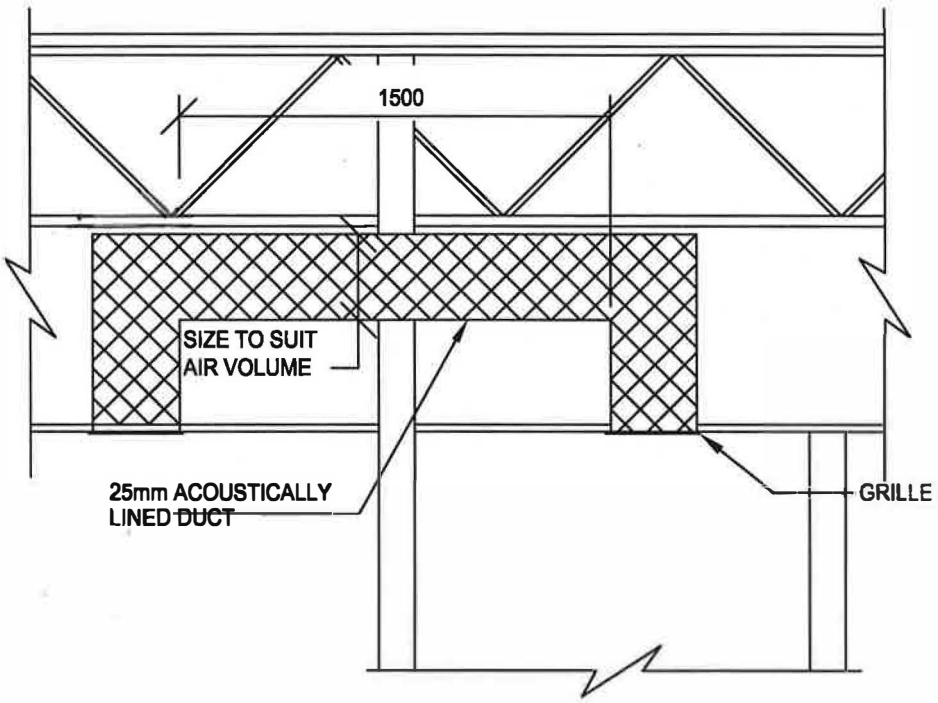
PLAN

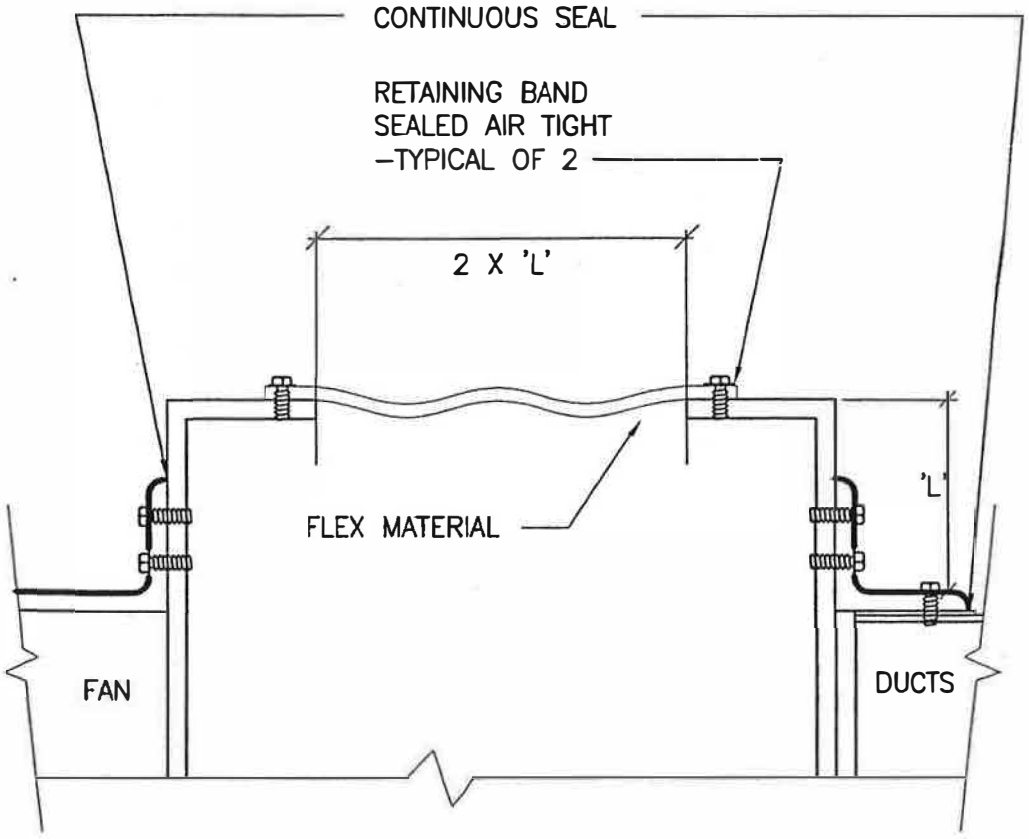


ELEVATION

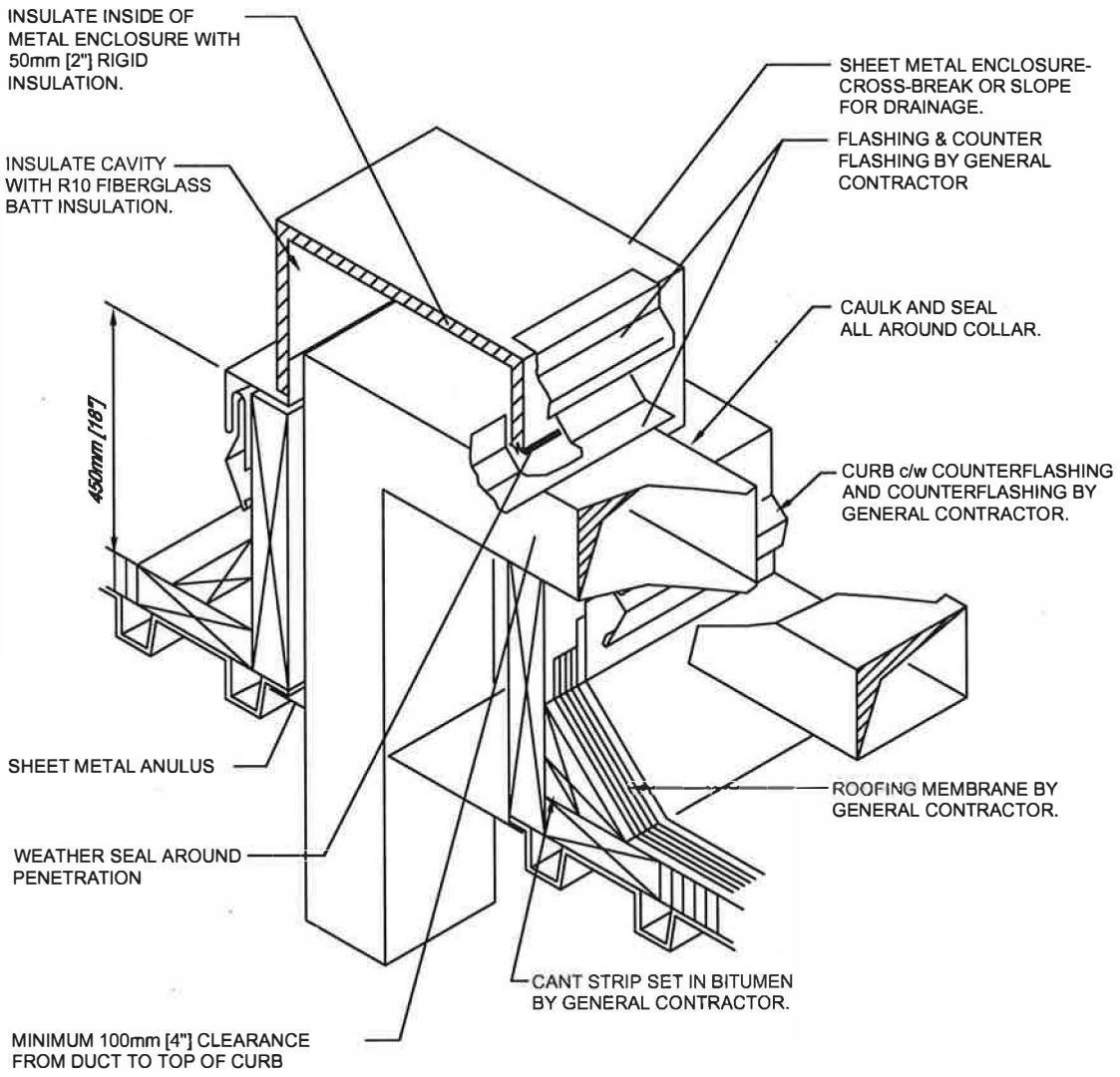
NOTES:

1. D=DIAMETER OF DUCT
2. DUCT TAKE–OFF SHALL BE AS SHOWN UNLESS SHOWN OTHERWISE ON FLOOR PLAN


1500
SIZE TO SUIT
AIR VOLUME
25mm ACOUSTICALLY
LINED DUCT
GRILLE

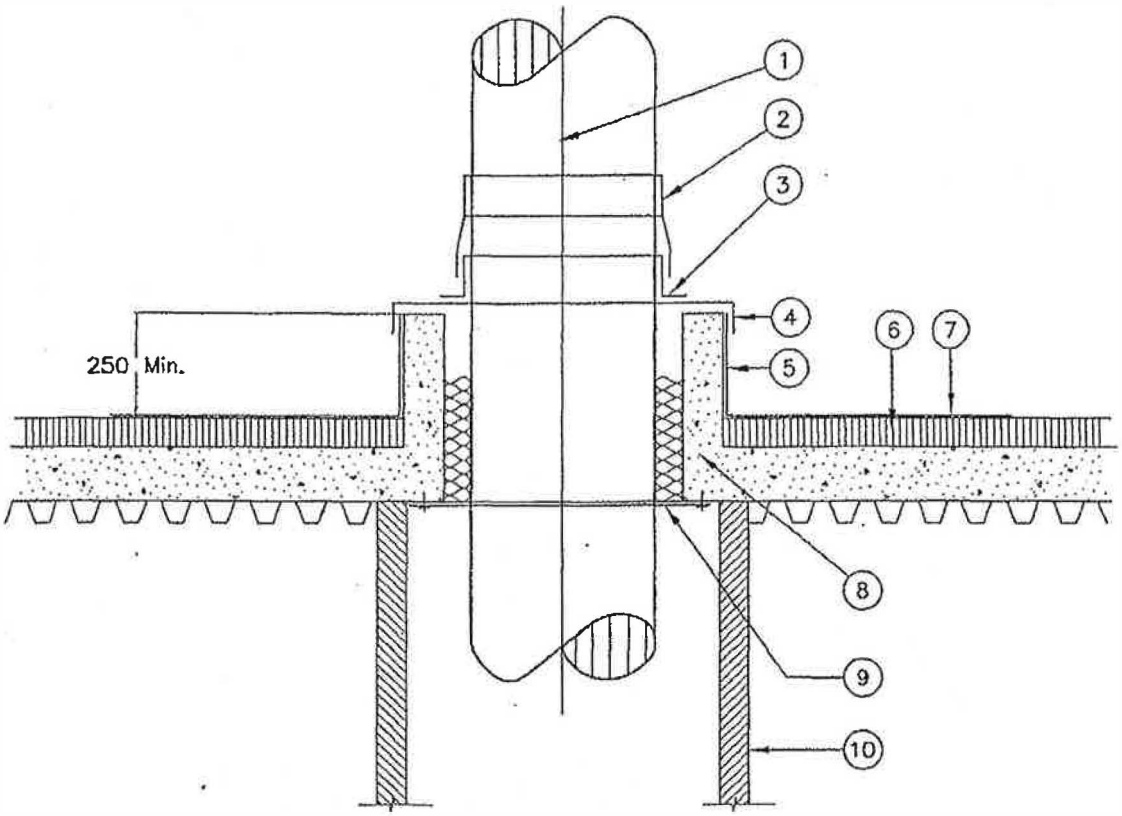


TYPICAL –BOTH SIDES



NOTES:

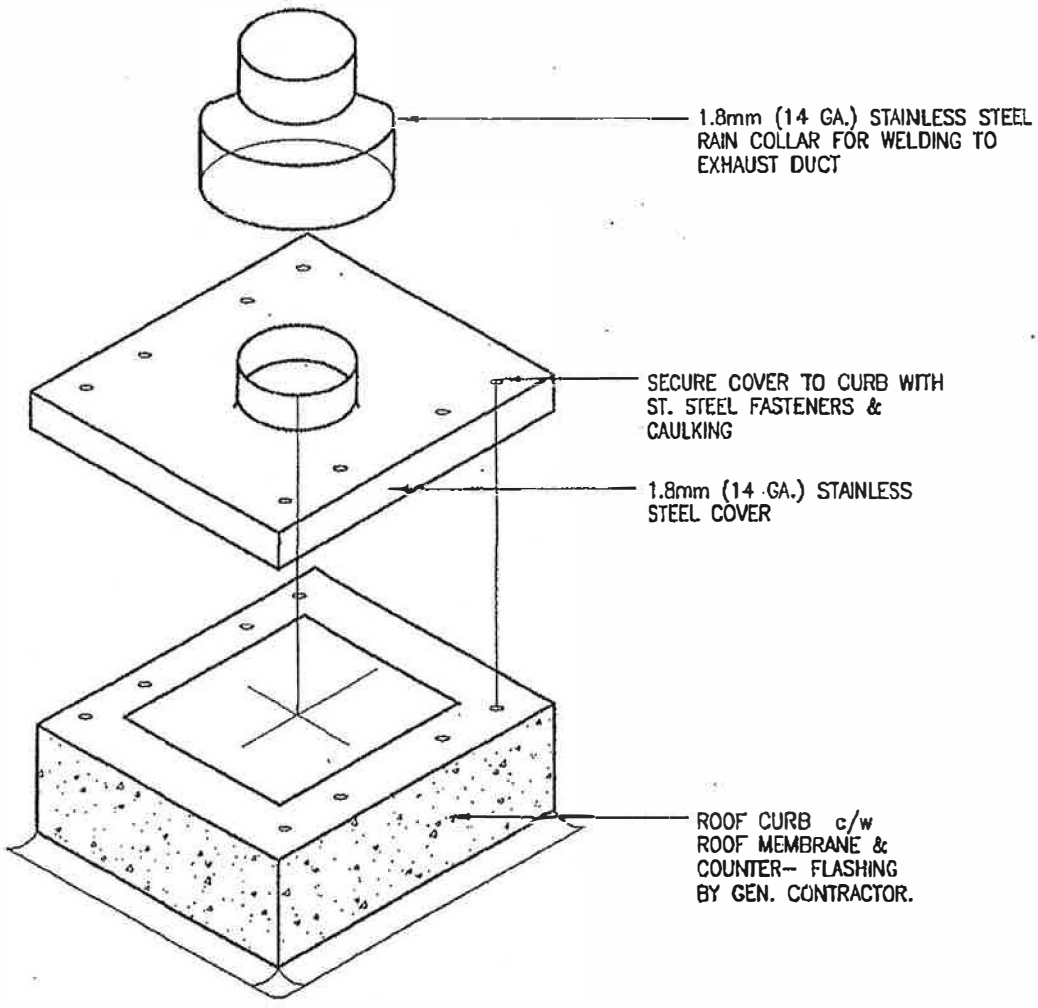
1. ALL WORK BY THIS DIVISION, UNLESS OTHERWISE NOTED.
2. ALL FLASHING BY GENERAL CONTRACTOR



DUCT ROOF PENETRATION DETAIL

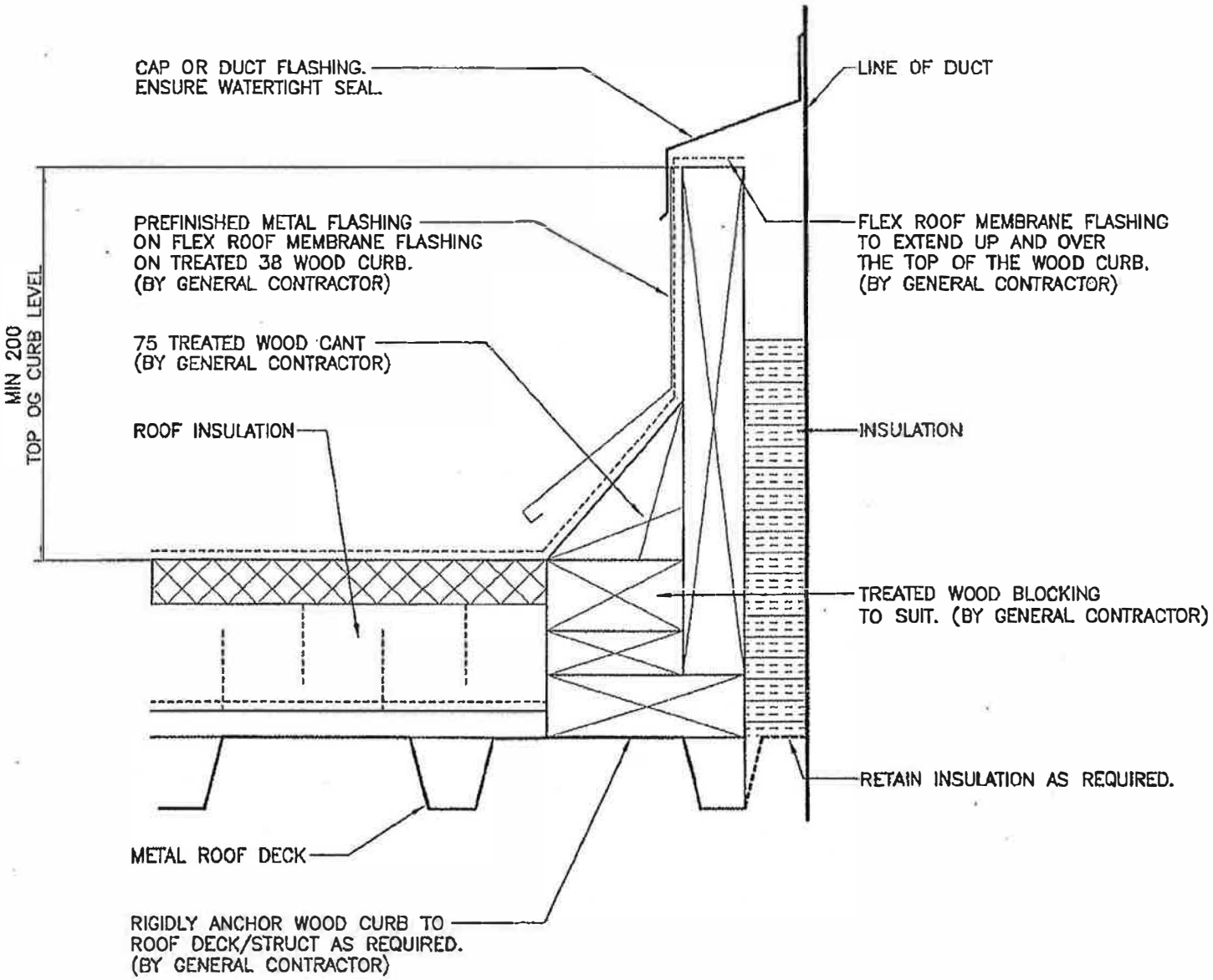
N T S

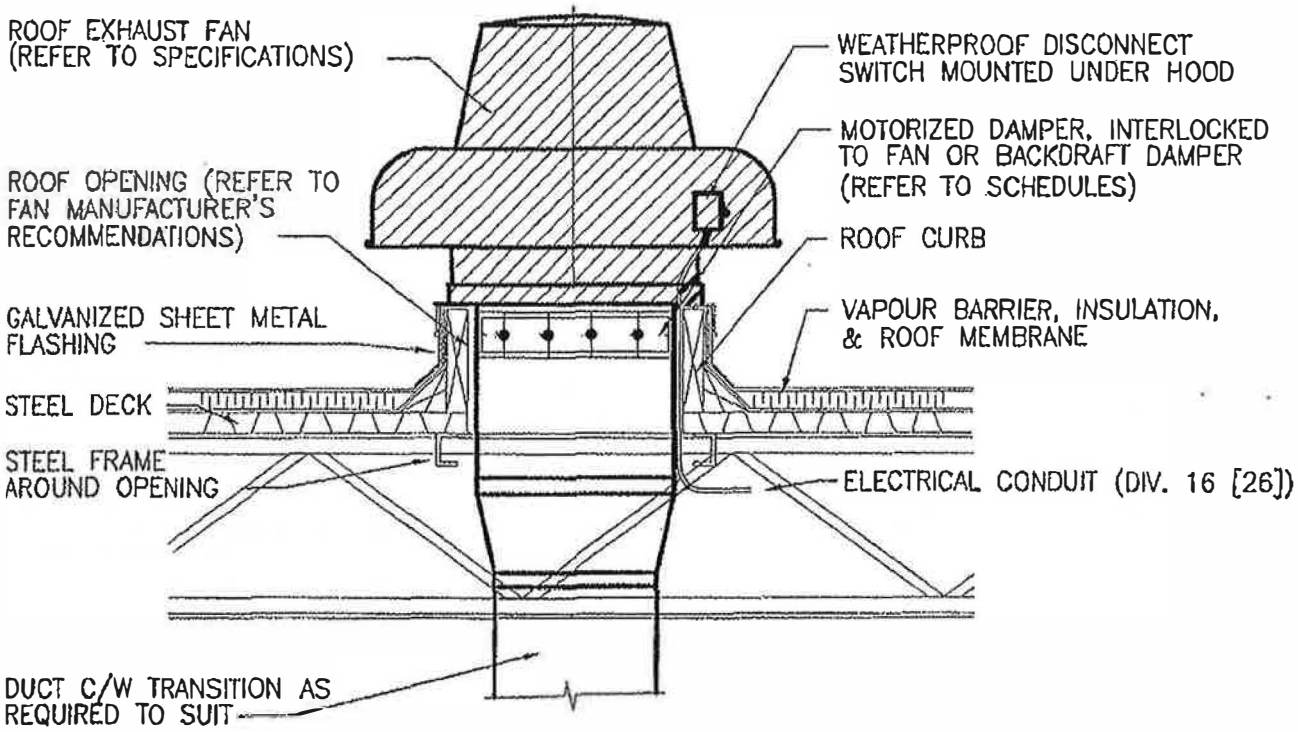
1. 316L STAINLESS STEEL EXHAUST DUCT INSULATED ABOVE ROOF WITH 50mm THICK FLEXIBLE INSULATION & COVERED WITH ALUM JACKET.
2. 1.8mm [14 GA] STAINLESS STEEL FLASHING WELDED OR CLAMPED AND SEALED TO EXHAUST DUCT.
3. STAINLESS STEEL COLLAR WELDED TO CURB CAP. SEE ALSO DETAIL MD-852
4. STAINLESS STEEL CURB CAP. SEE ALSO DETAIL MD-852
5. ROOF CURB BY GENERAL CONTRACTOR.
6. ROOF INSULATION
7. ROOFING MEMBRANE BY GEN. CONTRACTOR.
8. BATT INSULATION LOOSELY PACKED ALL AROUND DUCT
9. SHEET METAL INSULATION RETENTION ANNULUS FASTENED TO STRUCTURE
10. RATED DUCT ENCLOSURE.

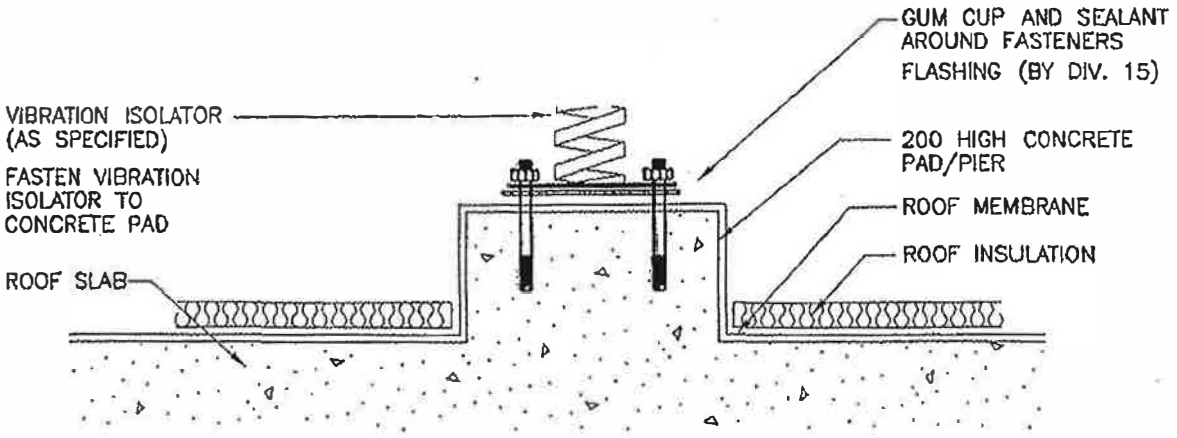


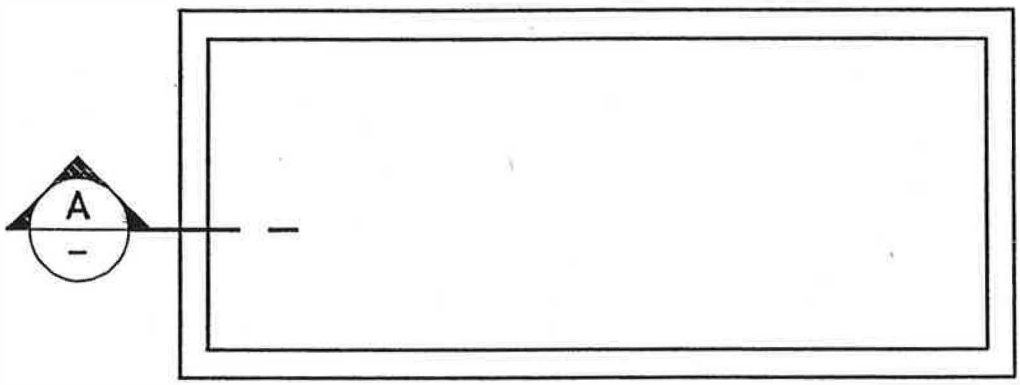
NOTE: READ IN CONJUNCTION WITH DETAIL MD-853

ROOF CURB CAP DETAIL

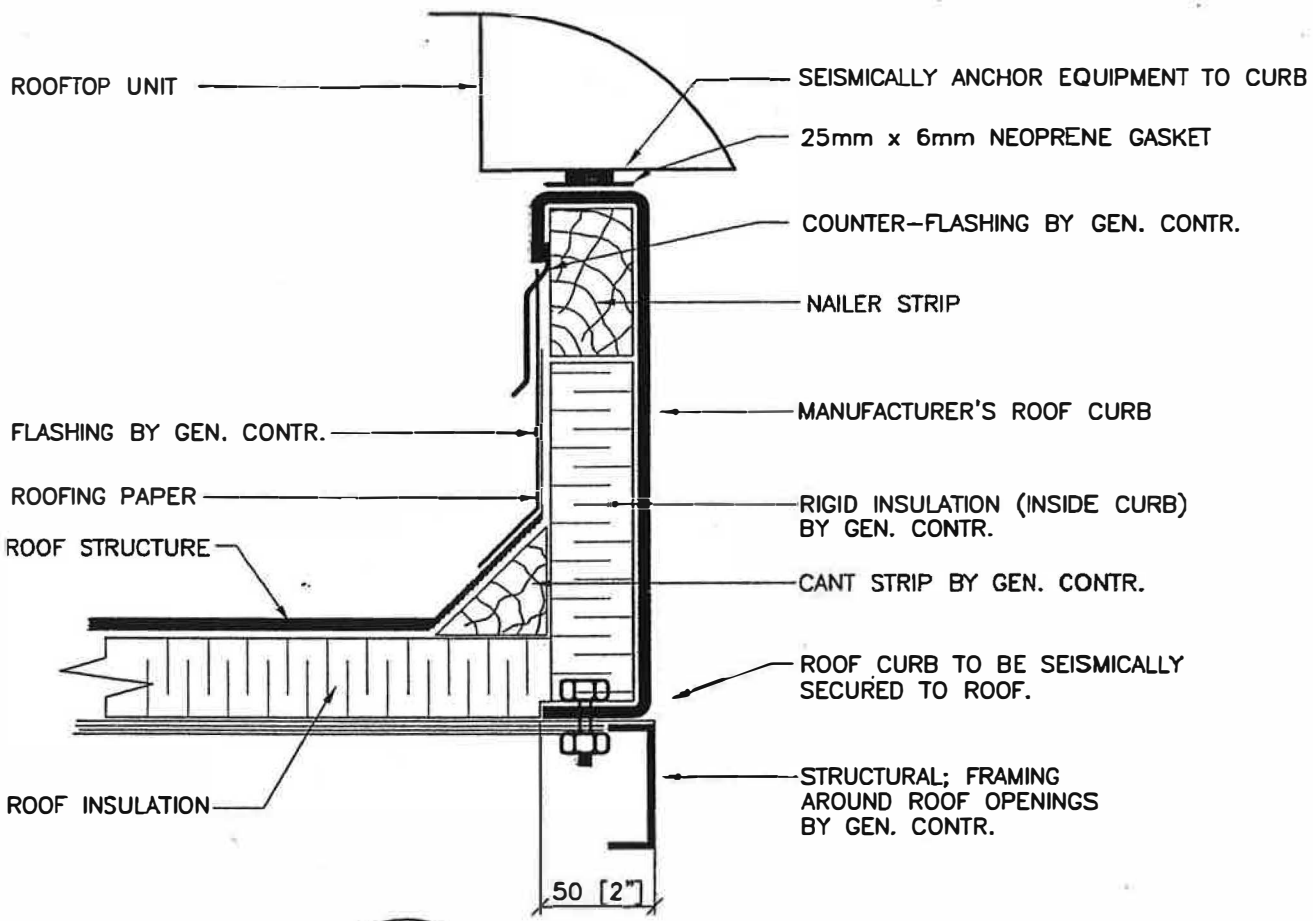

CAP OR DUCT FLASHING.
ENSURE WATERTIGHT SEAL.
LINE OF DUCT
PREFINISHED METAL FLASHING
ON FLEX ROOF MEMBRANE FLASHING
ON TREATED 38 WOOD CURB.
(BY GENERAL CONTRACTOR)
FLEX ROOF MEMBRANE FLASHING
TO EXTEND UP AND OVER
THE TOP OF THE WOOD CURB.
(BY GENERAL CONTRACTOR)
MIN 200
TOP OG CURB LEVEL
75 TREATED WOOD CANT
(BY GENERAL CONTRACTOR)
ROOF INSULATION
INSULATION
TREATED WOOD BLOCKING
TO SUIT. (BY GENERAL CONTRACTOR)
RETAIN INSULATION AS REQUIRED.
METAL ROOF DECK
RIGIDLY ANCHOR WOOD CURB TO
ROOF DECK/STRUCT AS REQUIRED.
(BY GENERAL CONTRACTOR)


ROOF EXHAUST FAN (REFER TO SPECIFICATIONS)
WEATHERPROOF DISCONNECT SWITCH MOUNTED UNDER HOOD
MOTORIZED DAMPER, INTERLOCKED TO FAN OR BACKDRAFT DAMPER (REFER TO SCHEDULES)
ROOF OPENING (REFER TO FAN MANUFACTURER'S RECOMMENDATIONS)
ROOF CURB
GALVANIZED SHEET METAL FLASHING
VAPOUR BARRIER, INSULATION, & ROOF MEMBRANE
STEEL DECK
STEEL FRAME AROUND OPENING
ELECTRICAL CONDUIT (DIV. 16 [26])
DUCT C/W TRANSITION AS REQUIRED TO SUIT


GUM CUP AND SEALANT
AROUND FASTENERS
FLASHING (BY DIV. 15)
VIBRATION ISOLATOR
(AS SPECIFIED)
FASTEN VIBRATION
ISOLATOR TO
CONCRETE PAD
200 HIGH CONCRETE
PAD/PIER
ROOF MEMBRANE
ROOF INSULATION
ROOF SLAB

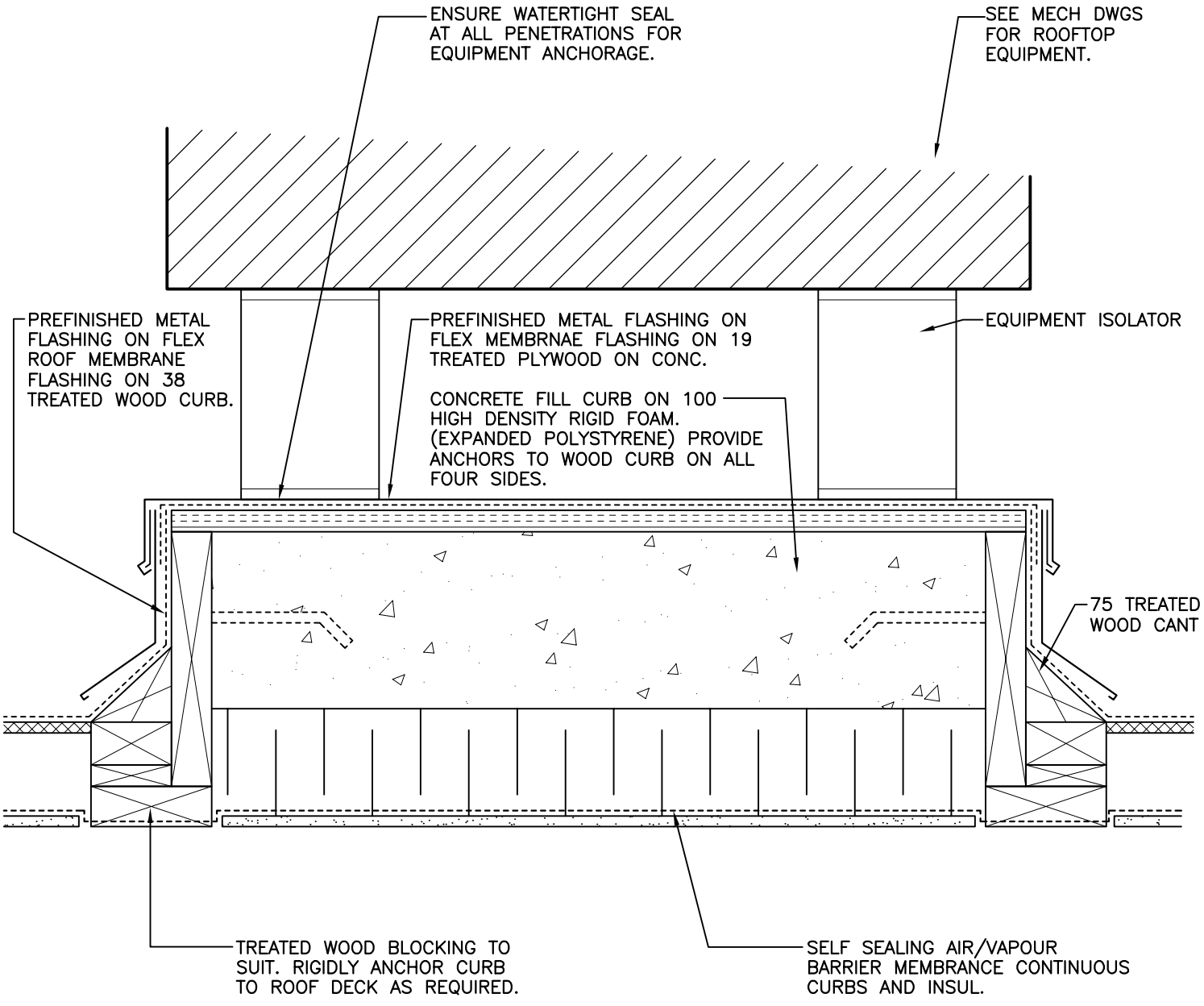


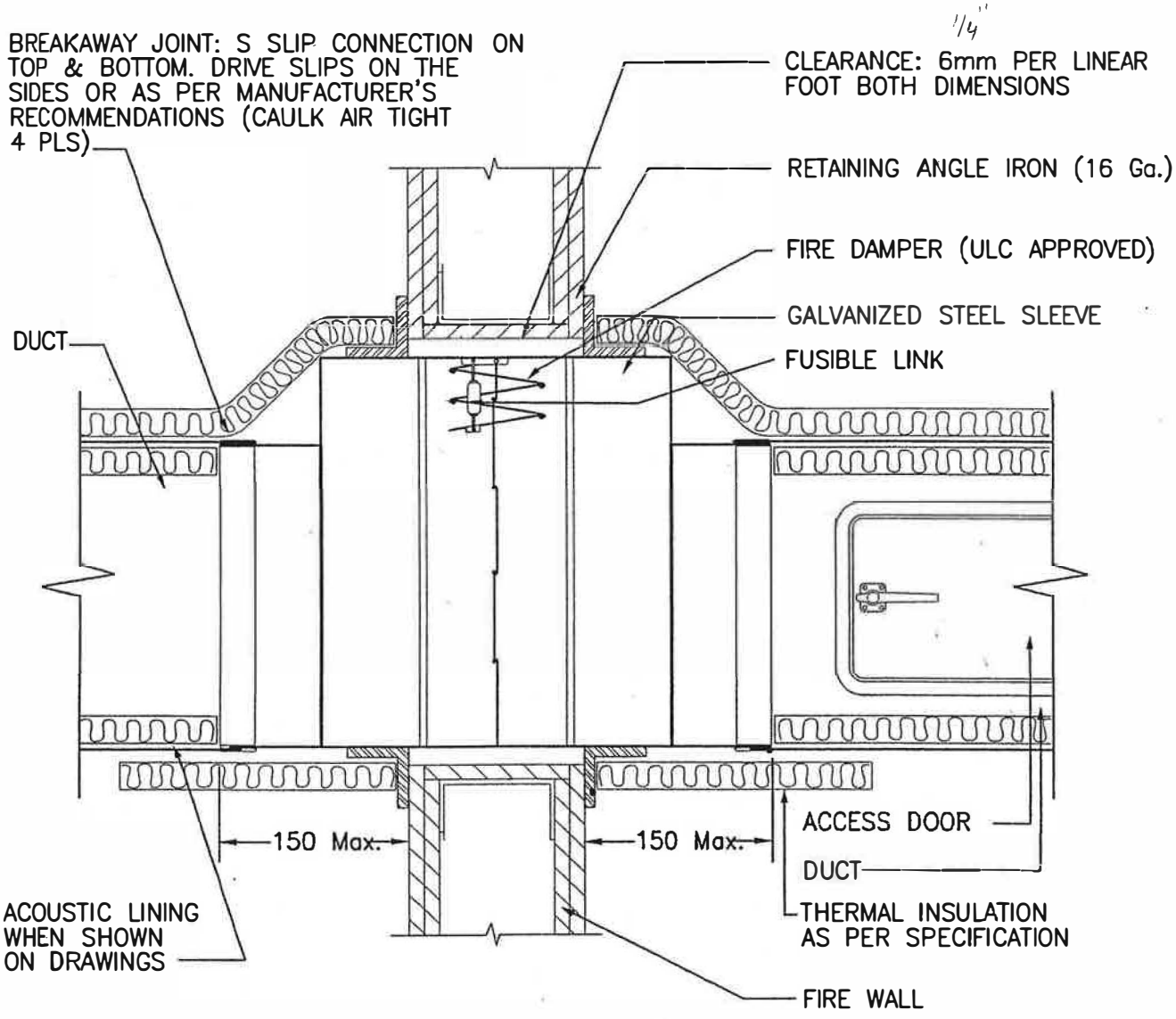
EQUIPMENT ROOF CURB PLAN

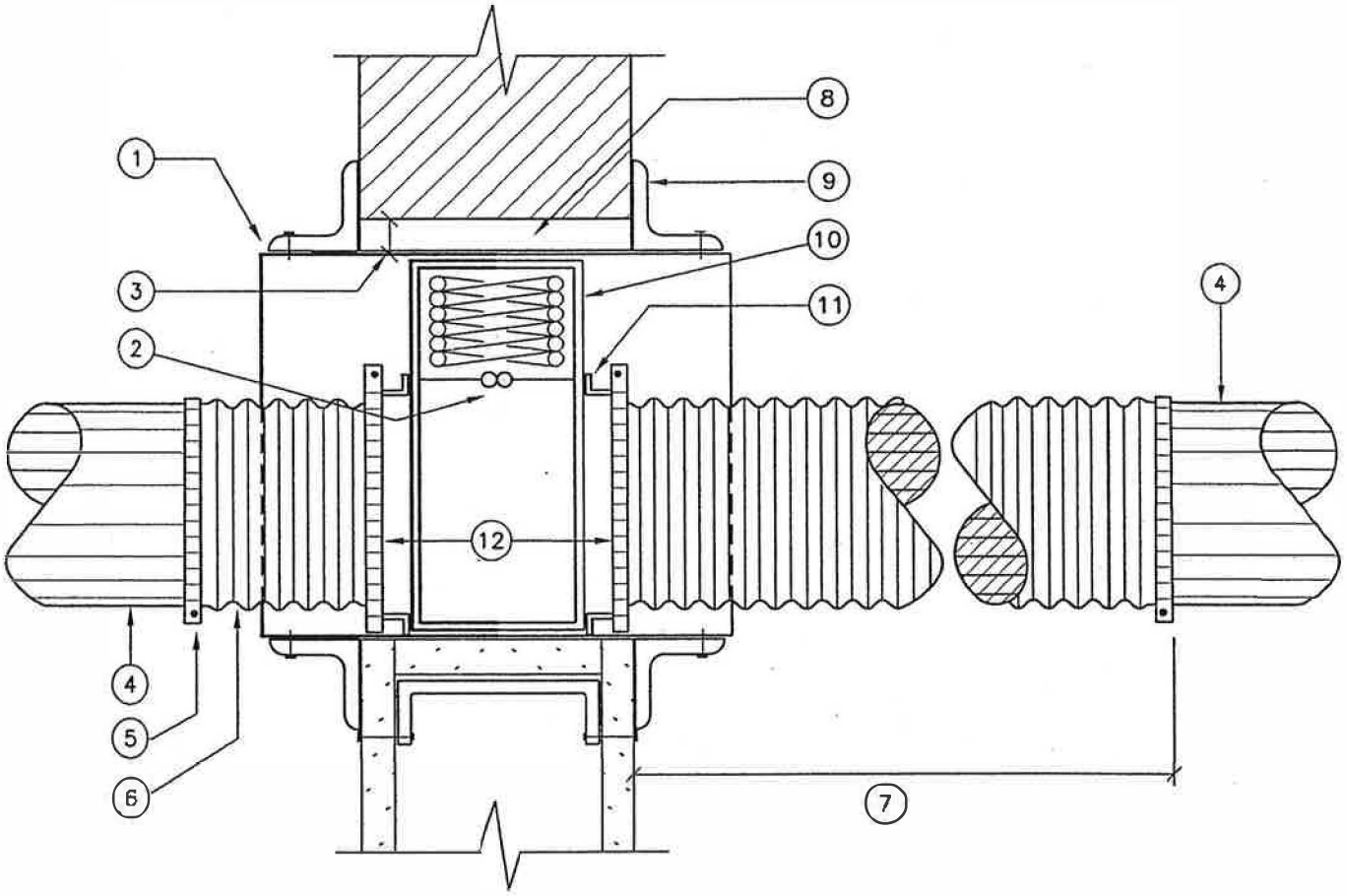


A CROSS-SECTION

SCALE: N.T.S.

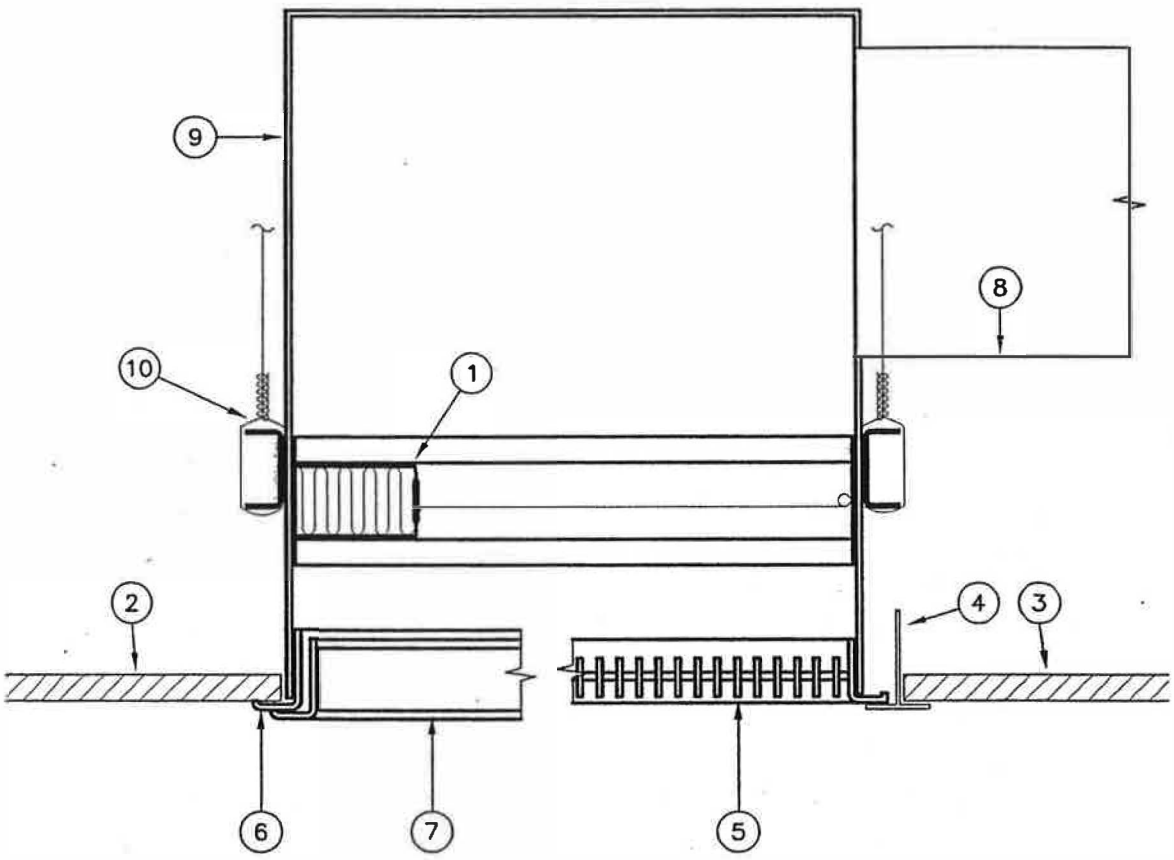

ENSURE WATERTIGHT SEAL AT ALL PENETRATIONS FOR EQUIPMENT ANCHORAGE.
SEE MECH DWGS FOR ROOFTOP EQUIPMENT.
PREFINISHED METAL FLASHING ON FLEX ROOF MEMBRANE FLASHING ON 38 TREATED WOOD CURB.
PREFINISHED METAL FLASHING ON FLEX MEMBRNAE FLASHING ON 19 TREATED PLYWOOD ON CONC.
EQUIPMENT ISOLATOR
CONCRETE FILL CURB ON 100 HIGH DENSITY RIGID FOAM. (EXPANDED POLYSTYRENE) PROVIDE ANCHORS TO WOOD CURB ON ALL FOUR SIDES.
75 TREATED WOOD CANT
TREATED WOOD BLOCKING TO SUIT. RIGIDLY ANCHOR CURB TO ROOF DECK AS REQUIRED.
SELF SEALING AIR/VAPOUR BARRIER MEMBRANCE CONTINUOUS CURBS AND INSUL.


BREAKAWAY JOINT: S SLIP CONNECTION ON TOP & BOTTOM. DRIVE SLIPS ON THE SIDES OR AS PER MANUFACTURER'S RECOMMENDATIONS (CAULK AIR TIGHT 4 PLS)
1/4"
CLEARANCE: 6mm PER LINEAR FOOT BOTH DIMENSIONS
RETAINING ANGLE IRON (16 Ga.)
FIRE DAMPER (ULC APPROVED)
GALVANIZED STEEL SLEEVE
FUSIBLE LINK
DUCT
150 Max.
150 Max.
ACCESS DOOR
DUCT
THERMAL INSULATION AS PER SPECIFICATION
ACOUSTIC LINING WHEN SHOWN ON DRAWINGS
FIRE WALL



NOTES: (#)

1. GALVANIZED STEEL SLEEVE.
2. FUSIBLE LINK.
3. 12.5mm [1/2"] MAXIMUM CLEARANCE.
4. DUCT.
5. CLAMP CONNECTION ON FLEX.
6. FLEXIBLE CONNECTION.
7. FLEXIBLE DUCT LENGTH – 3 X DIAMETER.
8. OPENING SIZE. SEE STANDARD SMACNA B.C. DETAIL.
9. STEEL RETAINING ANGLES. SEE STANDARD SMACNA B.C. DETAIL.
10. APPROVED TYPE FIRE DAMPER.
11. TO BE AIR TIGHT.
12. BREAK-AWAY JOINTS.



NOTES:

1 U.L.C. LISTED FIRE RATED CEILING DAMPER, WHERE SPECIFIED. INSTALLATION AS PER SMACNA STANDARD DETAILS.

2 CEILING MEMBRANE.

3 CEILING PANEL

4 CEILING TEE

5 T.B. MOUNTING GRILLE WITH REMOVEABLE CORE, AS SPECIFIED.

6 MOUNTING FRAME, AS SPECIFIED.

7 SURFACE MOUNTED GRILLE, AS SPECIFIED.

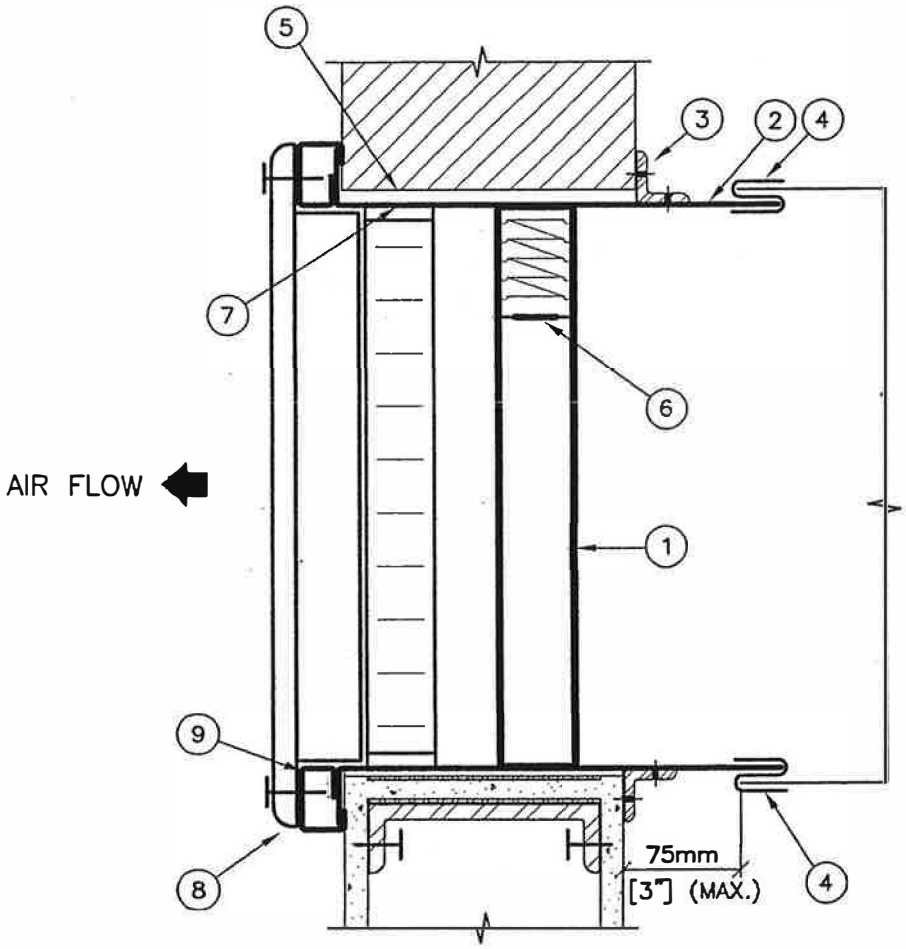
8 SHEET METAL DUCT. SIZE AS SHOWN ON FLOOR PLANS.

9 SHEET METAL PLENUM.

10 1.47mm [16 Ga.] 40mm [1– 1/2"] STEEL CHANNEL ATTACHED TO DAMPER FRAME AND UPPER "C" – PAN WITH SHEET METAL SCREWS, MIN. OF 2 EACH SIDE, AND NOT OVER 150mm [6"] O.C.

MD 28 006

FIRE DAMPER & SUPPLY GRILLE INSTALLATION



NOTES:

1 APPROVED SHUTTER TYPE FIRE DAMPER.

2 GALVANIZED STEEL SLEEVE – MATERIAL THICKNESS 3.28mm [10 Ga.]

3 RETAINING ANGLE IRON – SEE SMACNA DETAILS.

4 BREAKAWAY JOINT – USING "S" SLIP CONNECTION ON TOP AND BOTTOM & DRIVE SLIP ON SIDES. CAULK AIRTIGHT.

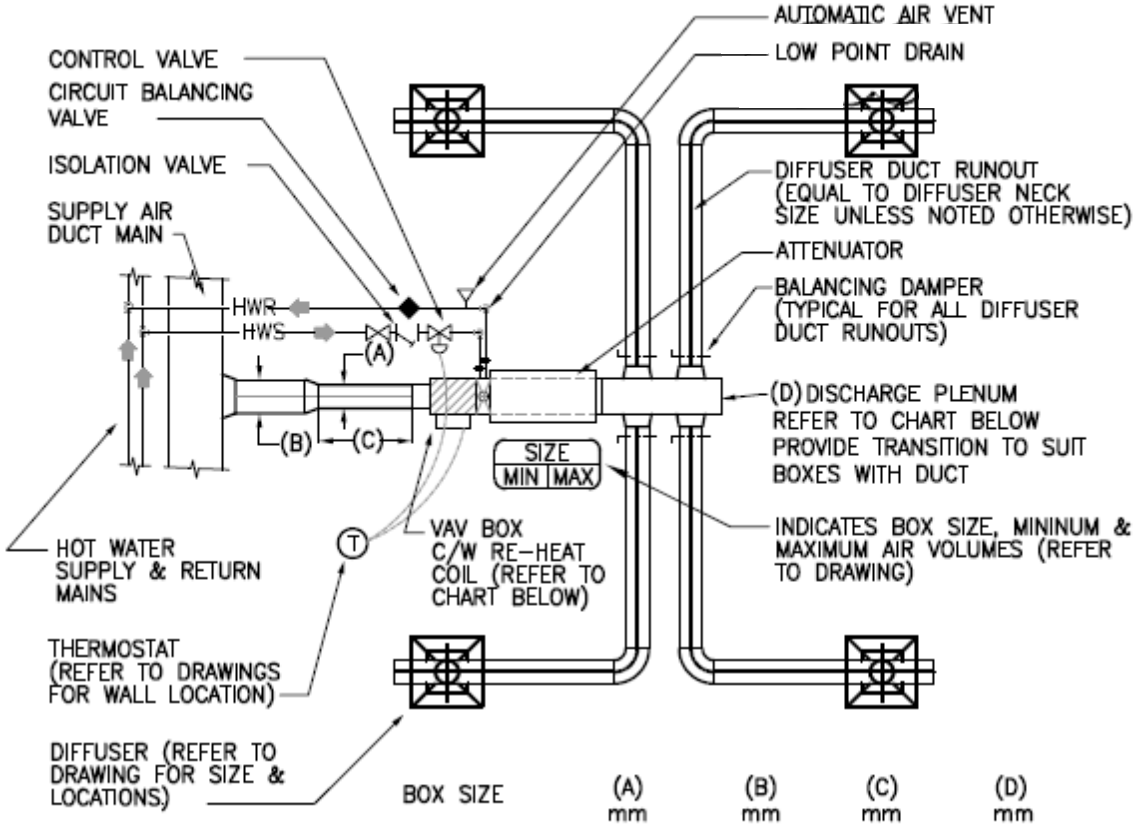
5 OPENING SIZE – SEE SMACNA DETAILS.

6 FUSIBLE LINK

7 SLEEVE – FLANGED TO FORM RETAINING ANGLE.

8 REGISTER SIZE TO SUITE BOX FRAME – SECURED TO BOX FRAME.

9 EXTENSION BOX FRAME WITH MITRED FINISHED CORNERS – TO RECEIVE SECURING SCREWS FOR REGISTER OR GRILLE. ALTERNATIVE METHODS OF SECURING GRILLES & REGISTER WILL BE CONSIDERED.



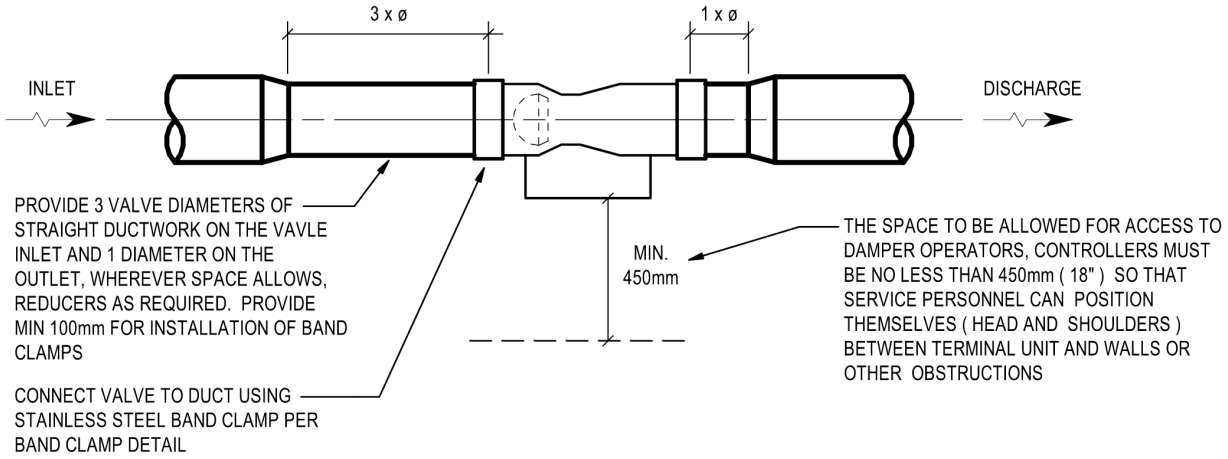
BOX SIZE	(A) mm	(B) mm	(C) mm	(D) mm
4	100~	150~	400	300X200
5	125~	150~	500	300X200
6	150~	200~	600	300X200
7	175~	200~	700	300X250
8	200~	250~	800	300X250
9	225~	250~	900	350X300
10	250~	300~	1000	350X300
12	300~	350~	1200	400X400
14	350~	400~	1400	500X450
16	400~	450~	1600	600X450

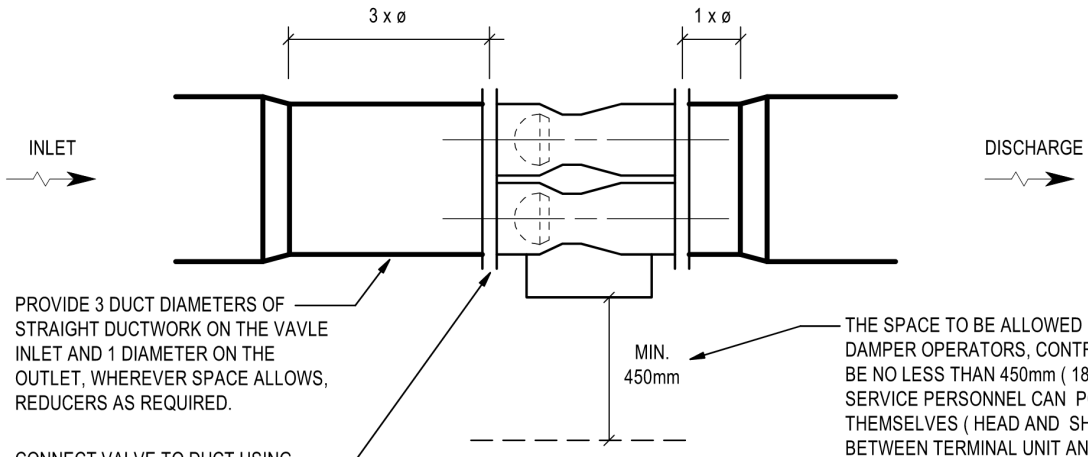
NOTES

1. (C) IS THE STRAIGHT LENGTH (Min.) OF DUCT EQUAL TO 4 TIMES THE INLET DIAMETER OF THE BOX.

2. ONE THERMOSTAT PER VAV BOX UNLESS NOTED OTHERWISE. EXACT LOCATION TO BE CONFIMED WITH ARCHITECT PRIOR TO INSTALLATION, REFER TO DRAWINGS.

3. CIRCUIT BALANCING VALVE TO BE SIZED BASED ON FLOW NOT PIPE SIZE.


3 x ø
1 x ø
INLET
DISCHARGE
PROVIDE 3 VALVE DIAMETERS OF STRAIGHT DUCTWORK ON THE VAVLE INLET AND 1 DIAMETER ON THE OUTLET, WHEREVER SPACE ALLOWS, REDUCERS AS REQUIRED. PROVIDE MIN 100mm FOR INSTALLATION OF BAND CLAMPS
CONNECT VALVE TO DUCT USING STAINLESS STEEL BAND CLAMP PER BAND CLAMP DETAIL
MIN. 450mm
THE SPACE TO BE ALLOWED FOR ACCESS TO DAMPER OPERATORS, CONTROLLERS MUST BE NO LESS THAN 450mm (18") SO THAT SERVICE PERSONNEL CAN POSITION THEMSELVES (HEAD AND SHOULDERS) BETWEEN TERMINAL UNIT AND WALLS OR OTHER OBSTRUCTIONS



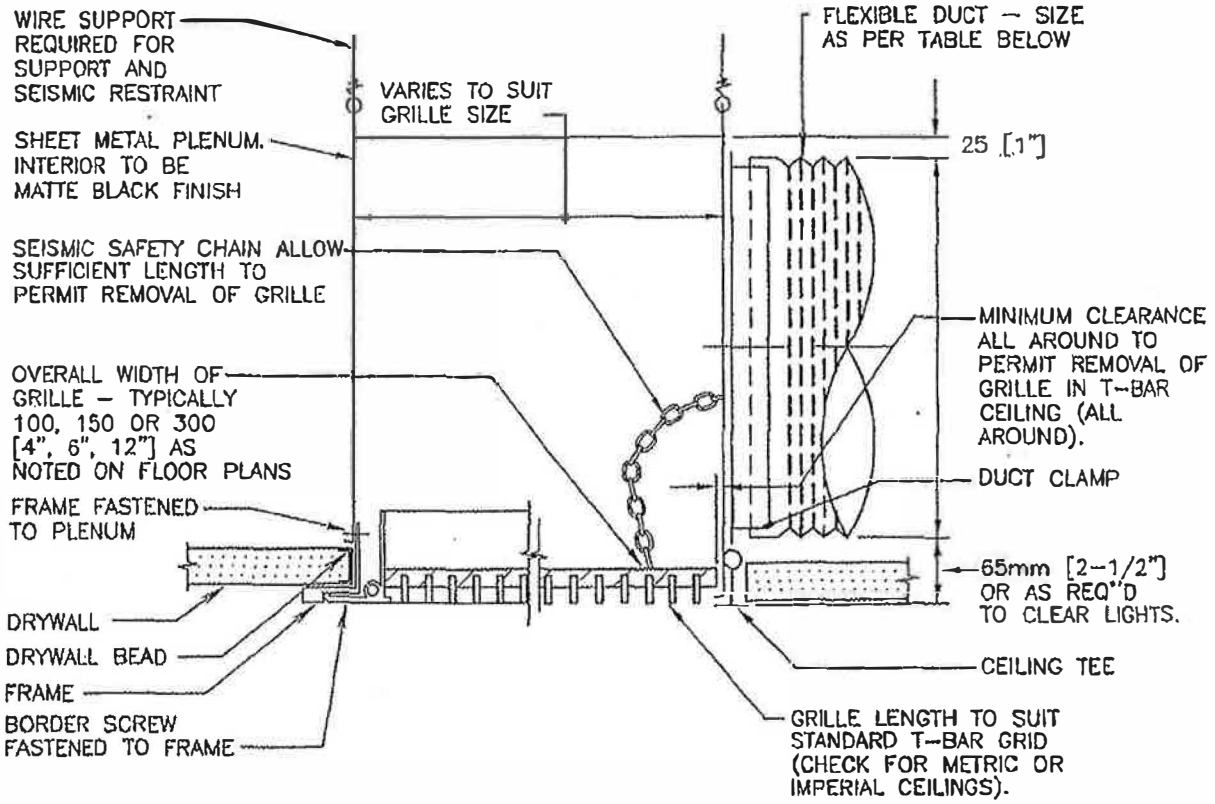
PROVIDE 3 DUCT DIAMETERS OF STRAIGHT DUCTWORK ON THE VAVLE INLET AND 1 DIAMETER ON THE OUTLET, WHEREVER SPACE ALLOWS, REDUCERS AS REQUIRED.

CONNECT VALVE TO DUCT USING FACTORY RECTANGULAR MOUNTING FLANGE. FLANGE CONNECTION PER FUME HOOD EXHAUST FLANGE DETAIL

THE SPACE TO BE ALLOWED FOR ACCESS TO DAMPER OPERATORS, CONTROLLERS MUST BE NO LESS THAN 450mm (18") SO THAT SERVICE PERSONNEL CAN POSITION THEMSELVES (HEAD AND SHOULDERS) BETWEEN TERMINAL UNIT AND WALLS OR OTHER OBSTRUCTIONS

NOTE:
ONE DUCT DIAMETER (ø) EQUALS

- 2x10: 400mm
- 2x12: 450mm
- 3x12: 500mm
- 4x12: 550mm
- 2x14: 500mm
- 3x14: 550mm
- 4x14: 600mm

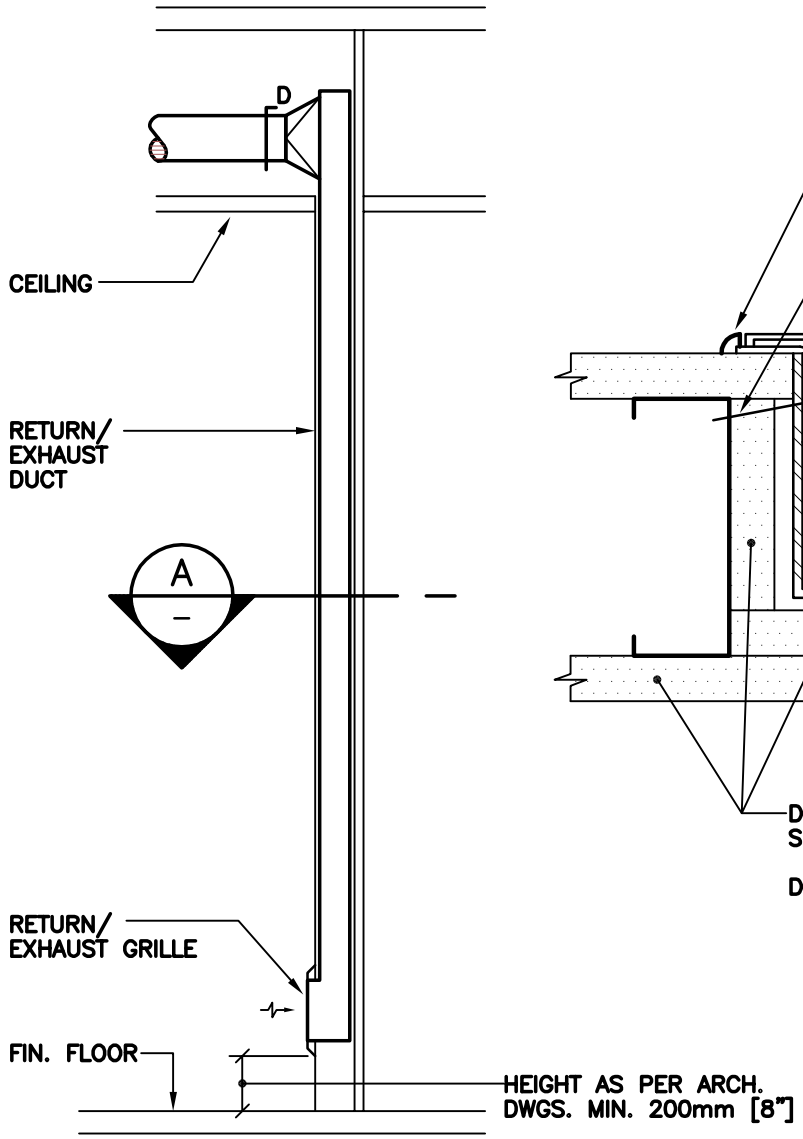


FLEXIBLE CONNECTION SIZE TABLE

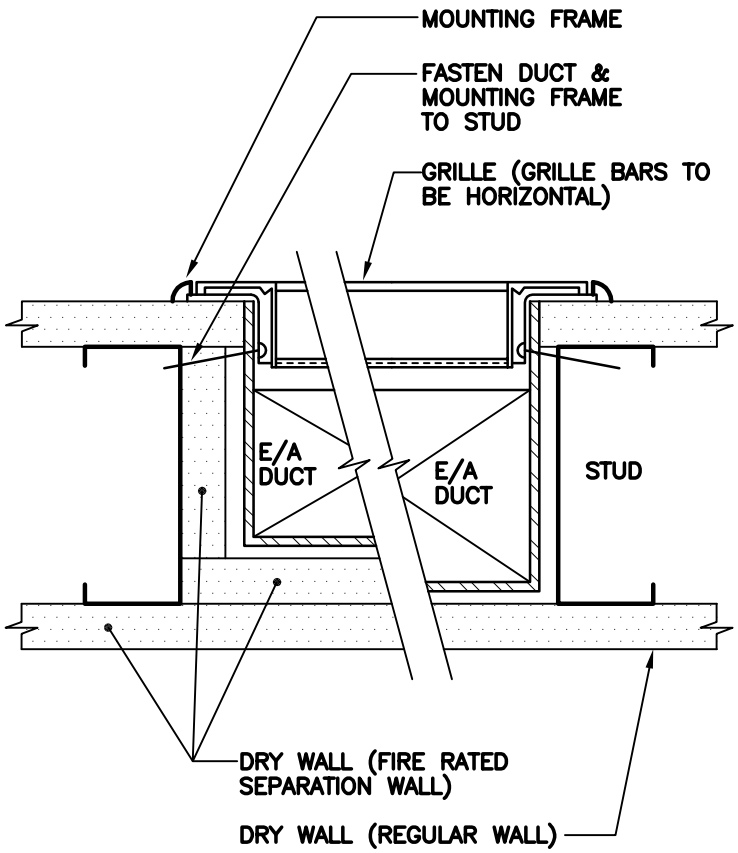
GRILLE SIZE	600x100 [24"x4"]	600x150 [24"x6"]	600x300 [24"x12"]	600x450 [24"x18"]
FLEX. CONNEC.	200 [8"] DIA.	250 [10"] DIA.	300 [12"] OVAL	350 [14"] OVAL

NOTE:

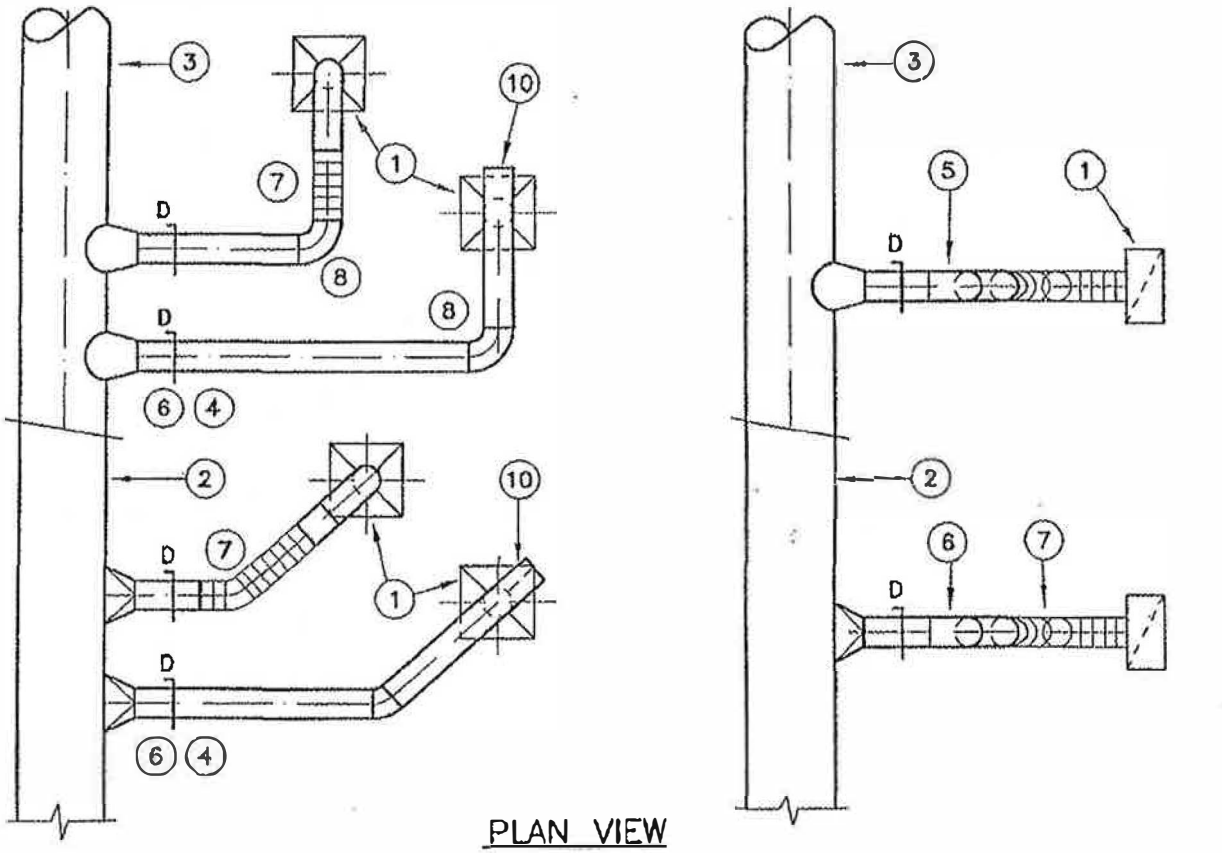
INSTALL BALANCING DAMPER AT DUCT TAKEOFF.



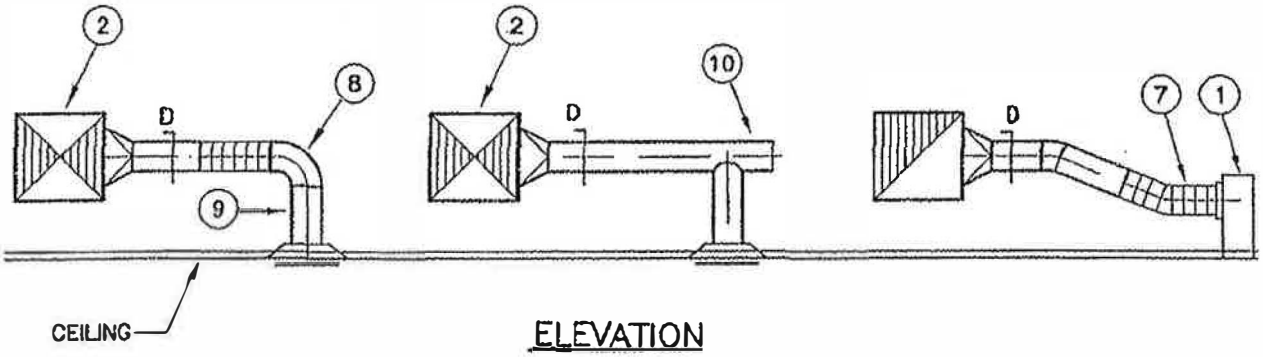
ELEVATION



SECTION 'A'



PLAN VIEW

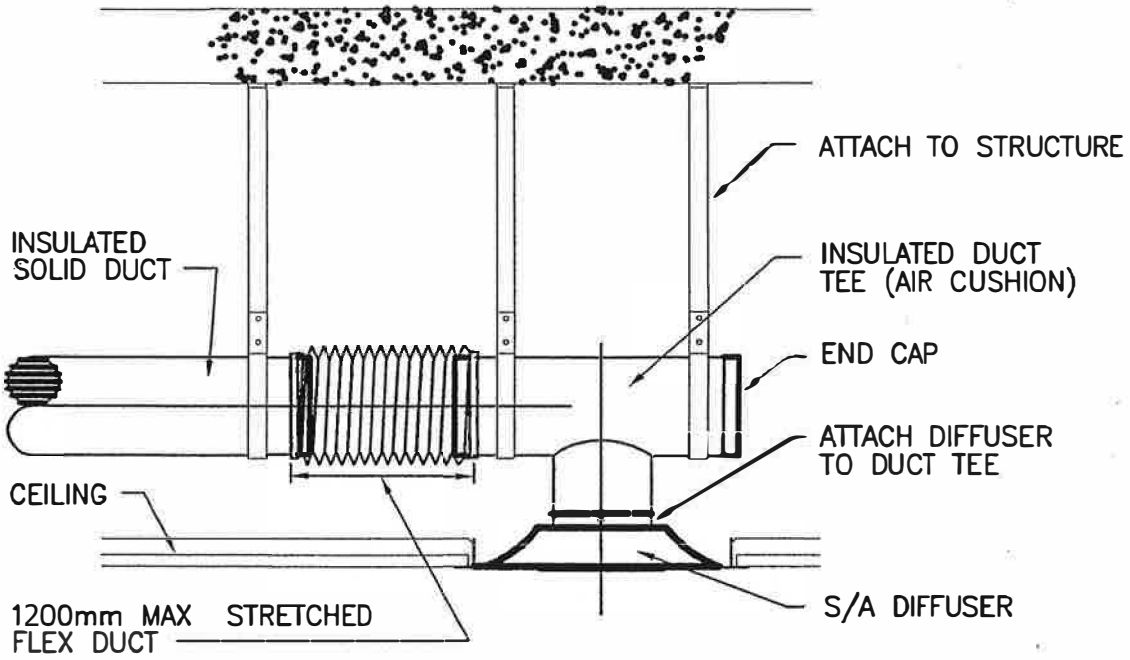


ELEVATION

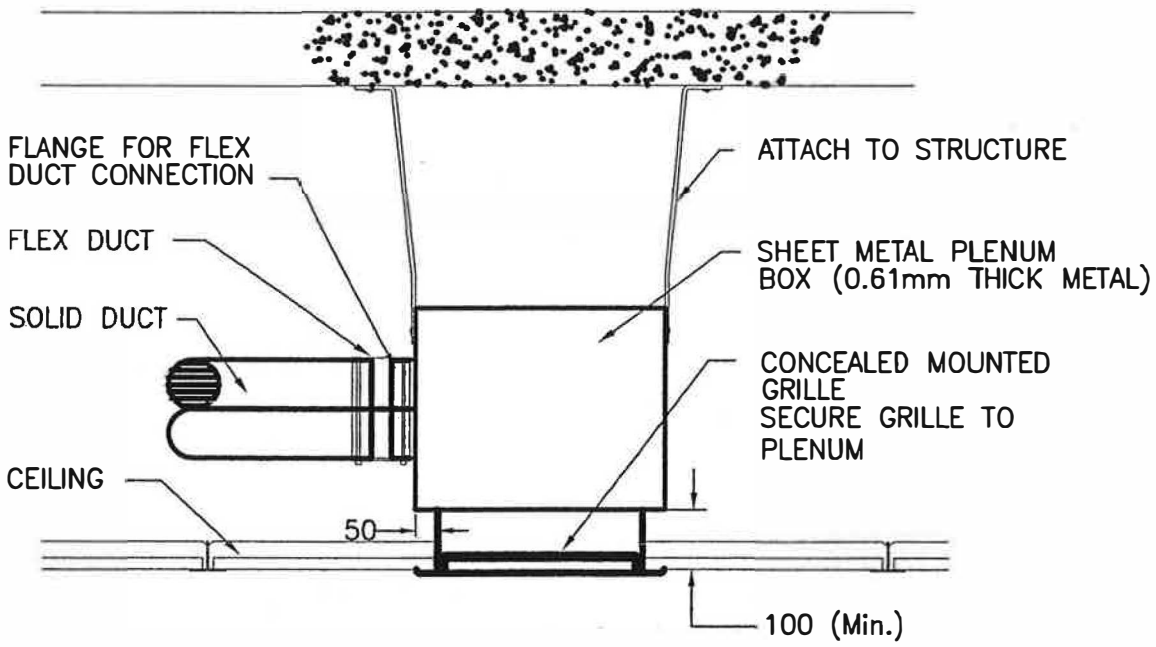
NOTES (#)

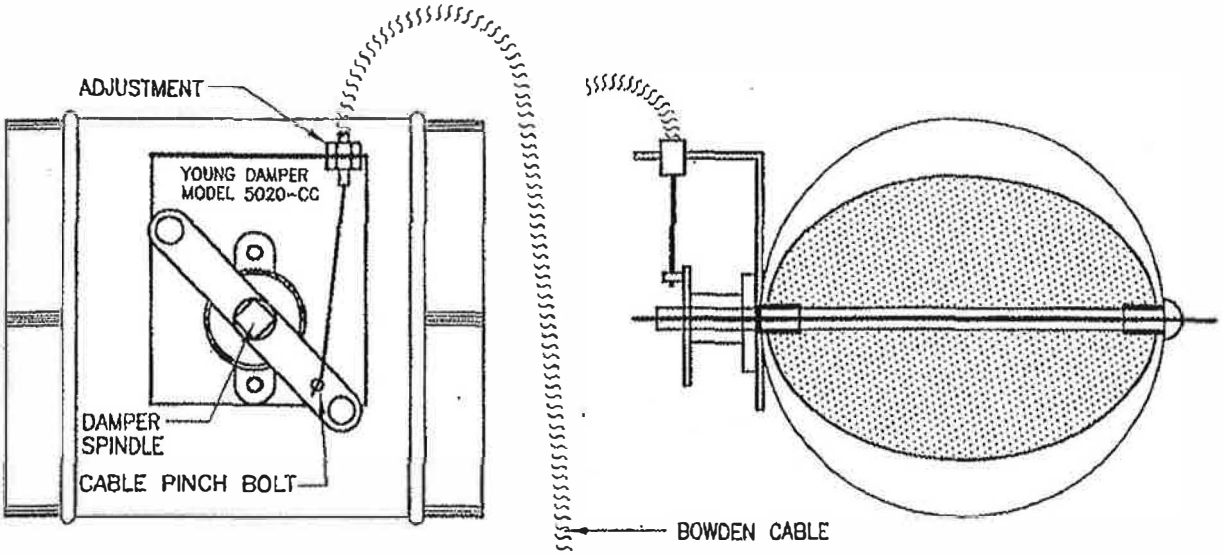
1. AIR TERMINAL UNIT AS SCHEDULED
2. RECTANGULAR DUCT – TYP
3. ROUND DUCT – TYP
4. DUCT SIZE TO MATCH DIFFUSER NECK SIZE
5. DUCT SIZE AS SCHEDULED – SEE MD-822
6. RIGID DUCT
7. FLEX DUCT – MAX. LENGTH AS SPECIFIED
   – MAX. BEND PERMITTED 90 DEG
   USE ALL RIGID DUCT FOR EXPOSED STRUCTURE.
8. RIGID DUCT ELBOW – RADIUS = 1.5 x DIA. MIN.
9. RIGID DUCT MIN. 1 DUCT DIA. LONG FROM ELBOW TO DIFFUSER
10. PROVIDE CUSHION HEAD FOR DIFFUSER WHERE CEILING SPACE IS LIMITED. TRANSITION TO EQUIVALENT RECTANGULAR DUCT AS REQUIRED. CUSHION HEAD LENGTH = 1x DIFFUSER DIAMETER

NOTE: SEISMIC RESTRAINTS AS PER SPECIFICATIONS



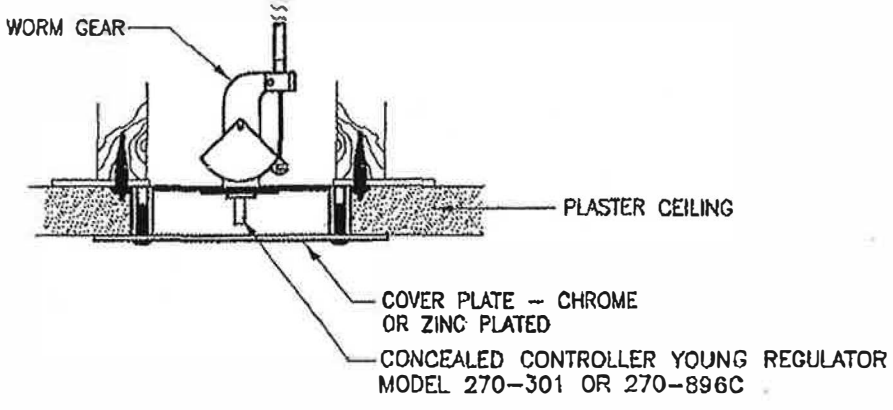
NOTE: SEISMIC RESTRAINTS AS PER SPECIFICATIONS.





SIDE VIEW

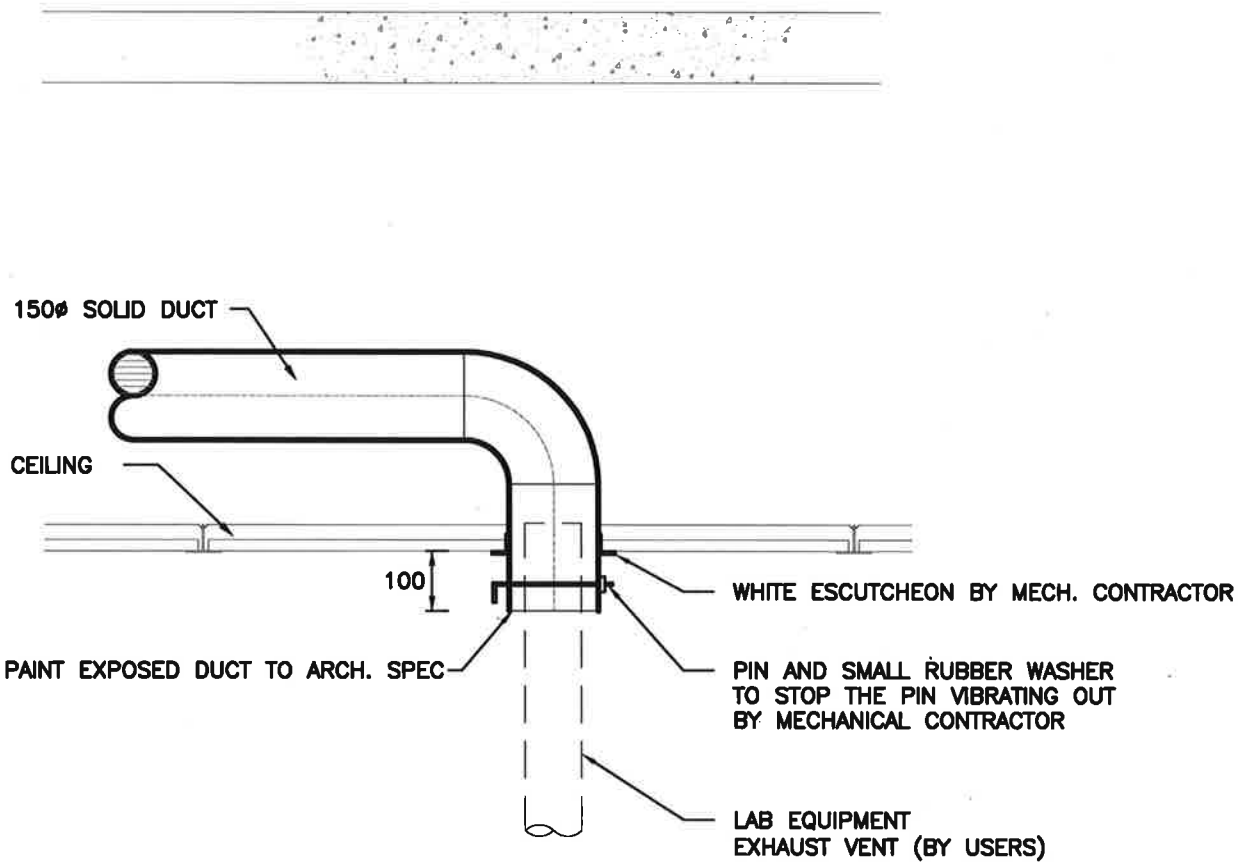
END VIEW

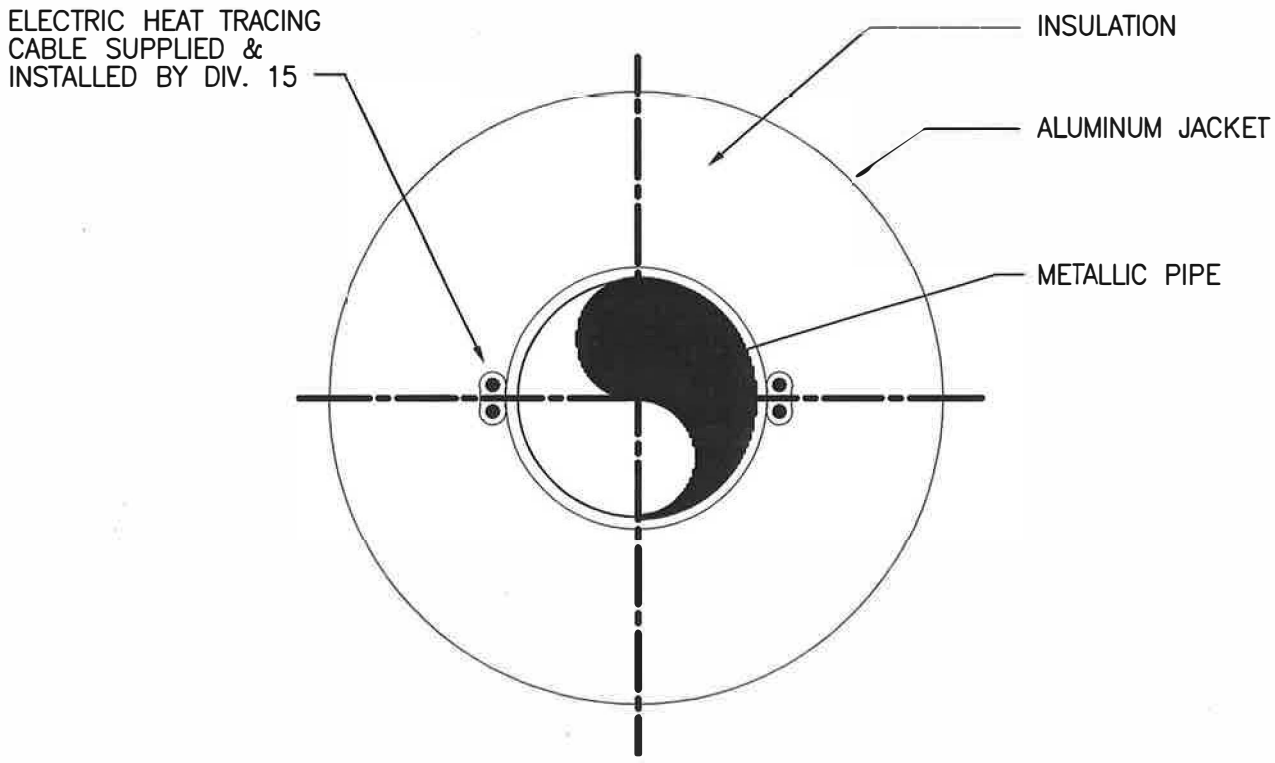


NOTE:
USE MODEL 270–275 CONTROLLER FOR MOUNTING BEHIND GRILLES OR IN PLENUMS ETC.)

DETAIL AT CEILING

NOTE: SEISMIC RESTRAINTS AS PER SPECIFICATIONS.





NOTES

ALL PIPES EXPOSED TO THE OUTDOOR AND/OR NOTED ON THE DRAWINGS ARE TO BE HEAT TRACED & INSULATED.

INSULATION AND JACKET ARE TO BE INSTALLED ONLY AFTER REVIEW & APPROVAL OF HEAT TRACING BY ENGINEER

REFER TO SPECIFICATION FOR INSULATION & JACKET REQUIREMENTS

1 General

1.1 GENERAL

.1 The following points list indicates the input and output points that shall be connected to the B.A.S. Any additional points that are noted in Section 23 09 93 and 23 09 95 to be under DDC control shall also be included as if they were on the points list. All points associated with one mechanical system shall be connected to the same Stand Alone Panel (SAP). All points shall be connected to SAPs unless they are specifically noted in the points list as TUC points or if the TUC meets the same specifications for user custom programmability as the SAP in Section 23 09 24.

.2 Program alarms as specified in the points list and sequences with user adjustable alarm thresholds. Provide descriptors for all programmed alarms which can be accessed via the graphics at the OWS(s).

.3 Refer to drawings for location of temperature sensors, thermostats, humidity sensors, CO2, Pressure and occupancy sensors.

1.2 DEVICE LEGEND

.1 Refer to Section 25 09 13 for specification of devices.

.2 RTS = Room Temperature Sensor

.3 DTS = Duct Temperature Sensor

.4 ITS = Immersion temperature Sensor

.5 ATS = Averaging Duct Temperature Sensor

.6 OTS = Outdoor Temperature Sensor

.7 HS = Humidity Sensor

.8 DPT = Differential Pressure Transmitters

.9 SPT = Static Pressure Transmitter

.10 VPT = Velocity Pressure Transmitter

.11 PSW = Pressure Switch

.12 TSW = Temperature Switch

.13 IPT = Current / Pneumatic Transducer

.14 CR = Current Relay

.15 EPR = Electric / Pneumatic Relay

.16 FSW = Flow Switch

.17 ESW = End Switch

.18 ER = Electric Relay

.19 DME = Damper Actuator Modulating Electronic

.20 DTE = Damper Actuator Two Position Electronic

.21 DMP = Damper Actuator Modulating Pneumatic

.22 DTP = Damper Actuator Two Position Pneumatic

.23 DMI = Damper Actuator Modulating Incremental Control

.24 VME = Valve Actuator Modulating Electronic

.25 VTE = Valve Actuator Two Position Electronic

.26 VMP = Valve Actuator Modulating Pneumatic

.27 VTP = Valve Actuator Two Position Electronic

.28 VMI = Valve Actuator Modulating Incremental Control

.29 MFT = VAV Box Flow Transmitter

.30 FMS = Electronic Flow Measuring Station

.31 WFS = Water Flow Measuring Station

1.3 TABLE LEGEND

.1 **DI** = DIGITAL INPUT; **DO** = DIGITAL OUTPUT; **AI** = ANALOG INPUT; **AO** = ANALOG OUTPUT; **X** = TUC POINT; **H** = HIGH ALARM; **L** = LOW ALARM; **S** = STATUS ALARM

2 Input / Output Points List

2.1 SYSTEM: GLOBAL

	INPUT		OUTPUT			
Point Description	**DI**	**AI**	**DO**	**AO**	**Alarm**	**Notes**
Outdoor Air Dry Bulb Temperature		X				1
Outdoor Air Humidity		X				1
Outdoor Air Wet Bult Temperature		X				1
Outdoor Air CO2 Level		X				1
Outdoor Air Enthalpy		X				1
Space Temperature		X				Typical, 1
Space Humidity		X				Typical, 1
Space CO2 sensor		X				Typical, 1
Space Pressure Sensor		X				Typical, 1
Space Occupancy Sensor	X					Typical, 1
Building Pressure sensor	X					1
Pressure Monitoring Device	X					Typical, BACnet
Space Pressure Sensor		X			X	Typical, 1
Fire Alarm Signal	X				X	Stage I, Stage II, Smoke Vent, 1
Lighting Control System	X		X			BACnet, 5
Lighting control relay panel (typical)	X		X			Refer to electrical drawings for location and quantity

UPS	X	X			X	Typical, 1
HEPA Filter Diffuser Status / Dirty Condition		X			X	Typical, 1
Glycol Heating Loop Differential Pressure Sensor		X			X	1
Glycol Chilled Water Loop Differential Pressure Sensor		X			X	1
Trap Primers			X			Typical, 1

2.2 SYSTEM: RTU-3A&3B

	INPUT		**OUTPUT**			
Point Description	**DI**	**AI**	**DO**	**AO**	**Alarm**	**Notes**
Outdoor Air Damper				X		Typical, 1
Outdoor Air Damper End Switch	X				X	Typical, 1
Supply Air Damper			X			Typical, 1
Supply Air Damper End Switch	X				X	Typical, 1
Pre-Filter Status		X			X	Typical, 1
Dynamic V8 Filter Status		X				Typical, 1
Dynamic V8 Filter Alarm	X				X	Typical, 1
Supply Fan VFD BACnet						Typical, 1, BACnet
Supply Fan Alarm	X				X	Typical, 1
Supply Fan Enable			X			Typical, 1
Supply Fan Speed Setpoint				X		Typical, 1
Supply Fan Status	X					Typical, 1
Supply Fan Power Input		X				Typical, 1
Supply Fan Air Flow		X				Typical, 1
Supply Duct Static Pressure		X			X	Typical, 1
Implosion Door Status	X				X	Typical, 1, hardwire interlock
AHU Supply Plenum Pressure Switch	X				X	Typical, 1, hardwire interlock
Supply Air Duct Temperature		X			X	Typical, 1
Supply Air Duct Humidity		X			X	Typical, 1
AHU Leaving Air Temperature		X			X	Typical, 1
AHU Leaving Air Humidity		X			X	Typical, 1

	INPUT		OUTPUT			
Point Description	**DI**	**AI**	**DO**	**AO**	**Alarm**	**Notes**
Outdoor air Temperature Downstream of Pre-heat coil		X			X	Typical, 1
Outdoor air Temperature Downstream of Re-heat coil		X				Typical, 1
Outdoor air Temperature Downstream of Cooling Coil		X				Typical, 1
Low Temperature Detect	X				X	Typical, 1, Freeze stat hard wired
Hot water Pump Enable / Disable	X			X		Typical, 1
Hot water Pump Status		X			X	Typical, 1
AHU Service Corridor Temperature		X			X	1
AHU Service Corridor Electric Heater Status		X			X	1
AHU Service Corridor Fan Status		X			X	1
Heating Control Valves (one per coil)				X	X	Typical, 1
Cooling Control Valves (one per coil)				X	X	Typical, 1
Steam Control Valves (one per humidifier)				X	X	Typical, 1
Steam Pressure		X			X	1
Condensate return temperature		X				
Cold water solenoid valve		X				
AHU Cooling Coil Chilled Water Entering Temperature		X			X	Typical, 1
AHU Cooling Coil Chilled Water Leaving Temperature		X			X	Typical, 1
AHU Pre-Heat Coil Entering Heating Water Temperature		X			X	Typical, 1
AHU Pre-Heat Coil Leaving Heating Water Temperature		X			X	Typical, 1
AHU Re-Heat Coil Entering Heating Water Temperature		X			X	Typical, 1
AHU Re-Heat Coil Leaving Heating Water Temperature		X			X	Typical, 1
Hi Limit Humidi-stat	X					Typical, 1
Air Proving Switch	X					1, hardwire interlock

2.3 SYSTEM: EXHAUST FANS EF-WW-0-1A & 1B

	INPUT		OUTPUT			
Point Description	**DI**	**AI**	**DO**	**AO**	**Alarm**	**Notes**
Exhaust Duct Static Pressure		X			X	1
Exhaust Air Temperature		X				1
Exhaust Air Humidity		X			X	1
Exhaust Air CO2 Level		X			X	1
Exhaust Fan VFD BACnet						Typical, 1 BACnet
Exhaust Fan Alarm	X				X	Typical, 1
Exhaust Fan Enable			X			Typical, 1
Exhaust Fan Speed Setpoint				X		Typical, 1
Exhaust Fan Status	X					Typical, 1
Exhaust Fan power input		X				Typical, 1
Exhaust Air Pressure Switch	X				X	Typical, 1, hardwire interlock
Exhaust Fan Air Flow		X				Typical, 1
Fan Isolation Damper				X		Typical, 1
Fan Isolation Damper End Switch	X				X	Typical, 1
Exhaust Fan Plenum By-pass Damper				X		1
Exhaust Fan Plenum By-pass Damper	X				X	1
Start/Stop Signal From BSC	X					Typical, 1
Biosafety Cabinet Alarm	X				X	Typical 1, 4

2.4 SYSTEM: AIR VALVES (W/ AND W/ RE-HEAT COILS)

	INPUT		OUTPUT			
Point Description	**DI**	**AI**	**DO**	**AO**	**Alarm**	**Notes**
Damper Control			X		X	Typical, 1
Air Flow Measurement		X			X	Typical, 1
Discharge Air Temperature		X			X	Typical, 1
Heating Output			X			Typical, 1
Zone Humidity		X			X	Typical, 1
Zone Set-point		X				Typical, 1

Zone Temperature		X			X	Typical, 1
Zone CO2		X			X	Typical, 1
Reheat Coil Control Valve				X		Typical, 1
Reheat Coil Control Valve Position		X			X	Typical, 1
Zone Occupancy	X					Typical, 1

2.5 SYSTEM: HEAT TRACE

	INPUT		**OUTPUT**			
Point Description	**DI**	**AI**	**DO**	**AO**	**Alarm**	**Notes**
Heat Trace	X				X	1, 3

Notes:

1. Show all points on graphics
2. BACNet interface for monitoring only. Control and monitoring points listed to be hardwired.
3. Alarm on loss of continuity
4. Coordinate with BSC suppliers for BMS interface
5. Coordinate with Electrical Contractor and FMO

END OF SECTION

Part 1 General

1.1 GENERAL SYSTEM DESCRIPTION

.1 The University Hospital of Northern BC Pharmacy is undergoing a complete renovation to bring the space to NAPRA requirements. This will involve removing existing systems and installing new ones.

.2 A new, modern, control system is desired for the Pharmacy including a laboratory air control system to monitor and control the sterile compounding suites and adjacent spaces.

.3 BMS contractor shall ensure the existing BMS system and associated wiring and devices essential for operation of the mechanical systems of the building remain protected and operational during construction.

.4 The mechanical systems for the addition are generally consist of the following:

.1 A new Pharmacy Air Handling unit (RTU-3A &3B) is dedicated to the pharmacy compounding and support rooms. The new air handling is a duplex system with two tunnels, each sized for 100% of the required capacity (N+1 redundancy). Each tunnel consists of the following:

.1 Sized for 100% outside air.

.2 One supply fans sized each at 100% of the required airflow capacity.

.3 The air handling unit will be used to distribute conditioned air to the pharmacy spaces for heating, cooling and humidity control.

.4 The air handling unit has a pre-heating coil, to bring the outside air from the design conditions to above freezing conditions to prevent frosting of the interior of the unit, and a heating coil to complete the heat to the air supply conditions. The heating coil also provides reheat when dehumidification is required.

.5 The air handling unit is provided with a glycol cooling coil designed to meet the cooling load at 100% outside air conditions and provide dehumidification.

.6 Humidification is provided to the unit via steam from the plant. A steam dispersion module is located in the AHU.

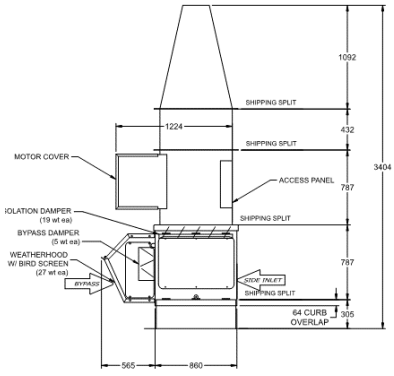
.7 Please note: the air handling unit is not capable of providing recirculation as most of the air is required to be exhausted by NAPRA standards.

.2 A new stainless steel Hazardous Exhaust System and duplex entrained exhaust fan (EF-WW-01-1A & 1B) is located on the roof (exterior). The dedicated exhaust systems consist of the following:

.1 New duplex (entrained) up blast exhaust system for the hazardous sterile compounding room.

.2 Each fan is provided with a bypass air plenum c/w bypass damper that provides entrained air and increases the dilution of the Hazardous Air leaving the building.

.3 Each fan is provided with an Isolation Damper to isolate each fan for maintenance or replacement.



Duplex HD Exhaust Fan

.3 Heating

.1 **AHU Heating**: Heating is provided from the existing boiler plant and heat exchangers located in the sub-basement plant room. Heat to the systems is provided from the existing heating

water systems. New Heating components for this system include the following:

.1 A heat exchanger, located in the mechanical room, to heat the glycol system using the hospital heating water return. This will help reducing the hot water return temperature to maximize the efficiency of the condensing boilers being installed in a separate project.

.2 Two variable flow hot water pumps, in a duty-standby configuration, providing hot water to the primary of the heat exchanger.

.3 Two variable flow hot glycol pumps, in a duty-standby configuration, supplying hot water from the secondary of the heat exchanger to the pre-heating and heating coils in the AHU.

.4 A glycol system to provide make-up glycol to the system.

.5 A glycol pre-heating coil with a destratification, constant flow pump.

.6 Glycol heating coils located in the new air handling unit

.2 **Re-Heat:** Heat to the spaces is primarily provided by reheat coils associated with each venturi air valve.

.1 Heating is provided to re-heat coils, located in the pharmacy, from the existing heating water system in the space.

.4 Cooling

.1 The air handling unit is provided with a cooling coil connected to a chilled water system of the building.

.5 Domestic cold water, hot water and recirculation is provided from the existing building systems located in the sub-basement mechanical room.

.6 Fire Protection – the fire sprinklers are connected to the existing building system.

1.2 CONTROLS CONTRACTOR

.1 Please note that the controls contractor shall be the base building contractor and that the control systems include:

.1 Reliable Controls and

.2 Phoenix Controls Vantage system for the compounding pharmacy (or wherever Venturi valves are shown / specified on the drawings and specifications).

1.3 ADDITIONAL SEQUENCES

.1 Please refer to 25 90 10 – Compounding Pharmacy Airflow control for additional information regarding the pharmacy differential pressure monitoring and control system.

Part 2 Products – Refer to Section 25 09 13

Part 3 Execution

3.1 GENERAL

.1 The existing BMS operator workstation (OWS) will control the Air handling unit, hazardous exhaust fan, all associated equipment (for the AHU and Exhaust fan), Pre-heat control system etc. In addition the BMS will receive alarm conditions from the Pharmacy TDU.

.2 Set-points shall be adjustable on the BAS OWS. All default set-points shall be tested, set and recorded during testing and balancing. Work with testing and balancing Agency to assist with TAB and verify default set-points.

.3 Consultant, Commissioning Agent and Controls Contractor shall optimize final control sequences.

3.2 HVAC CONTROL OBJECTIVES:

.1 Program the system to meet the following objectives:

.1 Maintain the required minimum air changes per hour of supply air in each space, based on room volume and exhaust air quantities, by the modulation of the air valves.

.2 Maintain the required temperature set point in each space by modulating the AHU supply air temperature and the re-heat coils as needed.

.3 Maintain the required pressurization cascade between spaces by modulating the air valves in the exhaust.

.4 Maintain the relative humidity within the required parameters by increasing the cooling when dehumidification is required or supplying steam when humidification is required.

.5 Maintain the supply hot water temperature set point by modulating the primary pumps supplying hot water to the heat exchanger.

.6 Monitor and control set points and provide alarms when the deviation from the set point is beyond the required parameters.

.7 Monitor and control equipment and provide alarms when their status differs from the instruction received or, for equipment with internal controls, when an alarm is emitted.

.8 Alternate duty-standby equipment on a weekly basis.

.9 Start standby equipment on failure of the duty equipment.

.10 Allow for the adjustment of set-points. Set-points shall be adjustable via:

.1 The Pharmacy Terminal Display Unit (TDU) for the following control components:

.1 Pharmacy Differential Pressure Monitoring and Control (Refer to 25 09 13)

.2 Final control of room temperature setpoints and control via. variable volume controls of the venturi valves and associated re-heat coils.

.3 Other elements indicated in specifications section 25 09 35

.11 Energy Objectives

.1 Provide no more heating than is essential (minimize reheat).

.2 Provide no more cooling that is essential.

.3 Provide temperature, humidity and pressure reset functions for air and water systems to reduce energy consumption.

3.3 ALARMS AND SAFETIES

.1 All room temperature, humidity, and pressure sensors shall alarm their high or low alarm condition, as defined in the system database, at the operators Terminal Display Unit (TDU). Alarm points will be taken from dry contacts on the TDU and connected to the existing BMS.

.2 Other temperature and humidity sensors shall alarm their high or low alarm condition, as defined in the system database, at the operators existing workstation (BMS).

.3 An alarm shall be generated at the OWS when any motor status as sensed by a current sensing relay does not match the commanded value for that motor.

3.4 POST FIRE ALARM EQUIPMENT RESTART

.1 Fire Alarm Systems in buildings will override BMS control of designated equipment in an alarm condition. The BMS shall monitor a set of contacts output from the fire alarm system for status indication of a building fire alarm. The BMS Controls Contractor shall coordinate building equipment that is shut down by the Fire Alarm System.

.2 Alarms shall be annunciated by the BMS to indicate the equipment failure/shut down and the building fire alarm condition. The BMS shall not annunciate nuisance alarms for monitored input points on systems shut down by the BMS or fire alarm system (e.g. high supply air temperature, low duct static pressure, etc.).

.3 Equipment shut down by the fire alarm system shall not be automatically restarted. The BMS shall not restart the equipment until the following steps are taken (Note: the sequence of operation for this mode shall be reviewed and approved by UHNBC):

.1 Building fire alarm condition has been cleared.

.2 Operator acknowledges the fire alarm.

.3 Operator with appropriate access level resets the BMS system shut down software point.

.4 Operator with appropriate access level commands a single “Post Fire Alarm Equipment Restart” software command point.

.4 Once the above conditions have been satisfied and the BMS receives a Post Fire Alarm Equipment restart command the BMS shall initiate the restart of any equipment shut down by the fire alarm system. The restart sequence shall provide an orderly start-up of the motors for each individual system with time delay between restarts of individual systems. Start of systems shall be according to normal system start up sequences. Only those motors which should be operational in accordance with the Occupancy Schedule or application software programming requirements shall be restarted.

3.5 POST BUILIDNG POWER FAILURE QUIPMENT RESTART

.1 Power failures in buildings will result in building equipment shutting down. The BMS shall monitor building electrical distribution equipment status for indication of a building power failure condition. Some building equipment will be serviced with emergency power and UPS power supplies. The BMS Controls Contractor shall coordinate building equipment that is serviced with emergency and UPS power supplies.

.2 Post Building Power Failure Equipment Restart facilities shall be provided to ensure the controlled and orderly start-up of building equipment following a power failure and to prevent over or under pressurization of any area.

3.6 MONITORING

.1 The BMS monitors the following conditions and parameters as a minimum:

.1 Fire Devices

.1 All fire / smoke damper positions;

.2 Smoke detection (from fire alarm panel);

.3 Fire Alarms:

.1 Stage I

.2 Stage II

.3 Smoke Vent Mode

.2 Ventilation System:

.1 All motorized mechanical damper positions.

.2 Supply air temperature and humidity.

.3 Duct main static pressure.

.4 Exhaust air temperatures and humidity level

.5 Variable Speed Drive full interface (i.e. status and energy use).
.6 Supply, return and exhaust fan plenum static pressure.
.7 Air filter differential pressure sensors indicate the air pressure drop across each filter section.
.8 Freeze alarms.
.9 Air handling unit fan operating airflow.
.10 Exhaust system Operating airflow.
.11 Control damper end switch.
.12 Control valve feedback signal (where specified).

.3 Room Level Controls
.1 Air Supply (l/s).
.2 Temperature (ºC).
.3 Humidity.
.4 Relative pressurizations.
.5 CO2 (where applicable).
.6 Occupancy mode (where applicable).
.7 Air Change Rate - Air Changes per Hour (ACH).

.4 Outdoor Air Conditions
.1 Outdoor air dry-bulb temperature.
.2 Outdoor air wet-bulb temperature.
.3 Outdoor Enthalpy.
.4 Outdoor Humidity.

.5 Lighting system

.6 BMS Sensor Failure
.1 Associated BMS control output retained in last commanded state. If an alternative sensor can be utilized for satisfactory control the BMS shall incorporate automatic control logic to implement the revised control.
.2 On failure of information only type BMS input points shall be annunciated as alarms.

3.7 AIR HANDLING UNIT – RTU-3A & 3B – PHARMACY

.1 . General Description

.1 The Pharmacy compounding suite is fed from a new Air Handling unit RTU-3A & 3B. The unit consists of 2 tunnels, each sized for 100% of the total capacity but both normally operate at approximately 50%. The system provides cool 100% outside air and is intended to be able to operate 24/7.

.2 Refer to 25 09 35 – Pharmacy Clean Room Airflow Control for additional information on pressure and airflow requirements for the Pharmacy compounding suite.

.3 Redundancy:

.1 The unit is designed to provide 100% redundancy.

.4 Catastrophic Event Management:

.1 The mechanical and controls contractors are to work with the Mechanical Engineer, Commissioning Authority and Northern Health to ensure that the final system setup is coordinated with Northern Health Catastrophic Event Management Contingency Plans.

.2 During a catastrophic event the air handling system shall be manually switched over via the BMS to maintain minimum air exchange rates as appropriate to the HCF.

.3 During a catastrophic event the Duplex hazardous exhaust fan (EF-WW-0-1A & 1B) shall continue to operate as normal (24/7 operation) in order to maintain the pressure differential requirements outlines in Specification Section 25 09 35 and NAPRA Model Standard for Compounding of Hazardous Sterile Preparations https://napra.ca/sites/default/files/2017-09/Mdl_Stnds_Pharmacy_Compounding_Hazardous_Sterile_Preparations_Nov2016_Revised_b.pdf)

.4 Systems for controlling HVAC functions during a catastrophic event shall be manually initiated from the BMS (and shall not be automatic – although the sequence once initiated shall be automatic).

.5 The AHU shall maintain minimum air exchange rates during a catastrophic event (refer to the Environmental Control drawings for each department (M101 series) for detailed minimum air flow set points)

.6 The new air handling unit and associated components shall be programmed to be controlled manually by the BMS during a catastrophic event for the following scenarios (per CSA Z317.2):

.1 Continue to operate normally with 100% outdoor air during an **internal** catastrophic event.

.2 Operation will continue to operate normally using 100% outside air and FMO shall install MERV 13 or 14 pre-filters in the empty pre-filter (forest fire / smoke) rack located in the unit, during an **external** catastrophic event. This operation with HVAC systems at increased Static Pressure during a Forest Fire event (added MERV 14 or 13 Filters) and

.3 Operation with the AHU stopped “(to prevent spread of localized contamination) during an internal or external catastrophic event;

.2 Air Flow Requirements:

.1 For additional information refer to the Environmental Controls drawings

.2 Total Requirements (RTU-3A & 3B):

.1 Supply Air: 1,400 l/s

.2 Min. Outside Air: 1,400 l/s (100%)

.3 Return Air: 0 l/s

.3 Components

.1 Pharmacy Air Handling unit: RTU-3A & 3B

.1 Outdoor air damper (x2)

.2 MERV 8 summer Pre-Filter (x2)

.3 Pre-Heat Coil (RTU-3-PHC-1/2)

.4 Pre-Heat Coil 2-way Control Valve (RTU-3-PHC-CV-1/2)

.5 Pre-Heat Coil destratification pump (P-27A/B)

.6 MERV 8 winter pre-filter / MERV 13 Forest Fire Pre-Filter. Forest Fire pre-filter not installed under normal conditions (x2)

.7 Cooling Coil (RTU-3-CC-1)

.8 Heating Coil (RTU-3-HC-1/2)

.9 Heating Coil 3-way Control Valve (RTU-3-HC-CV-1/2)

.10 Humidifier (Externally Mounted c/w connections to AHU) (HUM-RTU-3A/B)

.11 Supply Fan – Normally operate at approximately 50% each (RTU-3-SF-1/2)

.12 Supply Fan VFDs (one per fan) (RTU-3-VFD-1/2)

.13 Dynamic V8 Final Filters

.14 Supply air damper (x2)

.4 Related Points

.1 Outside air temperature ~~(From Existing BMS)~~

.2 Supply air duct static pressure

.3 Supply air relative humidity

.4 Venturi (Phoenix) Supply Air Valves

.5 Class II Type 2 Bio-Safety Cabinet

.6 Phoenix Laboratory Monitoring system (Refer to 25 09 35)

.5 Control Components

.1 Pharmacy Air Handling unit: AHU-PH-1

.1 Supply air temperature

.2 Supply fans on/off

.3 Supply fans VFD speed control

.4 Supply fans operating status

.5 Outside air control damper

.6 Outside air summer prefilter pressure drop

.7 Outside air winter / smoke air prefilter pressure drop (in AHU)

.8 Supply air final filter pressure drop

.9 Pre-heating coil control valve, 2-way modulating

.10 Heating coil control valve, 3-way modulating

.11 Cooling coil control

.12 Supply air control damper

3.8 HIGH PLUMB EXHAUST SYSTEM – EF-WW-0-1A & 1B – PHARMACY

.1 . General Description

.1 The Hazardous Compounding suite is provided with a Hazardous duplex High Plumb Exhaust system serving the following rooms:

.1 PREP AREA

.2 NON HD ANTE

.3 NON HD COMP

.4 HD COMP

.5 HD ANTE

.6 HD STORAGE

.2 Redundancy:

.1 The unit is designed to provide 100% redundancy.

.3 Catastrophic Event Management:

.1 The mechanical and controls contractors are to work with the Mechanical Engineer, Commissioning Authority and Northern Health to ensure that the final system setup is coordinated with Northern Health Catastrophic Event Management Contingency Plans.

.2 During a catastrophic event the Duplex hazardous exhaust fan (EF-WW-0-1A & 1B) shall continue to operate as normal (24/7 operation) in order to maintain the pressure differential requirements outlines in Specification Section 25 09 35 and NAPRA Model Standard for Compounding of Hazardous Sterile Preparations https://napra.ca/sites/default/files/2017-09/Mdl_Stnds_Pharmacy_Compounding_Hazardous_Sterile_Preparations_Nov2016_Revised_b.pdf)

.3 Systems for controlling HVAC functions during a catastrophic event shall be manually initiated from the BMS (and shall not be automatic – although the sequence once initiated shall be automatic).

.4 The new air handling unit and associated components shall be programmed to be controlled manually by the BMS during a catastrophic event for the following scenarios (per CSA Z317.2):

.1 Continue to operate normally with 100% outdoor air during an **internal** catastrophic event.

.2 Operation will continue to operate normally using 100% outside air and FMO shall install MERV 13 or 14 pre-filters in the empty pre-filter (forest fire / smoke) rack located in the unit, during an **external** catastrophic event. This operation with HVAC systems at increased Static Pressure during a Forest Fire event (added MERV 14 or 13 Filters) and

.3 Operation with the AHU stopped "(to prevent spread of localized contamination) during an internal or external catastrophic event;

.2 Air Flow Requirements:

.1 For additional information refer to the Environmental Controls drawings

.2 Total Requirements (EF-WW-0-1A & 1B):

.1 Exhaust: 1,400 l/s

.3 Components

.1 Hazardous (HD) Exhaust Fan - EF-WW-0-1A & 1B

.1 Total Exhaust Requirement: 1,400 l/s

.2 Exhaust Fans (1 running normally at 1,400 l/s l/s each)

.3 Variable Speed Drives (one per fan)

.4 Air Entrainment Bypass Control Dampers (one per fan)

.5 Isolation Damper (one per fan)

.4 Related Points

.1 Exhaust air duct static pressure

.2 Venturi (Phoenix) Exhaust Air Valves

.3 Class II Type 2 Bio-Safety Cabinet

.4 Phoenix Laboratory Monitoring system (Refer to 25 09 35)

.5 Control Components

.1 HD Exhaust Fan (EF-WW-0-1A & 1B)

.1 HD Exhaust fans (duplex) on/off

.2 HD Exhaust fans VFD speed control

.3 HD Air Entrainment Bypass Control Dampers

.4 HD Isolation Dampers

3.9 AHU AND EF CONTROL SEQUENCE

.1 System Off:

.1 Pharmacy Air Handling unit: RTU-3A & 3B

.1 Supply fans shall be off.

.2 Outdoor air intake control dampers shall be closed.

.3 Cooling controls shall be off

.4 Heating control valve shall be closed when OAT > 5°C, otherwise open.

.5 Humidification shall be off

.2 HD Exhaust Fan (EF-WW-0-1A & 1B)

.1 HD Exhaust Fans shall be off.

.2 HD Air Entrainment Bypass Control Dampers closed

.3 HD Isolation Dampers closed

.2 System Start-up

.1 Pharmacy Air Handling unit: RTU-3A & 3B

.1 Air Unit fans shall normally start together on signal that the exhaust fan (EF-WW-0-1A & 1B) is operative.

.2 Destratification pumps starts running and pre-heating coil control valve opens to 50% if outdoor temperature is below 10 °C (50 °F)

.3 Outdoor air dampers open to 100%

.4 After the system reads the damper is open both fans will start at the minimum setting and send the signal that the unit is operational.

.5 The pre-heating, heating, and cooling coil controls will modulate to maintain a supply air temperature of 12°C-18°C (adj).

.6 Fans will modulate to maintain the required pressure set point in the supply duct, to be set by the air balancer on start up.

.2 HD Exhaust Fan (EF-WW-0-1A & 1B)

.1 Upon system start-up command, the VFD on the duty exhaust fan is commanded on at 20% speed with the isolation dampers closed and flow bypass dampers fully open. Once fan speed feedback reaches 15% speed, fan isolation damper will open. When isolation damper is proven open VFD is slowly ramped up to 100% speed. Once the VFD is at full speed, the bypass damper is modulated to maintain the exhaust duct static pressure set-point.

.2 If at any time an exhaust fan fails and its speed feedback falls below 15%, associated isolation damper will close and the standby fan is commanded on. To equalize runtimes, the DDC system automatically switches the lead and lag fans every week, or as selected at the OWS.

.3 Refer to specification 25 09 35 and drawings for additional requirements

.3 Start-up after single unit failure:

.1 Pharmacy Air Handling unit: RTU-3A & 3B

.1 Fan Failure: The BMS will control to the duct static pressure setpoint based on remaining fan being ramped up to compensate for the failed fan.

.2 Temperature or humidity control failure: The BMS will stop the tunnel with the failure and ramp up the remaining fan to maintain the desired static pressure.

.3 Outdoor air damper failure: If one of the dampers does not open, the associated tunnel will not start and the other will maintain the desired static pressure.

.4 Re-Start after Failure: Operating fan to ramp down to prevent system over pressurization, the other fan speeds up until flow ratio between the two units is maintained proportional to the unit capacity.

.5 If airflow demand exceeds the available capacity of RTU-3, BMS shall shed non-critical loads in order to reduce air supply to Type II and III spaces (as specified in CSA Z317.2 and NAPRA) as follow:

.1 Type I spaces (e.g. compounding rooms, ante room, HD room, etc.): All supply VAV's operate in normal mode.

.2 Type II spaces: All supply VAV's go to 100% (adjustable, TBC during balancing) minimum airflow setpoint.

.3 Type III spaces: All supply VAV's go to 100% (adjustable, TBC during balancing) minimum airflow setpoints.

.4 Reduce airflow in Type III and Type II spaces as necessary to keep Type I spaces operational.

.5 Exhaust VAV's shall track the supply VAV's to maintain space pressurization.

.6 Note: the sequence of operation for this mode shall be reviewed and approved by UHNBC.

.2 HD Exhaust Fan (EF-WW-0-1A & 1B)

.1 Fan Failure: Go through the startup mode on the remaining fan to bring sufficient exhaust flow to the Biosafety Cabinet and the exhaust from the remainder of the spaces. The BMS will control to the exhaust flows and pressure differential setpoints based on the requirements outlined in specifications 25 09 35.

.2 Ramp up the working fan up to prevent system over exhaust pressurization.

.4 Normal Operation:

.1 Pharmacy Air Handling unit: RTU-3A & 3B

.1 The AHU system consists of 2 supply fans. The system is designed to deliver 100% of the airflow if one of the fans fail.

.2 All fans are intended to run in parallel to maintain equal flow. During Normal Operation, both fans shall operate 24/7, to deliver the required capacity based on the duct static pressure. Each fan will run at approximately at 50%.

.2 HD Exhaust Fan (EF-WW-0-1A & 1B) – Duty / Standby

.1 The HD Exhaust Fan system consists of 2 (duplex) exhaust fans each size for 100% of the require flow. The fans will operate as duty / standby.

.2 A single fan is intended to run at all time to ensure adequate upward velocity for the entrained exhaust air stream.

.3 The BMS shall alternate the operation of HD exhaust fans on a weekly basis (adjustable). If one fan fails to operate, the BMS shall automatically start the standby fan. An alarm signal shall be sent to BMS.

.5 **Pharmacy Air Handling unit**: RTU-3A & 3B Static pressure control:

.1 The supply air fan speed drives shall modulate as required to maintain remote supply duct static pressure at setpoint. To minimize energy consumption, the

static pressure setpoint shall be as low as possible to maintain the air valve flow rates required.

.2 The RTU-3A & 3B fans shall be controlled in unison to achieve this duct pressure set point. There shall be one (1) supply air duct static pressure (SP) sensor, at a location near the ends of the main duct runs.

.3 Additional duct static pressure sensor shall be provided at the supply air plenum of the AHU to provide monitoring of fan operation. These static pressure sensors will also be used to control the AHU fans during emergency operation modes such as external catastrophic event or duct smoke detector.

.4 Adjust these setpoints during commissioning phase to determine the minimum possible setting.

.6 **HD Exhaust Fan** (EF-WW-0-1A & 1B) – Duty / Standby - Static pressure control:

.1 The EF-WW-0-1A & 1B fans (Duty / Standby) shall be controlled achieve this duct pressure set point. There shall be one (1) exhaust duct static pressure (SP) sensors, at a location near the ends of the main duct runs.

.2 Additional duct static pressure sensor shall be provided at the exhaust air ductwork (on the roof) adjacent to the EF-WW-0-1A & 1B to provide monitoring of fan operation. These static pressure sensors will also be used to control the fans during emergency operation modes such as external catastrophic event.

.3 Once the exhaust fan is proven on and isolation damper is opened, the exhaust fan ramps to design speed.

.4 The exhaust fan operates at constant speed to maintain the discharge plume height, while the outdoor air by-pass damper modules to maintain the static duct pressure set point (initially set at 125Pa (adjustable)). This set point will be high enough to maintain control at all VAV boxes on a normal operation cooling load design day.

.5 Adjust these setpoints during commissioning period, to determine the minimum possible setting.

.6 Duty cycle fan rotation (one per week):

.1 When rotation occurs:

.2 Past duty fan will start to ramp down slowly.

.3 Exhaust fan bypass damper continues to modulate to maintain exhaust plenum pressure set point.

.4 Standby fan will become duty fan.

.5 Duty fan will be enabled with isolation damper closed and commanded to 20% speed. After speed feedback reads more that 15% speed, isolation damper is opened. Once damper is confirmed opened, fan will start to ramp up to 100%.

.6 Speed of fan ramping up and down are different. Ramp up is 3 times (to be confirmed by Control contractor and commissioning agent) faster than ramp down. This allows system to meet both fans at about 70% (to be confirmed by Controls contractor and commissioning agent) of their speeds.

.7 Once ramping down fan reaches 40% (to be confirmed by Controls contactor and commissioning agent) speed, fan is turned OFF to prevent air to start flowing in reverse direction due to low speed of the fan.

.7 Once fan speed feedback falls below 15%, isolation damper is closed and system resumes normal operation.

.8 Adjust these setpoints during commissioning phase to determine the minimum possible setting.

.7 **Pharmacy Air Handling unit:** RTU-3A & 3B - Supply Air Temperature Control:

.1 The AHU components include the duct mounted pre-heat coil control, final heating coil control, Cooling Control.

.2 After supply fan operation is verified within a 1 minute delay (adj.) the AHU Supply Air Temperature (SAT) sensor modulates the preheat control valve, final heating control valve, and the ~~DX Heat Pump Heating and~~ Cooling Control in sequence to maintain the SAT-SP.

.3 SAT PID is provided by the lead unit as long as system communication is confirmed. Units work in parallel from the lead unit PID control loop, similar to fan speed control strategy.

.4 The supply air temperature setpoint will vary between 12°C and 18°C (adjustable) as required to maintain space temperatures at setpoint.

.5 The intent is to minimize simultaneous heating and cooling at zone VAV's. AHU supply air temperature setpoint (SAT-SP) is based on index VAV air damper position.

.6 Adjust SAT-SP so that zone requiring most cooling (index) is at 95% of max flow.

.8 Pharmacy Air Handling unit: RTU-3A & 3B – Humidity control:

.1 Humidity level is controlled on the return air temperature. The relative humidity in the return air will be maintained at 45% +/-5% (Modifiable).

.2 Reading from room sensors of RH below 30% or above 60% will override the return air sensor and will command the humidification loop until the space humidity is within 40% and minimum 50%, when the control loop will be controlled by the return humidity sensor.

.3 If there is more than one room outside the RH parameters:

.1 Dehumidification has priority over humidification.

.2 The sensor with the higher deviation takes priority.

.4 On humidification demand, the steam humidifier associated with the AHU tunnel that is running will be activated and modulate to maintain the return air relative humidity.

.5 On dehumidification demand

.1 If the humidifiers are in operation the air supply relative humidity will be decreased in 10% increments (modifiable) each five minutes until the return air RH set-point is achieved.

.2 If the humidifiers are not in operation, the cooling coil air temperature discharge set-point will be changed to 10 °C (50°F) (adj.).

.9 Catastrophic Event Management

.1 Provide on the BMS graphics a set of user enabled toggles to initiate "External Catastrophic Event Control Mode" (bare minimum outside air) and "Internal Catastrophic Event Control Mode" (100% outside air, no recirculation). This management system per CSA Z317.2 shall not be automatic but shall be started through the BMS by Northern Health Operators.

.2 Balancing and commission agents shall test and record setpoints for different operation scenarios (e.g. normal operation, external catastrophic event) and coordinate the results with Controls contactor.

.3 Control of each mode shall be as follows:

.1 External Catastrophic Event Mode (minimum outside air)

.1 Supply air will be adjusted to maintain 4 air changes per hour (modifiable) in each room, plus BSC exhaust if the biosafety cabinet must be kept running.

.2 Exhaust fans will run to maintain the desired pressure cascade.

.3 Once catastrophic event mode is manually disabled by the user, system shall revert to normal operation.

.4 Note: the sequence of operation for this mode shall be reviewed and approved by UHNBC.

.2 Internal Catastrophic Event Control Mode (full outside air)

.1 RTU-3A & 3B shall remain at 100% outdoor air mode.

.2 HD Exhaust Fans shall continue to operate.

.3 Once catastrophic event outbreak control mode is manually disabled by the user, system shall revert to normal operation.

.10 Fail Modes:

.1 If one AHU fan fails to operate as intended, the fan shall shut down, and the second fan shall ramp up speed to achieve the required performance.

.2 To prevent problems the various control functions must be carefully synchronized on fan start-up and shutdown.

.11 Alarms:

.1 If any temperature sensor is reading above or below its intended operating range a BMS alarm shall be initiated.

.2 If any current sensor/operating status point is reading above or below its intended operating range a BMS alarm shall be initiated.

.3 If any pressure sensor (filter, static, etc.) is reading above or below its intended operating range a BMS alarm shall be initiated.

.12 Freeze Protection:

.1 A freeze protection controller with a 6 m sensing element supported downstream of the pre-heat coil shall cause the system to shut down upon sensing air temperature of 4°C or lower. Reset to be at sensing device. Heating coil control valve shall be full open.

.2 Under a low temperature condition, the outside air dampers close, supply fan of the associated unit(s) is disabled, heating coil pump in the heating mode remains running with the modulation valve fully open. This switch must be manually reset at both the switch location and through a software switch at the operator workstation in order to restart the systems supply fans.

.3 Low temperature alarm to be monitored at BMS.

.13 Implosion Door and Pressure Switch:

.1 The implosion doors are monitored with a magnetic door switch. If the switch is activated while the unit is running the fan system is shut down.

.2 In addition, pressure switch will be provided in supply and exhaust ductwork to shut-down the units if extremely low or high pressure is detected.

.14 Fire Mode Operation:

.1 Upon activation of a Stage 1 Fire Alarm signal, the Air Handling Unit and HD Exhaust system shall remain in normal operation mode.

.2 Upon activation of a Stage 2 Fire Alarm registered outside of the new Pharmacy department, the air handling unit and HD Exhaust system shall remain in normal operation mode.

.3 If the Stage 2 Fire Alarm is registered within the new emergency Pharmacy or the duct detector identifies smoke in the system, the Air Handling Unit and HD Exhaust system shall stop**.** Note: the sequence of operation for this mode shall be reviewed and approved by UHNBC.

.15 After-hours Operation:

.1 BMS shall transmit a signal to non-critical zone boxes to revert to the OFF-hours mode. Supply and exhaust fans will automatically ramp down to maintain duct static pressure setpoint.

.2 Although the air circulation rate is reduced during un-occupied period, normal pressurization levels shall be maintained as per CSA Z317.2 and NAPRA Standard.

.3 After-hours operation can also be initiated by occupancy sensor or by the occupants by pressing a button on room thermostat. Once initiated, HVAC systems shall operate under normal operation mode for a resettable duration (i.e. 2 hours).

.16 Heating During Unoccupied Periods:

.1 During unoccupied periods in certain areas of the building the ventilation system shall be shut down unless space temperature falls below the unoccupied set point at which time the VAVs shall modulate open and the preheat coil modulates to maintain set point. Provide a suitable deadband to prevent fan cycling.

.17 Room Temperature, Humidity and Differential Pressure Monitoring and Control:

.1 Temperature

.1 The temperature will be monitored and controlled by the TDU and controlled in each space as indicated on the drawings.

.2 Humidity

.1 Humidity will be monitored in each space. The humidification level will be controlled at the air handling unit based on feedback from the following equipment

.1 The room Temperature / Humidity Sensors (from the TDU) and

.2 Duct supply air humidity sensor

.3 The following rooms shall be provided with temperature / humidity sensors:

.1 2 - NON HD ANTE

.2 3 - NON HD COMP

.3 5 - HD ANTE

.4 4 - HD COMP

.5 6 - HD STORAGE

.4 The following rooms shall be provided with Adjustable temperature sensor that display temperature:

.1 1 - Prep Area

.5 Pressure Control

.1 Refer to specifications section 25 09 35 for additional information

3.10 RE-HEAT CONTROL

.1 General Description: Re-heat Coils in the ceiling are provided for each room fed from the hospital hot water system.

.2 Temperature sensors shall modulate 2-way heating control valves via the pharmacy terminal display unit and room temperature sensors.

.3 Components

.1 Re-heat Coils

.2 Re-heat 2-way control valves

.4 Related Points

.1 Space temperature sensors

.5 Related Systems

.1 New Air Handling unit

.6 Normal Operation

.1 Space temperature / humidity sensor shall modulate re-heat control valve to maintain space temperature at set point.

.7 Alarms

.1 If any temperature sensor are reading above or below its intended operating range a BMS alarm shall be initiated.

3.11 TECHNOLOGY INTERFACE:

.1 Include for interface with the following: Lighting, Fire Alarm, occupancy sensors, Electric metering, etc. as outlined in the electrical specification.

3.12 DIVISION 26 ALARMS

.1 The BMS shall monitor Division 26 dry contact alarm outputs provided by Division 26 for recording and annunciation at the OWS(s). Systems to be monitored include, SCADA system, UPS, Security, Fire Alarm stage 1 and stage 2, Lighting, Switchgears, Emergency Power Systems, Transformers etc. Final points list to be clarified with Div. 26.

.2 Various pieces of electrical equipment are specified complete with BACNet capabilities. Provide connection to the items and provide interface with the building's DDC system.

.3 Wiring between the dry contacts and the BMS panels shall be by Division 23 contractor.

.4 Provide monitoring of all alarm and trouble conditions of the UPS systems by the BMS. Include a countdown timer located at OWS to display output alarm contacts triggered at 75%, 50%, and 25% battery life.

.5 Provide an audible warning at OWS to indicate that the UPS battery supply has less than ten minutes of power remaining. Provide adequate labelling.

3.13 HEPA FILTER MONITORING:

.1 HEPA filters pressure drop shall be monitored at the BMS.

.2 HEPA filter locations include:

.1 HEPA diffusers in Pharmacy

.3 DDC Alarms:

.1 Any pressure out of range.

3.14 HEAT TRACING

.1 There are two types of heat tracing for piping systems, freeze protection and temperature maintenance.

.2 Heat trace systems are self-regulating and shall be monitored by the BMS.

.3 Refer to drawings and specifications for details.

3.15 TREND LOGGING AND HISTORIAN

.1 Set up trend logs with archiving as required for sustainability documentation, for troubleshooting, energy management and preventive maintenance.

3.16 PLUMBING TRAP PRIMERS

.1 Floor drain traps equipped with trap primers are specified to be fed from BMS controlled solenoid valves.

.2 Solenoid valves shall cycle on/off as per a programmed schedule.

3.17 FIRE AND SMOKE CONTROL (FSC) SYSTEM:

.1 General:

.1 This section should be read in conjunction with Division 26 (Electrical).

.2 Provide all necessary co-ordination with the Electrical Sub-Contractor, the Life Safety Fire Alarm supplier/installer and all other parties whose work this system must interface with and connect to. Controls Contractor to review fire alarm shop drawings for interface with the control system.

.3 The majority of the Fire and Smoke Control (FSC) systems as described herein, shall be controlled by the Fire Alarm System (F/A) (Div. 26) and where noted by the Building Management System (BMS) (Division 23).

.4 All BMS standalone panels (SAP's) used for the FSC system shall be located in fire rated service areas.

.5 The FSC system is a life safety system. Only reliable components shall be used.

.6 All fans and control equipment serving FSC systems shall be connected to “Vital” electrical power supply.

.7 The FSC system shall be designed to fail-safe.

.8 Control of all smoke dampers will be by the Fire Alarm system.

.9 Control of all supply, return and exhaust fans will be by the Fire Alarm system.

.10 Provide two relays for each fan system controlled by the BMS and Fire Alarm System for operation of the motor control circuits. One relay connected into the "auto" circuit of the H.O.A. switch shall be used for normal H.V.A.C. system operation, controlled by BMS. The other relay connected into the "common" circuit of the H.O.A. switch shall operate for fire alarm shut-down, operated by the Fire Alarm System. The relay is energized to close contacts and maintain normal operation. Relay is de-energized to open contacts for emergency shutdown.

.11 Coil freeze protection low limits to be by-passed in a fire mode condition.

.12 Alarms indicating non-opening and/or non-closing of smoke and control dampers or groups of dampers and non shut-down or start-up of fans shall be logged in as critical alarms.

.13 Refer to the Life Safety Fire Alarm System in the Electrical Specification and coordinate with Division 26 such that alarm conditions and control commands are communicated to the BMS and that status indications are communicated to the Fire Alarm System. (Note that all interface should be done through the specified software interface between the BMS and Fire Alarm System or dry contacts).

.14 The Fire and Smoke Control systems sequence shall be initiated on fire alarm first stage and second stage as noted in this section.

.15 The BMS shall buffer fire alarm system inputs to prevent momentary alarm/trouble reporting to the BMS.

.16 Division 26 / 27 shall provide one alarm signal for each duct smoke detector.

.17 Division 26 / 27 shall provide a SYSTEM RESET signal to indicate that the fire alarm situation is over, and the HVAC systems can be automatically reset. On receipt of a reset signal from the Fire Alarm system, all HVAC systems shall be reset to their "normal" mode of operation.

.18 Division 26 / 27 shall provide and install smoke detectors in discharge plenums of each air handling unit or supply air branch as required to provide accurate smoke detection. If smoke is sensed in the supply duct from any supply air handling unit, then only that unit will shut down.

.19 Division 23 shall cooperate with Division 26 to ensure proper interface between BMS and Fire Alarm System.

.20 Provide digital inputs for alarm and control information such that the operation (closure) of a set of dry contacts in the Fire Alarm System (provided by Division

26) will activate the input.

.21 BMS shall receive a “fire in the zone” signal from the Fire Alarm System, and provide command signal to match the effect of the Fire Alarm System action (shut-down of the units and systems), to avoid nuisance status alarms.

.22 BMS shall monitor the equipment status under “Fire” signal (received from the Fire Alarm System), and provide command signal to match the effect of the Fire Alarm System action (shut-down of the units and systems), to avoid nuisance status alarms.

END OF SECTION

PIPING COMPONENTS

REAL OBJECT	SYMBOL	
		ISOLATION VALVE (GENERIC REFER TO SPEC FOR DETAILS)
		GLOBE VALVE
		BUTTERFLY VALVE
		BALL VALVE
		PLUG VALVE
		NEEDLE VALVE
		CHECK VALVE (GENERIC)
		BALANCING VALVE (REFER TO SPEC FOR DETAILS)
		PRESSURE REDUCING VALVE
		2-WAY CONTROL VALVE
		3-WAY CONTROL VALVE
		FLOAT OPERATED VALVE ACTUATOR
		SAFETY OR RELIEF VALVE
		ANGLE VALVE
		BOILER STOP AND CHECK VALVE
BFP		BACKFLOW PREVENTER (GENERIC)
		MULTI-PURPOSE VALVE (SHUTOFF, BALANCING AND CHECK)
		PUMP (GENERIC REFER TO SCHEDULES)
		Y STRAINER (GENERIC)
		STEAM TRAP (GENERIC)
		AUTOMATIC AIR VENT
		MANUAL AIR VENT
		VACUUM BREAKER
		SHOCK ABSORBER
		TEMPERATURE GAUGE
		PRESSURE GAUGE
		TEMPERATURE AND PRESSURE TAP
		SIGHT FLOW GLASS
		FLEXIBLE CONNECTOR
		EXPANSION JOINT
		GUIDE
		ANCHOR
	1%	FLOW ARROW
		PIPING SLOPE
		PIPE CAP
		PIPE BREAK
		PIPE CROSS
		PIPING ELBOW UP
		PIPING ELBOW DOWN
		PIPING TEE UP
		PIPING TEE DOWN
		PIPING TEE (SCHEMATIC)
		UNION CONNECTION
		FLANGED CONNECTION
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
CO	CO	STANDARD CLEAN-OUT IN LINE END OF RUN
	CO	STANDARD CLEAN-OUT THROUGH FLOOR END OF RUN
	CO	STANDARD CLEAN-OUT THROUGH FLOOR IN LINE
		PIPE INSULATION
	150	PIPE SIZE (mm)
	XX	PIPING ROUTED BELOW SLAB OR GRADE

VENTILATION (HVAC)

* NOTE: ALL DUCT SIZES ARE INTERIOR, FREE DIMENSIONS

REAL OBJECT	
SA	SUPPLY AIR
RA	RETURN AIR
OA	OUTDOOR AIR
EA(G)	GENERAL EXHAUST AIR
EA(W)	WASHROOM EXHAUST AIR
EA(ISO)	ISOLATION EXHAUST AIR
EA(LAB)	LABORATORY EXHAUST AIR
EA(K)	KITCHEN EXHAUST AIR
→	AIR FLOW ARROW
450x250 — 450x250	RECTANGULAR DUCT AND SIZE*
450ø — 450ø	ROUND DUCT AND SIZE*
450x250ø — 450x250ø	FLAT OVAL DUCT AND SIZE*
450x250	EXTERIOR DUCT TREATMENT*
450x250	RECTANGULAR DUCT WITH ACOUSTIC LINING*
450x250	EXTERIOR DUCT TREATMENT - FIRE WRAP*
450x250	DUCT SECTION, SUPPLY AIR. SIZE* IS HORIZONTAL DIM. x VERTICAL DIM. APPLIES TO RECT., ROUND AND OVAL
	DUCT SECTION, OUTSIDE AIR. APPLIES TO RECT., ROUND AND OVAL
	DUCT SECTION, RETURN AIR. APPLIES TO RECT., ROUND AND OVAL
	DUCT SECTION, EXHAUST AIR. APPLIES TO RECT., ROUND AND OVAL
	FLEXIBLE DUCT
	ELBOW TURN, SUPPLY DOWN. APPLIES TO RECT., ROUND AND OVAL
	ELBOW TURN, OUTSIDE AIR DOWN. APPLIES TO RECT., ROUND AND OVAL
	ELBOW TURN, RETURN DOWN. APPLIES TO RECT., ROUND AND OVAL
	ELBOW TURN, EXHAUST DOWN. APPLIES TO RECT., ROUND AND OVAL
	CHANGE IN DUCT ELEVATION RISING
	CHANGE IN DUCT ELEVATION DROPPING
	END CAP
	ELBOW, RECTANGULAR, SMOOTH RADIUS WITHOUT VANES (1.5 R/W DEFAULT)
	ELBOW, ROUND, SMOOTH RADIUS (1.5 R/W DEFAULT)
OR	MITERED ELBOW, RECTANGULAR, WITH TURNING VANES
AD	RECTANGULAR TO ROUND TRANSITION
AD AD	DUCT ACCESS DOOR (TOP, SIDE, BOTTOM)
FC	FLEXIBLE CONNECTION
BDD	BACKDRAFT DAMPER
M	MANUAL DAMPER
M	MOTORIZED DAMPER
M	FIRE DAMPER
	SMOKE DAMPER
	SMOKE AND FIRE DAMPER
QUANTITY TYPE SIZE (mm) VOLUME (L/S)	AIR OUTLET OR INLET TAG (REFER TO SCHEDULE)
	RECTANGULAR DIFFUSER, SUPPLY. OPTIONAL ARROWS SHOW THE FLOW DIRECTION.
	RECTANGULAR REGISTER OR GRILLE, RETURN
	RECTANGULAR REGISTER OR GRILLE, EXHAUST
	ROUND DIFFUSER, SUPPLY
	LINEAR DIFFUSER
	SIDEWALL REGISTER OR GRILLE, SUPPLY
	SIDEWALL GRILLE, RETURN OR EXHAUST
UC	UNDERCUT DOOR
	DOOR GRILLE OR LOUVER
	TRANSFER GRILLE OR LOUVER
ID-#	EQUIPMENT TAG (REFER TO SCHEDULE)
QUANTITY TYPE LENGTH (mm) CAPACITY (kW)	RADIATION HEATING TAG (REFER TO SCHEDULE)
- EQ DPS	RELATIVE PRESSURIZATION BASED ON CSA Z317.2 REQUIREMENTS

MECHANICAL SHEET LIST

Sheet Number	Sheet Name
M001	MECHANICAL SYMBOL LEGEND AND GENERAL NOTES
M100	LEVEL 0 - HVAC ENVIRONMENTAL CONTROLS
M101	LEVEL 0 - HVAC - DEMO
M102	LEVEL 0 - HVAC - OVERVIEW
M103	LEVEL 0 - HVAC - NEW
M104	LEVEL 0 - HYDRONIC - NEW
M105	LEVEL 1 - HVAC - NEW
M106	LEVEL 2, LEVEL 3, & UPPER ROOF - HVAC - NEW
M200	LEVEL 0 - PLUMBING OVERVIEW
M201	LEVEL 0 - SANITARY PLUMBING - DEMO & NEW
M202	LEVEL 0 - PLUMBING - DEMO & NEW
M300	LEVEL 0 - FIRE PROTECTION PLAN
M400	MECHANICAL SCHEMATICS
M401	MECHANICAL SCHEMATICS
M500	MECHANICAL SCHEDULES
M501	MECHANICAL SCHEDULES

NOTE: NOT ALL SYMBOLS, SYSTEMS, AND ABBREVIATIONS MAY BE USED ON THIS PROJECT

PIPING SYSTEMS (HVAC)

REAL OBJECT	SYMBOL	
BBD		BOILER BLOWDOWN
BFW		BOILER FEED WATER
BR		BRINE RETURN
BS		BRINE SUPPLY
CHWR		CHILLED WATER RETURN
CHWR(G)		CHILLED WATER RETURN - GLYCOL
CHWR(P)		CHILLED WATER RETURN - PROCESS
CHWS		CHILLED WATER SUPPLY
CHWS(G)		CHILLED WATER SUPPLY - GLYCOL
CHWS(P)		CHILLED WATER SUPPLY - PROCESS
CWR		CONDENSER WATER RETURN
CWR(CT)		CONDENSER WATER RETURN (COOLING TOWER)
CWS		CONDENSER WATER SUPPLY
CWS(CT)		CONDENSER WATER SUPPLY (COOLING TOWER)
DTR		DUAL TEMPERATURE RETURN (HOT OR CHILLED)
DTS		DUAL TEMPERATURE SUPPLY (HOT OR CHILLED)
HPWR		HEAT PUMP WATER RETURN
HPWS		HEAT PUMP WATER SUPPLY
HRR		HEAT RECOVERY LOOP RETURN
HRS		HEAT RECOVERY LOOP SUPPLY
HWR		HEATING WATER RETURN
HWR(G)		HEATING WATER RETURN - GLYCOL
HWS		HEATING WATER SUPPLY
HWS(G)		HEATING WATER SUPPLY - GLYCOL
REF(HG)		REFRIGERANT HOT GAS
REF(L)		REFRIGERANT LIQUID
REF(S)		REFRIGERANT SUCTION
REF(V)		REFRIGERANT VENT
RV		RELIEF VENT
S(##)		STEAM (NOMINAL PRESSURE IN KPA)
CS(##)		STEAM - CLEAN (NOMINAL PRESSURE IN KPA)
C(##)		STEAM CONDENSATE (NOMINAL PRESSURE IN KPA)
H(##)		STEAM HUMIDIFICATION (NOMINAL PRESSURE IN KPA)
PC(##)		STEAM PUMPED CONDENSATE (NOMINAL PRESSURE IN KPA)
SV		STEAM VENT

GENERAL SYMBOLS

	DEMOLITION
	EXISTING SUPPLY
	EXISTING RETURN
	NEW WORK
1 M###	DETAIL NUMBER DETAIL CALLOUTS SHEET ON WHICH DETAIL IS SHOWN
# M###	SECTION NUMBER SECTIONS SHEET ON WHICH SECTION IS SHOWN
FLOOR 0'-0"	FLOOR OR ROOF LEVEL NAME VERTICAL ELEVATION
N	NORTH ARROW
1	DRAWING REVISION
	MATCH LINE
	GRAPHIC SCALES
EL. 10000	ELEVATION
ELEVATION TOP OF	DATUM ELEVATION
#### name	SPACE TAG
###	DEMOLITION KEYNOTE
###	KEYNOTE
X.XX%	SLOPE ARROW
	CIRCULAR BREAK SYMBOL
	CENTER LINE
	GRID BUBBLE AND LINE

DRAINAGE

REAL OBJECT	SYMBOL	
AV		ACID VENT
AW		ACID WASTE
CD		CONDENSATE DRAIN
CD(P)		CONDENSATE DRAIN (PUMPED)
GV		GREASE VENT
FT		FOOTING DRAIN
GW		GREASE WASTE
V		SANITARY VENT
V(O)		SANITARY VENT (OIL)
SAN		SANITARY WASTE
SAN(O)		SANITARY WASTE (OIL)
SAN(P)		SANITARY WASTE (PUMPED)
ST		STORM DRAIN
ST(O)		STORM OVERFLOW
ST(P)		STORM PUMPED

PLUMBING

REAL OBJECT	SYMBOL	
CA(##)		COMPRESSED AIR (NOMINAL PRESSURE IN KPA)
DI		DEIONIZED WATER
DIR		DEIONIZED WATER RECIRCULATING
DW		DISTILLED WATER
DCW		DOMESTIC COLD WATER
DCW(S)		DOMESTIC COLD WATER SOFTENED
DHW		DOMESTIC HOT WATER
DHWR		DOMESTIC HOT WATER RECIRCULATING
DHW(S)		DOMESTIC HOT WATER SOFTENED
NPCW		NON-POTABLE COLD WATER
NPCW(S)		NON-POTABLE COLD WATER SOFTENED
NPHW		NON-POTABLE HOT WATER
NPHW(S)		NON-POTABLE HOT WATER SOFTENED
TP		NON-POTABLE TRAP PRIMER
		FIXTURE TRAP
RD-#		ROOF DRAIN
FD-#		FLOOR DRAIN
		PLUMBING FIXTURES

FIRE PROTECTION

REAL OBJECT	SYMBOL	
		UPRIGHT SPRINKLER
		CONCEALED PENDANT SPRINKLER
		SIDEWALL SPRINKLER
		FIRE EXTINGUISHER

CONTROLS

CO2 OR CO2	CARBON DIOXIDE SENSOR
CO OR CO	CARBON MONOXIDE SENSOR
DS	DEWPOINT SENSOR
DPS	DIFFERENTIAL PRESSURE SENSOR
EM	ENERGY METER
M OR F	FLOW METER
FS OR FS	FLOW SWITCH
FZ	FREEZE STAT
H OR H	HUMIDITY SENSOR
LC	LEVEL CONTROL
LS	LIMIT SWITCH
Nox	NITROGEN OXIDE SENSOR
OCC	OCCUPANCY SENSOR
O2	OXYGEN SENSOR
PS OR P	PRESSURE SENSOR
PMU	PRESSURE DIFFERENTIAL MONITORING UNIT
RPD	ROOM PRESSURE DISPLAY
SP	STATIC PRESSURE SENSOR
TS OR T	TEMPERATURE SENSOR
TDU	TERMINAL DISPLAY UNIT
T	THERMOSTAT
VSD	VARIABLE SPEED DRIVE
AFS	AIR FLOW SWITCH
	CONTROLS WIRE

GENERAL NOTES

1. ALL ACCESS PANELS IN THE CEILING OF PHARMACY DEPARTMENT SHALL BE CASKETED TO PREVENT AIR LEAKAGE.
2. ALL NEW EXPOSED PIPES AND DUCTWORK SHALL BE PAINTED TO MATCH THE COLOR OF EXITING SERVICES IN THAT ROOM.
3. THE CONTRACTOR IS RESPONSIBLE FOR PERMITS.
4. COORDINATE WITH THE BUILDING ENGINEER FOR ALL WORK AFFECTING BASE BUILDING HVAC, PLUMBING OR LIFE SAFETY SYSTEMS.
5. COORDINATE WITH OWNER FOR ALL INTERACTION OF EXISTING SYSTEM UNDER OPERATION.
6. CORE DRILLING, HAMMER DRILLING, TABLE SAWS AND OTHER WORK OF A NOISY, DUSTY OR VIBRANT NATURE MUST BE DONE AT TIMES AGREED TO IN ADVANCE BY OWNER.
7. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LEAVE THE SPACE CLEAN WITH NO DEMOLISHED PARTS LEFT FROM EXISTING SYSTEM.
8. LOCATION OF EXISTING EQUIPMENT SHOWN ON THIS DRAWING IS FOR INFORMATION ONLY. CONTRACTOR SHALL REVIEW AND CHECK THE EXACT LOCATION, SIZE, ELEVATION AND INVERT OF ALL EXISTING EQUIPMENT, DUCTWORK AND PIPING ON SITE PRIOR TO COMMENCING WITH WORK.
9. GPRS SCAN STRUCTURAL SLAB/WALLS FOR LOCATIONS OF RE-BAR TO LOCATE NEW OPENINGS AS REQUIRED, AND AS DIRECTED BY THE STRUCTURAL ENGINEER. POSITION CORE TO CLEAR REINFORCEMENT. REVIEW LOCATION WITH STRUCTURAL CONSULTANT.
10. PROVIDE OPENINGS IN FULL-HEIGHT WALLS FOR NEW DUCTWORK, PIPES AND CONDUIT TO PASS THROUGH. SEAL AROUND PENETRATIONS FOR SOUND ATTENUATION AND SMOKE/FIRE SEPARATION AS REQUIRED.
11. MODIFY THE SIZE AND ROUTING OF ALL EXISTING AND NEW PIPING AND DUCTWORK AS REQUIRED TO SUIT THE CONDITION WITHOUT EXTRA COST TO THE OWNER. PROVIDE ADEQUATE OFFSETS, AND TRANSITIONS ON NEW DUCTWORK AS REQUIRED TO SUIT SITE CONDITIONS.
12. THE MECHANICAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS AND DETAILS. SEE ARCH. WALL ELEVATIONS, REFLECTED CEILING PLANS, SECTIONS AND DETAILS FOR PRECISE LOCATION OF ALL VISIBLE MECHANICAL ELEMENTS.
13. ALL EXPOSED SERVICES TO HAVE THEIR FINAL LOCATION AND HEIGHT APPROVED BY ARCHITECT PRIOR TO WORK BEING DONE.
14. PATCH AND MAKE GOOD ROOF, CEILING AND WALL FOR NEW WORK, AND FOR EXISTING SERVICES REMOVED. COORDINATE WITH GENERAL OR CONSTRUCTION MANAGER.
15. ENSURE THAT PIPING AND FITTING LAYOUT HAVE ENOUGH FLEXIBILITY FOR EASY REMOVAL OF THE NEW EQUIPMENT IN THE FUTURE WITHOUT CUTTING OR REMOVAL OF PIPING.
16. ALL NEW EQUIPMENT, VALVES ETC. ARE TO BE PROPERLY LABELED, INCLUDING IDENTIFICATION OF PIPING.
17. ALL EXISTING INSULATION THAT IS DAMAGED DURING CONSTRUCTION TO BE REPLACED WITH NEW.
18. ALLOW FOR NEW IDENTIFICATION OF EXISTING EQUIPMENT, DUCTWORK AND PIPING.
19. ALL MECHANICAL WORK SHALL BE COORDINATED WITH DIVISION 26 (ELECTRICAL). REFER TO ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR THE SCOPE OF DIVISIONS 26, 27.
20. DECOMMISSION SYSTEM AT BMS WHERE MECHANICAL HVAC EQUIPMENT HAS BEEN REMOVED. REMOVE ABANDONED WIRING AND CONDUIT, ETC.
21. COORDINATE WITH ELECTRICAL TRADES TO DE-COMMISSION ELECTRICAL WIRING, CONDUIT, ETC TO MAIN FEED WHERE MECH. EQUIPMENT HAS BEEN REMOVED.
22. ALL MISCELLANEOUS METAL PIPE SLEEVES TO BE PRIMED AND PAINTED FOR RUST INHIBITING AND WEATHER PROTECTION.
23. SALVAGED EQUIPMENT OF VALUE TO BE HANDED OVER TO THE OWNER FOR KEEPING AND FUTURE RE-USE.
24. THE SMALLEST PIPE TO BE USED IS 20MM (3/4") UNLESS OTHERWISE NOTED. PIPE SIZE TO COILS SHALL BE SAME SIZE AS COIL CONNECTIONS UNLESS NOTED.
25. ALL HORIZONTAL PIPING TAKE-OFFS FROM VERTICAL PIPING RISERS SHALL BE C/W ISOLATION VALVES AND CIRCUIT SETTERS FOR BALANCING AND SERVICE ISOLATION AT EACH LEVEL - TYPICAL.
26. EQUIPMENT START UP TO BE DONE BY SUPPLIER'S FACTORY TRAINED TECHNICIAN.
27. ALLOW FOR ALL NECESSARY DUCT AND PIPE FITTINGS, BENDS, TRANSITIONS, CHANGES OF DIRECTION ETC. TO COORDINATE THE NEW MECHANICAL SERVICES INSTALLATION WITH THE EXISTING STRUCTURE AND SERVICES.
28. LABEL ALL NEW EQUIPMENT WITH LAMACOID LABELS MATCH EXISTING SIZE AND COLOR. INCLUDE ELECTRICAL FEED PANEL AND CIRCUIT.
29. ARRANGE AND PAY FOR THE SERVICE OF A B.C. REGISTERED PROFESSIONAL STRUCTURAL ENGINEER WHO SPECIALIZES IN THE RESTRAINT OF BUILDING ELEMENTS. THIS STRUCTURAL ENGINEER, HEREIN, REFERRED TO AS THE SEISMIC ENGINEER SHALL PROVIDE ALL REQUIRED ENGINEERING SERVICES RELATED TO SEISMIC RESTRAINTS OF NON-VIBRATION ISOLATED EQUIPMENT, DUCTWORK, PIPING AND SUPPORTS.
30. THE SEISMIC ENGINEER SHALL PROVIDE ASSISTANCE TO THE CONTRACTOR AS NECESSARY DURING THE COURSE OF RESTRAINT OF EQUIPMENT, DUCTWORK AND PIPING SEISMICALLY RESTRAIN ALL NEW EQUIPMENT.
31. CONTRACTOR IS RESPONSIBLE FOR REQUESTING CLARIFICATION OF AMBIGUOUS INSTRUCTIONS BEFORE STARTING WORK.
32. WELDING ON PREMISES MUST CONFORM TO SPECIFIC GUIDELINES INCLUDING CSA Z.317 REGARDING HANDLING OF SMOKE, PRESSURIZED TANKS, WHMIS, AND FIRE ALARM. CONTACT BUILDING ENGINEER FOR DETAILS.
33. REFER TO THE STRUCTURAL AND ARCHITECTURAL DRAWINGS FOR THE REQUIREMENTS OF ANY CONCRETE WORK, SCANNING, CUTTING, ATTACHMENT TO THE STEEL BEAMS, ETC.
34. INFECTION CONTROL ISSUES FOR CONTRACTORS WORKING AT THE DISCHARGE OPENINGS OF EXHAUST DUCTS:
34.1 IH HAS ADOPTED THE FOLLOWING INFECTION CONTROL PRECAUTIONS FOR CONTRACTORS WORKING AT THE DISCHARGE OPENINGS OF ROOFTOP EXHAUST DUCTS.
34.2 INFECTION CONTROL REQUIRES THAT WORKERS MUST BE MADE AWARE OF THE FACT THAT HOSPITAL EXHAUST DUCTS MAY CARRY DUST AND SPORE PARTICLES, HOWEVER, NOT ACTIVE TB. DUST AND SPORES, RESIDING IN THESE DUCTS, MAYBE DISCHARGED TO THE EXTERIOR WITH THE AIR MASS CREATED WITHIN THESE DUCTS.
34.3 ALTHOUGH THE LEVEL OF RISK FOR POTENTIAL CONTAMINATION IS LOW, IT IS ADVISABLE THAT CONSTRUCTION WORKERS, ESPECIALLY THOSE WHO ARE SENSITIVE TO RESPIRATORY ILLNESSES, WEAR APPROPRIATE DUST MASKS CAPABLE OF FILTERING FINE PARTICLES.
35. INSTALL FIRE STOPPING AND SMOKE SEAL MATERIAL AND COMPONENTS IN ACCORDANCE WITH ULC CERTIFICATION AND MANUFACTURER'S INSTRUCTIONS IN FORMED, SLEEVED OR CORED PENETRATIONS.
36. FURNISH ALL LABOUR, MATERIAL, EQUIPMENT AND SERVICES NECESSARY TO SUPPLY AND INSTALL FIRESTOPPING AND SMOKE SEALS AROUND ALL THE EXISTING MECHANICAL SERVICE PIPING, DUCTWORK AND CONDUIT PENETRATIONS THROUGH FIRE RATED WALLS AND FLOOR ASSEMBLIES. REFER TO ARCH CODE DWGs FOR DETAILS. PATCH AND SEAL ALL EXISTING OPENINGS IN WALLS AND FLOORS THAT WILL NOT BE USED FOR NEW SERVICES.
37. REVIEW TYPE AND LOCATION OF ACCESS PANELS IN DRYWALL ON SITE PRIOR TO INSTALLING. NEW ACCESS PANELS SHALL LINE-UP IN DRYWALL WHILE ALLOWING ACCESS TO MECHANICAL EQUIPMENT.
38. ALL PENETRATIONS (I.E. DUCTWORK, PIPING, CONDUITS) THROUGH FLOORS SHALL BE FIRE SEALED AROUND.
39. SEAL ALL PIPE, DUCT, CONDUIT, ETC. PENETRATIONS THROUGH THE WALLS, FLOOR AND CEILING OF ALL AREAS TO PREVENT AIR LEAKAGE. REFER TO ARCH. DRAWINGS FOR DETAILS.
40. PROVIDE NEW DUCTWORK AND PIPING AND RECONNECT TO THE EXISTING SYSTEMS, AND RE-BALANCE AND COMMISSION EXISTING SERVICES THAT ARE TO BE REMOVED AND RE-INSTALLED (RE & RE).
41. PROVIDE MAINTENANCE AREAS AROUND ALL EQUIPMENT AS REQUIRED BY CODES AND RECOMMENDED BY THE EQUIPMENT MANUFACTURER. PAY PARTICULAR ATTENTION TO COIL ACCESS AND REMOVAL.
42. INSTALL PIPING AND DUCTWORK SO THAT ALL VALVES, DAMPERS AND ACCESS DOORS ARE ACCESSIBLE.
43. ALL HORIZONTAL DUCT MAINS TAKE-OFFs FROM VERTICAL DUCT MAIN RISERS SHALL BE C/W BALANCING DAMPERS FOR BALANCING AND SERVICE ISOLATION-TYP
44. CONTRACTOR TO CO-ORDINATE THERMOSTAT LOCATION TO AVOID INSTALLATION OVER DIMMER SWITCHES OR HEAT EMITTING DEVICES PRIOR TO INSTALLATION. LOCATE ALLTHERMOSTATS 300mm AWAY FROM DOOR OPENING RADIUS. COORDINATE EXACT LOCATION ON SITE PRIOR TO INSTALLATION.
45. UNLESS OTHERWISE NOTED, BRANCH DUCTS SERVING INDIVIDUAL AIR TERMINALS TO MATCH AIR TERMINAL CONNECTION SIZE OR AIR TERMINAL SIZE REFER TO THE AIR TERMINALSCHEDULES IN THE SPECIFICATION.
46. LOCATE BALANCE DAMPERS OVER ACCESSIBLE CEILINGS WHERE POSSIBLE. WHERE DAMPERS MUST BE LOCATED OVER NON-COMBUSTIBLE CEILING, PROVIDE CONCEALED REGULATORS AS SPECIFIED.
47. ALL AIR TERMINALS TO BE C/W BALANCING DAMPERS AT DUCT BRANCH FOR BALANCING.
48. PROVIDE FLEXIBLE CONNECTORS WHERE MECHANICAL SERVICES (I.E. DUCTWORK, PIPES, CONDUITS, ETC.) CROSS STRUCTURAL SEISMIC AND EXPANSION JOINTS

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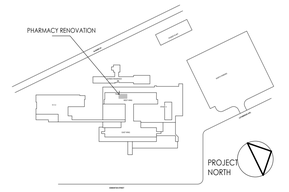


ADDENDUM 7	CH	MB	2024-02-09
Issued/Revision	By	Appd	YYYY.MM.DD

Permit/Seal

Client/Project Logo

northern health
the northern way of caring

Client/Project
Northern Health Authority

UHNBC(University Hospital of Northern BC)-Pharmacy upgrade

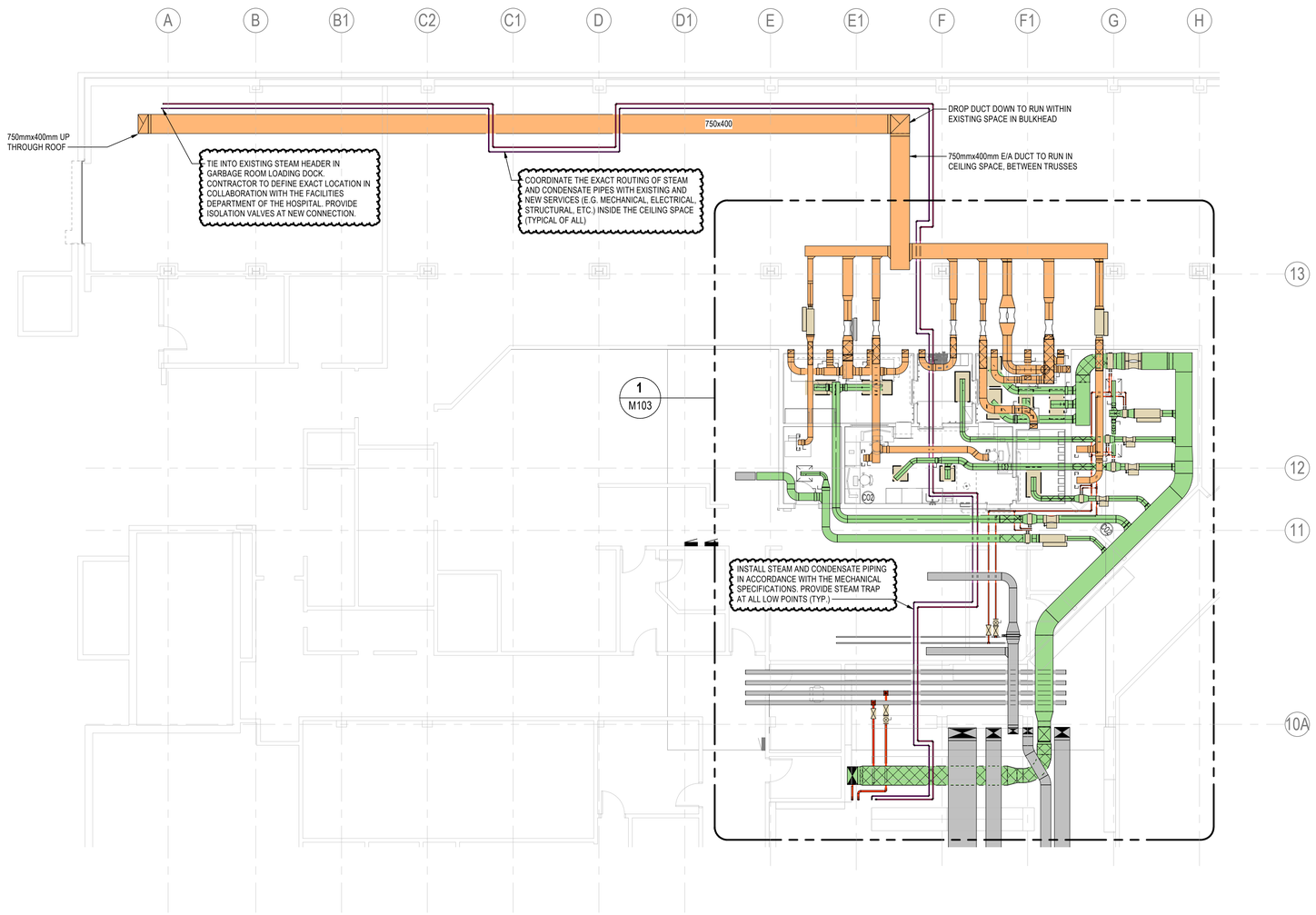
1475 Edmonton St, Prince George, BC V2M 1S2

Title
MECHANICAL SYMBOL LEGEND AND GENERAL NOTES

Project No.	Scale
144320228	As indicated
Revision	Drawing No.
1	M001

GENERAL NOTES:

1. COORDINATE WITH FMO FOR THE REQUIRED SHUTDOWNS. PRIOR TO RE-ACTIVATING A SYSTEM THAT IS SHUTDOWN, PERFORM A THOROUGH INSPECTION OF THE SYSTEM TO ENSURE THE SYSTEM IS READY FOR RE-COMMISSIONING I.E. THE STEAM LINES SHALL BE DRAINED TO PREVENT STEAM HAMMERING.



1 / M102 LEVEL 0 HVAC OVERVIEW PLAN

1 : 100

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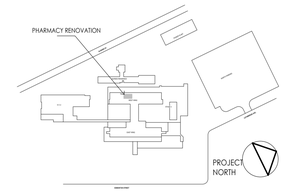


Issued/Revision		By	Appd	YYYY.MM.DD
2	ADDENDUM 7	CH	MB	2024-02-09
1	ISSUED FOR TENDER	MD	MB	2023-09-08

Permit/Seal

Client/Project Logo

northern health
the northern way of caring

Client/Project
Northern Health Authority

UHNBC(University Hospital of Northern BC)-Pharmacy upgrade

1475 Edmonton St, Prince George, BC V2M 1S2

Title
LEVEL 0 - HVAC - OVERVIEW

Project No.
144320228

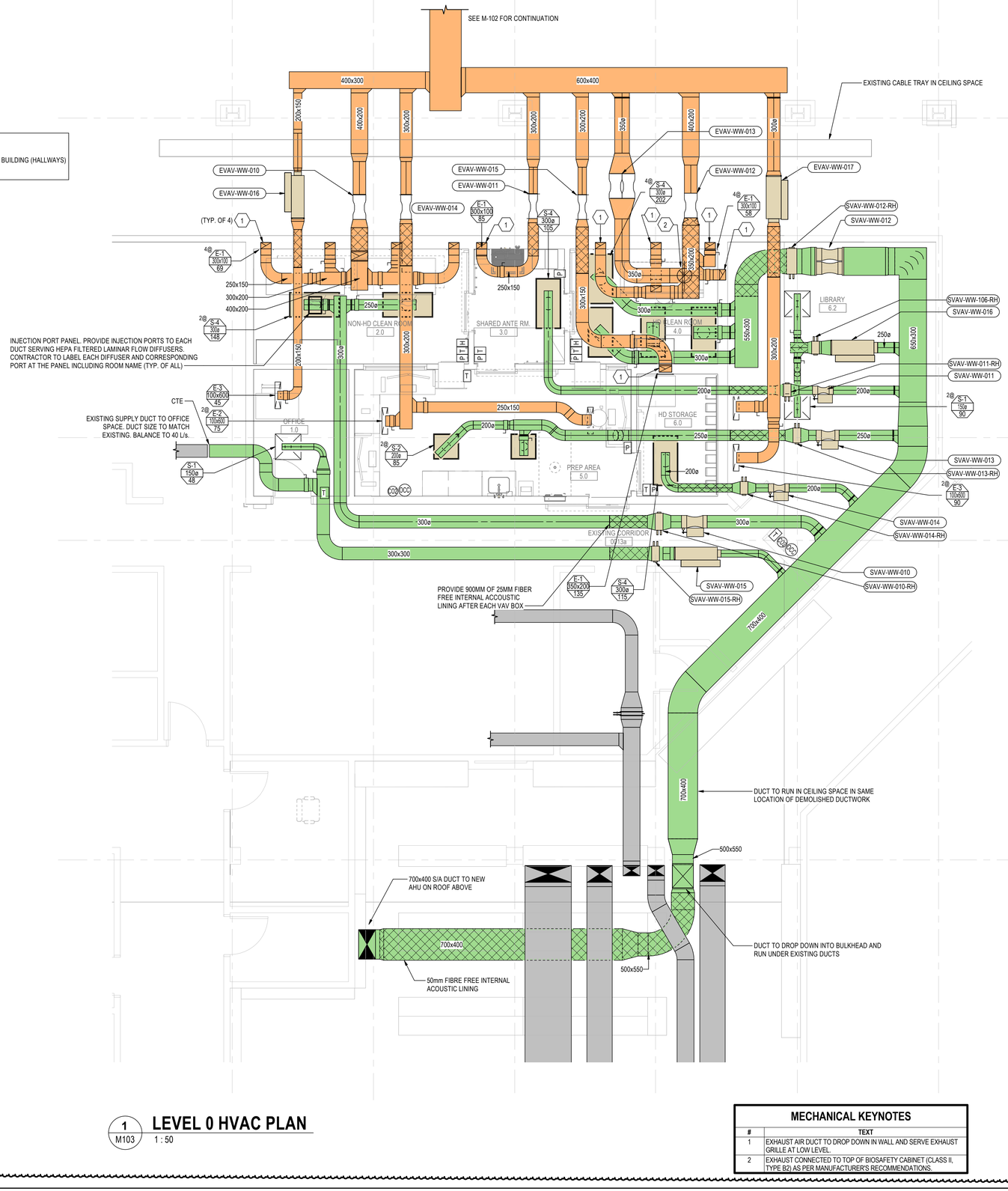
Scale
1 : 100

Revision
2

Drawing No.
M102

GENERAL NOTES:

1. ANY WORK TO BE COMPLETED IN OCCUPIED AREAS OF THE BUILDING (HALLWAYS) SHALL BE DONE AFTER DAYTIME HOURS.



1 LEVEL 0 HVAC PLAN
M103 — 1 : 50

MECHANICAL KEYNOTES

#	TEXT
1	EXHAUST AIR DUCT TO DROP DOWN IN WALL AND SERVE EXHAUST GRILLE AT LOW LEVEL.
2	EXHAUST CONNECTED TO TOP OF BIOSAFETY CABINET (CLASS II, TYPE B2) AS PER MANUFACTURER'S RECOMMENDATIONS.

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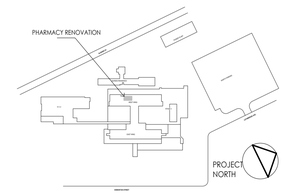

3	ADDENDUM 7	CH	MB	2024-02-09
2	ADDENDUM 2	CH	MB	2024-01-11
1	ISSUED FOR TENDER	MD	MB	2023-09-08
Issued/Revision		By	Appd	YYYY.MM.DD

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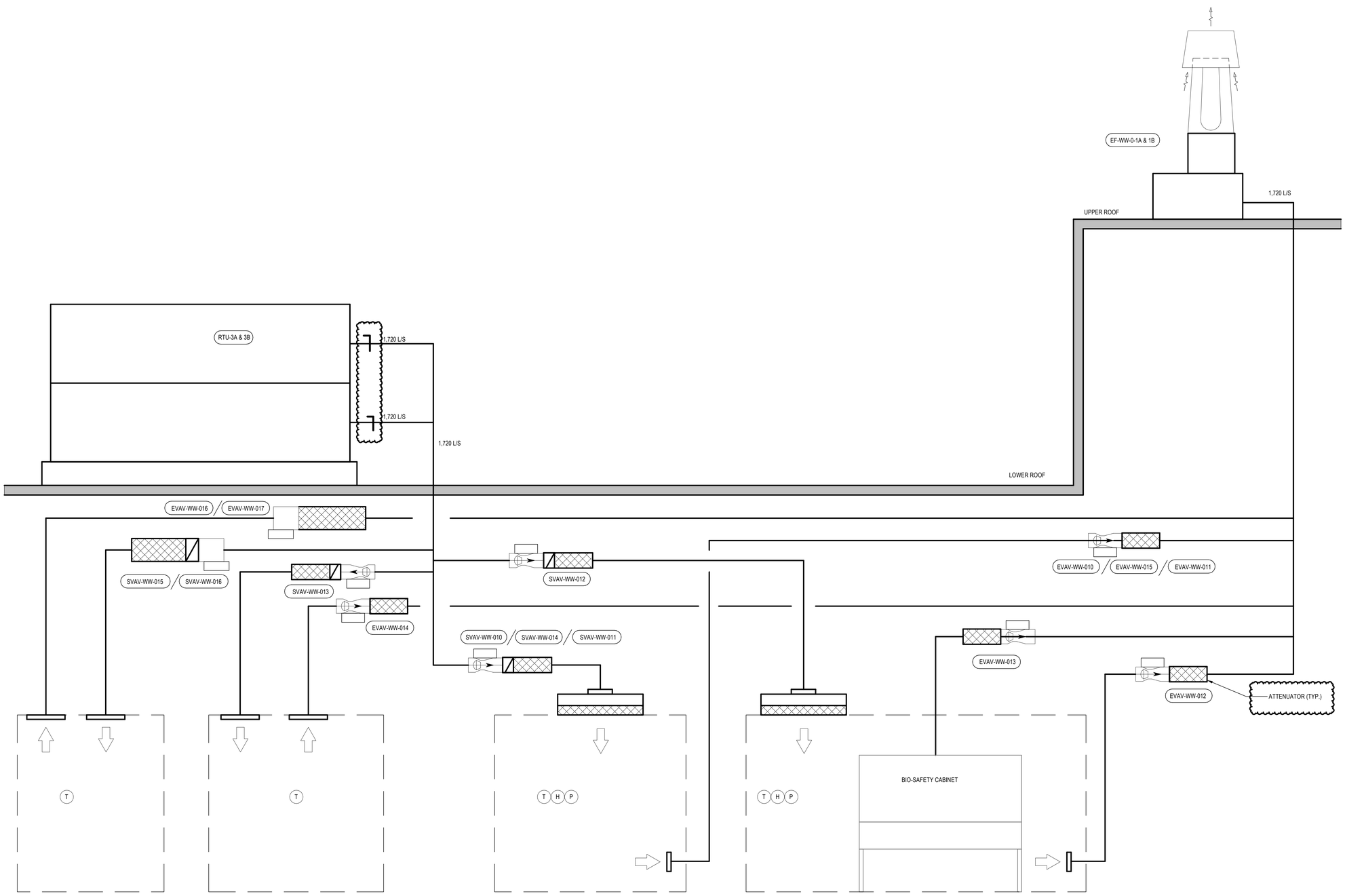
Title
LEVEL 0 - HVAC - NEW

Project No.	Scale
144320228	1 : 50
Revision	Drawing No.
3	M103



OFFICE / LIBRARY STAFF ROOM TYPICAL LAYOUT

UNCLASSIFIED PREP / STORAGE TYPICAL LAYOUT

NON-HD CLEAN ROOM / HD STORAGE / SHARED ANTE ROOM TYPICAL LAYOUT

HD CLEAN ROOM

1 M400 VENTILATION SCHEMATIC

NTS

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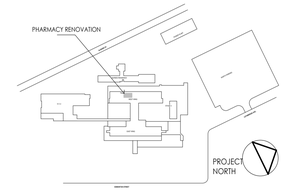

3	ADDENDUM 7	CH	MB	2024-02-09
2	ADDENDUM 2	CH	MB	2024-01-11
1	ISSUED FOR TENDER	MD	MB	2023-09-08
Issued/Revision		By	Appd	YYYY.MM.DD

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Title
MECHANICAL SCHEMATICS

Project No.
144320228

Scale
NTS

Revision
3

Drawing No.
M400

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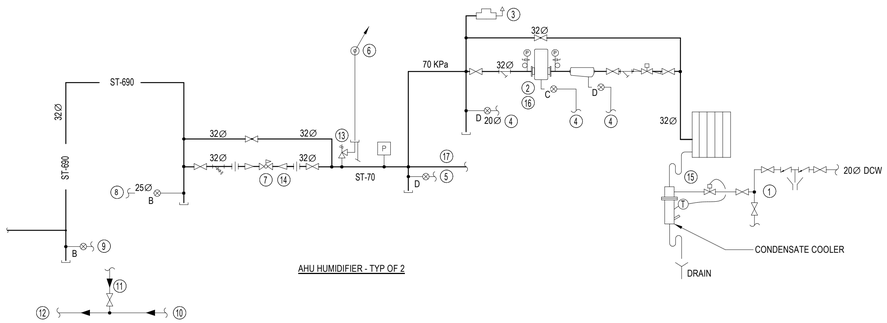
ORIGINAL SHEET - ARCH D

STEAM TRAP STATION TYPES:

TYPE A: INVERTED BUCKET STEAM TRAP STATION
TYPE B: THERMODYNAMIC STEAM TRAP STATION
TYPE C: THERMOSTATIC DRAIN STEAM TRAP STATION
TYPE D: F&T STEAM TRAP STATION

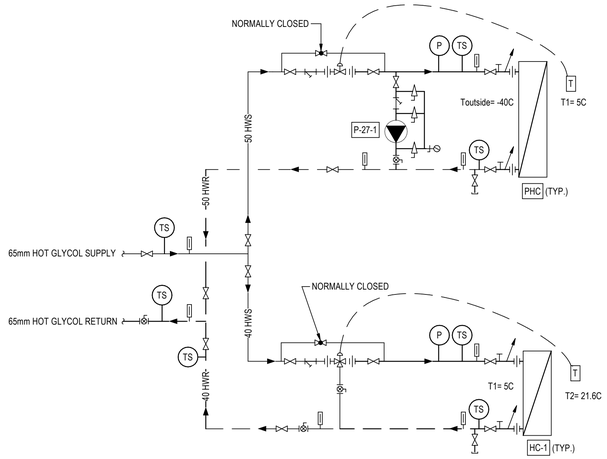


AHU HUMIDIFIER - TYP OF 2

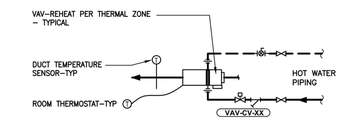
1 STEAM SCHEMATIC
M401 NTS

1. PROVIDE COLD WATER PIPE TO DRAIN COOLERS OF AHUs. MODIFY AND RE-INSULATE EXISTING COLD WATER PIPING TO SUIT. COORDINATE WITH UHNBC FMO FOR REQUIRED SHUTDOWNS. PROVIDE ISOLATION VALVES AT TIE-IN TO THE EXISTING DCW PIPING.
2. 5 MICRON STEAM FILTER EQUIVALENT TO DONALDSON MODEL P-EG C/W FLUORAZ O-RING
3. THERMOSTATIC AIR VENT AND VACUUM BREAKER
4. TO CONDENSATE COOLER. INSULATE, HEAT TRACE, AND ALUMINUM JACKET PIPING SYSTEM ON THE ROOF FOR FREEZE PROTECTION (TYPICAL OF ALL PIPING ON ROOF)
5. 20Ø CONDENSATE TO CONDENSATE COOLER
6. COORDINATE WITH AHU MANUFACTURER FOR CORING THROUGH THE AHU ENCLOSURE ROOF AND SEALING THE PENETRATION
7. COORDINATE WITH AHU MANUFACTURER FOR SUPPORTING AND ATTACHMENT OF PRV STATION AND PIPING TO THE AHU SERVICE ENCLOSURE WALL, FLOOR AND ROOF (TYP.). MECHANICAL CONTRACTOR'S SEISMIC / PIPING ENGINEER TO PROVIDE INCIDENTAL FORCES TO AHU MANUFACTURER PRIOR TO PREPARATION OF AHU SHOP DRAWINGS FOR COORDINATION
8. 25Ø CONDENSATE LINE TO FLASH TANK
9. PROVIDE CONDENSATE TRAP AND PIPING FOR AHU-PH-01A&B AHU's STEAM SYSTEM, AND CONNECT TO EXISTING CONDENSATE PIPE. COORDINATE WITH FMO FOR EXACT TIE-IN POINT. MODIFY AND RE-INSULATE EXISTING CONDENSATE PIPING TO SUIT. COORDINATE WITH UHNBC FOR STEAM AND CONDENSATE SYSTEM SHUTDOWNS. PROVIDE ISOLATION VALVES AT TIE-IN TO EXISTING STEAM AND CONDENSATES PIPING.

   IN ADDITION, PROVIDE THERMOSTATIC (LIQUID EXPANSION) STEAM TRAP AT ALL LOW POINTS IN NEW STEAM PIPING TO DRAIN CONDENSATE DURING SYSTEM SHUT-DOWN. PIPE TRAP TO SAN DRAIN ON LEVEL 0 IN ACCORDANCE WITH BC PLUMBING CODE (TYP.)
10. EXISTING CONDENSATE PIPE INSIDE THE BUILDING
11. NEW HIGH PRESSURE CONDENSATE FROM NEW STEAM PIPING
12. EXISTING HIGH PRESSURE CONDENSATE PIPE TO FLASH TANK
13. PRESSURE RELIEF BY SPIRAX SARCO MODEL 750 (1-1/4" x 1-1/2" ORIFICE G) C/W DRIP PAN ELBOW (1-1/2"), OR EQUIVALENT
14. PRV MODEL SPIRAX SARCO 15Ø 25P OR EQUIVALENT
15. WATER SEAL
16. DRIP LEG FOR TYPE C TRAP SHALL BE DEEP TO AVOID CONDENSATE BACKING UP INTO THE STEAM FILTER WHEN THE TRAP IS CLOSED.
17. 32Ø TO OTHER HUMIDIFIER



2 RTU-3A &3B HEATING COIL SCHEMATIC (TYP.)
M401 NTS



TYPICAL VAV

3 VAV CONNECTIONS
M401 NTS

Stantec

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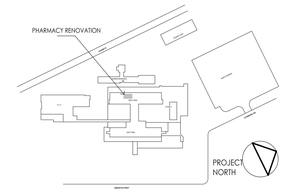
Consultant

Notes



3	ADDENDUM 7	CH	MB	2024-02-09
2	ADDENDUM 2	CH	MB	2024-01-11
1	ISSUED FOR TENDER	MD	MB	2023-09-08
Issued/Revision		By	Appd	YYYY.MM.DD

Permit/Seal

Client/Project Logo

northern health
the northern way of caring

Client/Project
Northern Health Authority

UHNBC(University Hospital of Northern BC)-Pharmacy upgrade

1475 Edmonton St, Prince George, BC V2M 1S2

Title
MECHANICAL SCHEMATICS

Project No.
144320228

Scale
As indicated

Revision
3

Drawing No.
M401