

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:
Travaux publics et Services gouvernementaux
Canada
Place Bonaventure, portail Sud-Est
800, rue de La Gauchetière Ouest
7^{ème} étage
Montréal
Québec
H5A 1L6
FAX pour soumissions: (514) 496-3822

SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

Comments - Commentaires

Vendor/Firm Name and Address
Raison sociale et adresse du
fournisseur/de l'entrepreneur

Issuing Office - Bureau de distribution
Travaux publics et Services gouvernementaux Canada
Place Bonaventure, portail Sud-Est
800, rue de La Gauchetière Ouest
7^{ème} étage
Montréal
Québec
H5A 1L6

Title - Sujet Ottawa - Bay 2 refit	
Solicitation No. - N° de l'invitation 9F030-120286/A	Amendment No. - N° modif. 002
Client Reference No. - N° de référence du client 9F030-12-0286	Date 2013-02-25
GETS Reference No. - N° de référence de SEAG PW-\$MTC-025-12265	
File No. - N° de dossier MTC-2-35320 (025)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2013-03-05	
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input checked="" type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Couture, Danielle	Buyer Id - Id de l'acheteur mtc025
Telephone No. - N° de téléphone (514) 496-3863 ()	FAX No. - N° de FAX (514) 496-3822
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction:	

Instructions: See Herein

Instructions: Voir aux présentes

Delivery Required - Livraison exigée	Delivery Offered - Livraison proposée
Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur	
Telephone No. - N° de téléphone Facsimile No. - N° de télécopieur	
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)	
Signature	Date

Solicitation No. - N° de l'invitation

9F030-120286/A

Client Ref. No. - N° de réf. du client

9F030-12-0286

Amd. No. - N° de la modif.

002

File No. - N° du dossier

MTC-2-35320

Buyer ID - Id de l'acheteur

mtc025

CCC No./N° CCC - FMS No/ N° VME

La date de clôture pour le projet mentionné ci-dessus a été reporté au 5 mars 2013, 02:00 p.m.

- L'addenda no. 2 fait partie intégrante de l'appel d'offres.

Les autres termes et conditions demeurent les mêmes.



Agence spatiale Canadian Space
canadienne Agency

LABORATOIRE DAVID FLORIDA – IMMEUBLE 65
3701, avenue Carling, C.P. 11490, succursale H
Ottawa (Ontario) K2H 8S2



Addenda n° 2

La demande de proposition no **9F030-120286/A « Rénovation de baie 2, Agence Spatiale Canadienne, Ottawa, Ontario »** est par la présente modifiée:

1. Généralités :

1. Les dessins partiels des records d'atelier du AHU-5 pré-acheté pour information générale.

FIN DE L'ADDENDA



Delivering Real Success®

HAAKON AIR HANDLING UNIT
GENERAL SPECIFICATION

Effective: September 2012

SCOPE

Air handling units are designed and manufactured to the specific requirements of this project.

Haakon is certified for all structural welds in accordance with CSA W47.1 and CSA W59 and AWS D1.1.

ACOUSTICAL PERFORMANCE

The casing has been tested for acoustical performance by an independent laboratory that is accredited. Performance data is as follows:

Sound Transmission Loss DB ASTM E-90 & E413-73

	1	2	3	4	5	6	7	8	
4" wall	20	20	28	41	51	56	55	57	STC=40

Sound Absorption ASTM C423-84A & E795-83

	1	2	3	4	5	6	7	8	
4" wall	.40	.65	1.38	1.28	1.09	1.05	1.02	1.02	STC =40

CASING

Walls and roofs are constructed of 16 gauge galvanized steel, 4" thick acoustic thermal panels. The inner liner is 22 gauge solid, galvanized steel. Washdown stainless steel liner is to be provided in cooling coil and humidifier sections. Insulation is 4" thick 4.2 lb. density fibreglass. All permanently joined flanged panel surfaces are sealed with an individual strip of 1/8" X 3/8" tape sealer. All panel seams are sealed during assembly to produce an airtight unit.

All insulation used in air handling unit walls, roof and base has a flame spread rating of less than 25 and a Smoke Developed rating of less than 50 per ASTM E84 and UL 723 and Can/ULC S102-M88.

Insulation meets the requirements NFPA 90A and 90B standards.

Outdoor units have roof panels broken outward to provide a lapped joint watertight seal. Outdoor roof is sloped a minimum of 5/8" away from the access side.

BASE CONSTRUCTION

Base is constructed from 8 inch perimeter channel iron frame with intermediate channel and angle iron supports.

Structural support is provided beneath all major components.

A 0.125 inch aluminum checker plate floor is installed on the base. Floor seams are continuously welded providing a completely flat unit floor. A 1-1/2" perimeter collar is provided to ensure the unit is internally watertight. The collar is alternately screwed down and tack welded to the unit base on one (1) foot centres. Joint is caulked to be watertight. Base is provided with a minimum of four (4) lifting lugs per unit section. The base is insulated with 4" thick, 4.2 lbs. density fibreglass insulation. The 22 gauge galvanized steel base liner is broken, tack welded and sealed for rigidity and vapour barrier integrity.

ACCESS DOORS

Access doors are 16 gauge galvanized steel with 22 gauge galvanized steel liner on the inside. Corners are welded for rigidity. 4.2 lb. density insulation is sandwiched between the outer and inner skins. A 12" round double glazed tempered glass window is provided in each door.

Two chrome plated "Ventlock" model #310 high pressure door latches are installed on both sides of door. A continuous stainless steel piano hinge is welded to door and casing. Door opening is fully gasketed with continuous 1/2" closed cell hollow round black gasket with a metal encapsulated reinforced backing that mechanically fastens to the door opening perimeter. Door frames are made from 16 gauge galvanized steel with the outside of the door flush to the unit. Minimum door width is 24". Door height is the maximum permitted by the height of the unit up to 72".

Doors open against positive pressure.

ROOF CURBS

Roof curbs are manufactured from 12 gauge galvanized steel. A 2 x 4 nailing strip is provided around the entire perimeter.

Manufacturer will supply seismic restraints to secure the air handling unit to the roofcurb in accordance with the National Building Code.

FANS

Fans carry the AMCA seal for airflow and sound.

Fans to be Acoustiflo SWSI plenum fans complete with standard construction features. Inlet silencers are to be provided on the return fans. Fan and motor assembly is to be balanced to AMCA BV-5.

Fan bearings are self aligning, grease lubricated, extra heavy duty anti-friction ball or spherical roller type, selected for an L10 life of 200,000 hours at design operating conditions. Bearings are mounted on the integral fan scroll bracing.

Variable speed drives are factory mounted on the unit. Factory wiring between the VSD and fan motors is provided. All casing penetrations are sealed air tight. Terminal block within the VSD is provided for for field termination of line side wiring.

Airflow measuring probes are provided on the fan inlets. Each airflow probe contains 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 is located outside the inlet throat so it will not obstruct airflow.

An Airflow display is provided to digitally display the fans current airflow.

MOTORS

Motors are designed for HVAC duty and meet NEMA MG1 requirements. Motor enclosure(s) are totally enclosed fan cooled. IEEE841 motors are not available for the specified fan type.

Motor windings have class F insulation with class B temperature rise ratings.

Nameplates are stainless steel and contain both NEMA data and bearing data.

Motors used with variable frequency drives are complete with a brush system to electrically ground the shaft and discharge any induced voltage on the motor shaft, with a direct path to ground.

Motor(s) are supplied with a 3 year warranty.

VIBRATION ISOLATION

Vibration isolators to be installed as per Acoustiflo standard specifications.

COILS

Coils are fully enclosed within casing and mounted on angle frames manufactured to allow coils to be individually removed. Cooling coil frames are 12 ga 304 stainless steel. Heating coil frames are 16 ga satin coat galvanized steel.

Removable coil access panels are provided to remove coils through casing wall. Coil covers are double wall construction with all exposed edges of insulation covered with sheet metal including holes through the cover for coil header stub outs. Coils are individually removable towards the access side.

All drain pans are double wall continuously welded 304 stainless steel. Intermediate drain pans are interconnected with stainless steel 1" down pipes. Condensate drain are a minimum 1-1/4" diameter stainless steel tube extending 1" out from unit for solder connection to trap. Drain pans are sloped within unit and fully drainable.

Coils are certified in accordance with ARI Standard 410.

Construction:

Tubes	Horizontal, copper.
Fins	Aluminum mechanically bonded to tubes.
Headers	Seamless copper with vent and drain connections.
Casing	16 gauge galvanized steel for heating coils and stainless steel for cooling coils, with 16 gauge center and end supports.
Connections	Same end, counterflow, with vent, drain, supply and return stubs extended to outside of unit casing with grommets for airtight casing.

PREFILTERS

Prefilters are 2" Camfil-Farr 30/30, MERV 8, medium efficiency, pleated, disposable type. The filter is listed by Underwriters Laboratories as Class 2.

Prefilters are installed in a prefabricated channel rack.

Prefilters are slide out from side access section.

FILTERS

Filters are high performance, Camfil-Farr S-Flo, MERV 13, deep pleated 15" long bag type. Each filter consists of glass fibre media, media support grid, contour stabilizer and enclosing frame.

Filter media is of high density microfine glass fibres laminated to a non-woven synthetic backing to form a lofted filter blanket. The filter media has an average efficiency of 80-85% on the ASHRAE Test Standard 52. The filter is listed by Underwriters Laboratories as Class 2.

Holding frames are factory fabricated of 16 gauge galvanized steel.

Filters are slide out from side access section.

FINAL HEPA FILTERS

Final filters are high performance, AAF Astrocel G, 12" long HEPA filter type. Each filter consists of media, media support grid, contour stabilizer and enclosing frame.

Final filter media is of submicron glass fibres formed into a high density paper. The filter media has an average efficiency of 99.97% on the ASHRAE Test Standard 52. The filter is listed by Underwriters Laboratories as Class 1.

Holding frames are factory fabricated of 16 gauge galvanized steel and are equipped with gaskets and 2 heavy duty positive sealing fasteners. Each fastener is capable of withstanding 25 lbs. pressure without deflection. They are capable of being attached or removed without the use of tools.

Final filters lift out from upstream access section.

DRAINS

1 1/4" capped floor drain connections on the bottom of the unit for complete drainability of the base pan are provided in the following sections.:

Fresh Air Plenums
Humidifier Sections
Sections upstream and downstream of coils
All sections where unit has washdown liner

Contractor will be required to make connections and complete required trapping and piping within the unit base and roof curb.

FINISH

Unit(s) are painted with two components etch bond primer and finish painted with alkyd enamel. All uncoated steel is painted with red oxide primer. All metal surfaces are prepainted with vinyl wash primer to ensure paint bond to metal.

Outdoor units are painted with polyurethane. Owner's representative to provide colour sample to match with approval.

LIGHTS

Marine lights with protective cast metal cage and glass globes complete with duplex receptacles are installed on the wall across from the access doors. One (1) switch with an indicator light is installed on the exterior of the unit. Wiring is factory installed from switch to all lights in EMT conduit with liquid tight connections. Electrical power is 120V/1/60.

FILTER GAUGES

Magnehelic filter gauges are to be provided with a 0-10V external control signal to indicate air pressure drop. Gauges to be accurate to 3%.

LOUVRES

Louvre blades are fixed on a 45 degree angle, and on 4" centres equal to Alcan 6063-T5 extruded aluminum.

Frame is Alcan 6064-T5 extruded aluminum, 4" wide.

Birdscreen is galvanized, 1/2" x 1/2" opening fixed to the rear with cadmium plated screws.

Finish is natural mill finish.

HOODS

Fresh air and exhaust air hoods are provided complete with 1/2" x 1/2" birdscreen and finished to match the unit. A rain gutter is provided on all edges of the hood. Outside air is sized for maximum inlet velocity of 600 FPM.

ALUMINUM AIRFOIL DAMPERS

Aluminum airfoil frames and blades are a minimum of 12 gauge extruded aluminum. Blades are 6" wide single air foil design.

Frames are extruded aluminum channel with grooved inserts for vinyl seals. Standard frames 2" x 4" x 5/8" on linkage side, 1" x 4" x 1" on the other sides.

Pivot rods are 7/8" hexagon extruded aluminum interlocking into blade section. Bearings are double sealed type with a Celcon inner bearing on a rod within a Polycarbonate outer bearing inserted into frame so that the outer bearing cannot rotate.

Bearing is designed so that there is no metal-to-metal or metal-to-bearing riding surfaces. Interconnecting linkage has a separate Celcon bearing to eliminate friction in linkage.

Blade linkage hardware is installed in frame out of airstream. All hardware is on non-corrosive reinforced material or cadmium plated steel.

Damper seals are designed for minimum air leakage by means of overlapping seals.

Internal hollows are insulated with 7/8" thick polyurethane foam with R factor of 5.0 per inch where required. Blades are 100% thermally broken. Frame is insulated with polystyrene, R factor of 5.0 per inch.

Damper blades are maximum 40" long per section.

Dampers greater than 2 sections wide are provided with a jackshaft.

Dampers are: T.A. Morrison "TAMCO series 1000" and "TAMCO series 9000" where noted.

DAMPER OPERATORS

Electronic damper operators with all linkage and hardware internally mounted are factory installed.

Damper operators are mounted in easily accessible sections of the air handling unit.

STEAM HUMIDIFIER

Air handling unit manufacturer will mount steam grid provided by humidifier manufacturer. Balance of steam humidifier components are mounted in the field by the contractor. Refer to schedules for absorption distances.

FACTORY LEAK TESTING

Each air handling unit is pressure tested to ensure the leakage rate of the casing does not 0.5% of the unit airflow at 1.5% of the rated static pressure for 4" thick casing units.

Test is conducted in accordance with SMACNA duct construction manual. A calibrated orifice is used to measure leakage airflow.

An officer of the air handling unit company will certify test results. Copies of certified test results are forwarded to the consultant.

"Double duct" or "side by side" units have each duct or side tested independently.

FLOOD TESTING

Each unit base is flooded to a level of 1.25" after manufacturing to assure no leakage through the floor and the perimeter water barrier. The results of the flood test are certified by the manufacturer.

WARRANTY

The warranty period commences at the date of initial startup and continues for a period of one (1) year not to exceed eighteen (18) months from shipment. Manufacturer's warranty includes parts only. Manufacturer's warranty does not include maintenance during the warranty period. Proper preventative maintenance is required.



AHU-5 Performance Data



Delivering Real Success®

Toronto : Tel: (416) 661-3400 Fax: (416) 661-0100
 Hamilton : Tel: (905) 643-7719 Fax: (905) 643-3203
 Kitchener : Tel: (519) 748-1860 Fax: (519) 748-9466
 London : Tel: (519) 457-6700 Fax: (519) 457-8900
 Oshawa : Tel: (905) 579-6700 Fax: (905) 579-5290
 Ottawa : Tel: (613) 728-7400 Fax: (613) 728-8032
 Sudbury: Tel: (705) 855-1589 Fax: (705) 855-7182

**AIR HANDLING UNIT
SCHEDULE**

JOB: 2125235OTTA - CSA AHU Pre-Tender

DATE: January 31, 2013

	AIR HANDLING			COOLING COIL	HEATING COIL	PREHEAT COIL		
	SUPPLY	RETURN						
TAG	AHU-5		TAG	CC-1	HC-1	HC-1 (Smoke)		
MODEL NUMBER	Haakon Custom		AIRFLOW (CFM)	16000	16000	4000		
MANUFACTURER	Haakon		EAT DB/WB (°F)	76.0/63.2	66.5	-20		
ESP (IN.)	2.5	2	LAT DB/WB (°F)	55.0/53.2	84.2	64.3		
TSP (IN.)	6.75	2.25	TOTAL CAP. (MBH)	496.1	306.4	365.5		
AIRFLOW (CFM)	16000	16000	SENS CAP. (MBH)	467.6	306.4	365.5		
SPEED (RPM)	1750	1150	REFRIG. TYPE OR % WATER	Water	Water	Water		
MOTOR SIZE QTY - HP	1-30	2-5	EWT OR SUCTION TEMP (°F)	42	180	180		
POWER INPUT QTY - BHP	1-24	2-4.25	LWT (°F)	52.35	117.6	155.1		
VOLTAGE	575/3/60		FLOW (USGPM)	90	10	30		
MOTOR TYPE	TEFC		WPD (FT)	8.87	1.68	11.87		
INDOOR / OUTDOOR	Outdoor		APD (IN.)	0.46	0.05	0.01		
PRESSURE			FACE AREA (FT ²)	32.25	32.25	32.25		
DT / BT	DT		FACE VELOCITY (FPM)	496	496	496		
FAN TYPE	ACFQ2 SW	ACFQ4S SW	COIL QTY - FHxFL (IN.)	2 - 27x86	1 - 54x86	1 - 54x86		
AIRFLOW MODULATION	VFD	VFD	ROWS / FINS PER INCH	4/10	1/8	1/8		
PRE FILTER	2" MERV8	12" MERV14	COIL TYPE	5WG	5MI	5MI		
FINAL FILTER	12" HEPA		COPPER FINS	No	No	No		
HUMIDIFIER SECTION	Manifold Included							
SHIPPING WT (LBS)	22000							
REMARKS								
HC-1 (Smoke) is the rating for the heating coil in smoke control mode.								
Operating Weight: 22211.3 lbs								
SOUND POWER LEVELS RE:10⁻¹² WATTS								
	1	2	3	4	5	6	7	8
SUPPLY	78	75	84	77	75	72	71	66
RETURN	63	62	77	65	65	64	64	61
VOLTAGE								
		120/1/60	208-230/1/60	208-230/3/60	460/3/60	575/3/60		
# OF ELECTRICAL FEEDS								
		1				1		
MCA								
		15				58		
Description								
		Light Circuit				Unit Power		



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 Sudbury : Tel: (705) 855-1589 Fax: (705) 855-7182

**AIR HANDLING UNIT
SCHEDULE
(SI)**

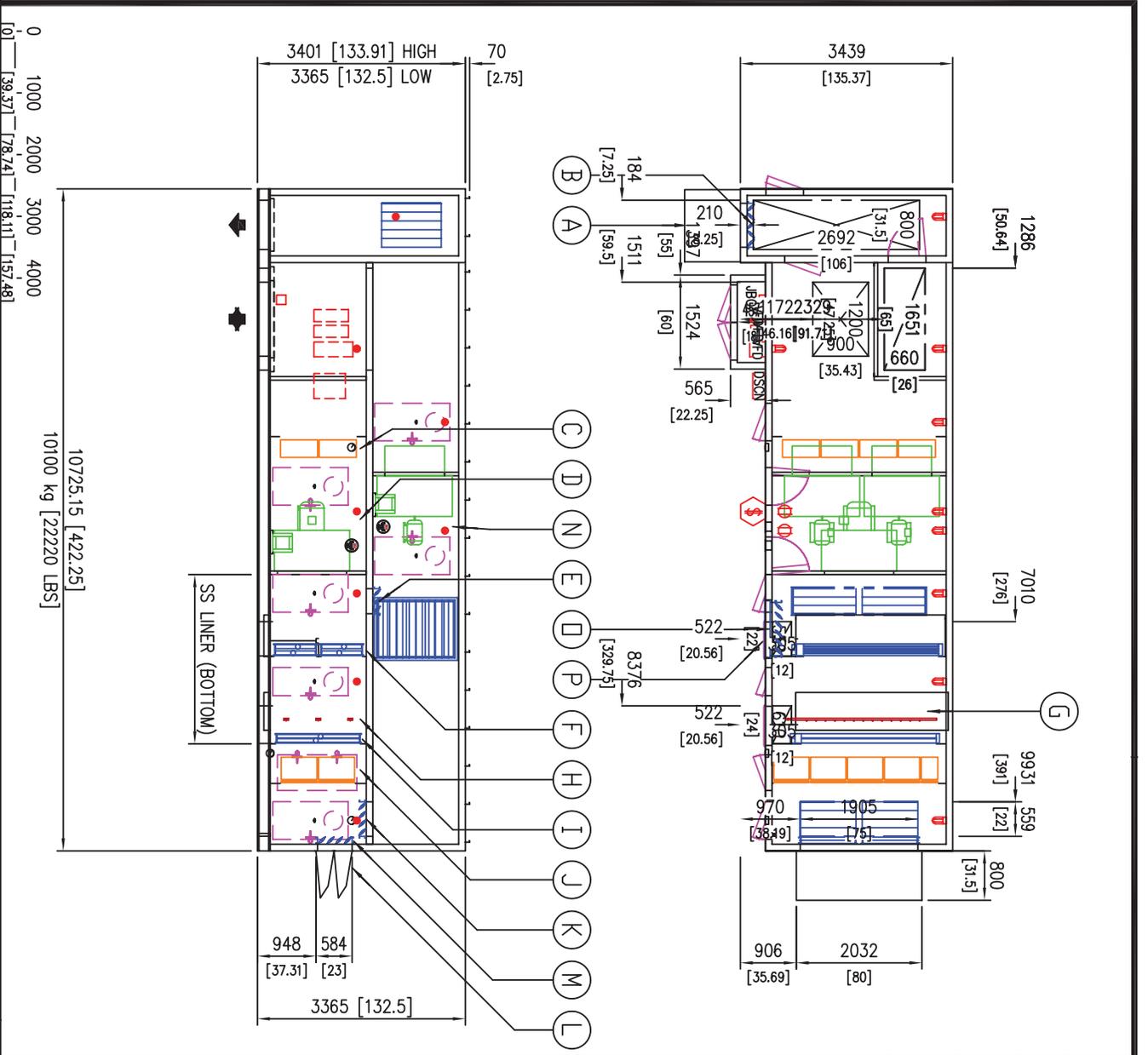
JOB: 2125235OTTA - CSA AHU Pre-Tender

DATE: January 31, 2013

	AIR HANDLING			COOLING COIL	HEATING COIL	PREHEAT COIL						
	SUPPLY	RETURN										
TAG	AHU-5		TAG	CC-1	HC-1	HC-1 (Smoke)						
MODEL NUMBER	Haakon Custom		AIRFLOW (L/S)	7550	7550	1888						
MANUFACTURER	Haakon		EAT DB/WB (°C)	24.4/17.3	19.17	-28.89						
ESP (PA)	623	498	LAT DB/WB (°C)	12.8/11.8	29.00	17.94						
TSP (PA)	1681	560	TOTAL CAP. (KW)	145.41	89.81	107.13						
AIRFLOW (L/S)	7550	7550	SENS CAP. (KW)	137.05	89.81	107.13						
SPEED (RPS)	29.2	19.2	REFRIG.TYPE OR % WATER	Water	Water	Water						
MOTOR SIZE QTY - KW	1-22.4	2-3.7	EWT OR SUCTION TEMP (°C)	5.56	82.22	82.22						
POWER INPUT QTY - KW	1-17.9	2-3.2	LWT (°C)	11.31	47.56	68.39						
VOLTAGE	575/3/60		FLOW (L/S)	5.7	0.6	1.9						
MOTOR TYPE	TEFC		WPD (KPA)	26.5	5.0	35.5						
INDOOR / OUTDOOR	Outdoor		APD (PA)	115	12	2						
PRESSURE			FACE AREA (M ²)	3.0	3.0	3.0						
DT / BT	DT		FACE VELOCITY (M/S)	2.52	2.52	2.52						
FAN TYPE	ACFQ2 SW	ACFQ4S SW	COIL QTY - FHxFL (MM)	2-686x2,184	1-1,372x2,184	1-1,372x2,184						
AIRFLOW MODULATION	VFD	VFD	ROWS / FINS PER CM	4/4	1/3.2	1/3.2						
PRE FILTER	2" MERV8	12" MERV14	COIL TYPE	5WG	5MI	5MI						
FINAL FILTER	12" HEPA		COPPER FINS	No	No	No						
HUMIDIFIER SECTION	Manifold Included											
SHIPPING WT (KG)	10000.0											
REMARKS												
HC-1 (Smoke) is the rating for the heating coil in smoke control mode.												
Operating Weight: 10096.0 kg												
SOUND POWER LEVELS RE:10⁻¹² WATTS												
	1	2	3	4	5	6	7	8				
SUPPLY	78	75	84	77	75	72	71	66				
RETURN	63	62	77	65	65	64	64	61				
VOLTAGE							120/1/60	208-230/1/60	208-230/3/60	460/3/60	575/3/60	
# OF ELECTRICAL FEEDS							1				1	
MCA							15				58	
Description							Light Circuit				Unit Power	



AHU-5 Drawing



<p>D EA DAMPER : PARALLEL BLADES MAKE : T.A. Morrison 9000 SIZE : 940 X 1270</p>	<p>P LOUVRE SIZE : 940 X 1270 Sid Louvre</p>	<p>UNIT MOUNTING The unit is designed to be mounted on a roof curb. Note : Calculated unit weights are shipping weights and do not reflect operating conditions, items which are field installed or ship loose.</p>	<p>A 5000cm OA HOOD</p>
<p>B 5000cm OA DAMPER : OPPOSED BLADES MAKE : T.A. Morrison 9000 SIZE : 1016 X 762</p>	<p>C HEPA FILTERS : LEFT-OUT UPSTREAM VELOCITY : 2.56 m/s TYPE : 30mm AAF Activated HCC 99.97% @. Gasket seal SIZE : 8 @ 610 X 610</p>	<p>D FAN : ACF02 SW, Arrangement-4 (ESP=2.5) AIR FLOW : 7550 l/s T.S.P. : 1678 Pa MOTOR : 22.36 kW, TFC Prem-Eff, 575/3/60 RPM : 1750 (ROUNDED SHAFT) ISOLATORS : OS DEF : 51 mm</p>	<p>E RA BYPASS DAMPER : PARALLEL BLADES MAKE : T.A. Morrison 1000 SIZE : 2184 X 457</p>
<p>F COOLING COIL TYPE : 4 ROW SIZE : 2 @ 686 X 2184 CONN : RIGHT PULL : RIGHT DRAIN : BOTTOM RIGHT/EL : 2.55 m/s</p>	<p>G DRAIN PAN</p>	<p>H HUMIDIFIER</p>	<p>I HEATING COIL TYPE : 1 ROW SIZE : 1 @ 1372 X 2184 CONN : RIGHT PULL : RIGHT VEL : 2.55 m/s</p>
<p>J FILTERS : SLIDE-OUT RIGHT VELOCITY : 2.28 m/s TYPE : 51mm (MERV 8) Farr 30/30 381mm Fan S-Flo 80-85%</p>	<p>K RA DAMPER : PARALLEL BLADES MAKE : T.A. Morrison 1000 SIZE : 1956 X 610</p>	<p>L OA HOOD TYPICAL OF 2</p>	<p>M OA DAMPER : PARALLEL BLADES MAKE : T.A. Morrison 9000 SIZE : 1956 X 610</p>
<p>N FAN : 2 @ ACF04S SW, Arrangement-4 (ESP=2) AIR FLOW : 3775 l/s T.S.P. : 559 Pa MOTOR : 3.73 kW, TFC Prem-Eff, 575/3/60 RPM : 1150 (ROUNDED SHAFT) ISOLATORS : OS DEF : 51 mm</p>			

PROJECT		Canadian Space Agency	
JOB NO.	7538	DRAWN BY	DW
TAG	AHU-5	DATE	JAN 25/13
		DWG NO.	7538AHU1SD01
		TYPE	OUTDOOR
		ACCESS SIDE	RIGHT
		DWG UNITS	SCALE
			N.T.S.
		SALES OFFICE	HIS OTTAWA
		SALES ENGINEER	Adam Graham

OPENINGS AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS. RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES.

11851 DYKE ROAD, RICHMOND, B.C. CANADA V7A 4X8

SIN 958-466-2301



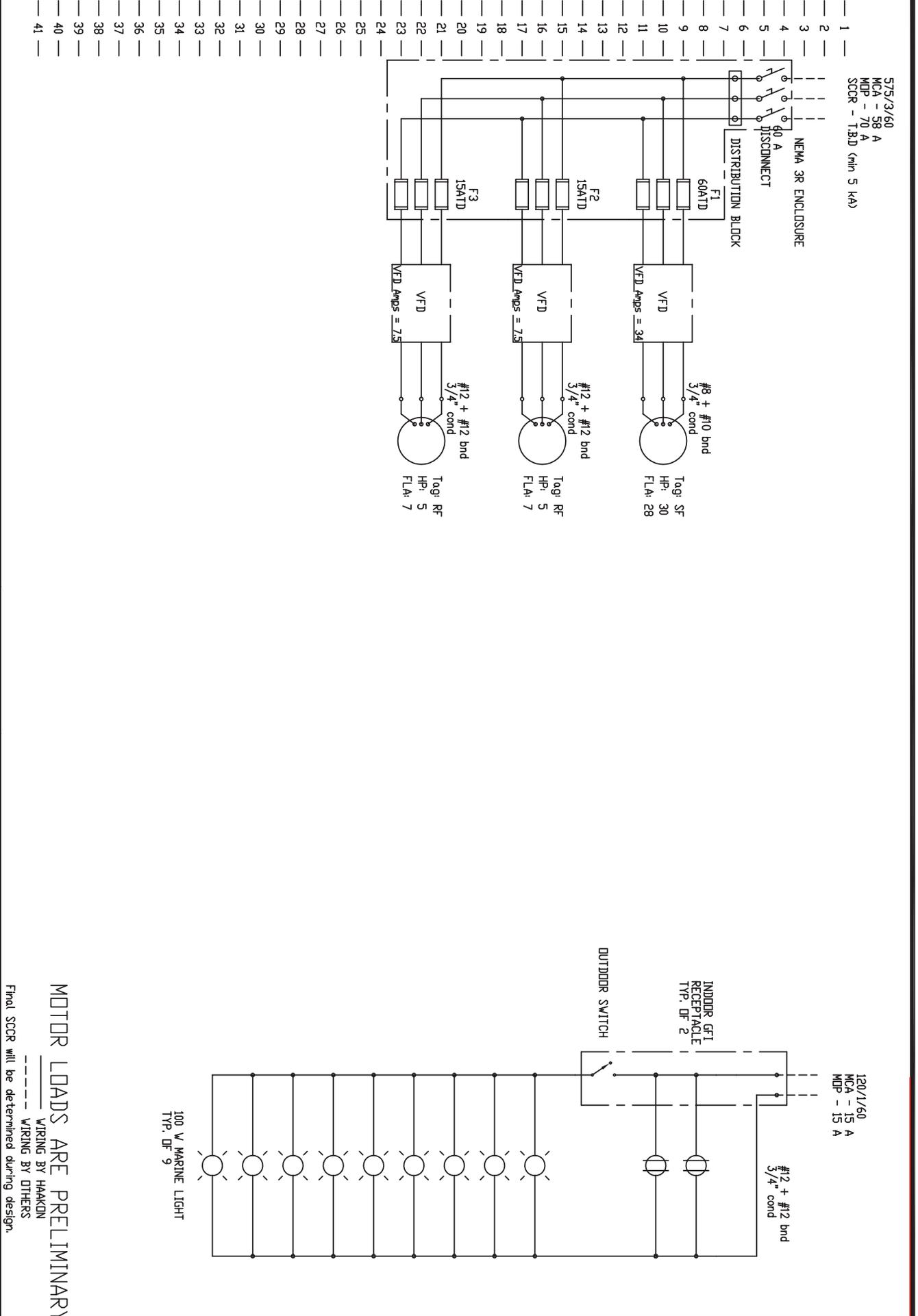
AHU-5 Electrical Drawing

JOB NO.	7538	DRAWN BY	DW	DWG NO.	7538U1CS01	CERTIFICATION:	ETL
TAG	AHU-5	DATE	JAN 24/13	UNIT:	OUTDOOR, NEMA1 INSIDE	CONDUIT:	EMT

PROJECT Canadian Space Agency

REVISIONS		
NO	DATE	BY
1		
2		
3		

HAAKON INDUSTRIES
 11851 DYKE ROAD, RICHMOND, B.C. CANADA V7A 4X8

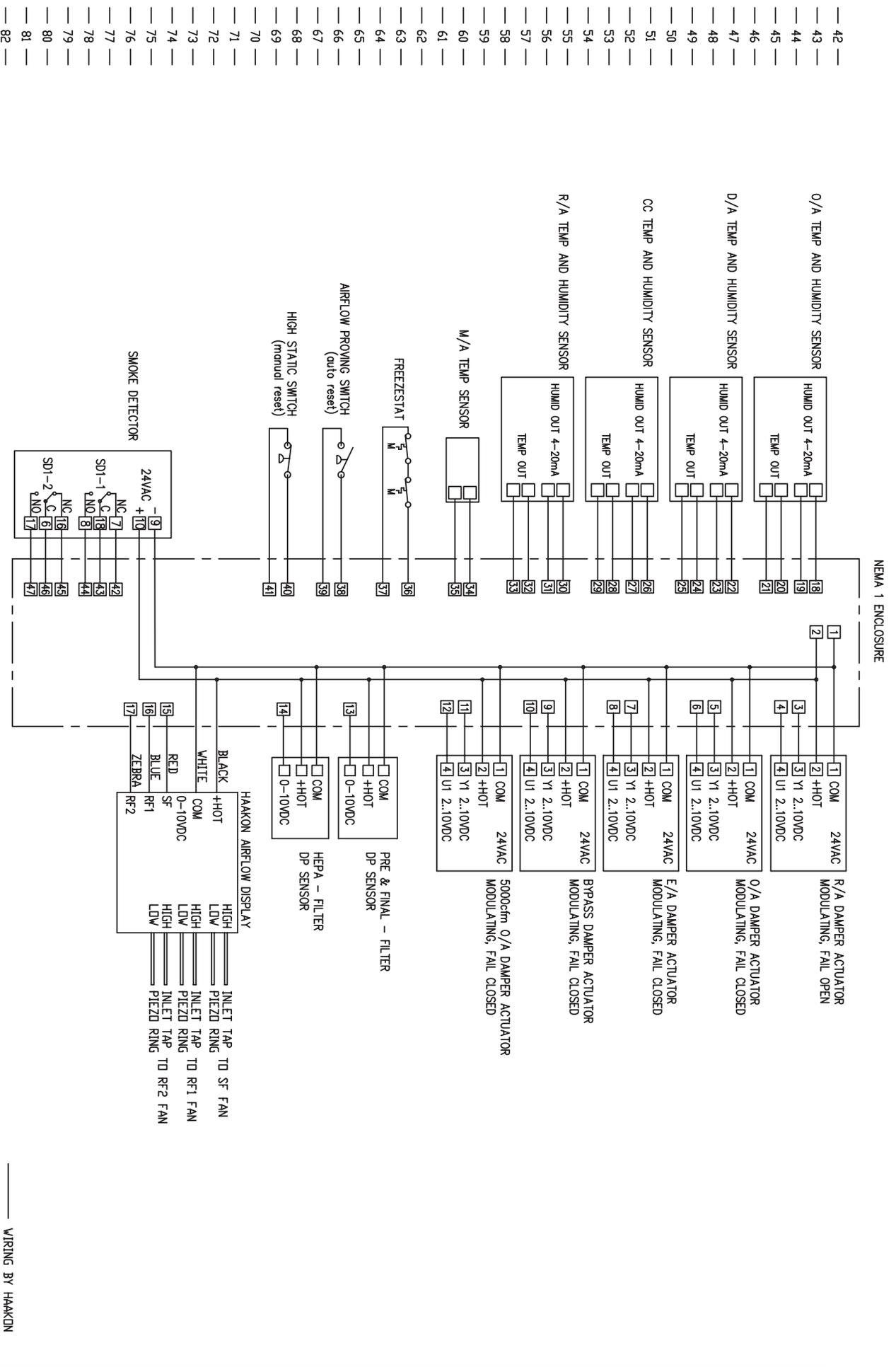


MOTOR LOADS ARE PRELIMINARY
 WIRING BY HAAKON
 WIRING BY OTHERS
 Final SCRR will be determined during design.



AHU-5 Controls Drawings

No controller is to be provided in this contract. A sensor package is provided as shown with wiring back to the main unit control panel. Controls contractor is to provide controller and any other requirements not shown.



----- WIRING BY HAAKON
 - - - - - WIRING BY OTHERS

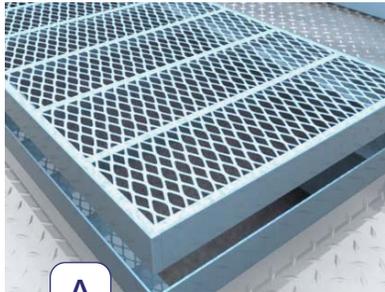
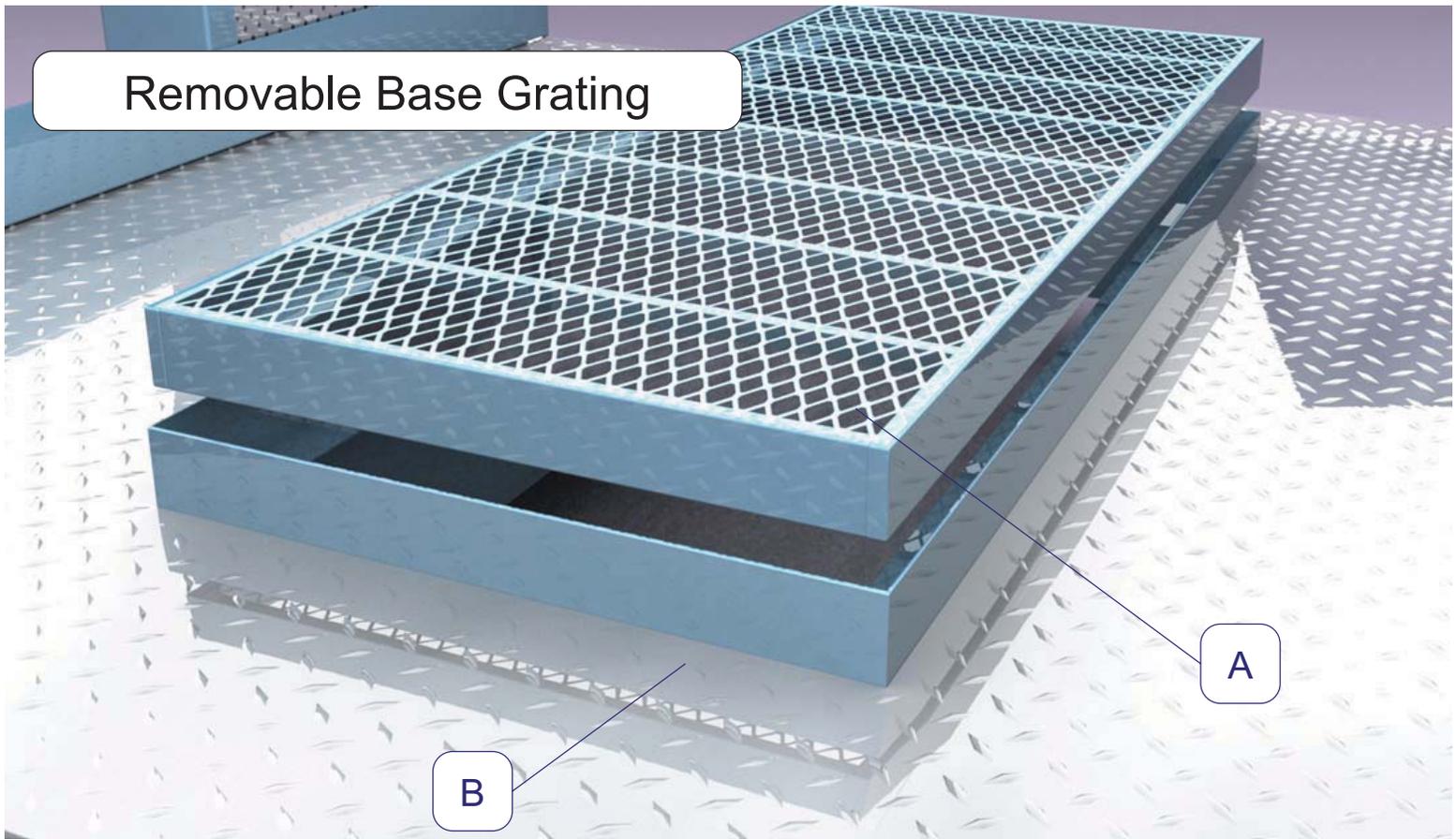
PROJECT		Canadian Space Agency	
JOB NO.	7538	DRAWN BY	DW
TAG	AHU-5	DATE	JAN 25/13
		DWG NO.	7538U1CS02
		UNIT:	OUTDOOR, NEMAT INSIDE
		CERTIFICATION:	CONDUIT:
		ETL	EMT
		NO	3
		DATE	
		BY	





AHU-5 Unit Construction Details

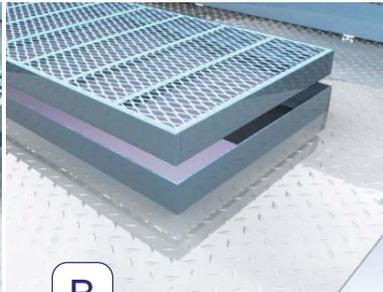
Removable Base Grating



A

Grating

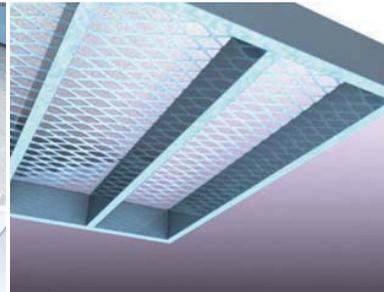
Removable grating made from expanded metal and flatbar is provided.



B

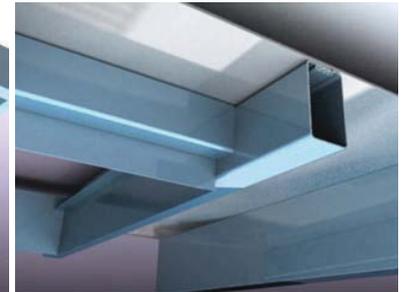
Collar

A 1.5" high collar is installed around the base opening.



Support

Tube steel is installed in the unit base, around base opening for strength.



Connection

Collar extends below the base liner for field connection.

TAG:AHU-1 airflow1, AHU-1 ra, AHU-1 sa

PROJECT:

DRAWN BY
DATE

DW
2012-11-27

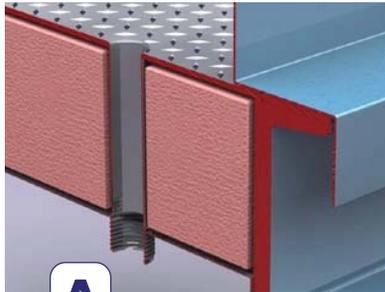
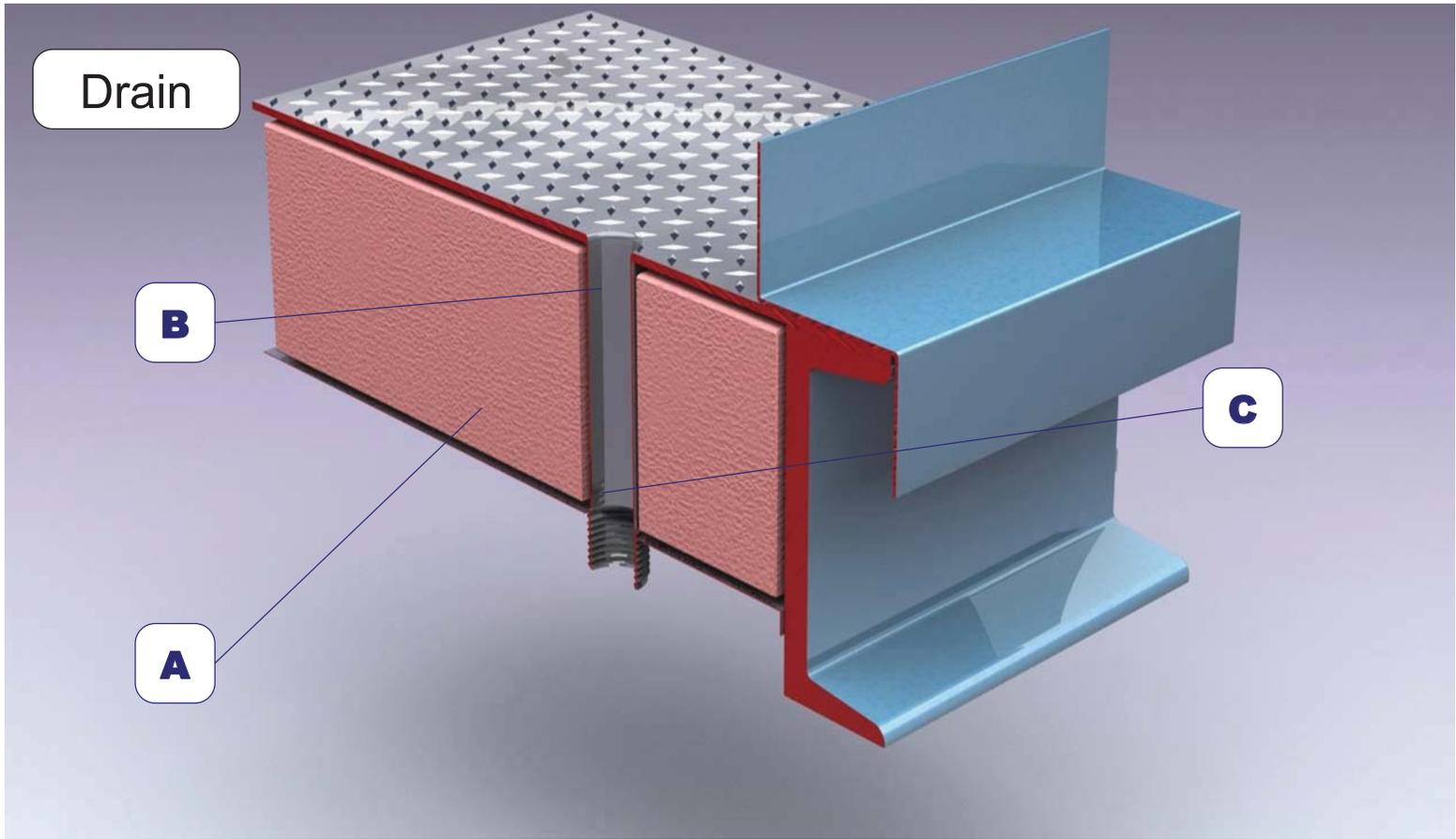
Canadian Space Agency

JOB NO. 45451
UNITS IMPERIAL

DWG NO
REVISION

45451DT33





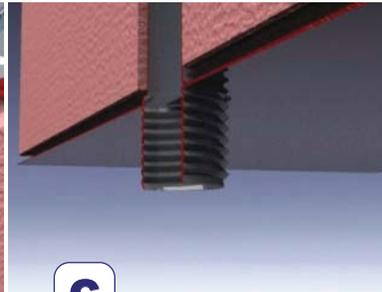
A Drain

32 mm Standard Drain drains are provided at the locations shown on the drawings and are insulated with base insulation.



B Inlet

A 32 mm drain pipe is continuously welded to unit floor.



C Discharge

A 32 mm diameter drain connection terminates out the bottom of the unit.

PROJECT:

DRAWN BY: DW
DATE: 2013-01-25

Canadian Space Agency

JOB NO.: 7538
UNITS: METRIC

TAG:AHU-5

DWG NO: 7538DT04
REVISION:



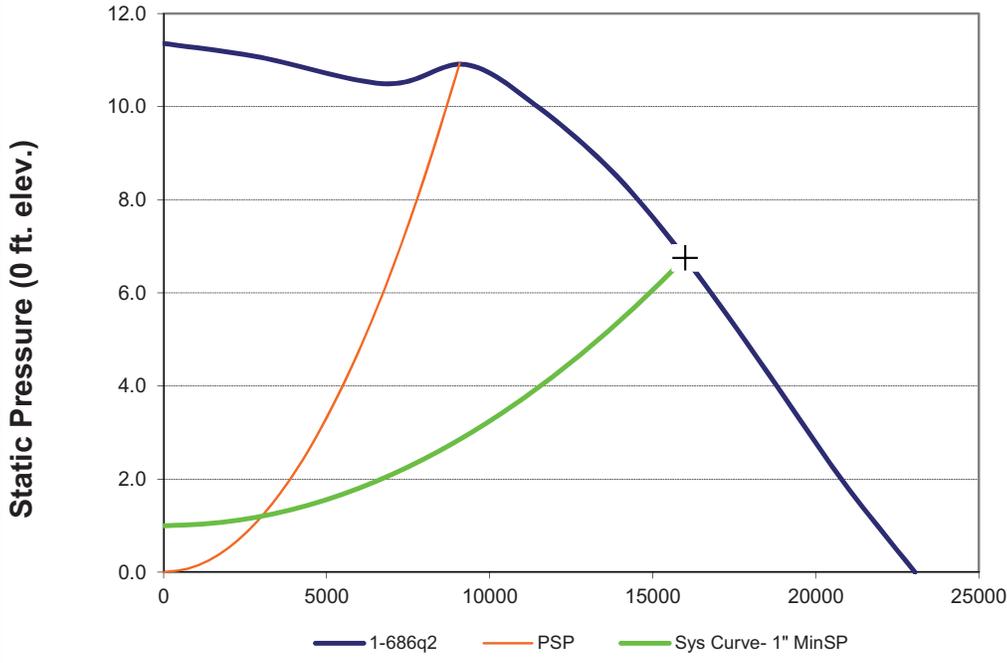


AHU-5 Fan and Motor Details

PROJECT: Canadian Space Agency
 TAG: AHU-5 SF

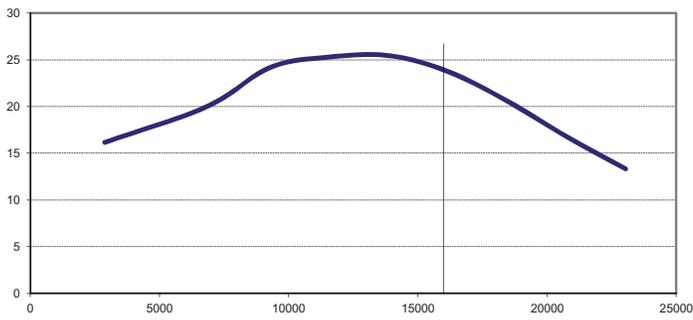
AHU FLOW (CFM) 16,000
 STATIC PRESSURE (IN) 6.75

Assumed MinSP= 1"

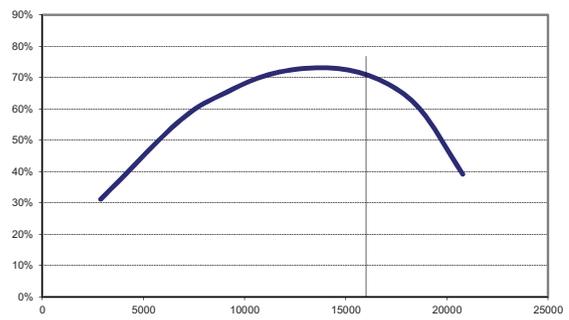


Array	
No. Modules	1
Conn. Load	30 HP
Total BHP	24.0
Mtr kW input	19.2
Fan	
Wheel RPM	2081
Max RPM	2546
Class	CL III
SE	71%
% PSP	62%
MinFlow@PSP	19%
Motor	
BHP/Motor	24.0
Mtr Size	30 HP
Speed(nom)	1770
Frame	286T
Speed(operating)	71 Hz

AHU BHP (0 ft. elev.)



Static Efficiency (0 ft. elev.)



Selection	1-686q2
Density	1.00

0 ft.

Sound Power (dB) - Re: 10-12 watts- at Quantity

Center Freq.	62.5	125	250	500	1000	2000	4000	8000
Outlet Lw	88	86	93	86	81	78	77	72
Inlet Lw	89	84	101	88	83	83	83	77

Motor selection limited to:
 100% of nameplate

2011 Rev 5.3
 1/18/13



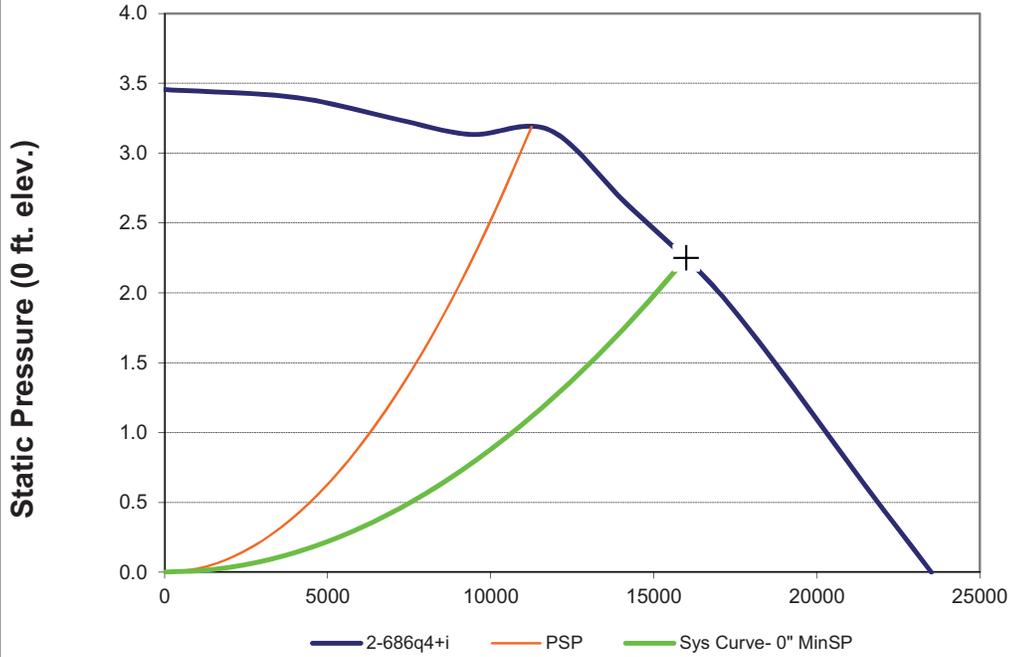
US Patent 7,001,140
 US Patent 7,357,621

686q2

PROJECT: Canadian Space Agency
 TAG: AHU-5 RF

AHU FLOW (CFM) 16,000
 STATIC PRESSURE (IN) 2.25

Assumed MinSP= 0"



Array

No. Modules	2
Conn. Load	10 HP
Total BHP	8.5
Mtr kW input	7.3

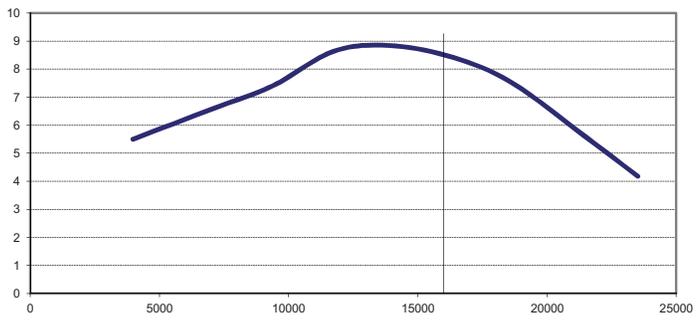
Fan

Wheel RPM	1137
Max RPM	1981
Class	CL II
SE	66%
% PSP	69%
MInFlow@PSP	n/a

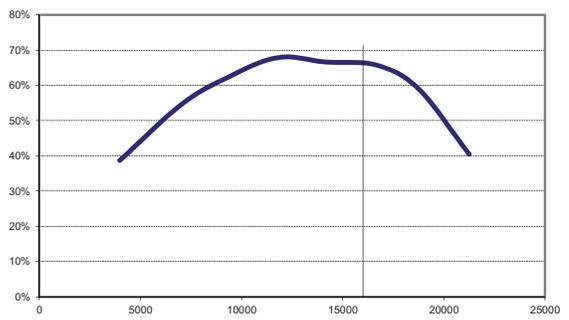
Motor

BHP/Motor	4.3
Mtr Size	5 HP
Speed(nom)	1180
Frame	215T
Speed(operating)	58 Hz

AHU BHP (0 ft. elev.)



Static Efficiency (0 ft. elev.)



Selection	2-686q4+i
Density	1.00

0 ft.

Sound Power (dB) - Re: 10-12 watts- at Quantity

Center Freq.	62.5	125	250	500	1000	2000	4000	8000
Outlet Lw	76	75	80	73	69	66	61	63
Inlet Lw	74	74	76	66	66	65	64	64

Motor selection limited to:
 100% of nameplate

2011 Rev 5.3
 1/21/13



US Patent 7,001,140
 US Patent 7,357,621

686q4+i

Part Detail									
Revision:	-	Status:	PRD/A	Change #:		Proprietary:	No		
Type:	AC	Prod. Type:	1060M	Elec. Spec:	10WGY670	CD Diagram:			
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	10C152	Layout:			
Frame:	286TC	Mounting:	F1	Poles:	04	Created Date:	07-29-2010		
Base:	RG	Rotation:	R	Insulation:	F	Eff. Date:	07-30-2010		
Leads:	3#10	Literature:		Elec. Diagram:		Replaced By:			
Nameplate NP2138L									
CAT.NO.	CEM4104T-5	P/N		ENCLOSURE		TEFC			
SPEC.	10C152Y670G1	CC	010A	FRAME		286TC	S/N		
HP	30	CLASS	F	HZ		60			
RPM	1765	PH	3	DES		B			
VOLT	575	KVA-CODE	G	ODE BRG		6309	DE BRG	6311	
AMP	28	USABLE AT 208V							
RATING	40C AMB-CONT	GREASE		POLYREX EM					
NEMA-NOM-EFF	93.6	PF	87	SER.F.		1.15			
HTR-VOLTS		HTR-AMPS		MAX. SPACE HEATER TEMP.					

Part Detail									
Revision:	-	Status:	PRD/A	Change #:		Proprietary:	No		
Type:	AC	Prod. Type:	3748M	Elec. Spec:	37WGS899	CD Diagram:			
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	37G813	Layout:			
Frame:	215T	Mounting:	F1	Poles:	06	Created Date:	08-04-2010		
Base:	RG	Rotation:	R	Insulation:	F	Eff. Date:	08-11-2010		
Leads:	3#14	Literature:		Elec. Diagram:		Replaced By:			
Nameplate NP1259L									
CAT.NO.	EM3708T-5								
SPEC.	37G813S899G1								
HP	5								
VOLTS	575								
AMP	5.8								
RPM	1160								
FRAME	215T	HZ	60	PH	3				
SER.F.	1.15	CODE	K	DES	A	CL	F		
NEMA-NOM-EFF	89.5	PF	72						
RATING	40C AMB-CONT								
CC	010A	USABLE AT 208V							
DE	6307	ODE	6206						
ENCL	TEFC	SN							

Contents

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SPX9000 Drives

Product Description

The Cutler-Hammer® SPX9000 Series Adjustable Frequency Drives from Eaton's electrical business are specifically designed for high performance applications. Equipped with high processing power, the SPX9000 can use information from an encoder or a resolver in order to provide very precise motor control. Sensorless vector and simple frequency control are also supported. Typical applications requiring high performance are: master-slave drives, positioning applications, winder tension control and synchronization.

The core of the SPX9000 is a fast micro-processor, providing high dynamic performance for applications where good motor handling and reliability are required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The SPX9000 supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Simultaneous fast monitoring of several drives can be done by using the 9000Xdrive tool and CAN communication. In applications where reliability and quality are essential for high-performance, the Cutler-Hammer SPX9000 is the logical choice.

The 9000X Family of Drives includes HVX9000, SVX9000, and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

Features and Benefits

- Speed error < 0.01%, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5V (RS-422), 15V or 24V, depending on the option card
- Full torque control at all speeds, including zero
- Torque accuracy < 2%; < 5% down to zero speed
- Starting torque > 200%, depending on motor and drive sizing
- Integrated datalogger for system analysis
- Fast multiple drive monitoring with PC
- Full capability for master/slave configurations
- High-speed bus (12 Mbit/s) for fast inter-drive communication
- High-speed applications (up to 7200 Hz) possible
- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters L standard up to 200 hp I_L 575V
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12 keypad on all drives
- Hand-Held Auxiliary 240 Power Supply allows programming/monitoring of control module without applying full power to the drive
- The SPX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" Precision application programs consisting of:
 - Basic
 - Standard
 - Local/Remote
 - Multi Step Speed Control
 - PID Control
 - Multi-Purpose Control
 - Pump and Fan Control with Auto Change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- UL Listed
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard from:
 - 1 – 30 hp/380 – 500V
 - 3/4 – 15 hp/208 – 230V
- NEMA Type 1 enclosures available Frame Sizes FR4 – FR11, NEMA Type 12 enclosures available Frame Sizes FR4 – FR10
- Open Chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Technical Data and Specifications

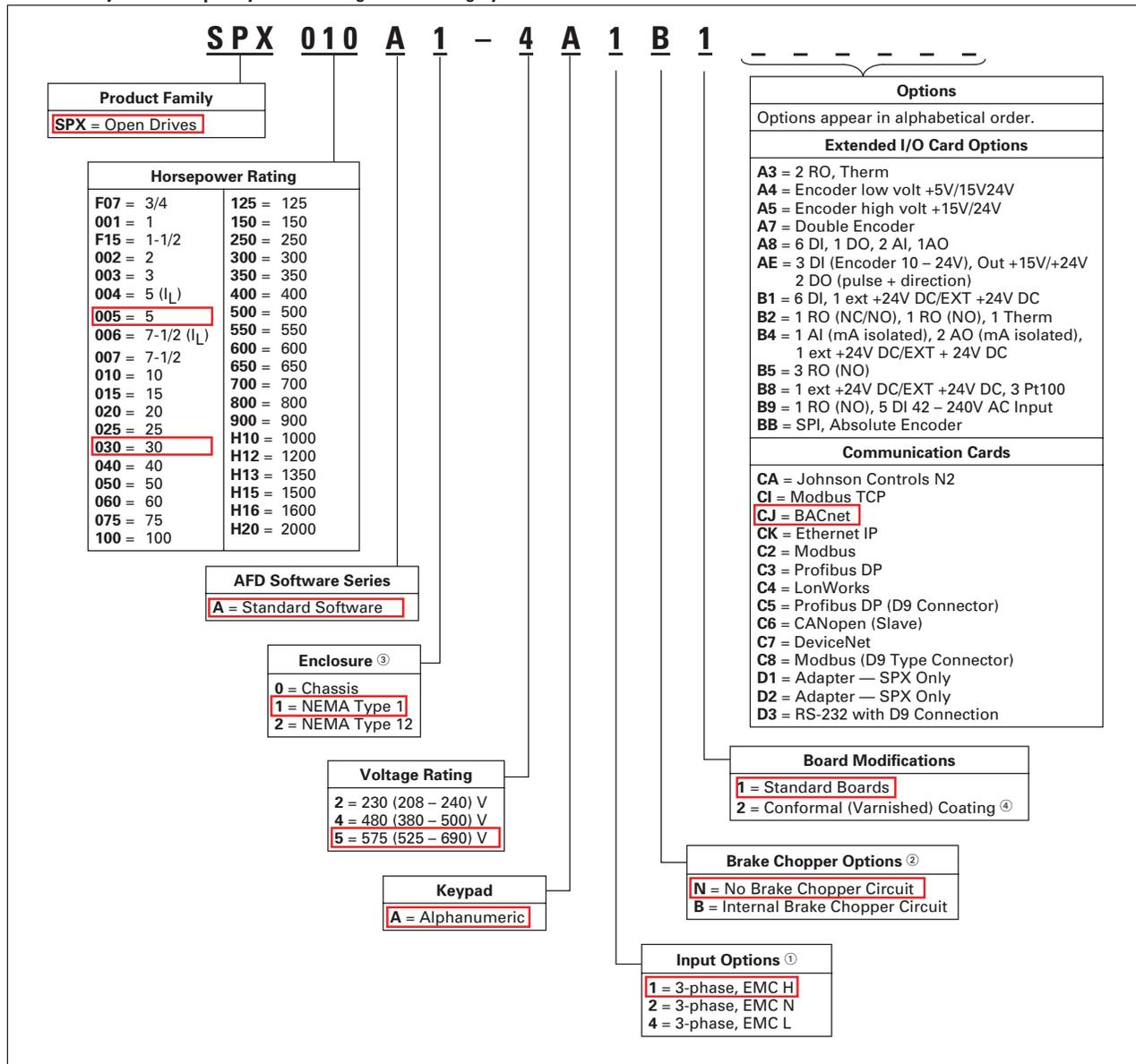
Table 5-1. SPX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC
Output Ratings	
Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload Current (I_H/I_L)	150% I_H , 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control Closed Loop Frequency Control Closed Loop Vector Control
Switching Frequency Frame 4 – 6 Frame 7 – 12	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analogue Input: Resolution .1% (10-bit), accuracy \pm 1% V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H (FR4 – FR9) 14°F (-10°C), no frost to 104°F (+40°C) I_L (FR10 and up) 14°F (-10°C), no frost to 104°F (+40°C) I_L (All Frames)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54, Open Chassis/IP20

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Control Connections	
Analogue Input Voltage	0 to 10V, R = 200 k Ω (-10 to 10V joystick control) Resolution .1%; accuracy \pm 1%
Analogue Input Current	0(4) to 20 mA; R_i - 250 Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V \pm 15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analogue Output	0(4) to 20 mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy \pm 2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / .4A
Protections	
Overcurrent Protection	Trip limit 4.0 x I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)
High Performance Features	
Speed Error	<0.01%, depending on the encoder
Encoder Support	Incremental or absolute
Encoder Voltages	5V (RS-422), 15V or 24V, depending on the option card
Torque Control	Full torque control at all speeds, including zero
Torque Accuracy	<2%; <5% down to zero speed
Starting Torque	>200%, depending on motor and drive sizing
Master/Slave Configurations	Full capability
System Analysis	Integrated data logger
PC Communication	Fast multiple drive monitoring with PC
Inter-Drive Communication	High-speed bus (12 Mbits/s)
High-Speed Applications	Up to 7200 Hz

Catalogue Number Selection

Table 5-2. Adjustable Frequency Drive Catalogue Numbering System



① All 230V Drives and 480V Drives up to 200 hp (I_L) are only available with Input Option 1 (EMC level H). 480V Drives 250 hp (I_L) or larger are available with Input Option 2 (EMC level N). 575V Drives 200 hp (I_L) or larger are available with Input Option 2. 575V Drives up to 150 hp (I_L) are available with Input Option 4 (EMC level L).

② 480V Drives up to 30 hp (I_L) are only available with Brake Chopper Option B. 480V Drives 40 hp (I_L) or larger come standard with Brake Chopper Option N. 230V Drives up to 15 hp (I_L) are only available with Brake Chopper Option B. 230V Drives 20 hp and larger come standard with Brake Chopper Option N. All 575V Drives come standard without Brake Chopper Option (N). Note: N = No Brake Chopper.

③ 480V Drives 250 – 350 hp (I_L) and 690V Drives 200 – 300 hp (I_L) are available with enclosure style 0 (Chassis).

④ Factory promise delivery. Consult Sales Office for availability.

575V SPX9000 Drives

Table 5-8. 525 – 690V, NEMA Type 1 Drive

Frame Size	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalogue Number
FR6	2	3.33	3	4.5	SPX002A1-5A4N1
	3	4.5	—	5.5	SPX003A1-5A4N1
	—	5.5	5	7.5	SPX004A1-5A4N1
	5	7.5	7-1/2	10	SPX005A1-5A4N1
	7-1/2	10	10	13.5	SPX007A1-5A4N1
	10	13.5	15	18	SPX010A1-5A4N1
	15	18	20	22	SPX015A1-5A4N1
	20	22	25	27	SPX020A1-5A4N1
	25	27	30	34	SPX025A1-5A4N1
FR7	30	34	40	41	SPX030A1-5A4N1
	40	41	50	52	SPX040A1-5A4N1
FR8	50	52	60	62	SPX050A1-5A4N1
	60	62	75	80	SPX060A1-5A4N1
	75	80	100	100	SPX075A1-5A4N1
FR9	100	100	125	125	SPX100A1-5A4N1
	125	125	150	144	SPX125A1-5A4N1
	150	144	—	170	SPX150A1-5A4N1
	—	170	200	208	SPX175A1-5A4N1

Table 5-9. 525 – 690V, NEMA Type 12 Drive

Frame Size	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalogue Number
FR6	2	3.33	3	4.5	SPX002A2-5A4N1
	3	4.5	—	5.5	SPX003A2-5A4N1
	—	5.5	5	7.5	SPX004A2-5A4N1
	5	7.5	7-1/2	10	SPX005A2-5A4N1
	7-1/2	10	10	13.5	SPX007A2-5A4N1
	10	13.5	15	18	SPX010A2-5A4N1
	15	18	20	22	SPX015A2-5A4N1
	20	22	25	27	SPX020A2-5A4N1
	25	27	30	34	SPX025A2-5A4N1
FR7	30	34	40	41	SPX030A2-5A4N1
	40	41	50	52	SPX040A2-5A4N1
FR8	50	52	60	62	SPX050A2-5A4N1
	60	62	75	80	SPX060A2-5A4N1
	75	80	100	100	SPX075A2-5A4N1
FR9	100	100	125	125	SPX100A2-5A4N1
	125	125	150	144	SPX125A2-5A4N1
	150	144	—	170	SPX150A2-5A4N1
	—	170	200	208	SPX175A2-5A4N1

Table 5-10. 525 – 690V, Open Chassis Drive

Frame Size	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalogue Number
FR10	200	208	250	261	SPX200A0-5A2N1
	250	261	300	325	SPX250A0-5A2N1
	300	325	400	385	SPX300A0-5A2N1
FR11	400	385	450	460	SPX400A0-5A2N1
	450	460	500	502	SPX450A0-5A2N1
	500	502	—	590	SPX500A0-5A2N1
FR12	—	590	600	650	SPX550A0-5A2N1
	600	650	700	750	SPX600A0-5A2N1
	700	750	800	820	SPX700A0-5A2N1
FR13	800	820	900	920	SPX800A0-5A2N1
	900	920	1000	1030	SPX900A0-5A2N1
	1000	1030	1250	1180	SPXH10A0-5A2N1
FR14	1350	1300	1500	1500	SPXH13A0-5A2N1
	1500	1500	2000	1900	SPXH15A0-5A2N1
	2000	1900	2300	2250	SPXH20A0-5A2N1

① FR10 – FR14 includes a 3% line reactor but it is not integral to chassis.

May 2007

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 5-1**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

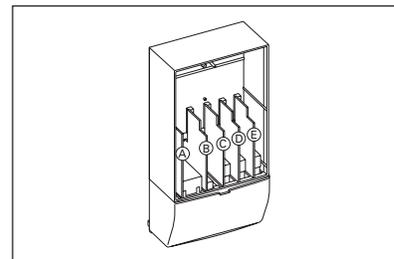


Figure 5-1. 9000X Series Option Boards

Table 5-11. Option Board Kits

Option Kit Description ^②	Allowed Slot Locations ^①	Field Installed Catalogue Number	Factory Installed Option Designator	SVX Ready Programs							
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC	
Standard I/O Cards (See Figure 5-1)											
2 RO (NC/NO)	B	OPTA2	—	X	X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/EXT +24V DC	A	OPTA9	—	X	X	X	X	X	X	X	X
Extended I/O Card Options											
2 RO, Therm	B	OPTA3	A3	—	X	X	X	X	X	X	X
Encoder low volt +5V/15V/24V	C	OPTA4	A4	—	X	X	X	X	X	X	X
Encoder high volt +15V/24V	C	OPTA5	A5	—	X	X	X	X	X	X	X
Double encoder — SPX Only	C	OPTA7	A7	X	X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	OPTA8	A8	—	X	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	OPTAE	AE	X	X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1	B1	—	—	—	—	—	X	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2	B2	—	—	—	—	—	X	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4	B4	—	X	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5	B5	—	—	—	—	—	X	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8	B8	—	—	—	—	X	X	X	X
1 RO (NO), 5 DI 42 – 240V AC Input	B, C, D, E	OPTB9	B9	—	—	—	—	—	X	X	X
SPI, Absolute Encoder	C	OPTBB	BB	—	—	—	—	—	—	—	—
Communication Cards ^③											
Modbus	D, E	OPTC2	C2	X	X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2	CA	—	—	—	—	—	—	—	—
Modbus TCP	D, E	OPTC1	C1	X	X	X	X	X	X	X	X
BACnet	D, E	OPTCJ	CJ	X	X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK	CK	X	X	X	X	X	X	X	X
Profibus DP	D, E	OPTC3	C3	X	X	X	X	X	X	X	X
LonWorks	D, E	OPTC4	C4	X	X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5	C5	X	X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6	C6	X	X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7	C7	X	X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8	C8	X	X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD1	D1	X	X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD2	D2	X	X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3	D3	X	X	X	X	X	X	X	X
Keypad											
9000X Series Local/ Remote Keypad (Replacement Keypad)	—	KEYPAD-LOC/REM	—	—	—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	OPTRMIT-KIT-9000X	—	—	—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	PP00104	—	—	—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.
 ② AI = Analogue Input; AO = Analogue Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
 ③ OPTC2 is a multi-protocol option card.

5

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analogue Value Objects (AVOs) to communicate drive parameters. The card supports 9.6,

19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates

range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

5

Options

Control Panel Options

Table 5-12. Control Panel Factory Options

Description	Factory Installed	Field Installed
	Option Code	NEMA Type 1 Catalogue Number
Local/Remote Keypad SVX9000 Control Panel — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SPX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	A	KEYPAD-LOC/REM
Keypad Remote Mounting Kit — This option is used to remote mount the SPX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft. cable, keypad holder and mounting hardware.	—	OPTRMT-KIT-9000X
Keypad Blank — 9000X Series select keypad for use with special and custom applications.	—	KEYPAD-BLANK

Dimensions

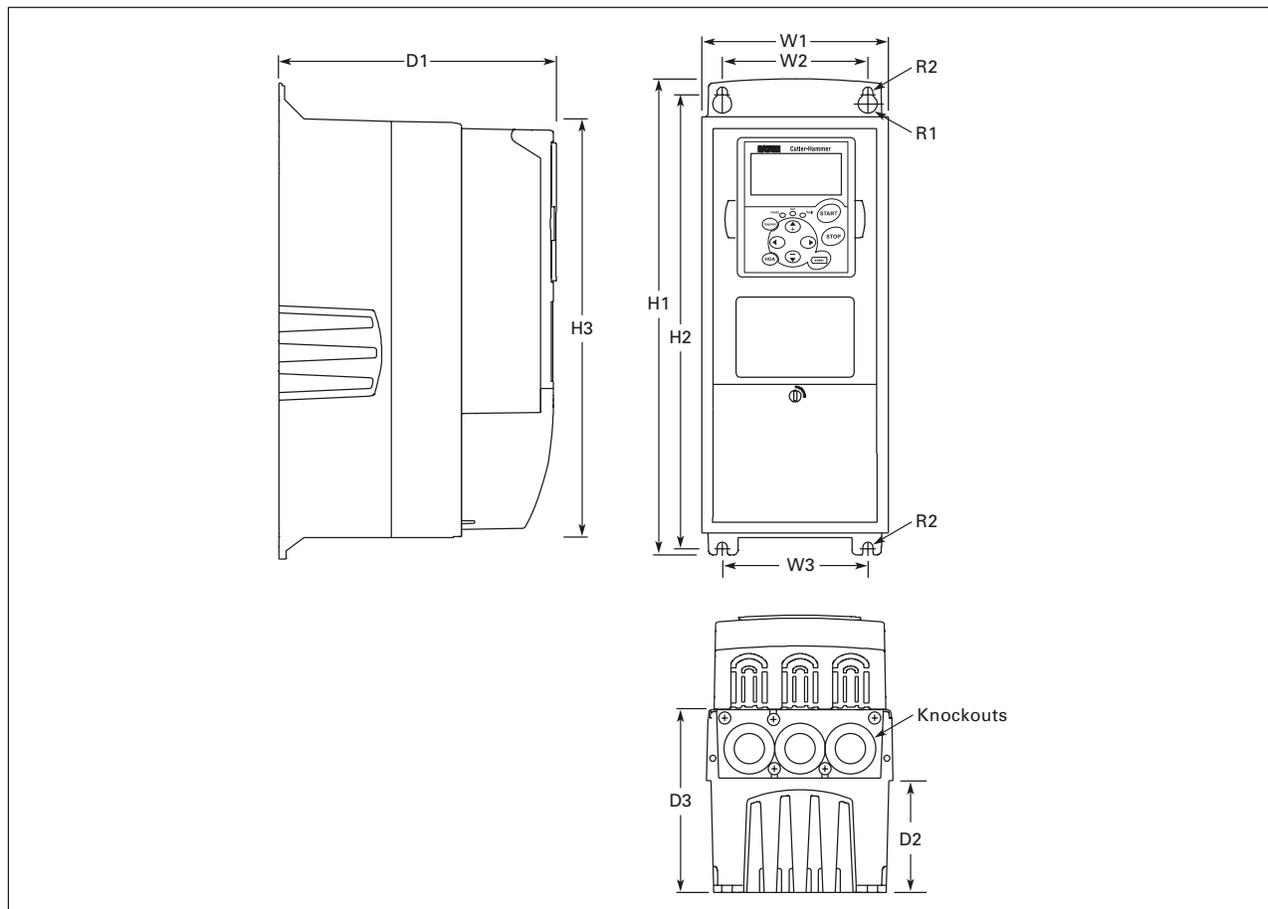


Figure 5-2. NEMA Type 1 and ~~NEMA Type 12~~ SPX9000 Drive Dimensions, ~~FR4, FR5~~ and FR6

Table 5-22. SPX9000 Drive Dimensions

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm) N1 (O.D.)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		
FR4	230V	3/4 - 3	12.9	12.3	11.5	7.5	3.0	5.0	5.0	3.9	—	.5	.3	11.0	3 @ 1.1
	480V	1 - 5	(327)	(313)	(292)	(190)	(77)	(126)	(128)	(100)	(5)	(13)	(7)	(28)	
FR5	230V	5 - 7-1/2	16.5	16.0	15.3	8.4	3.9	5.8	5.7	3.9	—	.5	.3	17.9	2 @ 1.5
	480V	7-1/2 - 15	(419)	(406)	(389)	(214)	(100)	(148)	(144)	(100)	(8)	(13)	(7)	(37)	1 @ 1.1
FR6	230V	10 - 15	22.0	21.3	20.4	9.3	4.2	6.5	7.6	5.8	—	.6	.4	40.8	3 @ 1.5
	480V	20 - 30	(558)	(541)	(519)	(237)	(105)	(165)	(195)	(148)	(15.5)	(9)	(19)	(37)	
	575V	2 - 25													

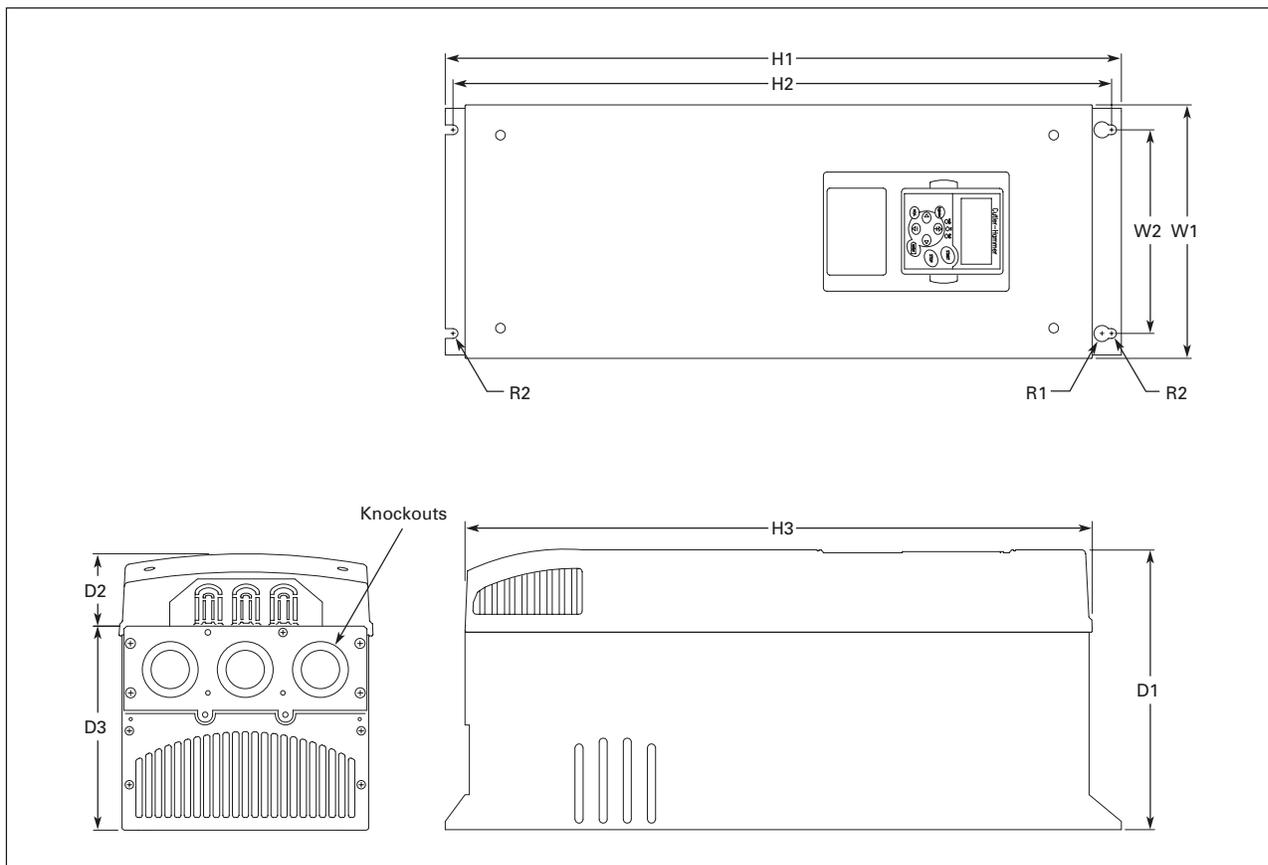


Figure 5-4. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR7

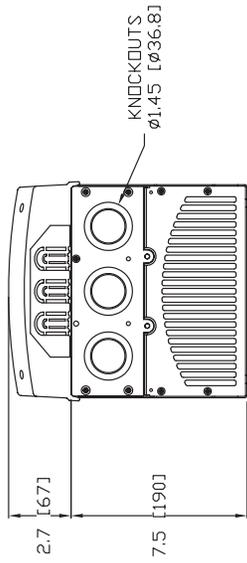
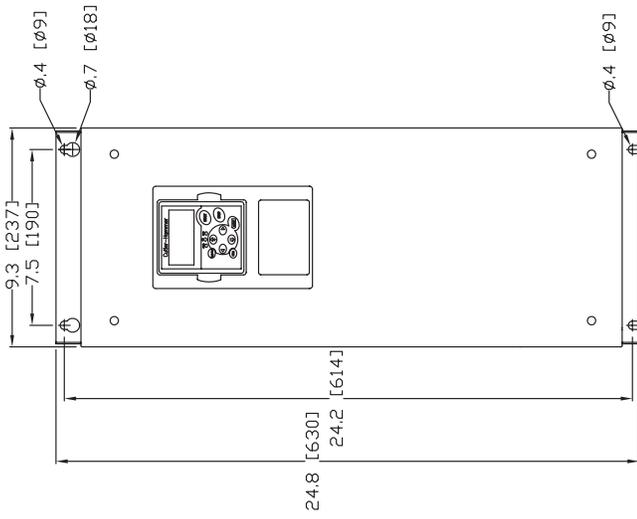
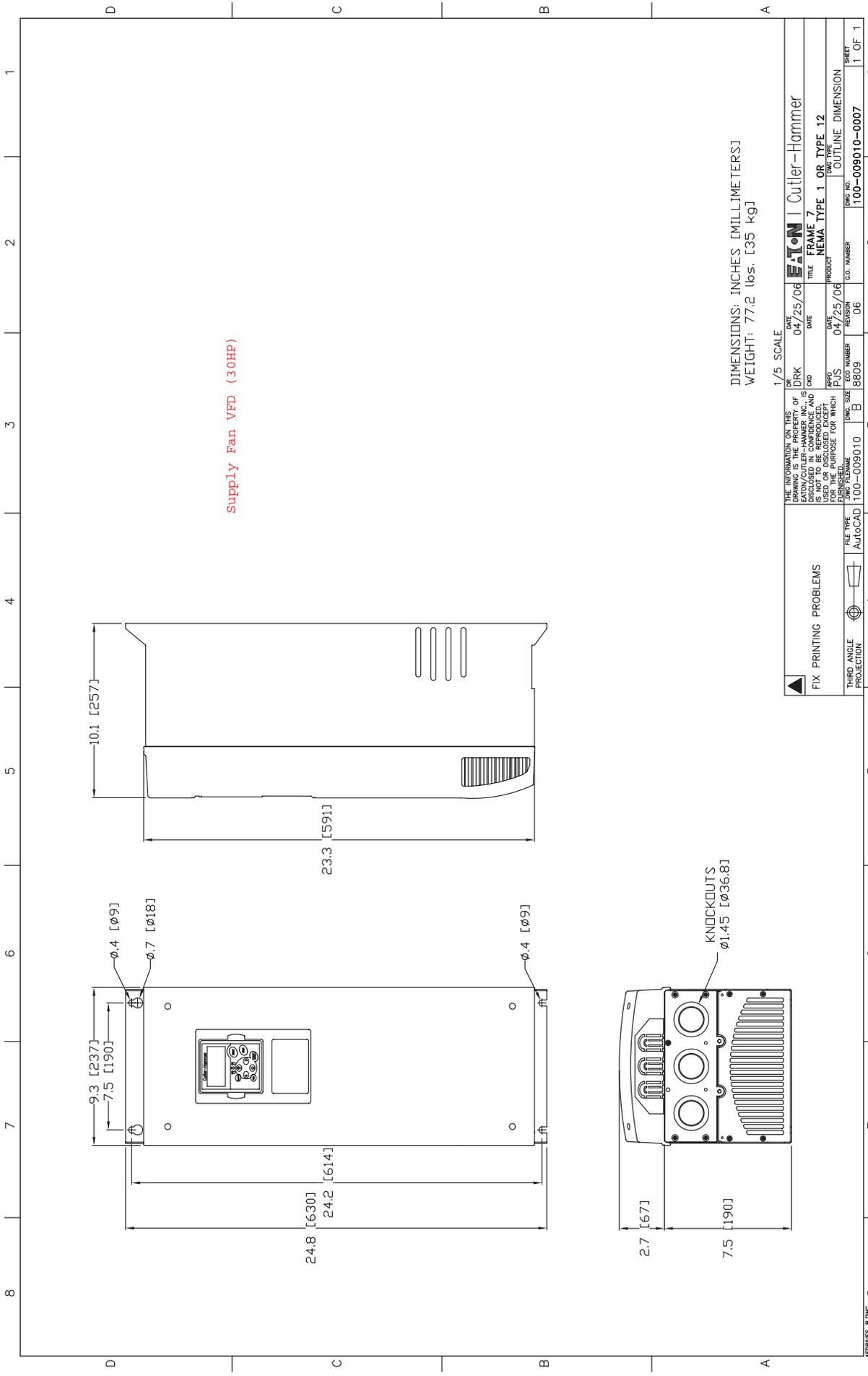
Table 5-25. SPX9000 Drive Dimensions, FR7

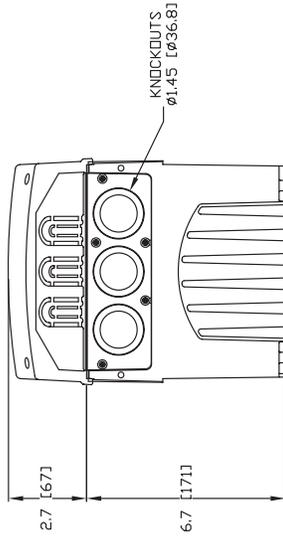
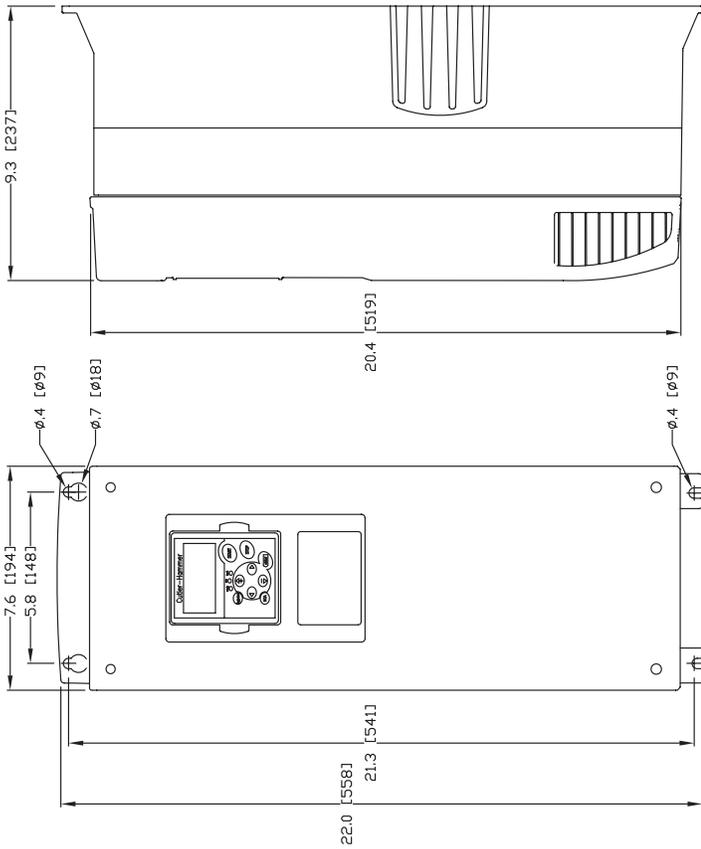
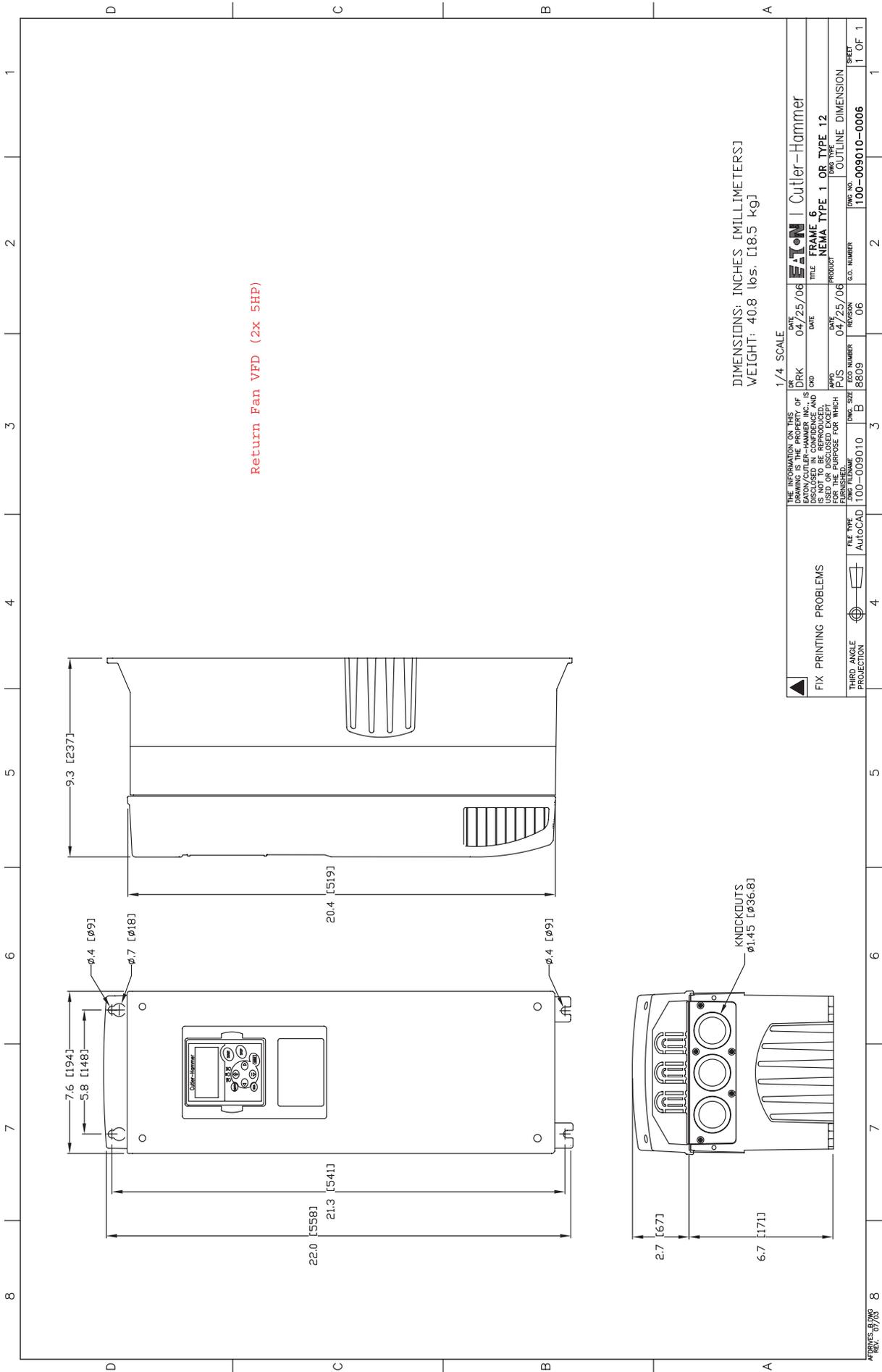
Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)										Weight Lbs. (kg)	Knockouts @ Inches (mm) N1 (O.D.)
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		
FR7	230V	20 – 30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	.7 (18)	.4 (9)	77.2 (35)	3 @ 1.5 (37)
	480V	40 – 60												
	575V	30 – 40												

Table 5-44. 9000X Series Replacement Parts — FR6 – FR9 SPX9000 Drives, 525 – 690V

Frame:	6										7		8			9				Catalogue Number
hp (I _H):	2	3	5 ^①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ^①		
Control Board																				
	1	1	1	1	1	1	1	1	1	1	1					1	1	1	VB00561	
Driver Board																				
	1																		VB00404-0004-6	
		1																	VB00404-0005-6	
			1																VB00404-0007-6	
				1															VB00404-0010-6	
					1														VB00404-0013-6	
						1													VB00404-0018-6	
							1												VB00404-0022-6	
								1											VB00404-0027-6	
									1										VB00404-0034-6	
Power Boards																				
	1	1	1	1	1	1	1	1	1										VB000414	
										1									VB000419-0041-6	
											1								VB000419-0052-6	
												1							VB000422-0062-6	
													1						VB000422-0080-6	
														1					VB000422-0100-6	
Power Modules																				
															1				FR09-100-5-ANS ^②	
																1			FR09-125-5-ANS ^②	
																	1		FR09-150-5-ANS ^②	
																		1	FR09-175-5-ANS ^②	
Electrolytic Capacitors																				
	2	2	2	2	2	2	2	2	2										PP01093	
										2	2	4	4		8	8	8	8	PP01041	
													4						PP01040	
Fuses																				
												1	1	1	1	1	1	1	PP01094	
												2	2	2	2	2	2	2	PP01095	
Cooling Fans																				
	1	1	1	1	1														PP01061	
						1	1	1	1										PP01062	
										1	1								PP01063	
												1	1	1					PP01123	
	1	1	1	1	1	1	1	1	1	1	1								PP01049	
												1	1	1					CP01180	
															1	1	1	1 ^③	PP01068	
															1	1	1	1	PP01080	
Fan Power Supply																				
															1	1	1		VB00299	
IGBT Modules																				
	3	3	3	3	3	3	3	3	3										PP01091	
										1	1								PP01089	
												1	1	1					PP01127	
IGBT/Diode (Brake)																				
	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	PP01040	
Diode Module																				
	1	1	1	1	1	1	1	1	1										PP01092	
Diode/Thyristor Modules																				
										3	3								PP01071	
															3	3	3	3	PP01072	
Rectifying Boards																				
										1	1								VB00442	
															1	1	1	1	VB00460	
Rectifying Module Sub-assemblies																				
															1	1	1		FR09810	
															1	1	1		FR09811	

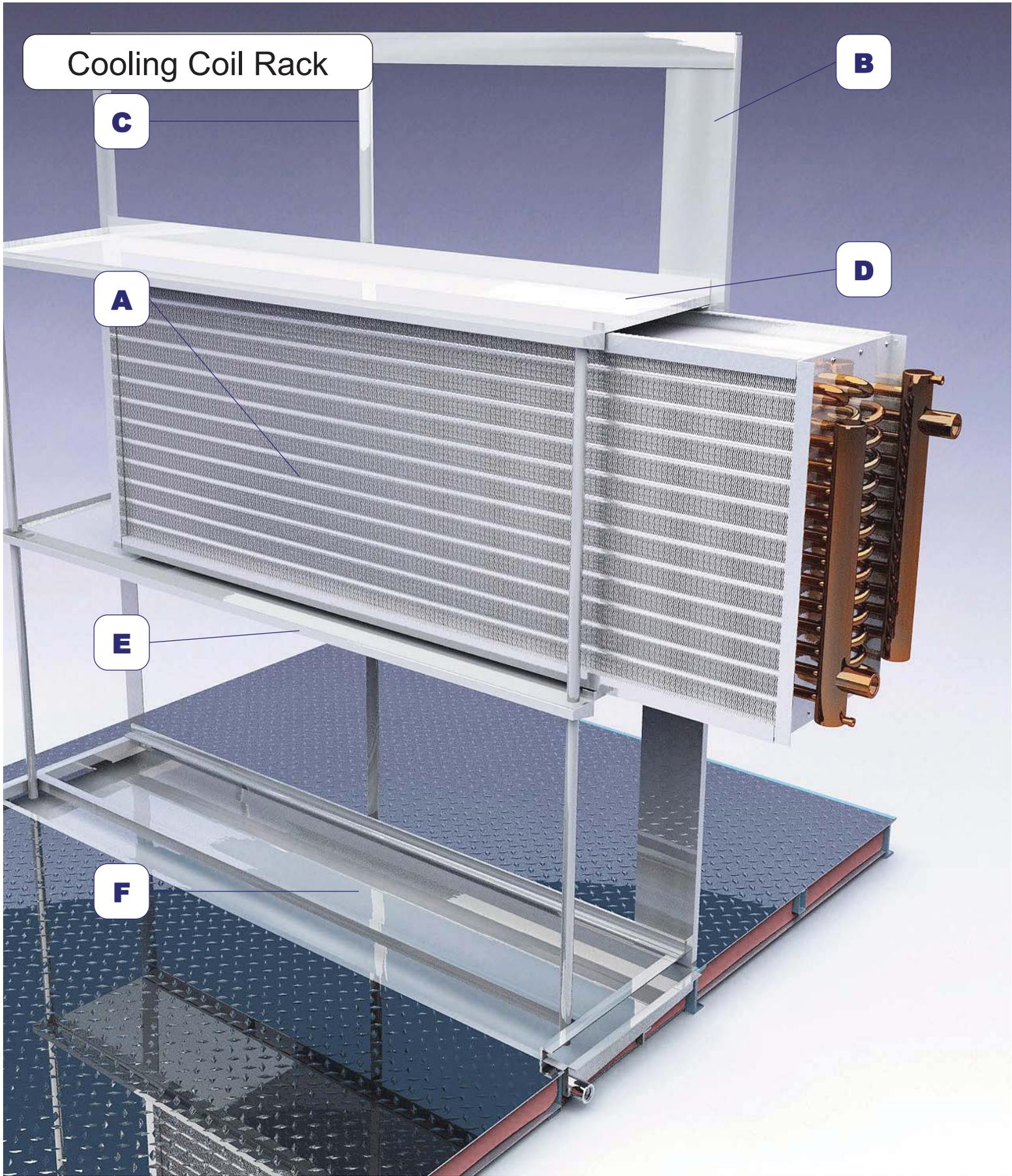
① I_L only; has no corresponding I_H rated hp rating.
 ② See Table 5-46 for details.
 ③ For NEMA Type 12, two PP01068 internal fans are needed.







AHU-5 Coil Details



Cooling Coil Rack

C

B

A

D

E

F

TAG:AHU-5 COOLING

PROJECT:

Canadian Space Agency

DRAWN BY
DATE

DW
2013-01-25

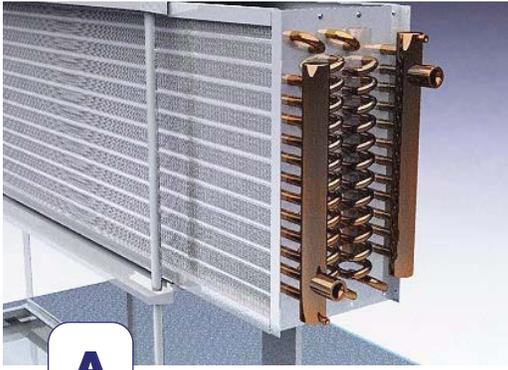
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UNITS

7538
METRIC

DWG NO
REVISION

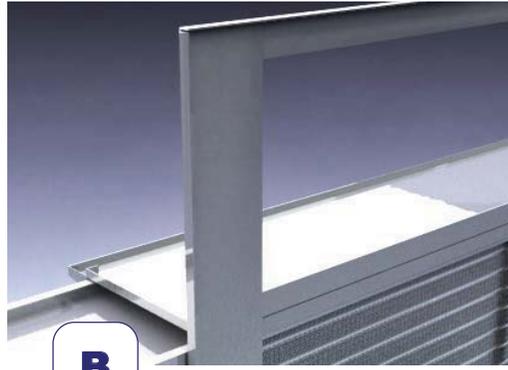
7538DT03





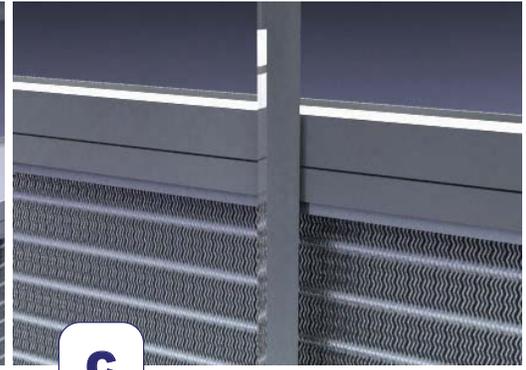
A Coils

Cooling coil racks are designed to allow each coil to be individually removed. Coils are fully enclosed within the unit casing.



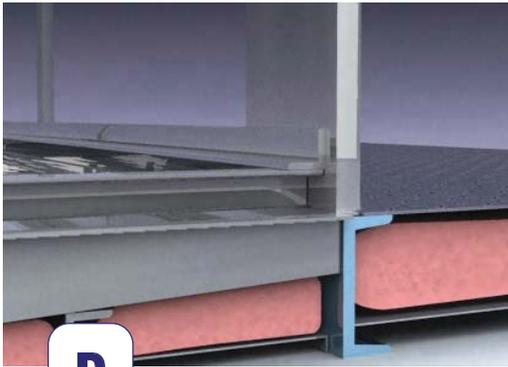
B Blank-off

Coil rack blank-off and frame support is fabricated out of 1.6 mm type 304 stainless steel.



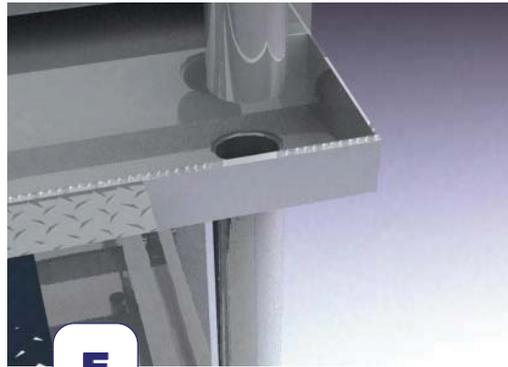
C V-Brace

A 'V-Brace' fabricated out of 1.6 mm type 304 stainless steel is tack welded to the coil rack frame for extra rigidity.



D Coil Rack Frame

Coil rack frame is constructed of 2.8 mm type 304 stainless steel.



E Extra Drain Pans

Intermediate drain pans are provided for multi-coil racks. Intermediate drain pans are fabricated from the same material as the main drain pan.

Intermediate drain pans are interconnected with 25 mm type 304 stainless steel drain lines.



F Drain Pan

Drain pans are fabricated out of 1.6 mm type 304 stainless steel, and continuously welded to ensure that they are watertight. A FPT type 304 stainless steel drain fitting is also provided on the drain pan end. Drain pan height and extension downstream of the cooling coil's air exiting face are tabulated below. Drain pan is sloped both in the direction of airflow and towards the drain connection.

Tag	Pan Hei	Pan Ext	Drain Size
AHU-5 COOLING	185	457	32

PROJECT:

DRAWN BY
DATE

DW
2013-01-25

Canadian Space Agency

JOB NO.
UNITS

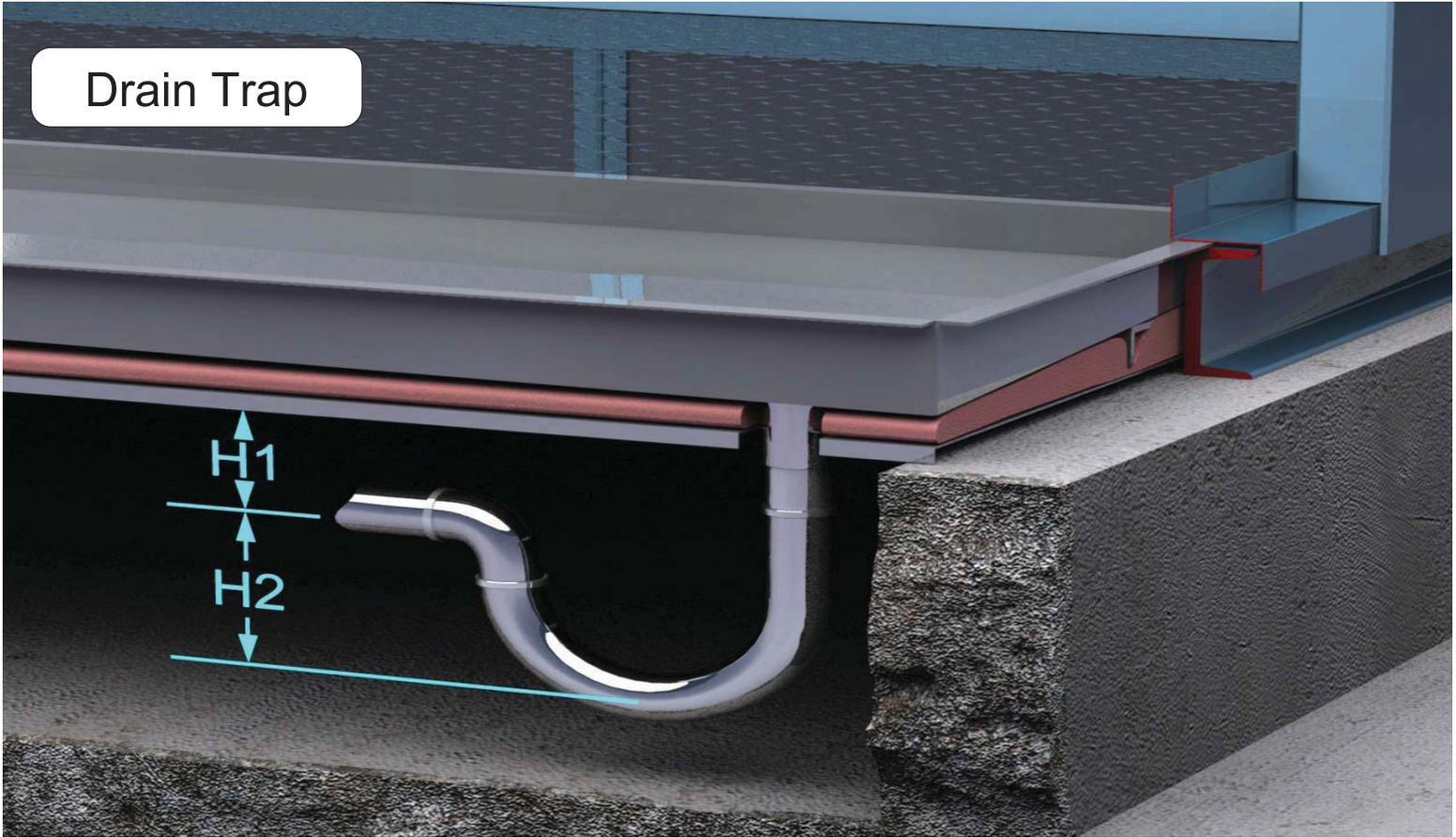
7538
METRIC

DWG NO
REVISION

7538DT04



Drain Trap



Draw Thru Drain Trap

DRAIN TRAPS ARE BY OTHERS : Trap all drains as shown on the drawing. Values H1 and H2 are referenced in the table below for each coil.

Tag	Y	H1	H2	Drain Size
AHU-5 COOLING	0	197	111	32

Drain traps and piping within unit base and curb is by others.

TAG:AHU-5 COOLING

PROJECT:

DRAWN BY DW
DATE 2013-01-25

Canadian Space Agency

JOB NO. 7538
UNITS METRIC

DWG NO
REVISION

7538DT04



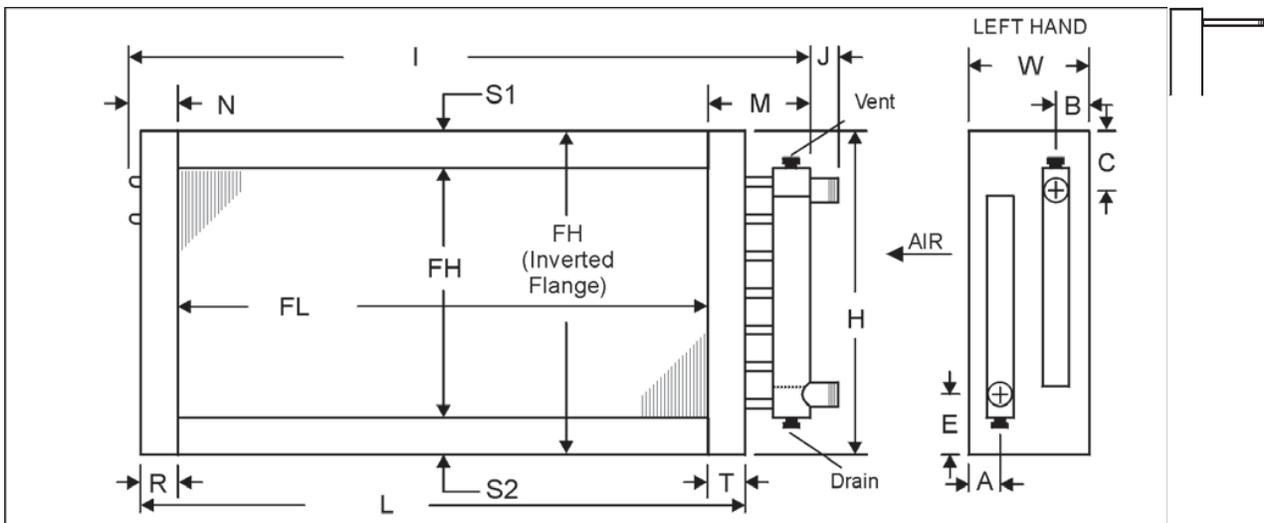
Customer:
 Contact:
 Telephone:
 Cell:
 Fax:
 Job:
 Quote #:

Date: 1/21/2013
 From:
 Company:
 Return Tel:
 Return Fax:

ITEM	QTY	MODEL NUMBER						HAND
		TYPE	FPI	ROWS	FIN	FH (IN)	FL (IN)	
HC-1	1	5MI	08	01	A	54.00	86.00	Left

MATERIALS OF CONSTRUCTION		OPTIONS				
Finns	0.0075 Aluminum	Coating	None		TurboSpirals	No
Tubes	0.020 Copper	Casing Type	Flanged		Moisture Eliminator	No
Casing	Galvanized Steel	Vent & Drain	.50 MPT Ext./Length of Conn.		Mounting Holes	No
Conn. Material	Carbon Steel				Label Kit	Yes
Conn. Type	MPT				Drain Headers	No
Conn. Size	1.500				Tube Ferrules	No
Weight (LBS)	153.0					

Vent/Drain Location



DIMENSIONAL DATA(IN)																
A	B	C	D	E	F	H	I	J	L	M	N	R	S1	S2	T	W
1.88	1.88	1.87	0.00	1.87	0.00	55.50	92.50	10.00	89.00	4.50	2.00	1.50	0.75	0.75	1.50	6.00

NOTES:

GENERAL NOTES:

1. All dimensions are in (in)
2. Manually verifying dimensions is highly recommended.
3. One intermediate tube support fabricated from stock of the same material as the casing will be provided.
4. The supply line should be connected to the lower connection on the leaving air side for counterflow operation.
5. Coils will vent and drain through factory-installed vent and drain fittings when mounted level for horizontal flow.
6. Connection location other than standard could affect vent and drain locations. Consult factory.

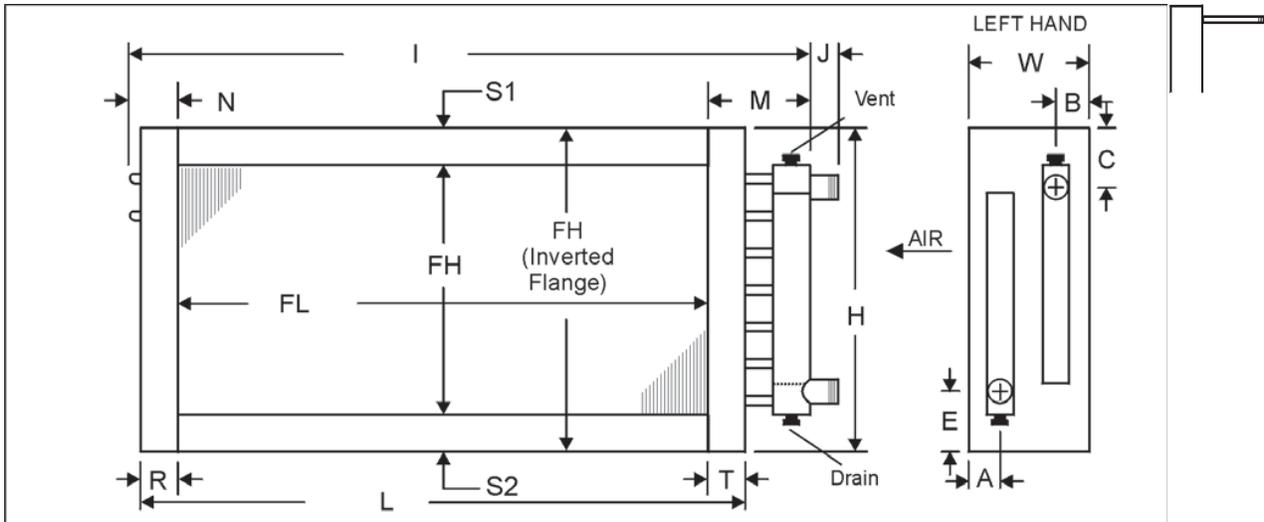
Customer:
 Contact:
 Telephone:
 Cell:
 Fax:
 Job:
 Quote #:

Date: 1/21/2013
 From:
 Company:
 Return Tel:
 Return Fax:

ITEM	QTY	MODEL NUMBER						HAND
		TYPE	FPI	ROWS	FIN	FH (IN)	FL (IN)	
CC-1,2	2	5WG	10	04	B	27.00	86.00	Left

MATERIALS OF CONSTRUCTION		OPTIONS				
Finns	0.0075 Aluminum	Coating	None		TurboSpirals	No
Tubes	0.020 Copper	Casing Type	Flanged		Moisture Eliminator	No
Casing	304L S/S	Vent & Drain	.50 MPT Ext./Length of Conn.		Mounting Holes	No
Conn. Material	Carbon Steel				Label Kit	Yes
Conn. Type	MPT				Drain Headers	No
Conn. Size	2.000				Tube Ferrules	No
Weight (LBS)	216.0					

Vent/Drain Location



DIMENSIONAL DATA(IN)																
A	B	C	D	E	F	H	I	J	L	M	N	R	S1	S2	T	W
1.80	1.80	1.76	0.00	1.76	0.00	28.50	93.50	10.00	89.00	5.00	2.50	1.50	0.75	0.75	1.50	7.50

NOTES:

GENERAL NOTES:

1. All dimensions are in (in)
2. Manually verifying dimensions is highly recommended.
3. One intermediate tube support fabricated from stock of the same material as the casing will be provided.
4. The supply line should be connected to the lower connection on the leaving air side for counterflow operation.
5. Coils will vent and drain through factory-installed vent and drain fittings when mounted level for horizontal flow.
6. Connection location other than standard could affect vent and drain locations. Consult factory.



AHU-5 Humidifier Manifold Details

Project Name: CSA AHU Pre-Tender

Tag	Qty	Humidifier Model	Load (lbs/hr)	Air Volume (CFM)	Input (Mbh)	Control Input Signal	Dispersion Model	Absorp. Dist. (inches)	Entering Conditions Dry Bulb/RH	Leaving Conditions Dry Bulb/RH	Duct Area WxH (inches)	Heat Gain from Assembly	Heat Gain from Steam
H-1	1	(1)GFS-200	116.96	16000.00	200	2-10 VDC	(1)RAPID-SORB	14	54.4(°F)/55%	55.0(°F)/71%	86 x 42	0.13(°F)	0.50(°F)

STEAM GENERATOR TO BE PROVIDED IN ANOTHER CONTRACT

Project Name: CSA AHU Pre-Tender
 Quote Date: 01.17.2013 Unit of Measure: Inch-Pound
 Humidifier Tag: H-1

System Quantity:	1	Calculation Method:	Mechanical	Airflow (CFM)	16000.00
Elevation (feet)	374.0	Desired Dry Bulb (°F)	72.0	Entering Outside Air (%)	25
Entering Dry Bulb (°F)	-20.0	Desired RH (%)	40	Load (lbs/hr)	116.96
Entering RH (%)	50	Actual RH (%)	40	Load Plus Loss (lbs/hr)	119.65

STEAM GENERATOR PROVIDED IN ANOTHER CONTRACT

(All Values are per unit, unless otherwise noted)

Energy Source	Natural Gas
Water Type	Potable
Total Humidifier Capacity (lbs/hr)	150.0

Model	Qty.	Volts/Phase/Amp (Each)	Humidifier Outlet			Size (inches) W x H x L	Input (Mbh)	Recommended Vent Size (inches)
			Type	Diameter (inches)	Qty.			
GTS-200	1	120/Single/1.8	Hose	2	1	26.38 x 41.00 x 54.35	200	5

Selected Humidifier Options:

- Type of Water: Potable
- Sealed Combustion Air
- Flush (None)
- Keypad, Language, English
- Keypad, Unit Of Measure, Inch-Pound

Selected Control Options:

- Building Automation System, BacNet
- VAPOR-LOGIC 4
- Type of Control, Modulating
- Type of Signal by Others 2-10 VDC
- Airflow Proving Switch, Pressure
- Humidistat, Modulating High Limit, Duct

Humidifier Notes:

Minimum water conductivity of 2 grains/gallon (100 µS/cm)
 Power block maximum wire connection size of 6 gauge.

Model	Qty.	Header Size (inches)	Tube (inches)			Tube Qty.	Dispersion Inlet		Face Dimensions (inches)	
			Size	Center	Active Length		Type	Diameter (inches)	Width	Height
RAPID-SORB 1.5"	1	2	1.5	18	36	4	Hose	2	86	42

AHU Conditions

Absorption Dist. (inches)	14	Airflow	Horizontal
Mounting Location	Coil	Air Velocity (ft/min)	638
Coil Width (inches)	86	Airflow Pressure Drop (in.)	0.0
Coil Height (inches)	42	Entering RH (%)	55
Entering Duct Temp (°F)	54.4	Leaving RH (%)	71
Leaving Duct Temp (°F)	55.0	Heat Gain: Assembly (°F)	0.12
Header Location	Inside AHU	Heat Gain: Steam (°F)	0.5
Water Seal Location	Inside AHU	Ins. Load + Loss (lbs/hr)	119.65

Selected Dispersion Options:

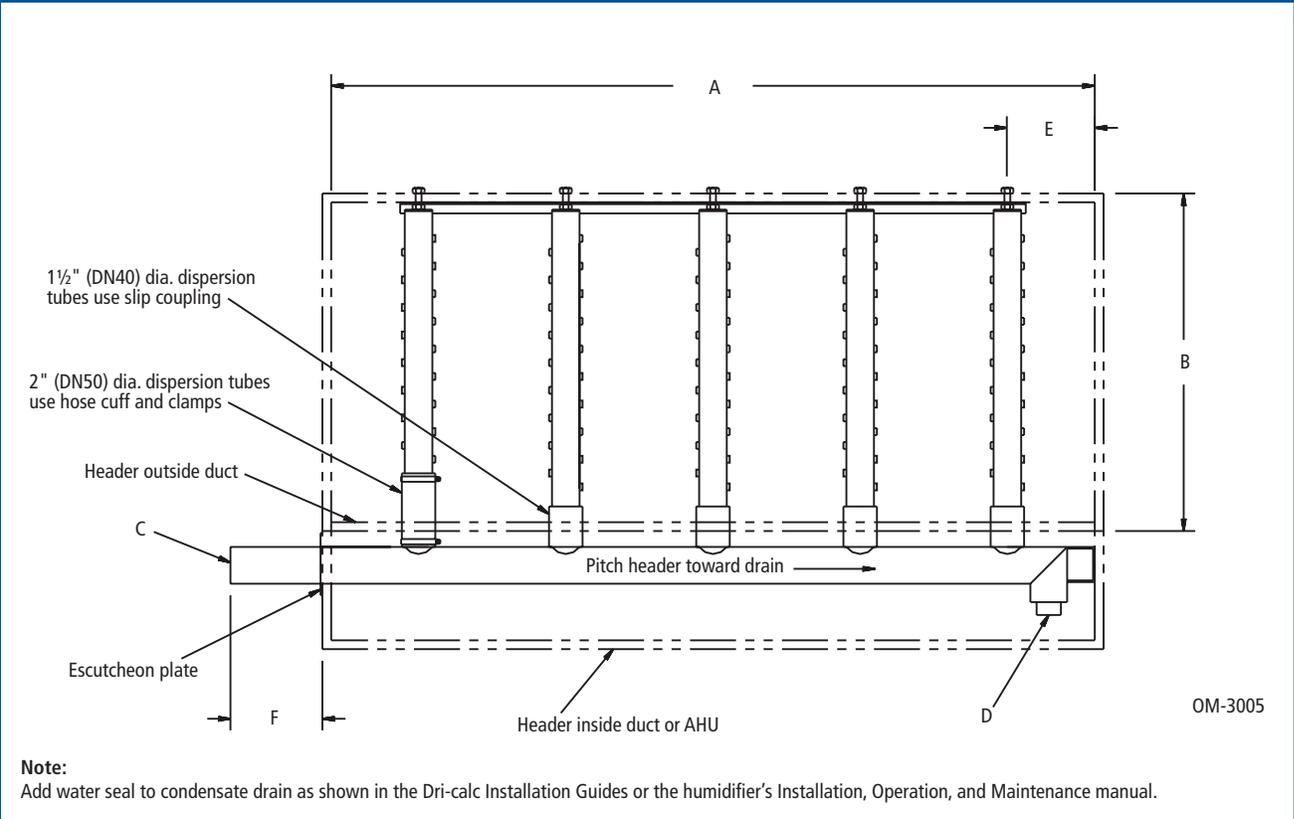
- Extended Inlet, 6 (inches)
- Insulated Tube(s)

Dispersion Notes:

The minimum interconnecting piping diameter is 2 (inches) for the developed length of 40 (feet) that you entered.

Rapid-sorb dispersion

**Figure 21-1:
Rapid-sorb dimensions**



**Table 21-1:
Rapid-sorb dimensions**

Dimension	Description	Inches (mm)
A	Face width	12" (305) minimum to 120" (3048) maximum in 1" (25) increments
B	Face height	12" (305) minimum to 120" (3048) maximum in 1" (25) increments
C	Steam inlet	Determined by humidifier maximum capacity
D	Condensate drain	3/4" pipe thread (DN20)
E	Distance from tube center to inside of duct or AHU wall	4.5" (114) minimum
F	Distance from outside of duct or AHU wall to end of Rapid-sorb leader	4.5" (114) minimum

Note:
All Rapid-sorb units are custom-sized and field-assembled to fit the duct or air handler. Consult DRI-STEEM for sizes larger or smaller than those listed above.

mc_121311_1321

**Table 21-2:
Rapid-sorb tube capacities***

Tube diameter		Insulated (High-Efficiency Tubes)		Uninsulated	
inches	DN	lbs/hr	kg/h	lbs/hr	kg/h
1 1/2	40	43	19.5	40	18.2
2	50	80	36.4	77	35

Note:
* Capacities shown are for horizontal airflow. See Dri-calc for vertical airflow capacities. If face height is <22" (559 mm), tube quantity per panel may need to increase to compensate for reduced capacity of short tubes. Consult DRI-STEEM or see Dri-calc for the correct calculation.



AHU-5 Damper and Actuator Details

T.A. Morrison 1000

A

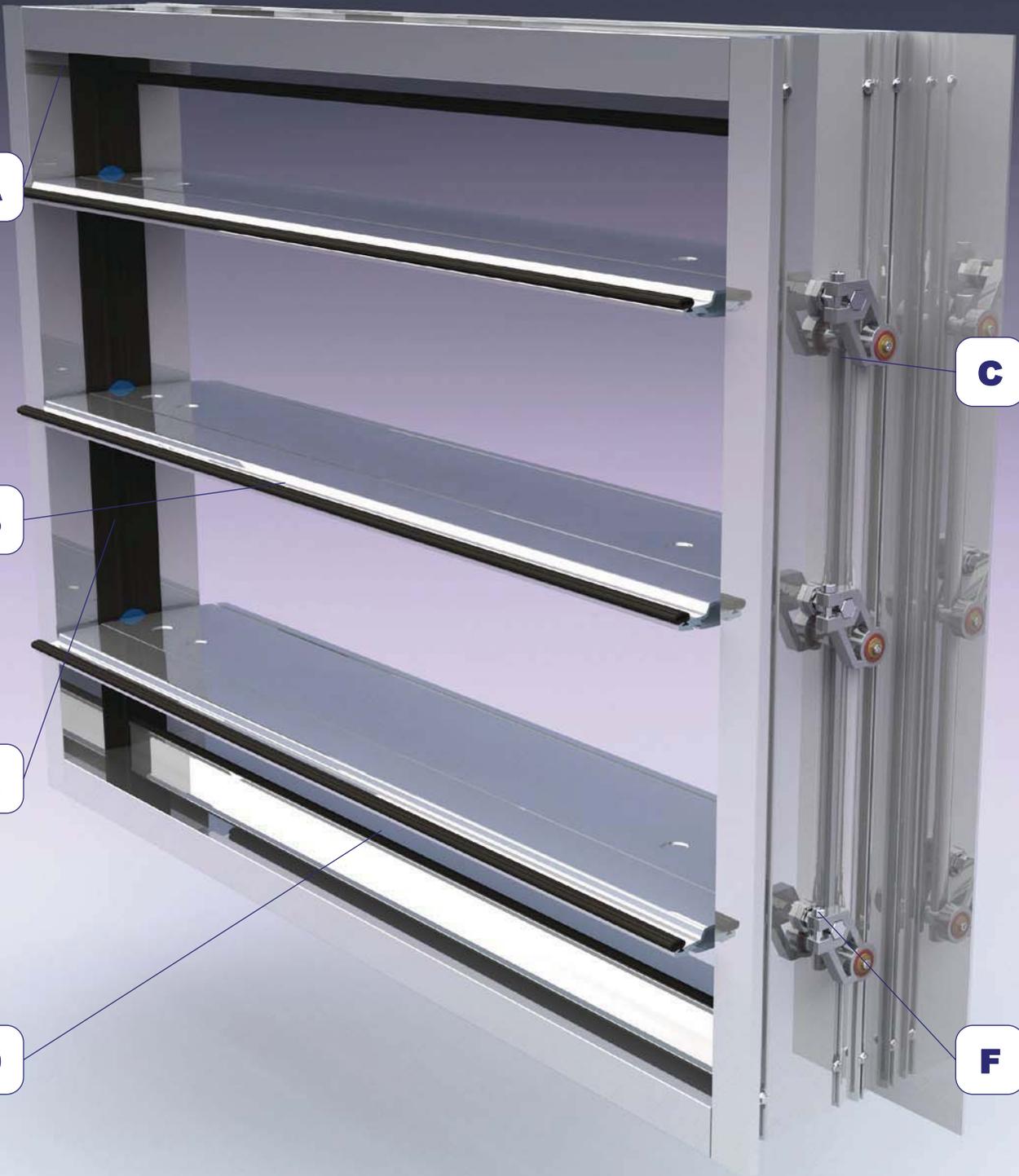
B

E

D

C

F



TAG:AHU-1 airflow1 oa, AHU-1 ra bypass, AHU-1, AHU-1 ea

PROJECT:

DRAWN BY
DATE

DW
2012-11-27

Canadian Space Agency

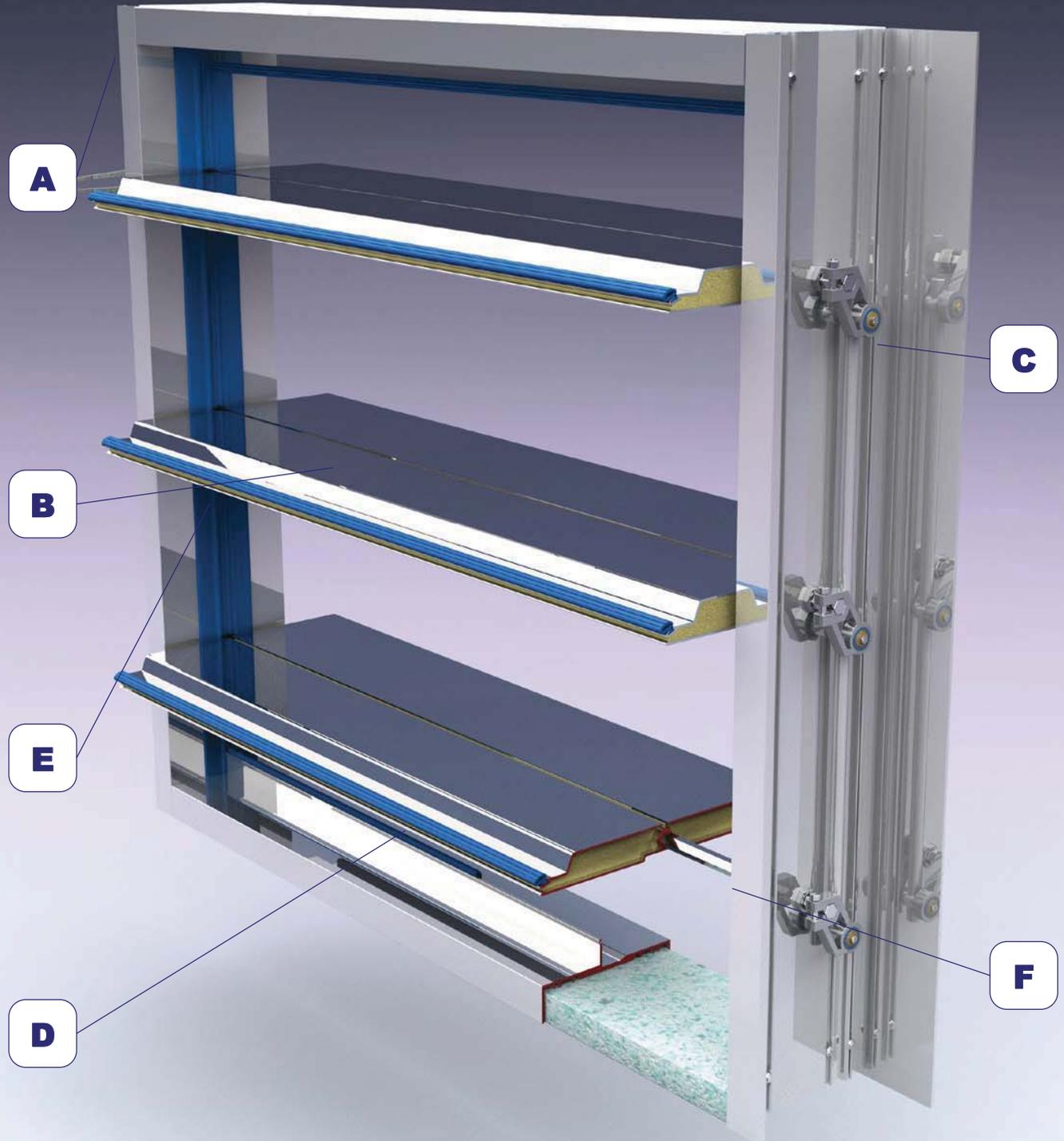
JOB NO. 45451
UNITS IMPERIAL

DWG NO
REVISION

45451DT27



T.A. Morrison 9000 (OA & EA)



TAG:AHU-1 airflow1 oa, AHU-1, AHU-1 ea

PROJECT:

DRAWN BY
DATE

DW
2013-01-17

Canadian Space Agency

JOB NO. 7538
UNITS METRIC

DWG NO
REVISION

7538DT03



NFB24-SR, NFB24-SR-S, NFX24-SR, NFX24-SR-S

Proportional, Spring Return, 24 V, for 2 or 10 VDC or 4 to 20 mA Control Signal



Technical Data		NFB24-SR, NFB24-SR-S, NFX24-SR, NFX24-SR-S
Power supply		24 VAC ±20%, 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	3.5 W
	holding	2.5 W
Transformer sizing		6 VA (class 2 power source)
Electrical connection	NFB...	3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	NFX...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector -S models: Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA)
		500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in switch
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	motor	95 seconds
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤40dB(A) motor @ 95 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.15 lbs (1.9 kg); 4.4 lbs (2.0 kg) with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
NFB24-SR-S, NFX24-SR-S		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Torque min. 90 in-lb, for control of air dampers

Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

Operation

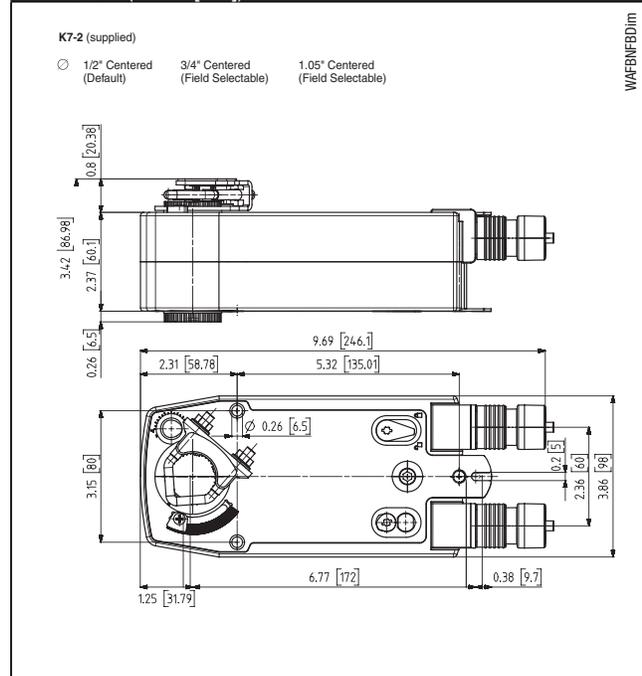
The NFB and NFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB and NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The NFB24-SR and NFX24-SR uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFB24-SR-S and NFX24-SR-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The NFB24-SR, NFB24-SR-S, NFX24-SR and NFX24-SR-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Dimensions (Inches [mm])



M40024 - 05/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3./4., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

NOTE: When using NFB24-SR, NFB24-SR-S, NFX24-SR and NFX24-SR-S actuators, only use accessories listed on this page. For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuator must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position feedback. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

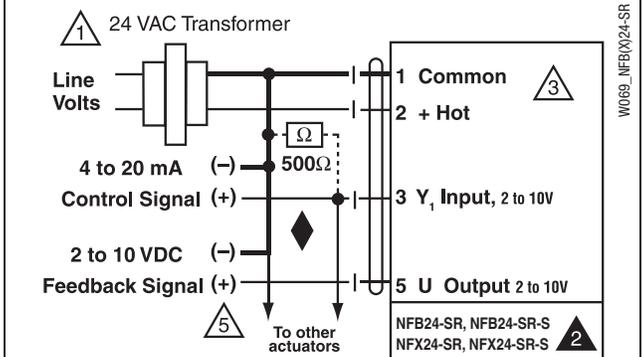
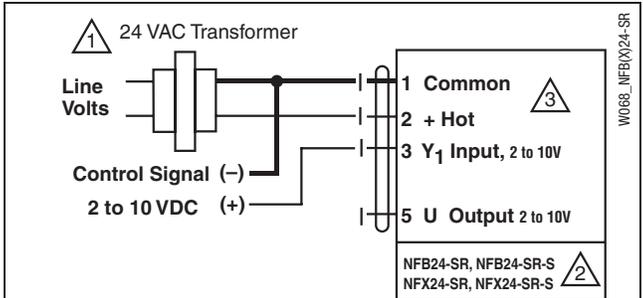
INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**
Actuators may be connected in parallel. Power consumption and input impedance must be observed.
- 3 Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.
- 4 Actuator may also be powered by 24 VDC.
- 5 For end position indication, interlock control, fan startup, etc., NFB24-SR-S and NFX24-SR-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.
- 6 Only connect common to neg. (-) leg of control circuits

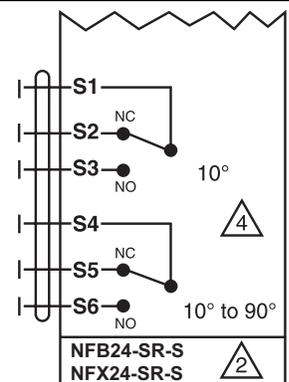
APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

WARNING Live Electrical Components!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



Auxiliary switches for NFB24-SR-S, NFX24-SR-S





AHU-5 Temperature and Humidity Sensor Details

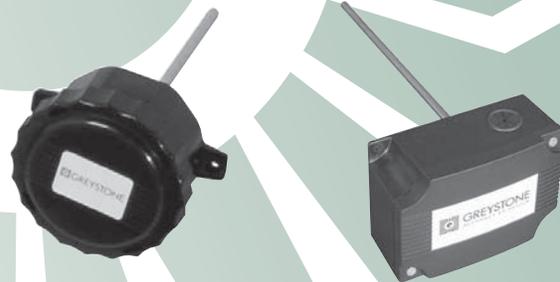


GREYSTONE

ACCURACY BY DESIGN

DUCT TEMPERATURE SENSOR TE200B Series

The B series single point rigid duct temperature sensor utilizes a precision sensor that is encapsulated in 6.35 mm (0.25") OD, 304 series stainless steel probe and is available in various lengths (see ordering chart) All probes provide excellent heat transfer, fast response and resistance to moisture penetration. It is available with a variety of enclosures.



SPECIFICATION:

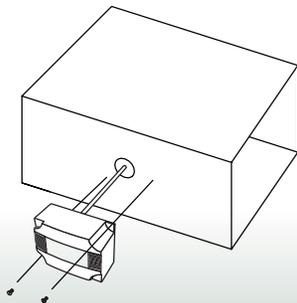
- Sensor Type:.....Thermistor or RTD
See Ordering Chart
- Temperature Range:..-20 to 105 °C (-4 to 221 °F)
Higher Ranges Available
Contact Greystone
- Wire Material:.....PVC insulated, parallel bonded
(Type 2, 100 ohm platinum uses FT-4)
- Probe Material:.....304 Series Stainless Steel
- Probe Dimensions:.....0.25" (6.35 mm) Diameter
- Enclosure:.....Standard - ABS - UL94-V - NEMA 12 (IP64)
Round (E) - ABS - NEMA 12 (IP64)
Metal (M) - Gal. Steel - NEMA 1 (IP30)
Weatherproof (W) - Cast Alum. NEMA 3R (IP64)
- Termination:.....Pigtail 2 or 3 wire
Terminal block with (E) enclosure

TYPICAL INSTALLATION:

For complete installation and wiring details, please refer to the product installation instructions.

The duct type probes are installed in the side of the duct to monitor a single point temperature within the duct. Select a probe length that allows the probe to span the duct width. Install the probe in a straight section of duct at a suitable distance downstream from any heating, cooling or humidification devices.

Each enclosure style provides mounting tabs on the outside of the enclosure for ease of installation.



PART NUMBER SELECTED

PRODUCT SELECTION INFORMATION:

MODEL	Product Description
TE200B	Duct Temperature Sensor

CODE	Enclosure (ABS enclosure is standard)
-	ABS enclosure, standard (no code required, leave blank)
M	Metal utility box
E	Round ABS, w/gasketed cover
W	Aluminum weatherproof box

CODE	Sensor
2	PT100-100 Ω Plat. IEC 751, 385 Alpha, thin film
5	1801 Ω, NTC Thermistor, ±0.2 C
6	3000 Ω, NTC Thermistor, ±0.2 C
7	10,000 Ω, Type 3, NTC Thermistor, ±0.2 C
8	2.252 KΩ, NTC Thermistor, ±0.2 C
9	100,000 Ω, NTC Thermistor, ±0.2 C
11	LM334 IC, 1.0uA/ C
12	PT1000-1000 Ω Platinum, IEC 751, 385 Alpha, thin film
13	1000 Ω Nickel
14	10,000 Ω, Type 3, NTC Therm., ±0.2 C c/w 11K shunt resistor
15	PT3000 PTC Platinum, ±0.2 C
20	20,000 Ω, NTC Thermistor, ±0.2 C
21	LM335 IC, 10mv/ C
24	10,000 Ω, Type 2, NTC Thermistor, ±0.2 C

CODE	Probe Length
A2	50 mm (2")
B2	100 mm (4")
C2	150 mm (6")
D2	200 mm (8")
E2	300 mm (12")
F2	450 mm (18")

TE200B - 7 E 2

SUBMITTAL Duct Humidity Transducer

Part Number:

PRODUCT SELECTION INFORMATION:

MODEL	Product Description
RH200	Duct Humidity Transducer

CODE	Enclosure
A	ABS enclosure, standard
M	Metal utility box
E	Round ABS, w/gasketed cover
W	Aluminum weatherproof box

CODE	Accuracy
02	2%
03	3%
05	5%

CODE	Optional Temperature Sensor
L	PT100-100 Ω Plat. IEC 751, 385 Alpha, thin film
C	PT1000-1000 Ω Platinum, IEC 751, 385 Alpha, thin film
F	1801 Ω, NTC Thermistor, ±0.2 C
E	3000 Ω, NTC Thermistor, ±0.2 C
H	100,000 Ω, NTC Thermistor, ±0.2 C
D	10,000 Ω, Type 3, NTC Thermistor, ±0.2 C
J	10,000 Ω, Type 2, NTC Thermistor, ±0.2 C
K	20,000 Ω, NTC Thermistor, ±0.2 C
M	1000 Ω Nickel
B	10,000 Ω, Type 3, NTC Thermistor, ±0.2 C w/ 11K shunt resistor
G	2,252K Ω, NTC Thermistor, ±0.2 C

CODE	Options
AC	LCD display (ABS Enclosure only)

RH200	A	02	K	-
-------	---	----	---	---

Greystone Energy Systems, Inc. reserves the right to make design modifications without prior notice.

EXAMPLE: Duct humidity, ABS Enclosure, 2% c/w 20 K Thermistor

LCD Specifications:

Display Units % RH (Factory set)
 Display Range 0 - 99.9%
 Display Resolution 0.5% for display of 00.0 to 99.9
 Display Update Rate 3 times per second
 Display Size 24 mm W x 11 mm H (0.95" x 0.45") three digit

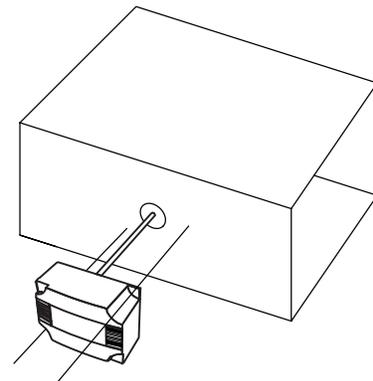
The RH200 series uses a highly accurate and reliable Thermoset Polymer based capacitance humidity sensor and state-of-the-art digital linearization and temperature compensated circuitry to monitor humidity levels. The sensor is encapsulated in a 9" (228.60 mm) long by 0.5" (12.7 mm) diameter 304 S/S probe. An 60 micron HDPE filter protects the sensor for contaminants. A variety of enclosures are available. Additional options such as integrated temperature sensor and LCD display are available.

Sensor Type	Thermoset Polymer based capacitive
Range	0 to 100% RH
Accuracy	±2, 3, or 5 % (5 to 95% RH)
Response	15 Seconds typical
Stability	±1% RH typical @ 50% RH in 5 years
Operating Temperature	-40 to 70 °C (-40 to 158 °F)
Power Supply	18 to 30 Vdc, 15 to 26 Vac
Output Signal	Jumper-selectable 4-20 mA current loop 0-1, 0-5, or 0-10 Vdc
Consumption	22 mA maximum
Enclosure	Standard - ABS - UL94-V - NEMA 1 (IP10) Round (E) - ABS - NEMA 4X (IP56) Metal (M) - Galvanized Steel - NEMA 1 (IP10) Weatherproof (W) - Cast Aluminum - NEMA 3R (IP14)
Probe	304 series stainless steel w/ 60 micron HDPE filter
Optional Temperature Sensor	Various RTD's and thermistors available as 2 wire resistance outputs (See ordering chart)
Wiring Connections	Screw terminal block (14 to 22 AWG)

Installation:

The duct type probes are installed through a hole in the side of the duct to monitor a single point humidity within the duct. Install the probe in a straight section of duct at a suitable distance downstream from any heating, cooling or humidification devices.

Each enclosure style provides mounting tabs on the outside of the enclosure for ease of installation .



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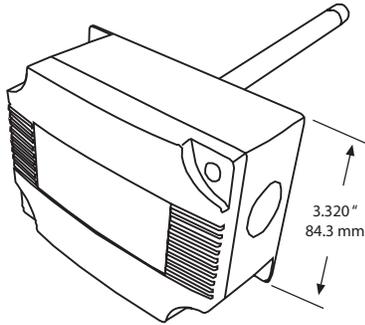
RoHS
COMPLIANT



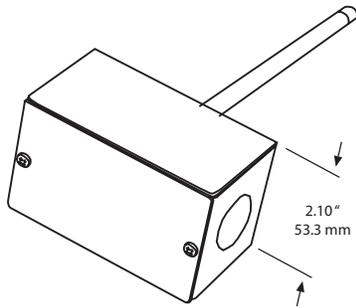
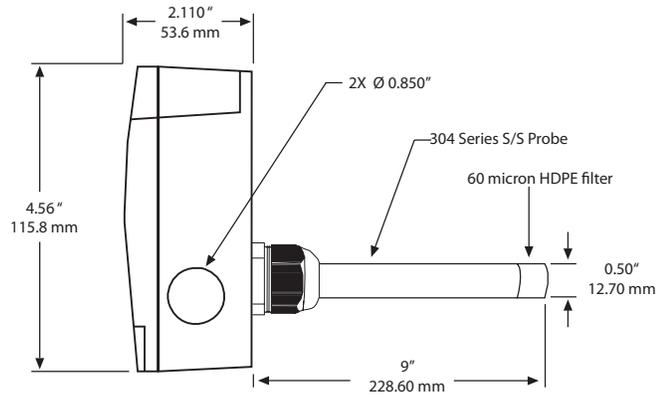
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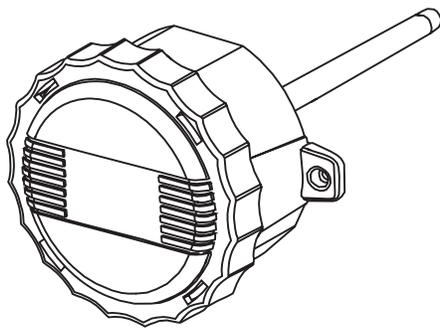
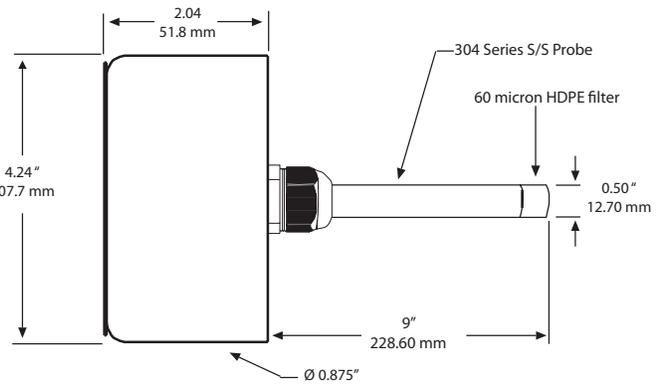
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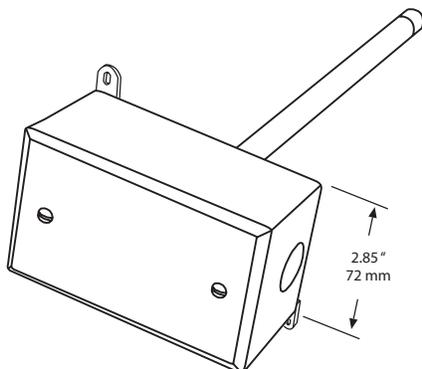
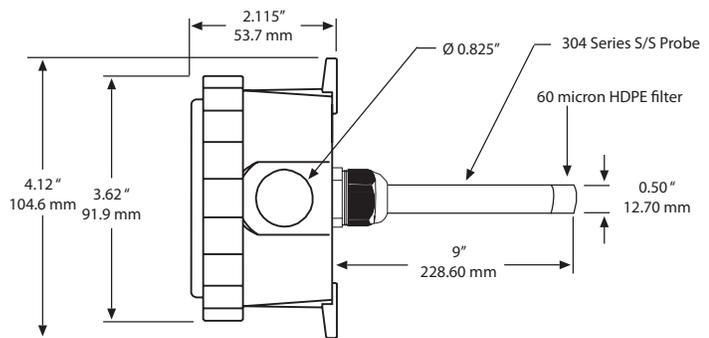
ABS Enclosure



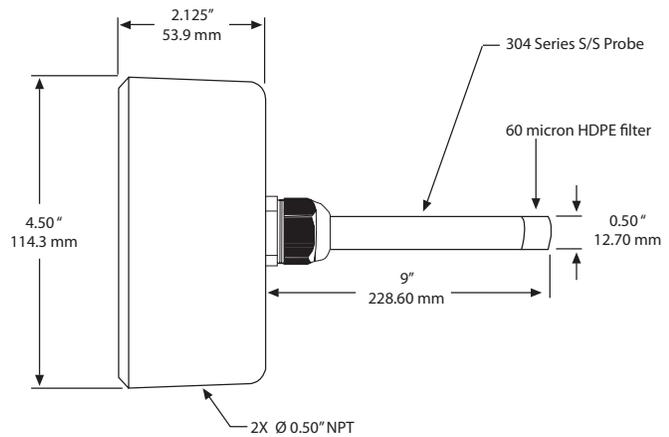
Metal Enclosure (M)



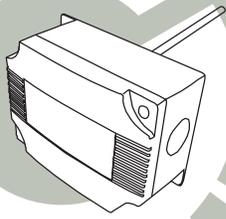
Round ABS Enclosure (E)



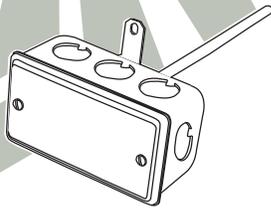
Weatherproof Enclosure (W)



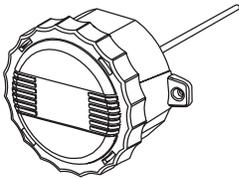
Dimensions:



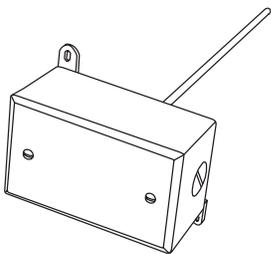
ABS Enclosure



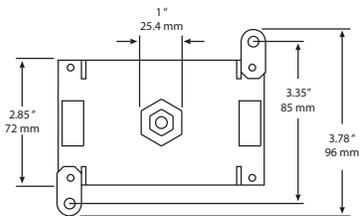
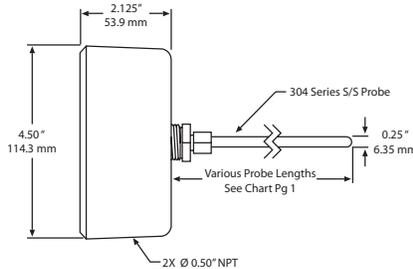
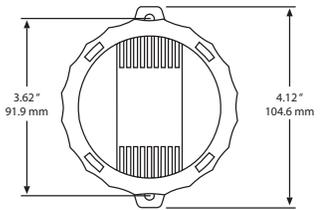
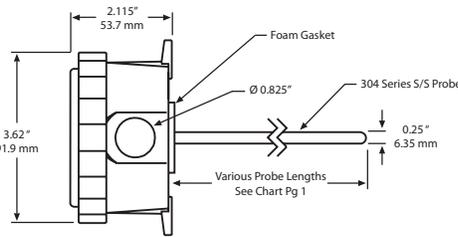
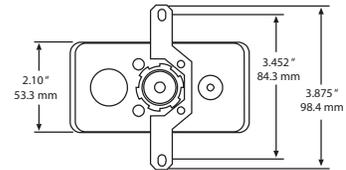
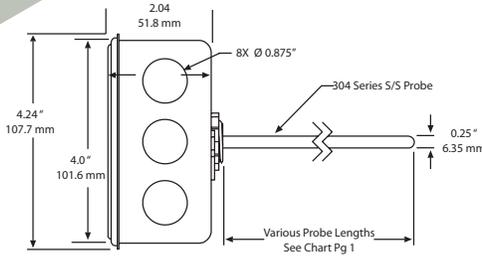
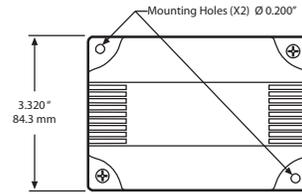
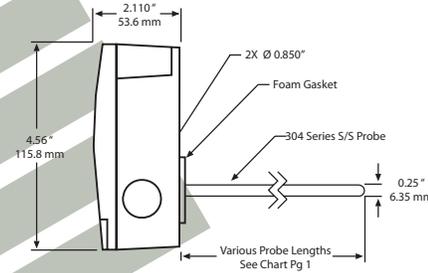
Metal Enclosure (M)



Round ABS Enclosure (E)



Weatherproof Enclosure (W)



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e-mail: mail@greystoneenergy.com
www.greystoneenergy.com

RoHS
COMPLIANT



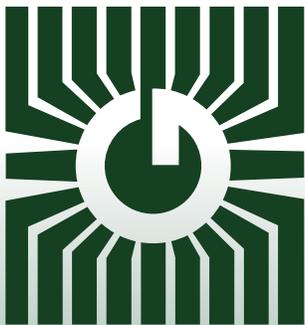
Greystone Energy Systems Inc. is one of North America's largest ISO registered manufacturers of HVAC sensors and transducers for Building Automation Management Systems.

We have conscientiously established a worldwide reputation as an industry leader by maintaining leading-edge design technology, prompt technical support, and a commitment to on-time deliveries. We take pride in our Quality Management System which is ISO 9001 certified, assuring our customers of consistent product reliability.

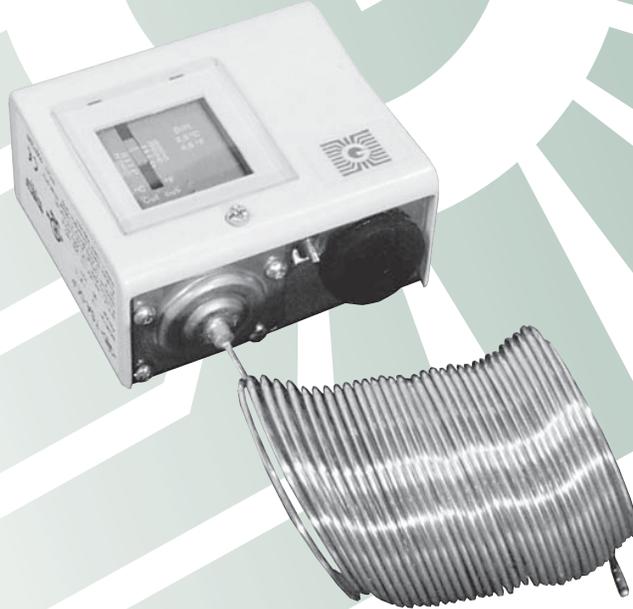
GREYSTONE HAS AN ISO 9001 REGISTERED QUALITY SYSTEM

GREYSTONE

ACCURACY BY DESIGN



FROST PROTECTION THERMOSTAT LLC Series



LLC-307 model
shown above

FEATURES:

- SPDT or DPDT
- Auto or manual reset version
- 6 meter (20') capillary
- Optional capillary mounting clip

*Peace of mind
through reliable
temperature switches*

GREYSTONE HAS AN **ISO 9001** REGISTERED QUALITY SYSTEM

DESCRIPTION:

The LLC series frost protection thermostats provide a switched output based on the average temperature detected along a six meter (20 foot) capillary sensor.

The unit is fixed across a duct using capillary mounting clips, downstream of the frost coil and is used to prevent the icing up of filters, fans and coils.

SPECIFICATIONS:

Control Range	SPDT DPDT	+1.7 to +20°C (35 to 68°F) +1.1 to + 21°C (34 to 70°F)
Differential	SPDT DPDT	2.5°C (4.5°F) 2.5°C (4.5°F)
Electrical Ratings	SPDT DPDT	24 F.L.A. inductive @ 120 VAC 24 F.L.A. inductive @ 240 VAC 720 VA max pilot duty @ 120-600 VAC 144 VA max pilot duty @ 24 VAC 14 F.L.A. inductive @ 120 VAC 12 F.L.A. inductive @ 240 VAC 720 VA max pilot duty @ 120-600 VAC 144 VA max pilot duty @ 24 VAC
Capillary	SPDT DPDT	6m x 2mm dia copper (20' x 0.1") 6m x 2mm dia copper (20' x 0.1")
Ambient Range	SPDT DPDT	Operating: -51 to 71°C (-60 to 160°F) Operating: -51 to 71°C (-60 to 160°F)
Protection	SPDT DPDT	IP 23, NEMA1 IP 23, NEMA1
Housing Dimensions	SPDT DPDT	75 x 40 x 85mm (2.938 x 1.963 x 3.344") 92 x 67 x 140mm (3.625 x 2.625 x 5.5")

ORDER INFORMATION:

LLC-306 - SPDT Auto reset frost protection thermostat

LLC-307 - SPDT Manual reset frost protection thermostat

LLC-316 - DPDT Auto reset frost protection thermostat c/w 5 mounting clips

LLC-317 - DPDT Manual reset frost protection thermostat c/w 5 mounting clips

LLC-CLIPS - Capillary mounting clips

* Greystone reserves the right to make design changes at any time.



GREYSTONE
ACCURACY BY DESIGN

Greystone Energy Systems Inc.
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Canada E1E 4G7

(506) 853-3057 Fax: (506) 853-6014
North America: 1-800-561-5611
e-mail: mail@greystoneenergy.com
www.greystoneenergy.com



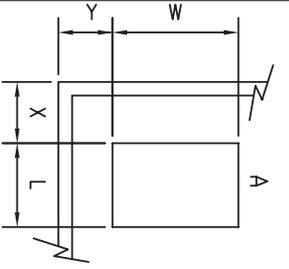
Greystone Energy Systems Inc. is one of North America's largest ISO registered manufacturers of HVAC sensors and transducers for Building Automation Management Systems.

We have conscientiously established a worldwide reputation as an industry leader by maintaining leading-edge design technology, prompt technical support, and a commitment to on-time deliveries. We take pride in our Quality Management System which is ISO 9001 certified, assuring our customers of consistent product reliability.

GREYSTONE HAS AN **ISO 9001** REGISTERED QUALITY SYSTEM

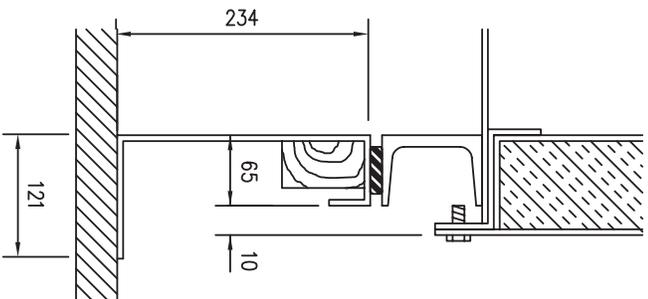
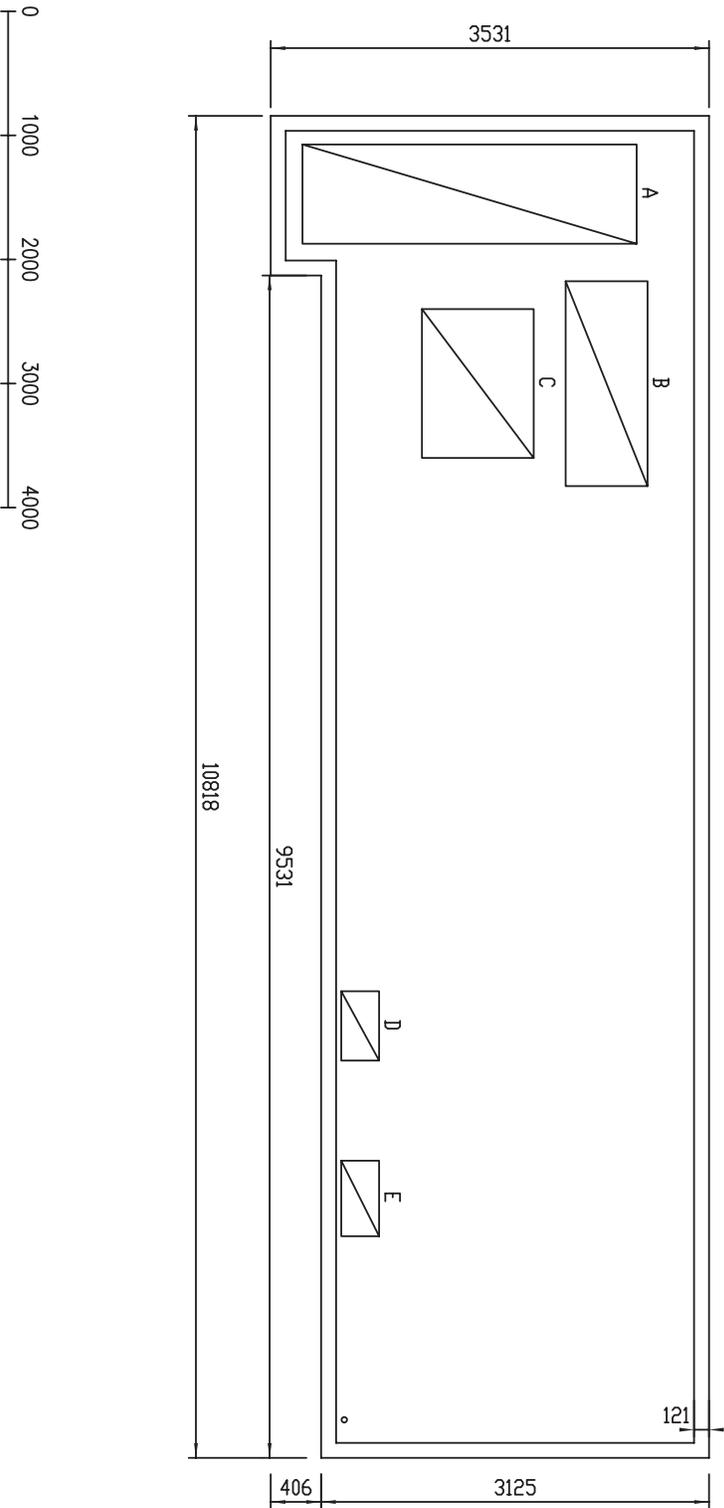


AHU-5 Roof Curb Details



FOOT PRINT DIAGRAM - outline is base of roof curb

TAG	OPENING	X	Y	W	L
A	DISCH	231	256	2692	800
B	RA INLET	1333	2376	660	1651
C	SA DISCH	1558	1219	900	1200
D	PIPE CHASE	7057	569	305	559
E	PIPE CHASE	8422	569	305	610



SECTION VIEW

Roof Curb Weight: 449 kg

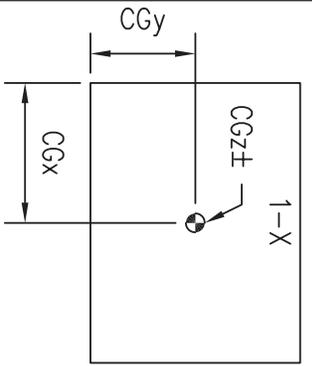


SWG VER: Jan 23 2013

JOB NO.		7538	DRAWN BY	DW	DWG NO.	7538U11FP02	ACCESS SIDE	RIGHT	DWG UNITS	mm	SALES OFFICE	HTS OTTAWA
TAG		AHU-5	DATE	JAN 25/13	TYPE	OUTDOOR	15:29	SCALE	N.T.S.	SALES ENGINEER	Adm Grahm	
PROJECT												
Canadian Space Agency												

OPENINGS AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS. RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES.

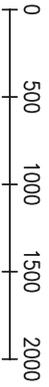
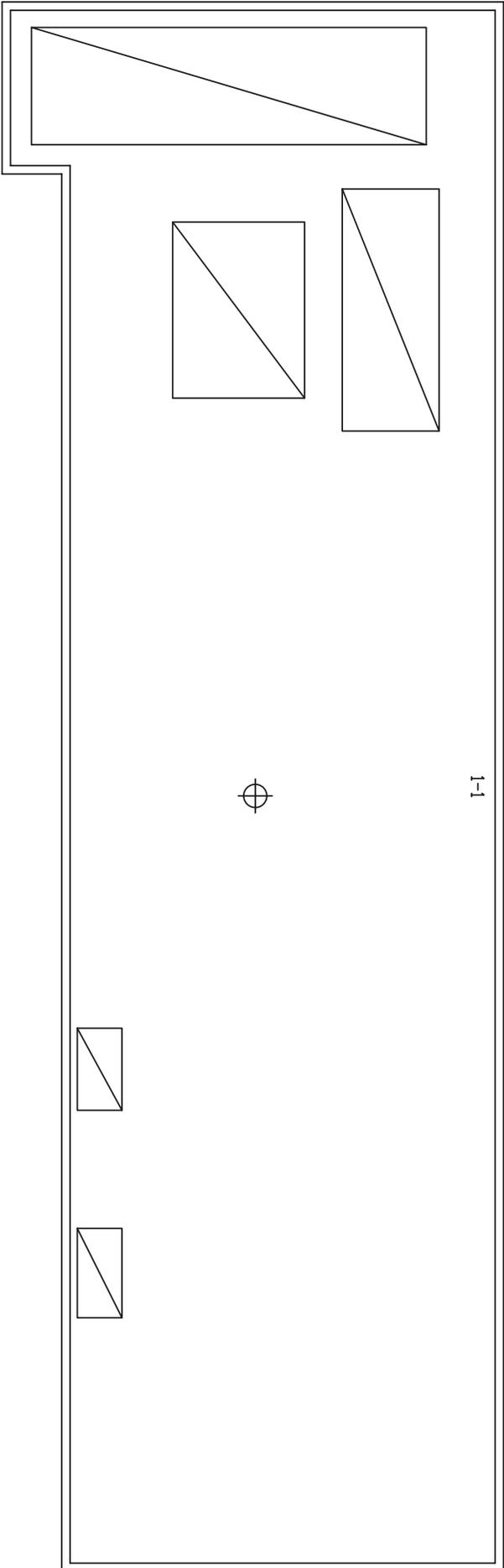




FOOTPRINT WEIGHT DIAGRAM - outline is perimeter of base

TAG	CGx	CGy	CGz	Total
Unit	5410	1727	1626	9819

All weights are in KG



PROJECT

Canadian Space Agency

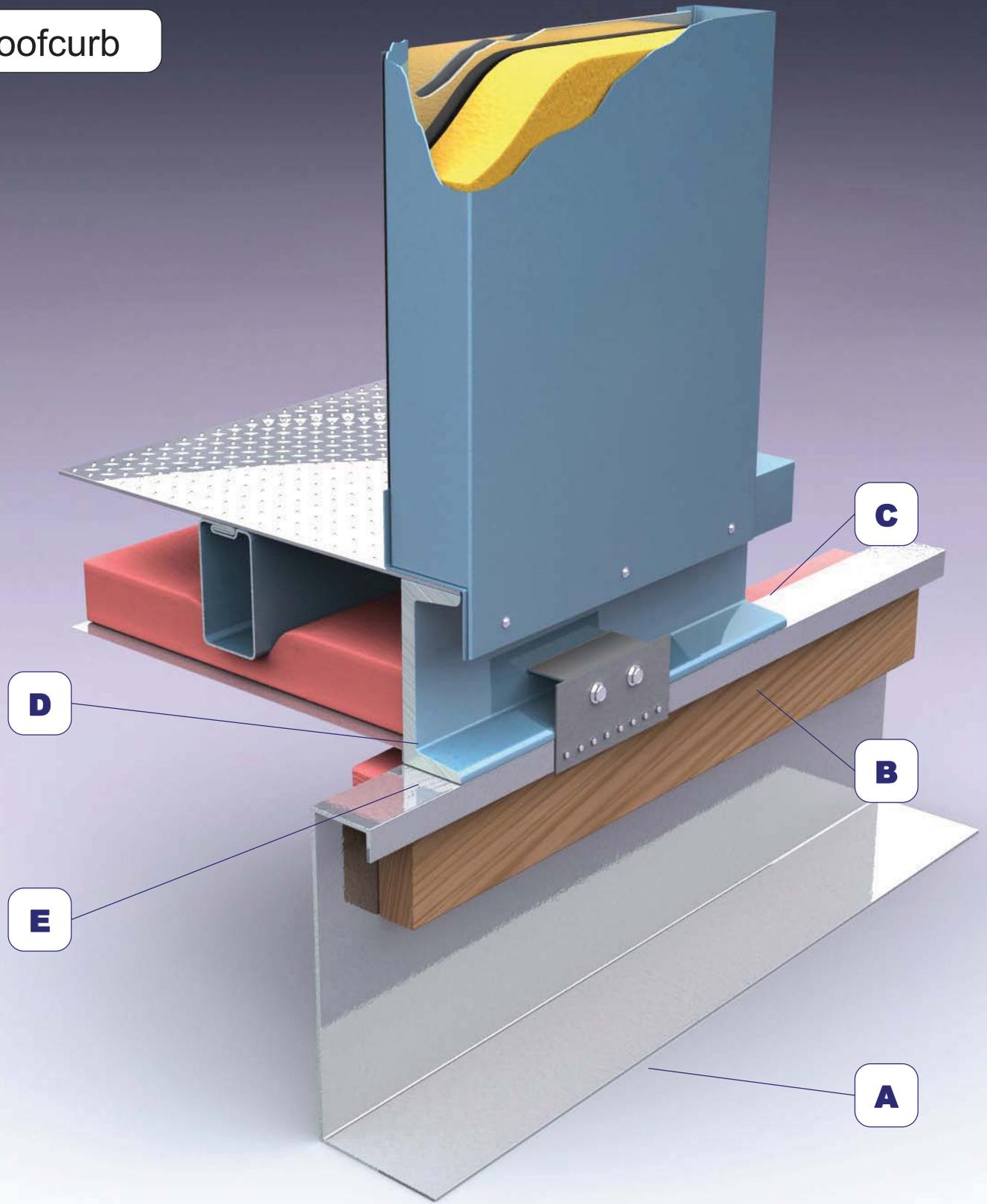
JOB NO.	7538	DRAWN BY	DW	DWG NO.	7538U11PW01	ACCESS SIDE	RIGHT	DWG UNITS	mm	SALES OFFICE	HTS OTTAWA
TAG	AH-5	DATE	JAN 25/13	TYPE	OUTDOOR	15:29	SCALE	N.T.S.		SALES ENGINEER	Adm Graham

OPENINGS AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS. RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES.



506 VER- Jan 23 2013

Roofcurb



TAG:AHU-5

PROJECT:

DRAWN BY
DATE

DW
2013-01-25

Canadian Space Agency

JOB NO. 7538
UNITS METRIC

DWG NO
REVISION

7538DT06





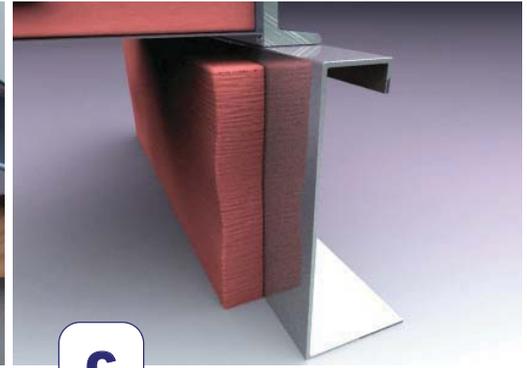
A **Roof Curb**

The roof curb is fabricated from 2.7 mm galvanized steel. The roof curb is designed for a maximum 6.3 mm deflection in the air handling unit when the curb is perimeter supported. Roof curb to be installed level and continuously supported around the perimeter and at all splits.



B **Nailing Strip**

A 2" x 4" cedar nailing strip is provided.



C **Insulation**

The roof curb is pre-insulated with 102 mm rigid fibre neoprene coated insulation.



D **Unit Base Channel**

The support channel section of the air handling unit.



E **Roof Curb Seal**

The air handling unit is sealed to the roof curb with a continuous bead of caulking. The caulking is supplied with the unit to be field installed.

PROJECT:

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DATE

DW
2013-01-25

Canadian Space Agency

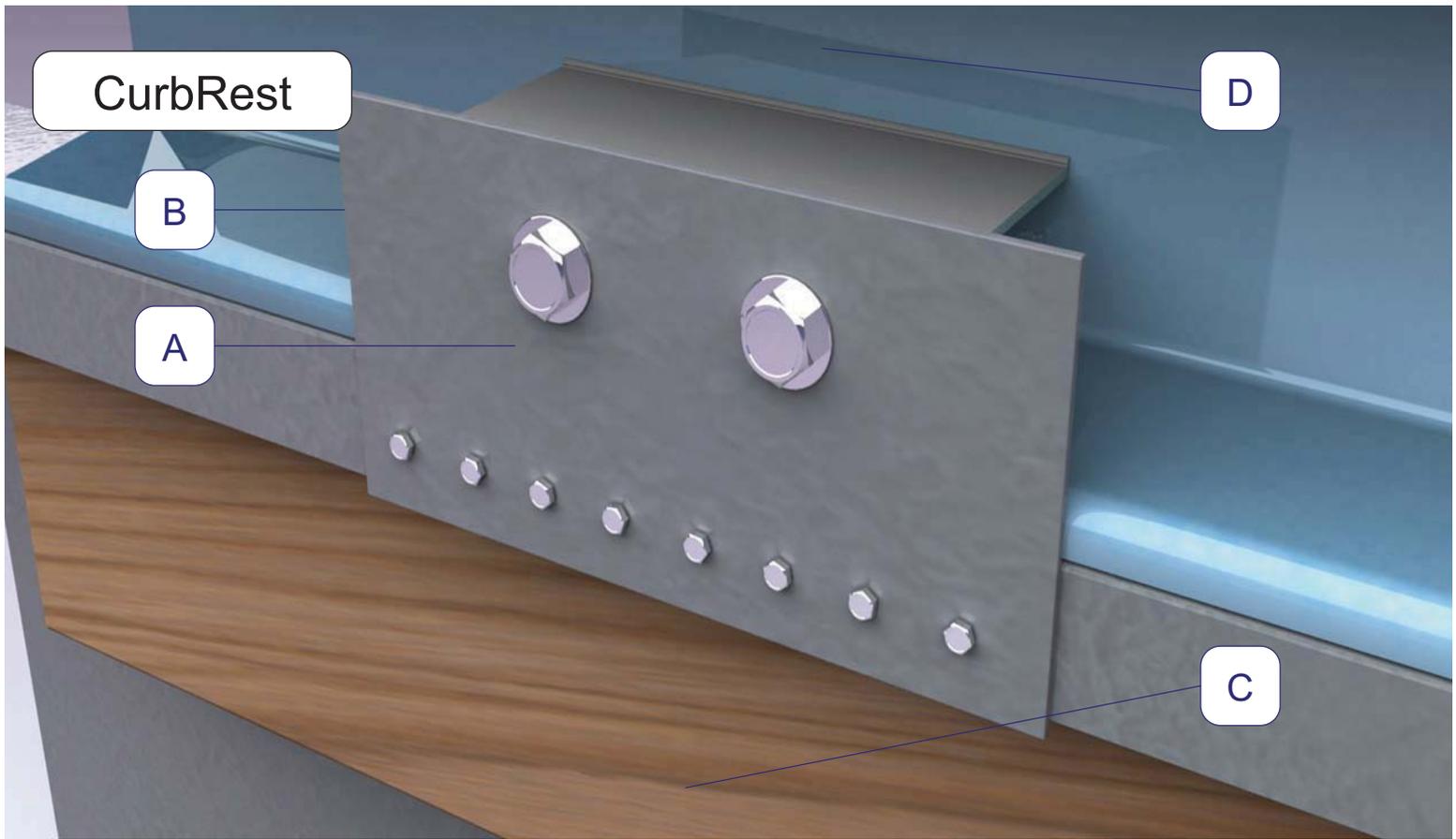
JOB NO.
UNITS

7538
METRIC

DWG NO
REVISION

7538DT07





CurbRest

B

A

D

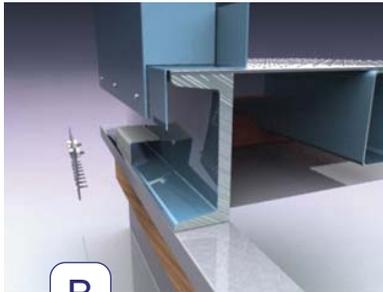
C



A

Restraint Plate

Restraint plate fabricated from of 12 gauge galvanized steel. Plate to ship loose and field installed by others. Restraint plate shall be provided with appropriate number of 5/8 in dia. x 1 in grade 5 bolts and 1/4 in tek screws.



B

Unitbase Channel Base

See CASING DETAIL for channel size.



C

Roofcurb

See ROOFCURB DETAIL for specifications.



D

Restraint Angle Anchor

Restraint angle anchor fabricated from 12 gauge satin coat steel or hot rolled steel.

PROJECT:

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DATE

DW
2012-11-27

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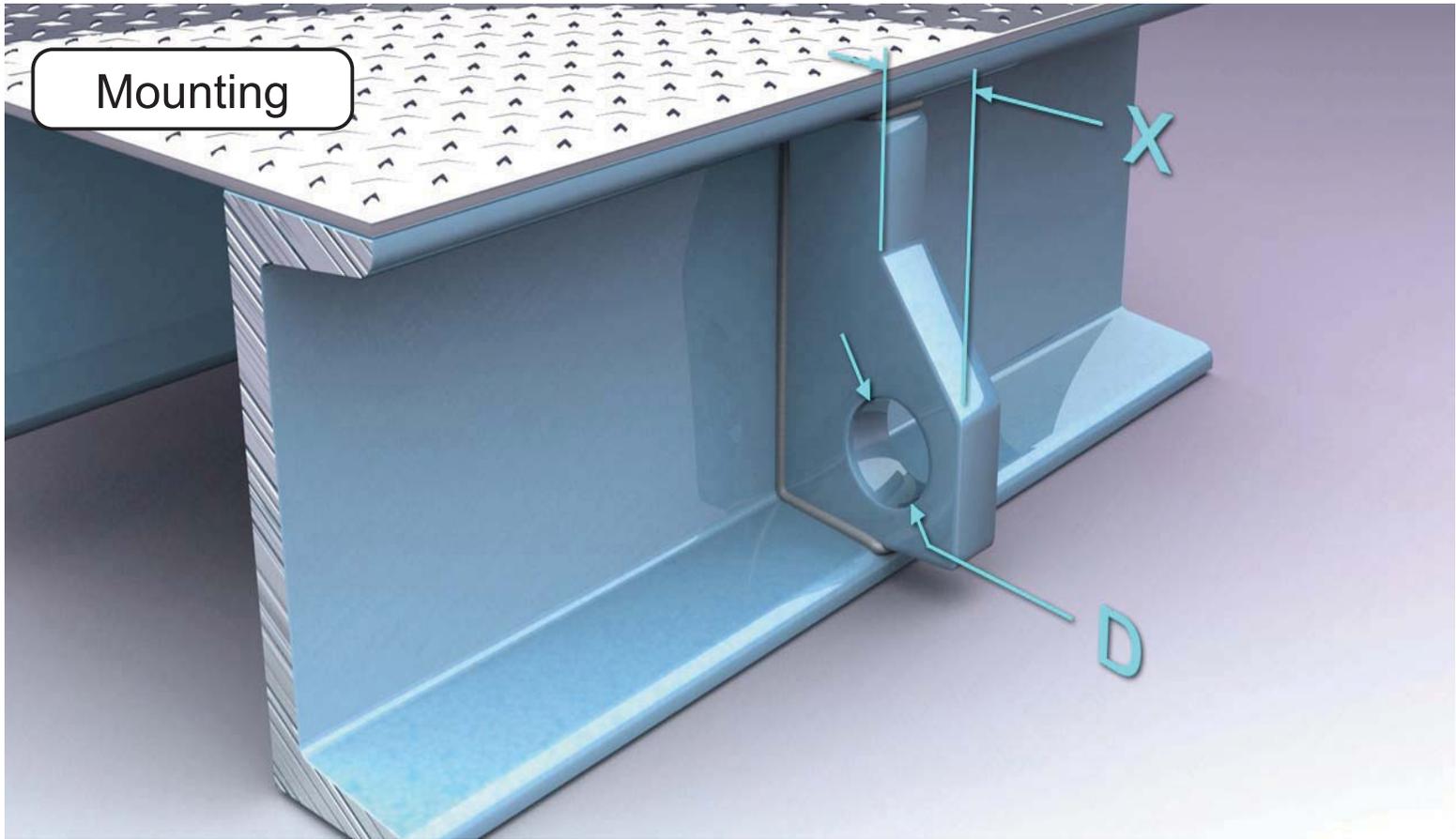
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UNITS IMPERIAL

TAG:AHU-1

DWG NO
REVISION

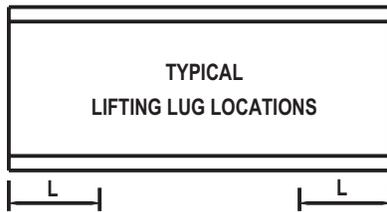
45451DT36





The unit is designed to be mounted on a roof curb.

Lifting lugs are typically located at one quarter of the overall unit length from the end, or 12 inches from the end, whichever is greater.



CHANNEL SIZE	"X"	"D"
4"	1.29"	1.125"
6"	1.23"	1.25"
8"	1.46"	1.25"
10"	1.14"	1.25"
12"	2.09"	1.25"

TAG:AHU-1

PROJECT:

DRAWN BY
DATE

DW
2012-11-27

Canadian Space Agency

JOB NO. 45451
UNITS IMPERIAL

DWG NO
REVISION

45451DT37

