PART 1 GENERAL

1.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 01340 – Shop Drawings, Samples, and Mock-Ups.

.2 Indicate:

.1 Equipment, capacity and piping connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

1.2 Closeout Submittals

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01730 - Operation and Maintenance Manual.

PART 2 PRODUCTS

2.1 Horizontal Unit Heaters

.1 Casing: 1.2 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.2 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 1 MPa.

.3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.

.4 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor supports.

.5 Air outlet: four-way adjustable louvres.

.6 Capacity: as indicated. Base hot water heating capacity on 82 °C (180 °F) E.W.T. and 11 °C (20 °F) temperature drop.

.7 Control room thermostat: electric, line low voltage, locking cover, set point locking device, concealed adjustment, plastic brushed aluminum stainless steel cover and guard, thermometer in cover.

.8 Acceptable manufacturers: Engineered Air, McQuay, Rittling.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's instructions.

.2 Provide double swing pipe joints as indicated.

.3 Check final location with Engineer if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.4 Hot water units: for each unit, install gate valve on outlet and lockshield globe calibrated balancing valve on inlet of each unit. Install drain valve at low point. Install manual air vent at high point.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Thermostats on outside walls: mount on insulated backplates.

.8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSA B228.1-1968, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.2 Product Data

.1 Submit product data in accordance with Section 01340 - Shop Drawings, Samples and Mock-Ups.

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 Certification of Ratings

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 General

.1 Manufacture in accordance with CSAB228.1.

2.2 Flexible Connections

.1 Frame: galvanized sheet metal frame mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40°C to plus 90°C, density of 1.3 kg/m2.

2.3 Access Doors in Ducts

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm thick complete with sheet metal angle frame and 25mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.

.2 301 to 450 mm: 4 sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

.6 300 x 300 mm glass viewing panels.

2.4 Turning Vanes

.1 Factory or shop fabricated single thickness and double thickness with without trailing edge, to recommendations of SMACNA and as indicated.

2.5 Instrument Test .1 Ports

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

PART 3 EXECUTION

3.1 Installation

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100mm.

.3 Minimum distance between metal parts when system in operation: 75mm

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

.1 Size:

.1 600 x 600 mm for person size entry.

.2 400 x 400 mm for servicing entry.

.3 300 x 300 mm for viewing.

.4 As indicated.

.2 Location:

.1 At fire and smoke dampers.

.2 At control dampers.

.3 At devices requiring maintenance.

.4 At locations required by code.

.5 At reheat coils.

.6 Elsewhere as indicated.

.3 Instrument test ports.

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations.

.1 For traverse readings:

.1 At ducted inlets to roof and wall exhausters.

.2 At inlets and outlets of other fan systems.

.3 At main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Consultant.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible - 1985.

1.2 Product Data

.1 Submit product data in accordance with Section 01340 - Shop Drawings, Samples and Mock-Ups.

.2 Indicate the following: Material guage, handle material, and installation method.

PART 2 PRODUCTS

2.1 General

.1 Manufacture to SMACNA standards.

2.2 Single Blade Dampers

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100mmas indicated.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

PART 3 EXECUTION

3.1 Installation

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A 653M- 95 , Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.2 Product Data

.1 Submit product data in accordance with Section 01340 - Shop Drawings, Samples and Mock-Ups.

.2 Indicate the following:

.1 Performance data.

.2 Operating torque.

1.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01730 - Operations and Maintenance Manual.

1.4 Certification of Ratings

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

PART 2 PRODUCTS

2.1 Multi-Leaf Dampers

.1 Opposed or Parallel blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: compatible with damper.

.6 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at Pa differential across damper.

.2 Pressure drop: at full open position to be less than 3.7 Pa differential across damper at 3.7 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

PART 3 EXECUTION

3.1 Installation

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 15820 - Duct Accessories.

.5 Ensure dampers are observable and accessible.

END OF SECTION

PART 1 GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 01340 - Shop Drawings, Samples and Mock-Ups.

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.6 Neck size and panel size.

1.2 Samples

.1 Submit samples in accordance with Section 0130 - Shop Drawings, Samples and Mock-Ups.

.2 Samples are required for following: Grilles and diffusers (one for each type specified).

1.3 Extra Materials

.1 Provide maintenance materials in accordance with Section 01730 - Operations and Maintenance Manual.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.4 Manufactured Items

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.5 Certification of Ratings

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 General

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.2 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: standard as directed by Consultant .

.5 Acceptable material: E.H. Price, Titus, Nailor.

2.2 Supply Grilles and Registers

.1 General: with opposed blade dampers.

.2 Refer to Mechanical Schedules for types and sizes.

2.3 Return and Exhaust Grilles and Registers

.1 General: with opposed blade dampers.

.2 Refer to Mechanical Schedules for types and sizes.

2.4 Diffusers

.1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.

.2 Refer to Mechanical Schedules for types and sizes.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible.

END OF SECTION

PART 1 GENERAL

1.1 General

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.

1.2 Qualifications of TAB Personnel

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Engineer within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

1.3 Purpose of TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 Exceptions

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 Co-ordination

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 Pre-TAB Review

.1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

1.7 Start-up

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 15.

1.8 Operation of Systems During TAB

.1 Operate systems for length of time required for TAB and as required by Engineer for verification of TAB reports.

1.9 Start of TAB

.1 Notify Consultant 7 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, caulking.

.5 All pressure, leakage, other tests specified elsewhere Division 15.

.6 All provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 All outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 Application Tolerances

.1 Do TAB to following tolerances of design values:

.1 All other HVAC systems: plus 5%, minus 5%.

.2 Hydronic systems: plus or minus 10%.

1.11 Accuracy Tolerances

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 Instruments

.1 Prior to TAB, submit to Engineer list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.13 Submittals

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

.2 Submit preliminary balancing report for review prior to marking any final settings.

.3 Submit final report after all work has been completed.

1.14 Preliminary TAB Report

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB Report

.1 Format to be in accordance with referenced standard.

.2 TAB report to show all results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to Consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 Verification

.1 All reported results subject to verification by Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Consultant.

.4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.17 Settings

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 Completion of TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.19 Air Systems

.1 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB SMACNA ASHRAE.

.2 Do TAB of all systems, equipment, components, controls specified in Division 15, and the following systems, equipment, components, controls:

.1 Central air handling system including supply, return and exhaust fans.

.2 Miscellaneous exhaust systems.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB or qualified to standards of AABC or NEBB.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by or to standards of AABC or NEBB.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At each controller, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 **Hydronic Systems**

.1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.

.2 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB SMACNA ASHRAE.

.3 Do TAB of all systems, equipment, components, controls specified Division 15 and the following systems, equip ment, components, controls:

.1 Primary hydronic loops.

.4 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB or qualified to standards of AABC or NEBB.

.5 Quality assurance: perform TAB under direction of supervisor qualified by or to standards of AABC or NEBB.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.

.7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each heat exchanger (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.

.2 At each controller, controlled device.

.8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water.

1.21 **Domestic HWC Systems**

.1 Meet all requirements as specified for hydronic systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device.

.3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.22 Other Systems

.1 Plumbing systems:

.1 TAB procedures:

.1 Flush valves: adjust to suit project pressure conditions.

.2 Pressure booster systems: test for capacity and pressures under all conditions and at all times.

.3 Controlled flow roof drain systems: adjust weirs to suit actual roof conditions, slopes, areas drained.

.4 Pumped sanitary systems: test for proper operation at all possible flow rates.

1.23 Other TAB Requirements

.1 General requirements applicable to all work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter summer design conditions at all times.

.3 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with all systems in all possible combinations of normal operating modes.

1.24 Post- Occupancy TAB

.1 Measure DBT, WBT (or %RH), air velocity, air flow patterns, NC levels, in occupied zone of following areas:.

.2 Emergency evacuation: Participate in full scale emergency evacuation exercises. Repeat smoke management tests at this time.

.3 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

PART 2 PRODUCTS – not used

PART 3 EXECUTION – not used

END OF SECTION

DILLON CONSULTING LIMITED

Equipment Specification Sheet

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

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

Notes:	Standard of Acceptance: Armstrong S45

DILLON CONSULTING LIMITED

Equipment Specification Sheet

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

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

Notes:	Standard of Acceptance: Armstrong S35

DILLON CONSULTING LIMITED

Equipment Specification Sheet

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

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

Notes:

Supply with:

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

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

Standard of Acceptance:

Burnham V85W

DILLON CONSULTING LIMITED

Equipment Specification Sheet

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

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

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