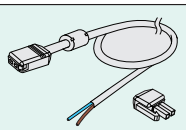
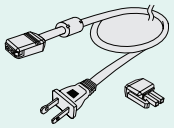
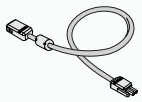
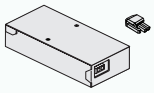
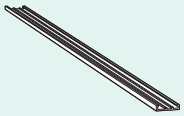
Accessories

Item	Housing Color	Dimensions	Item Number	Philips 12NC		
Leader Cable (includes terminator), UL / cUL	Black	3 m (10 ft)	108-000032-10	912400130570		For connection to standard junction box
Leader Cable (includes terminator), CE / CCC	Black	3 m (10 ft)	108-000032-11	912400130571		
Leader Cable (includes terminator), UL / cUL	White	3 m (10 ft)	108-000032-12	912400130572		
Leader Cable (includes terminator), CE / CCC	White	3 m (10 ft)	108-000032-13	912400130573		
Leader Cable (includes terminator), UL, US Plug	Black	2.4 m (8 ft)	108-000032-14	912400130574		For portable installations
Jumper Cable, UL / cUL	White	305 mm (1 ft)	108-000033-06	910503700895		Depending on the installation's design, you may need jumper cables to add space between fixtures
		1.5 m (5 ft)	108-000033-07	910503700896		
Jumper Cable, CE / CCC	White	305 mm (1 ft)	108-000033-08	910503700897		
		1.5 m (5 ft)	108-000033-09	910503700898		
Wiring Compartment (includes terminator)	White	2.9 x 6.8 x 16 cm (1.17 x 2.7 x 6.32 in) *(H x W x L)*	120-000076-01	912400130576		Can be used for direct connection to conduit
Mounting Track	White	1219 mm (4 ft)	120-000125-00	910503701788		Optional mounting track ensures straight runs of fixtures

Use Item Number when ordering in North America.

Compatible Dimmers†

Supplier	Part Number	Description	Voltage
Philips	913701252701	Captivation Phase Dimmer DC-DPD-I-1S-101	120 VAC
Philips	913703021009	DTE310	230 VAC
Philips	912400133633	Data Adapter, DALI to ELV, DigiDim 452	230 VAC
Philips	913701252701	Captivation Phase Dimmer DC-DPD-I-1S-101	277 VAC
Philips Strand	A21 with IGBT module	A21 Dimmer Cabinet with IGBT Dimmer Module	120 VAC
Philips Strand	A21 with IGBT module	A21 Dimmer Cabinet with IGBT Dimmer Module	277 VAC
Lutron	NTELV-600	Nova T Electronic Low Voltage Dimmer	120 VAC
Lutron	PHPM-PA-DV-WH	Phase-Adaptive Power Module	120 VAC
Lutron	PHPM-PA-DV-WH	Phase-Adaptive Power Module	277 VAC

† These dimmers have been tested in our lab and found to be compatible with this product. All installations are different. We highly reccommend performing a full mockup of every lighting circuit, including all luminaires and controls, to test for the desired dimming range. Visit http://1.usa.gov/1g3cGfs for more information.

Submittal Cover Sheet

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

No.: 23 36 16
Job: 3556
MIAMI U NORTH QUAD
501 E. HIGH ST
OXFORD, OH 45056

SUBJECT	SUBMITTED DATE	SPECIFICATION SECTION	REVISION
VAV TERMINAL BOXES		23 36 16	1

RESPONSIBLE CONTRACTOR

M GROTHAUS
BRUNER
3637 LACON ROAD
HILLIARD, OH 43026

SUPPLIER

MUSSUN SALES
901 ENGLESIDE DRIVE
COLUMBUS, OH 43215

Tel: 614-294-4822 Fax: 614-294-5435

MANUFACTURER

TITUS

REMARKS

BRUNER

Reviewed for general conformance with the design concept of the Project and general compliance with the information given in the contract documents.

Reviewed By: Ben Sleeper
Date: 9/2/15

Space Below Reserved For Architect's Review Stamp

WE HEARBY STATE THAT THIS DOCUMENT HAS BEEN REVIEWED FOR CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS. THIS APPROVAL IN NO WAY RELEASES THE SUBCONTRACTOR/SUPPLIER FROM HIS RESPONSIBILITY TO ADHERE TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS INCLUDING ALL DIMENSIONS AND QUANTITIES.

- [X] REVIEWED
- [ ] REVIEWED AS NOTED
- [ ] NOT REVIEWED
- [ ] CORRECT AND RESUBMIT
- [ ] FOR RECORD ONLY

W.T. SUBMITTAL NO. 233616-0002-R0
THE WHITING-TURNER CONTRACTING CO.

BY. JS DATE. 9/3/15

August 28, 2015

Titus: Re-Submittal

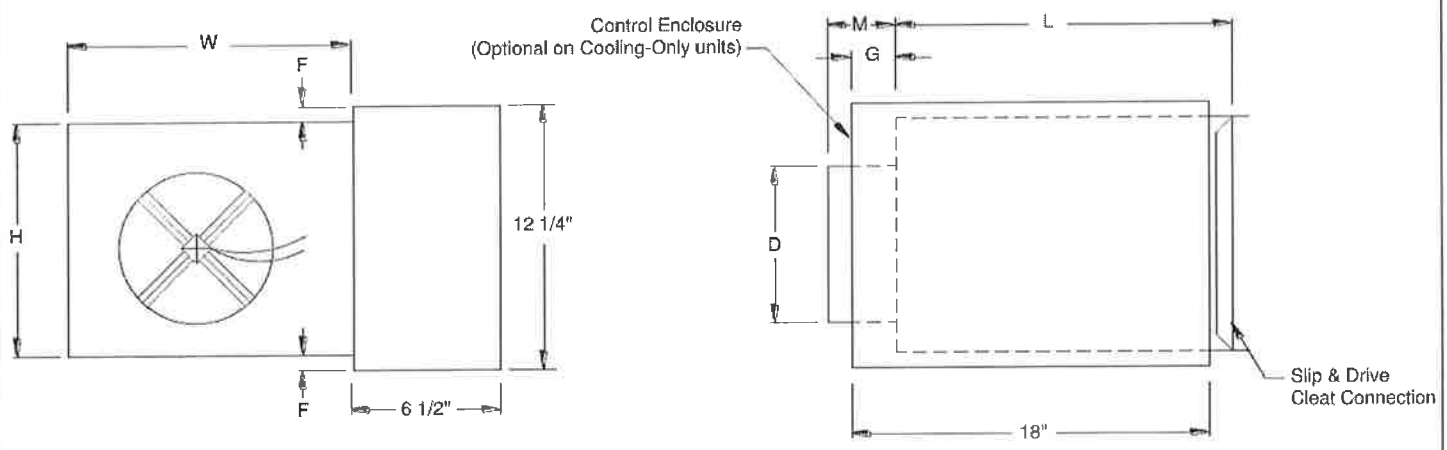
Project:	Martin Dining Hall Miami University
Product:	VAV Terminals
Contractor:	Bruner Corp.
Submitted by:	Joe Stukey Mussun Sales Inc. 901 Ingleside Ave. Columbus Ohio 43215 614-294-4822 jstukey@mussun.com

Titus Submittal

DESV-1.0 6-23-15

DESV

Single Duct Terminal Unit
Direct Digital Control, Pressure Independent



Right hand unit shown. All dimensions are in inches.

Inlet Size	CFM Range	D	F	G	H	L	M	W
4	0-225	3 7/8	2 1/8	7 3/8	8	15 1/2	5 3/8	12
5	0-350	4 7/8	2 1/8	7 3/8	8	15 1/2	5 3/8	12
6	0-500	5 7/8	2 1/8	7 3/8	8	15 1/2	3 3/8	12
7	0-650	6 7/8	1 1/8	7 3/8	10	15 1/2	3 3/8	12
8	0-900	7 7/8	1 1/8	7 3/8	10	15 1/2	3 3/8	12
9	0-1050	8 7/8	-	5 3/8	12 1/2	15 1/2	3 3/8	14
10	0-1400	9 7/8	-	5 3/8	12 1/2	15 1/2	3 3/8	14
12	0-2000	11 7/8	-	5 3/8	15	15 1/2	3 3/8	16
14	0-3000	13 7/8	-	3 3/8	17 1/2	15 1/2	3 3/8	20
16	0-4000	15 7/8	-	3 3/8	18	15 1/2	3 3/8	24
24 x 16	0-8000	23 7/8 x 15 7/8	1 1/8	5 3/8	18	15	3 3/8	38

Accessories (Optional)

Check ☑ if provided.

- ☐ 24 V Control Transformer
- ☐ Dust Tight Enclosure Seal
- ☐ Fibre Free Liner
- ☐ ½" EcoShield Liner
- ☑ ½" Fibre Free Liner
- ☐ 1" Fiberglass Liner
- ☐ 1" EcoShield Liner
- ☐ 1" Fibre Free Liner
- ☐ Low Leakage Seal/Test/Certify
- ☐ SteriLoc Liner
- ☐ UltraLoc Liner
- ☐ ½" EcoShield Liner (Foil Face)
- ☐ 1" EcoShield Liner (Foil Face)
- ☐ Disconnect Switch
- ☐ Hanger Brackets
- ☐ Removable Air Flow Sensor
- ☑ Bottom Access Door
- ☐ OSP & IBC Certification
- ☐ _____

General Description

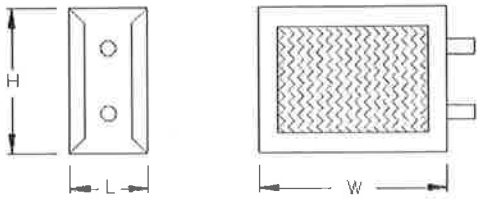
- Heavy gauge steel housing. Mechanically sealed and gasketed, leak resistant construction. Less than 2% of nominal cfm at 1.5" sp wg.
- Dual density internal insulation, treated to resist air erosion. Meets requirements of NFPA 90A and UL 181.
- Rectangular discharge opening is designed for slip and drive cleat duct connection.
- Multipoint center averaging inlet velocity sensor.
- Digital control packages can be factory mounted by Titus.
- Choice of right hand or left hand control location.
- Model DESV can be installed horizontally, vertically, or at any angle. Operation is not affected by position.
- Gauge tees for cfm measurement.
- OSHPD Seismic Certification: OSP-0352-10

Accessories (Optional)

☑ Hot Water Coil Section

- Aluminum ripple fins, 10 per inch
- Coil pipe connections are male, sweat, type "L" copper. Connection sizes are ½" OD for 1 row coil unit sizes 04-08. All other coils have $^{7}/_{8}$" OD.
- Coil is installed at discharge of unit.
- On units with attenuators, coil are installed at the discharge of attenuator.

☐ 1 Row
☑ 2 Row
☑ 3 Row
☐ 4 Row



☐ Electric Coil Section ☐ Optional SCR Controlled Electric Heater ☐ Optional Lynergy Controlled Electric Heater

Standard Features

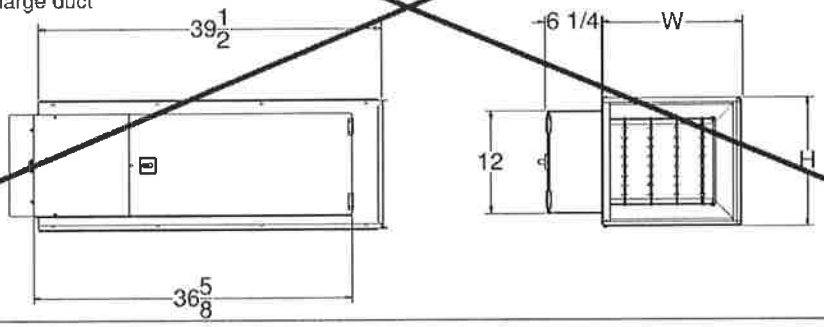
- Single side access to low voltage, high voltage, and electric heater controls.
- Automatic reset thermal cutouts, one per element
- Manual reset secondary protection.
- Positive pressure flow switch
- Magnetic contactor for each step.
- Slip and drive cleat discharge duct connection.

Options

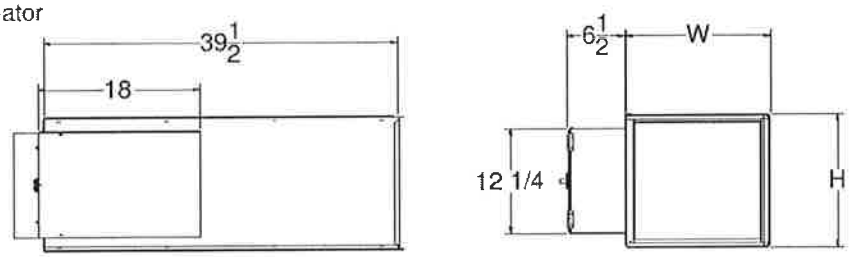
☐ Fuse Block
☐ Disconnect switch, door interlock type
☐ Dust tight construction
☐ Mercury contactors

Supply Voltage

☐ 208V, 1 ph, 60Hz
☐ 240V, 1 ph, 60Hz
☐ 277V, 1 ph, 60Hz
☐ 208V, 3 ph, 60Hz
☐ 480V, 3 ph, 60Hz (4 wire wye standard)



☑ Integral Sound Attenuator



Inlet Size	H	W	Water Coil	
			L (1-2 Row)	L (3-4 Row)
4	8	12	5	7 1/4
5	8	12	5	7 1/4
6	8	12	5	7 1/4
7	10	12	5	7 1/4
8	10	12	5	7 1/4
9	12 1/2	14	5	7 1/4
10	12 1/2	14	5	7 1/4
12	15	16	5	7 1/4
14	17 1/2	20	7 1/2	9 3/4
16	18	24	7 1/2	9 3/4
24 x 16	18	38	5	7 1/4

The total length of the DESV unit is the summation of the unit length (with or without attenuator) and the length of the optional water coil.

This submittal is meant to demonstrate general dimensions of this product. The drawings are not meant to detail every aspect of the product. Drawings are not to scale. Titus reserves the right to make changes without written notice.

Single Duct Terminal Unit Schedule

Tag	Model	Size		CFM		Static Pressure			NC Levels		Hot Water Heat Coil										
		Unit	Outlet	Max	Min	Inlet	Down	Min	Rad	Dis	CFM	MBH	EAT	EWT	LAT	APd	GPM	LWT	WPd	Rows	FPI
0-01	DESV	06	12x8	300	90	1	0.5	0.24	14	11	150	6	55	130	89.3	0.16	0.7	113.9	0.07	2-RH	10
0-02	DESV	06	12x8	170	55	1	0.5	0.09	-	-	85	4	55	130	94	0.06	0.4	111.8	0.02	2-RH	10
0-03	DESV	12	16x15	1350	405	1	0.5	0.4	19	18	675	21	55	130	84.2	0.39	2.2	110.4	0.69	2-RH	10
0-04	DESV	12	16x15	1350	405	1	0.5	0.4	22	18	675	21	55	130	84.2	0.39	2.2	110.4	0.69	2-RH	10
0-05	DESV	12	16x15	1350	405	1	0.5	0.4	22	18	675	21	55	130	84.2	0.39	2.2	110.4	0.69	2-RH	10
0-06	DESV	10	14x13	840	255	1	0.5	0.36	19	17	420	16	55	130	91	0.35	2.2	114.9	0.58	2-RH	12
0-07	DESV	10	14x13	840	255	1	0.5	0.36	19	17	420	16	55	130	91	0.35	2.2	114.9	0.58	2-RH	12
0-08	DESV	06	12x8	175	55	1	0.5	0.09	-	-	90	4	55	130	92.9	0.07	0.4	111.3	0.02	2-RH	10
0-09	DESV	08	12x10	510	155	1	0.5	0.38	18	15	420	17	55	130	92	0.36	2.1	113.8	0.57	3-RH	10
0-10	DESV	06	12x8	200	60	1	0.5	0.12	10	-	100	4	55	130	87.7	0.08	0.3	106.1	0.01	2-RH	10
0-11	DESV	08	12x10	350	105	1	0.5	0.14	13	13	175	6	55	130	88.7	0.13	0.6	108.5	0.07	2-RH	10
0-12	DESV	08	12x10	415	125	1	0.5	0.21	15	14	210	9	55	130	92.3	0.2	0.9	111	0.15	2-RH	12
0-13	DESV	06	12x8	240	75	1	0.5	0.16	11	10	120	5	55	130	90	0.11	0.5	111.6	0.03	2-RH	10
0-14	DESV	12	16x15	1120	340	1	0.5	0.29	18	17	560	19	55	130	85.6	0.28	1.8	109.1	0.46	2-RH	10
1-01	DESV	10	14x13	830	250	1	0.5	0.3	19	17	415	13	55	130	84.7	0.29	1.4	110.7	0.24	2-RH	10
1-02	DESV	12	16x15	1245	375	1	0.5	0.35	19	17	625	20	55	130	84.7	0.34	2	109.7	0.57	2-RH	10
1-03	DESV	10	14x13	830	250	1	0.5	0.3	19	17	415	13	55	130	84.7	0.29	1.4	110.7	0.24	2-RH	10
1-04	DESV	12	16x15	1245	375	1	0.5	0.35	19	17	625	20	55	130	84.7	0.34	2	109.7	0.57	2-RH	10
1-05	DESV	06	12x8	300	90	1	0.5	0.24	14	11	150	5	55	130	86.1	0.16	0.5	109.6	0.03	2-RH	10
1-06	DESV	10	14x13	825	250	1.25	0.5	0.44	19	17	550	24	55	130	95	0.43	3.3	115.4	0.98	3-RH	10
1-07	DESV	08	12x10	450	135	1	0.5	0.21	15	15	225	8	55	130	85.9	0.2	0.7	108.3	0.09	2-RH	10
1-08	DESV	14	20x18	1715	515	1	0.5	0.33	17	14	860	29	55	130	85.6	0.31	2.8	109.4	0.76	2-RH	10
1-09	DESV	12	16x15	1460	440	1	0.5	0.45	20	18	730	23	55	130	83.6	0.44	2.4	110.9	0.81	2-RH	10
1-10	DESV	12	16x15	1375	415	1.25	0.5	0.61	19	18	825	36	55	130	95.1	0.6	4.9	115.2	2.45	3-RH	10
1-11	DESV	06	12x8	300	90	1	0.5	0.24	14	11	150	5	55	130	86.1	0.16	0.5	109.6	0.03	2-RH	10
1-12	DESV	12	16x15	1545	455	1.25	0.5	0.74	20	19	760	33	55	130	94.5	0.73	3.7	112.2	1.41	3-RH	10
1-13	DESV	14	20x18	1960	590	1	0.5	0.42	18	14	980	31	55	130	84.5	0.38	3.2	110.2	0.99	2-RH	10

1-14	DESV	10	14x13	945	285	1	0.5	0.37	20	18	475	15	55	130	83.1	0.36	1.5	110.5	0.27	2-RH	10
1-15	DESV	14	20x18	1690	510	1.25	0.5	0.48	17	14	815	40	55	130	100	0.45	4.8	113.2	1.88	3-RH	10
1-16	DESV	08	12x10	410	125	1.25	0.5	0.26	15	14	350	15	55	130	95.4	0.25	2.1	115.2	0.57	3-RH	10
1-17	DESV	08	12x10	350	105	1	0.5	0.16	13	13	175	8	55	130	94.5	0.16	0.8	111.1	0.12	2-RH	12
1-18	DESV	06	12x8	230	70	1	0.5	0.15	11	-	180	7	55	130	89.8	0.1	1.1	117.5	0.16	2-RH	10
1-19	DESV	14	20x18	1725	520	1	0.5	0.34	17	14	865	29	55	130	85.5	0.31	2.8	109.4	0.76	2-RH	10
1-20	DESV	14	20x18	1725	520	1	0.5	0.34	17	14	865	29	55	130	85.5	0.31	2.8	109.4	0.76	2-RH	10
1-21	DESV	10	14x13	1020	310	1.25	0.5	0.63	22	19	510	21	55	130	93	0.62	2.2	110.7	0.44	3-RH	10
1-22	DESV	10	14x13	650	195	1.25	0.5	0.3	17	17	365	18	55	130	99.5	0.29	2.2	113.8	0.44	3-RH	10
1-23	DESV	06	12x8	150	45	1	0.5	0.07	-	-	75	3	55	130	93.1	0.05	0.3	109.1	0.01	2-RH	10

Notes:
1. Selections are based on Titus as Manufacturer.
2. All performance based on tests conducted in accordance with ASHRAE 130-2008 and AHRI 880-2008.
3. All NC levels determined using AHRI 885-2008 Appendix E.
4. All airflow, pressure losses and heating performance values have been corrected for altitude.
5. Units of measure: dimensions (in), airflow (cfm), water flow (gpm), air pressure (in wg), water head losses (ft) and temperatures (degF).
6. Water pressure drop (WPd) units is in ft. water.

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Submittal Cover Sheet

No.: 23 75 00 (7)
Job: 3556
MIAMI U NORTH QUAD
501 E. HIGH ST
OXFORD, OH 45056

SUBJECT	SUBMITTED DATE	SPECIFICATION SECTION	REVISION
AHU - MARTIN HALL	07/06/2015	23 75 00	0

RESPONSIBLE CONTRACTOR

M GROTHAUS
BRUNER
3637 LACON ROAD
HILLIARD, OH 43026

SUPPLIER

ENVIRONMENTAL COMFORT
909 KING AVENUE
COLUMBUS, OH 43201

Tel: 614-299-6464 Fax: 614-299-7653

MANUFACTURER

TEMTROL

REMARKS

BRUNER

Reviewed for general conformance with the design concept of the Project and general compliance with the information given in the contract documents.

Reviewed By: Mark Grothaus
Date: 7/6/15

Space Below Reserved For Architect's Review Stamp

WE HEARBY STATE THAT THIS DOCUMENT HAS BEEN REVIEWED FOR CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS. THIS APPROVAL IN NO WAY RELEASES THE SUBCONTRACTOR/SUPPLIER FROM HIS RESPONSIBILITY TO ADHERE TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS INCLUDING ALL DIMENSIONS AND QUANTITIES.

- [X] REVIEWED
- [ ] REVIEWED AS NOTED
- [ ] NOT REVIEWED
- [ ] CORRECT AND RESUBMIT
- [ ] FOR RECORD ONLY

W.T. SUBMITTAL NO. 237500-0004-R0
THE WHITING-TURNER CONTRACTING CO.

BY. JS DATE. 7/6/15

Environmental Comfort, LLC

909 King Ave., Suite 200, Columbus, OH 43212
Phone (614) 299-6464, Fax (614) 299-7653

Equipment Submittal

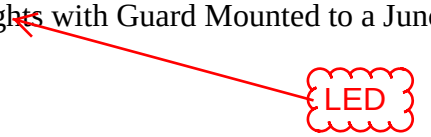
To:	***Bruner Corporation***	***Project Name:***	***Miami University – Martin Hall***
		Date:	***7/1/2015***
From:	***Daniel Pagán***	***Location:***	***Oxford, OH***
		Specification:	***23 75 00***

We are submitting the following equipment for approval on the subject project.
Please review and contact me with any questions.

Temtrol – ITF Series Air Handling Units

Three (3) – Air Handling Units with the Following Options:

- Double Wall Construction with 3" Thick Walls w/ Fiberglass Insulation
- 16 ga. Exterior with 20 ga. Galvanized Interior Liner Access Doors as Specified
- Premium Efficient Supply and Return Motors w/ Factory Mounted Variable Frequency Drives
- Direct Drive Plenum Fan
- Chilled Water Cooling Coil
- Hot Water Heating Coil
- Stainless Steel Drain Pan
- 2" – MERV 8 Pre Filters, 12" Cartridge Filters – MERV 13 65% Efficient (2 Sets)
- GFI Outlet and Marine Type Lights with Guard Mounted to a Junction Box
- One Year **Parts Only** Warranty



Notes:

- **All Ruskin damper assemblies are only available in 6" increments. All openings to be coordinated with installing contractor.**
- **All temperature controls, control valves, and airflow monitoring stations are not included in our pricing and are to provided and field installed by others.**
- **All internal piping and interconnecting wiring to be provided by installing contractor.**
- **1st year labor warranty provided by others**

Prepared By:

Daniel Pagán

Temtrol
Phone - 405-263-7286 Fax - 405-263-4924

JOB: **MIAMI UNIVERSITY - MARTIN HALL**

TEMTROL REP: **ENVIRONMENTAL COMFORT, LLC.**

ORDER NUMBER: **T020238**

GENERAL:

- *Factory fabricated (ITF) indoor air handling unit. (One piece construction unless noted by a demount on unit drawing). All units (single and multi-sectioned) ship fully assembled and sealed unless they exceed maximum shipping capacities. Multi-sectioned units, shipped in one piece, will require field disassembly by the installing contractor. All unit openings will be sealed for "shipping". Units will ship on an open flat bed trailer and require off loading within three (3) hours of arrival at the jobsite or be subjected to demurrage fees. Upon arrival, units shall be cleaned (if necessary) and inspected by the contractor. Damaged or missing components must be noted on the bill of lading. Units should be properly stored indoors per Temtrol Operation and Maintenance manual. If units are stored for an extended period of time, routine maintenance is required.*
- *Multi-sectioned units with factory furnished lights or electrical conduit will be furnished with flex connections at each demount. Electrical connections will be re-connected by installing contractor after the unit is reassembled and set in place.*
- *Right and left determined by facing in the direction of air flow with air hitting the back of your neck.*
- *All dimensions in inches.*
- *Steel grating provided over all floor penetrations where access is provided.*
- *The Air Handling Unit schedule indicates total static pressure only. All internal losses and available external static pressure are shown on the static pressure summary sheet in this submittal. Written verification of external static pressure is required by the engineer prior to release for production to prevent improper fan selection.*

UNIT BASE / FLOOR / FRAMEWORK:

- *Unit base frame manufactured with heavy gauge rectangular structural tubing and coated with an air dried (phenolic) corrosion inhibitive finish. Perimeter base rails are fitted with lifting lugs at the unit or section (if demounted) corners. "Double Bottom" floor includes heavy gauge C-Channel and structural angle support members. The floor cavity is insulated with closed cell spray foam insulation and sealed for airtight / watertight application. Foam is 0-, 0-, (Non VOC) UL 94HF1 rated. Upper perimeter support "mechanical frame" is gasketed (thermal break) prior to attachment of the unit panels. See unit data sheet for specified floor and / or frame construction.*

EXTERIOR PANEL (Painted):

- *Exterior panels are mill coated on both sides with a Polyceram 3200 coating system including polyester resin for long term corrosion resistance which meets or exceeds the following standards. (ASTM B-117) Salt Spray Resistance 5% salt fog at 95 degrees F. Passes 2,500 hrs. (ASTM D-2247) Humidity Resistance 100% salt fog at 95 degrees F. Passes 2,500 hrs. The complete exterior is painted with a finish coat of industrial air-dried (alkyd) enamel. Unless otherwise indicated on unit data sheet, exterior color will be Sandstone.*

  Panels are fabricated using state of the art, robotic manufacturing cells to guarantee an air tight precision fit. Formed heavy gauge panels are insulated and encased with an internal liner then fastened to the gasketed (thermal break) upper "mechanical frame" assembly. All panels are completely removable from the exterior. See unit drawings for total wall thickness, material and applicable inner liner.

INSULATION / LINERS (DOUBLE WALL CONSTRUCTION):

- *Unit panels and liners are filled with a dual density fiberglass (R4.2 per inch thick). The insulation has an effective thermal conductivity (C) of .24 (BTU in./sq.ft. F°) and a noise reduction coefficient (NRC) of 0.70 per one inch thick (based on a type "A" mounting). Coefficients meet or exceed a 3.0 P.C.F. density material rating. Insulation meets erosion requirements of UL 181 facing the air stream and fire hazard classification of 25/50 (per ASTM-84 and UL 723). See unit drawing for total wall thickness and internal double wall liners are as indicated on unit drawings.*

FANS:

- *Type PF-09 (Plug Fan) SWSI direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified class III as required. Fans are rated in accordance with and certified by AMCA for performance. All fans are selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan is selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed. Each fan/motor assembly is dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .022" per second peak, filter in (.55mm per second peak, filter in) For optional fan construction see unit data sheet.*

ISOLATION BASE:

- *Fans, motors and drives are internally spring isolated on a phenolic coated, structural steel base complete with UV Rated flex connections. Isolators are Amber / Booth seismically restrained type (Suitable for Zone 4 applications) See unit data sheet (fan performance curve) for specified deflection.*

PREMIUM EFFICIENCY MOTORS

MOTORS:

- *BALDOR: NEMA Design B T-FRAME motors are mounted on an adjustable base. The motors are tested to IEEE standard 112 test method B and NEMA MG 12.58.2 and 12.59 table 12-10. See unit data sheet (fan performance curve) for voltage, rpm, and efficiencies. Baldor motors feature ISR (Inverter spike resistant) magnetic wire. All motors meet or exceed the requirements of the Energy Policy Act of 1992.*

SHAFT:

- *Shaft Grounding Kit: Shaft grounding brush assembly protects motor bearings from electrical discharge machining due to stray shaft currents. See unit data sheet for applicable unit motor and attached cut sheet.*

FANWALL® / FANS:

- *The multiple fan array systems include multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified class III as required. Fans are rated in accordance with and certified by AMCA for performance. All fans are selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan array is selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed. Each fan/motor cube or cell includes a minimum 10 gauge, G 90 Galvanized steel intake wall, .100 aluminum spun fan inlet funnel, and a 7 gauge steel motor support plate rail and structure. Each fan/motor assembly is dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .03" per second peak, filter in (.55mm per second peak, filter in) For optional fan construction see unit data sheet. NOTE: After units are set in place and prior to startup, fan wheels should be hand rotated to check for clearance between wheel and fan inlet cone. If adjustment is required; installing contractor should refer to the Temtrol Operation and Maintenance manual provided.*

FANWALL® / MOTORS:

- *FANWALL motors are TEAO premium efficiency and selected at the specified operating voltage and rpm as indicated on the fan performance curves. Motors are (NEMA MG-1 Part 30 and 31, section 4.4.2.rated) manufactured by Baldor (or as indicated on unit data sheets) for use in multiple fan arrays that operate at varying synchronous speeds as driven by an approved VFD. All motors include permanently sealed minimum L10-500,000 hr bearings and the Baldor shaft grounding brush assembly to protect the motor bearings from electrical discharge machining by safely channeling harmful shaft currents to ground. Motors have a 1.15 service factor, Class H rated wire, Class H rated varnish and Class F insulation. Motors are rated for 120 Hz continuous operation.*

FANWALL® Flow Cone (Air monitoring device):

- *FANWALL® Flow Cone provided as indicated on unit data sheet. The flow measuring system consists of a flow measuring station with two static pressure taps located at the throat of the fan inlet cone. Optional accessories are indicated on unit data sheet.*

VFD:

- *VFD is provided by Temtrol and Factory Mounted. See attached VFD cut sheet for specific options provided.*

ELECTRICAL:

- *Unless indicated on the unit data sheet, all electrical and automatic control devices are to be furnished and installed in the field by OTHERS. See unit data sheet for specified electrical requirements.*

COILS:

- *All coil assemblies are leak tested under water at 315 PSIG. PERFORMANCE is CERTIFIED under AHRI Standard 410. Coils exceeding the range of AHRI standard rating conditions will be as noted on the coil computer printout. Coils are constructed of seamless copper tubing mechanically expanded into fin collars. Fins are die formed plate type. Headers are seamless copper with die formed tube holes. Intermediate tube supports supplied on coils over 44" fin length with an additional support every 42" multiple thereafter. See unit data sheet (coil performance physical data) for options as specified.*

- *Type WC (water coils) - Connections are male pipe thread (MPT) Schedule 40 Red Brass. Vents and drains are provided for complete coil drainage. Coils are suitable for 250 PSIG working pressure.*

CONDENSATE PAN:

- *The entire condensate pan / coil support assembly is fabricated from 16 gauge 304 stainless steel. The pan, recessed into the foam insulated-double bottom base is completely sealed. All pans are "Double Bottom" construction with welded corners. Note: Drain connections are standard 1-1/4" MPT connection unless noted on unit data sheet. Unless indicated on the unit drawing, pan is pitched towards a single drain connection as indicated on the unit drawing. Note: Units in excess of 160 inches in width may require drain connections on both sides of the unit or staggered connections on the same side. See unit drawings for drain locations.*

FILTERS / FILTER GAGE:

- *See unit data sheet for specific Filtration / Filter gage requirements.*

Dampers:

- *Control dampers feature .125" thick 6063T5 extruded aluminum frame, 6063T5 extruded aluminum airfoil type blades, 1/2" axels, molded synthetic bearings, flexible compression metal jamb seals and Ruskiprene blade edge seals mechanically locked into the blade edge. All damper linkage and jack shafting are concealed within the frame. Dampers are leakage and pressure rated per AMCA 500. Actuators are both furnished and mounted by OTHERS.*

Unit Data Sheet

Model Number: ITF-DHRE42

Report Created: 6/30/2015 2:36:10PM Submittal 02

Unit Tag: AHU-1
Serial Number: T020238-001-00
Job Number: J000052470

Job Name:	MIAMI UNIVERSITY - MARTIN HALL	**Unit Type:**	INDOOR
Rep. Firm:	ENVIRONMENTAL COMFORT, LLC.	**Unit Weight:**	22000 Lbs.
Rep. Contact:	DAN PAGAN @ 614-299-6464		
Temtrol Eng.:	JBJ		

Unit Notes

Unit Details

Exterior Casing: 16ga. Galvanized - Painted
Floor Material: 16ga. Galvanized
Sub Floor Material: 20ga. Galvanized
Base Size: 6 in.

Access Doors:

Quantity	Windows	T.O.S.L.	P.K.S.	Louvers
6	5	6	0	0

Static Pressure Summary

Supply

Description	Static
HEATING 5WC - 4 - 46.5 X 130 X 2 - 8 AL	0.16
COOLING 5WC - 6 - 46.5 X 130 X 6 - 10 AL	0.77
2" PLEATED FLAT 30%	0.50
12" CARTRIDGE W/HEADER 65%	1.00
O/A CD60 DAMPER	0.14
S/A OPENING	0.11
CABINET	0.14
Internal Static Pressure	2.82
Available External Static Pressure	3.68
Total Supply Static Pressure	6.50

Comment:

Return

Description	Static
E/A CD60 DAMPER	0.14
R/A OPENING	0.08
CABINET	0.13
Internal Static Pressure	0.35
Available External Static Pressure	2.65
Total Return Static Pressure	3.00

Electrical

VAC/PH/HZ: 208/3/60

Unless otherwise noted below all electrical and automatic control devices are furnished and installed by others in the field.
208/3/60 (SCCR) Short Circuit Current Rating @ __ KAIC
VFD(s) furnished by Factory for installation and wiring.
Guarded vapor-proof light fixture(s) with LED light bulb(s). Fixture locations shown on unit drawings are approximate.
All lights controlled by a single light switch. One GFI outlet provided.
120 volt power for lighting and/or GFI outlets shall be provided by Others
Motor Overload Panel with aux. contacts wired in series for field wiring to remote monitoring.
Single feed Overload Panel.
6” Digital Touch Screen with PLC, displays each individual fan CFM and total CFM.

Model Number: ITF-DHRE42

Report Created: 6/30/2015 2:36:10PM Submittal 02

Unit Tag: AHU-1
Serial Number: T020238-001-00
Job Number: J000052470

FWT-22-90 [RETURN FAN] - QTY 3

PHYSICAL

Array: Row x Column (QTY)	1 x 3 (3)
Airflow Monitor / QTY	
Cone Constant Pp	2710(Pp)^0.5
Back draft dampers / Qty	FBD-8 (3 Qty)
Elevation	0.00 ft
Motor / Frame / Qty	4.5 hp / 182T / 3
VAC/PH/HZ - RPM / Encl	208/3/60 - 1750/TEAO
Total Hp	13.5 hp

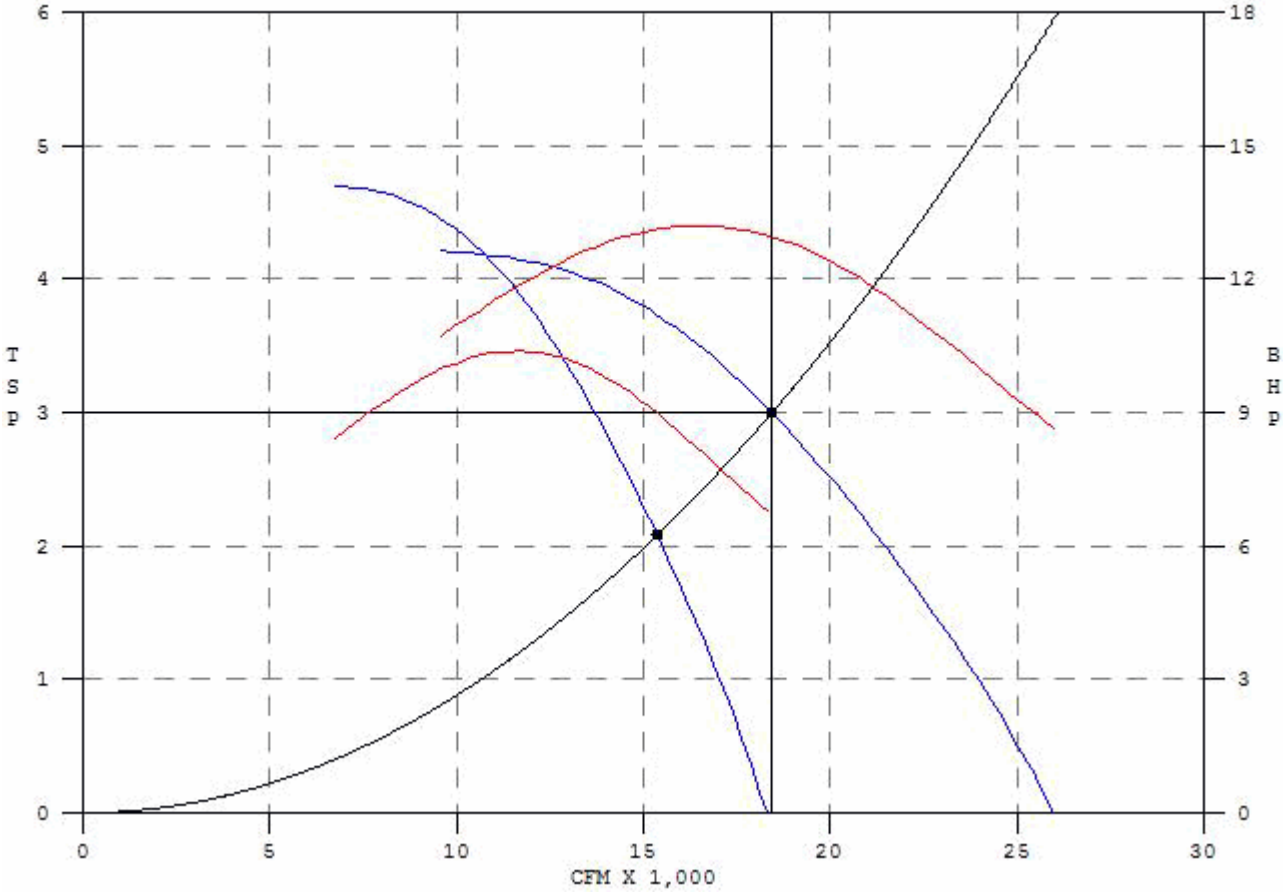
OPERATION

	100%	w/ Failed Fan
Total CFM:	18450 cfm	15368 cfm
CFM per fan:	6150.00 cfm	7684.00 cfm
TSP:	3.00 in. Wg.	2.08 in. Wg.
Fan RPM:	1717 rpm	1814 rpm
Active Cells:	3	2
BHP per fan:	4.31 hp	4.49 hp
Operating Hz:	59.7 Hz	63.1 Hz
Connected BHP:	12.94 hp	8.99 hp

SOUND OCTAVE BAND	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz	8000hz	A-Weighted
Inlet / Discharge	91 / 78	89 / 79	86 / 87	84 / 72	80 / 72	80 / 71	76 / 65	69 / 56	87 / 81

Comment:

-



Model Number: ITF-DHRE42

Report Created: 6/30/2015 2:36:10PM Submittal 02

Unit Tag: AHU-1
Serial Number: T020238-001-00
Job Number: J000052470

FWT-16-90 [SUPPLY FAN] - QTY 4

PHYSICAL

Array: Row x Column (QTY)	1 x 4 (4)
Airflow Monitor / QTY	
Cone Constant Pp	1490(Pp)^0.5
Back draft dampers / Qty	FBD-6 (4 Qty)
Elevation	0.00 ft
Motor / Frame / Qty	8 hp / 213T / 4
VAC/PH/HZ - RPM / Encl	208/3/60 - 3500/TEAO
Total Hp	32 hp

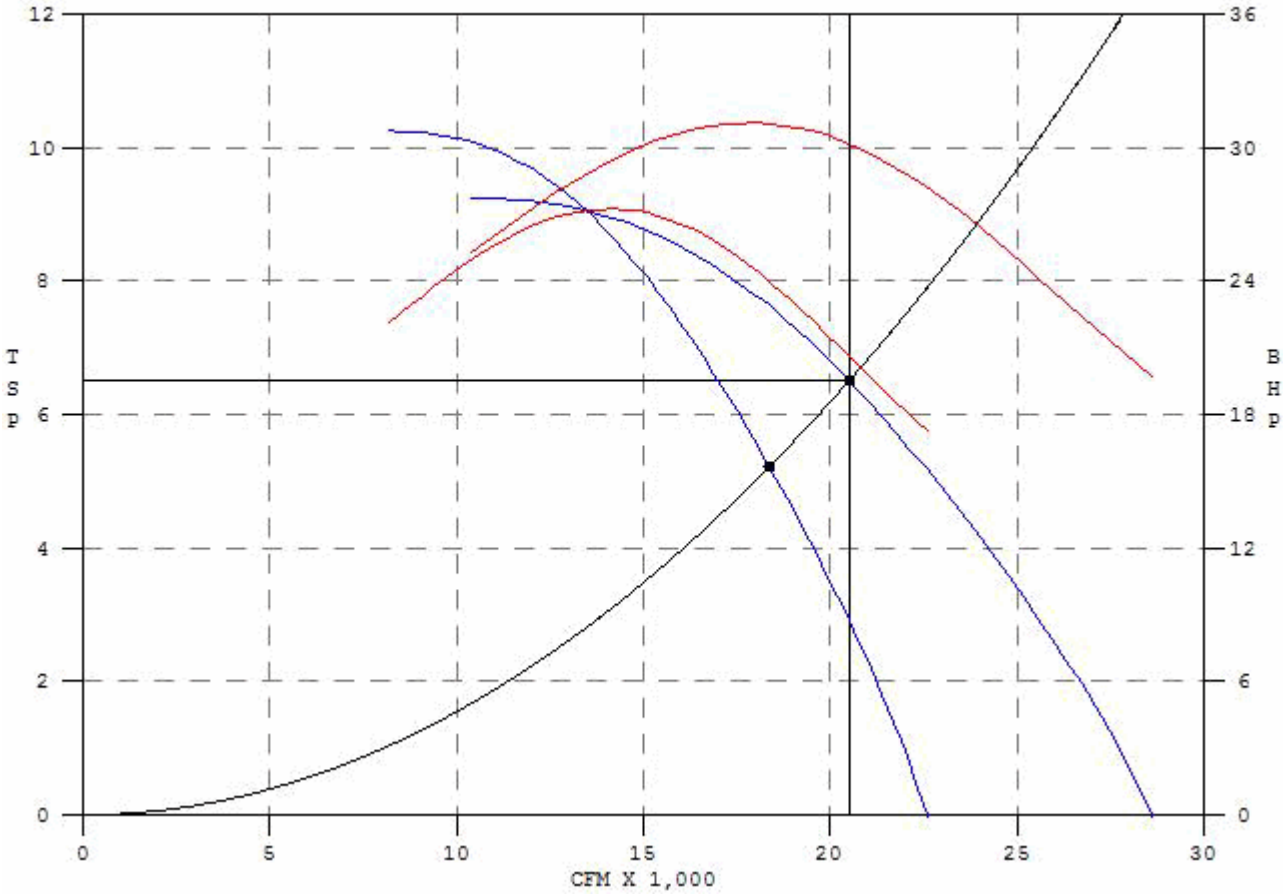
OPERATION

	100%	w/ Failed Fan
Total CFM:	20500 cfm	18371 cfm
CFM per fan:	5125.00 cfm	6123.67 cfm
TSP:	6.50 in. Wg.	5.22 in. Wg.
Fan RPM:	3418 rpm	3599 rpm
Active Cells:	4	3
BHP per fan:	7.54 hp	8.00 hp
Operating Hz:	58.3 Hz	61.3 Hz
Connected BHP:	30.17 hp	23.99 hp

SOUND OCTAVE BAND	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz	8000hz	A-Weighted
Inlet / Discharge	95 / 87	90 / 84	88 / 89	95 / 83	91 / 83	90 / 81	89 / 79	86 / 74	97 / 88

Comment:

-



Model Number: ITF-DHRE42

Unit Tag: AHU-1
Serial Number: T020238-001-00
Job Number: J000052470

Report Created: 6/30/2015 2:36:10PM Submittal 02

[Coil # 1] Hot Water Coil - (Qty. 1) 5WC - 4 - 46.5 x 130 x 2 - 8 AL

PHYSICAL

Total Face Area / FV :	42.0 / 488.0
Coil FH x FL:	46.50 X 130.00
Rows - FPI:	2 - 8
Serpentine:	0.50
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA GALV.
Sup.Conn - Qty / Size:	(1) 2-1/2" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 2-1/2" MPT SCH40 Red Brass Per Coil
Coating:	NONE

OPERATION

ACFM / SCFM - Alt.:	20,500 / 21,097 - Sea Level
EDB :	55 °F
LDB :	85.1 °F
Sensible Heat:	689,403 Btu/Hr
Fluid - %:	Water
EFT / LFT:	130 / 109.7 °F
GPM:	68.60
Fluid Velocity:	4.90 ft/s
FPD:	11.11 ft
APD:	0.16 in. Wg.
Hand:	RIGHT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.

[Coil # 2] Chilled Water Coil - (Qty. 1) 5WC - 6 - 46.5 x 130 x 6 - 10 AL

PHYSICAL

Total Face Area / FV :	42.0 / 488.0
Coil FH x FL:	46.50 X 130.00
Rows - FPI:	6 - 10
Serpentine:	1.00
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA 304 SS
Sup.Conn - Qty / Size:	(1) 3" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 3" MPT SCH40 Red Brass Per Coil
Coating:	NONE

Drain Pan - 139W x 42L 16 GA 304 SS RIGHT HAND

OPERATION

ACFM / SCFM - Alt.:	20,500 / 19,765 - Sea Level
EDB / EWB:	80 / 67 °F
LDB / LWB:	52.8 / 52.5 °F
Total Heat:	868,251 Btu/Hr
Sensible Heat:	592,244 Btu/Hr
Fluid - %:	Water
EFT / LFT:	44 / 58.1 °F
GPM:	122.90
Fluid Velocity:	4.60 ft/s
FPD:	17.13 ft
APD:	0.77 in. Wg.
Hand:	RIGHT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.

[Filter Bank # 1] Pre - 2" Pleated Flat - 30% / Final - 12" Cartridge w/Header - 65%

Type: Flat **Frames:** Galvanized **Location / Service:** Up Stream / Face Load

Bank Size: 48 H x 132 W **(Qty) Size:** (6)20x24 & (6)24x24

Face Area (ft²) / FV (fpm): 44.0 / 466

Filter Bank Gauge: Dwyer Model 2002

Media - Pre Filter	**APD:** 0.50	**Class:** II	**Supplied Sets:** 2 Sets	**Clips:**
Media - Final Filter	**APD:** 1.00	**Class:** II	**Supplied Sets:** 2 Sets	**Clips:**

Comment: Filter frames, media and holding clips are furnished by Factory.
-

30% - MERV 8
65% - MERV 13

Model Number: ITF-DHRE42

Report Created: 6/30/2015 2:36:10PM Submittal 02

Unit Tag: AHU-1
Serial Number: T020238-001-00
Job Number: J000052470

Openings

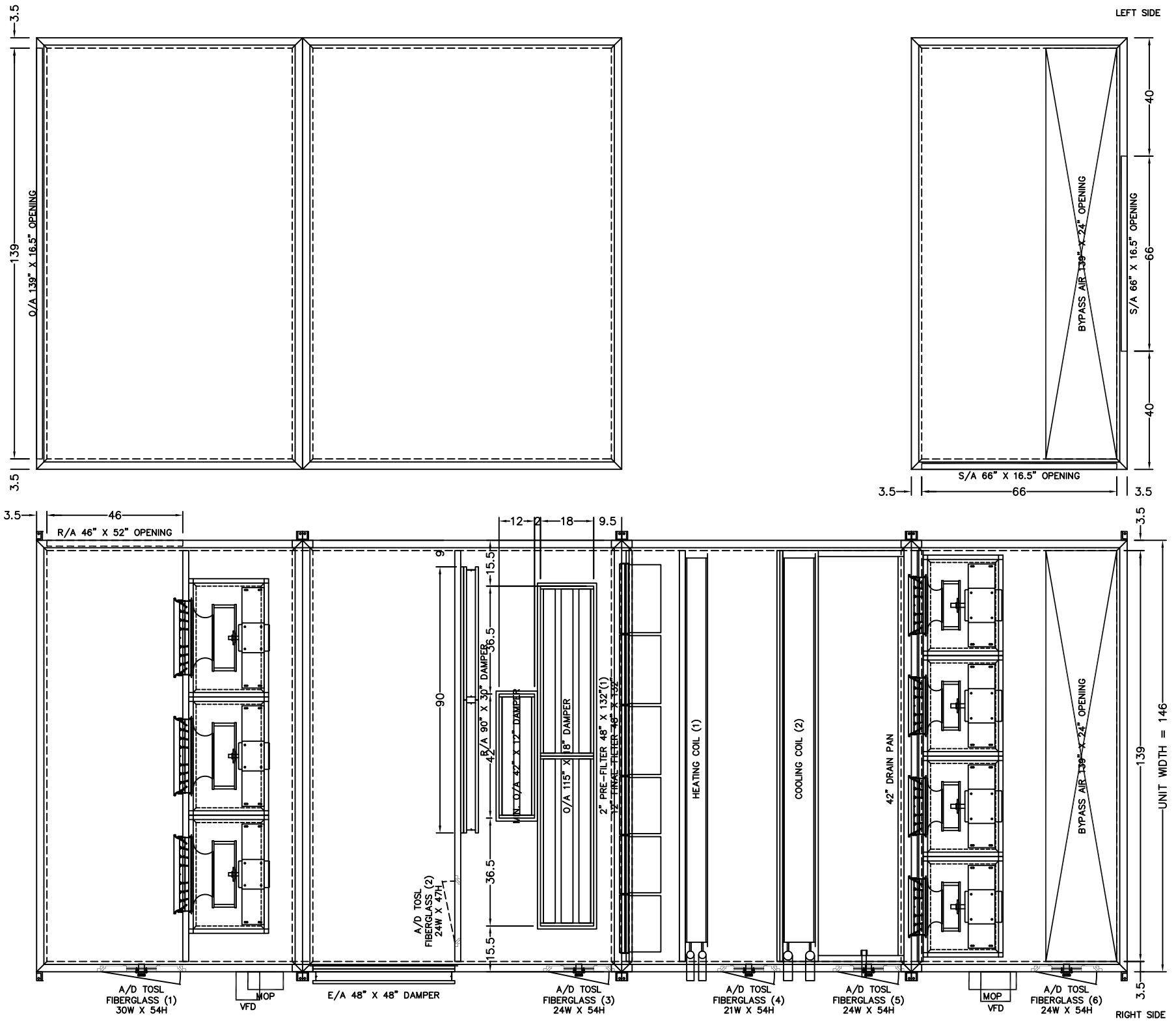
Description	Size (A x B)	Location	CFM	FV
R/A	46 x 52	Side - Left	18450	1,110
O/A	139 x 16.5	End - Intake	20500	1,287
S/A	66 x 16.5	Side - Right	10250	1,355
S/A	66 x 16.5	End - Discharge	10250	1,355
Bypass Air	139 x 24	Top	20500	884

Dampers

Description	Bank Size (AxB)	Location	CFM	FV	Model # / Action
R/A	90 x 30	Int - Vertical	18450	1132	CD50 / Parallel Left
O/A	115 x 18	Top	16400	1307	CD50 / Opposed
Min. O/A	42 x 12	Top	4100	1350	CD50 / Parallel Left
E/A	48 x 48	Side - Right	18450	1325	CD60 / Opposed

COORDINATE FINAL REQUIRED OPENING SIZES WITH INSTALLING CONTRACTOR.

DAMPER SIZES TO BE AS SHOWN ON H503. INCLUDE DIVIDER PLATE AS SHOWN FOR MIN OUTSIDE AIR AND ECONOMIZER OUTSIDE AIR FLOW STREAMS TO SUPPORT INSTALLATION OF AIR FLOW MEASURING STATION REQUIRED IN MIN OUTSIDE AIR FLOW STREAM.



DAMPER SIZES TO BE AS SHOWN ON H503 (REFER TO BULLETIN #3, DATED 4/24/15). INCLUDE DIVIDER PLATE AS SHOWN FOR MIN OUTSIDE AIR AND ECONOMIZER OUTSIDE AIR FLOW STREAMS TO SUPPORT INSTALLATION OF AIR FLOW MEASURING STATION REQUIRED IN MIN OUTSIDE AIR FLOW STREAM.

Temtrol
a Nortek Air Solutions Brand
PH (405) 263 7286 www.Temtrol.com

Job Name	MIAMI UNIVERSITY – MARTIN HALL				
Unit Tag	AHU–1			Unit Type	INDOOR
Rep Firm	ENVIRONMENTAL COMFORT, LLC.			Weight 22000 lbs	Box Qty 7
Rep Contact	DAN PAGAN @ 614–299–6464			Model No	ITF–DHRE42
Ver 2011.100	SAE JBJ	SERIAL No. T020238–001–00	Job No J000052470	Date m/d/y 06–30–15	Rev Rev 02

All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.

Unit Data Sheet

Model Number: ITF-DHRE20

Report Created: 6/30/2015 3:51:12PM Submittal 02

Unit Tag: AHU-2
Serial Number: T020238-002-00
Job Number: J000052471

Job Name:	MIAMI UNIVERSITY - MARTIN HALL	**Unit Type:**	INDOOR
Rep. Firm:	ENVIRONMENTAL COMFORT, LLC.	**Unit Weight:**	8000 Lbs.
Rep. Contact:	DAN PAGAN @ 614-299-6464		
Temtrol Eng.:	JBJ		

Unit Notes

Unit Details

Exterior Casing: 16ga. Galvanized - Painted
Floor Material: 16ga. Galvanized
Sub Floor Material: 20ga. Galvanized
Base Size: 7 in.

Access Doors:

Quantity	Windows	T.O.S.L.	P.K.S.	Louvers
6	4	6	0	0

Static Pressure Summary

Supply

Description	Static
HEATING 5WC - 6 - 45 X 64 X 2 - 8 AL	0.13
COOLING 5WC - 12 - 45 X 64 X 6 - 10 AL	0.67
2" PLEATED FLAT 30%	0.50
12" CARTRIDGE W/HEADER 65%	1.00
O/A CD60 DAMPER	0.13
S/A OPENING	0.06
CABINET	0.13
Internal Static Pressure	2.62
Available External Static Pressure	3.88
Total Supply Static Pressure	6.50

Return

Description	Static
E/A CD60 DAMPER	0.12
R/A OPENING	0.10
CABINET	0.10
Internal Static Pressure	0.32
Available External Static Pressure	1.68
Total Return Static Pressure	2.00

Comment:

Electrical

VAC/PH/HZ: 208/3/60

Unless otherwise noted below all electrical and automatic control devices are furnished and installed by others in the field.
208/3/60 (SCCR) Short Circuit Current Rating @ __ KAIC
VFD(s) furnished by Factory for installation and wiring.
Input power wiring to VFD's are not wired together for single point connection. Interconnection to be performed in the field by Others.
Guarded vapor-proof light fixture(s) with LED light bulb(s). Fixture locations shown on unit drawings are approximate.
All lights controlled by a single light switch. One GFI outlet provided.
120 volt power for lighting and/or GFI outlets shall be provided by Others
Motor Overload Panel with aux. contacts wired in series for field wiring to remote monitoring.
Single feed Overload Panel.

Model Number: ITF-DHRE20

Report Created: 6/30/2015 3:51:12PM Submittal 02

Unit Tag: AHU-2
Serial Number: T020238-002-00
Job Number: J000052471

[SUPPLY FAN] PF09-18 (Dual)-80 / CL III 2 Inch ITF Unit Fans

PHYSICAL

Motor / Frame / Eff:	7.5hp / 213T / NEMA Prem
VAC/PH/HZ - RPM / Encl:	208/3/60 - 1750/TEAO
Speed / Qty - Belts:	N/A(-) -
Mtr Max Inertial Load:	64 WR²
MtrShv / Bushing / Shaft:	N/A
FanShv / Bushing / Shaft:	N/A
Isolation / Deflection:	SWERT-2
Wheel Material / Inertia:	Steel / 13 WR²
Direct Drive:	YES
Max Fan Speed:	3862

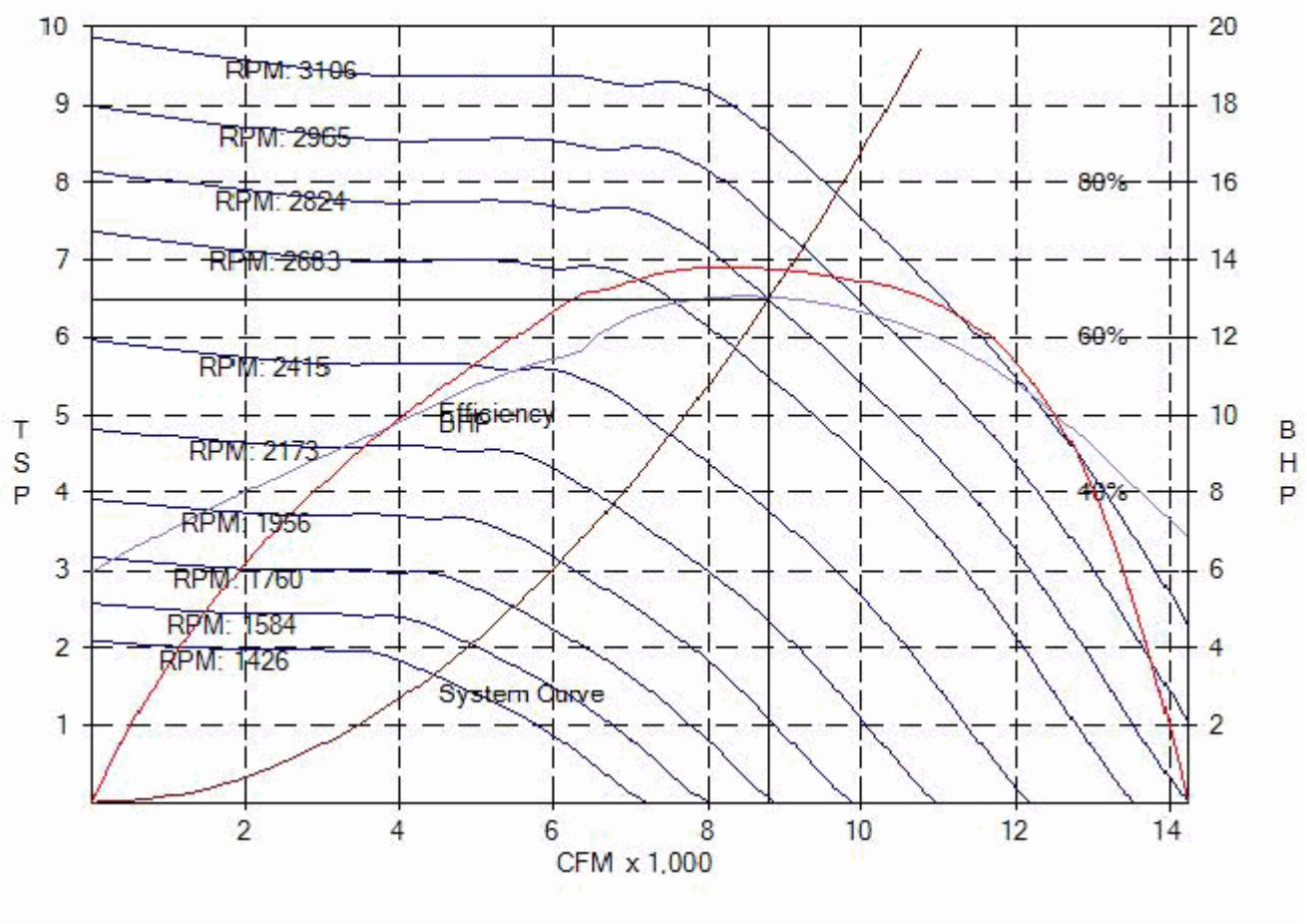
OPERATION

Fan CFM @ Alt:	8,800 @ Sea Level
SP @ Alt:	6.50 in. Wg.
Adj. SP @ Alt:	6.50 in. Wg.
SP @ Sea Level:	6.50 in. Wg.
Fan RPM :	2,824
Fan BHP:	13.04
Static / Mech. Efficiency:	69.0% / 72.0%
Inlet / Outlet Velocity:	1,930 / 2,142 FPM
Plenum Outlet Velocity:	1,200 FPM

SOUND OCTAVE BANDS

	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz	8000hz	A-Weighted
Inlet / Discharge	94 / 96	90 / 82	90 / 83	100/ 91	86 / 91	88 / 88	86 / 85	82 / 80	98 / 95

Comment: -



Model Number: ITF-DHRE20

Report Created: 6/30/2015 3:51:12PM Submittal 02

Unit Tag: AHU-2
Serial Number: T020238-002-00
Job Number: J000052471

[RETURN FAN] PF09-22 (single)-105 / CL III 2 Inch ITF Unit Fans

PHYSICAL

Motor / Frame / Eff:	5.0hp / 184T / NEMA Prem
VAC/PH/HZ - RPM / Encl:	208/3/60 - 1750/TEAO
Speed / Qty - Belts:	N/A (-) -
Mtr Max Inertial Load:	47 WR²
MtrShv / Bushing / Shaft:	N/A
FanShv / Bushing / Shaft:	N/A
Isolation / Deflection:	SWERT-2
Wheel Material / Inertia:	Steel / 9 WR²
Direct Drive:	YES
Max Fan Speed:	3166

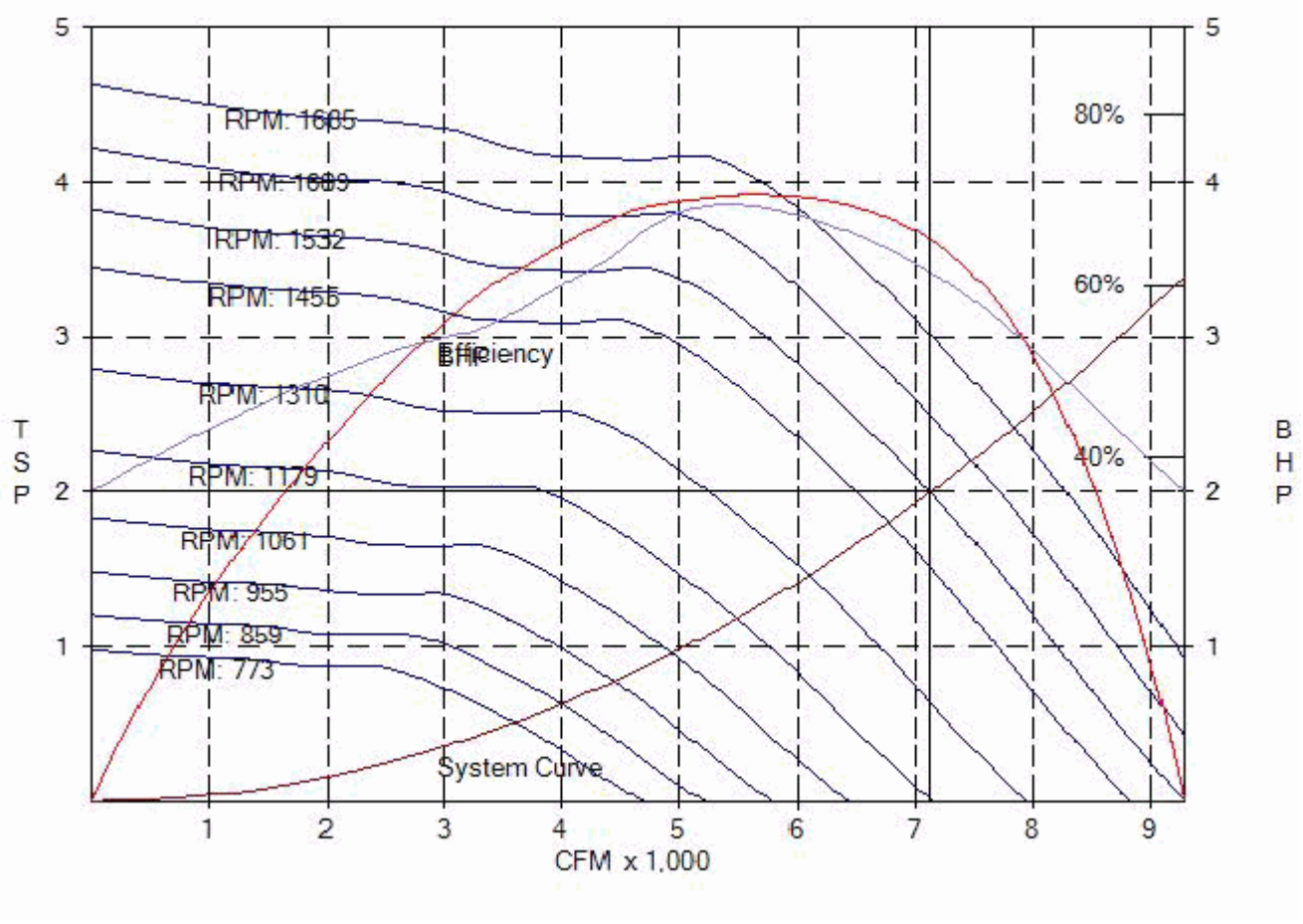
OPERATION

Fan CFM @ Alt:	7,128 @ Sea Level
SP @ Alt:	2.00 in. Wg.
Adj. SP @ Alt:	2.00 in. Wg.
SP @ Sea Level:	2.00 in. Wg.
Fan RPM :	1,532
Fan BHP:	3.43
Static / Mech. Efficiency:	65.5% / 72.5%
Inlet / Outlet Velocity:	2,449 / 1,859 FPM
Plenum Outlet Velocity:	1,200 FPM

SOUND OCTAVE BANDS

	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz	8000hz	A-Weighted
Inlet / Discharge	81 / 82	81 / 76	93 / 85	76 / 76	75 / 75	78 / 77	75 / 73	65 / 62	87 / 83

Comment: -



Model Number: ITF-DHRE20

Unit Tag: AHU-2
Serial Number: T020238-002-00
Job Number: J000052471

Report Created: 6/30/2015 3:51:12PM Submittal 02

[Coil # 1] Hot Water Coil - (Qty. 1) 5WC - 6 - 45 x 64 x 2 - 8 AL

PHYSICAL

Total Face Area / FV :	20.0 / 440.0
Coil FH x FL:	45.00 X 64.00
Rows - FPI:	2 - 8
Serpentine:	0.33
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA GALV.
Sup.Conn - Qty / Size:	(1) 1-1/2" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 1-1/2" MPT SCH40 Red Brass Per Coil
Coating:	NONE

OPERATION

ACFM / SCFM - Alt.:	8,800 / 9,056 - Sea Level
EDB :	55 °F
LDB :	85.6 °F
Sensible Heat:	300,105 Btu/Hr
Fluid - %:	Water
EFT / LFT:	130 / 109 °F
GPM:	28.90
Fluid Velocity:	3.30 ft/s
FPD:	5.76 ft
APD:	0.13 in. Wg.
Hand:	LEFT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.

[Coil # 2] Chilled Water Coil - (Qty. 1) 5WC - 12 - 45 x 64 x 6 - 10 AL

PHYSICAL

Total Face Area / FV :	20.0 / 440.0
Coil FH x FL:	45.00 X 64.00
Rows - FPI:	6 - 10
Serpentine:	0.50
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA 304 SS
Sup.Conn - Qty / Size:	(1) 2" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 2" MPT SCH40 Red Brass Per Coil
Coating:	NONE

Drain Pan - 73W x 37L 16 GA 304 SS LEFT HAND

OPERATION

ACFM / SCFM - Alt.:	8,800 / 8,485 - Sea Level
EDB / EWB:	80 / 67 °F
LDB / LWB:	52.3 / 52.1 °F
Total Heat:	381,919 Btu/Hr
Sensible Heat:	258,541 Btu/Hr
Fluid - %:	Water
EFT / LFT:	44 / 58.1 °F
GPM:	54.10
Fluid Velocity:	4.10 ft/s
FPD:	16.00 ft
APD:	0.67 in. Wg.
Hand:	LEFT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.

[Filter Bank # 1] Pre - 2" Pleated Flat - 30% / Final - 12" Cartridge w/Header - 65%

Type: Flat **Frames:** Galvanized **Location / Service:** Up Stream / Face Load

Bank Size: 48 H x 72 W **(Qty) Size:** (6)24x24

Face Area (ft²) / FV (fpm): 24.0 / 367

Filter Bank Gauge: Dwyer Model 2002

Media - Pre Filter	**APD:**	0.50	**Class:**	II	**Supplied Sets:**	2 Sets	**Clips:**
Media - Final Filter	**APD:**	1.00	**Class:**	II	**Supplied Sets:**	2 Sets	**Clips:**

Comment: Filter frames, media and holding clips are furnished by Factory.

-

Model Number: **ITF-DHRE20**

Report Created: **6/30/2015 3:51:12PM Submittal 02**

Unit Tag: **AHU-2**

Serial Number: **T020238-002-00**

Job Number: **J000052471**

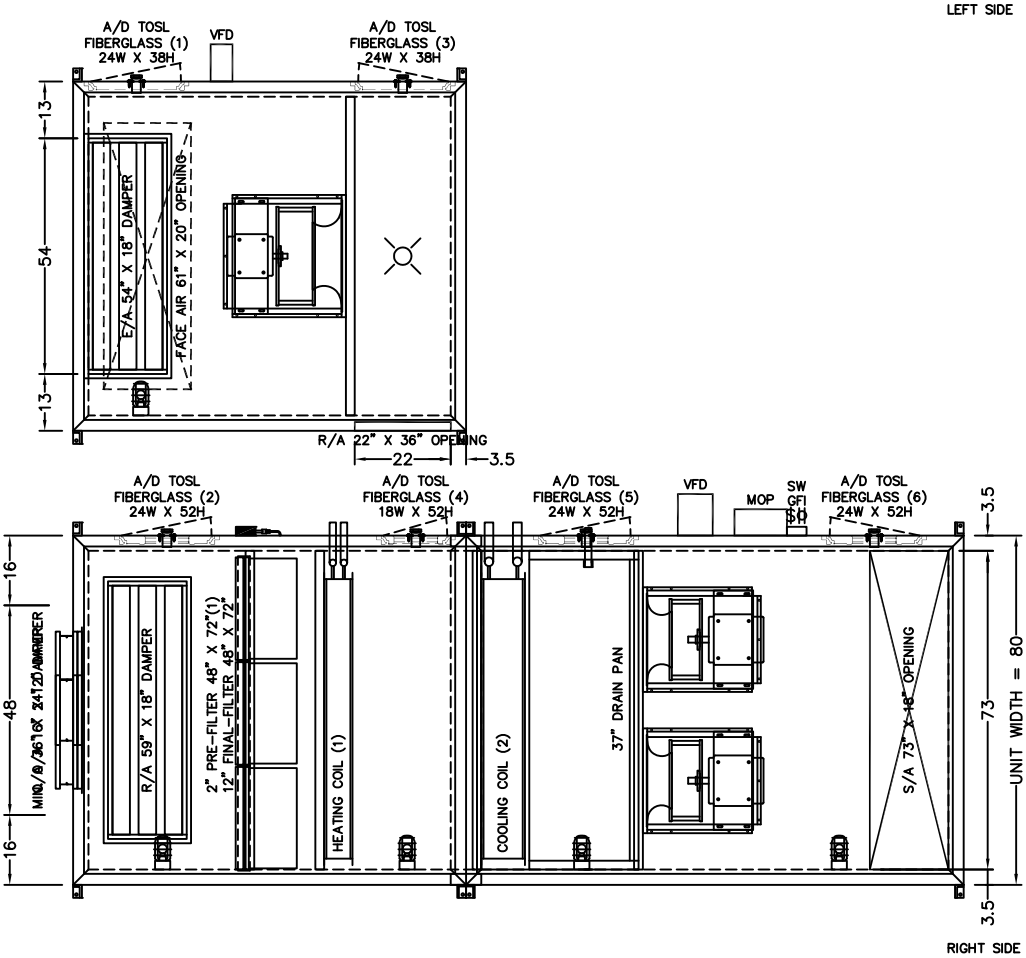
Openings

Description	Size (A x B)	Location	CFM	FV
R/A	22 x 36	Side - Right	7128	1,296
S/A	73 x 18	Top	8800	964
Face Air	61 x 20	Floor	7128	967

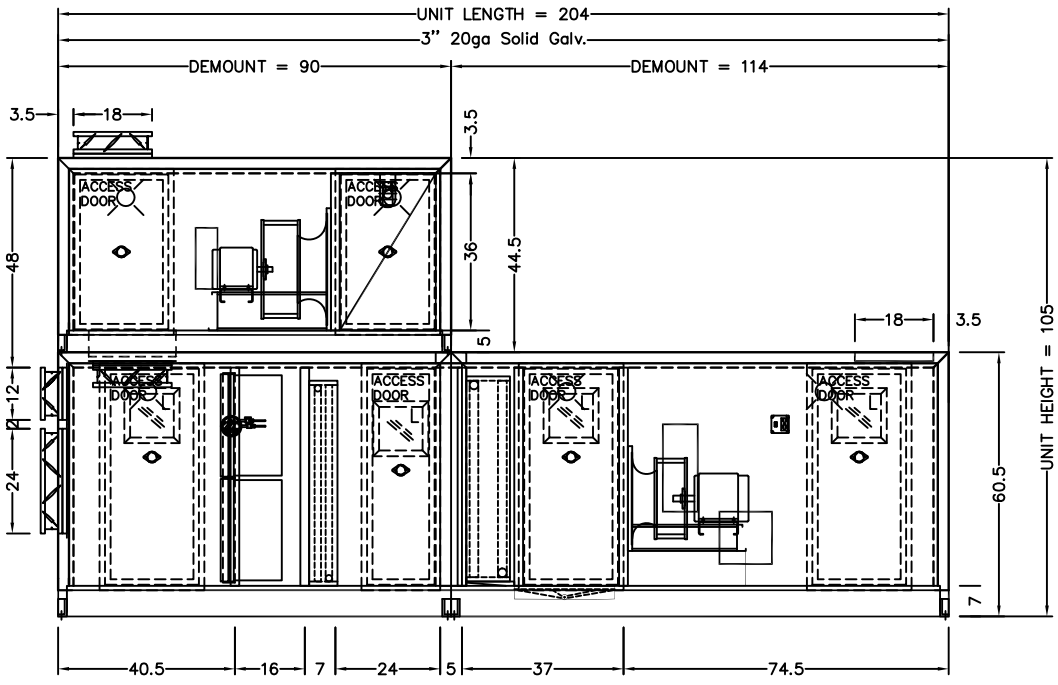
Comment: Grating -

Dampers

Description	Bank Size (AxB)	Location	CFM	FV	Model # / Action
R/A	59 x 18	Top	7128	1107	CD50 / Parallel Left
O/A	36 x 24	End - Intake	7200	1345	CD50 / Opposed
Min. O/A	16 x 12	End - Intake	1600	1336	CD50 / Opposed
E/A	54 x 18	Top	7128	1211	CD50 / Opposed



PLAN VIEW



RIGHT ELEVATION

Temtrol
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PH (405) 263 7286 www.Temtrol.com

Job Name: MIAMI UNIVERSITY – MARTIN HALL					
Unit Tag: AHU-2				Unit Type: INDOOR	
Rep Firm: ENVIRONMENTAL COMFORT, LLC.				Weight: 8000 lbs	Box Qty: 3
Rep Contact: DAN PAGAN @ 614-299-6464				Model No: ITF-DHRE20	
Ver: 2011.100	SAE: JBJ	SERIAL No.: T020238-002-00	Job No: J000052471	Date m/d/y: 06-30-15	Rev: Rev 02

Unit Data Sheet

Model Number: ITF-DH12

Report Created: 6/30/2015 4:06:40PM Submittal 02

Unit Tag: MUA-1
Serial Number: T020238-003-00
Job Number: J000052472

Job Name:	MIAMI UNIVERSITY - MARTIN HALL	**Unit Type:**	INDOOR
Rep. Firm:	ENVIRONMENTAL COMFORT, LLC.	**Unit Weight:**	5500 Lbs.
Rep. Contact:	DAN PAGAN @ 614-299-6464		
Temtrol Eng.:	JBJ		

Unit Notes

Unit Details

Exterior Casing: 16ga. Galvanized - Painted
Floor Material: 16ga. Galvanized
Sub Floor Material: 20ga. Galvanized
Base Size: 7 in.

Access Doors:

Quantity	Windows	T.O.S.L.	P.K.S.	Louvers
5	5	5	0	0

Static Pressure Summary

Supply

Description	Static
HEATING 5WC - 4 - 36 X 45 X 2 - 12 AL	0.24
COOLING 5WC - 8 - 36 X 45 X 6 - 12 AL	0.90
HEATING 5WC - 8 - 36 X 45 X 1 - 12 AL	0.11
2" PLEATED FLAT 30%	0.50
12" CARTRIDGE W/HEADER 65%	1.00
O/A CD60 DAMPER	0.08
S/A OPENING	0.04
CABINET	0.13
Internal Static Pressure	3.00
Available External Static Pressure	3.50
Total Supply Static Pressure	6.50

Comment:

Electrical

VAC/PH/HZ: 208/3/60

Unless otherwise noted below all electrical and automatic control devices are furnished and installed by others in the field.
VFD(s) furnished by Factory for installation and wiring.
Guarded vapor-proof light fixture(s) with LED light bulb(s). Fixture locations shown on unit drawings are approximate.
All lights controlled by a single light switch. One GFI outlet provided.
120 volt power for lighting and/or GFI outlets shall be provided by Others

Model Number: ITF-DH12

Report Created: 6/30/2015 4:06:40PM Submittal 02

Unit Tag: MUA-1
Serial Number: T020238-003-00
Job Number: J000052472

[SUPPLY FAN] PF09-18 (single) / CL III 2 Inch ITF Unit Fans

PHYSICAL

Motor / Frame / Eff:	10.0hp / 215T / NEMA Pre
VAC/PH/HZ - RPM / Encl:	208/3/60 - 3500/TEAO
Speed / Qty - Belts:	N/A (-) -
Mtr Max Inertial Load:	21 WR²
MtrShv / Bushing / Shaft:	N/A
FanShv / Bushing / Shaft:	N/A
Isolation / Deflection:	SWERT-2
Wheel Material / Inertia:	Steel / 3 WR²
Direct Drive:	YES
Max Fan Speed:	3862

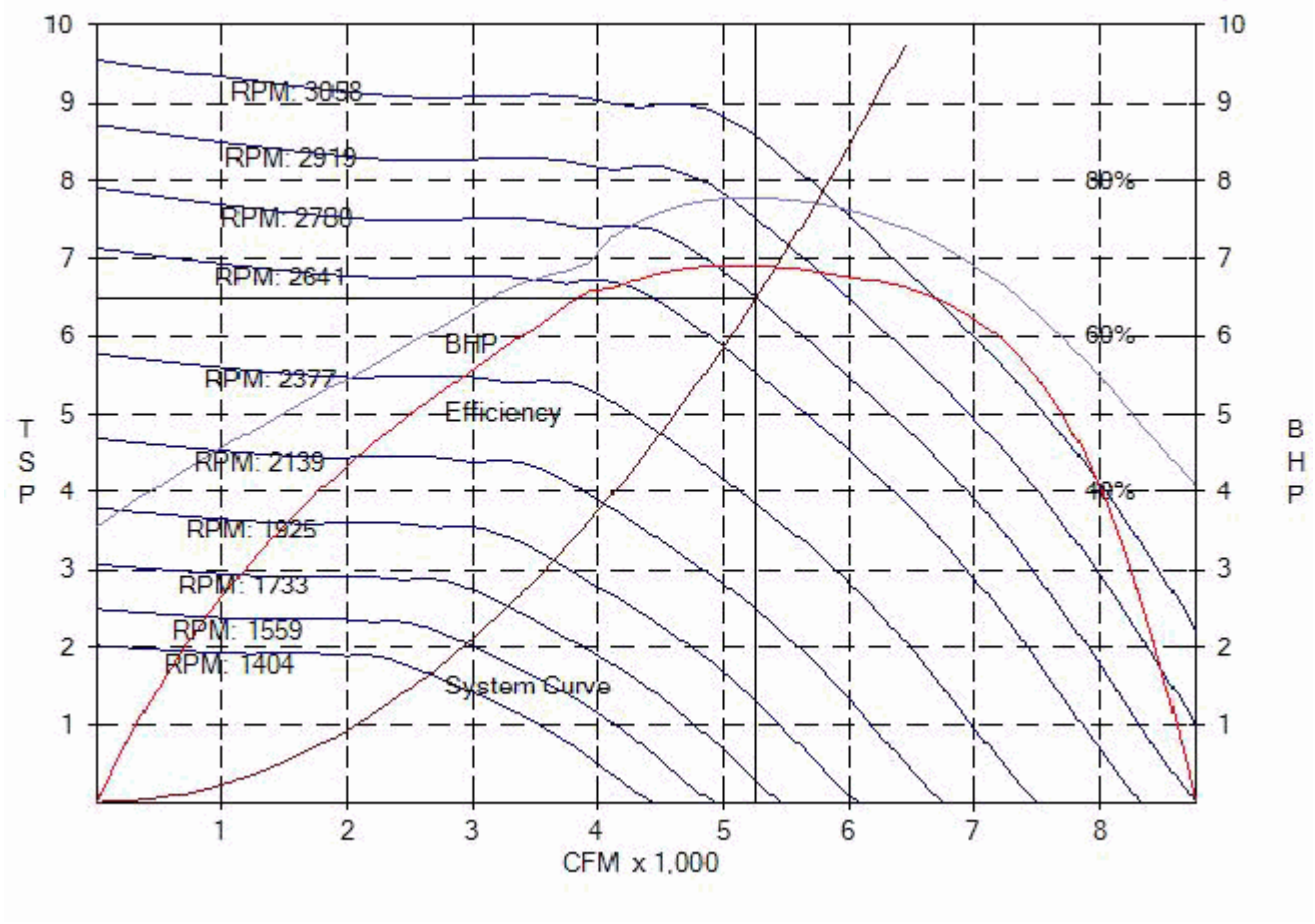
OPERATION

Fan CFM @ Alt:	5,260 @ Sea Level
SP @ Alt:	6.50 in. Wg.
Adj. SP @ Alt:	6.50 in. Wg.
SP @ Sea Level:	6.50 in. Wg.
Fan RPM :	2,780
Fan BHP:	7.79
Static / Mech. Efficiency:	69.1% / 71.9%
Inlet / Outlet Velocity:	2,307 / 2,048 FPM
Plenum Outlet Velocity:	1,200 FPM

SOUND OCTAVE BANDS

	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz	8000hz	A-Weighted
Inlet / Discharge	89 / 92	84 / 80	86 / 80	94 / 84	82 / 85	83 / 82	81 / 79	78 / 74	93 / 89

Comment: -



Model Number: ITF-DH12

Unit Tag: MUA-1
Serial Number: T020238-003-00
Job Number: J000052472

Report Created: 6/30/2015 4:06:40PM Submittal 02

[Coil # 1] Hot Water Coil - (Qty. 1) 5WC - 4 - 36 x 45 x 2 - 12 AL

PHYSICAL

Total Face Area / FV :	11.3 / 468.0
Coil FH x FL:	36.00 X 45.00
Rows - FPI:	2 - 12
Serpentine:	0.50
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA GALV.
Sup.Conn - Qty / Size:	(1) 2" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 2" MPT SCH40 Red Brass Per Coil
Coating:	NONE

OPERATION

ACFM / SCFM - Alt.:	5,260 / 6,061 - Sea Level
EDB :	0 °F
LDB :	69.3 °F
Sensible Heat:	455,278 Btu/Hr
Fluid - %:	Water
EFT / LFT:	130 / 109.7 °F
GPM:	45.30
Fluid Velocity:	4.30 ft/s
FPD:	4.70 ft
APD:	0.24 in. Wg.
Hand:	LEFT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.
2. A water - glycol mixture is required to protect coil if fluid flow is interrupted at the specified EDB.

[Coil # 2] Chilled Water Coil - (Qty. 1) 5WC - 8 - 36 x 45 x 6 - 12 AL

PHYSICAL

Total Face Area / FV :	11.3 / 468.0
Coil FH x FL:	36.00 X 45.00
Rows - FPI:	6 - 12
Serpentine:	0.75
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA 304 SS
Sup.Conn - Qty / Size:	(1) 2" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 2" MPT SCH40 Red Brass Per Coil
Coating:	NONE

Drain Pan - 54W x 37L 16 GA 304 SS LEFT HAND

OPERATION

ACFM / SCFM - Alt.:	5,260 / 4,912 - Sea Level
EDB / EWB:	95 / 75 °F
LDB / LWB:	54.1 / 54 °F
Total Heat:	347,930 Btu/Hr
Sensible Heat:	222,107 Btu/Hr
Fluid - %:	Water
EFT / LFT:	44 / 58.1 °F
GPM:	49.20
Fluid Velocity:	3.10 ft/s
FPD:	6.16 ft
APD:	0.90 in. Wg.
Hand:	LEFT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.

Model Number: ITF-DH12

Unit Tag: MUA-1
Serial Number: T020238-003-00
Job Number: J000052472

Report Created: 6/30/2015 4:06:40PM Submittal 02

[Coil # 3] Hot Water Coil - (Qty. 1) 5WC - 8 - 36 x 45 x 1 - 12 AL

PHYSICAL

Total Face Area / FV :	11.3 / 468.0
Coil FH x FL:	36.00 X 45.00
Rows - FPI:	1 - 12
Serpentine:	0.13
Fin Thickness / Matl:	0.008" / AL
Tube O.D. / Wall:	5/8" / 0.025"
Tube Material:	CU
Case Thickness / Matl:	CT: 1" CB: 1" / 16 GA GALV.
Sup.Conn - Qty / Size:	(1) 1-1/4" MPT SCH40 Red Brass Per Coil
Ret.Conn - Qty / Size:	(1) 1-1/4" MPT SCH40 Red Brass Per Coil
Coating:	NONE

OPERATION

ACFM / SCFM - Alt.:	5,260 / 5,413 - Sea Level
EDB :	55 °F
LDB :	76.6 °F
Sensible Heat:	126,951 Btu/Hr
Fluid - %:	Water
EFT / LFT:	130 / 103.3 °F
GPM:	9.60
Fluid Velocity:	3.70 ft/s
FPD:	4.98 ft
APD:	0.11 in. Wg.
Hand:	LEFT
FFI:	0.00

Comment:

1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.com.

[Filter Bank # 1] Pre - 2" Pleated Flat - 30% / Final - 12" Cartridge w/Header - 65%

Type: Flat **Frames:** Galvanized **Location / Service:** Up Stream / Face Load

Bank Size: 36 H x 48 W **(Qty) Size:** (2)12x24 & (2)24x24

Face Area (ft²) / FV (fpm): 12.0 / 438

Filter Bank Gauge: Dwyer Model 2002

Media - Pre Filter	**APD:**	0.50	**Class:**	II	**Supplied Sets:**	2 Sets	**Clips:**
Media - Final Filter	**APD:**	1.00	**Class:**	II	**Supplied Sets:**	2 Sets	**Clips:**

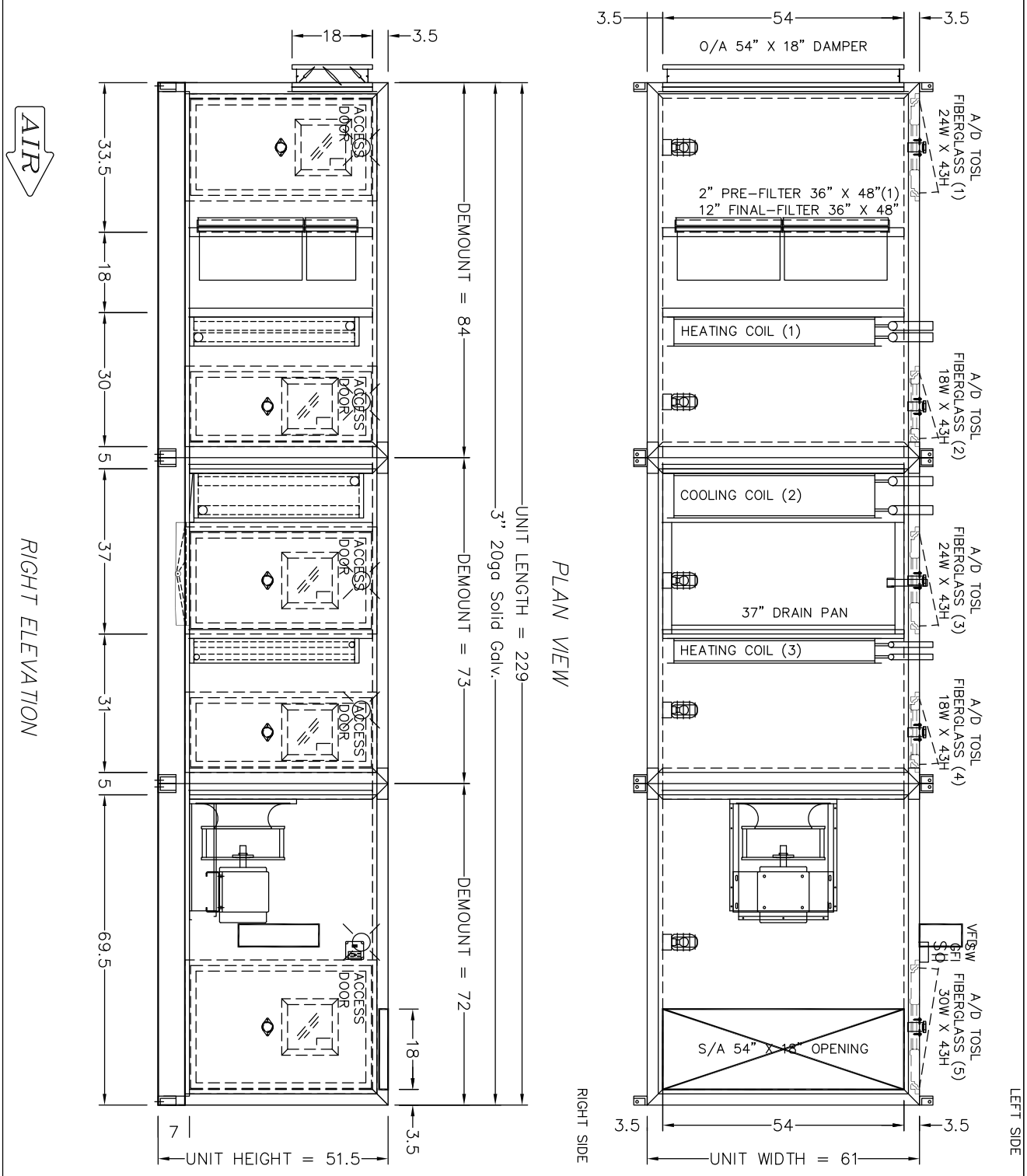
Comment: Filter frames, media and holding clips are furnished by Factory.
-

Openings

Description	Size (A x B)	Location	CFM	FV
S/A	54 x 18	Top	5260	779

Dampers

Description	Bank Size (AxB)	Location	CFM	FV	Model # / Action
O/A	54 x 18	End - Intake	5260	894	CD50 / Opposed



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Job Name	MIAMI UNIVERSITY – MARTIN HALL				
Unit Tag	MUA–1			Unit Type	INDOOR
Rep Firm	ENVIRONMENTAL COMFORT, LLC.			Weight 5500 lbs	Box Qty 3
Rep Contact	DAN PAGAN @ 614–299–6464			Model No	ITF–DH12
Ver	SAE	SERIAL No.	Job No	Date m/d/y	Rev
2011.100	JBJ	T020238–003–00	J000052472	06–30–15	Rev 02

All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.

YASKAWA

Z1000 HVAC Drive

3 HP to 500 HP

Fan and Pump Applications

The Z1000 variable speed drive is designed for building automation applications such as fans, pumps, and cooling towers through 500 HP. The Z1000 features an easy-to-read LCD keypad that provides Hand-Off-Auto interface and a real time clock. These features make the Z1000 perfect for most building automation applications that require reliable motor control.

Harmonic Mitigation*
Built-in 5% line impedance for input harmonic reduction.

Noise Filter*
On board EMI/RFI filter complies with IEC 61800-3 restricted distribution for first environment.

Serial Communications
Embedded BACnet communications (BTL Certified), along with Modbus/ Memobus.

Ratings
Plenum Rated (UL 1995). Seismic Rated (IBC 2012).
OSHPD (OSP-0293-10). Made with RoHS compliant materials.

Internal Real-Time Clock
Time and date stamping for events, along with timer controls for starting stopping and speed changes without the need for external controls.

PI Feature
Maintains a set point for closed loop control of fans and pumps for pressure, flow or temperature regulation and eliminates the need for a closed loop output signal from a BAS. Independent PI to control an external device in the system.

LCD Operator
5-Line 16 character alpha-numeric, easy to read and understand display, with Hand-Off-Auto functions.

Carrier Frequency
5 kHz carrier frequency with dynamic noise control for quiet motor operation.

Application Macros
Choose from pre-configured set up macros to match the application for quick and easy set up.

Sealed Heatsink*
Allows for drive to be mounted in a NEMA 12 enclosure with heatsink external.

** Available only as options, 300-500HP ratings.*

Specifications

Overload Capacity
- 110% for 60 seconds,

Output Frequency
- 0.01 to 240 Hz

Control Methods
- V/Hz Control
- Open Loop Vector Control for Permanent Magnet motors

Motor Types
- Squirrel Cage Induction
- Interior Permanent Magnet (IPM)

Enclosures
- NEMA Type 1 / IP20 : 3 - 100 HP 208V and 3 - 250 HP 480V
- Open Type / IP00 : 125 - 150 HP 208V and 300 - 500 HP 480V

Ambient Operating Temperature
- -10°C to 40°C (14°F to 104°F)

Certification
- UL, CSA, CE, IBC, RoHS, OSHPD

Standard I/O
- Seven Multi-Function Programmable Digital Inputs (24Vdc)
- Two Multi-Function Programmable Analog Inputs (0-10VDC or 4-20mA)
- One Fault Relay Output (Form C - 2 Amps at 250Vac max)
- Three Multi-Function Programmable Relay Output (Form A - 2 Amps @ 250Vac max)
- Two Multi-Function Programmable Analog Outputs (0-10Vdc or 4-20mA)
- One 24 Vdc, 150 mA Transducer or Transmitter Power Supply for customer use

Network Communications
- Built-in Metasys, APOGEE FLN, BACnet, RS485/422 - Programmable up to 76.8 kbps
- Optional: LonWorks, EtherNet/IP

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Yaskawa America, Inc. | Tel: 1-800-YASKAWA (927-5292) | www.yaskawa.com
Drives & Motion Division

Z1000 HVAC Drive

3 HP to 500 HP

Fan and Pump Applications

208V Class

Model Number CIMR-ZU2A	Rated Output Current (Amps)	HP	Dimensions (in.)			Enclosure Type
			H	W	D	
0011FAA	10.6	3	14.1	4.9	8.6	IP20 NEMA Type 1
0017FAA	16.7	5				
0024FAA	24.2	7.5	17.6		9.2	
0031FAA	30.8	10				
0046FAA	46.2	15	20.1	7.9	9.4	
0059FAA	59.4	20				
0075FAA	74.8	25	21.3	10.0	10.3	
0088FAA	88.0	30				
0114FAA	114	40				
0143FAA	143	50	30.5	13.4	15.7	
0169FAA	169	60				
0211FAA	211	75				
0273FAA	273	100				
0343AAA	343	125	31.5	19.7	13.8	IP00 Open-Type
0396AAA	396	150				

480V Class

Model Number CIMR-ZU4A	Rated Output Current (Amps)	HP	Dimensions (in.)			Enclosure Type
			H	W	D	
0005FAA	4.8	3	14.1	4.9	8.6	IP20 NEMA Type 1
0008FAA	7.6	5				
0011FAA	11.0	7.5				
0014FAA	14.0	10	17.6		9.2	
0021FAA	21.0	15				
0027FAA	27.0	20				
0034FAA	34.0	25	20.1	7.9	9.4	
0040FAA	40.0	30				
0052FAA	52.0	40	21.3	10	10.3	
0065FAA	65.0	50				
0077FAA	77.0	60				
0096FAA	96.0	75				
0124FAA	124	100	27.6	11.8	11.4	
0156FAA	156	125	30.5	14.2	15.7	
0180FAA	180	150				
0240FAA	240	200				
0302FAA	302	250	41.1	16.1	18.9	
0361AAA	361	300	37.4	19.7	14.6	IP00 Open-Type
0414AAA	414	350	44.9	26.4		
0480AAA	480	400				
0515AAA	515	450				
0590AAA	590	500				

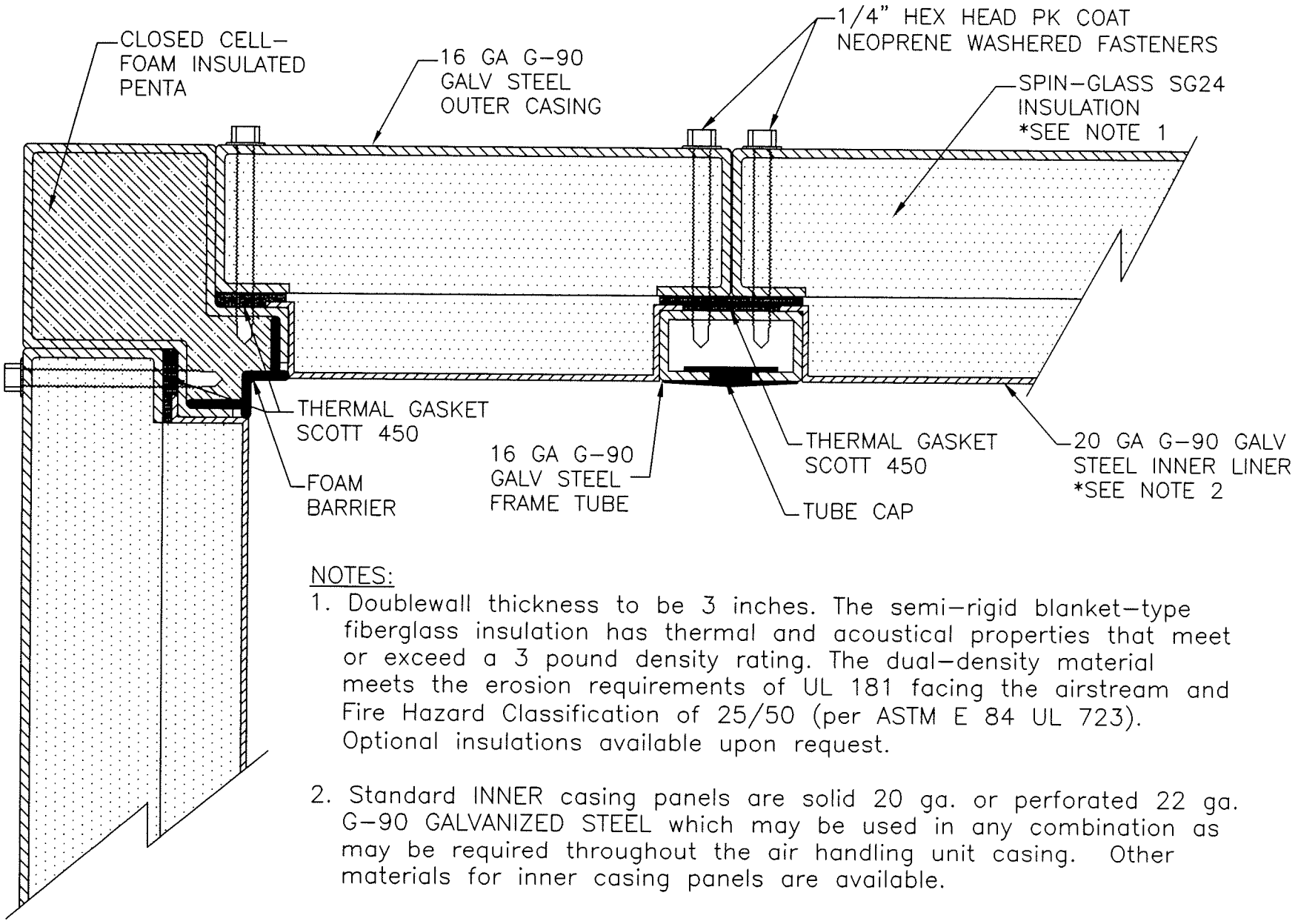
FREE Estimating Tools

- Energy Savings Predictor
- Harmonics Estimator
- Carbon Footprint Calculator

iTunes App

Energy savings app for the iPhone and the iPod touch is available at iTunes.com - search for Yaskawa.

Document Number: FL.Z1000.01 • 01-01-2014 • © 2014



NOTES:

1. Doublewall thickness to be 3 inches. The semi–rigid blanket–type fiberglass insulation has thermal and acoustical properties that meet or exceed a 3 pound density rating. The dual–density material meets the erosion requirements of UL 181 facing the airstream and Fire Hazard Classification of 25/50 (per ASTM E 84 UL 723). Optional insulations available upon request.

2. Standard INNER casing panels are solid 20 ga. or perforated 22 ga. G–90 GALVANIZED STEEL which may be used in any combination as may be required throughout the air handling unit casing. Other materials for inner casing panels are available.

Temtrol
www.temtrol.com
15 EAST OKLAHOMA AVENUE OKARCHE, OK.73762
PH: (405) 263-7286 FAX: (405) 263-4924

ITF

ITF 3 INCH DOUBLE WALL CASING DETAIL

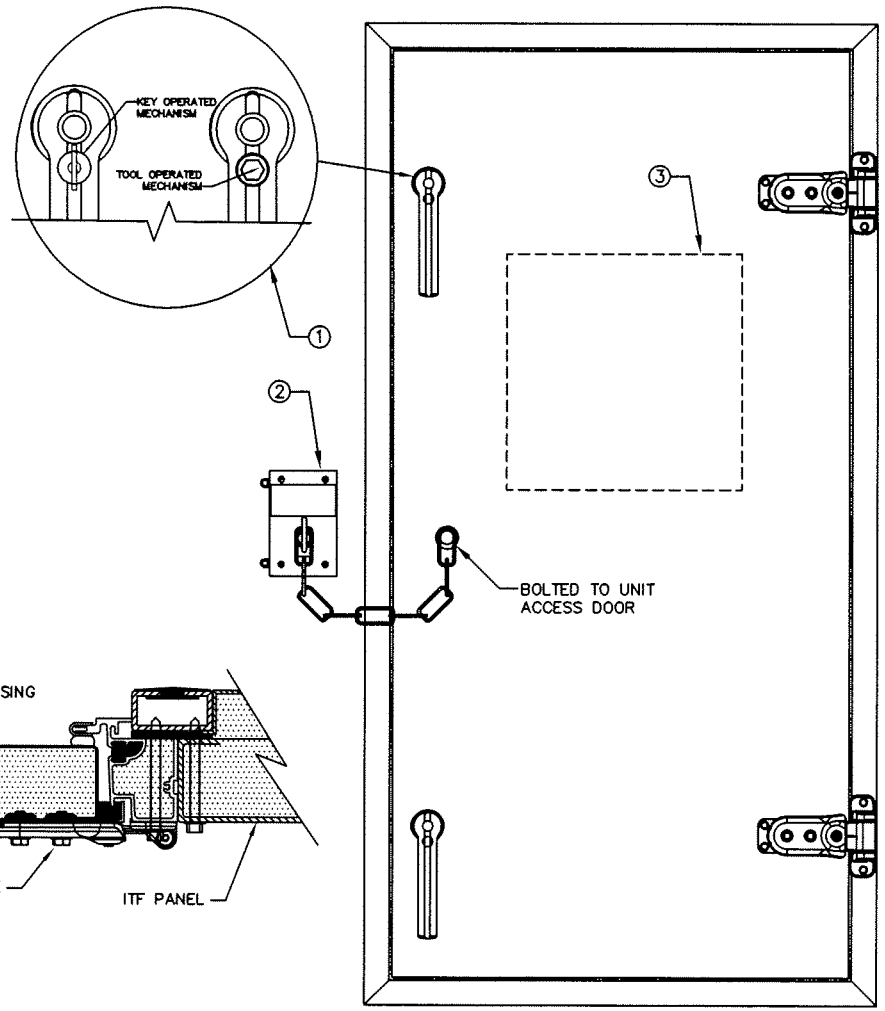
File Name: ITF 3" DOUBLE WALL.dwg
Date: 1–18–10
Drawn by: MEB

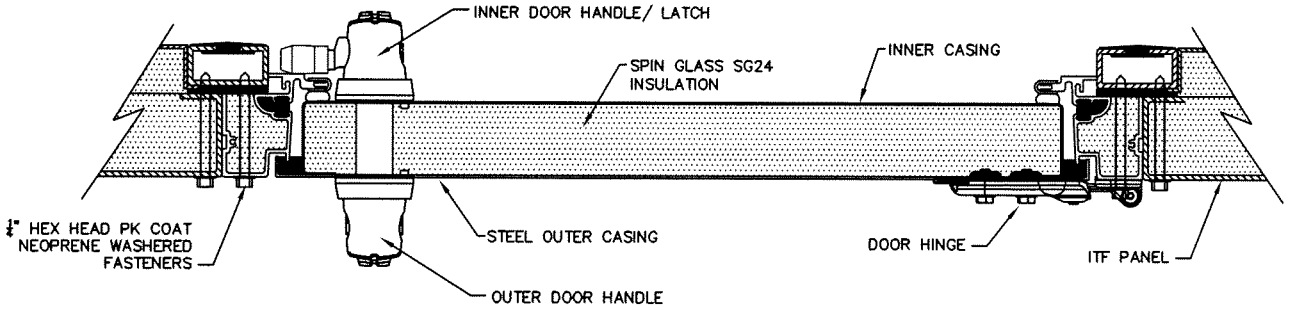
AVAILABLE OPTIONS:

1.)Tool operated or key operated safety latch furnished on the fan section access door. The latch complies with title 8 CAL–OSHA, ETL and the mechanical protection requirements of UL 1995.

2.)Interlocking mechanism on fan section access door. This de–energizing switch complies with CAL–OSHA, ETL and the mechanical protection requirements of UL 1995. (See electrical section for wiring requirements.)

3.)(10" x10") dual thermal pane, UV rated safety glass. As shown on unit drawing. Ventlok Type 699 test port as shown on unit drawing.



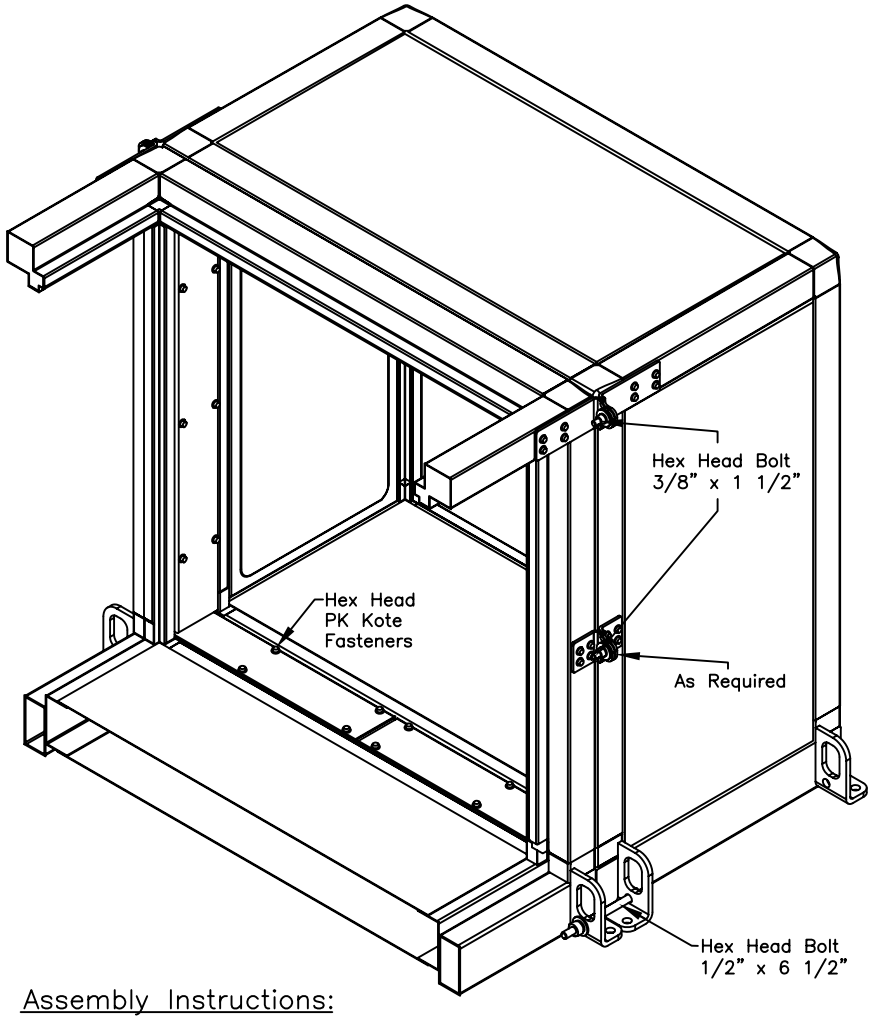


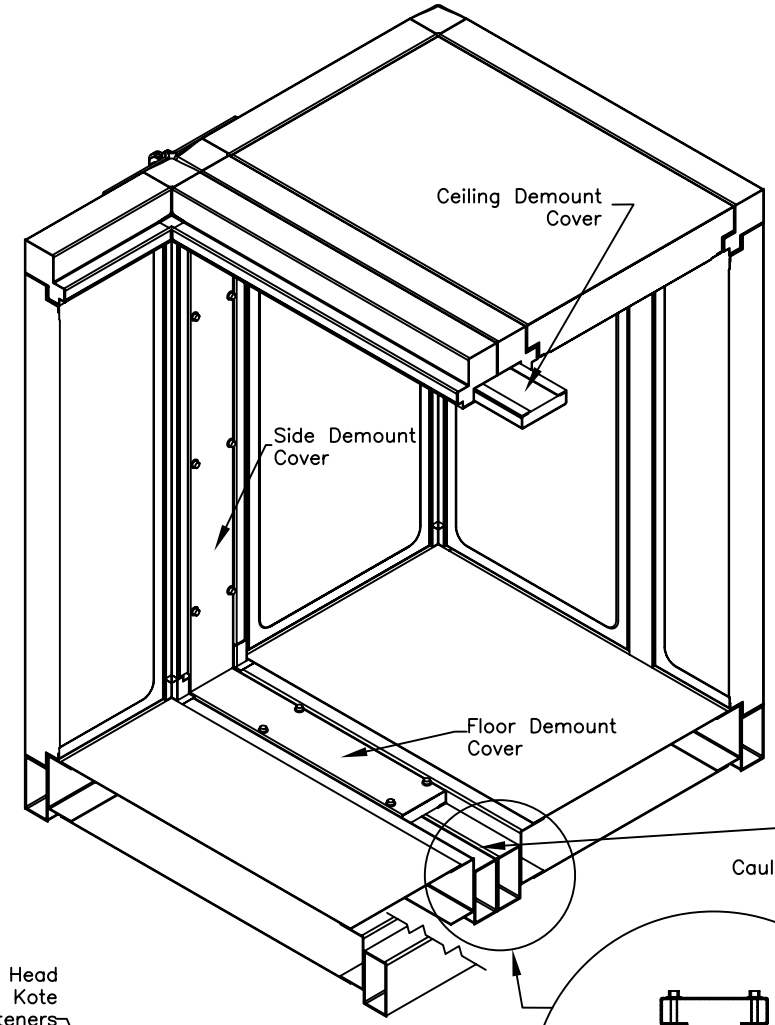
NOTE: REFER TO SUBMITTAL FOR HARDWARE SPECIFICATIONS.

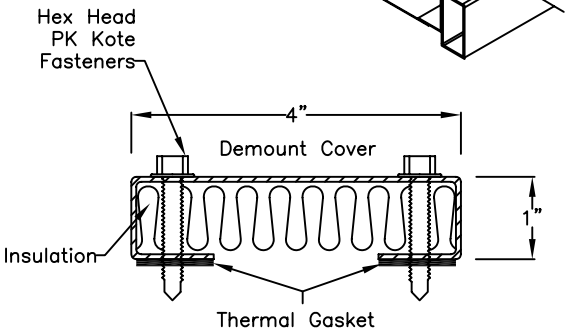
Temtrol
www.temtrol.com
15 EAST OKLAHOMA AVENUE OKARCHE, OK.73762
PH: (405) 263–7286 FAX: (405) 263–4924

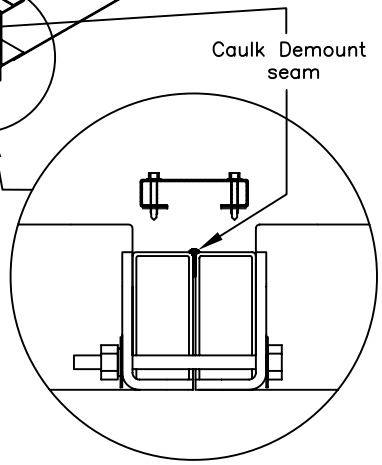
ITF ACCESS DOOR DETAIL

File Name: ITF Door Detail.dwg
Date: 1–18–10
MEB









Assembly Instructions:

1. Pull unit sections together by lugs and bolt together with supplied hardware.
2. Caulk Demount seam inside and out.
3. Install Insulated Floor and Ceiling Demount Covers first, followed by the Side Demount Covers. (Note: Floor and Ceiling Demount Covers ship in a minimum of two pieces).

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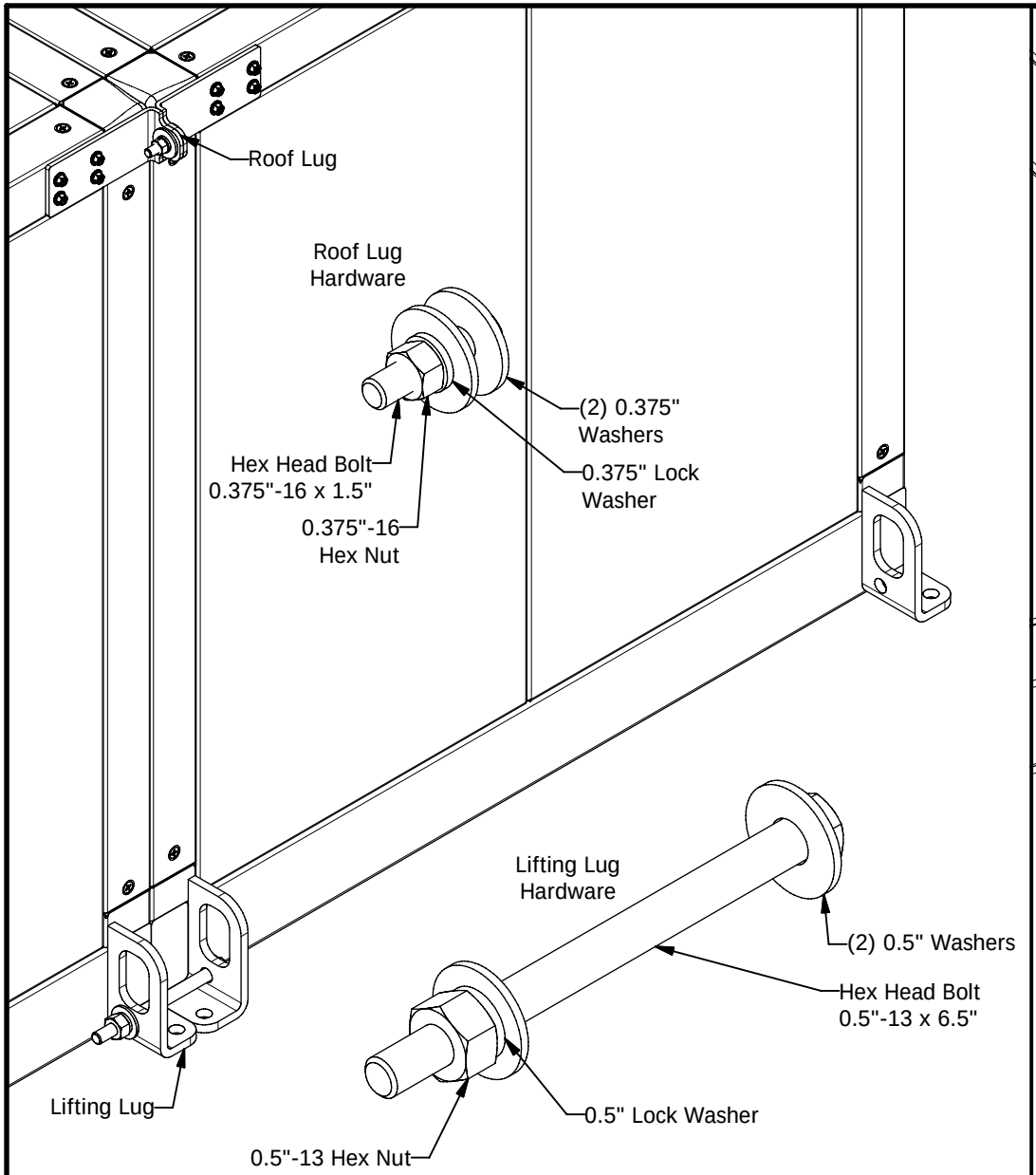
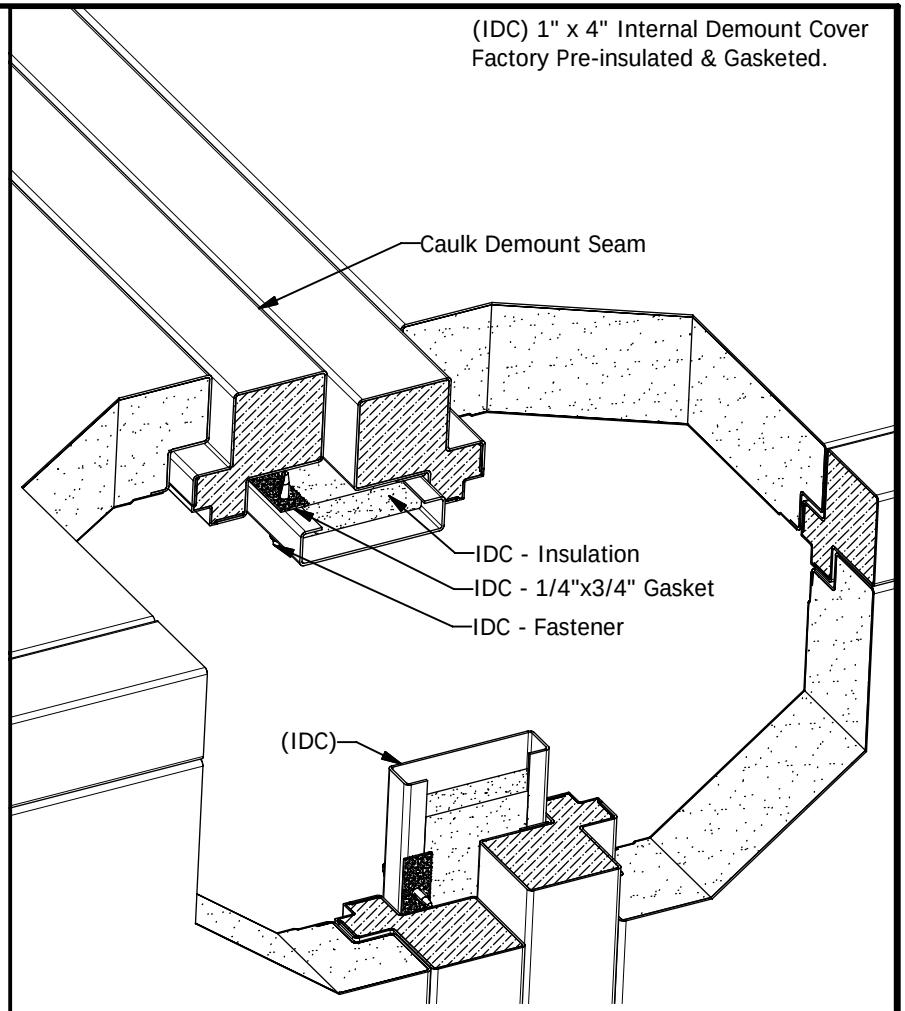
ITF

DEMOUNT RE-ASSEMBLY DETAIL

File Name: DEMOUNT COVER.dwg
Date: 10-22-07
Drawn by: MEB





1a.) Units are shipped fully assembled and sealed unless they exceed maximum shipping capabilty. Field disassembly will be the responsibility of the installing contractor.
1b.) Remove protective covering from the ends of each segment (only if unit is shipped in multiple pieces).
2.) Set and level first segment. Set and level next segment.
3.) Bolt lifting & roof lugs together on the exterior of the unit.
4.) Install Internal Demount Covers. (as shown)
5.) (Rooftop Only) See "Weatherproofing Roof Top Demount Seams" detail
6.) Repeat the above for each additional segment.

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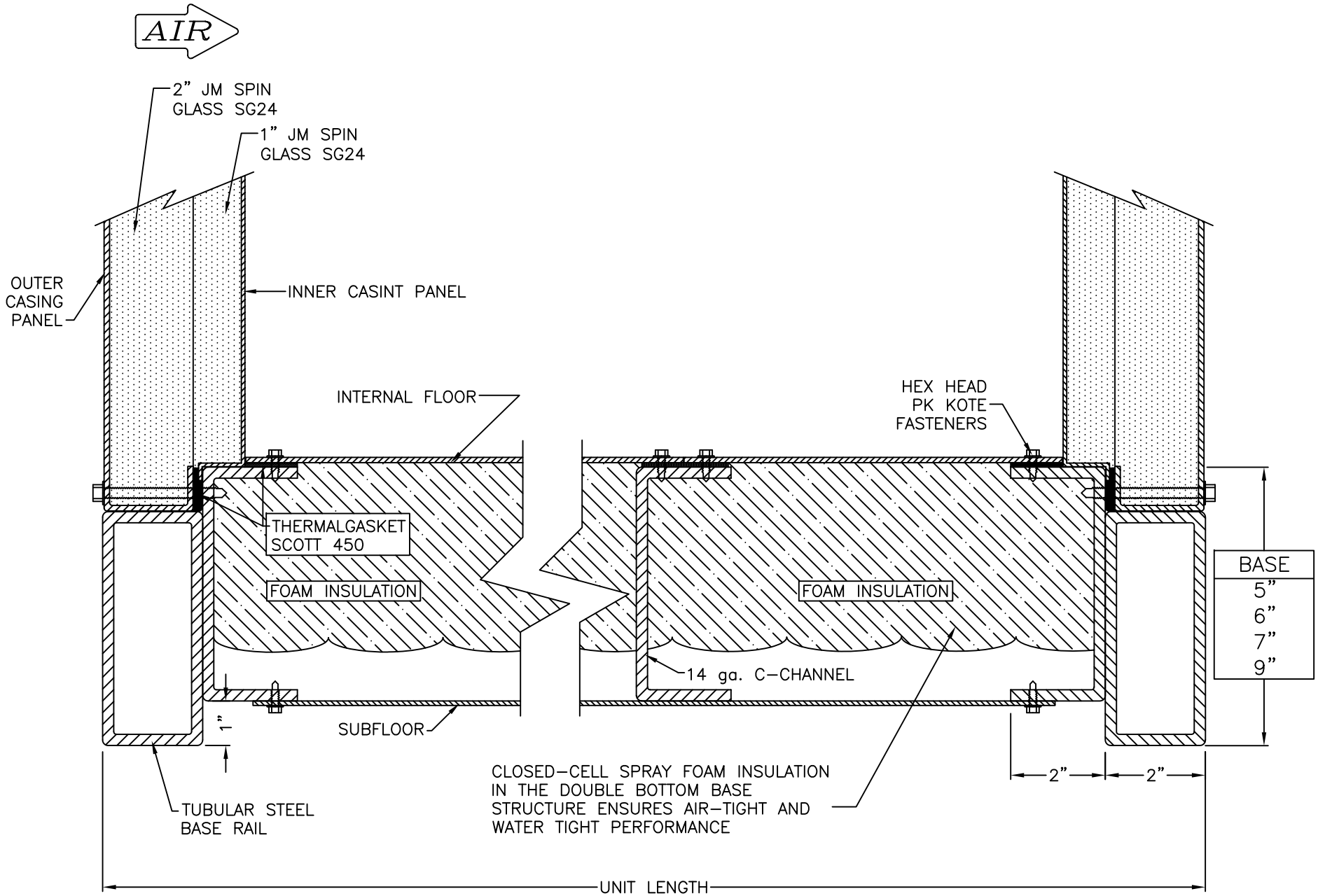
ITF Demount Instructions

File Name: ITFDetails.idw

Date: 3-28-07



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ITF

ITF BASE DETAIL RIGHT ELEVATION

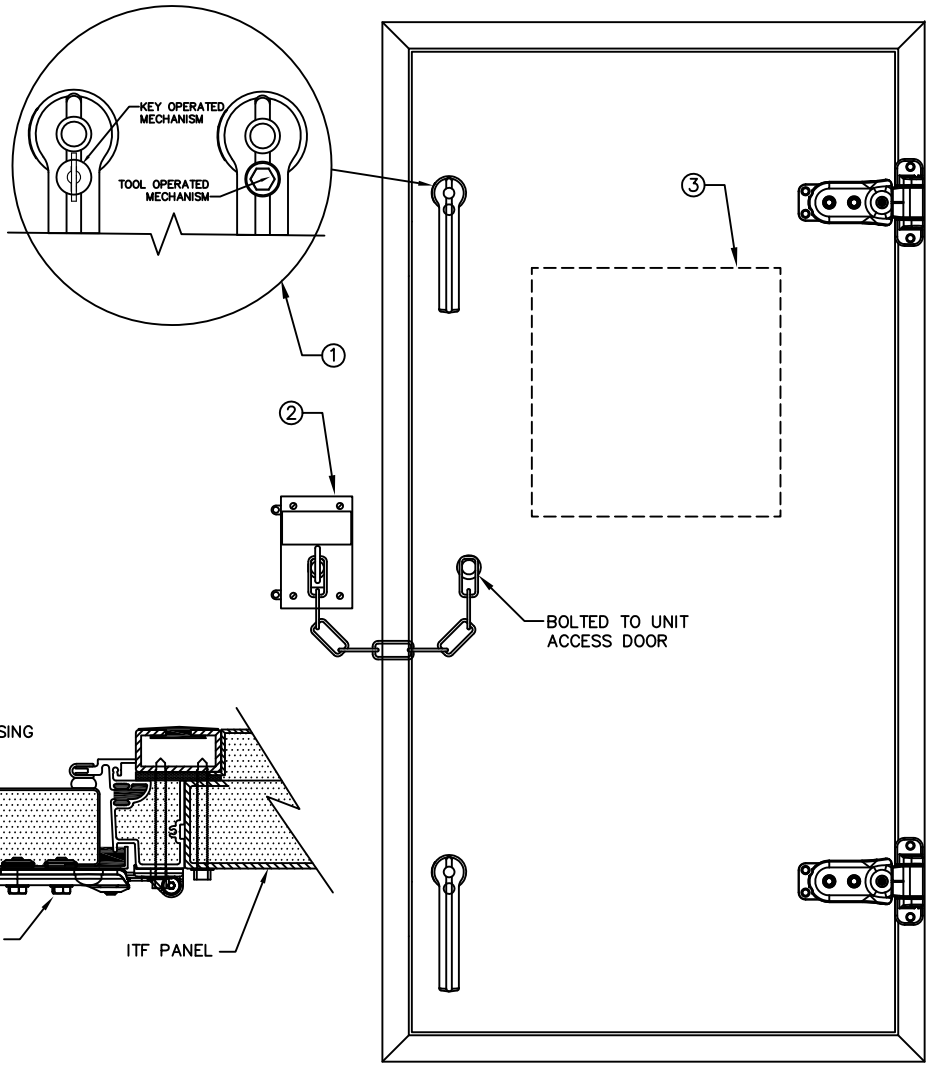
File Name: ITF Base 3" DW.dwg
Date: 12-21-09
Drawn by: MEB

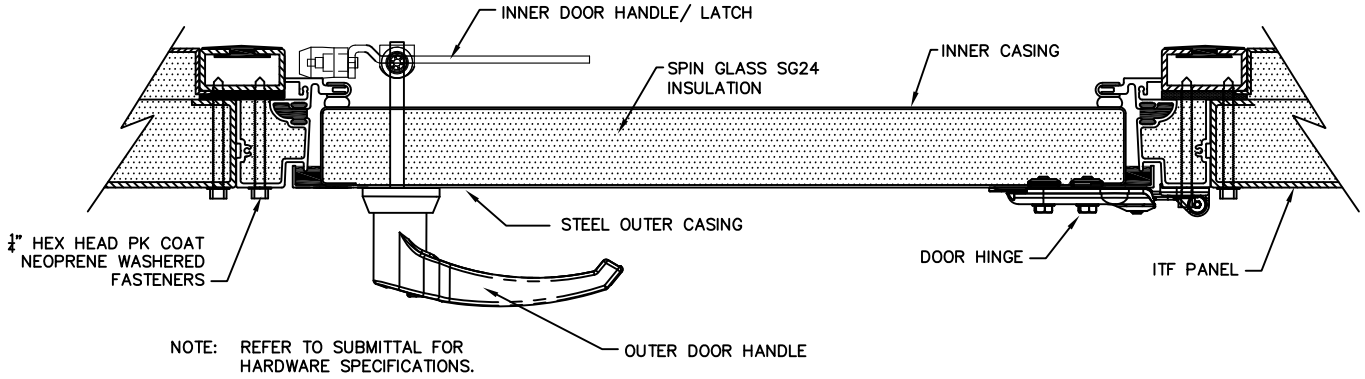
AVAILABLE OPTIONS:

1.)Tool operated or key operated safety latch furnished on the fan section access door. The latch complies with title 8 CAL–OSHA, ETL and the mechanical protection requirements of UL 1995.

2.)Interlocking mechanism on fan section access door. This de–energizing switch complies with CAL–OSHA, ETL and the mechanical protection requirements of UL 1995. (See electrical section for wiring requirements.)

3.)(10" x10") dual thermal pane, UV rated safety glass. As shown on unit drawing. Ventlok Type 699 test port as shown on unit drawing.





NOTE: REFER TO SUBMITTAL FOR HARDWARE SPECIFICATIONS.

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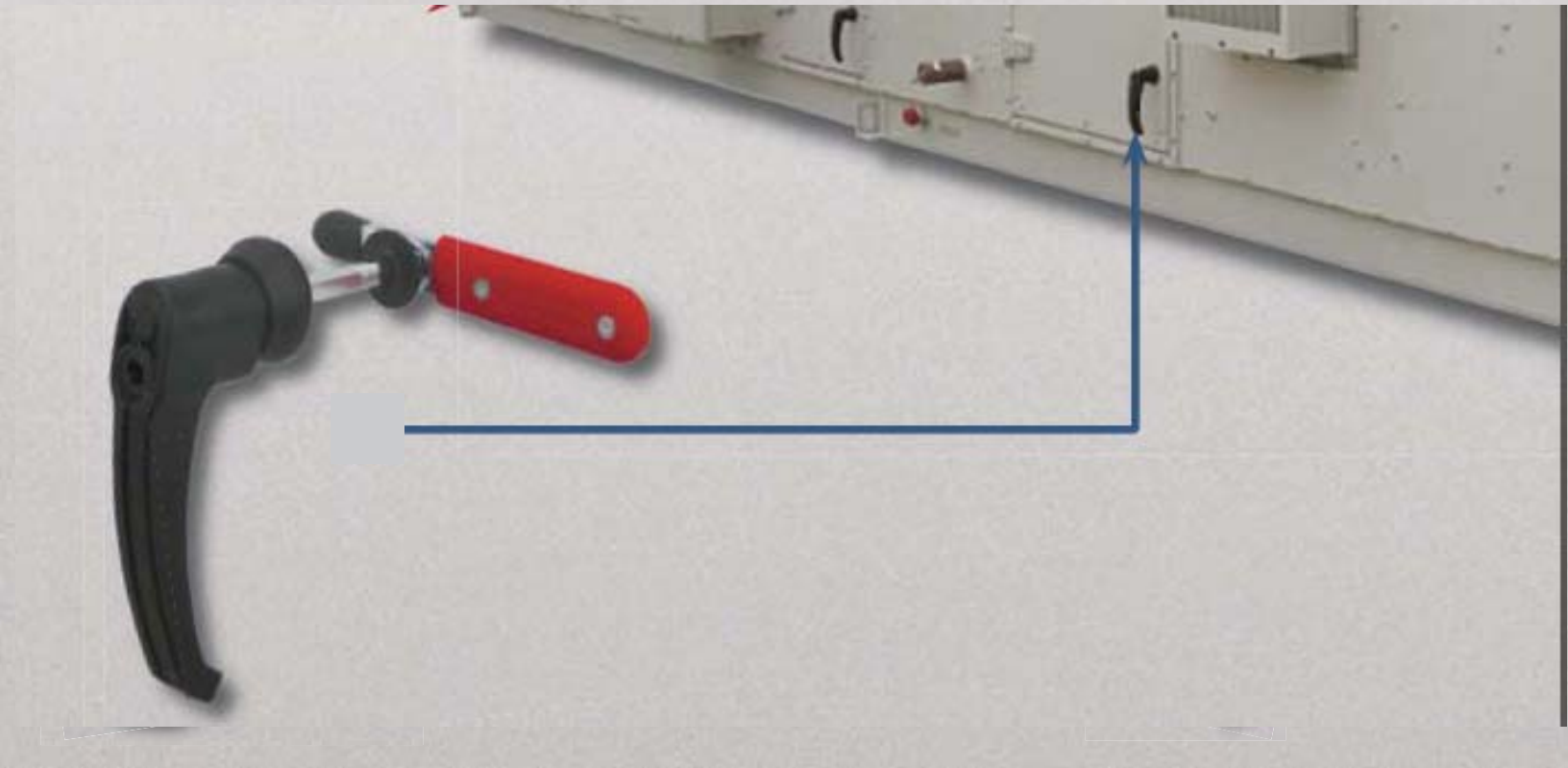
ITF ACCESS DOOR DETAIL

File Name: ITF Door Detail.dwg
Date: 12–17–12
ADC

Handles

Our innovative Klima-Flex ventilation handles are available in a variety of configurations and address many of the shortcomings of traditional designs. Durable glass reinforced nylon construction provides UV stability and thermal break. Tool operated, pad-lockable and key-locking versions are available to meet varied security requirements. To prevent breakage, the handles can be removed from the latching mechanism during shipping and installation. When partnered with other components in the Klima-Flex family these handles provide an industry leading latching solution for both in-swing and out-swing doors.

Part #	Locking feature	Door movement	Material
265076-00	Non-Locking	Out-Swing	PA6
265076-10	Key-Locking	Out-Swing	PA6
265076-30	5/16 Hex Tool	Out-Swing	PA6
265077-00	Pad-Lockable	Out-Swing	PA6
265076-02-16	Non-Locking	In-Swing	PA6
265076-12-16	Key-Locking	In-Swing	PA6
265076-32-16	5/16 Hex Tool	In-Swing	PA6
265076-62-10	Pad-Lockable	In-Swing	PA6
265076-52RD	Inside release	Out-Swing	CSR & PA6
26210010 RHG	Inside release w/ Roller	Out-Swing	CSR & PA6



RUSKIN®

AMCA LICENSED
See Page 2

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

CD60 LOW LEAKAGE CONTROL DAMPER

High Performance Airfoil
Class 1A Leakage Rated

APPLICATION

The CD60 is a low leak, galvanized steel damper designed with airfoil blades for higher velocity and pressure HVAC systems. It meets the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and is AMCA licensed as a Class 1A damper.

STANDARD CONSTRUCTION

FRAME
5" x 1" x 16 gage (127 x 25 x 1.6) galvanized steel hat channel reinforced with corner braces for structural strength equal to 11 gage (3.05) channel frames. Low profile 3 1/2" x 3/8" x 16 gage (89 x 10 x 1.6) galvanized steel channel top and bottom frame on dampers under 12" (305) high.

BLADES
Galvanized steel airfoil shaped, double skin construction of 14 gage (2.0) equivalent thickness, 6" (152) wide. Parallel or opposed action.

SEALS
Ruskiprene blade edge seals and flexible metal compressible jamb seals.

BEARINGS
Stainless steel sleeve.

LINKAGE
Concealed in frame.

AXLES
1/2" (13) plated steel hex. Removable control shaft extends 6" (152) beyond frame.

MAXIMUM SIZE
Single section – 60"w x 72"h (1524 x 1829).
Multiple section assembly – Unlimited size.

MINIMUM SIZE
Single blade – 8"w x 6"h (203 x 152).
Two blades, parallel or opposed action: 8"w x 10"h (203 x 254).

TEMPERATURE LIMITS
-72°F (-60°C) minimum and +275°F (+135°C) maximum.

FEATURES

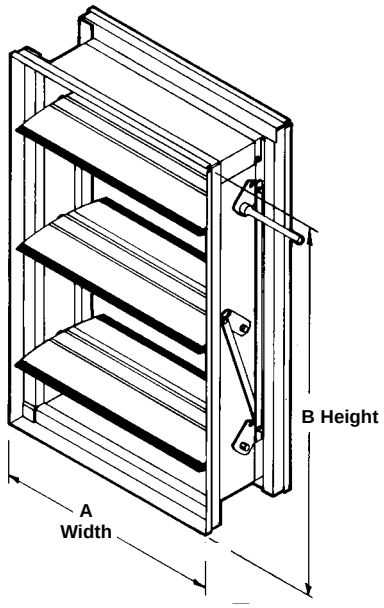
- Airfoil blade design for low pressure drop and less noise generation.
- One piece interlocking frame design to reduce racking.
- Positive lock axles, noncorrosive bearings and shake proof linkage for low maintenance operation.
- Blade edge seals mechanically lock into the blade for superior sealing.

OPTIONS

- Factory-installed, pneumatic and electric actuators.
- Enamel and epoxy finishes.
- SP100 Switch Package to remotely indicate damper blade position.
- Heavier frame construction with U-channel frame.
- Front, rear or double flange frame with or without bolt holes.
- Face and bypass configurations.

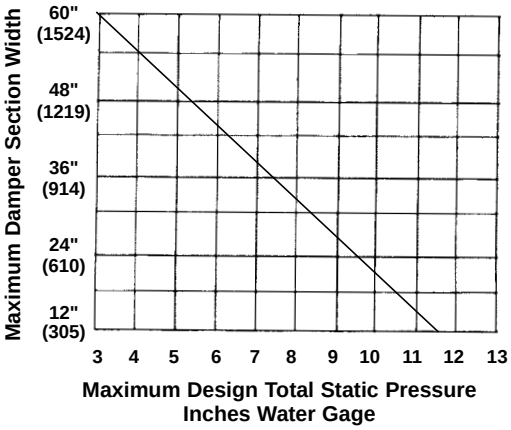
NOTE: Dimensions shown in parenthesis ( ) indicate millimeters.

*Units furnished approximately 1/4" (6) smaller than given opening dimensions.



CD60 AMCA LICENSED PERFORMANCE DATA

CD60 PRESSURE LIMITATIONS



The CD60 may be used in systems with total pressures exceeding 3.5" by reducing damper section width as indicated. Example: Maximum design total pressure of 8.5" w.g. would require CD60 damper with maximum section width of 36" (914).
Pressure limitations shown above allow maximum blade deflection of 1/180 of span on 60" (1524) damper widths. Deflections in other damper widths (less than 48" [1219]) at higher pressures shown will result in blade deflection substantially less than 1/180 of span.

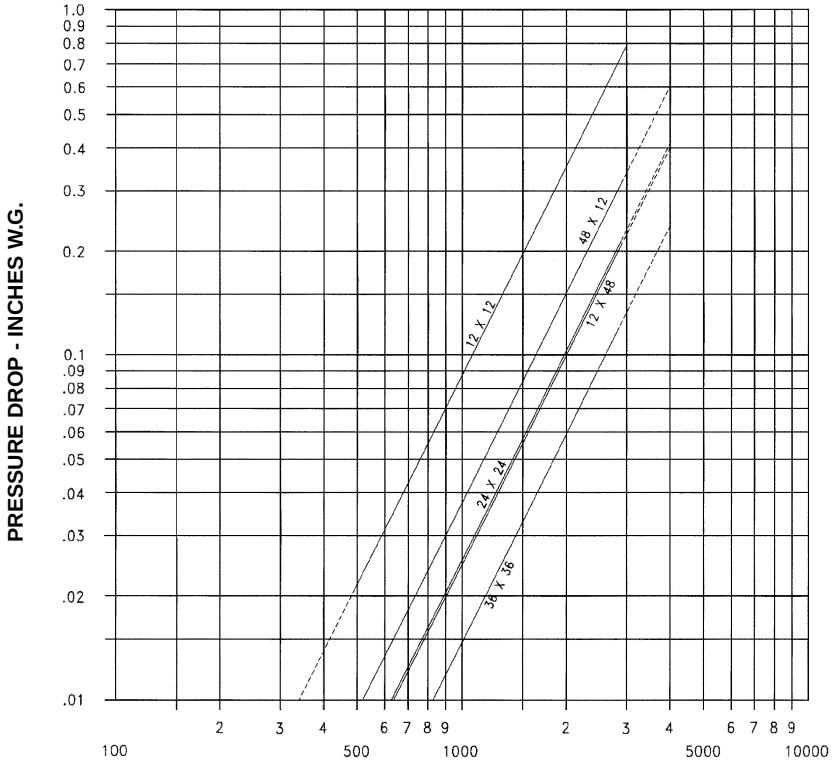
Ruskin Company certifies that the CD60 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program.The AMCA International Certified Ratings Seal applies to Air Performance and Air Leakage.

Pressure/ Class	Leakage, ft3/min/ft2 (L/s/m2)			
	Required Rating		Extended Ranges (Opt.)	
	1" (0.25 kPa)	4" (1.0 kPa)	8" (2.0 kPa)	12" (3.0 kPa)
1A	3 (15.2)	N/A	N/A	N/A
1	4 (20.3)	8 (40.6)	11 (55.9)	14 (71.1)
2	10 (50.8)	20 (102)	28 (142)	35 (178)
3	40 (203)	80 (406)	112 (569)	140 (711)

DAMPER WIDTH (INCHES)	1 IN. W.G.	4 IN. W.G.	8 IN. W.G.
12" (305)	IA	I	II
24" (610)	IA	I	II
36" (914)	IA	I	NA
48" (1219)	IA	I	NA
60"(1524)	IA	I	NA

Leakage testing conducted in accordance with AMCA Standard 500-D-98. Torque applied holding damper closed, 5 in. lbs./sq. ft. on opposed blade dampers and 7 in. lbs./sq. ft. on parallel blade dampers. Air leakage is based on operation between 50°F to 104°F. All data corrected to represent standard air density 0.075 lbs/ft^3.

VELOCITY VS. PRESSURE DROP



FACE VELOCITY - FEET/MINUTE
AMCA FIG. 5.3

CD60 sizes 12 x 12, 24 x 24, 48 x 12, 12 x 48, 36 x 36 (305 x 305, 610 x 610, 1219 x 305, 305 x 1219, 914 x 914)

All data corrected to represent standard air at a density of 0.075 lbs/ft^3.

CD60 SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans, or in accordance with schedules, control dampers that meet the following minimum construction standards. Frame shall be 16 gage (1.6) galvanized steel structural hat channel with tabbed corners for reinforcement for 11 gage (3.05) structural equivalence. Blades shall be 14 gage (2.0) equivalent thickness galvanized steel, roll-formed airfoil type for low pressure drop and low noise generation. Blade edge seals shall be Ruskiprene type or equivalent suitable for -72°F (-60°C) to +275°F (+135°C) mechanically locked into the blade edge. Adhesive or clip-on type seals are unacceptable. Jamb seals shall be flexible metal, compression type to prevent leakage between blade end and damper frame. Blade end overlapping frame is unacceptable.

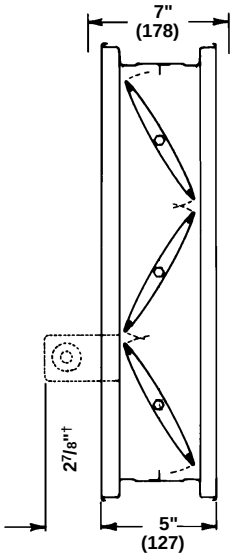
Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame. Axles shall be hexagonal positively locked into the damper blade. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure drop and noise. Submittal must include leakage, maximum air flow and maximum pressure ratings based on AMCA Publication 500. Damper shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as a class 1A damper. Dampers shall be Ruskin CD60 model.

Specifier Select Options.

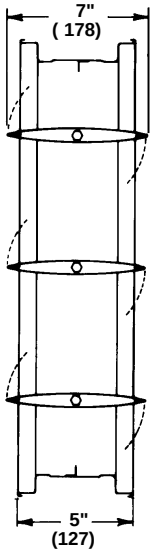
SP100: Dampers shall be equipped with factory installed damper position indication switch package. The switch package shall include two position indication switches linked directly to the damper blade to provide full open and full closed damper blade position. The switch package shall be capable of interfacing with the HVAC control system and provide remote damper blade position status. Switch package shall be Ruskin Model SP-100.

Factory Mounted Damper Actuators: If control damper actuators are required, they shall be furnished and mounted by the damper manufacturer in their factory. Each damper shall be cycle tested at the factory prior to shipment.

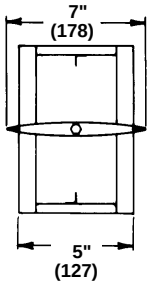
DIMENSIONAL INFORMATION



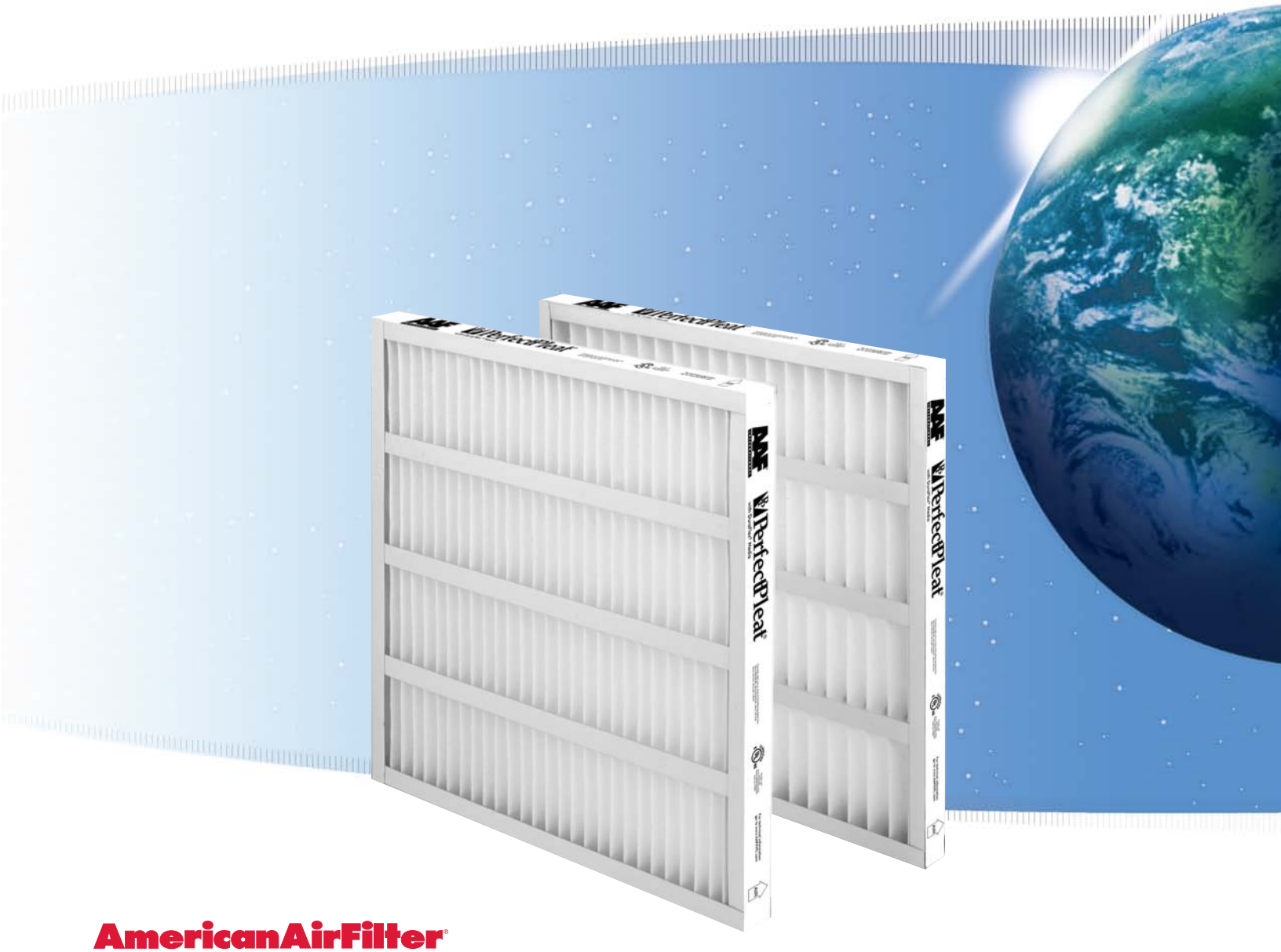
OPPOSED BLADE



PARALLEL BLADE



Low profile frame illustrated is typical for units under 12" (305) high.



AmericanAirFilter®

PerfectPleat® HC M8
PerfectPleat®

1" and 2" Extended Surface, Pleated Filter with Process-Controlled Quality

With DuraFlex® Media

Better Air is Our Business®

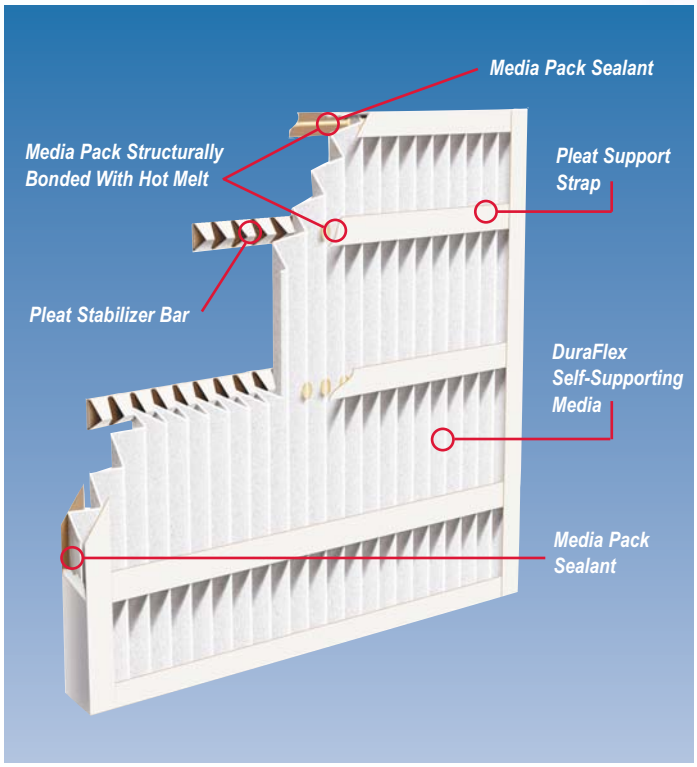
AAF® INTERNATIONAL

AmericanAirFilter®

PerfectPleat® HC M8 - MERV 8
PerfectPleat® - MERV 7

Extended Surface, Pleated Filter with Process-Controlled Quality

- ***Mechanical efficiency — does not rely on electret charge technology***
- ***Form and fit unlike any other pleat available today***
- ***Self-supporting DuraFlex® media made from virgin fiber; no wire support needed***
- ***Consistent media with controlled fiber size and blend***
- ***High capacity model, PerfecPleat HC M8, available for applications where higher efficiencies, airflow, and longer life are important***
- ***Available in 1", 2" and *4" models***
- ***Patented media, filter design, and manufacturing process. Patents covered under one or more of the following US 6398839 B2; US 6254653 B1; US 6159318; US 6165242; US 6387140 B1 (1" model only)***



PerfectPleat 2" Construction

The Air Filtration Leader

AAF International, one of the world's largest manufacturers of air filtration products, is known for technical innovation and excellence. Designed, developed, and patented by AAF, the PerfectPleat is a product with form and fit unlike any other pleated filter in the marketplace today. In addition, the PerfectPleat has the filtering efficiency you need and expect.

Superior Design and Construction

Drawing on years of experience in manufacturing quality air filters, AAF has created a state-of-the-art process for producing pleated filters. The extremely high quality of these filters is a result of three unique innovations: a new, automated manufacturing process; a unique, self-supporting media; and a filter construction that provides incredible strength without wire support.

Since their introduction, pleated filters have become a larger and more important segment of the filtration marketplace. However, conventional design and process are not conducive to the manufacture of consistently pleated media packs or finished filters. Inconsistency in pleat arrangement, variations in media, improper bonding of media to frame, along with antiquated manufacturing techniques, have a negative impact on efficiency, resistance, durability, and strength. The automated and controlled process AAF has developed for the PerfectPleat eliminates these inconsistencies and irregularities. Our automated manufacturing process offers consistency unmatched by conventionally manufactured pleats.

** See brochure AFP-1-206 for 4" model.*

DuraFlex® Media - Patented Media Design

Uniform size virgin fibers are assembled in closely controlled blends to create a media that is both self-supporting and remarkably consistent in performance. When pleated, DuraFlex will hold its shape without the wire support characteristic of conventional pleated filters. That means no potential for the formation of rust and safer handling - no nicks or cuts for the installer or handler.

With the superior resiliency of DuraFlex media and no need for wire support, the PerfectPleat can sustain significant abuse and maintain its shape and pleat spacing. The absence of the wire also makes the filter totally incinerable, which simplifies disposal. The PerfectPleat meets or exceeds all current expectations for service life.

As a result of its unique design, PerfectPleat can withstand significant damage.

DuraFlex media has "memory" which allows PerfectPleat to remain functional, even when the frame has been compromised.

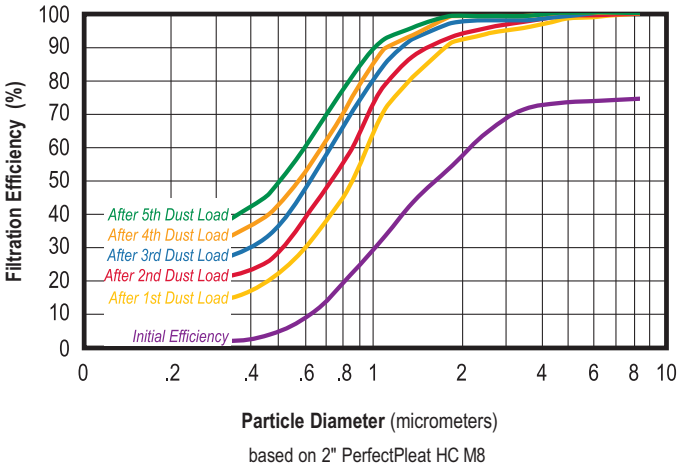
Increasing Efficiency — Throughout Life of the Filter

PerfectPleat is designed to consistently increase its efficiency throughout the service life of the filter. Competitive pleated panel filters, manufactured using an electret charge to obtain the MERV 8 rating, perform with declining efficiency over time. PerfectPleat HC M8 and PerfectPleat have initial MERV 8 and MERV 7 ratings respectively, but the efficiency increases significantly when dust loading begins.

Applications

PerfectPleat's self-supporting characteristics allow a pleating pattern that promotes airflow and maximizes dust holding capacity (DHC). The PerfectPleat HC M8 is ideal for applications where pleated filters are currently in use and higher efficiencies are required or desired. PerfectPleat is best suited for standard capacity pleated filter applications. Heavy Duty (HD) PerfectPleat is available for applications where extremely low temperature and high airflow are present. See Brochure AFP-1-201. Every PerfectPleat offers superior durability and performance when properly installed and maintained.

Particle Size Efficiency Curves



based on 2" PerfectPleat HC M8

Environmentally Responsible Air Filtration Solutions

AAF International is committed to operating with a goal of sustainability. We have implemented several initiatives to work and manufacture in an environmentally responsible manner and contribute more to protecting our planet by using fewer natural resources and reducing our carbon footprint. AAF's PerfectPleat product design minimizes base raw material consumption and meets our "Green" product development standards. The PerfectPleat product line is totally incinerable and the absence of support wire simplifies disposal. Used during construction, PerfectPleat HC M8 may contribute to LEED® certification points under IEQ categories.

2" PerfectPleat — Heavy Duty Frame

The perimeter frame of the PerfectPleat HC M8 and PerfectPleat is constructed from the highest wet-strength 28 pt. beverage carrier board available, securely bonded to the media pack. The 28 pt. thickness improves filter strength and helps resist damage.

Uniquely designed pleat stabilizers are bonded to the media on the air leaving side to ensure uniform pleat spacing and provide additional strength. On the air-entering side, support straps add to the PerfectPleat's rigidity. The support straps and pleat stabilizers ensure integrity against turbulent airflow and provide excellent lateral stability for installation in side-access systems.

1" PerfectPleat — Strength and Durability

The 1" PerfectPleat HC M8 and PerfectPleat have the same durability and performance as the 2" models. Both are made using DuraFlex media encased in a 28 pt. beverage carrier board frame. PerfectPleat 1" models feature a perimeter frame, with three supporting straps on the air entering and air leaving sides of the filter. Both models resist crushing and abuse and can be used in any application where 1" filters are currently in place. PerfectPleat HC M8 is rated MERV 8 and PerfectPleat rates MERV 7.

PerfectPleat HC M8, 1" thick, air leaving side. A blue stripe designates PerfectPleat HC M8 media.

AmericanAirFilter®

PerfectPleat® HC M8 - MERV 8
PerfectPleat® - MERV 7

Product Information Standard Sizes

Nominal Sizes (Inches) (W x H x D)	Actual Sizes (Inches) (W x H x D)	Rated Airflow Capacity (SCFM) 300 FPM	500 FPM	625 FPM	Pleats Per Filter PerfectPleat HC M8 1"	PerfectPleat 1"	PerfectPleat HC M8 2"	PerfectPleat 2"
10 x 10 x 1	9½ x 9½ x ¾	200	**350**		11	11		
10 x 20 x 1	9½ x 19½ x ¾	400	**700**		11	11		
12 x 12 x 1	11½ x 11½ x ¾	300	**500**		14	14		
12 x 20 x 1	11½ x 19½ x ¾	500	**850**		14	14		
12 x 24 x 1	11⅜ x 23⅜ x ¾	600	**1000**		14	14		
14 x 20 x 1	13½ x 19½ x ¾	600	**1000**		16	16		
14 x 25 x 1	13½ x 24½ x ¾	750	**1200**		16	16		
15 x 20 x 1	14½ x 19½ x ¾	650	**1050**		17	17		
16 x 16 x 1	15½ x 15½ x ¾	550	**900**		19	19		
16 x 20 x 1	15½ x 19½ x ¾	650	**1100**		19	19		
16 x 25 x 1	15½ x 24½ x ¾	850	**1400**		19	19		
18 x 20 x 1	17½ x 19½ x ¾	750	**1250**		21	21		
18 x 24 x 1	17⅜ x 23⅜ x ¾	900	**1500**		21	21		
18 x 25 x 1	17½ x 24½ x ¾	950	**1550**		21	21		
20 x 20 x 1	19½ x 19½ x ¾	850	**1400**		24	24		
20 x 25 x 1	19½ x 24½ x ¾	1050	**1750**		24	24		
24 x 24 x 1	23⅜ x 23⅜ x ¾	1200	**2000**		29	29		
25 x 25 x 1	24½ x 24½ x ¾	1300	**2200**		30	30		
10 x 20 x 2	9½ x 19½ x 1¾	400	**700**	850			11	8
12 x 20 x 2	11½ x 19½ x 1¾	500	**850**	1050			14	10
12 x 24 x 2	11⅜ x 23⅜ x 1¾	600	**1000**	1250			14	10
14 x 25 x 2	13½ x 24½ x 1¾	750	**1200**	1500			16	11
15 x 20 x 2	14½ x 19½ x 1¾	650	**1050**	1300			17	12
15 x 25 x 2	14½ x 24½ x 1¾	800	**1300**	1650			17	12
16 x 16 x 2	15½ x 15½ x 1¾	550	**900**	1100			19	13
16 x 20 x 2	15½ x 19½ x 1¾	650	**1100**	1400			19	13
16 x 24 x 2	15⅜ x 23⅜ x 1¾	800	**1350**	1650			19	13
16 x 25 x 2	15½ x 24½ x 1¾	850	**1400**	1750			19	13
18 x 25 x 2	17½ x 24½ x 1¾	950	**1550**	1950			21	15
18 x 24 x 2	17⅜ x 23⅜ x 1¾	900	**1500**	1900			21	15
20 x 20 x 2	19½ x 19½ x 1¾	850	**1400**	1750			24	17
20 x 24 x 2	19⅜ x 23⅜ x 1¾	1000	**1650**	2100			24	17
20 x 25 x 2	19½ x 24½ x 1¾	1050	**1750**	2150			24	17
24 x 24 x 2	23⅜ x 23⅜ x 1¾	1200	**2000**	2500			29	20
25 x 25 x 2	24½ x 24½ x 1¾	1300	**2150**	2700			30	21

PerfectPleat and PerfectPleat HC M8 filters are classified UL Class 2. Testing was performed according to UL Standard 900 and CAN 4-S111.

Performance Data

Filter	Pleats Per Lineal Foot	Rated Initial Resistance (in. w.g.) 300 FPM	500 FPM	625 FPM	Recommended Final Resistance (in. w.g.)	ASHRAE 52.2 MERV	Continuous Operating Temperature Limits °F	°C
PerfectPleat HC M8 2"	15.0	.16	**.33**	.43	1.0	8	170°	77°
PerfectPleat 2"	10.0	.14	**.30**	.45	1.0	7	170°	77°
PerfectPleat HC M8 1"	15.0	.31	**.62**	----	1.0	8	170°	77°
PerfectPleat 1"	15.0	.20	**.48**	----	1.0	7	170°	77°

AAF® INTERNATIONAL
10300 Ormsby Park Place Suite 600
Louisville, Kentucky 40223-6169

www.aafintl.com
Customer Service 888.AAF.2003
Fax 888.223.6500

AAF has a policy of continuous product research and improvement and reserves the right to change design and specifications without notice.

ISO Certified Firm

AFP-1-200P MAR '09 VI 5M

RigiFil®

Extended-Surface Rigid Air Filter with Synthetic Media

- *All Metal Rigid Construction*
- *Ideal for VAV Systems*
- *Synthetic Media with Plastic Pleat Spacers*
- *Available in Four Efficiencies (90-95%, 80-85%, 60-65%, and 50-55%)*
- *UL Class 2*

Available with peripheral header.

The RigiFil is a rigid, durable extended surface filter that is ideal for variable air volume (VAV) systems. It provides a higher level of filtration in those applications where cleaner air is required. With metal cell sides and synthetic media, the RigiFil also offers superior moisture resistance and dependability. Each efficiency is designated by a color coded media: yellow (90-95%), pink (80-85%), green (60-65%), and white (50-55%).

STURDY CONSTRUCTION FOR DEPENDABLE PERFORMANCE

The RigiFil, with its galvanized steel cell sides and plastic pleat spacers, withstands the most demanding applications. The pleat spacers maintain the shape of the synthetic media pack and ensure that both the efficiency and dust-holding capacity are maximized. The media pack is bonded to the cell sides to ensure a leak-free seal.

AAF® INTERNATIONAL

SELECTION GUIDE AND PERFORMANCE DATA

All Metal - Class 2 Synthetic

Part Number	Description	Nominal Size (In.)	Actual Size (In.)	Airflow (CFM)	*Resistance (In. W.G.) Initial	Final	Media Area (Ft. Sq.)
327-295-001	RigiFil 90-95%	24x24x12	23.38x23.38x11.50	2000	.54	1.5	58
327-295-002	RigiFil 90-95%	12x24x12	11.38x23.38x11.50	1000	.54	1.5	29
327-295-003	RigiFil 90-95%	20x24x12	19.38x23.38x11.50	1660	.54	1.5	48
327-295-004	RigiFil 90-95%	20x20x12	19.38x19.38x11.50	1400	.54	1.5	40
327-395-001	RigiFil PH 90-95%	24x24x12	23.38x23.38x11.50	2000	.61	1.5	50
327-395-002	RigiFil PH 90-95%	12x24x12	11.38x23.38x11.50	1000	.61	1.5	25
327-395-003	RigiFil PH 90-95%	20x24x12	19.38x23.38x11.50	1660	.61	1.5	40
327-395-004	RigiFil PH 90-95%	20x20x12	19.38x19.38x11.50	1400	.61	1.5	33
327-285-001	RigiFil 80-85%	24x24x12	23.38x23.38x11.50	2000	.34	1.5	58
327-285-002	RigiFil 80-85%	12x24x12	11.38x23.38x11.50	1000	.34	1.5	29
327-285-003	RigiFil 80-85%	20x24x12	19.38x23.38x11.50	1660	.34	1.5	48
327-285-004	RigiFil 80-85%	20x20x12	19.38x19.38x11.50	1400	.34	1.5	40
327-385-001	RigiFil PH 80-85%	24x24x12	23.38x23.38x11.50	2000	.39	1.5	50
327-385-002	RigiFil PH 80-85%	12x24x12	11.38x23.38x11.50	1000	.39	1.5	25
327-385-003	RigiFil PH 80-85%	20x24x12	19.38x23.38x11.50	1660	.39	1.5	40
327-385-004	RigiFil PH 80-85%	20x20x12	19.38x19.38x11.50	1400	.39	1.5	33
327-265-001	RigiFil 60-65%	24x24x12	23.38x23.38x11.50	2000	.23	1.5	58
327-265-002	RigiFil 60-65%	12x24x12	11.38x23.38x11.50	1000	.23	1.5	29
327-265-003	RigiFil 60-65%	20x24x12	19.38x23.38x11.50	1660	.23	1.5	48
327-265-004	RigiFil 60-65%	20x20x12	19.38x19.38x11.50	1400	.23	1.5	40
327-365-001	RigiFil PH 60-65%	24x24x12	23.38x23.38x11.50	2000	.26	1.5	50
327-365-002	RigiFil PH 60-65%	12x24x12	11.38x23.38x11.50	1000	.26	1.5	25
327-365-003	RigiFil PH 60-65%	20x24x12	19.38x23.38x11.50	1660	.26	1.5	40
327-365-004	RigiFil PH 60-65%	20x20x12	19.38x19.38x11.50	1400	.26	1.5	33
327-255-001	RigiFil 50-55%	24x24x12	23.38x23.38x11.50	2000	.22	1.5	58
327-255-002	RigiFil 50-55%	12x24x12	11.38x23.38x11.50	1000	.22	1.5	29
327-255-003	RigiFil 50-55%	20x24x12	19.38x23.38x11.50	1660	.22	1.5	48
327-255-004	RigiFil 50-55%	20x20x12	19.38x19.38x11.50	1400	.22	1.5	40
327-355-001	RigiFil PH 50-55%	24x24x12	23.38x23.38x11.50	2000	.25	1.5	50
327-355-002	RigiFil PH 50-55%	12x24x12	11.38x23.38x11.50	1000	.25	1.5	25
327-355-003	RigiFil PH 50-55%	20x24x12	19.38x23.38x11.50	1660	.25	1.5	40
327-355-004	RigiFil PH 50-55%	20x20x12	19.38x19.38x11.50	1400	.25	1.5	33

EFFICIENCY

Yellow (90-95%), Pink (80-85%), Green (60-65%), White (50-55%)

NOTES

All listed efficiencies are averages according to ASHRAE 52.1.
All performance data is based on ASHRAE 52.1 test method. Performance tolerances conform to section 7.4 of ARI Standard 850-78.
Rated UL and cUL Class 2.
Temperature limitation is 200°F (93°C) continuous, and 220°F (107°C) intermittent.
Actual depth of 12" filter is 11.50" (292mm).
Headered models available with 3/4" (19mm) header.

**Maximum recommended final resistance in system design may indicate a lower change-out point.*

AAF INTERNATIONAL®
10300 ORMSBY PARK PL STE 600
LOUISVILLE KY 40223-6169
P O BOX 35690
LOUISVILLE KY 40232-5690
www.aafintl.com

For Additional Information On AAF Products,
Call The Answer Center
888.AAF.2003

Member National Air Filtration Association

ISO-9001 DNV CERTIFICATED FIRM

Temtrol, Inc.
Phone - 405-263-7286 Fax - 405-263-4924

INFORMATION COVERING :

SERIES ITF

AIR HANDLERS
INDOOR - MOUNTED
AIR HANDLING UNITS
I-ITF-07

INSTRUCTION

MANUAL

INSTALLATION

"START-UP"

OPERATION -

MAINTENANCE

& INSPECTION

Temtrol, Inc.
Phone - 405-263-7286 Fax - 405-263-4924

INFORMATION COVERING : SERIES ITF

AIR HANDLERS
INDOOR - MOUNTED
AIR HANDLING UNITS
I-ITF-07

CES GROUP LIMITED WARRANTY

Unless otherwise agreed in writing signed by Seller: (a) Seller warrants: (i) All Products (excluding software and spare parts) manufactured by Seller will conform to the specifications and submittals provided by Seller and will be free of defects in material and workmanship ("**Defects**") for 12 months following start-up or 18 months following ship date, whichever occurs first, under normal use and regular service and maintenance, if installed and maintained pursuant to Seller's instructions. For warranty purposes, start-up occurs when the equipment (or any portion thereof) is started for operation regardless of when the building may be ready for operation. Products that include required start-up by Seller will not be warranted hereunder unless Seller (or its authorized representative) performs the start-up. If Seller requires a completed start-up form and such form has not been received by Seller within six (6) months from shipment, then start-up will be deemed to have occurred on the ship date. New spare parts will be free of Defects for 12 months following ship date. Buyer must notify Seller of any Defect promptly upon discovery and if such notification occurs within the applicable warranty period, Seller shall remedy such Defect by, at Seller's option, adjustment, repair or replacement of Products or any affected portion of Products, or providing a refund of the portion of the purchase price attributable to the defective portion of the Product. Buyer assumes all responsibility and expense for removal, reinstallation and freight charges (both for return and delivery of new parts). Buyer must grant Seller access to the premises at which Products are located at all reasonable times so that Seller can evaluate any Defect and make repairs or replacements on site. Repaired or replaced portions of Products are warranted until the later of the end of the warranty period applicable to the defective portion of Products repaired or replaced; or 30 days following the completion of the repair or ship date of the replacement parts; and (ii) Services will be of workmanlike quality. If Buyer notifies Seller of any nonconforming Services within 30 days after Services are completed, Seller shall re-perform, if able to be cured, those Services directly affected by such failure, at its sole expense. Buyer's sole remedy for such nonconforming Services is limited to the cost of re-performing the Services.

(b) Buyer is responsible for disassembly and re-assembly of non-Seller supplied products. Seller does not warrant and shall have no obligation with respect to any Products that: (i) have been repaired or altered by someone other than Seller or Seller's authorized representative; (ii) have been subject to misuse, abuse, neglect, intentional misconduct, accident, Buyer or third party negligence, unauthorized modification or alteration, use beyond rated capacity, a Force Majeure Event, or improper, or a lack of, maintenance; (iii) are comprised of materials provided by, or designed pursuant to instructions from, Buyer; (iv) have failed due to ordinary wear and tear; (v) have been exposed to adverse operating or environmental conditions including but not limited to contaminants, corrosive agents, chemicals or minerals, (vi) were manufactured or furnished by others and which are not an integral part of a product manufactured by Seller, or (vii) have not been fully paid for by Buyer. Refrigerants, fluids, oils and expendable items such as filters are not covered by this Limited Warranty. If Seller has relied upon any specifications, information, representations or descriptions of operating conditions or other data supplied by Buyer or its agents to Seller in the selection or design of Products, and actual operating conditions or other conditions differ, any warranties or other provisions contained herein that are affected by such conditions will be null and void.

(c) Buyer is solely responsible for determining the fitness and suitability of Products for the use contemplated by Buyer. Buyer shall ensure that (i) the Products are used only for the purposes and in the manner for which they were designed and supplied, (ii) all persons likely to use or come into contact with the Products receive appropriate training and copies of applicable instructions and documentation supplied by Seller, (iii) all third parties who use or may be affected by or rely upon the Products are given full and clear warning of any hazards associated with them or limitations of their effectiveness and that safe working practices are adopted and complied with, (iv) any warning notices displayed on the Products are not removed or obscured, (v) any third party to whom the Products are supplied agrees not to remove or obscure such warning notices. Buyer assumes all responsibility for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use of Products, either alone or in combination with other Products or components.

(d) If Software is Licensed: Seller warrants that the Seller-originated software included within Products ("**Seller Software**"), when properly installed, will substantially conform to the applicable functions specified in its documentation for a period of 30 days following its ship date. If any failure to conform to this warranty occurs during such 30-day period, Seller shall, upon prompt written notice of the specific non-conformity from Buyer, correct such non-conformity by repair or replacement, FOB Seller's facility (EXW per INCOTERMS 2010 for international shipments), of the defective program or refund Buyer's purchase price applicable to the defective program. Seller has no obligation for Seller Software failures resulting from: (i) unauthorized modification of the Seller Software; (ii) Buyer or third party supplied software, or interfacing or integration with Buyer or third party supplied software. The foregoing warranty does not apply to software originating from third parties ("**Third Party Software**"). To the extent applicable and authorized by the Third Party Software supplier, Seller hereby assigns to Buyer any warranties provided by such suppliers. Seller provides Third Party Software "as is," without any warranties, express or implied. Seller has no obligation for Third Party Software failures.

(e) THE WARRANTIES SET FORTH HEREIN ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES WITH RESPECT TO PRODUCTS, SOFTWARE AND SERVICES, AND ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY AGAINST INFRINGEMENT; AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, USAGE OF TRADE, AND FITNESS FOR A PARTICULAR PURPOSE. **Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to Buyer. SELLER DOES NOT WARRANT THAT THE OPERATION OF SOFTWARE WILL BE UNINTERRUPTED OR ERROR FREE, OR THAT ANY DEFECT OR MALFUNCTION IN THE SOFTWARE IS CORRECTABLE OR WILL BE CORRECTED.** THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE REMEDIES FOR ANY AND ALL CLAIMS ARISING FROM OR RELATED TO PRODUCTS AND SERVICES. All warranty claims must be received by Seller on or before the end of the applicable warranty period.

Limitation of Remedy and Liability. Seller's total liability under the Agreement, whether in law, equity, contract, infringement, negligence, strict liability or other otherwise, shall not exceed one-half the price paid by Buyer under the Agreement for the Product or Services giving rise to the claim. Under no circumstances shall Seller be liable for special, incidental, indirect, punitive or consequential damages for any reason. "**Consequential damages**" includes, without limitation, loss of anticipated profits; business interruption; loss of use, revenue, reputation or data; costs incurred, including without limitation, costs for capital, fuel or power; loss or damage to property or equipment; and environmental clean-up. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to Buyer. Any action arising under or relating to the Agreement, (whether based in law, equity, contract, infringement, negligence, strict liability, other tort or otherwise), must be commenced within one year after the date of shipment or delivery of Product or Services. Seller assumes no obligation or liability for technical advice given or not given, or results obtained. Seller has set its prices and entered into the Agreement in reliance upon the limitations of liability and other terms and conditions specified herein, which allocate the risk between Buyer and Seller and form a basis of this bargain between the parties.

CES GROUP TERMS AND CONDITIONS OF SALE

These Terms and Conditions of Sale and the non-conflicting provisions in Seller's quotation (if any), acknowledgement or invoice from Seller (collectively, the "**Agreement**") govern in all respects all sales of any products ("**Products**") and services (the "**Services**") from the Nortek / CES Group legal entity selling Products and Services ("**Seller**") to purchaser ("**Buyer**"). Buyer acknowledges that Seller, through its affiliates (i.e., parents, subsidiaries and other affiliates) offers expanded manufacturing capability, and Seller may in its sole discretion manufacture, supply or deliver from any location or source, including any of its affiliates, any Products or Services and such manufacture, supply or delivery from such affiliates shall also be subject to these Terms and Conditions.

1. Prices and Taxes. Prices are those in effect when Seller accepts a purchase order. Seller may accept or reject purchase orders in its sole discretion. Buyer must pay or promptly reimburse Seller for any sales, use or any other local, state, provincial or federal taxes arising from the sale or delivery of the Products and Services or provide an exemption certificate. All prices, models and material specifications are subject to change or withdrawal by Seller without notice.

2. Payment. Except to the extent credit terms are expressly agreed in writing by Seller, Buyer shall pay invoices, without setoff, 1% 10 / net 30 days from date of invoice, in the currency specified on the invoice. If Buyer fails to make any payment or pay any invoice according to its terms, or upon such credit terms as expressly agreed to in writing by Seller, then, in addition to all other rights and remedies available to Seller: (a) Buyer is responsible for any and all commercially reasonable charges, expenses or commissions incurred by Seller in stopping delivery, transportation and storage of Products, and in connection with the return or resale of Products; (b) Seller has the right to terminate the Agreement or suspend further performance under the Agreement and other agreements with Buyer; and (c) Buyer shall be liable to Seller for all reasonable costs of collection, including reasonable attorneys' fees. Past due amounts are subject to service charges of 1½% per month (or the maximum amount permitted by law) and, if credit terms have been agreed to in writing, Seller reserves the right to charge lawful rates of interest upon any outstanding balance, whether past due or not. Whenever, in Seller's judgment, reasonable grounds for insecurity arise concerning Buyer's ability to make payment when due, Seller may demand additional satisfactory security or adequate assurance of due performance, may refuse delivery except for cash, including payment for all goods previously delivered under the contract, or may stop delivery or reclaim the Products, in addition to all other remedies provided for by law. Buyer's purchase order, and any shipping or delivery instructions, shall each constitute the Buyer's separate written representation that it is solvent.

3. Changes. Seller may revise prices, dates of delivery, and warranties upon acceptance of requests by Buyer for modifications to Products or Services. If Buyer rejects proposed changes to made-to-order Products deemed necessary by Seller to conform to the applicable specification, Seller is relieved of its obligation to conform to such specification to the extent that conformance may be affected by such objection in the reasonable opinion of Seller.

4. Shipment and Delivery. Deliveries of Products, title (subject to any lawful reservation of Seller's security interest) and risk of loss pass to Buyer FOB Seller's facility (EXW per INCOTERMS 2010 for international shipments). Buyer is responsible for all demurrage or detention charges. Title to any software provided with Products remains with Seller or its supplier. Any claims for shortages or damages suffered in transit must be submitted directly to the carrier. All shipping dates are approximate and not guaranteed. Seller reserves the right to make partial shipments. Seller is not bound to tender delivery of any Products for which Buyer has not provided shipping instructions. If shipment of Products is postponed or delayed by Buyer for any reason, including a Force Majeure Event (defined in Section 9), Seller may move Products to storage for the account of and at the risk of Buyer and the Products will be deemed delivered. Products may not be returned except with the prior written consent of Seller, which may include additional terms.

5. Inspection and Acceptance. Unless otherwise agreed in writing signed by Seller, Buyer shall inspect Products upon receipt at the first delivery destination. Buyer's failure to inspect Products and give written notice to Seller of any alleged defects or non-conformity within ten (10) days after receipt at first delivery destination shall constitute Buyer's irrevocable acceptance of Products delivered. Notice of any latent defect must be delivered to Seller in writing within ten (10) days of start-up.

6. Limited Warranty. Unless otherwise agreed in writing signed by Seller: (a) Seller warrants: (i) All Products (excluding software and spare parts) manufactured by Seller will conform to the specifications and submittals provided by Seller and will be free of defects in material and workmanship ("**Defects**") for 12 months following start-up or 18 months following ship date, whichever occurs first, under normal use and regular service and maintenance, if installed and maintained pursuant to Seller's instructions. For warranty purposes, start-up occurs when the equipment (or any portion thereof) is started for operation regardless of when the building may be ready for operation. Products that include required start-up by Seller will not be warranted hereunder unless Seller (or its authorized representative) performs the start-up. If Seller requires a completed start-up form and such form has not been received by Seller within six (6) months from shipment, then start-up will be deemed to have occurred on the ship date. New spare parts will be free of Defects for 12 months following ship date. Buyer must notify Seller of any Defect promptly upon discovery and if such notification occurs within the applicable warranty period, Seller shall remedy such Defect by, at Seller's option, adjustment, repair or replacement of Products or any affected portion of Products, or providing a refund of the portion of the purchase price attributable to the defective portion of the Product. Buyer assumes all responsibility and expense for removal, reinstallation and freight charges (both for return and delivery of new parts). Buyer must grant Seller access to the premises at which Products are located at all reasonable times so that Seller can evaluate any Defect and make repairs or replacements on site. Repaired or replaced portions of Products are warranted until the later of the end of the warranty period applicable to the defective portion of Products repaired or replaced; or 30 days following the completion of the repair or ship date of the replacement parts; and (ii) Services will be of workmanlike quality. If Buyer notifies Seller of any nonconforming Services within 30 days after Services are completed, Seller shall re-perform, if able to be cured, those Services directly affected by such failure, at its sole expense. Buyer's sole remedy for such nonconforming Services is limited to the cost of re-performing the Services.

(b) Buyer is responsible for disassembly and re-assembly of non-Seller supplied products. Seller does not warrant and shall have no obligation with respect to any Products that: (i) have been repaired or altered by someone other than Seller or Seller's authorized representative; (ii) have been subject to misuse, abuse, neglect, intentional misconduct, accident, Buyer or third party negligence, unauthorized modification or alteration, use beyond rated capacity, a Force Majeure Event, or improper, or a lack of, maintenance; (iii) are comprised of materials provided by, or designed pursuant to instructions from, Buyer; (iv) have failed due to ordinary wear and tear; (v) have been exposed to adverse operating or environmental conditions including but not limited to contaminants, corrosive agents, chemicals or minerals, (vi) were manufactured or furnished by others and which are not an integral part of a product manufactured by Seller, or (vii) have not been fully paid for by Buyer. Refrigerants, fluids, oils and expendable items such as filters are not covered by this Limited Warranty. If Seller has relied upon any specifications, information, representations or descriptions of operating conditions or other data supplied by Buyer or its agents to Seller in the selection or design of Products, and actual operating conditions or other conditions differ, any warranties or other provisions contained herein that are affected by such conditions will be null and void.

(c) Buyer is solely responsible for determining the fitness and suitability of Products for the use contemplated by Buyer. Buyer shall ensure that (i) the Products are used only for the purposes and in the manner for which they were designed and supplied, (ii) all persons likely to use or come into contact with the Products receive appropriate training and copies of

applicable instructions and documentation supplied by Seller, (iii) all third parties who use or may be affected by or rely upon the Products are given full and clear warning of any hazards associated with them or limitations of their effectiveness and that safe working practices are adopted and complied with, (iv) any warning notices displayed on the Products are not removed or obscured, (v) any third party to whom the Products are supplied agrees not to remove or obscure such warning notices. Buyer assumes all responsibility for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use of Products, either alone or in combination with other Products or components.

(d) If Software is Licensed: Seller warrants that the Seller-originated software included within Products ("**Seller Software**"), when properly installed, will substantially conform to the applicable functions specified in its documentation for a period of 30 days following its ship date. If any failure to conform to this warranty occurs during such 30-day period, Seller shall, upon prompt written notice of the specific non-conformity from Buyer, correct such non-conformity by repair or replacement, FOB Seller's facility (EXW per INCOTERMS 2010 for international shipments), of the defective program or refund Buyer's purchase price applicable to the defective program. Seller has no obligation for Seller Software failures resulting from: (i) unauthorized modification of the Seller Software; (ii) Buyer or third party supplied software, or interfacing or integration with Buyer or third party supplied software. The foregoing warranty does not apply to software originating from third parties ("**Third Party Software**"). To the extent applicable and authorized by the Third Party Software supplier, Seller hereby assigns to Buyer any warranties provided by such suppliers. Seller provides Third Party Software "as is," without any warranties, express or implied. Seller has no obligation for Third Party Software failures.

(e) THE WARRANTIES SET FORTH IN THIS SECTION 6 ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES WITH RESPECT TO PRODUCTS, SOFTWARE AND SERVICES, AND ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY AGAINST INFRINGEMENT; AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, USAGE OF TRADE, AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to Buyer. SELLER DOES NOT WARRANT THAT THE OPERATION OF SOFTWARE WILL BE UNINTERRUPTED OR ERROR FREE, OR THAT ANY DEFECT OR MALFUNCTION IN THE SOFTWARE IS CORRECTABLE OR WILL BE CORRECTED. THE REMEDIES PROVIDED IN THIS SECTION 6 ARE BUYER'S SOLE REMEDIES FOR ANY AND ALL CLAIMS ARISING FROM OR RELATED TO PRODUCTS AND SERVICES. All warranty claims must be received by Seller on or before the end of the applicable warranty period.

7. Limitation of Remedy and Liability. Seller's total liability under the Agreement, whether in law, equity, contract, infringement, negligence, strict liability or other otherwise, shall not exceed one-half the price paid by Buyer under the Agreement for the Product or Services giving rise to the claim. Under no circumstances shall Seller be liable for special, incidental, indirect, punitive or consequential damages for any reason. "**Consequential damages**" includes, without limitation, loss of anticipated profits; business interruption; loss of use, revenue, reputation or data; costs incurred, including without limitation, costs for capital, fuel or power; loss or damage to property or equipment; and environmental clean-up. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to Buyer. Any action arising under or relating to the Agreement, (whether based in law, equity, contract, infringement, negligence, strict liability, other tort or otherwise), must be commenced with one year after the date of shipment or delivery of Services. Seller assumes no obligation or liability for technical advice given or not given, or results obtained. Seller has set its prices and entered into the Agreement in reliance upon the limitations of liability and other terms and conditions specified herein, which allocate the risk between Buyer and Seller and form a basis of this bargain between the parties.

8. Indemnity. (a) Seller shall defend at its own expense any action brought against Buyer by a third party alleging that Products (the "**Indemnified Items**") directly infringe any United States patent, and shall pay all damages and costs finally awarded in any such action, provided that Buyer has promptly notified Seller in writing of the action, delivers all necessary assistance in the defense of the action, and permits Seller to control all aspects of the defense, including settlement rights. Seller has no obligation with regard to: (i) any non-Seller originated Products, software or processes, including Indemnified Items or processes which have been modified or combined with non-Seller products or processes; (ii) any Indemnified Items or process provided pursuant to a design provided by or on behalf of Buyer; (iii) any patent issued after the date of the Agreement; (iv) any action settled or otherwise terminated without the prior written consent of Seller; or (v) any claims arising from, or related to, Seller's adherence to any specifications or instructions provided by or on behalf of Buyer.

(b) If Buyer's use of any Indemnified Items is enjoined or, in Seller's opinion, is likely to be enjoined or subject to an infringement claim, Seller, at its expense and at its option and, in conjunction with its defense obligations under this Section 8 in full satisfaction of its indemnity obligations under this Section 8, may replace the applicable portion of the Indemnified Items with a substitute free of any infringement, modify the Indemnified Items so that they are free of any infringement, or procure for Buyer a license or right to use the Indemnified Items. If none of the foregoing options are practical using commercially reasonable efforts, Seller shall have the right to remove the Indemnified Items and refund to Buyer any amounts paid to Seller for such Indemnified Items depreciated over a seven-year period. This Section 8 states Seller's sole and exclusive remedy with respect to claims of infringement or misappropriation of third party proprietary rights of any kind.

(c) If Buyer or any of its agents modifies the Indemnified Items supplied by Seller or combines any of them with any other products or process to produce products or perform a process not furnished by Seller, and such modification, combination, production or performance is the cause of alleged infringement of a United States patent, Buyer shall defend and indemnify Seller in the same manner and to the same extent that Seller would be obligated to indemnify Buyer under this Section 8.

(d) Buyer shall indemnify, defend and hold harmless Seller and its affiliates and their respective shareholders, officers, directors, members, agents and employees against all expenses, costs (including reasonable attorneys' fees), claims, demands, damages, liability, suits or the like arising in connection with or out of (i) any breach by Buyer of the Agreement; or (ii) Seller's adherence to specifications or use of material furnished or specified by Buyer or any of its agents. Additionally, if all or a part of the Indemnified Items sold hereunder are incorporated into an improvement to real property owned by a third party, Buyer will indemnify, defend and hold harmless Seller and its affiliates and their respective shareholders, officers, directors, members, agents and employees against any claim by such third party or its guests or invitees to the extent that the claim seeks to recover damages or otherwise to invoke any legal or equitable remedies beyond those for which Seller has agreed to be liable hereunder.

9. Excuse of Performance. Seller has no liability for non-performance due to acts of God; acts of Buyer; war (declared or undeclared); terrorism or other criminal conduct; fire; flood; weather; sabotage; strikes, or labor or civil disturbances; governmental requests, restrictions, laws, regulations, orders, omissions or actions; unavailability of, or delays in, utilities or transportation; default of suppliers or other inability to obtain necessary materials; embargoes or any other events or causes beyond Seller's reasonable control (each, a "**Force Majeure Event**"). Deliveries or other performance may be suspended for an appropriate period of time or canceled by Seller upon notice to Buyer in the event of a Force Majeure Event, but the remainder of the Agreement will otherwise remain unaffected as a result of the Force Majeure Event. If Seller determines that its ability to perform the Services or the total demand for Products is hindered, limited or made impracticable due to a Force Majeure Event, Seller may delay delivery of Products and Services and allocate its available supply of Products (without obligation to acquire other supplies of any such Products) among its customers on such basis as Seller determines to be equitable without liability for any failure of performance. In the event of a Force Majeure Event, the date of delivery will be extended by a period equal to the delay plus a reasonable time to train and resume production, and the price will be equitably adjusted to compensate Seller for such delay and related costs and expenses.

10. Laws and Regulations. Compliance with any federal, state, provincial or local laws, regulations and directives ("**Laws**") relating to the installation, operation or use of Products or Services is the sole responsibility of Buyer. In addition, Buyer shall comply with all applicable laws, rules, regulations and orders related to anti-bribery or anti-corruption legislation (including without limitation the U.S. Foreign Corrupt Practices Act of 1977 and all national, state, provincial or territorial anti-bribery and anti-corruption statutes) and, as such, will make no offer, payment or gift, will not promise to pay or give, and will not authorize, directly or indirectly, the promise or payment of, any money or anything of value to any government official, any political party or its officials, or any person while knowing or having reason to know that all or a portion of such money or item of value will be offered, given or promised for the purpose of influencing any decision or act to assist Seller or Buyer or otherwise obtaining any improper advantage or benefit. The Agreement is governed by the laws of the State where Seller's principal office is located, without giving effect to its conflict of laws rules, and the parties consent to the exclusive jurisdiction and venue of the federal and state courts located in such State. The application of the United Nations Convention on Contracts for the International Sale of Goods does not apply.

11. Drawings. Any designs, manufacturing drawings or other information submitted to Buyer remain the exclusive property of Seller. Buyer shall not, without Seller's prior written consent, copy such information or disclose such information to a third party.

12. Cancellation. Buyer may cancel orders only upon reasonable advance written notice and upon payment to Seller of cancellation charges which include: (a) all costs and expenses incurred by Seller, and (b) a fixed sum of 10% of the total price of Products to compensate for disruption in scheduling, planned production and other indirect and administrative costs.

13. Export Control. Certain Products may be subject to export controls under the Laws of the US and other countries. Buyer must comply with all such Laws and not export, re-export or transfer, directly or indirectly, any such Product except in compliance with such Laws.

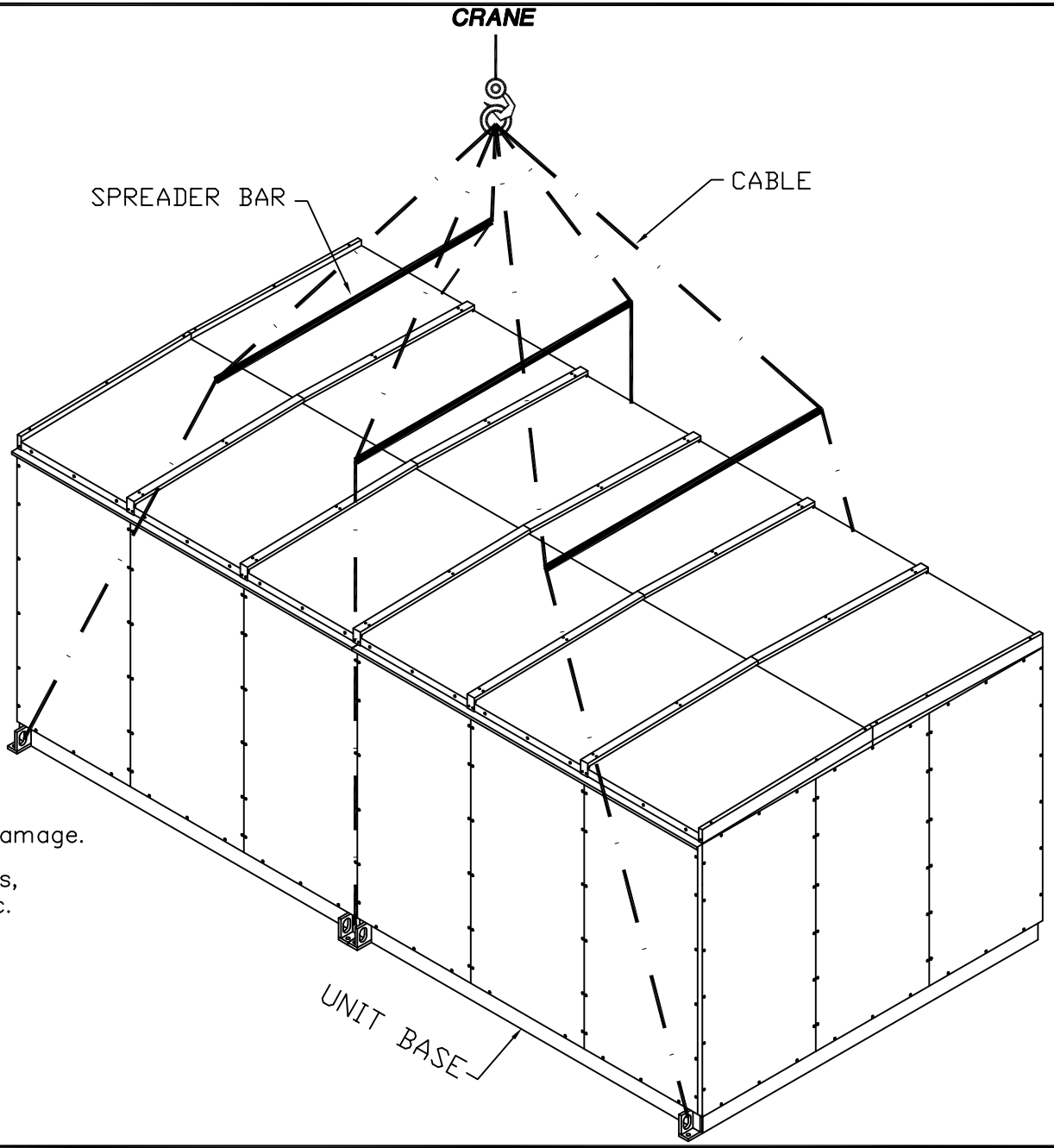
14. General Provisions. The Agreement constitutes the entire agreement between the parties and supersedes all other communications between the parties relating to the subject matter of the Agreement. Seller's quotations are offers that may only be accepted in full. No conditions, usage or trade, course of dealing or performance, understanding or agreement purporting to modify, vary, explain, reject, or supplement the Agreement shall be binding unless made in writing and signed by both parties, expressly and specifically referencing the Agreement, and no modification or objection shall be caused by Seller's receipt, acknowledgment, or acceptance of purchase orders, shipping instruction forms, or other documentation containing different or additional terms to those set forth herein. No waiver by either party with respect to any breach or default or of any right or remedy and no course of dealing, shall be deemed to constitute a continuing waiver of any other breach or default or of any other right or remedy, unless such waiver is expressed in writing signed by both parties, specifically referencing the Agreement. Nothing in the Agreement confers upon any person other than Seller and Buyer any right or remedy under or by reason of this Agreement. All typographical or clerical errors made by Seller in any quotation, acknowledgment or publication are subject to correction.

BUYER accepts these terms and conditions:

Signature:_____

Print Name:_____

Date:_____



All lifting lugs supplied MUST be attached with equal cable tension while rigging before lift. Spreader bars by others are required to eliminate casing damage.

Caution to be taken that door handles, electrical panels, filter gauges, hoods, etc. are not in the way of cables which could be broke, bent or damaged.

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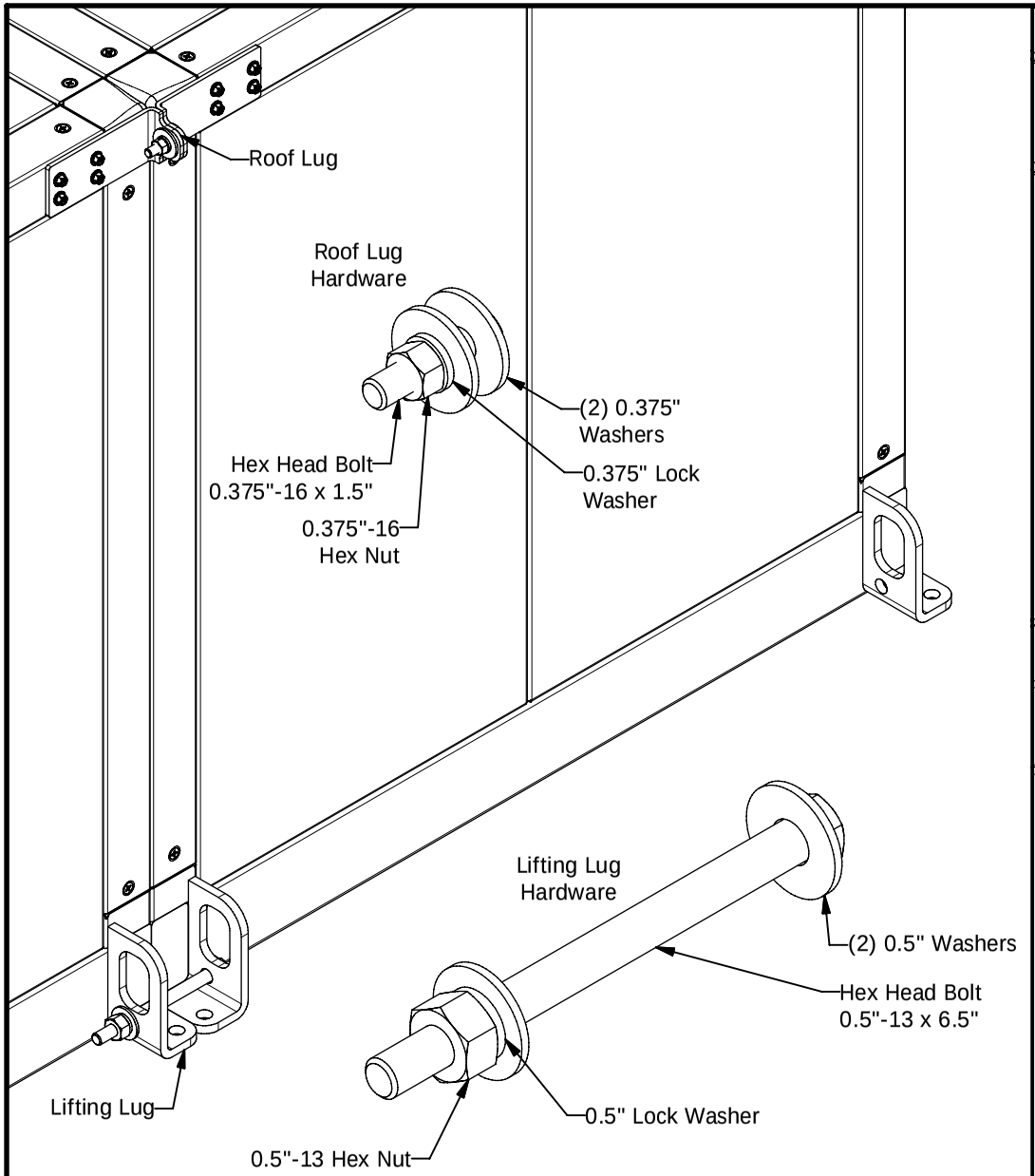
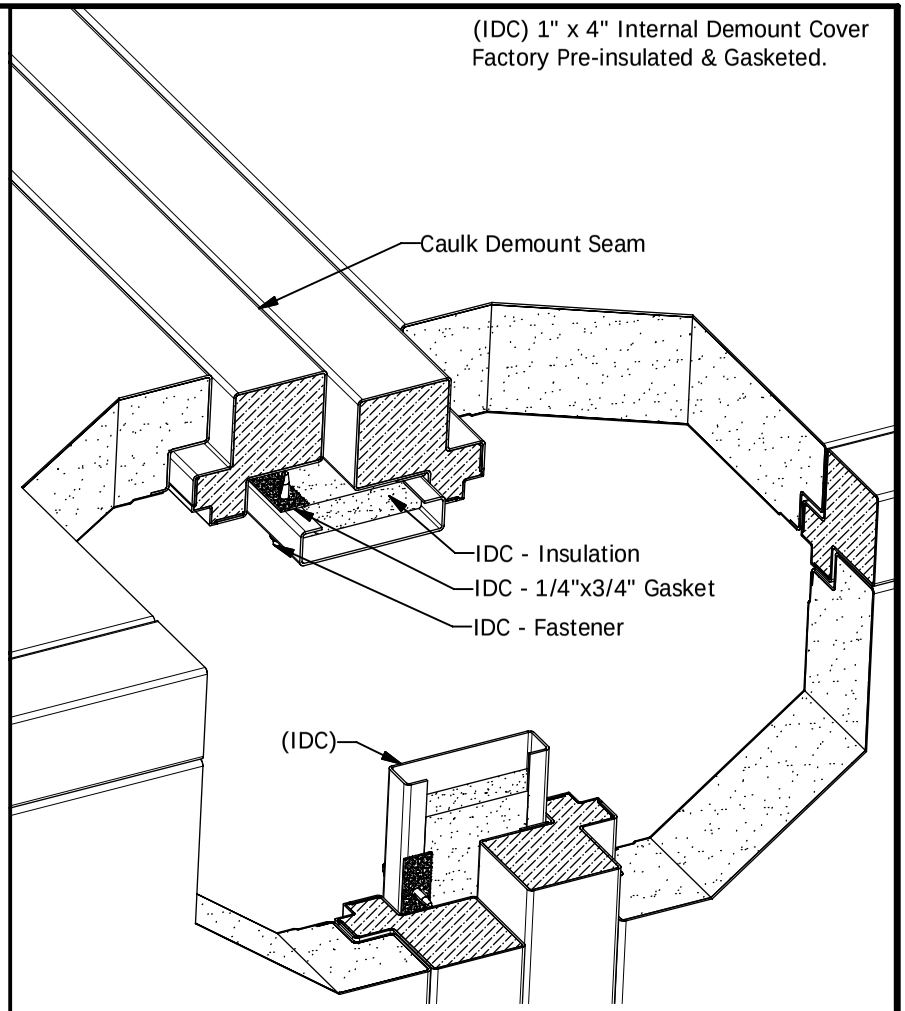
LIFTING AND RIGGING DETAIL

8-12-03





1a.) Units are shipped fully assembled and sealed unless they exceed maximum shipping capabilty. Field disassembly will be the responsibility of the installing contractor.
1b.) Remove protective covering from the ends of each segment (only if unit is shipped in multiple pieces).
2.) Set and level first segment. Set and level next segment.
3.) Bolt lifting & roof lugs together on the exterior of the unit.
4.) Install Internal Demount Covers. (as shown)
5.) (Rooftop Only) See "Weatherproofing Roof Top Demount Seams" detail
6.) Repeat the above for each additional segment.

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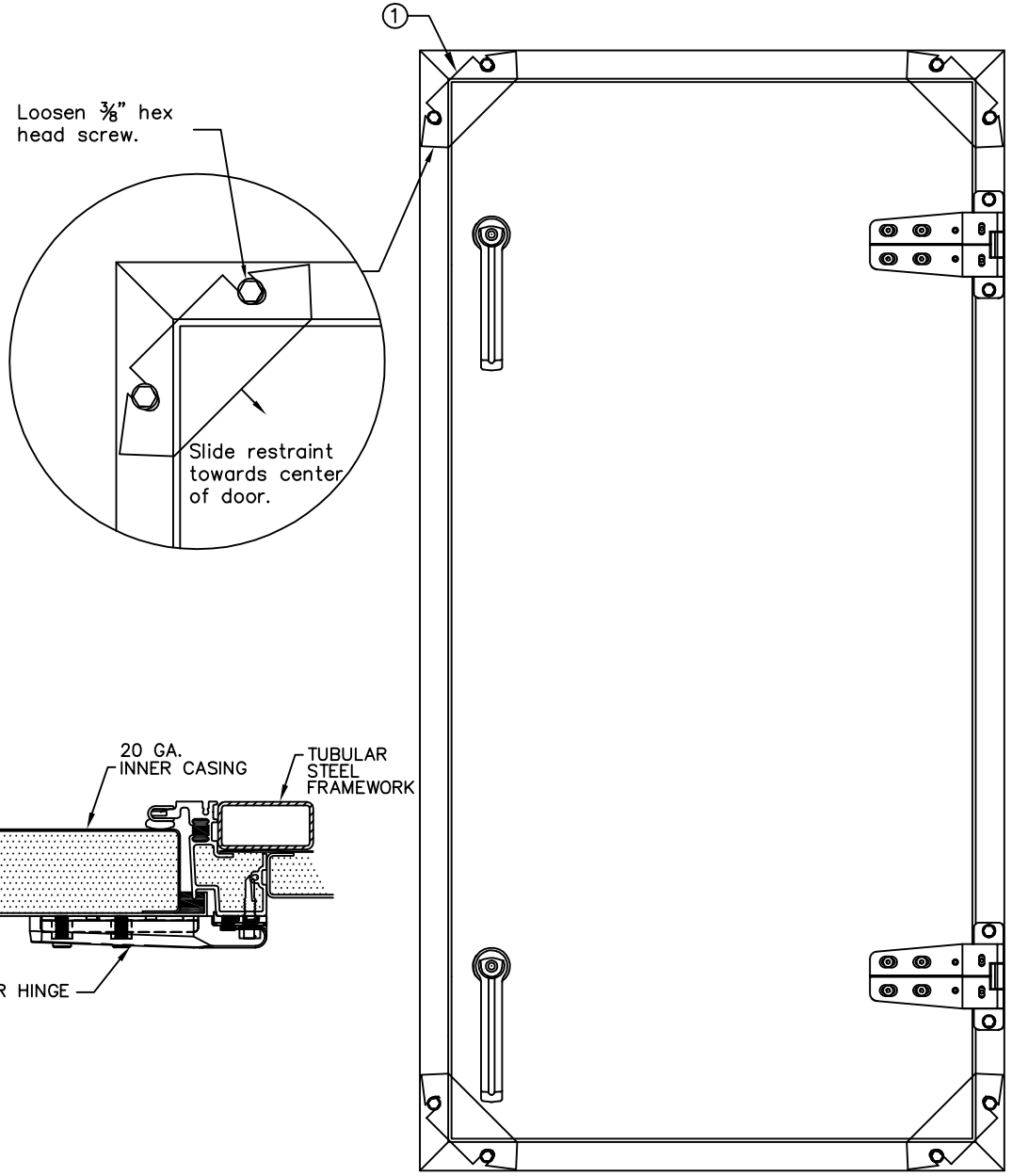
ITF Demount Instructions

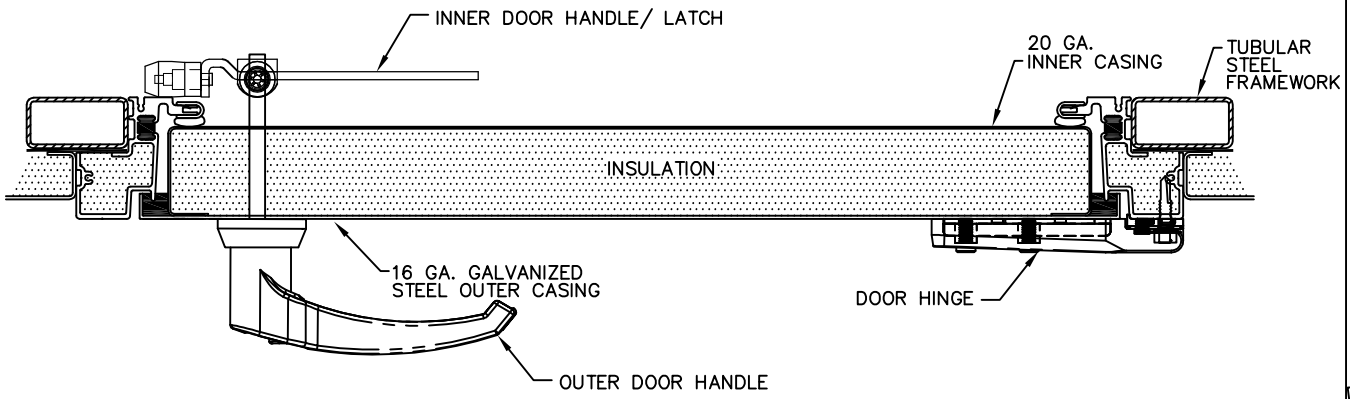
File Name: ITFDetails.idw
Date: 3-28-07

SHIPPING RESTRAINT INSTRUCTIONS:

1.) Loosen 3/8" hex head screw, remove, and discard restraint.

Note: Screws must be tightened after restraint is removed.





NOTE: REFER TO SUBMITTAL FOR HARDWARE SPECIFICATIONS.

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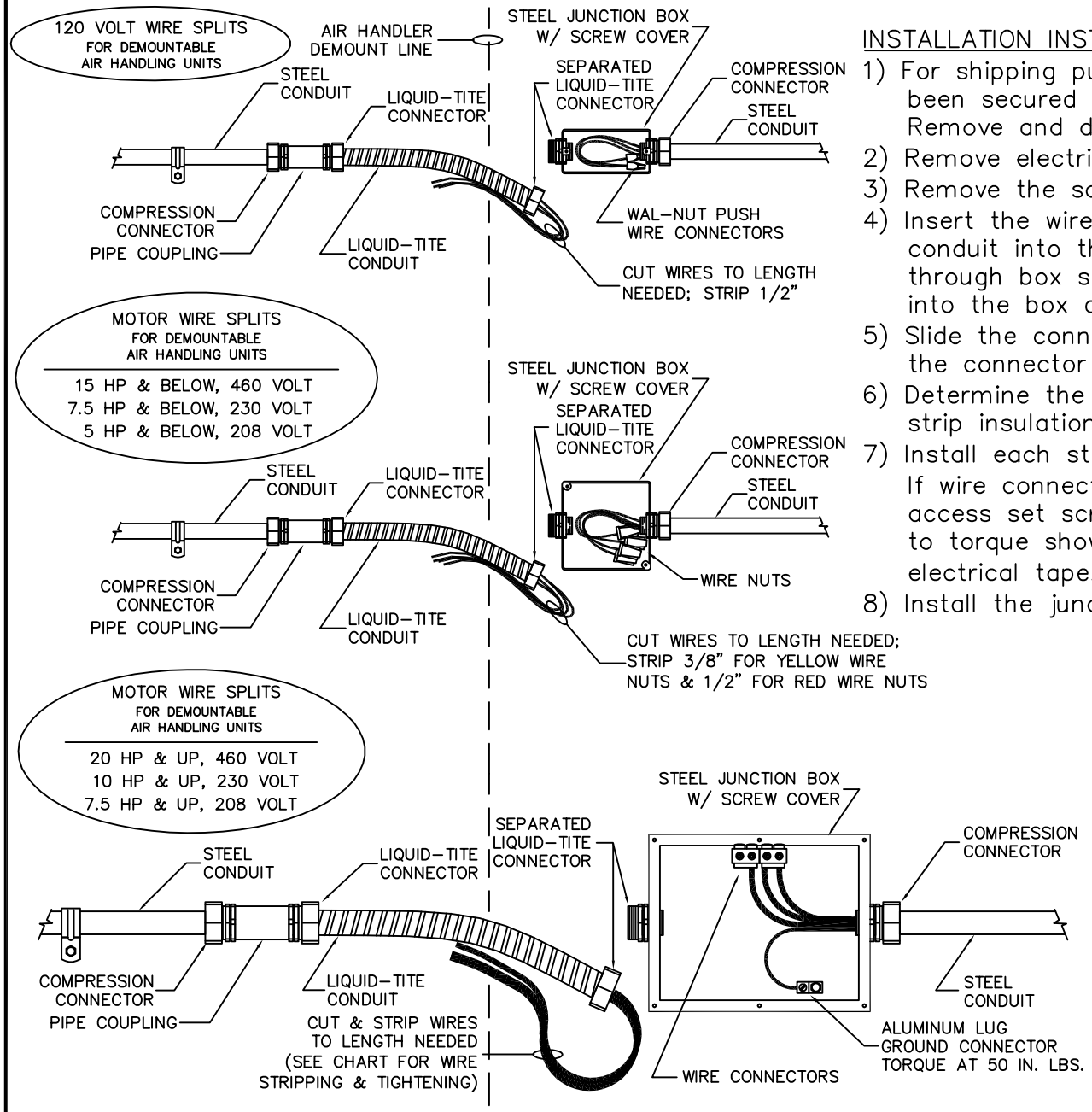
ACCESS DOOR SHIPPING RESTRAINT

File Name: SHIPPING RESTRAINT

Date: 08-14-06



INSTALLATION INSTRUCTIONS:

1) For shipping purposes, the liquid–tite conduit may have been secured to unit casing with a conduit strap. Remove and discard strap to free conduit.
2) Remove electrical tape securing wires to liquid–tite conduit.
3) Remove the screw cover from junction box.
4) Insert the wires that are contained in the liquid–tite conduit into the liquid–tite connector, then pull wires through box so that the liquid–tite conduit can be fitted into the box connector.
5) Slide the connector nut, that is installed on the conduit, to the connector and thread nut on connector, then tighten.
6) Determine the length of each wire needed, then cut and strip insulation.
7) Install each stripped wire end into matching wire connector. If wire connector is "IT" model, remove rubber plugs to access set screws. Once wire is inserted, torque set screw to torque shown. Install rubber access plugs and secure with electrical tape. (See note under wire connector chart)
8) Install the junction cover.

CONNECTOR TORQUES (INCH POUNDS)					
CONNECTOR MODEL WIRE STRIP LENGTH		IT–4 11/16"	IT–1/0 7/8"	IT–3/0 1"	IT–250 1 1/4"
WIRE SIZES	#14–#10	35	35		
	#8	40	75		
	#6–#4	45	110	110	110
	#1–#3		150	150	150
	1/0		180	180	180
	2/0			180	180
	3/0			250	250
	4/0				250
	250				360

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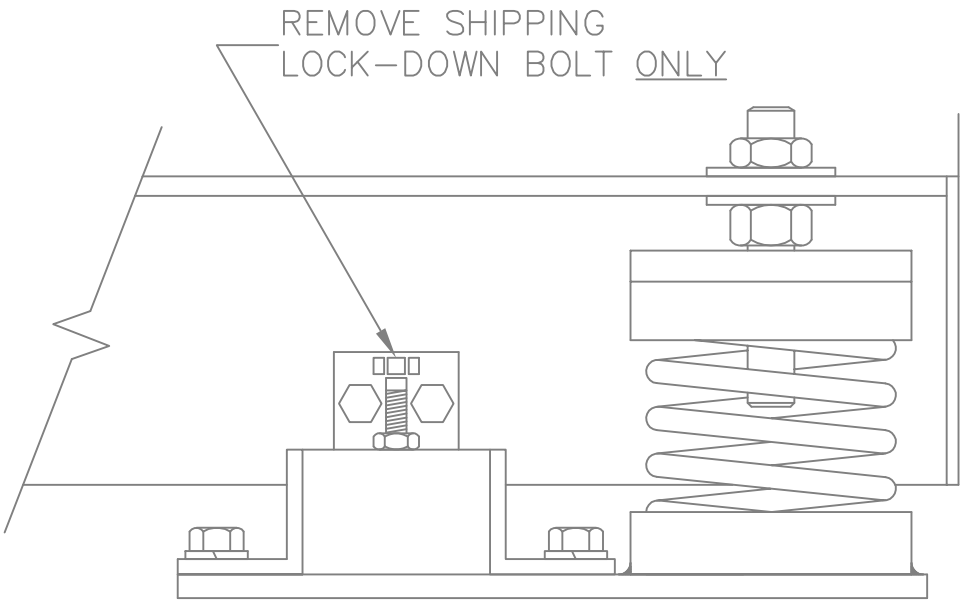
WIRING SPLITS AT DEMOUNTS

8/18/2003

NOTE:
Wires must be torqued and insulation stripped as shown. The wire insulation on a properly installed wire must be inside the insulated connector conductor port no less than 3/8 inch. Install access plugs and secure plugs with at least two wraps of electrical tape across plugs and around connector body.



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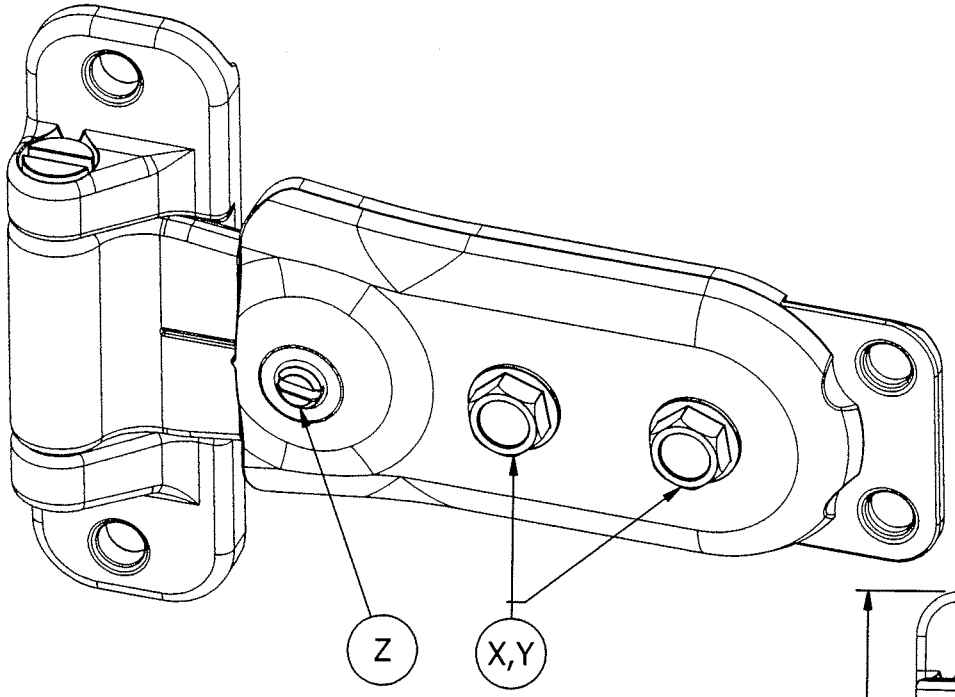
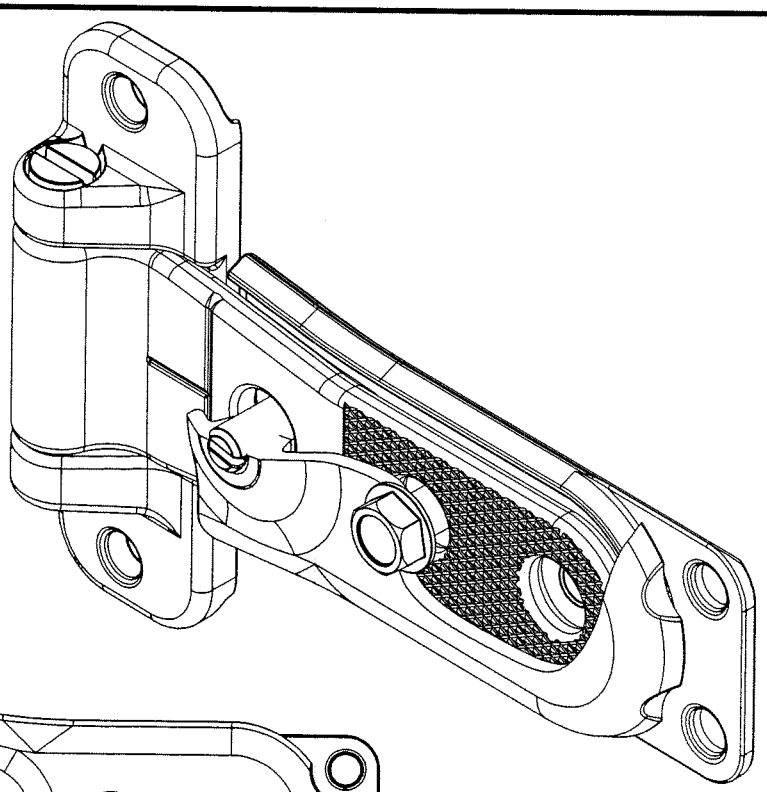
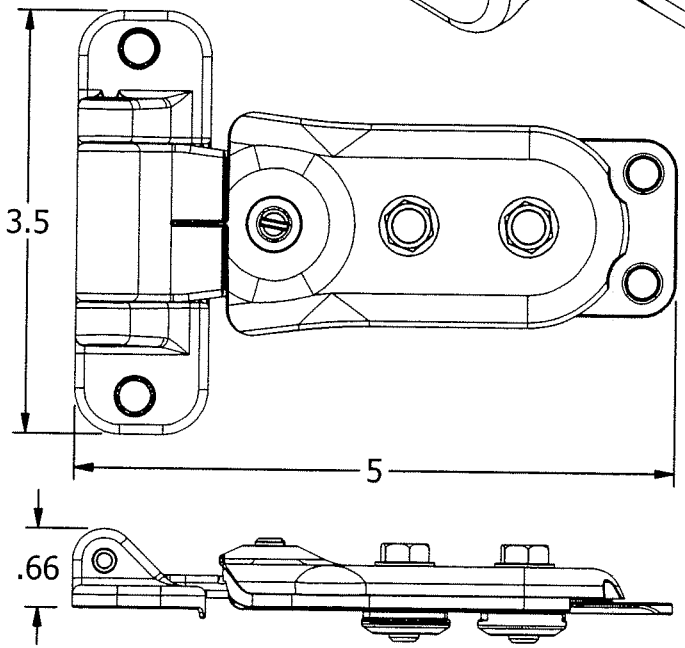
Job Name: SHIPPING LOCK DOWN					Unit Serial No: –
Rep. Contact: –			Temtrol Engineer: BLU		Unit Tag: –
Pro–Select II Version: –	Drawing Date: 08–12–2003	Rep. Firm: –	Unit Type: –	# of Pieces: –	Job No: –







ADJUSTMENT INSTRUCTIONS

X,Y: Left / Right & Up / Down Adjustment

A. Loosen both 1/4" bolts with a 3/8" Hex
B. Move door to desired position
C. Tighten both 1/4" bolts with a 3/8" Hex

Z: Compression Adjustment

A. Tighten set screw to compress
B. Loosen set screw to uncompress

Note: Adjustment must be made to all hinges at the same time.

SS3 = Stainless Steel / 3-Way Adjustable

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SS3 HINGE
ADJUSTMENT INSTRUCTIONS

File Name: SS3 Hinge.dwg

Date: 6-13-08

Temtrol, Inc.
Manufacturers of ….. Customized Air Handling Units

P.O. Box 409 • 15 East Oklahoma Avenue • Okarche, OK 73762 • (405) 263-7286

SERIES ITF - INDOOR - MOUNTED AIR HANDLING UNITS

Delivery, Storage, Installation,
"Start-up", Maintenance and Inspection Instructions

(A) DELIVERY

(1) Equipment is purchased F.O.B. Factory and is the responsibility of receiving party to inspect unit upon arrival at the destination before unloading or moving unit to its permanent location; inspect closely for damage which may have been caused in transit. Report damage to delivering carrier promptly (list damage or shortage on freight bill if possible). If damage is noted or discrepancies found, the local Temtrol, Inc. sales representative should be notified immediately so that corrective action may be instigated. Where local repairs or alterations are required, the representative should be fully informed by the contractor as to the extent and expected cost of work required. ***Unauthorized back-charges will not be recognized by Temtrol, Inc.***

(B) STORAGE

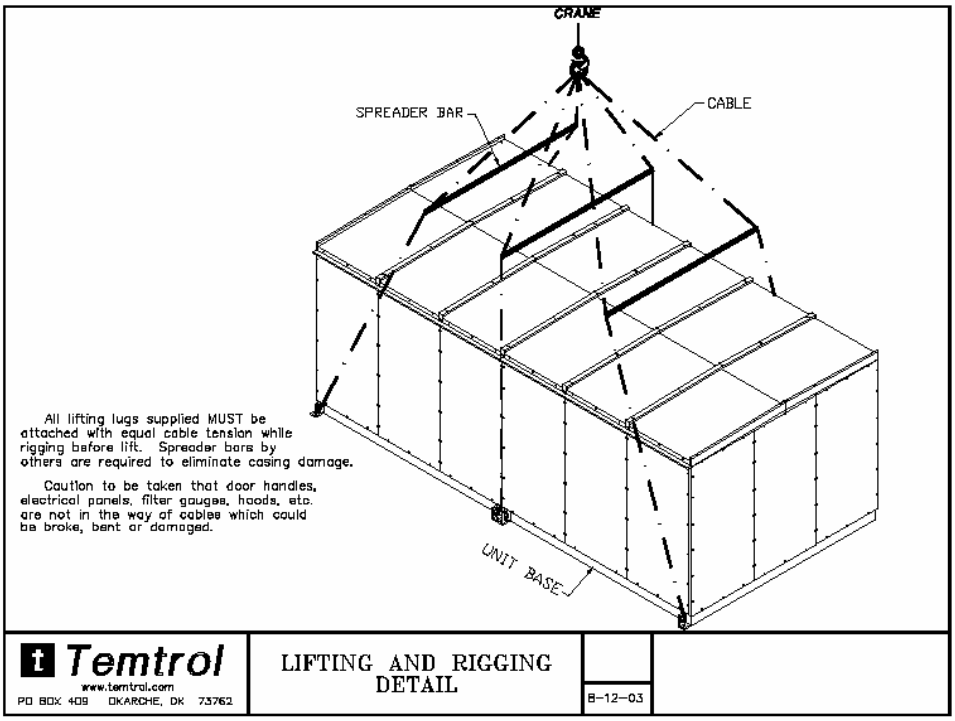
(1) Should storage of unit be required caution should be taken to set unit relatively level and in clean location to protect motor, bearings, coils, filters and etc. from excessive dust. Also avoid storage in location where children play and/or public access. **Air handling units should not be used as on site storage for other mechanical trades.** If units are to be stored for an extended period of time the following maintenance procedures must be performed:

a. Fan wheels should be rotated by hand every 30 days.
b. Each month bearings should be purged with new grease to remove condensation.
c. Before start-up new grease must be added to the bearings
d. Belts should be removed, then prior to start-up, inspect and replace if necessary, reinstall belt.
e. All openings and access doors must remain sealed during storage.
f. Dampers must be cleaned and lubricated prior to start-up.
g. Extended storage could result in condensation on the inside of the unit. Affected areas should be cleaned and dried prior to start-up.

(C) INSTALLATION

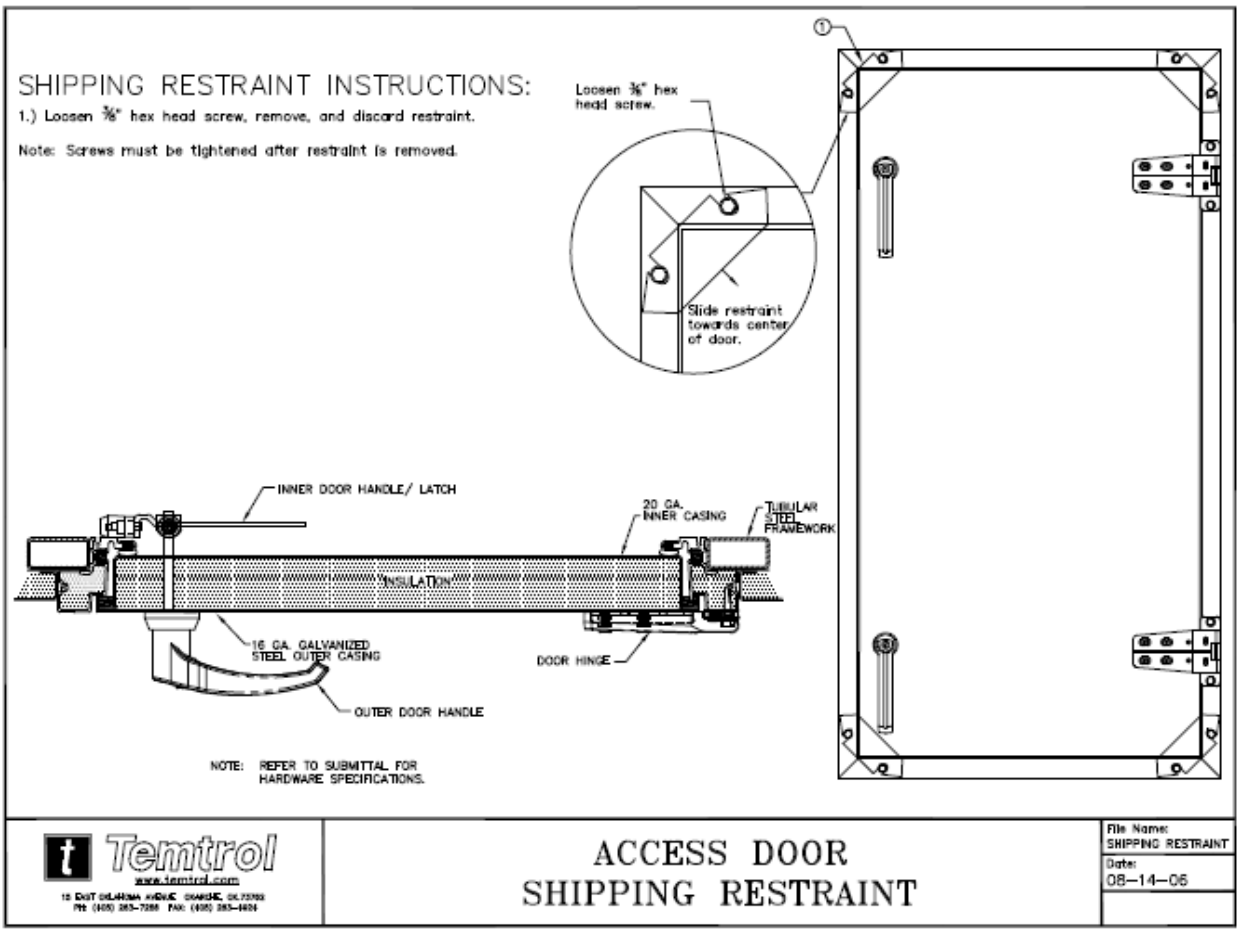
(1) An experienced, reliable rigger should be selected to handle the unloading and final placement of the equipment. Handle equipment with care during installation to avoid damage due to twisting, bouncing or tilting. Rigger should be advised that the unit contains delicate components and is to be handled in upright position only. Avoid excessive stress to fans, shafts, bearings, coil fin and tubes, dampers, isolators, filter accessories, humidifiers, piping, electrical, motors, drives, access doors and insulation. This will save time and expense during start-up and initial service warranty period.

(2) Lifting brackets are provided on the sides of the unit and equal tension of cables at each bracket is essential for weight distribution and safety. Rigging cables should be as long as the longest unit piece dimension at corners to prevent stress on assembly.



Larger Drawing Located In The Manual

(3) The unit foundation must be adequate to support weight of unit without deflection to maintain spirit level of unit after installation.



Larger Drawings Located In The Manual

(4) Access Door Shipping Restraint:

a. Loosen 3/8” hex head screws.
b. Slide restraint towards center of door – remove & discard.
c. Retighten hex head screws.

(5) Steam coils are drainable if unit is level. Water coils are also drainable except for special circuiting. When special circuitry has been furnished coil must be protected from freeze damage by means of anti-freeze liquids or heaters.

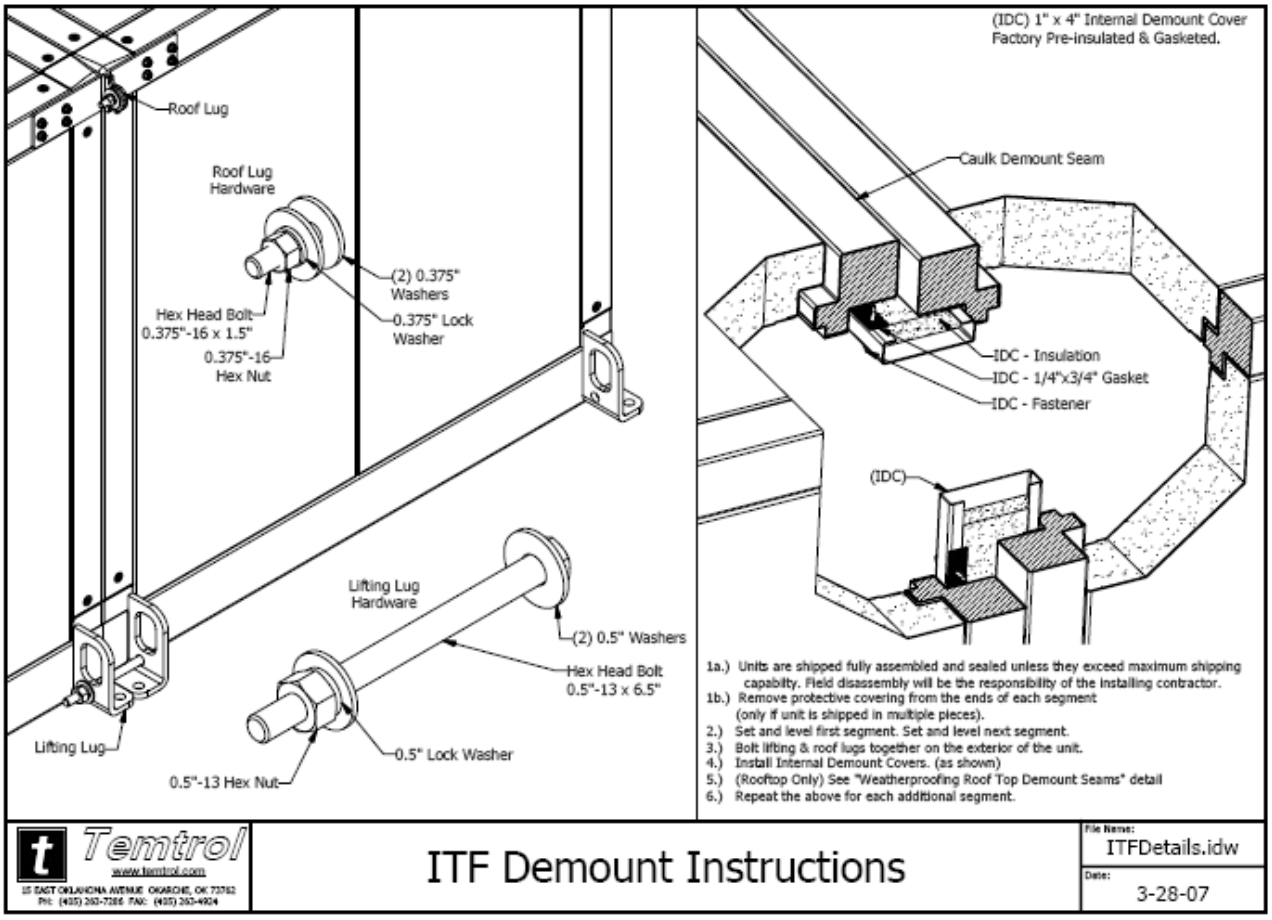
(6) Condensate drain lines from pan must be pitched and include a water seal or trap to prevent the passage of air into or out of the unit via the drain in the field by the contractor. Intermediate pans for coils more than one high include downspouts to main pan. A minimum of 2 x (S.P.) trap is required in the condensate line to prevent condensate back up (more trap is required for units with SP higher than 1 1/2" wg).

(7) Multi-section units if furnished have (IDC) 1” x 4” internal demount cover factory pre-insulated and gasketed.

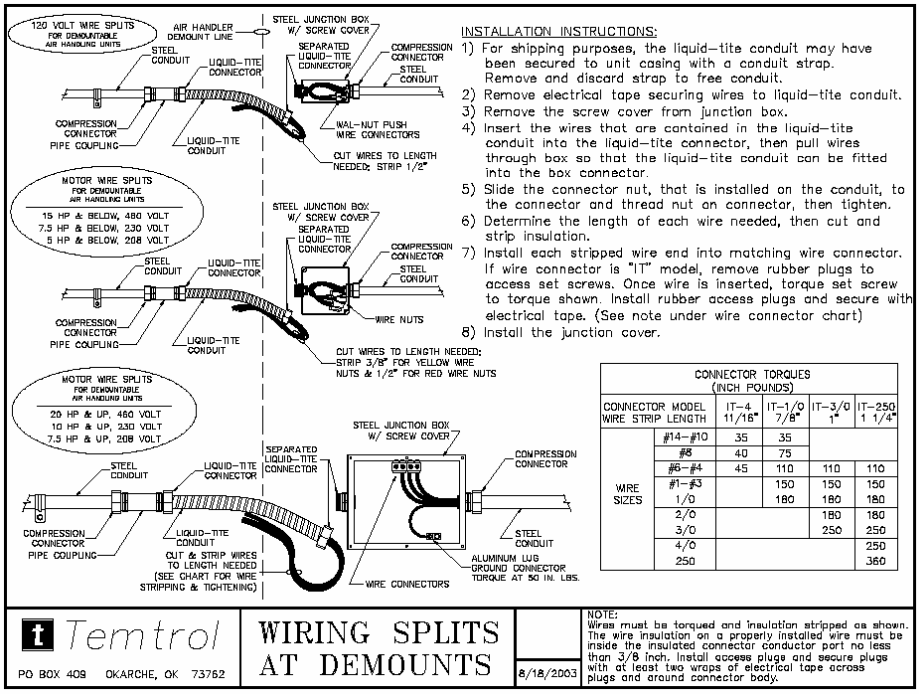
1a. Units are shipped fully assembled and sealed unless they exceed maximum shipping capability. Field disassembly will be the responsibility of the installing contractor.
1b. Remove protective covering from the ends of each segment – (only if unit is shipped in multiple pieces).
2. Set and level first segment. Set and level the next segment.
3. Bolt lifting lugs together on the exterior of the unit using factory furnished hex head bolt (.05” – 13 x 6.5”), (2) 0.5” washers, .05” hex nut plus 0.5” lock washer.
4. Bolt roof lugs together on the exterior of the unit using factory furnished Hex head bolt (0.375” – 16 x 1.5”), (2) 0.375” washers, .0375” – 16 hex nut plus 0.375” lock washer.
5. Caulk demount seam.
6. Install internal demount covers (IDC)
   a. IDC- Insulation
   b. IDC ¼” x ¾” gasket.
   c. IDC Fastener
7. Repeat the above for each additional segment.

Note: Standing seams must fit level and flush to properly seal the demount

Please refer to the bill of lading for the location of the assemble hardware.



Larger Drawings Located In The Manual



Larger Drawing Located In The Manual

(7a) Wiring Splits at Demounts:

1a. For shipping purposes, the liquid-tite conduit may have been secured to unit casing with a strap. Remove and discard strap to free conduit.

2a. Remove electrical tape securing wires to liquid-tite conduit.

3a. Remove the screw from junction box.

4a. Insert the wires that are contained in the liquid-tite conduit into the liquid-tite connector, then pull wire through box so that the liquid-tite conduit can be fitted into the box connector.

5a. Slide the connector nut, that is installed on the conduit, to the connector and thread nut on connector, then tighten.

6a. Determine the length of each wire needed, then cut and strip insulation.

7a. Install each stripped wire end into matching wire connector. If wire connector is "IT" model, remove rubber plugs to access set screws. Once wire is inserted, torque set screw to torque shown on drawing. Install rubber access plugs and secure with electrical tape.

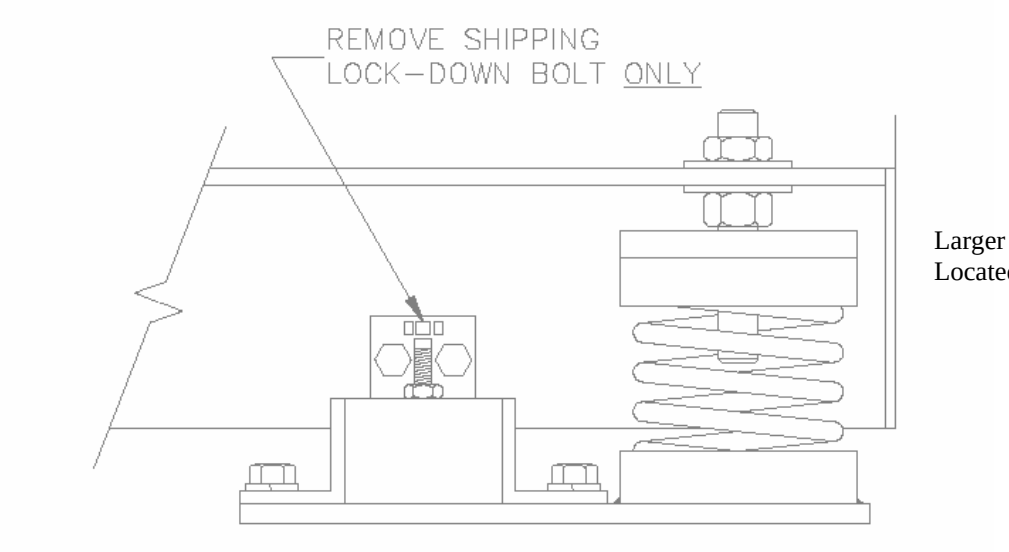
Note: Wires must be torqued and insulated stripped as shown. The wire insulation on a properly installed wire must be inside the insulated connector conductor port no less than 3/8 inch. Install access plus and secure plus with at least two wraps of electrical tape across plus and around connector body.

8a. Install the junction cover.

(8) Observe all pertinent local ordinances and codes covering installation and operation of air handling equipment. Adequate clearance for the service and removal of components should be provided (Do Not install unit in a tight space or dangerously close to other equipment especially on access side).

(D) "START-UP" SERVICE

(1) After unit is permanently positioned, fan isolation shipping lock-down bolt, only (see drawing), should be removed. If load points are not on same plane after supports are removed readjust isolator or shim until elevation of load points are uniform if isolated inside. External isolators should also be adjusted or shimmed until elevation of load points is uniform by use of top adjusting bolt of isolator if furnished.



Larger Drawing
Located In Manual

(2) All plumbing in field should be done with back-up wrenches on stubouts and swing joint piping or flex piping to avoid damage to headers and tubes. If, for any reason, it is necessary to cut a hole in the unit casing, this hole should be cut through a side panel (not through an access door) and then carefully sealed. Access doors should be closed and latched securely to avoid plumbing freeze up.

(3) Vault type door latches provided on access doors can be adjusted by changing position of bevelled flange or handle on inside. Access door gasketing must not be removable or leakage of air could result.

(4) Check motor mounting to make sure all nuts are tight. Confirm that the motor voltage, phase, and HP size are compatible with wiring. Motor nameplate amperage is maximum. All electrical connections should be tight, complete and properly terminated.

(5) Supply and return air duct flanges are provided and should be attached to ducts with flexible connector unless fans are internally isolated. Multizone units require field zoning of individual zone segments by use of "W" clips which attach to zone separators.

(6) Fan blower wheels should rotate freely. Check motor and fan sheave for proper alignment and make sure set screws are tight. Check bearing-collar set screws on fan shaft and fan hub set screws for tightness. Loose collars and/or set screws will ruin the shaft quickly. Ball bearings have been lubricated at the factory and do not need further attention at start-up. Do Not operate fans with imbalance. During fan (supply and return) start-up observe the rotation and if fan is operating backward, reverse two legs of the supply electrical power if three phase.

(7) Rotate damper (Face & Bypass, Outside Air, Return Air, Exhaust and Zone Dampers) shafts to test action; rough handling may have caused damper blades to bind. Damper shaft extension (1/2" shaft) is provided to accept manual or automatic controls. Do Not overdrive damper motors, this will deform dampers and/or linkage.

(8) Outside air inlet hood, exhaust outlets or mixing dampers (if not mounted when shipped) have been predrilled for attachment in field. After mounting, hoods should be caulked for weatherizing. Both the hood and the outlets include birdscreen and louvers if a weatherproof unit is provided.

(9) Filters (when furnished by TEMTROL, INC.) are often furnished and mounted in the racks or in boxes inside the unit. Check to make sure the filter cartridge count is correct. (Filter count is found on the Data Sheet). If filter count is short, the exact number received should be noted on the freight bill at the time of delivery. Check to make sure that filter media has been installed properly in the rails. Check to be sure that the filters called for are used; failure to use the filters that your TEMTROL, INC. Air Handler has been designed for can cause fan motor overload and/or cause the coils to become dirty and restrict airflow. Filter access doors should always be latched firmly to stop air by-pass around filter cartridges.

(10) Check all screws, bolts, nuts and piping connections for tightness.

(11) If unit heaters are provided check thermostat settings to insure freeze protection.

(12) Supply and return fan drives are provided in the mid-speed adjustment range when variable speed sheaves are furnished. The motor sheave pitch diameter is field adjustable for the required air flow. When final adjustments are complete the current draw of the motor should be checked and compared to full load amperage rating of the motor. After supply fan is set, the return fan drives should be adjustable for proper pressurization of the building. Sheaves with two or more grooves should be adjusted by the same number of 1/2 or full turns from closed position to insure the same pitch diameter so belts bear equal load. DO NOT FORCE BELT OVER THE GROOVES. Hub type fan sheaves are furnished. Sheaves must be tightened securely before drive is operated.

(13) Hinged or slide rail motor mounts are furnished with two adjusting bolts. Bolts must be adjusted equally or so drives maintain proper alignment. Correct belt tension should be acquired by use of belt tension checker tool. Over tightened belts reduce belt and bearing life substantially, yet belts \must be tight enough to prevent slippage.

(14) Humidifiers if installed include operator, trap, strainer and manifold mounted or furnished and mounted by contractor. Supply steam connects at top to strainer and return connects at leaving side of trap. Piping to and from humidifier should not be reduced in size with pitch (of 1/2" in 10') length without sag.

(15) After 24 hours operation re-check "start-up" items.

(16) See Prestart and Operation Check Sheet.

(E) MAINTENANCE AND INSPECTION SERVICES

(1) *FAN* - Check blades for dirt and/or grease build-up especially on concave sides. Check set screws and/or set collars of fan wheel and bearings for tightness. Check bearing mounting bolts and fan housing cut off blade bolts and nuts for tightness. If fans are furnished with housing drains, see that "weep holes" in bottom are open. If housing access door is furnished be sure it is properly sealed and latched. Remove all debris from fan section and unit in general.

(2) *BEARINGS AND SHAFT* - Ball or Roller bearings are greased at the factory and therefore ready to run at "start-up"; however routine maintenance and inspection is required there after. Normal operation of bearings are "cool or warm to touch". High bearing temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seams noisy, indicates too little grease. If running discloses an excessive amount of grease in the bearings the grease fittings should be removed until the excess has escaped. Fan shafts should be coated to prevent corrosion yet check that dirt or debris build-up is not accumulating which could affect balance.

(3) *FAN BEARING LUBRICATION* - Lubrication intervals vary with the period of operation and temperature of the air. Do Not Over-Lubricate. The bearing is factory lubricated with Lithium based grease of NGL1#2 consistency, such as Sinclair Litholene Multipurpose, Avalinia #2, Texaco Multifax #2, Humble Lidok #2, Mobil Armyac#781 or Phillips Philube L2.

START – UP REPORT

Temtrol, Inc.
Manufacturers of ….. Customized Air Handling Units

Start – UP Date: _____

Job Name: _____Unit Serial Number – U _____

A Start- Up report must be submitted for each unit on the job. For warranty purposes, start – up occurs when the equipment and/or blowers are started for operation regardless of when the building may be ready for operation.

GENERAL

	Initials or ✓
1. Inspect the unit for shipping and installation damage.	
2. Check Bill of Lading against material received	
3. Make sure all packing material has been removed from unit.	
4. Inspect unit demounts for proper re-assembly (if unit shipped in sections)	

PRE-START

1. Remove shipping lock down bolts. See drawing on inside Supply Fan access door	
2. Check fan wheel set screws for tightness and motor and fan sheave for proper alignment	
3. Manually rotate fan wheels and motors to assure freedom of movement	
4. Check main supply voltage	
5. Check electrical connections for tightness	
6. Check main fan amp draw (Refer to motor nameplate)	
7. Check condensate drain traps (Separate traps are required for each drain connection)	
8. Inspect system piping for proper installation	
9. Check to see that proper filters are installed	
10. Clean inside of unit of all construction dirt and debris	
11. Adjust access doors for proper alignment if necessary	

OPERATIONAL CHECK
Warning ! Do not operate unit if system is not properly balanced.

1. Check damper operation to assure freedom of movement	
2. Momentarily start fan motor and assure correct rotation	
3. Check belts for tightness	
4. If unit is equipped with variable frequency drive, refer to enclosed manufacturers recommended start-up procedures.	
5. Record motor rpm / amp: Supply fan # 1 _____ rpm Supply Fan # 1 _____ amps Supply fan # 2 _____ rpm Supply Fan # 2 _____ amps Return Fan # 1 _____ rpm Return Fan # 1 _____ amps Return Fan # 2 _____ rpm Return Fan # 2 _____ amps	
6. Record unit External Static Pressure (esp.) and Total Static Pressure (tsp). Supply fan # 1 _____ esp Supply Fan # 1 _____ tsp Supply fan # 2 _____ esp Supply Fan # 2 _____ tsp Return fan # 1 _____ esp Return Fan # 1 _____ tsp Return fan # 2 _____ esp Return Fan # 2 _____ tsp	
7. Record Unit Supply and Return CFM: Supply air CFM: _____ Return air CFM: _____	
8. Verify unit is operating at design conditions	
9. While unit is in operation verify no excess standing water in drain pan.	

Note: After 24 hours of operation re-check set screws on bearing collar and fan hub for proper tightness.

Ball and Roller Bearing Setscrew Tightening Torque			
Dia.	Hex Size Across Flats	Min. Recommended Torque Valuline	
#10 (109)	3/32	in.lbs	ft.lbs
1/4	1/8	22	1.8
5/16	5/32	40	3.3
3/8	3/16	65	5.4
7/16	7/32	130	10.8
1/2	1/4	200	16.7
5/8	5/16	290	24.2
3/4	3/8	470	39.2

The following table should be used as a relubrication guide:

Conditions

SPEED	TEMPERATURE	CLEANLINESS	GREASE INTERVAL
100 RPM	Up to 120 degrees F	Clean	6 to 12 months
500 RPM	Up to 150 degrees F	Clean	2 to 6 months
1000 RPM	Up to 180 degrees F	Clean	2 wks to 2 months
1500 RPM	Over 210 degrees F	Clean	Weekly
Any Speed	Up to 150 degrees F	Dirty	Daily to 2 wks
Any Speed	Over 150 degrees F	Dirty	Daily to 2 wks
Any Speed	Any Temperature	Very Dirty	Daily to 2 wks
Any Speed	Any Temperature	Extreme Cond.	Daily to 2 wks

Add grease slowly with shaft rotating, until a slight bead forms at the seals.

Start – Up performed by: _____ Date: _____

Notes:

_____

_____

_____

_____

(4) *MOTOR AND MOTOR BEARINGS* - Check for dirt and debris accumulation on "air travel" openings of open type motors to prevent overheating. Relubricate motor bearings every 2000 hours of operation while it is warm and at a stand still. Remove and clean upper and lower grease plugs. Insert grease fittings into upper hole adding a small amount of clean grease with a low pressure gun. Run motor 5 minutes before replacing plugs. Excessive grease will overheat the bearings. Use only high grade mineral grease having a 200 degrees F safe operating temperature. (If special lubrication instructions are shown on the motor nameplate they will supersede all other instructions).

(5) *SHEAVES* - After air balance, require no further adjustment. However, sheave locking devices, wear, alignment and belt tension should be checked on a regular basis.

(6) *DAMPER BLADES AND LINKAGE* - should be inspected regularly for dirt and/or debris build up to insure abnormal wear or damage does not occur. Winterize damper system prior to cold weather to insure that proper sequence of control is being maintained, paying close attention to operation of outside air intake. Outside air damper should be checked closely for minimal leakage when closed.

(7) *OUTSIDE AIR INTAKE HOOD* - should be checked for debris in birdscreen and/or obstructions to air flow (such as old boxes, new walls or fences, etc.) around unit. Clean or remove as required.

(8) *WATER COILS* - (Heating and Cooling) if not antifreeze protected or heater protected should be drained as thoroughly as possible and then treated in the following manner:

> Fill each coil independently with an antifreeze solution using a small circulating pump and again drain. Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be a diluting effect. The small amount of antifreeze solution remaining in coil must always be concentrated enough to prevent freeze-up. Carefully read instruction for mixing antifreeze solution used. Some products will have a higher freezing point in its natural state than when mixed with water.

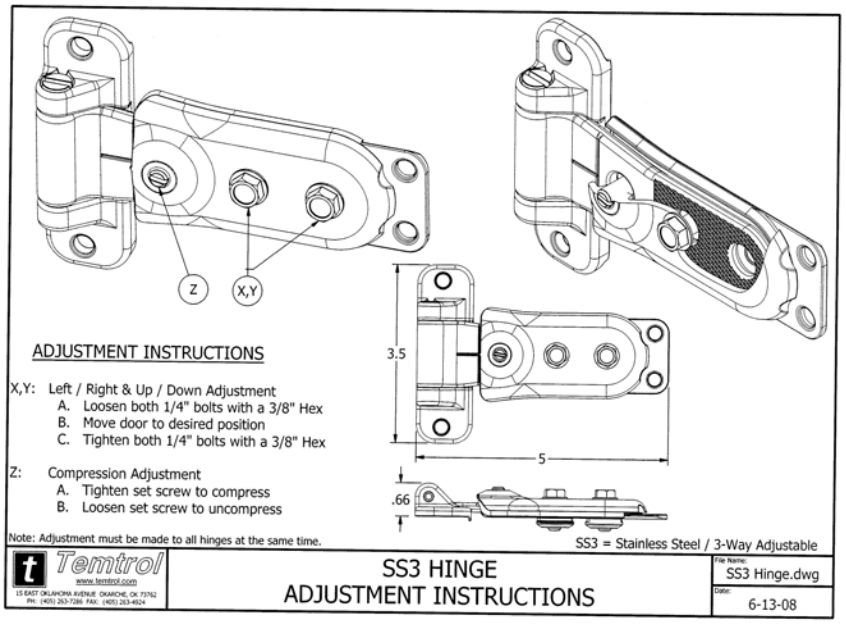
Failure of controls, outside air dampers and air stratification can cause freeze-up and permanent coil damage if above precautions are not observed. Do Not allow dirt to accumulate between the fins of coils. Use water, steam or air to remove dirt.

(9) *STEAM COIL* - fins should be cleaned in the same manner as Water Coils. Steam lines to and from unit should be checked for pitch, pipe sag and blockage to avoid "Water-hammer". Strainers and traps require annual cleaning minimum.

(10) *CONDENSATE PAN* - should be checked for dirt and debris build-up and cleaned. Trap and drain should also be cleaned especially if blockage is evident.

(11) *FILTER ASSEMBLY* - tracks should be checked for rail seal retention where required and all rails should be cleaned annually to control dirt build-up, filter drag and dust by-pass during change out of media. Dirty filters reduce the air volume handled by the unit, and thereby its capacity. Unit should not be run without proper filters or fan motor overload, dirty coil and restricted air flow will result. Proper media retainers should be used at all times to avoid possible media "blow-out", which can cause blockage of air flow and/or damage rotating fan and motor parts. Do not operate media beyond its rated capacities before change out or "blow-out" damage can result.

(12) *CASING AND ACCESS DOORS* - should be checked for leakage (air and/or water). Door gasket must be in proper alignment and if damaged, should be replaced. Inside access panels must be latched properly to avoid air recirculation.



Larger Drawing Located In The Manual

Door Adjustment: (All adjustments must be made to all hinges at the same time)

X,Y: Left/Right and Up/Down adjustment;
- A. Loosen both 1/4” bolts with a 3/8” hex.
- B. Move door to desired position.
- C. Tighten both 1/4” bolts with a 3/8” hex.

Z: Compression Adjustment;
- A. Tighten set screw to compress.
- B. Loosen set screw to uncompress.

(13) *COILS* - can be removed from unit through either end of unit. After removing piping and end panels, remove bolts holding coil to structural frame at the air entering side of coil. The coil and casing can then be pulled out.

(14) *WIRING AND COMPONENTS* - should be made and remain in accordance with National, State and local codes that apply to this equipment. Check connections of wiring and retighten so danger of a poor connection causing overheating and component failure through inadequate current handling can be avoided. Good practice and safety indicates that before attempting service to components, de-energize the systems and only after workers are clear of rotating and electrical devices can unit be energized again.

(15) *ULTRAVIOLET (UV) GERMICIDAL IRRADIATION LIGHTS* – The United States Environmental Protection Agency (EPA) believes that molds and bacteria inside buildings have potential to cause health problems in sensitive individuals [(1)]. If specified, Temtrol provides ultraviolet lights (UV-C) as a factory-engineered and installed option in select commercial air handling products.

When UV lights are factory provided, polymer materials that are susceptible to deterioration by the UV-C light will be substituted or shielded from direct exposure to the light. In addition, UVC-radiation can damage human tissue, namely eyes and skin. To reduce the potential for inadvertent exposure to the lights by operating and maintenance personnel, electrical interlocks that automatically disconnect power to the lights are provided at all unit entry points to equipment where lights are located.

1. United States Environmental Protection Agency: A Brief Guide to Mold, Moisture and your Home; Brochure EPA 402-K-02-003.

WARNING
Equipment Damage, And Personal Safety Risk, From Ultraviolet (UV) Lights!
Temtrol does not recommend field installation of ultraviolet lights in its air handling equipment for the intended purpose of improving indoor air quality. High intensity C-band ultraviolet light known to severely damage polymer (plastic) materials and poses a personal safety risk to anyone exposed to the light without proper personal protective equipment (can cause damage to eyes and skin). Polymer materials commonly found in HVAC equipment that may be susceptible include insulation on electrical wiring, fan belts, thermal insulation, various fasteners and bushings. Degradation of these materials can result in serious damage to the equipment.

Temtrol accepts no responsibility for the performance or operation of our air handling equipment in which ultraviolet devices were in stalled outside of the Temtrol factory.

(16) *AIR FILTER GAUGE* - "pick-ups" should point against air flow for best results without restriction. Oil Manometers require split to operate properly (check zero set).

(17 *HUMIDIFIER* - strainer screen in supply line should be cleaned a few days after put in operation and thereafter at least once a season - more often if much dirt is found in the screen. The trap should be inspected at the same time strainer is cleaned.

(18 *UNIT HEATER OR ELECTRIC COIL* - should be checked for dirt on resisters and removed by use of air only. **DO NOT** attempt cleaning without positive shut down.

(19) *PNEUMATIC OPERATORS* - and linkage should be inspected for sequence and travel and vacuum hose leaks especially prior to cold weather usage where furnished.

(20) *OTHER COMPONENTS* - not mentioned should be maintained per instructions attached to component.

(21) *REPLACEMENT PART* - (if required) orders for service or replacement must include serial number, model number and unit tag of unit as stamped on serial plate, attached to unit. If replacement parts are required, state date of installation of unit, date of start-up and date of failure, along with an explanation of the malfunction and a description of the replacement parts required. Goods may not be returned except by permission of authorized factory officials of TEMTROL, INC. at Okarche, Oklahoma and when so returned will be subject to a handling charge and transportation charges prepaid. Following our personal inspection of the returned part and if it is determined that the failure is due to faulty material or workmanship, credit will be issued on customer's purchase order if warranty is still in effect.

INDOOR - MOUNTED
I-ITF-07

CABINET	
Panels	ITF-0001
Insulation	ITF-0002
Neoprene gasketing	ITF-0003
Metal flange seal	ITF-0004
Lifting lugs	ITF-0005
Weatherproof screws	ITF-0006
Roof-curb	ITF-0007
Curb gasketing	ITF-0008
Drain Pan with drain	ITF-0009
Pan insulation board	ITF-0010
FAN (S/A = Supply Air or R/A = Return Air)	
Housing	ITF-0101
Cutoff	ITF-0102
Inlet funnels	ITF-0103
Wheel	ITF-0104
Shaft	ITF-0105
Bearings	ITF-0106
Inlet Vanes	ITF-0107
Inlet Vane Linkage	ITF-0108
Inlet Screen	ITF-0109
Flex Connection	ITF-0110
Isolators	ITF-0111
Discharge diffuser	ITF-0112
Sheave and Bushing	ITF-0113
Lubrication fittings	ITF-0114
MOTOR (S/A or R/A)	ITF-0201
Horse Power w/ voltage, phase RPM	ITF-0202
Mount	ITF-0203
Sheave and Bushing	ITF-0204
Belts - size and length	ITF-0205
Belt guard	ITF-0206
DAMPER	
Face damper	ITF-0301
By-pass damper	ITF-0302
Face and ByPass combination	ITF-0303
Return air damper	ITF-0304
Outside air damper	ITF-0305
Relief - exhaust damper	ITF-0306
Fan discharge damper	ITF-0307
Recirculation damper	ITF-0308
Min. outside air damper	ITF-0309
Manual quadrant	ITF-0310
Interconnecting linkage	ITF-0311
Fire damper w/"fuse link"	ITF-0312
Operator	ITF-0313
COIL	
Pre-Cooling	ITF-0401
Cooling	ITF-0402
Preheat	ITF-0403
Heating	ITF-0404
Reheat	ITF-0405
Balance orifice	ITF-0406
Connection grommets	ITF-0407
Distributor w/nozzle	ITF-0408
Hot gas side-port	ITF-0409
Expansion valve	ITF-0410
Vent and drain plugs	ITF-0411
Top and/or bottom casings	ITF-0412
Electric heating	ITF-0413
COIL SYSTEMS (Special)	
Integral Face & By-pass Heating	ITF-0501
Reclaim wheel	ITF-0502
Reclaim gas-type	ITF-0503
Reclaim fluid run-around type	ITF-0504

HUMIDIFIER	
Humidifier (Steam)	ITF-0601
Water spray	ITF-0602
Humidifier pan w/drain	ITF-0603
FILTER RACKS	
Prefilter	ITF-0701
2nd filter	ITF-0702
Final filter	ITF-0703
Exhaust filter	ITF-0704
Roll type	ITF-0705
Charcoal type	ITF-0706
Retainer frames & clips	ITF-0707
Gauges	ITF-0708
FILTER MEDIA	
Prefilter cartridges	ITF-0801
2nd filter cartridges	ITF-0802
Final cartridges	ITF-0803
Exhaust filter cartridges	ITF-0804
Roll media	ITF-0805
Charcoal Media or tray	ITF-0806
ELECTRICAL	
Light fixture	ITF-0901
Disconnect(Main or service)	ITF-0902
Starter (S/A or R/A)	ITF-0903
Panel box	ITF-0904
Transformer	ITF-0905
Terminal strip	ITF-0906
Fuse block	ITF-0907
Fuses	ITF-0908
Unit heater	ITF-0909
ACCESS	
Door	ITF-1001
Door hinge	ITF-1002
Door latch	ITF-1003
Drip gutter	ITF-1004
Door gasket	ITF-1005
Window pane	WP-001
FINISH	
Internal coating	ITF-1101
Pan Mastic	ITF-1102
Touch-up paint (external)	ITF-1103

Not all listed parts apply to each unit.
Prices on application and as effective on date of shipment.
Many parts are available on open market.

WHEN ORDERING PARTS the following information must be given:

Unit Serial Number
Unit Model Number
Part Name + Location
Code Number + Place Number

EXAMPLE:

Job Symbol	AHU-1	AHU-2	AHU-3
Model No.	ITF-DV47	ITF-DH11	ITF-BD12
Serial No.	U100167-001	U100167-002	U100167-003

Serial No: = U100167-_____
Model =ITF- BD12
Fan sheave and bushing - S/A (Supply Air Fan) BZ-ITF-0013

Temtrol, Inc.

Temtrol, Inc.

INFORMATION COVERING:

AIR HANDLERS
INDOOR - MOUNTED

O & M - 07

PARTS LIST

JOB SYMBOL :				
MODEL NUMBER :				
DRAWING NUMBER:				
SERIAL NUMBER :				
PART NUMBER :				

JOB SYMBOL :				
MODEL NUMBER :				
DRAWING NUMBER:				
SERIAL NUMBER :				
PART NUMBER :				

MAINTENANCE

FREQUENCY SCHEDULE

Recommended Maintenance Service for Temtrol Equipment

Type of Service	Start-Up	Monthly	Every 6 Months	Shutdown	Annually
Inspect General Condition of Unit	X	X			
Clean Debris From Unit	X	X		X	
Check and Adjust Fan Belt Tension	X	X			
Check Unit for Unusual Noise or Vibration	X	X			
Check Fan Bearing Locking Collars	X		X		
Check Motor Voltage and Current	X		X		
Lubricate Fan Shaft Bearings	X		See Below	X	
Lubricate Motor Base Adjusting Screws	X		X	X	
Check Fan for Rotation Without Obstruction	X				
Check Fan for Proper Rotation	X				
Inspect Protective Finish					X
Replace Filters		X			
Lubricate Damper Linkage			X		
Check Fans for Unusual Vibration	X				X
Clean Outside of Coils			X	X	

IMPORTANT SAFETY NOTES

Before performing any maintenance or inspection, make certain that all power has been disconnected.

Adequate precautions should be taken to safeguard the equipment and the premises from damage, also the public from possible injury as appropriate for the installation of these products.

The following table should be used as a relubrication guide:

	Conditions		
SPEED	TEMPERATURE	CLEANLINESS	GREASE INTERVAL
100 RPM	Up to 120 degrees F	Clean	6 to 12 months
500 RPM	Up to 150 degrees F	Clean	2 to 6 months
1000 RPM	Up to 180 degrees F	Clean	2 wks to 2 months
1500 RPM	Over 210 degrees F	Clean	Weekly
Any Speed	Up to 150 degrees F	Dirty	Daily to 2 wks
Any Speed	Over 150 degrees F	Dirty	Daily to 2 wks
Any Speed	Any Temperature	Very Dirty	Daily to 2 wks
Any Speed	Any Temperature	Extreme Cond.	Daily to 2 wks

Add grease slowly with shaft rotating, until a slight bead forms at the seals.

Temtrol, Inc.
Phone - 405-263-7286 Fax - 405-263-4924

Trouble

Shooting

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
Noise	Impeller hitting inlet ring	a. Impeller not centered in inlet ring. b. Inlet ring damaged c. Crooked or damaged impeller d. Shaft loose in bearing e. Impeller loose on shaft f. Bearing loose in bearing support
	Impeller hitting cutoff	a. Cutoff not secure in housing b. Cutoff damaged c. Cutoff improperly positioned.
	Drive	a. Sheave not tight on shaft (motor and/or fan) b. Belts too loose. Adjust for belt stretching after 48 hours of operation. c. Belts too tight. d. Variable pitch sheaves not adjusted so each groove has same pitch dia. (multi-belt drives). e. Misaligned sheaves f. Belts worn g. Isolation base shipping restraints not removed. h. Belts oily or dirty
	Bearing	a. Defective bearing b. Needs Lubrication c. Loose on bearing supports d. Loose on shaft e. Seals misaligned f. Foreign material inside bearing g. Worn bearing h. Fretting corrosion between inner race and shaft.
	Shaft Seal Squeal	a. Need lubrication b. Misaligned
	Impeller	a. Loose on shaft b. Defective Impeller *Do not run fan - Contact manufacturer.* c. Unbalanced
Noise (Continued)		d. Worn as result of abrasive or corrosive

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
		material moving through flow passage
	Housing	a. Foreign material in housing b. Cutoff or other part loose (rattling during operation)
	Electrical	a. AC hum in motor or relay b. Starting relay chatter c. Noisy motor bearings d. Single phasing a 3 phase motor
	High Air Velocity	a. Duct work too small for application. b. Fan selection too small for application. c. Registers or grilles too small for application. d. Heating or cooling coil with insufficient face area for application.
	Pulsation or Surge	a. Restricted system causes fan to operate at poor point of rating. b. Fan too large for application c. Ducts vibrate at same frequency as fan pulsations.
	Rattles and/or Rumbles	a. Vibrating duct work b. Vibrating cabinet parts c. Vibrating parts not isolated from building.
CFM Low - Insufficient Air Flow	Fan	a. Mecanical volume control device is improperly set. b. Fan running backwards c. Cutoff missing or improperly installed. d. Dirty fan blades. e. Loose or slipping belts f. Fan speed too slow
	Duct System	a. Actual system is more restrictive (more resistant to flow) b. Dampers closed c. Registers closed d. Leaks in supply ducts e. Insulating duct liner loose.
CFM Low - Insufficient Air Flow (continued)	Filters	a. Dirty or clogged

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
	Coils	a. Dirty or clogged
	Obstructed Fan Inlets	a. Elbows, cabinet walls or other obstructions restrict air flow. Inlet obstructions cause more restrictive systems but do not cause increased negative pressure readings near the fan inlet(s). Fan speed may be increased to counteract the effect of restricted fan inlet(s)
	No Straight Duct at Fan Outlet	a. Fans which are normally used in duct system are tested with a length of straight duct at fan outlet. If there is no straight duct at the fan outlet, decreased performance will result. If it is not practical to install a straight section of duct at the fan outlet, the fan speed may be increased to overcome this pressure loss.
	Obstructions in High Velocity Air Stream	a. Obstruction near fan outlet b. Sharp elbows near fan outlet c. Improperly designed turning vanes d. Projections, dampers or other obstructions in part of system where air velocity is high
CFM High - Too Much Air Flow	System	a. Oversized duct work b. Access door open c. Registers or grilles not installed d. Damper set to by-pass coils e. Filter(s) none in place f. System resistance much lower than anticipated
	Fan	a. Fan speed too fast
Incorrect Static Pressure	System, Fan or Interpretation of Measurements	General Discussion: ● The velocity pressure at any point of measurement is function of the velocity of the air or gas and its density ● The static pressure measured in a "loose" or oversized system will be less than the static pressure in a "tight" or undersized system for the same air flow rate
Incorrect Static Pressure - Continue -		● In most systems, pressure measurements are indicators of how the installation is operating. These measurements are the result of air flow and as such are

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
		useful indicators in defining system characteristics ● Field static pressure measurements rarely correspond with laboratory static pressure measurements unless the fan inlet and fan outlet conditions of the installation are exactly the same as the inlet and outlet conditions in the laboratory
Static Pressure Low, CFM High	System	System has less resistance to flow than expected This is a common occurrence. Fan speed may be reduced to obtain desired flow rate. This will reduce HP (operating cost).
	Fan	a. Backward inclined impeller installed backwards. HP will be high b. Fan speed too high
Static Pressure Low, CFM Low	System	a. Fan inlet and/or outlet conditions not same as tested.
Static Pressure High CFM Low	System	a. Obstruction in system b. Dirty filters c. Dirty coils d. System too restricted
HP High	Fan	a. Backward inclined impeller installed backwards b. Fan speed too high c. Too low system resistance for forward curved fan
	System	a. Oversized duct work b. Face and by-pass dampers oriented so coil dampers are open at same time by-pass dampers are open c. Filter(s) - left out d. Access door open
	Fan Selection	a. Fan not operating at efficient point of rating. Fan size or type may not be best for application
Fan Does Not Operate	Electrical or Mechanical	a. Blown fuses b. Broken belts c. Loose pulleys d. Electricity turned off

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
		e. Impeller touching scroll f. Wrong voltage g. Motor too small and overload protector has broken circuit h. Optional thermostats, firestats, freezestats may lockout fan operation if set incorrectly

TROUBLE SHOOTING GUIDES
ELECTRIC HEATING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Electric Heater Not Operating	Electrical or Mechanical	● Disconnect switch or main circuit breaker may be in the "OFF" position. If heater has built-in disconnect switch, door must be closed and switch turned "ON" before heater will operate ● If the fan and heater are interlocked with a fan relay, the fan must be on before the heater will operate. If an air flow switch is used, air pressure in the duct must be sufficient (at least 0.7" W.C.) to close the switch before the heater will operate ● Automatic (or manual) reset thermal cutout may have opened when overheating resulted from insufficient air flow or poor air distribution. Allow heater temperature to return to normal so that automatic thermal cutout may reset or manual reset thermal cutout may be reset. Correct cause of overheating before proceeding. ● Heat limiter(s) may have opened if local "hot spot" developed or if automatic reset thermal cutout failed to open first, when overheating occurred. Correct cause of overheating and replace heat limiter. ● Check main fuses, if open, correct cause of failure before replacing fuses.
Electric Heater Cycles (Will Not Stay On)	Electrical or Mechanical	● Check air inlet and discharge openings for obstructions. See that filters are not clogged, fire dampers are open and air system is balanced ● Check to see that the heater terminal box is tight against duct and heater safety devices are receiving sufficient air flow. Air flow must be distributed evenly over entire face area. ● Look at heater coils in operation (through observation port in duct); any red area is not receiving enough air. (A small amount of redness is permissible inside the coil insulation bushings). Make sure that air flow through every part of the heater is sufficient. *Coils must not glow.* ● If air flow switch is used, contactors may "chatter" if air flow is not sufficient to keep switch fully on. ● If duct has internal insulation, the insulation may be blocking the safety devices.
Improper Temperature	Electrical or Mechanical	● Make sure associated control equipment, such as

TROUBLE SHOOTING GUIDES
ELECTRIC HEATING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Regulation		thermostats, are in the correct location and that all controls are adjusted according to manufacturer's specifications for existing field conditions. ● Check air system balance to see that correct amount of air flow is supplied for proper zone control. ● Automatic thermal cutout may be opening (cycling) before room thermostat is satisfied. (see "Electric Heater Cycles". Insufficient heat may be caused by: 1. Open heat limiter(s) or thermal cutout 2. Incorrect supply voltage 3. Heater too small (in wattage) for application –

TROUBLE SHOOTING GUIDES
Gas Furnace by Reznor

PROBLEM	PROBABLE CAUSE	SOLUTION
Pilot Will Not Light (Match Lit System)	1. Manual valve turned off	1 Open valve
	2. Air in gas line	2 Disconnect pilot line at shut off bleed air from gas supply line
	3. Incorrect lighting procedure	3 Follow instructions on cover of junction box.
	4. Dirt in pilot orifice	4 Remove orifice. Clean with compressed air or solvent (do not ream)
	5. Extremely high or low gas pressure	5 Check line pressure, this should be 3 oz or 5 in. water pressure minimum. 8 oz or 14 in. maximum
	6. Bent or kinked pilot tubing	6 Replace tubing
Pilot Lighted But Magnetic Gas Valve Will Not Open (All Manual Valves Are Open) (Match Lit System)	1. Power not turned on or thermostat not calling for heat.	1 Turn on power, check fuses, turn on thermostat
	2. Circuit to magnetic valve open	2 Check wiring and connections at transformer and thermostat
	3. Faulty transformer	3 Replace transformer
	4. Faulty or dirty thermocouple or safety pilot switch	4 Clean and test with millivolt meter or test kit. Replace defective part.
	5. Faulty thermostat	5 Replace thermostat
	6. Faulty magnetic valve	6 Replace valve or magnetic head
	7. High gas pressure	7 Max. gas pressure 8 oz or 14" W.C.
Venter Motor Will Not Start (RPV Models)	1. No power to unit	1 Turn on power, check supply fuses or circuit breaker
	2. No 24 volt power to venter relay	2 Turn up thermostat, check control transformer output Check for loose or improper wire connections
	3. Venter relay defective	3 Replace
	4. Defective motor or capacito	4 Replace motor or capacitor
Pilot Will Not Light (Spark Ignition System) (Venter Operation on RPV Models)	1. Manual valve not open	1 Open manual valve
	2. Air in gas line	2 Bleed gas line
	3. Dirt in Pilot Orifice	3 Remove and clean with air pressure
	4. Gas pressure too high or too low	4 Set supply pressure at 5" to 8" for natural gas - 11" for propane
	5. Kinked pilot tubing	5 Replace tubing
	6. Pilot valve does not open	6 If 24V available at valve, replace valve
	7. No Spark:	7
	a. Loose wire connection	a. Be certain all wire connections are solid
	b. Transformer failure	b. Be certain 24 volts is available
	c. Incorrect spark gap.	c. Maintain spark gap 7/64"
Pilot Will Not Light Con't	d. Spark cable shorted to	d. Replace worn or grounded spark cable

TROUBLE SHOOTING GUIDES
Gas Furnace by Reznor

PROBLEM	PROBABLE CAUSE	SOLUTION
(Spark Ignition System) (Venter Operation on RPV Models)	ground e. Spark electrode shorted to ground f. Drafts affecting pilot g. G60 control box not grounded h. Faulty G60 8. Optional lockout device interrupting control circuit by above causes 9. Faulty combustion air proving switch	 e. Replace pilot if ceramic spark electrode is cracked or grounded f. Make sure panels are in place and tightly secured to prevent improper or unusual drafts at pilot g. Make certain G60 is grounded to furnace chassis h. If 24V is available to G60 controller and all other causes have been eliminated, replace G60 8 Reset lockout by interrupting control circuit at thermostat 9 Replace combustion air proving switch
Pilot Lights, Main Valve Will Not Open (Spark Ignition System)	1. Manual valve not open. 2. Main valve not operating a. Defective valve b. Loose wire connection 3. G60 does not power main valve a. Loose wire connection b. Flame sensor grounded (Pilot lights - spark continues) c. Gas pressure incorrect d. Cracked ceramic at sensor e. Faulty G60	1 Open manual valve 2 a. Replace if 24V is measured at valve connection and valve remains closed b. Check and tighten all wiring connection 3 a. Check and tighten all wiring connection b. Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. c. Set supply pressure at 5" to 8" for natural gas - 11" for propane d. Replace sensor e. If all checks indicate no other cause replace G60 DO NOT ATTEMPT TO REPAIR G60 THERE ARE NO FIELD REPLACEMENT COMPONENTS CONTAINED IN THIS DEVICE.
No Heat	1. Dirty Filters	1 Clean or replace filters

TROUBLE SHOOTING GUIDES
Gas Furnace by Reznor

PROBLEM	PROBABLE CAUSE	SOLUTION
(Heater Operating)	2. Incorrect manifold pressure or orifices	2 Check manifold pressure
	3. Cycling on limit control	3 Check air throughput
	4. Improper thermostat or adjustment	4 See thermostat instructions
	5. Belt slipping on blower	5 Adjust belt tension
Cold Air is Delivered on Start-Up, During Operation	1. Fan control heater element improperly wired	1 Connect as per wiring diagram inside junction box cover
	2. Defective fan control	2 Replace fan control
	3. Incorrect manifold pressure	3 Check manifold and line pressure
Motor Will Not Run	1. Circuit open	1 Check wiring and connections
	2. Fan control inoperative	2 Replace fan control
	3. Contactor inoperative	3 Replace contactor
	4. Defective motor	4 Replace motor

TROUBLE SHOOTING GUIDES
HEATING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Coil Does Not Operate	Steam valve failure (Steam Coil)	a. Check steam valve. If air operated, check proper air pressure. If electrically operated check for no power or loose connection. If manual valve, check to see if valve is open. If necessary repair or replace valve. b. Defective thermostat or wrong setting
	Steam trap failure (Steam Coil)	Condensate backs up into coil. Check steam trap, repair or replace
	Diverter valve (Hot Water Coil)	a. Check power to valve as above b. Diverter valve piped wrong
Coil Does Not Deliver Adequate Heat	No steam or hot water	Check boiler for proper steam pressure or hot water temperature setting.
	Thermostat	a. Thermostat improperly located, relocate. b. Thermostat defective, replace c. Improper set point, reset d. Defective controls, see above
	Coil undersized	Replace with larger coil
	Insufficient steam pressure	Check boiler controls
	Lack of hot water	Hot water pump undersized or malfunctioning
	Dirty finned tubes	Vacuum or use air hose to gently clean dirt from finned tubes
Coil Leaks	Crack in brazed connection	Repair brazed joint
	Internal corrosion	Replace coil

TROUBLE SHOOTING GUIDES
COOLING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Coil Does Not Deliver Adequate Cooling	Lack of chilled water	Chilled water pump undersized or malfunctioning
	Dirty finned tubes	Vacuum or use air hose to gently clean dirt from finned tubes
	Coil undersized	Replace with larger coil
Coil Leaks	Crack in brazed connection	Repair brazed joint
	Internal corrosion	Replace coil
Moisture on Walls Downstream of Cooling Coil	Excess capicity through cooling coil	Check air flow through coil
	Standing water in drain pan	See "Condensate Drain Pan" Section
	V.A.V. unit (Low Volume Air Flow - High Volume Water Flow)	Verify that the air flow and water flow are synchronized

TROUBLE SHOOTING GUIDES
CONDENSATE DRAIN PAN

PROBLEM	PROBABLE CAUSE	SOLUTION
Standing Water in Drain Pan	Unit is not level	Check level of unit, shim if required.
	Drain connection is clogged	Remove dirt or debris from drain pan
	Condensate drain line to drain is not correctly pitched.	Check pitch in line towards floor drain
	Trap is sized incorrectly	● All condensate drain connections and floor drains must be trapped. Failure to properly trap a drain will result in flooding of the drain pan and potential water damage to the air-handling unit and other building facilities.

TROUBLE SHOOTING GUIDES
ELECTRIC MOTORS

PROBLEM	PROBABLE CAUSE	SOLUTION
Motor Fails to Start	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker
	Overload trips	Check and reset overload
	Improper line connections	Check connections with diagram supplied with motor
	Open circuit in winding or starting switch. Evidence by humming sound from motor when switch is closed	Check inside motor to determine if switch is closed. Check for loose connections.
	Improper current supplied	Check to determine that power supply agrees with motor nameplate specifications.
	Mechanical failure	Determine that motor and drive turn freely. Check bearings and lubrication
	Short circuited stator	Indicated by blown fuses. Motors must be rewound
	Poor stator coil connection	Remove end bells and locate with a test lamp.
	Defective rotor	Look for broken bars or end rings. Replace rotor
	Motor overloaded	Reduce load or replace unit with larger motor
	With a 3 phase power source one phase may be open	Check line for open phase
	Defective capacitor	Replace capacitor
Motor Stalls	Wrong application	Change type or replace unit with a larger motor, consult factory
	Overloaded motor	Reduce load or replace unit with a larger motor.
	Low line voltage	Check across AC line and correct if possible
Motor Runs and Then	Partial loss of line voltage	Check for loose connections. Determine adequacy

TROUBLE SHOOTING GUIDES
ELECTRIC MOTORS

PROBLEM	PROBABLE CAUSE	SOLUTION
Dies Down		of main power supply
	Stator shorts when motor warms up.	Replace stator
Motor Does Not Come Up to Speed	Motor under designed for application	Replace with a larger motor
	Voltage too low at motor terminals	Check across AC line and correct if possible
	Line wiring to motor too small	Install larger line wiring
	Broken rotor bars	Look for broken bars or end rings, replace motor.
	60 cycle motor connected to 50 cycle line supply	Replace unit with a 50 cycle motor.
Motor Takes Too Long to Accelerate	Excessive load	Replace with larger motor
	Loose connection(s)	Check connections and tighten where necessary
Wrong Rotation (3 Phase)	Improperly wired to AC line (Wrong sequence of phases)	Check wiring diagram on motor nameplate and correct. Reverse any two motor leads at line connection
Motor Overheats (Temperature Rise Above Ambient Greater Than Nameplate Specifications)	Motor overloaded	Replace with larger motor.
	Motor fan may be clogged with dirt preventing proper ventilation	Remove fan cover and clean, replace fan cover
	Motor (3 phase) may have one phase open	Check to insure that all connections are tight
	Partially shorted stator coil	Must be rewound
	Line voltage too high	Check across AC line and correct. Step-down transformer may be required
Motor Overheats -Continue-	Line voltage too low	Check across AC line. Consult power company. Step-up transformer may be required

TROUBLE SHOOTING GUIDES
ELECTRIC MOTORS

PROBLEM	PROBABLE CAUSE	SOLUTION
(Temperature Rise Above Ambient Greater Than Nameplate Specifications)	Rotor rubs stator bore	Check motor bearings and replace
	Worn bearings	Replace bearings and seals
Motor Vibrates When Connected to Driven Equipment	Motor mounting bolts loose	Tighten mounting bolts
	Rigid type coupling used to connect motor to driven equipment	Replace coupling with a proper coupling
	Driven equipment unbalanced	Balance driven equipment
	Worn motor bearings	Replace bearings and seals
	Motor (3 phase) running on single phase	Check for open circuit and correct
	Bent motor shaft	Replace shaft or rotor
Rapid Motor Bearing Wear	Excessive overhung load due to over tensioned drive	Check overhung load, retension drive.
	Excessive overhung load due to a smaller diameter sheave than recommended minimum used on motor shaft	Check "NEMA Sheave Selection Guide" in the Browning Catalog. Replace sheave with one of size equal to or greater than listing

TROUBLE SHOOTING GUIDES
VARIABLE SPEED DRIVES

PROBLEM	PROBABLE CAUSE	SOLUTION
Short Belt Life	Spin burns from belt slipping on drive under stalled load conditions or when starting	Tension belts
	Gouges or extreme cover wear caused by belts on drive guard or other objects	Eliminate obstruction or realign drive to provide clearance
	High ambient temperature	a. Use Gripnotch Belts b. Provide ventilation c. Shield belts
	Grease or oil on belts	a. Check for leaky bearings b. Clean belts and sheaves
	Worn sheaves	Replace sheaves
	Center distance shorter than recommended minimum when using standard sheave as a companion sheave	Increase center distance by using longer belts. Replace standard driven sheave with a companion sheave
	Belt misalignment	Realign drive with sheave set at mean pitch diameter
Belts Turn Over in Grooves	Damaged cord section in belts. Frayed or gouged belts.	Replace belts
	Excessive vibration	Tension belts, replace belts if damaged.
	Flat idler pulley misaligned	Realign idler
	Worn sheaves	Realign drive
Belt Squeal	Excessive overload. High starting load. Belts not tensioned properly.	Tension drive or redesign and replace drive.
	Insufficient arc of contact	Increase center distance or use Gripnotch Belts
Belt Breakage	Foreign material in drive	Provide drive guard

TROUBLE SHOOTING GUIDES
VARIABLE SPEED DRIVES

PROBLEM	PROBABLE CAUSE	SOLUTION
	Belts damaged during installation	Replace belts
	Shock or extreme overload	Eliminate overload cause or redesign drive.
Belt Stretch Beyond Take-up	Worn sheaves	Replace Sheaves
	Under designed drive	Redesign and replace drive
	Take-up slippage	Reposition take-up
	Drive excessively tensioned	Properly tension drive
	Damaged cord section during installation	Replace belts and properly install
Excessive Vibration	Damaged belt cord section	Replace belts
	Loose belts	Tension drive
	Belts improperly tensioned	Tension drive with slack of each belt on the same side of the drive
Belts too Long at Installation	Insufficient take-up	Use shorter belts
	Drive improperly set up	Recheck driver and driven machine set up
	Wrong size belts	Use correct size belts
Belts too Short at Installation	Insufficient take-up	Use longer belts
	Drive improperly set up	Recheck driver and driven machine set up
	Wrong size belts	Use correct size belts
Belts Mismatched at Installation	Belts matched by code number only	Replace belts with Machine Matched Belts
Belts Mismatched at Installation	Old belts and new belts used together on the same drive	Replace with new belts

TROUBLE SHOOTING GUIDES
VARIABLE SPEED DRIVES

PROBLEM	PROBABLE CAUSE	SOLUTION
- Continue -		
	Different brand name belts used on same drive	Replace with a set of Machine Matched Belts
	Driver and driven shaft shifted	Realign drive
	Worn sheaves	Replace sheaves
Belts Mismatched After Service	Belts improperly tensioned, causing more stretch of some belts than others	Replace belts and tension drive with slack of each belt on the same side of the drive
	Old belts and new belts used together on the same drive	Replace with new belts
	Different brand name belts used on same drive	Replace with a set of Machine Matched Belts.
	Driver and driven shafts shifted from parallel	Realign drive
	Belt cord section damaged during installation	Replace belts and install properly
Drive Fails to Adjust	Fretting corrosion (drive allowed to operate at one speed over a period of time).	Sheave must be disassembled, cleaned and lubricated, then reassembled.

Temtrol. Inc.®
Manufacturers of ….. Customized Air Handling Units

P.O. Box 409 • 15 East Oklahoma Avenue • Okarche, OK 73762 • (405) 263-7286

MODEL FWR/FWT – Fanwall Technology®

FWR – Fanwall Retrofit – Field Installed Fan Cubes
FWT – Fanwall – Factory Installed Fan Cubes/Array

Installation, Operation
And
Maintenance Guide

FOR YOUR SAFETY

Improper installation, adjustment, alteration service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

Temtrol, Inc., has a policy of continuous product improvement, and reserves the right to change design and specifications without notice.

WARRANTIES AND LIMITATIONS OF LIABILITY FOR BREACH OF WARRANTY

Temtrol, Inc., warrants all products to be free from defects in material and workmanship for twelve (12) months from date of shipment unless a start-up form is on file and accepted by Temtrol, in which case the warranty is twelve (12) months from the date of start-up, or eighteen (18) months from date of shipment, whichever is shorter. Said start-up form shall signify that the equipment has been properly started and adjusted, and is operating under normal conditions, prescribed ratings and specifications, and was installed by qualified personnel in accordance with Temtrol instructions and local codes and ordinances. For warranty purposes, start-up occurs when the equipment and/or blowers are started for operation of the equipment regardless of when the building may be ready for operation.

Temtrol's obligation hereunder shall be limited to the exchange of new parts for those returned to Temtrol's factory at buyer's expense and found to be defective, by Temtrol. Replacement parts shall be shipped F.O.B. Temtrol's factory. Replacement of parts hereunder shall not operate to extend the original warranty period as to any part, including replacement parts supplied hereunder.

This warranty does not cover corrosion; normal deterioration; misapplication; labor charges paid for parts replacement; adjustments; repairs or other work; loss of refrigerant; components supplied by others; defects in parts resulting from neglect, negligence, accident, fire, explosion, high or low voltage, jumpering or jamming controls; improper or contaminated fuel; excessive or inadequate fuel pressure; frozen heating coils; war; or any acts of God.

This warranty is void if equipment is misapplied or if any alterations are made to the basic design or operating requirements as listed on the original order and shipped from the factory unless approval is received in writing from Temtrol.

It is expressly understood that this warranty is made IN LIEU OF ALL OTHER WARRANTIES with the exception of those warranties attached hereto, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE and in consideration of the express warranty herein contained, BUYER EXPRESSLY WAIVES ANY RIGHT TO CLAIM OTHER WARRANTIES, EXPRESS AND IMPLIED.

It is further understood that Temtrol's liability for breach of warranty shall be limited to the terms of this warranty. Buyer agrees that Temtrol SHALL NOT, IN ANY EVENT, BE LIABLE FOR CONSEQUENTIAL DAMAGES and that buyer's sole and exclusive remedy shall be limited to that provided herein. Temtrol neither assumes nor authorizes any person to assume for it any obligation or warranty other than those stated herein.

Any suggestion to the contrary notwithstanding, Temtrol shall not, in any event have any liability under this warranty unless and until Temtrol has been paid in full for the products supplied. The warranty period shall begin to run as described above, however, whether or not payment has been

Note: IMPROPER INSTALLATION AND/OR OPERATION OF FWR/FWT CUBE WILL VOID WARRANTY

FACTORY PARTS

TEMTROL, INC. Parts Department:
Phone: (405) 263-7286
Fax: (405) 6263-4924
Email: sbausterst@temtrol.com
Address: 15 East Oklahoma Ave.
Okarche, OK 73762

(A) GENERAL DESCRIPTION

The **Temtrol FANWALLTechnology®** is a fan-array approach to air handler design that uses several smaller fans to replace one larger fan, providing design flexibility, reducing maintenance costs, and increasing energy savings.

A1. FWR – Fanwall Retrofit – Field Installed Fan Cubes

A2. FWT – Fanwall – Factory Installed Fan Cubes/Array

(B) STORAGE

(1) Should storage of FWR/FWT cubes be required caution should be taken to set FWR/FWT cubes indoors in a clean location to protect motor, fans, coplanar and etc., from excessive dust. Also avoid storage in location where children play and/or public access. If units are to be stored for an extended period of time the following maintenance procedures must be performed:

d. Manually rotate motor/wheel monthly.

FWR/FWT Cube

(2) A complete fan wheel/motor spare assembly storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment. Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

a. A wooden crate “shell” should be constructed to secure the motor during storage.

Complete fan wheel/motor spare assembly

This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening

reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1** where: (Rm is minimum resistance to ground in Meg−Ohms and kV is rated nameplate voltage defined as Kilo−Volts.) Example: For a 480VAC rated motor Rm =1.48 meg−ohms (use 5 MÙ). For a 4160VAC rated motor Rm = 5.16 meg−ohms.

b. Storage Preparation:

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.

2. Store in a clean, dry, protected warehouse where control is maintained as follows:

    a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.

    b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.

    c. Relative humidity must not exceed 60%.

    d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

    Note: Remove motor from containers when heaters are energized, re-protect if necessary.

3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.

    a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.

    b. Place new desiccant inside the vapor bag and reseal by taping it closed.

    c. If a zipper closing type bag is used instead of the heat sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.

    d. Place the shell over the motor and secure with lag bolts.

4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with antifriction bearings are to be greased at the time of going into extended storage with periodic service as follows:

    a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.

    b. Ball and roller bearing (antifriction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.

    c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.

d. "Provisions for oil mist lubrication" – These motors are packed with grease. Storage procedures are the same as paragraph 5b.

e. "Oil Mist Lubricated" – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under "Standard Condition" in Section 3, then rotate the shaft 15 times by hand.

6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.

7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

8. a. Non−Regreaseable Motors:
Non−regreasable motors with "Do Not Lubricate" on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

b. All Other Motor Types
Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.

2. The motor with regreasable bearing must be greased as instructed in this manual.

3. Replace the grease drain plug after greasing.

4. The motor shaft must be rotated a minimum of 15 times after greasing.

5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.

6. Bearings are to be greased at the time of removal from storage.

B1. Removal From Storage

1. Remove all packing material.

2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in

resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.

3. Re-grease the bearings as instructed in this manual.

4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

(C) SAFETY CONSIDERATIONS

(1) Installing and servicing air conditioning equipment can be hazardous due to system pressure and electrical components.

(2) Only trained and qualified service personnel should install or service air conditioning equipment. Untrained personnel can perform basic maintenance, such as cleaning and replacing filters. All other operations should be performed by trained service personnel.

(3) When working on air conditioning equipment, observe precautions listed in literature, tags and labels attached to unit.

(4) Follow all safety codes:
Wear safety glasses and work gloves.
Use quenching cloth for brazing operations.
Have fire extinguisher available.
Read these instructions thoroughly.

WARNING

Before installing or servicing system, always turn off main power to system.
There may be more than one disconnect switch.
Turn off accessory heater power if applicable.
Electrical shock can cause personal injury or death.

CAUTION

Before proceeding, make sure all electrical service to unit is locked in “Off” position.

(D) INSTALLATION CODES / PRECAUTIONS

Installation Codes:

(1) Electrical characteristics are shown on each motor nameplate and inside left hand corner of motor starter protector (MSP) lid for complete system.

(2) The unit shall be carefully installed in accordance with the standards of the National Fire Protection Association (National Electrical Code). Authorities having jurisdiction should be consulted before installations are made to verify local codes and installation procedures.

Installation Precautions:

(1) The services of qualified field service personnel are mandatory for safe and proper installation of this equipment.

(2) The following clearances from combustible materials are to be maintained:
Top - 6", control side – 48" opposite controls - 6", bottom - 0".
If roof curb is provided by others, it must be at least 4" high and constructed from non-combustible material.

(3) This unit is designed for installation on a level surface.
This is especially true if provided with an evaporative cooler.

(4) Do not locate the supply inlet opening within 10' of any exhaust discharge point or within 24" of any obstruction.

(E) INSTALLATION

(1) Electrical Connections:
All electrical wiring and connections including electrical grounding must be made in accordance with the latest edition of the National Electric Code . There may also be local codes that apply.

a. The FWR/FWT nameplate and the drawings state the line voltage and minimum ampacity requirements for this unit.

b. All external wiring must be within approved conduit and have a minimum temperature rating of 75°C.

IMPORTANT: If any of the original wire supplied with the unit must be replaced, it must be replaced with type THHN 75°C wire or its equivalent.

FWR

Fanwall

Retrofit

(F) INSTALLATION:
FANWALL ASSEMBLY- RETROFIT

FWR

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

(1) Verify factory furnished components are complete against enclosed packing list. Each FWR cube is numbered and must be located in the array per the submittal drawing. Refer to submittal for number of FWR cube and location in assembled array if applicable.

(2) *Prior to demolition of existing fan:* Verify FWR cube dimensions are correct and assembled array will fit inside existing air handling unit. Internal floor to ceiling and inside wall to wall dimensions were provided to Temtrol by others.

(3) Disconnect power to the existing fan at the main disconnect control panel.

(4) Make note of all wire locations for reinstallation later.

(5) Disconnect motor power cable from terminal located in motor J-Box and conduit fitting from J-Box, see page 11.

(6) Remove existing fan/motor assembly and clean the area thoroughly. **(Figure 1)**

(7) Make sure that floor on air handler is level and rigid.

(8) Locate and mark inlet for new FWR Array on floor of air handling unit. **(Figure 2)**

(9) Determine offset for the assembled array (from inside walls) on both sides of the unit and mark accordingly.

(10) Align first FWR cube (bottom row furthest from access side of unit) and *only* secure *first cube* to floor using tek screws. **(Figure 3a/b)**

(11) Continue setting FWR cubes along line (see above item # 8) until bottom row is complete. (*Do not* secure to floor) **(Figure 3a/b)**

(12) Check alignment and verify clearance on both sides of air handling unit inside walls. (Adjust accordingly

FIGURE 1

FIGURE 2

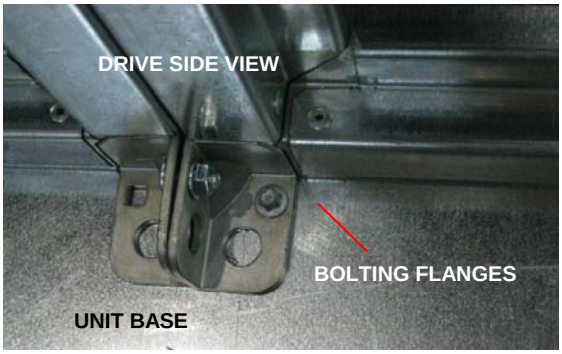
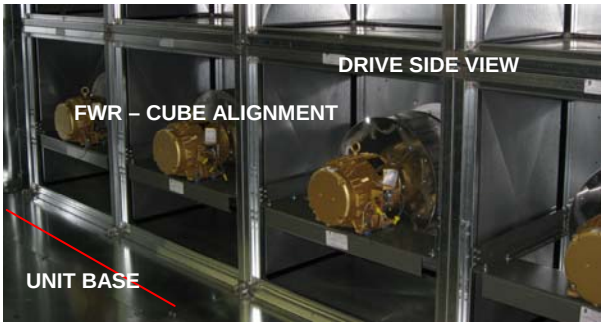


FIGURE 3a/b



if necessary).

(F) INSTALLATION:
FANWALL ASSEMBLY- RETROFIT- (con't)

FWR

(13) After alignment is verified, secure entire first row of FWR cubes to floor with tek screws **(Figure 4).**

(14) Install remaining FWR cubes and bolt together at corners on both inlet and discharge side of FWR cubes. **(Figure 5)**

(15) To secure the FWR array to the unit, Attach tie-off walls to sides and ceiling of unit then secure to FWR cubes. Apply caulking to tie-off walls and FWR cubes as required to prevent air from bypassing FWR Array. **(Figure 6)**
Note: Tie-off walls and caulking are furnished by others.

(16) Re-assemble air handling unit walls, doors, safety devices, etc. removed during retrofit per unit manufacturer's recommendations.

(17) Wire each FWR motor to overload panel (if furnished by Temtrol) per wiring diagram. Diagram is located inside the motor overload panel lid.

(18) Prior to connection of main power check Fan Wheel/Cone Alignment per pages 13 - 14 in this O & M, if necessary.

(19) Perform startup on VFD as specified by VFD manufacturer.

(20) Verify fans are rotating in the proper direction and operating at required CFM at design static pressure.

FIGURE 3a/b

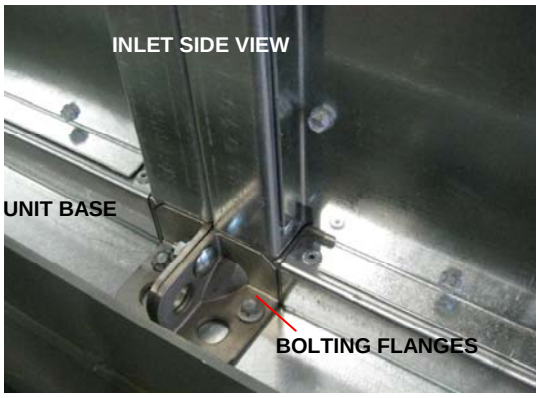


FIGURE 4

FIGURE 5

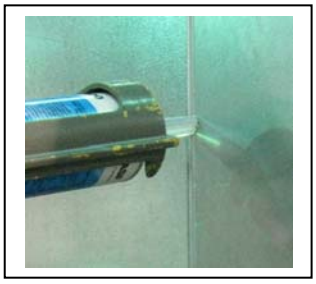


FIGURE 6

FWR / FWT

Fanwall – Field Retrofit

Fanwall – Factory Installed

(F) <u>MAINTENANCE</u>

(1) Monthly:

a. Motors are equipped with permanently sealed bearings and *do not* require lubrication.

b. Check fan wheel / cone for alignment – possible: binding noise or wheel rubbing against cone.

See “Fan Wheel/Cone Alignment” section.

(2) Every Six Months:

a. Check motor bearings for possible binding, noise or overheating.

b. Check supply fan and exhaust fan wheels for dirt and grease accumulation. Clean as necessary. Do not use caustic cleaning solutions.

(3) Yearly:

a. Lightly lubricate damper bushings and associated linkage (Ruskin - Back Draft Damper).

(4) Every Two Years:

a. Examine unit housing for signs of corrosion. Clean, replace or touch up with paint as necessary.

FWR FWT

(F) MAINTENANCE (Con't)

Fan Wheel/Motor replacement

(1) To replace a fan wheel/motor assembly, first disconnect power to the FWR/FWT at the main control panel.

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

DANGER! Risk of Injury

Rotating equipment. Always disconnect power to the fan motor before maintenance.

(2) To gain access to the fan / motor cartridge, remove the safety personnel screen on the motor end only (if applicable). **(Figure 7)**

(3) To remove safety personnel screen:
Loosen and remove all (4) hex screws from the bolting flange that retain the screen to the fan cartridge framing. **(Figure 8 a/b)**

FIGURE 7

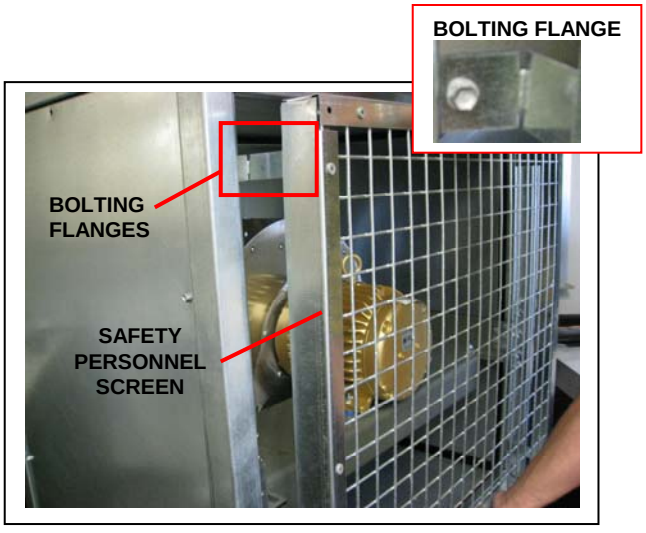


FIGURE 8a/b

FIGURE 8a/b

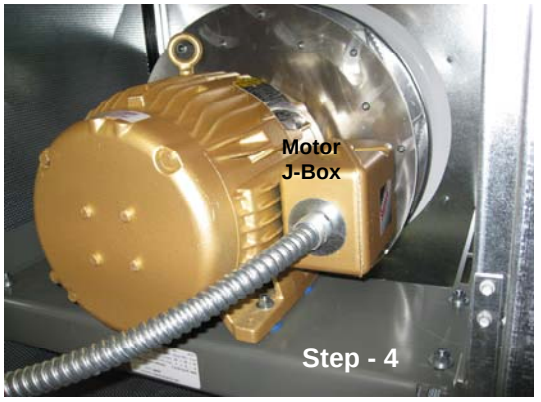
FWR FWT

(F) MAINTENANCE (Con't)

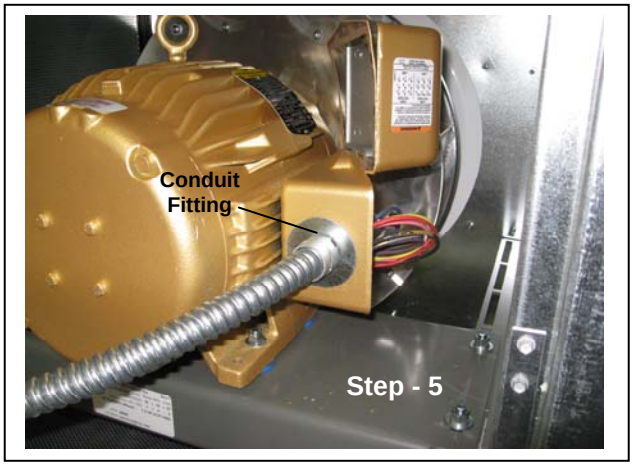
Fan Wheel/Motor Replacement Or
A Complete Motor Support With Fan Wheel/Motor Spare Assembly Replacement (Continue)

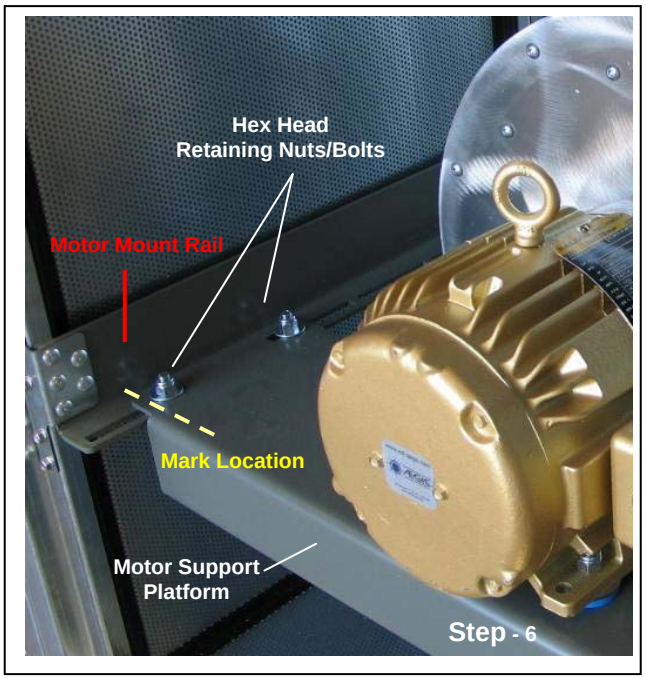
(4) Make note of all wire locations for reinstallation later.

(5) Disconnect motor power cable from terminal located in motor J-Box and conduit fitting from J-Box as shown.



(6) Mark motor support platform location on the motor mount rail (both sides), then loosen and remove all (4) hex nuts/bolts that retain the motor support platform to the fan cartridge framing. (See below)





(F1) MAINTENANCE (Con't – If Applicable)

FWR FWT

Fan Wheel/Motor replacement (Continue)

(7) After all (4) hex nuts/bolts have been removed, slide the motor support platform out a few inches away from inlet wall so that the motor lifting eye is clear of the fan cartridge framing.

(8) Remove fan wheel / motor assembly from fan cartridge.

(9) Loosen and remove all (4) hex nuts/bolts that retain the motor to motor support platform. Be careful not to loose the EAR pads (rubber blue bushings, if applicable). **(Figure 9.1 or Figure 9.2)**

(10) Lift and remove the wheel / motor assembly from the motor support platform.

(11) To remove the fan wheel from motor shaft, remove trans-torque bushing retaining hex nut. Be sure to measure and/or mark location of Trans-torque bushing nut on fan shaft. **(Figure 10)** Loosen progressively until bushing is free from wheel hub and motor shaft.

(12) Remove fan wheel / hub assembly from motor shaft. Trans-torque bushing:

Loosen = Turn counter clockwise
Tighten = Turn clockwise

When reinstalling trans-torque bushing to hub, making sure that the Trans-torque bushing nut is flush to the fan wheel hub, tighten the bushing retaining hex nut progressively and torque down per bushing specifications (75 foot lb).

(13) To install fan wheel / motor assembly into fan cartridge, reverse the steps above.

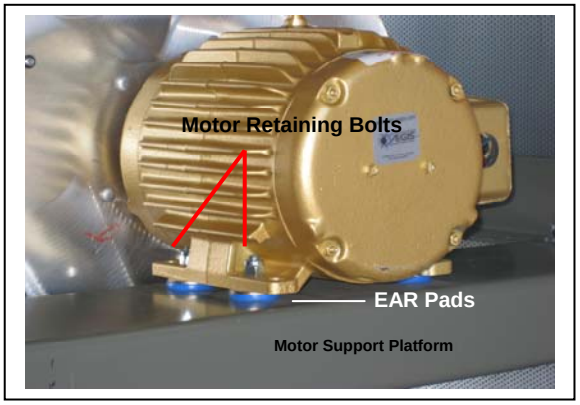


FIGURE 9.1 if applicable

IMPORTANT: Before Restarting – see next page

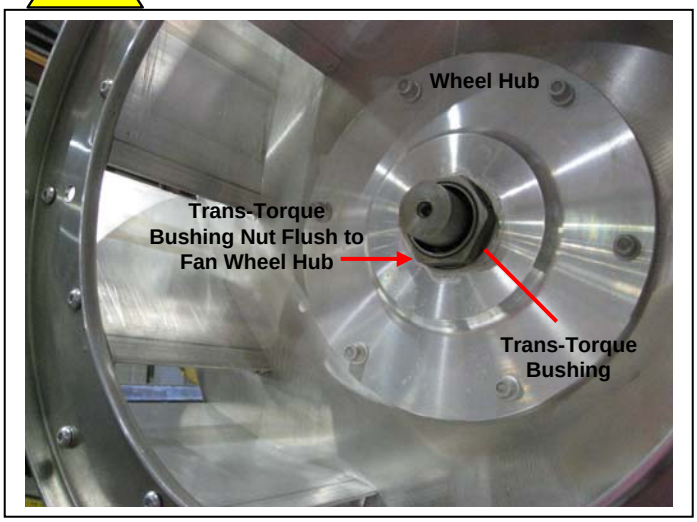


FIGURE 10

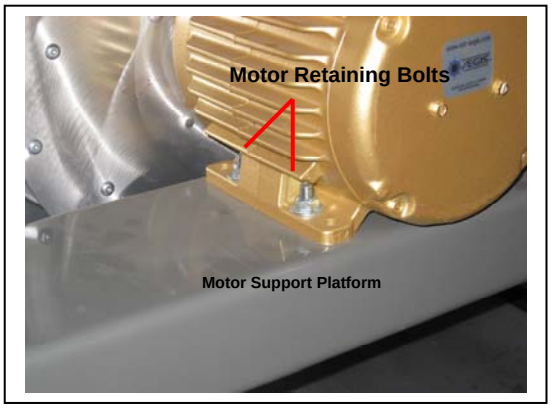


FIGURE 9.2 if applicable

(F1) MAINTENANCE (Con't – If Applicable)

FWR **FWT**

IMPORTANT: Before Restarting.

Re-balance fan wheel once the motor is re-installed on motor shaft.

Before operation, start the motor slowly to ensure the fan rotation is correct.
Drive side = It should be rotating clockwise, when looking at the motor end.
Inlet side = It should be rotation counter clockwise, when looking at the inlet end.
If the fan wheel is not rotating correctly, check the motor power leads for proper installation.

Also check inlet cone alignment to the fan wheel. Fan wheel should not be rubbing on the inlet cone. If cone alignment is required see instructions for "Fan Wheel/Cone Alignment" pages 17 - 18 .

(F2) MAINTENANCE (Con't – If Applicable)

A Complete Motor Support With Fan Wheel/Motor Spare Assembly Replacement:

(7a) After all (4) hex nuts/bolts have been removed, (if applicable, being careful not to loose the Karma Isolator pads part# K373, **Figure 9a**) slide the motor support platform out a few inches from inlet wall so that the motor lifting eye is clear of the fan cartridge framing.

(8a) Remove the complete motor support platform with fan wheel / motor assembly from fan cartridge.

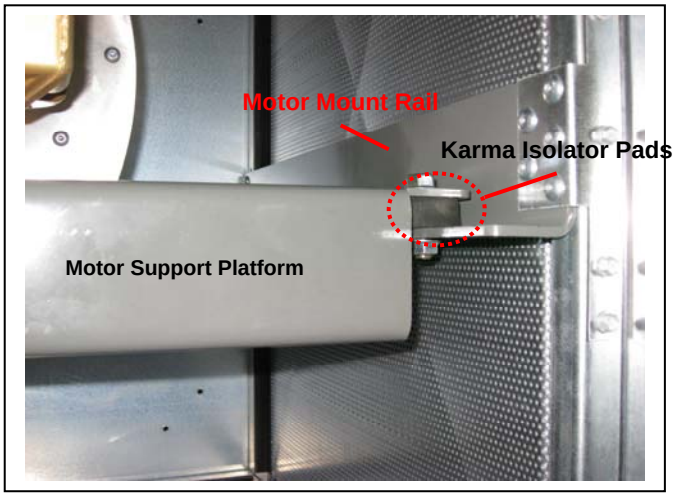


FIGURE 9a

(9a) To install the complete motor support platform with fan wheel / motor assembly into fan cartridge, reverse the steps above.

IMPORTANT: Before Restarting.

Re-balance fan wheel once the compete motor support platform with fan wheel / motor assembly is re-installed.

Before operation, start the motor slowly to ensure the fan rotation is correct.
Drive side = It should be rotating clockwise, when looking at the motor end.
Inlet side = It should be rotation counter clockwise, when looking at the inlet end.
If the fan wheel is not rotating correctly, check the motor power leads for proper installation.

Also check inlet cone alignment to the fan wheel. Fan wheel should not be rubbing on the inlet cone. If cone alignment is required see instructions for "Fan Wheel/Cone Alignment" pages 17 - 18 .

(F) MAINTENANCE (Con't)

FWR

FWT

Fan Wheel/Cone Alignment

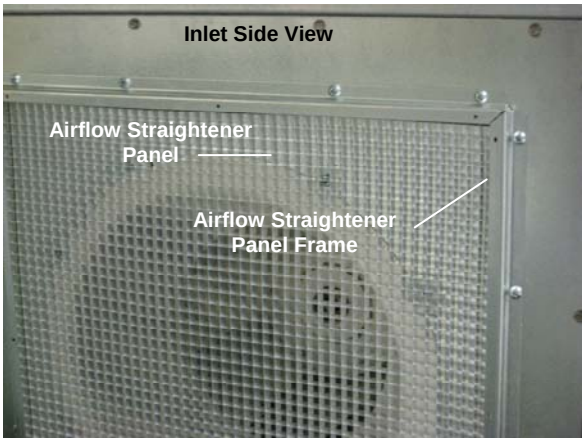
(1) To align fan wheel/cone, first disconnect power to the FWR/FWT at the main control panel.

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

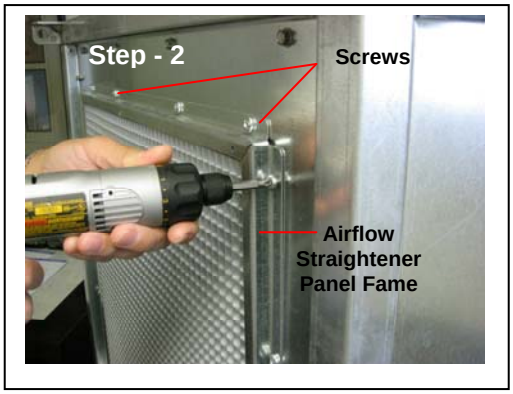
DANGER! Risk of Injury

Rotating equipment. Always disconnect power to the fan motor before maintenance.



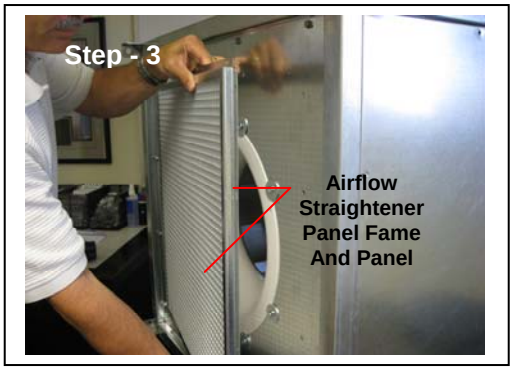
STOP ***Backdraft damper furnished – reverse instruction on pages 19-23. Then continue with #2 of this section***

(2) Remove all tek screws on the inlet side of the airflow straightener panel frame.



(3) Remove airflow straightener frame and panel for access to fan wheel/cone.

(4) Gently rotate the fan wheel to verify location of adjustment.



(5) To make adjustment, loosen (***do not remove***) all the cone retaining fasteners.

(F) MAINTENANCE (Con't)

FWR FWT

Fan Wheel/Cone Alignment (Continued)

(6) Using a rubber mallet, gently, tap around the cone until desired clearance is acquired between fan wheel and cone.

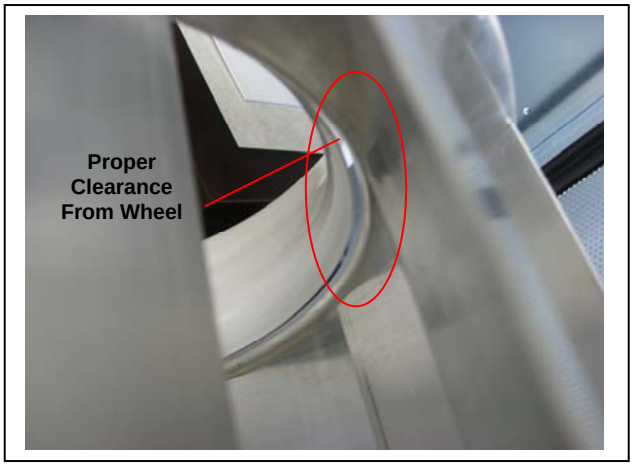
(7) Gently rotate the fan wheel to verify cone adjustment for proper clearance from fan wheel.

(8) Tighten all the cone retaining fasteners.

(9) Once again gently rotate the fan wheel to verify cone alignment.

(10) To install fan wheel/cone assembly, reverse the steps above.

Step – 7a/b & Step - 9

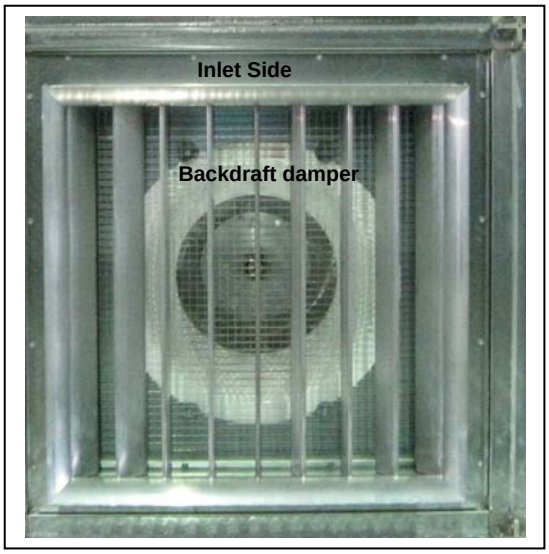


Step – 7a/b & Step 9

(F) MAINTENANCE (Con't)

FBD – Backdraft Damper (If Applicable)

(1) Units utilizing a fanwall may include a backdraft damper to cover the intake of a single fan so that the facility maintenance staff can block the back flow until service on the inoperative assembly can be preformed fan wheel/cone.



(2) First disconnect power to the FWR/FWT at the main control panel.

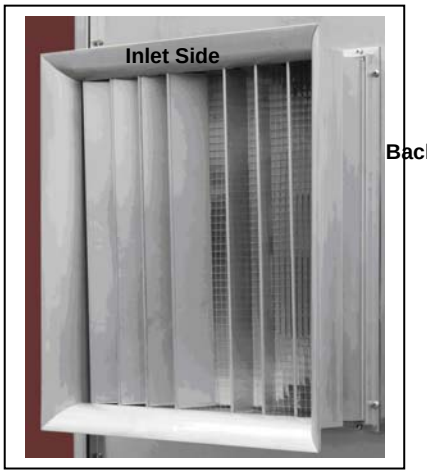
DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

DANGER! Risk of Injury

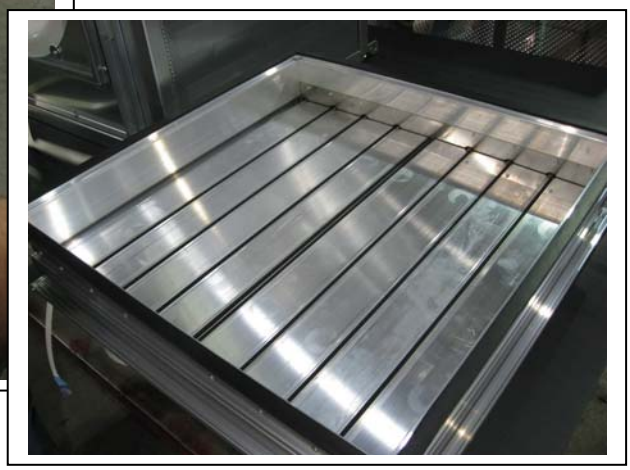
Rotating equipment. Always disconnect power to the fan motor before maintenance.

(3) On the back side frame of the backdraft damper apply gasketing on all four back sides prior to installation.



FBD – Backdraft damper

Step – 3



Step – 3: gasket applied to the back on all four back sides of the damper

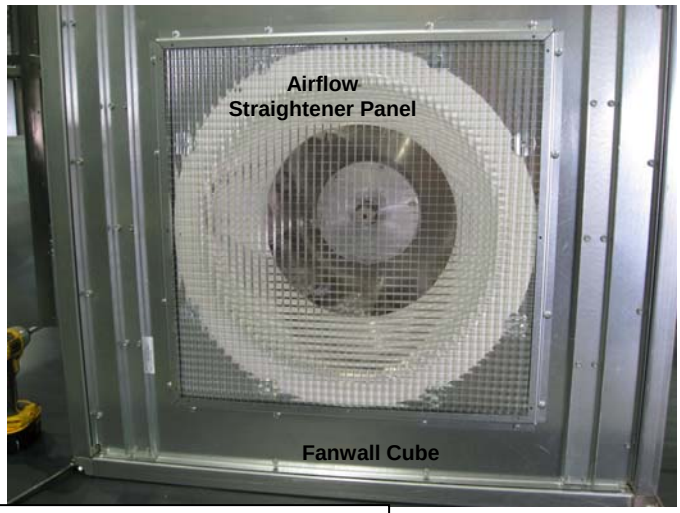
(F) MAINTENANCE (Con't)

FBD – Backdraft Damper (If Applicable)

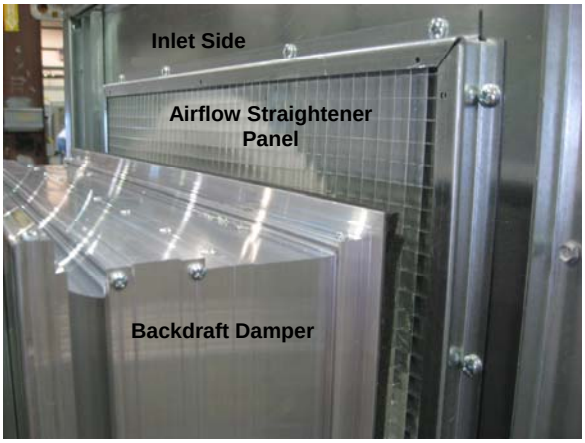
(4) On the inlet side of the fanwall cube the backdraft damper is installed over airflow straightener panel. ***Do not*** remove the airflow straightener panel.

(5) Note the direction of the damper blades. The blades should be running vertical, as shown in photo.

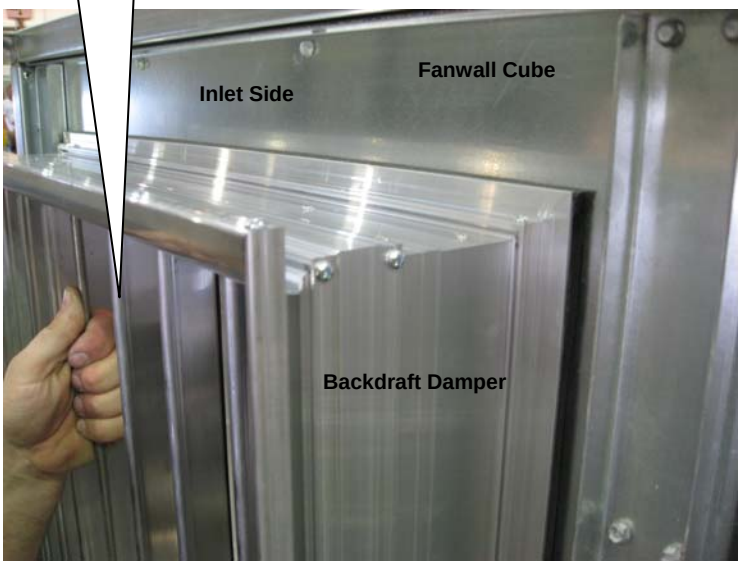
Step – 4



Step – 4



Note direction of damper blades

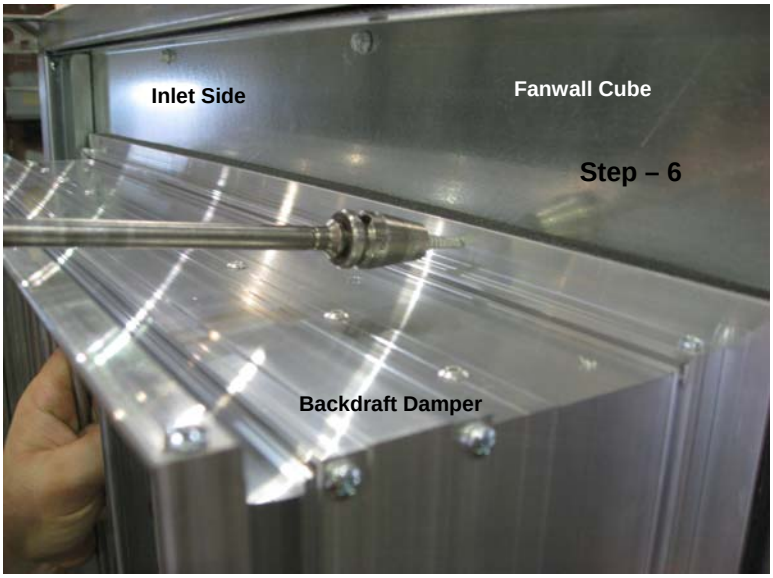


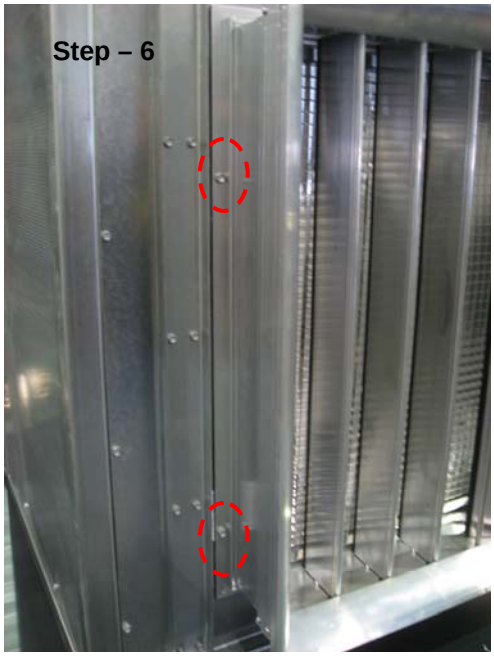
Step – 5

(F) MAINTENANCE (Con't)

FBD – Backdraft Damper (If Applicable)

(6) Secure the backdraft damper with self-tapping hex head fasteners on all sides: top, left, right and bottom.





(7) To remove backdraft damper, reverse the steps above.

(F) MAINTENANCE (Con't)

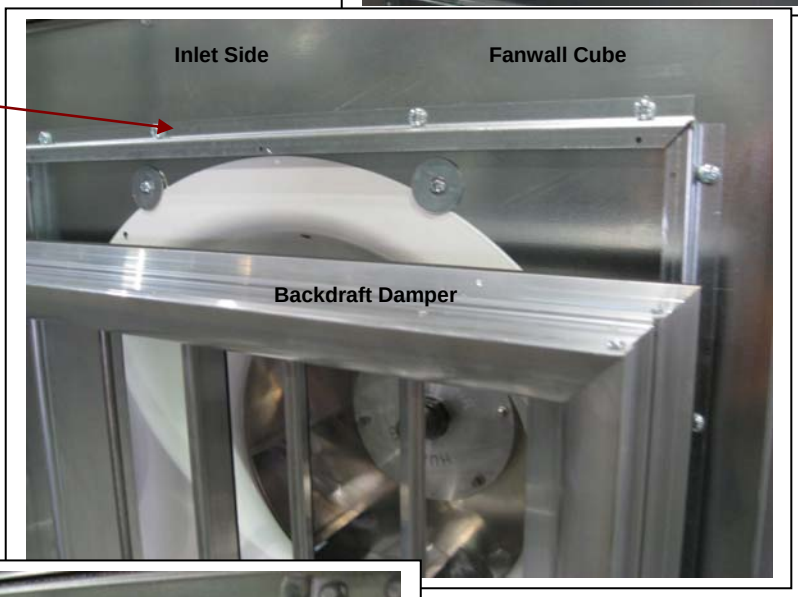
FBD – Backdraft Damper (If Applicable)

(4a) **No Airflow Staightener Panel:**
On the inlet side of the fanwall cube the backdraft damper is installed over "Z" piece. ***Do not*** remove the "Z" piece.

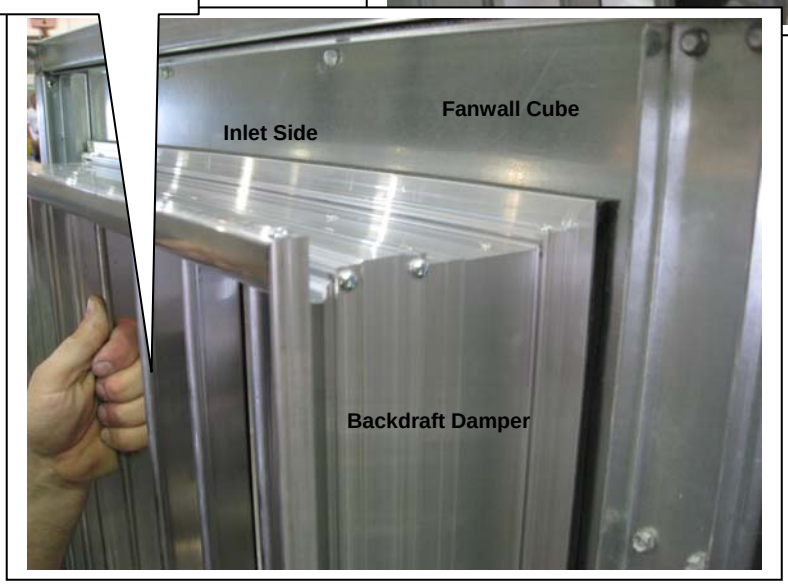
(5a) Note the direction of the damper blades. The blades should be running vertical, as shown in photo.

Step – 4a

Step – 4a



Note direction of damper blades

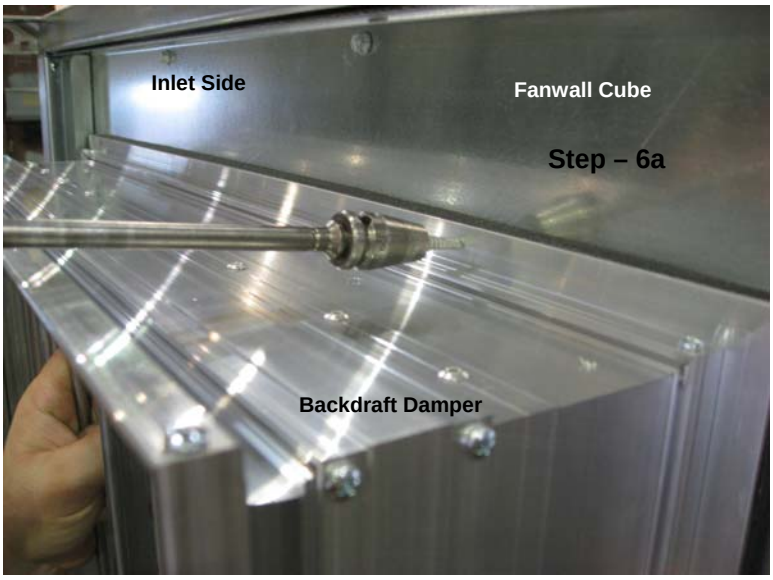


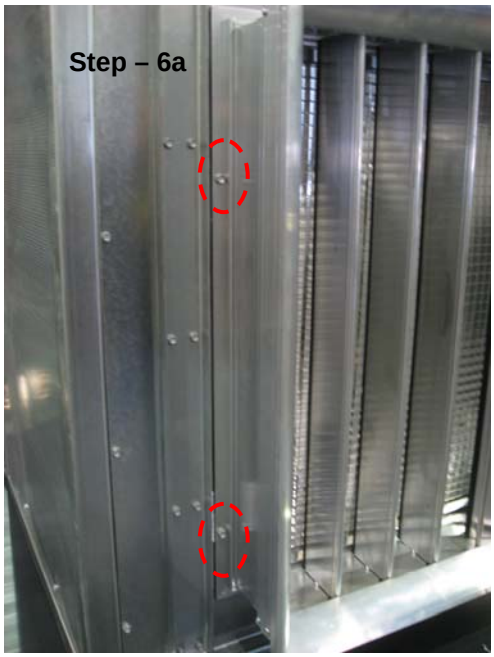
Step – 5a

(F) MAINTENANCE (Con't)

FBD – Backdraft Damper (If Applicable)

(6a) Secure the backdraft damper with self-tapping hex head fasteners on all sides: top, left, right and bottom.



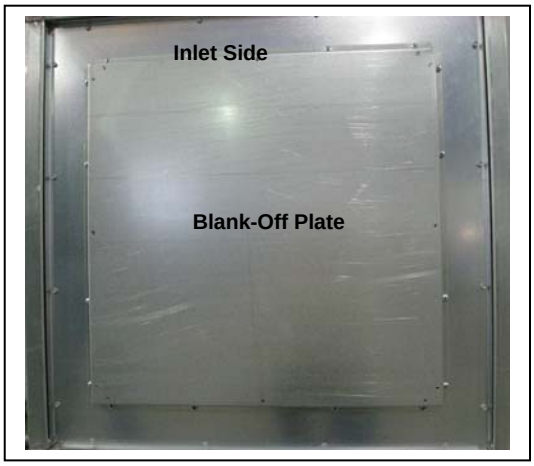


(7a) To remove backdraft damper, reverse the steps above.

(F) MAINTENANCE (Con't)

Blank-Off Plate (If Applicable)

(6) Units utilizing a fanwall may include a blank-off plate to cover the intake of a single fan so that the facility maintenance staff can block the back flow until service on the inoperative assembly can be preformed fan wheel/cone.



(7) First disconnect power to the FWR/FWT at the main control panel.

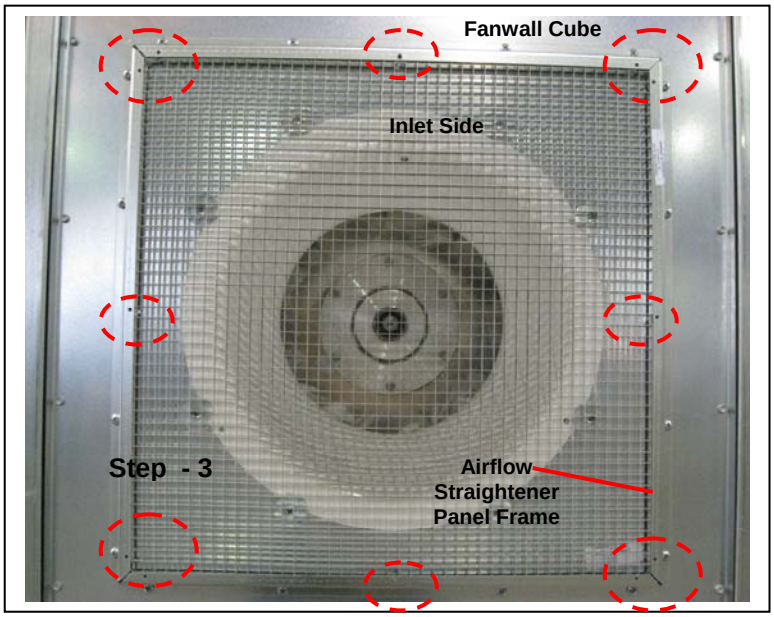
DANGER! Risk of Electric Shock

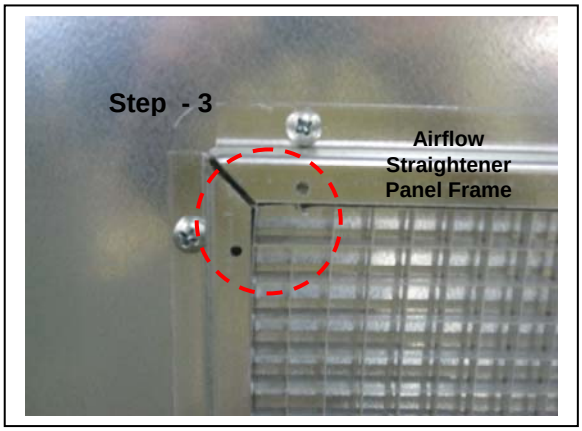
Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

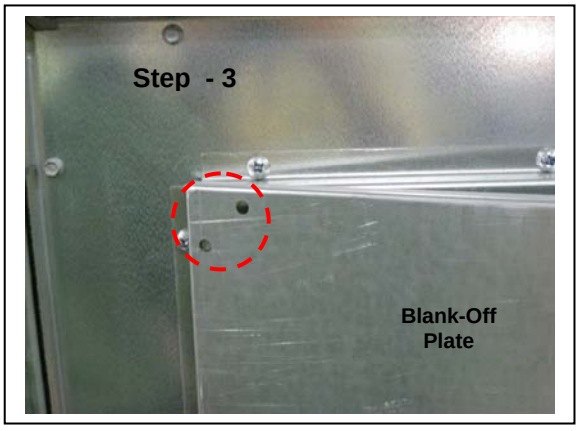
DANGER! Risk of Injury

Rotating equipment. Always disconnect power to the fan motor before maintenance.

(8) On the inlet side of the fanwall cube the airflow straightener panel frame has 12 pre-drilled holes which are located in the corners and middle. The pre-drilled holes match the pre-drilled holes in the blank off plate which are also located in the corners and the middle.





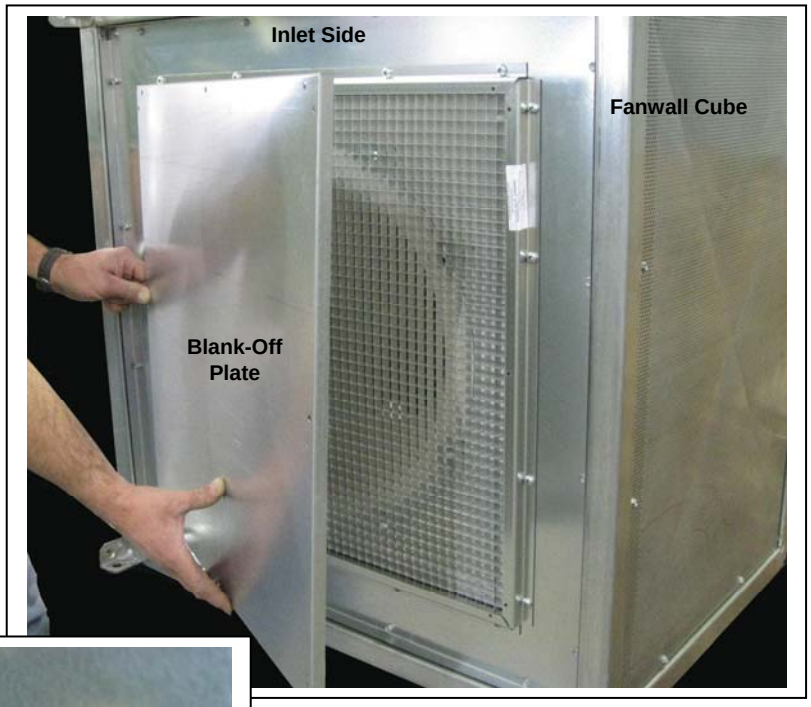


(F) MAINTENANCE (Con't)

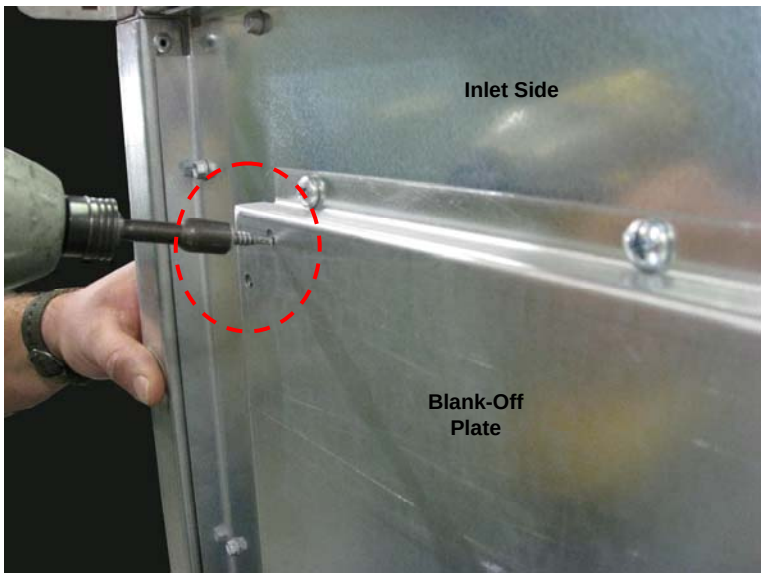
Blank-Off Plate (If Applicable)

(9) Match up the holes in both airflow straightener and the blank-off plate, it may require a gently tap to set into place. Secure it with hex head fastener in the pre-drilled holes furnished.

(10)To remove blank-off plate, reverse the steps above.



Step – 4 a/b



Step – 4 a/b

(G) MOTOR – MAINTENANCE - FWR/FWT

WARNING

UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection:

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

DANGER! Risk of Electric Shock

Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious for fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

(1) Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.

(2) Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.

(3) Check all electrical connectors to be sure that they are tight.

Baldor District Offices

www.baldor.com

UNITED STATES

ARIZONA
PHOENIX
4211 S 43RD PLACE
PHOENIX, AZ 85040
PHONE: 602-470-0407
FAX: 602-470-0464

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CLARKSVILLE
1001 COLLEGE AVE.
CLARKSVILLE, AR 72830
PHONE: 479-754-9108
FAX: 479-754-9205

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FAX: 323-721-5859

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FAX: 510-785-9910

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FAX: 203-269-5485

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ALPHARETTA, GA 30005
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FAX: 770-772-7200

5490 MCGINNIS FERRY PLACE
SUITE 133
ALPHARETTA, GA 30005
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FAX: 770-752-4257

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CHICAGO
1601 FRONTENAC ROAD
NAPERVILLE, IL 60563
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FAX: 630-848-5110

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COLUMBUS, IN 47201
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FAX: 812-378-2555

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INDIANAPOLIS, IN 46241
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DES MOINES, IA 50316
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FAX: 586-978-9969

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FAX: 315-253-9923

NORTH CAROLINA
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GREENSBORO, NC 27406
P O BOX 16500
GREENSBORO, NC 27416
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FAX: 336-273-6628

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FAX: 780-822-7878

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PHONE: 514-933-2711
FAX: 514-933-8639

VANCOUVER,
BRITISH COLUMBIA
1538 KEBET WAY
PORT COQUITLAM,
BRITISH COLUMBIA V3C 5M5
PHONE 604-421-2822
FAX: 604-421-3113

WINNIPEG, MANITOBA
54 PRINCESS STREET
WINNIPEG, MANITOBA R3B 1K2
PHONE: 204-942-5205
FAX: 204-956-4251

AUSTRALIA

UNIT 3, 6 STANTON ROAD
SEVEN HILLS, NSW 2147, AUSTRALIA
PHONE: (61) (2) 9674 5455
FAX: (61) (2) 9674 2495

UNIT 8, 5 KELLETTS ROAD
ROWVILLE, VICTORIA, 3178
AUSTRALIA
PHONE: (61) (3) 9753 4355
FAX: (61) (3) 9753 4366

EL SALVADOR

RESIDENCIAL PINARES DE SUIZA
POL. 15 #44,
NVA. SAN SALVADOR, EL SALVADOR
PHONE: +503 2288-1519
FAX: +503 2288-1518

CHILE

LUIS THAYER OJEDA 166,
OF 402 - PROVIDENCIA
SANTIAGO, CHILE
PHONE: 56-2-290-0762
FAX: 56-2-290-0762

CHINA

ROOM NO. A-8421
JIAHUA BUSINESS CENTER
808 HONG QIAO ROAD
SHANGHAI 200030, CHINA
PHONE: (86-21) 6447 3060
FAX: (86-21) 6407 8620

UNIT 905, 9TH FLOOR,
TOWER B WANDA PLAZA
NO. 93 JIANGUO ROAD,
CHAOYANG DISTRICT
BEIJING, 100022, CHINA
PHONE +86 (010) 58205516
FAX +86 (010) 58204231

GERMANY

DIESELSTRASSE 22
D-85551 KIRCHHEIM
MUNICH, GERMANY
PHONE: +49 89 90 5080
FAX: +49 89 90 50 8492

HERMANN-HEINRICH-GOSSEN-STRASSE 3
D-50858 KÖLN, GERMANY
PHONE: 49 2234 37941 0
FAX: 49 2234 37941 64

INDIA

14, COMMERCE AVENUE
MAHAGANESH COLONY
PAUD ROAD
PUNE - 411038
MAHARASHTRA, INDIA
PHONE: 91 20 25452717, 25452718
FAX: 91 20 25452719

ITALY

BALDOR ASR AG
SUCCURSALE DI MENDRISIO
VIA BORROMINI, 20A
CH-6850 MENDRISIO
SWITZERLAND
PHONE: 0041 91 640 99 50
FAX: 0041 91 630 26 33

JAPAN

DIA BLDG 802,
2-21-1 TSURUYA-CHO,
KANAGAWA-KU
YOKOHAMA, 221-0835, JAPAN
PHONE: 81-45-412-4506
FAX: 81-45-412-4507

KOREA

ROOM 208-37
INCHEON INDUSTRIAL GOODS
CIRCULATING CENTER
SONGHYEON 3-DONG, DONG-GU
INCHEON. KOREA, 401-705
PHONE: (82) 32 588 3253
FAX: (82) 32 588 3254

MEXICO

LEON, GUANAJUATO
KM. 2.0 BLVD. AEROPUERTO
LEÓN 37545, GUANAJUATO, MÉXICO
PHONE: 52 477 761 2030
FAX: 52 477 761 2010

MIDDLE EAST & NORTH AFRICA

VSE INTERNATIONAL CORP.
P. O. BOX 5618
BUFFALO GROVE, IL 60089-5618
PHONE: 847 590 5547
FAX: 847 590 5587

SINGAPORE

51 KAKI BUKIT ROAD 2
K B WAREHOUSE COMPLEX
SINGAPORE 417863
PHONE: (65) 6744 2572
FAX: (65) 6747 1708

PANAMA

AVE. RICARDO J. ALFARO
EDIFICIO SUN TOWERS MALL
PISO 2, LOCAL 55
CIUDAD DE PANAMÁ, PANAMÁ
PHONE: +507 236-5155
FAX: +507 261-5355

SWITZERLAND

POSTFACH 73
SCHUTZENSTRASSE 59
CH-8245 FEUERTHALEN
SWITZERLAND
PHONE: +41 52 647 4700
FAX: +41 52 659 2394

TAIWAN

1F, NO 126 WENSHAN 3RD STREET,
NANTUN DISTRICT,
TAICHUNG CITY 408
TAIWAN R.O.C
PHONE: (886) 4 238 04235
FAX: (886) 4 238 04463

UNITED KINGDOM

6 BRISTOL DISTRIBUTION PARK
HAWKLEY DRIVE
BRISTOL BS32 0BF U.K.
PHONE: +44 1454 850000
FAX: +44 1454 859001

VENEZUELA

AV. ROMA. QTA EL MILAGRO. URB.
CALIFORNIA NORTE
CARACAS, 1070
VENEZUELA
PHONE: 58-414-114-8623
FAX: 58-412-322-5790

(H) "START-UP" SERVICE

FANWALL® START – UP REPORT

(if applicable) **VFD UNIT MODELS**

Start – UP Date: _____

Temtrol recommends that the following **FWT START~UP REPORT** be performed on each unit and the results filed with the appropriate facility engineering office.

Unit Nameplate Data

Model No.	
Serial No.	
Supply CFM:	Supply HP:
Exhaust/Return CFM:	Exhaust/Return HP:

Mechanical System Checks

	Initials or ✓
1. Visually inspect fanwall/fan cube for damage.	
a. On Discharge side look for damage to Fans, Motors, Cells, etc.	
b. On Inlet side look for damage to inlet straightening grid and frame as well as cells.	
2. Fan Wheel / Motor	
a. Rotate fan wheel by hand to ensure it is properly aligned with inlet cone.	
b. Check motor bearings as fan wheel is rotating. Bearings should operate freely and be free of noise.	
c. Check that shaft ground kit is installed correctly.	
d. Check back draft damper for smooth operation if supplied. Open damper by hand to ensure a full range of motion without obstruction.	
3. HVAC System	
a. Check that all ducts, dampers and registers are set.	
b. Check that all openings and penetrations are sealed.	

FWT START~UP REPORT (Con't)

Electrical System Checks

1. De-Energized	
a. Check for any loose connections	
b. Check circuit breaker disconnect mechanisms / Mechanical interlocks operate properly	
c. Check VFD size and rating (voltage and horsepower)	
d. Check and set motor start protectors (MSP) for correct size and setting.	
e. Ensure all system components are adjusted to proper settings (temperature, amperage)	
2. Energized	
a. Connect proper input voltage power to line side of panel	
b. Energize incoming power circuit.	
c. Check for proper line voltage.	
d. Check voltage between all neutral terminations and panel ground (should be zero volts)	
e. Check internal power supplies for proper voltage output(s) and adjust as required	
f. Test and verify proper operations of all GFCI devices	
g. Check operation of cabinet cooling fans, adjust thermostat as specified on drawing	
h. Check and record all voltage readings	
i. Energize MSP one at a time to ensure correct motor rotation.	
j. Ensure that CFM monitoring system is functioning (if applicable).	

Comments

FWT/FWR

Trouble

Shooting

TROUBLE SHOOTING GUIDES
FWR - FWT

PROBLEM	PROBABLE CAUSE	SOLUTION
Fanwall Will Not Start Or Run At All	No main power	a. Check main power fuses with ohm meter b. Correct problem and replace fuses with size indicated on electrical diagram. c. Check disconnect switch. d. Turn to "On" position. e. Use volt meter to check for proper main voltage to unit. f. Restore power to unit.
	Faulty control circuit auxiliary contact on unit disconnect switch	a. Check contact with ohm meter. b. Replace switch if faulty.
	No control transformer output	a. Check primary and secondary fuses on transformer. b. Correct problem and replace fuse(s) with size indicated on electrical diagram. c. Check control transformer primary and secondary voltages. d. Replace transformer if faulty.
	Tripped overloads on motor starters	a. Verify overload trip setting is at or slightly above the motor nameplate fla. b. Reset overloads and measure operating current of motors. c. If current values are above nameplate fla, go to Motor Failure. d. Consult Baldor Service Center.
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter	a. Check source of power. Check overloads, fuses, controls, etc
Motor Failure	Improper supply voltage	a. Check voltage at motor. b. If incorrect, correct to proper value. c. Check for proper wiring at motor. d. Wire motor per diagram on motor or inside motor junction box.
	Motor overheating	a. Verify correct supply cfm. b. Adjust cfm to unit data plate value. c. Check for temperatures above 110°F. d. Consult Baldor Service Center.

TROUBLE SHOOTING GUIDES
FWR - FWT

PROBLEM	PROBABLE CAUSE	SOLUTION
Motor Failure (Con't)	Motor overloaded	a. Check amperage at motor. b. motor junction box. If amperage outside of motor nameplate limits, conduct additional field tests that follow. c. Check rotation of fan. d. Correct rotation, if necessary. e. Check motor shaft for freedom of movement. f. Replace motor or motor bearings if necessary. g Check for excessive cfm and/or static pressure. h. Correct cause of high static pressure and adjust airflow per start-up section instructions
	Overload. Compare actual amps (measured) with nameplate rating	a. Locate and remove source of excessive friction in motor or load. b. Reduce load or replace with motor of greater capacity.
	Single Phasing	a. Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation	a. Check external cooling fan to be sure air is moving properly across cooling fins. b. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage	a. Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator	a. Check air gap clearance and bearings. b. Tighten “Through Bolts”.
	Over voltage or under voltage	a. Check input voltage at each phase to motor.
	Open stator winding	a. Check stator resistance at all three phases for balance.
	Grounded winding	a. Perform dielectric test and repair as required.
	Improper connections	a. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. b. Refer to motor lead connection diagram

TROUBLE SHOOTING GUIDES
FWR - FWT

PROBLEM	PROBABLE CAUSE	SOLUTION
Excessive humming	High Voltage Eccentric air gap	a. Check input line connections. b. Have motor serviced at local Baldor service center.
Fan Capacity Low	High external static pressure	a. Check actual pressure against unit data plate pressure. b. Correct static pressure. If not possible, consult factory.
	Dampers improperly positioned	a. Verify proper position of unit air control dampers (if any) and all external dampers/diffusers. b. Correct damper position.
	Air leaks in system	a. Check ductwork and duct connections for leaks. b. Repair any leaks.
	Damaged fan wheel	a. Visually inspect wheel. b. Replace fan wheel if necessary.
	Incorrect fan rotation	a. Check wheel rotation with arrow on fan. b. Correct rotation if backwards.
	Obstructed inlet	a. Inspect inlet. b. Clear inlet.
Vibration And Noise	Misalignment	a. Check and align motor and driven equipment.
	Misalignment of wheel	a. Check alignment. b. Align if necessary.
	Dirty fan wheel	a. Inspect fan wheel. b. Clean fan wheel.
	Broken or loose bolts or set screws	a. Check bolts and setscrews for tightness. b. Replace or tighten as necessary.
	Fan delivering more than rated capacity	a. Refer to airflow verification in start-up procedure section b. Adjust drives per instructions in start-up procedure section.
	Loose dampers	a. Inspect dampers. b. Tighten dampers if loose.

TROUBLE SHOOTING GUIDES
FWR - FWT

PROBLEM	PROBABLE CAUSE	SOLUTION
Vibration And Noise (con't)	Shipping bolts and/or braces not removed	a. Verify all shipping blocks and braces are removed. b. Remove shipping attachments.
	Rubbing between rotating parts and stationary parts	a. Isolate and eliminate cause of rubbing. b. See "Fan Wheel/Cone Alignment" Section for adjustment.
	Rotor out of balance	a. Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance	a. Tune system or contact your Baldor Service Center for assistance.
	Foreign material in air gap or ventilation openings	a. Remove rotor and foreign material. b. Reinstall rotor. c. Check insulation integrity. d. Clean ventilation openings.

Library Members

Schedules

People - Restaurant

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	1 a.m.	10.0	
		1 a.m.	8 a.m.	0.0	
		8 a.m.	noon	50.0	
		noon	2 p.m.	85.0	
		2 p.m.	5 p.m.	25.0	
		5 p.m.	6 p.m.	30.0	
		6 p.m.	10 p.m.	90.0	
		10 p.m.	Midnight	15.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	1 a.m.	15.0	
		1 a.m.	8 a.m.	0.0	
		8 a.m.	noon	50.0	
		noon	2 p.m.	85.0	
		2 p.m.	5 p.m.	25.0	
		5 p.m.	6 p.m.	30.0	
		6 p.m.	10 p.m.	90.0	
		10 p.m.	Midnight	15.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	1 a.m.	15.0	
		1 a.m.	8 a.m.	0.0	
		8 a.m.	noon	50.0	
		noon	2 p.m.	85.0	
		2 p.m.	5 p.m.	25.0	
		5 p.m.	6 p.m.	30.0	
		6 p.m.	10 p.m.	90.0	
		10 p.m.	Midnight	15.0	

Library Members

Schedules

Heating Design	Start time	End time	Percentage	Utilization
	Midnight	Midnight	0.0	

Off (0%)

Simulation type: Reduced year

January - December Cooling design to Sunday	Start time	End time	Status	Equipment operation
	Midnight	Midnight	Off	

Misc - Restaurant

Simulation type: Reduced year

January - December Cooling design to Weekday	Start time	End time	Percentage	Utilization
	Midnight	8 a.m.	10.0	
	8 a.m.	11 a.m.	60.0	
	11 a.m.	Midnight	90.0	

January - December Saturday	Start time	End time	Percentage	Utilization
	Midnight	8 a.m.	10.0	
	8 a.m.	11 a.m.	60.0	
	11 a.m.	Midnight	90.0	

January - December Sunday	Start time	End time	Percentage	Utilization
	Midnight	8 a.m.	10.0	
	8 a.m.	11 a.m.	60.0	
	11 a.m.	Midnight	90.0	

Heating Design	Start time	End time	Percentage	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Parking lot lights

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	6 p.m.	0.0	
		6 p.m.	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	6 p.m.	0.0	
		6 p.m.	Midnight	100.0	

Library Members

Schedules

Lights - Restaurant

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	10.0	
		8 a.m.	11 a.m.	60.0	
		11 a.m.	Midnight	90.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	10.0	
		8 a.m.	11 a.m.	60.0	
		11 a.m.	Midnight	90.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	10.0	
		8 a.m.	11 a.m.	60.0	
		11 a.m.	Midnight	90.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Hamilton Hall - Miami University				
	Proposed Design	Baseline Design	Baseline Deduct	Description of Change
Plumbing	$638,421.00	$638,421.00	$0.00	N/A
Electric and Technology	$773,580.00	$729,726.00	$43,854.00	Reflects use of non-LED fixtures
HVAC	$1,465,719.00	$872,878.00	$592,841.00	Reflects use of VAV DX Rooftop Units w/ packaged VAV with reheat (ASHRAE 90.1-2007, Appendix G)
Total Incremental Cost			**$636,695.00**	Cost increase from baseline to proposed MEP design.

*Proposed design values taken from project GMP estimate

CHANGE ORDER

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560003
Change Order: 00000001
Date: 08/18/2015
Vendor Code: BARME
Job: 3556
MIAMI U NORTH QUAD

TO BARNETT MECHANICAL SERVICES LL
4545 GROVES ROAD
SUITE Q
COLUMBUS, OH 43232

SHIP TO MIAMI UNIVERSITY
501 E. HIGH ST
OXFORD, OH 45056

THIS P/O HAS BEEN CHANGED

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY			FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**
DESTINATION			JOHN W. BARNETT, JR

HOLD FOR RELEASE

SUBMIT 1 ELECTRONIC COPY OF SHOP DRAWING AND/OR CATALOG CUTS AND 1 ELECTRONIC COPY OF O&M'S TO BEN SLEEPER FOR
APPROVAL.

THE FOLLOWING IS TO MEET OR EXCEED ALL REQUIREMENTS OF THE PLANS,SPECIFICATIONS,ADDENDA,SUBMITTALS AND ALL ASSOCIATED DOCUMENTS AS
ISSUED BY WHITING TURNER AND INCLUSIVE OF ALL SUPPLEMENTAL DOCUMENTS ISSUED BY CR ARCHITECTURE AND DESIGN AND BRUNER CORPORATION
PROJECT NUMBER 3556.

BRUNER CORP WILL ISSUE JOINT CHECKS FOR ALL PAYMENTS

QUANTITY	ITEM	DESCRIPTION	UOM	UNIT COST	AMOUNT
0.000	HVAC EQUIPMENT ****CHANGED****	HVAC EQUIPMENT		0.00000	620,000.00
	(4) Temtrol - Indoor Air Handling Unit Four (4) Temtrol Indoor air handlers (5) Temtrol Indoor Dedicated Outside Air System (12)Temtrol Blower Coil Units Twelve (12) Temtrol Indoor air handlers Five (5) Temtrol Indoor air handlers with				
0.000	 ****ADDED****	MARTIN HALL		0.00000	180,950.00
	(2) TEMPROL INDOOR AHU-1 (1) TEMPTROL MUA-1 >>> NOTE: EQUIPMENT IS DUE ON SITE 10/2/2015 <<<				

Sub Total:	$800,950.00
Sales Tax:	$0.00
Freight:	$0.00
P/O Total:	$800,950.00

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

CHANGE ORDER

Purchase Order: 35560003
Change Order: 00000001
Date: 08/18/2015
Vendor Code: BARME
Job: 3556
MIAMI U NORTH QUAD

Original Purchase Order:	$620,000.00
Total Change Orders to Date:	$180,950.00
Original + Change Orders:	$800,950.00

PURCHASE ORDER NUMBER MUST APPEAR ON YOUR INVOICE.

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

Carrier®

turn to the experts™

INVOICE

Invoice No: 94244349

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 08/18/2015
Due Date: 09/17/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
41	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-20-1,241221-20-2,241221-20-3,241221-20-4,241221-20-5,241221-20-6,241221-20-7,241221-20-8,241221-20-9,241221-20-10,241221-20-11,241221-20-12,241221-20-13,241221-20-14,241221-20-15,241221-20-16,241221-20-17,241221-20-18,241221-20-19,241221-20-20,241221-20-21,241221-20-22,241221-20-23,241221-20-24,241221-20-25,241221-20-26,241221-20-27,241221-20-28,241221-20-29,241221-20-30,241221-20-31,241221-20-32,241221-20-33,241221-20-34,241221-20-35,241221-20-36,241221-20-37,241221-20-38,241221-20-39,241221-20-40,241221-20-41. FC-A, FR	1,466.00	60,106.00
54	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-30-3,241221-30-4,241221-30-5,241221-30-6,241221-30-7,241221-30-8,241221-30-9,241221-30-10,241221-30-11,241221-30-12,241221-30-13,241221-30-14,241221-30-15,241221-30-16,241221-30-17,241221-30-18,241221-30-19,241221-30-20,241221-30-21,241221-30-22,241221-30-23,241221-30-24,241221-30-25,241221-30-26,241221-30-27,241221-30-28,241221-30-29,241221-30-30,241221-30-31,241221-30-32,241221-30-33,241221-30-34,241221-30-35,241221-30-36,241221-30-37,241221-30-38,241221-30-39,241221-30-40,241221-30-41,241221-30-42,241221-30-43,241221-30-44,241221-30-45,241221-30-46,241221-30-47,241221-30-48,241221-30-49,241221-30-50,241221-30-51,241221-30-52,241221-30-53,241221-30-54,241221-30-1,241221-30-2. FC-A, FL	1,466.00	79,164.00
1	42SGA04FSYAA-YREB4 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-10-1. FC-A, F	1,443.00	1,443.00
31	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-20-42,241221-20-43,241221-20-44,241221-20-45,241221-20-46,241221-20-47,241221-20-48,241221-20-49,241221-20-50,241221-20-51,241221-20-52,241221-	1,466.00	45,446.00

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 08/18/2015
Due Date: 09/17/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
	20-53,241221-20-54,241221-20-55,241221-20-56,24122 1-20-57,241221-20-58,241221-20-59,241221-20-60,241 221-20-61,241221-20-62,241221-20-63,241221-20-64,2 41221-20-65,241221-20-66,241221-20-67,241221-20-68 ,241221-20-69,241221-20-70,241221-20-71,241221-20- 72. FC-A, FR		
2	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-30-55,241221-30-56. FC-A, FL	1,466.00	2,932.00
3	42SGA06FSYNA-YREB5 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241221-50-1,241221-50-2,241221-50-3. FC-B, FR	1,543.00	4,629.00
1	42SGA06FSYAA-YREB7 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241221-40-1. FC-B, F	1,561.00	1,561.00
8	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-20-73,241221-20-74,241221-20-75,241221-20-7 6,241221-20-77,241221-20-78,241221-20-79,241221-20 -80. FC-A, FR	1,466.00	11,728.00
71	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-30-57,241221-30-58,241221-30-59,241221-30-6 0,241221-30-61,241221-30-62,241221-30-63,241221-30 -64,241221-30-65,241221-30-66,241221-30-67,241221- 30-68,241221-30-69,241221-30-70,241221-30-71,24122 1-30-72,241221-30-73,241221-30-74,241221-30-75,241 221-30-76,241221-30-77,241221-30-78,241221-30-79,2 41221-30-80,241221-30-81,241221-30-82,241221-30-83 ,241221-30-84,241221-30-85,241221-30-86,241221-30- 87,241221-30-88,241221-30-89,241221-30-90,241221-3 0-91,241221-30-92,241221-30-93,241221-30-94,241221 -30-95,241221-30-96,241221-30-97,241221-30-98,2412 21-30-99,241221-30-100,241221-30-101,241221-30-102 ,241221-30-103,241221-30-104,241221-30-105,241221-	1,466.00	104,086.00

turn to the expe

INVOICE

Invoice No: 94244349

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 08/18/2015
Due Date: 09/17/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
	30-106,241221-30-107,241221-30-108,241221-30-109,241221-30-110,241221-30-111,241221-30-112,241221-30-113,241221-30-114,241221-30-115,241221-30-116,241221-30-117,241221-30-118,241221-30-119,241221-30-120,241221-30-121,241221-30-122,241221-30-123,241221-30-124,241221-30-125,241221-30-126,241221-30-127 . FC-A, FL		

SUB TOTAL	**311,095.00**
TAX	**0.00**
TOTAL	**311,095.00**

Please make checks payable to: **CARRIER CORPORATION**
PLEASE INCLUDE YOUR BILL-TO NUMBER ON YOUR REMITTANCE

REMIT TO: Carrier Corporation (Regular Mail) PO Box 905533 Charlotte, NC 28290-5533	REMIT TO: JP Morgan Chase (Overnight Express) 806 Tyvola Rd, Ste 108 Charlotte, NC 28217 ATTN: Carrier Corp/905533
WE GLADLY ACCEPT VISA, AMERICAN EXPRESS, & MASTERCARD. PLEASE CALL THE CONTACT ABOVE WITH ANY ISSUES OR CONCERNS	CARRIER CORPORATION - A DELAWARE CORP F.E.I.N. 06-0991716

INVOICE

Invoice No: 94275808

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 08/18/2015
Due Date: 09/17/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
41	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-20-1,241221-20-2,241221-20-3,241221-20-4,241221-20-5,241221-20-6,241221-20-7,241221-20-8,241221-20-9,241221-20-10,241221-20-11,241221-20-12,241221-20-13,241221-20-14,241221-20-15,241221-20-16,241221-20-17,241221-20-18,241221-20-19,241221-20-20,241221-20-21,241221-20-22,241221-20-23,241221-20-24,241221-20-25,241221-20-26,241221-20-27,241221-20-28,241221-20-29,241221-20-30,241221-20-31,241221-20-32,241221-20-33,241221-20-34,241221-20-35,241221-20-36,241221-20-37,241221-20-38,241221-20-39,241221-20-40,241221-20-41. FC-A, FR	1,466.00	60,106.00
54	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-30-3,241221-30-4,241221-30-5,241221-30-6,241221-30-7,241221-30-8,241221-30-9,241221-30-10,241221-30-11,241221-30-12,241221-30-13,241221-30-14,241221-30-15,241221-30-16,241221-30-17,241221-30-18,241221-30-19,241221-30-20,241221-30-21,241221-30-22,241221-30-23,241221-30-24,241221-30-25,241221-30-26,241221-30-27,241221-30-28,241221-30-29,241221-30-30,241221-30-31,241221-30-32,241221-30-33,241221-30-34,241221-30-35,241221-30-36,241221-30-37,241221-30-38,241221-30-39,241221-30-40,241221-30-41,241221-30-42,241221-30-43,241221-30-44,241221-30-45,241221-30-46,241221-30-47,241221-30-48,241221-30-49,241221-30-50,241221-30-51,241221-30-52,241221-30-53,241221-30-54,241221-30-1,241221-30-2. FC-A, FL	1,466.00	79,164.00
1	42SGA04FSYAA-YREB4 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-10-1. FC-A, F	1,443.00	1,443.00
31	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-20-42,241221-20-43,241221-20-44,241221-20-45,241221-20-46,241221-20-47,241221-20-48,241221-20-49,241221-20-50,241221-20-51,241221-20-52,241221-	1,466.00	45,446.00

turn to the experts

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 08/18/2015
Due Date: 09/17/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
	20-53,241221-20-54,241221-20-55,241221-20-56,24122 1-20-57,241221-20-58,241221-20-59,241221-20-60,241 221-20-61,241221-20-62,241221-20-63,241221-20-64,2 41221-20-65,241221-20-66,241221-20-67,241221-20-68 ,241221-20-69,241221-20-70,241221-20-71,241221-20- 72. FC-A, FR		
2	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-30-55,241221-30-56. FC-A, FL	1,466.00	2,932.00
3	42SGA06FSYNA-YREB5 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241221-50-1,241221-50-2,241221-50-3. FC-B, FR	1,543.00	4,629.00
1	42SGA06FSYAA-YREB7 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241221-40-1. FC-B, F	1,561.00	1,561.00
8	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-20-73,241221-20-74,241221-20-75,241221-20-7 6,241221-20-77,241221-20-78,241221-20-79,241221-20 -80. FC-A, FR	1,466.00	11,728.00
71	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241221-30-57,241221-30-58,241221-30-59,241221-30-6 0,241221-30-61,241221-30-62,241221-30-63,241221-30 -64,241221-30-65,241221-30-66,241221-30-67,241221- 30-68,241221-30-69,241221-30-70,241221-30-71,24122 1-30-72,241221-30-73,241221-30-74,241221-30-75,241 221-30-76,241221-30-77,241221-30-78,241221-30-79,2 41221-30-80,241221-30-81,241221-30-82,241221-30-83 ,241221-30-84,241221-30-85,241221-30-86,241221-30- 87,241221-30-88,241221-30-89,241221-30-90,241221-3 0-91,241221-30-92,241221-30-93,241221-30-94,241221 -30-95,241221-30-96,241221-30-97,241221-30-98,2412 21-30-99,241221-30-100,241221-30-101,241221-30-102 ,241221-30-103,241221-30-104,241221-30-105,241221-	1,466.00	104,086.00

turn to the experts

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 08/18/2015
Due Date: 09/17/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
	30-106,241221-30-107,241221-30-108,241221-30-109,241221-30-110,241221-30-111,241221-30-112,241221-30-113,241221-30-114,241221-30-115,241221-30-116,241221-30-117,241221-30-118,241221-30-119,241221-30-120,241221-30-121,241221-30-122,241221-30-123,241221-30-124,241221-30-125,241221-30-126,241221-30-127 . FC-A, FL Cancellation Invoice: 94270253 Original Invoice Number: 94244349		

SUB TOTAL	**311,095.00**
TAX	**0.00**
TOTAL	**311,095.00**

Please make checks payable to: **CARRIER CORPORATION**
PLEASE INCLUDE YOUR BILL-TO NUMBER ON YOUR REMITTANCE

REMIT TO: Carrier Corporation (Regular Mail) PO Box 905533 Charlotte, NC 28290-5533	REMIT TO: JP Morgan Chase (Overnight Express) 806 Tyvola Rd, Ste 108 Charlotte, NC 28217 ATTN: Carrier Corp/905533
WE GLADLY ACCEPT VISA, AMERICAN EXPRESS, & MASTERCARD. PLEASE CALL THE CONTACT ABOVE WITH ANY ISSUES OR CONCERNS	CARRIER CORPORATION - A DELAWARE CORP. F.E.I.N. 06-0991716

INVOICE

Invoice No: 94286645

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 09/02/2015
Due Date: 10/02/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
82	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241223-20-81,241223-20-82,241223-20-83,241223-20-84,241223-20-85,241223-20-86,241223-20-87,241223-20-88,241223-20-89,241223-20-90,241223-20-91,241223-20-92,241223-20-93,241223-20-94,241223-20-95,241223-20-96,241223-20-97,241223-20-98,241223-20-99,241223-20-100,241223-20-101,241223-20-102,241223-20-103,241223-20-104,241223-20-105,241223-20-106,241223-20-107,241223-20-108,241223-20-109,241223-20-110,241223-20-111,241223-20-112,241223-20-113,241223-20-114,241223-20-115,241223-20-116,241223-20-117,241223-20-118,241223-20-119,241223-20-120,241223-20-141,241223-20-142,241223-20-143,241223-20-144,241223-20-145,241223-20-146,241223-20-147,241223-20-148,241223-20-149,241223-20-150,241223-20-151,241223-20-152,241223-20-153,241223-20-154,241223-20-155,241223-20-156,241223-20-157,241223-20-158,241223-20-178,241223-20-159,241223-20-160,241223-20-161,241223-20-162,241223-20-163,241223-20-164,241223-20-165,241223-20-166,241223-20-167,241223-20-168,241223-20-169,241223-20-170,241223-20-171,241223-20-172,241223-20-173,241223-20-174,241223-20-175,241223-20-176,241223-20-177,241223-20-179,241223-20-180,241223-20-181,241223-20-182. FC-A, FR	1,466.00	120,212.00
9	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241223-30-128,241223-30-129,241223-30-130,241223-30-131,241223-30-132,241223-30-133,241223-30-134,241223-30-135,241223-30-136. FC-A, FL	1,466.00	13,194.00
5	42SGA04FSYAA-YREB4 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241223-10-6,241223-10-2,241223-10-3,241223-10-4,241223-10-5. FC-A, F	1,443.00	7,215.00
20	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial#	1,466.00	29,320.00

turn to the experts

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 09/02/2015
Due Date: 10/02/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
	241223-20-121,241223-20-122,241223-20-123,241223-20-124,241223-20-125,241223-20-126,241223-20-127,241223-20-128,241223-20-129,241223-20-130,241223-20-131,241223-20-132,241223-20-133,241223-20-134,241223-20-135,241223-20-136,241223-20-137,241223-20-138,241223-20-139,241223-20-140. FC-A, FR		
76	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241223-30-138,241223-30-139,241223-30-140,241223-30-141,241223-30-142,241223-30-143,241223-30-144,241223-30-145,241223-30-146,241223-30-147,241223-30-148,241223-30-149,241223-30-150,241223-30-151,241223-30-152,241223-30-153,241223-30-154,241223-30-155,241223-30-156,241223-30-157,241223-30-158,241223-30-159,241223-30-160,241223-30-161,241223-30-162,241223-30-163,241223-30-164,241223-30-165,241223-30-166,241223-30-167,241223-30-168,241223-30-169,241223-30-170,241223-30-171,241223-30-172,241223-30-173,241223-30-174,241223-30-175,241223-30-176,241223-30-177,241223-30-178,241223-30-179,241223-30-180,241223-30-181,241223-30-182,241223-30-183,241223-30-184,241223-30-185,241223-30-186,241223-30-187,241223-30-188,241223-30-189,241223-30-190,241223-30-191,241223-30-192,241223-30-193,241223-30-194,241223-30-195,241223-30-196,241223-30-197,241223-30-198,241223-30-199,241223-30-200,241223-30-201,241223-30-202,241223-30-203,241223-30-204,241223-30-205,241223-30-206,241223-30-207,241223-30-208,241223-30-209,241223-30-210,241223-30-211,241223-30-212,241223-30-213. FC-A, FL Cancellation Invoice: 94270253 Original Invoice Number: 94244349	1,466.00	111,416.00
		SUB TOTAL	**281,357.00**
		TAX	**0.00**
		TOTAL	**281,357.00**

INVOICE

Invoice No: 94289954

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 09/03/2015
Due Date: 10/03/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
1	42SGA06ASYNA-YRBA7 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241223-50-1. FC-B, CO, FR-LL	1,583.00	1,583.00
3	42SGA06ASYOA-YRBA8 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241223-80-1,241223-80-2,241223-80-3. FC-B, CO, FL-LL	1,583.00	4,749.00
1	42SGA06ASYAA-YRBA9 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241223-40-1. FC-B, CO, F-LL	1,601.00	1,601.00
1	42SGA04FSYNA-YREB2 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241223-20-183. FC-A, FR	1,466.00	1,466.00
31	42SGA04FSYOA-YREB3 Concealed Modular Hi-Rise Fan Coil 400 C Serial# 241223-30-214,241223-30-215,241223-30-216,241223-30-217,241223-30-218,241223-30-219,241223-30-220,241223-30-221,241223-30-222,241223-30-223,241223-30-224,241223-30-225,241223-30-226,241223-30-227,241223-30-228,241223-30-229,241223-30-230,241223-30-231,241223-30-232,241223-30-233,241223-30-234,241223-30-235,241223-30-236,241223-30-237,241223-30-238,241223-30-239,241223-30-240,241223-30-241,241223-30-242,241223-30-243,241223-30-244. FC-A, FL	1,466.00	45,446.00
4	42SGA06FSYNA-YREB5 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241223-70-4,241223-70-5,241223-70-6,241223-70-7. FC-B, FR	1,543.00	6,172.00
10	42SGA06FSYOA-YREB6 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241223-90-1,241223-90-2,241223-90-3,241223-90-4,241223-90-5,241223-90-6,241223-90-7,241223-90-8,241223-90-9,241223-90-10. FC-B, FL	1,543.00	15,430.00

INVOICE

Invoice No: 94289954

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 09/03/2015
Due Date: 10/03/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
1	42SGA06FSYNA-YREA5 Concealed Modular Hi-Rise Fan Coil 600 C Serial# 241223-60-1. FC-B, FR-LL	1,834.00	1,834.00

SUB TOTAL	**78,281.00**
TAX	**0.00**
TOTAL	**78,281.00**

Please make checks payable to: **CARRIER CORPORATION**
PLEASE INCLUDE YOUR BILL-TO NUMBER ON YOUR REMITTANCE

REMIT TO: Carrier Corporation (Regular Mail) PO Box 905533 Charlotte, NC 28290-5533	REMIT TO: JP Morgan Chase (Overnight Express) 806 Tyvola Rd, Ste 108 Charlotte, NC 28217 ATTN: Carrier Corp/905533
WE GLADLY ACCEPT VISA, AMERICAN EXPRESS, & MASTERCARD. PLEASE CALL THE CONTACT ABOVE WITH ANY ISSUES OR CONCERNS	CARRIER CORPORATION - A DELAWARE CORP. F.E.I.N. 06-0991716

INVOICE

Invoice No: 94332644

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 09/23/2015
Due Date: 10/23/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3638

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
9	42DFA08SRBY6AYER Ducted, Ceiling, Cabinet with Grilles Fa Serial# 241222-10-1,241222-10-2,241222-10-3,241222-10-4,24 1222-10-5,241222-10-6,241222-10-7,241222-10-8,2412 22-10-9. FC-D, R	1,673.00	15,057.00
5	42DFA08SLBY6AYER Ducted, Ceiling, Cabinet with Grilles Fa Serial# 241222-20-1,241222-20-2,241222-20-3,241222-20-4,24 1222-20-5. FC-D, L	1,673.00	8,365.00
6	42VAC03FRBY7AYERB0 Vertical Furred-In Fan Coil Unit 300 CFM Serial# 241222-30-1,241222-30-2,241222-30-3,241222-30-4,24 1222-30-5,241222-30-6. FC-C, R-LL	1,491.00	8,946.00
2	42VAC03FLBY7AYERB1 Vertical Furred-In Fan Coil Unit 300 CFM Serial# 241222-40-1,241222-40-2. FC-C, L-LL	1,491.00	2,982.00
13	42VAC03FRBY7AYERB8 Vertical Furred-In Fan Coil Unit 300 CFM Serial# 241222-50-1,241222-50-2,241222-50-3,241222-50-4,24 1222-50-5,241222-50-6,241222-50-7,241222-50-8,2412 22-50-9,241222-50-10,241222-50-11,241222-50-12,241 222-50-13. FC-C, R	1,200.00	15,600.00
12	42VAC03FLBY7AYERB9 Vertical Furred-In Fan Coil Unit 300 CFM Serial# 241222-60-1,241222-60-2,241222-60-3,241222-60-4,24 1222-60-5,241222-60-6,241222-60-7,241222-60-8,2412 22-60-9,241222-60-10,241222-60-11,241222-60-12. FC-C, L	1,214.00	14,568.00
6	42VCDBS-RU2 Complete Unit Year 2 Parts Only FC-C, R-LL	33.00	198.00
2	42VCDBS-RU2 Complete Unit Year 2 Parts Only FC-C, L-LL	33.00	66.00

turn to the experts

Bill-To: 500702
BRUNER CORP
ATTN ACCOUNTS PAYABLE
3637 LACON RD
HILLIARD, OH 43026-1202

Invoice Date: 09/23/2015
Due Date: 10/23/2015
Payment Terms: 1.25% 10 / Net 30 (Direct Sales)
Customer P.O. No: 35560002
Contract No: 8525631
Job No: 5400H6100
Contact Name: Kristin Collin
Phone: (614)410-3636

Job Site:
Miami University North Quad Ren.
Oxford, OH

Quantity	Material/Serial No.	Unit Price	Ext. Price
13	42VCDBS-RU2 Complete Unit Year 2 Parts Only FC-C, R	33.00	429.00
12	42VCDBS-RU2 Complete Unit Year 2 Parts Only FC-C, L	33.00	396.00
9	42VCDBS-RU2 Complete Unit Year 2 Parts Only FC-D, R	33.00	297.00
5	42VCDBS-RU2 Complete Unit Year 2 Parts Only FC-D, L	33.00	165.00

SUB TOTAL	**67,069.00**
TAX	**0.00**
TOTAL	**67,069.00**

Please make checks payable to: **CARRIER CORPORATION**
PLEASE INCLUDE YOUR BILL-TO NUMBER ON YOUR REMITTANCE

REMIT TO: Carrier Corporation (Regular Mail) PO Box 905533 Charlotte, NC 28290-5533	REMIT TO: JP Morgan Chase (Overnight Express) 806 Tyvola Rd, Ste 108 Charlotte, NC 28217 ATTN: Carrier Corp/905533
WE GLADLY ACCEPT VISA, AMERICAN EXPRESS, & MASTERCARD. PLEASE CALL THE CONTACT ABOVE WITH ANY ISSUES OR CONCERNS	CARRIER CORPORATION - A DELAWARE CORP. F.E.I.N. 06-0991716

CHAPEL
SINCE 1946

Order Date	6/11/2015
Job Name	Miami University Dorms
PO #	030A8083
Job #	150876

Purchase Order

Version 2015

Chapel Electric Co., LLC
1985 Founders Drive
Dayton, OH 45420
Phone: 937.222.2290
Fax: 937.222.1759
www.chapel.com
OH License # 22770

Vendor	Becker Electric	**Ship To**	Chapel Electric
	P.O. Box 247		1985 Founders Drive
	Dayton Ohio 45401-0247		Dayton OH 45420
Attention	Henry Johnson		
Phone	937-226-1341	**Foreman**	Steve Crawford
Email		**Cell #**	937-673-1335

Purchase Order Approved By:

Kenny Lowery
Project Manager

Bob Shaffer
Vice President, Contract Operations

Order Requirement Checklist

- ☑ Confirming order (Do not duplicate)
- ☐ Submit for approval
- ☑ Hold for release
- ☑ Release for immediate fabrication
- ☑ Order includes freight & delivery charges
- ☑ Prices firm for life of project
- ☑ Call 48 hours prior to delivery
- ☑ Non-Taxable (Direct Pay Permit # 98-002782)
- ☐ Project is Tax Exempt (Form is attached)
- ☐ Buy American requirement (BAA)
- ☐ 10% Retainage applies
- ☑ See attached Terms and Conditions

Field Technician Labor

☐ Field Technician labor required by Vendor (See Schedule D)*
* If this box is checked, Vendor must provide all items required by Schedule D, prior to arriving on site.

Purchase Order General Notes

1 Please enter full Purchase Order Number and Job Number on all invoices; submit invoices in duplicate.

2 In order to comply with OSHA Hazard Communications Standard, please submit a SDS form for any Hazardous Substance that may be included on this purchase order.

3 You must comply with EEO requirements of Executive Order 11246 and are obliged to annually file Standard Form 100 (EEO-1) per attached form.

4 Please have a company officer or authorized representative sign the this page acknowledging acceptance and return by fax or mail to Chapel Electric. Invoicing presented without the signed copy in our files will not be processed for payment.

Acknowledgement of Vendor Acceptance

Purchase Order Accepted By:

Authorized Signature & Date

PURCHASE ORDER ITEMS ATTACHED

CHAPEL
SINCE 1946

Order Date	6/13/2015
Job Name	Miami University Dorms
PO #	030A8083
Job #	150876

Purchase Order

Version 2015

QUANTITY	DESCRIPTION	C/C	UNIT PRICE	U/M	TOTAL
	The following material / equipment package:				
1	Lighting Package Lot		$ 480,000.00		$ 480,000.00
	is being purchased in accordance with the following:				
	a. Attached Quotation and / or Bill of Material				
	(providing same matches and includes each				
	and every piece of equipment and / or				
	miscellaneous materials, along with the				
	necessary Engineering and drawings,				
	required to provide a fully operable / working				
	system acceptable per the Contract Bid				
	Documents) and all Plans, Specifications,				
	and addenda.				
	b. Contingent upon approval by Architect and/or				
	Engineer, Owner.				
1	Lot of Submittals per Contract Documents		$ -		$ -
1	Lot of O & M Manuals per Contract Documents		$ -		$ -
1	Lot of Testing, Training, and Warranty		$ -		$ -
	TOTAL				$ 480,000.00

CHAPEL
SINCE 1946

Order Date	6/13/2015
Job Name	Miami University Dorms
PO #	030A8083
Job #	150876

Purchase Order

Version 2015

QUANTITY	DESCRIPTION	C/C	UNIT PRICE	U/M	TOTAL
	HEPBURN		$ -		$ -
151	B		$ -		#VALUE!
66	C1		$ -		#VALUE!
2	C2		$ -		#VALUE!
8	C3		$ -		#VALUE!
3	C4		$ -		#VALUE!
9	D1		$ -		#VALUE!
6	D2		$ -		#VALUE!
2	E		$ -		#VALUE!
183	G		$ -		#VALUE!
93	G1		$ -		#VALUE!
100	H		$ -		#VALUE!
17	H1		$ -		#VALUE!
45	H2		$ -		#VALUE!
5	H3		$ -		#VALUE!
60	L		$ -		#VALUE!
12	N2-24		$ -		#VALUE!
26	N4-48		$ -		#VALUE!
11	S		$ -		#VALUE!
1	UC-2		$ -		#VALUE!
1	UC-3		$ -		#VALUE!
5	X1		$ -		#VALUE!
4	X2		$ -		#VALUE!
20	X3		$ -		#VALUE!
12	X4		$ -		#VALUE!
1	EM1,		$ -		#VALUE!
36	GTD, EPC-1		$ -		#VALUE!
1	Lot, Sensors, powerpacks, LV, Switches, Dimming Startup		$ -		#VALUE!
1	Lot Of Spares		$ -		#VALUE!
1	C6		$ -		#VALUE!
6	H4		$ -		#VALUE!
1	N3-36		$ -		#VALUE!
2	W2		$ -		#VALUE!
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
	TOTAL				#VALUE!

CHAPEL
SINCE 1946

Order Date	6/13/2015
Job Name	Miami University Dorms
PO #	030A8083
Job #	150876

Purchase Order

Version 2015

QUANTITY	DESCRIPTION	C/C	UNIT PRICE	U/M	TOTAL
	FLOWER		$ -		$ -
155	B		$ -		#VALUE!
66	C1		$ -		#VALUE!
2	C2		$ -		#VALUE!
6	C3		$ -		#VALUE!
2	C5		$ -		#VALUE!
9	D1		$ -		#VALUE!
7	D3		$ -		#VALUE!
8	E		$ -		#VALUE!
201	G		$ -		#VALUE!
109	G1		$ -		#VALUE!
109	H		$ -		#VALUE!
13	H1		$ -		#VALUE!
65	H2		$ -		#VALUE!
22	H3		$ -		#VALUE!
45	L		$ -		#VALUE!
9	N2-24		$ -		#VALUE!
31	N4-48		$ -		#VALUE!
11	S		$ -		#VALUE!
6	UC-2		$ -		#VALUE!
3	UC-3		$ -		#VALUE!
5	X1		$ -		#VALUE!
3	X2		$ -		#VALUE!
21	X3		$ -		#VALUE!
20	X4		$ -		#VALUE!
4	EM1,		$ -		#VALUE!
41	GTD, EPC-1		$ -		#VALUE!
1	Lot, Sensors, powerpacks, LV, Switches, Dimming Startup		$ -		#VALUE!
1	Lot Of Spares		$ -		#VALUE!
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
	TOTAL				#VALUE!

PURCHASE ORDER TERMS AND CONDITIONS

1. AGREEMENT - This writing comprises the full and entire agreement between the parties affecting the materials / equipment provided for herein. No other agreements or understanding of any nature concerning the same has been entered into or will be recognized. Chapel Electric Co., LLC (Contractor) has made no inducements or representations to Vendor whatsoever except as expressly stated in this Purchase Order. No oral modification of this Purchase Order shall have any force or affect.

2. CONTRACT DOCUMENT COMPLIANCE - This entire order shall conform to and in every respect to the Plans, Specification and all Addenda.

3. DELIVERABLES – A complete set of electronic submittals and or shop drawings are required to be delivered to the Contractor with in (2) two weeks of the purchase date. All close out documentation, including O&M manuals must be delivered within (2) two weeks of final material / equipment shipments. Final payment will be withheld until all close out documentation has been submitted and approved.

4. RISK OF LOSS - Regardless of the F.O.B. point, title to the material shall remain with the Vendor until the material is delivered to Contractor, at the destination point, and all risk of loss, including loss by reason of shortage, damage, destruction, etc., shall not pass to Contractor until such time, and then only to the extent such risk would pass under applicable law.

5. PRICE - The price to be paid by Contractor for the material shall be that stated on the face hereof, or the lowest prevailing net price now given to any customer for like materials, whichever is lower, and, unless otherwise specified on the face hereof, Contractor shall be entitled to payment terms of not less than thirty days after the first day of the month following the month of the delivery of material, and the price shall be subject to a discount of 2 % if paid on the 10th of the month following the month of delivery.

6. INCLUSIONS - This purchase order shall include where applicable, but is not limited to:

   - All required shop drawings, wiring diagrams, and catalog cut sheets.
   - Instructions as required by installation personnel.
   - All necessary calibrations and adjustments.
   - Final test and check out.
   - Complete operating system.
   - Warranty per contract documents.
   - All specified spare parts / attic stock.
   - Field certification test and start up documents.

7. INSURANCE- In the event Vendor provides services in connection with the provision of product(s), including but not limited to field technician or installation labor, Vendor shall comply with the insurance requirements of Exhibit D, attached."

8. WARRANTY - Vendor hereby warrants that the material covered by this order shall (i) be in strict accordance with the specifications on the face hereof, (ii) be free from defect in design, materials, workmanship and otherwise free from defect, (iii) be merchantable and fit for the purposes for which it is intended, (iv) comply with all applicable federal, state, and local laws and regulations, including those that relate to occupational health and safety, (v) be free from any security interest, lien, or encumbrance so that unencumbered title will pass from Vendor to Buyer, and (vi) be free of any claim of a third party by way of patent of trademark infringement and, upon a breach of any of the foregoing warranties, Contractor shall be entitled to any of the rights and remedies against Vendor provided by the Uniform Commercial Code, and other applicable law, and Vendor specifically agrees to indemnify and save Contractor harmless from and against any and all third party claims which arise out of, relate to, or are incurred because of or incident to an actual or alleged breach of any of the foregoing warranties.

9. TIME IS OF THE ESSENCE - Time is of the essence and if Vendor, for any reason, whether or not beyond Vendor's control, does not strictly comply with the specified delivery date, or dates, Contractor may, in addition to other remedies provided by law, either approve in writing a revised delivery schedule, or cancel the contract or any part thereof without liability.

10. TERMINATION - Contractor may terminate this contract, or any part thereof, without cause at any time before shipment, and any claim of Vendor shall be limited to the reimbursement of reasonable costs to date, not in excess of the purchase price, necessarily incurred by Vendor in the performance of this contract up to the time it received notice of termination, without any allowance for loss of profits, or overhead and other indirect costs.

11. MISCELLANEOUS - No charge will be allowed for packing or crating, or for drayage, freight or other method of delivery unless so specified on the face hereof.

12. AFFIRMATIVE ACTION - "Incorporated by reference herein, and made a part of the agreement of the parties, are those aspects, if applicable, of Executive Order 11246 and the rules, regulations and relevant orders of the Secretary of Labor thereunder regarding the equal opportunity clause, the affirmative action clause for veterans and the affirmative action clause for handicapped workers."

13. INDEMNIFICATION- Vendor shall defend, indemnify and hold Contractor, Owner, their agents and employees, harmless from and against any claim, cost, expense, damage, loss or liability (including attorneys' fees) due to bodily injury (including death), property damage or environmental liabilities arising out of Vendor's provision of the product(s) and performance of any related Work, or resulting from Vendor's breach of this agreement, except that Vendor shall not be liable hereunder for the consequences of the sole negligence of Contractor.

Schedule D

Insurance and Workers' Compensation

The subcontractor will maintain insurance in coverage's and amounts sufficient to protect the Subcontractor, Contractor and Owner from claims under Workers' Compensation Acts and any other claims of property damage and bodily injury, including death, which may arise from the performance of the Work under this Subcontract, whether the Work is being performed by the Subcontractor, its subcontractors, or anyone directly or indirectly employed by either of them:

Limits of coverage to be as follows:

Workers' Compensation and Employers' Liability

- Workers' Compensation insurance as required by statute
- Employers' Liability coverage with limits of $500,000 per occurrence (may be provided as endorsement to General Liability for Ohio)
- Waiver of subrogation where allowable by law
- Non-election of workers' compensation coverage by sole proprietors, partners, and/or executive officers is not acceptable.

General Liability

- $1,000,000 per occurrence/$2,000,000 general aggregate/$2,000,000 Products/Completed operations Aggregate
- Limits apply per project
- Contractor and Owner are to be named as an additional insured on endorsement CG 20 10 11 85 (or its equivalent), providing coverage to the additional insured's for liability arising out of Subcontractor's ongoing and completed operations. Coverage afforded to the additional insured's shall be on a primary/noncontributory basis. Coverage shall continue in full force and effect through the statue of repose in the state which the work is performed.

Automobile Liability

- $1,000,000 per occurrence
- Covers owned, non-owned and hired vehicles
- If appropriate, documentation supporting a statement that Subcontractor does not own any vehicles
- Contractor and Owner shall be covered as an additional insured under the Automobile policy on a primary/noncontributory basis for liability arising out of the acts or omissions of Subcontractor

Excess/Umbrella Liability

- $1,000,000 per occurrence
- Contractor and Owner to receive coverage as an additional insured on a primary/noncontributory basis.

Installation Floater

- Property insurance to cover damage to Work in progress. Policy shall be written at contract value and shall provide for subrogation waiver in favor of Contractor and Owner.

Pollution Liability

- If the Work involves the handling, transportation or disposal of hazardous or potentially hazardous substances, Subcontractor shall purchase and maintain pollution liability coverage of at least $1,000,000 per occurrence.
- Coverage for property damage, bodily injury and cleanup/pollution remediation costs caused by a pollution event and otherwise excluded under Subcontractor's General or Auto Liability policies.
- Contractor and Owner to receive coverage as an additional insured on a primary/noncontributory basis, including coverage for claims arising out of Subcontractor's products and completed operations.
- Coverage shall remain in place for the duration of the project and (5) five years following completion of the project.

Professional Liability

- If the Work includes the provision of professional services, Subcontractor shall carry professional liability coverage of at least $1,000,000 per occurrence.
- Maximum deductible $25,000 unless otherwise approved by Contractor in writing
- Professional liability policy shall contain prior acts coverage sufficient to cover all Subcontract Work
- Coverage shall remain in place for the duration of the project and (5) five years following completion of the project.

Additional Terms and Requirements

- Insurance companies must have a minimum A.M. Best's rating of A-
- The Subcontractor will submit to the Contractor certificates of insurance certifying that the insurance policies required by this agreement are in force and shall be maintained during the duration of the Project. Upon request, subcontractor shall also provide a copy of the additional insured endorsement with the certificate of insurance.
- Subcontractor hereby waives any rights of recovery for loss or damage that it may otherwise have had against Contractor to the extent any such loss, damage or liability is covered under any policy of insurance required to be carried by Subcontractor hereunder. Subcontractor shall ensure its insurers shall honor such waiver, and shall not subrogate.
- Subcontractor specifically and expressly waives any immunity afforded it by virtue of Section 35, Article II of the Ohio Constitution and O.R.C. 4123.74, but only to the extent necessary to honor the indemnification obligation set forth in Paragraph 10 of this Subcontract Agreement

LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

360 INDUSTRIAL DRIVE
FRANKLIN, OH 45005
Phone: 937-743-1220 Fax: 937-743-1227

Purchase Order No.
10151008-1007500

VENDOR COPY

TO: RICHARDS ELECTRIC SUPPLY

4620 READING ROAD
CINCINNATI, OH 45229
ATTN: ANDY
Phone: Fax:

SHIP TO: LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

360 INDUSTRIAL DR.
FRANKLIN, OH 45005
Foreman: GREG BULACH
Foreman Cell: 513-267-2202

DATE ORDERED	TERMS	SHIPMENT TO BE MADE	SHIP VIA	FREIGHT
06/05/15	NET 30 DAYS	06/05/15	VENDOR TRUCK	FREIGHT ALLOWED

JOB NAME	JOB NUMBER	PROJECT MANAGER	HOLD CODE
NORTH QUAD SITE BP-32A - WHITING-TURNER	10151008	JOEL FELLMAN	HOLD FOR APPROVAL

ITEM	QTY	DESCRIPTION	ECM	PRICE	AMOUNT
1	1	LIGHTING PER RICHARDS QUOTE DATE 6/5/15			$178,401.62
2	1	ADDED TIVOLI LIGHTING PER ATTACHED RICHARDS QUOTE DATED 6/26/2015			$0.00
3	1	DELETE PL3 FIXTURES FOR EDGE PARTICIPATION COST SEE ATTACHED			$0.00
4	1	ADD (2) TYPE MARTIN TREE FIXTURES PER ATTD. RICHARDS QUOTE REF. "RFI-367 CHANGES"			$0.00
				Subtotal	**$178,401.62**

CHANGE ORDER #	CHANGE DATE	ITEM	CHANGE IN UNITS	DESCRIPTION	ECM	CHANGE IN UNIT COST	CHANGE IN AMOUNT
1	08/07/15	2	0	ADDED TIVOLI LIGHTING PER ATTACHED RICHARDS QUOT		0.00	11,282.00
2	09/01/15	3	0	DELETE PL3 FIXTURES FOR EDGE PARTICIPATION COST S		0.00	-40,830.00
3	12/08/15	4	0	ADD (2) TYPE MARTIN TREE FIXTURES PER ATTD. RICHAR		0.00	454.00
						CO Subtotal	**-29,094.00**

Tax Exempt Project	$0.00
PO TOTAL	$149,307.62

Confirming to: ANDY

Authorized By: _____ **Purchasing Agent**
MICHAEL HENDRIXSON
LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING LISTS AND CORRESPONDENCES FOR PAYMENT. TWO (2) INVOICE COPIES ARE REQUIRED. ALL MATERIAL TO BE UL LISTED.

Purchase Order No. 10151008-1007500
Change Order No. 3

LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

360 INDUSTRIAL DRIVE
FRANKLIN, OH 45005
Phone: 937-743-1220 Fax: 937-743-1227

Purchase Order No.
10151008-1007903

VENDOR COPY

TO:	SHIP TO:
CARDINAL DIVERSITY GROUP INC 3622 SALEM AVENUE DAYTON, OH 45406 ATTN: ED WILLIAMS/ANDY PRESTON @ RICHARDS Phone: 937-278-4941 Fax: 937-278-5410	TBD **Foreman:** GREG BULACH **Foreman Cell:** 513-267-2202

DATE ORDERED	TERMS	SHIPMENT TO BE MADE	SHIP VIA	FREIGHT
09/01/15	NET 30 DAYS	09/02/15	COMMON CARRIER	FREIGHT ALLOWED

JOB NAME	JOB NUMBER	PROJECT MANAGER	HOLD CODE
NORTH QUAD SITE BP-32A - WHITING-TURNER	10151008	JOEL FELLMAN	

ITEM	QTY	DESCRIPTION	ECM	PRICE	AMOUNT
1	1	PL3 FIXTURES PER ATTACHED RICHARDS ELECTRIC QUOTE DATED 8/31/15 +3% FOR HANDLING FEE			$42,055.00
				Subtotal	**$42,055.00**
				Tax Exempt Project	$0.00
				PO TOTAL	**$42,055.00**

Confirming to: ED WILLIAMS/ANDY PRESTON @ RICHARD

Authorized By: _____ **Purchasing Agent**
MICHAEL HENDRIXSON
LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING LISTS AND CORRESPONDENCES FOR PAYMENT. TWO (2) INVOICE COPIES ARE REQUIRED. ALL MATERIAL TO BE UL LISTED.

Purchase Order No. 10151008-1007903

Change Order No. _____

LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

360 INDUSTRIAL DRIVE
FRANKLIN, OH 45005
Phone: 937-743-1220 Fax: 937-743-1227

Purchase Order No.
10151009-1007559

VENDOR COPY

TO: RICHARDS ELECTRIC SUPPLY

4620 READING ROAD
CINCINNATI, OH 45229
ATTN: ANDY PRESTON
Phone: Fax:

SHIP TO: NORTH QUAD HAHNE HALL BP-26C - WHITING-TURNER

5357 BONHAM ROAD
OXFORD, OH 45056 US
Foreman: GREG BULACH
Foreman Cell: 513-267-2202

DATE ORDERED	TERMS	SHIPMENT TO BE MADE	SHIP VIA	FREIGHT
06/29/15	NET 30 DAYS	08/10/15	COMMON CARRIER	FREIGHT ALLOWED

JOB NAME	JOB NUMBER	PROJECT MANAGER	HOLD CODE
NORTH QUAD HAHNE HALL BP-26C - WHITING-TURNEI	10151009	JOEL FELLMAN	

ITEM	QTY	DESCRIPTION	ECM	PRICE	AMOUNT
1	1	LIGHTING PER ATTACHED RICHARDS BILL OF MATERIAL DATED 6/26/2015			$300,598.00
2	1	DELETE VAC SENSORS PER ATTACHED QUOTE 8/11/2015			$0.00
3	1	BULLETIN 4 CHANGES PER ATTACHED RICHARDS QUOTE 7/14/2015 NOTE: WORK ORDER 26C003 RECEIVED 8/28/15			$0.00
4	1	BULLETIN 5 CHANGES PER ATTACHED RICHARDS QUOTE 7/21/2015			$0.00
5	1	DELETE AND ADD CHANGES PER ATTACHED RICHARDS QUOTE 10/1/2015			$0.00
6	1	DELETE CHANGES PER ATTACHED RICHARDS BILL OF MATERIAL DATED 9/9/2015			$0.00
7	1	ADD (16) TYPE G1 FIXTURES PER ATTACHED RICHARDS QUOTE DATED 12/21/15			$0.00
8	1	DELETE AND ADD CHANGES PER ATTACHED RICHARDS QUOTE 11/5/15 REF. RFI-332			$0.00
9	1	ADD AND DELETE PER ATTACHED RIVCHARDS QUOTE DATED 1/11/15			$0.00
10	1	SWITCHES TO REPLACE DEFECTIVE MATERIAL-NO CHARGE			$420.15
11	1	CREDIT FOR CHARGE OF SWITCHES-ITEM #10			$-420.15
12	1	ADD (12) TYPE G1 FIXTURES PER ATTACHED RICHARDS QUOTE DATED 2/15/16			$0.00
13	1	ADD (1) TYPE L FIXTURE PER ATTACHED RICHARDS QUOTE DATED 12/9/15			$0.00
14	1	ADD (1) TYPE N2 FIXTURE PER ATTACHED RICHARDS QUOTE DATED 12/9/15			$0.00
15	1	ADD (2) TYPE N4 FIXTURE PER ATTACHED RICHARDS QUOTE DATED 1/6/16			$0.00
16	1	ADD (10) EPC-1 PER ATTACHED RICHARDS QUOTE 2143253-00			$0.00
17	1	FREIGHT			$62.50
18	1	ADD (1) H2 FIXTURE			$0.00
19	1	ADD (1) TYPE B FIXTURE			$0.00
20	1	ADD PER RICHARDS QUOTE 2156816-00 ATTACHED			$0.00
21	1	CHANGES TO PO			$5,734.95
22	1	SWITCHES & OCC SENSORS PER ATTACHED RICHARDS QUOTE2170873 DATED 7/6/16			$2,455.05
				Subtotal	**$308,850.50**

LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

360 INDUSTRIAL DRIVE
FRANKLIN, OH 45005
Phone: 937-743-1220 Fax: 937-743-1227

Purchase Order No.
10151009-1007559

VENDOR COPY

CHANGE ORDER #	CHANGE DATE	ITEM	CHANGE IN UNITS	DESCRIPTION	ECM	CHANGE IN UNIT COST	CHANGE IN AMOUNT
1	08/17/15	2	0	DELETE VAC SENSORS PER ATTACHED QUOTE 8/11/2015		0.00	-4,200.00
2	08/28/15	3	0	BULLETIN 4 CHANGES PER ATTACHED RICHARDS QUOTE		0.00	4,571.15
3	08/28/15	4	0	BULLETIN 5 CHANGES PER ATTACHED RICHARDS QUOTE		0.00	2,291.30
4	10/02/15	5	0	DELETE AND ADD CHANGES PER ATTACHED RICHARDS Q		0.00	-302.50
5	10/16/15	6	0	DELETE CHANGES PER ATTACHED RICHARDS BILL OF MA		0.00	-4,821.00
6	12/21/15	7	0	ADD (16) TYPE G1 FIXTURES PER ATTACHED RICHARDS Q		0.00	745.60
7	01/08/16	8	0	DELETE AND ADD CHANGES PER ATTACHED RICHARDS Q		0.00	10,054.40
8	01/13/16	9	0	ADD AND DELETE PER ATTACHED RIVCHARDS QUOTE DA		0.00	-223.60
9	02/23/16	12	0	ADD (12) TYPE G1 FIXTURES PER ATTACHED RICHARDS Q		0.00	597.00
10	03/02/16	13	0	ADD (1) TYPE L FIXTURE PER ATTACHED RICHARDS QUOT		0.00	315.80
	03/02/16	14	0	ADD (1) TYPE N2 FIXTURE PER ATTACHED RICHARDS QUC		0.00	449.75
	03/02/16	15	0	ADD (2) TYPE N4 FIXTURE PER ATTACHED RICHARDS QUC		0.00	1,033.80
11	03/25/16	16	0	ADD (10) EPC-1 PER ATTACHED RICHARDS QUOTE 214325		0.00	3,330.00
12	05/02/16	18	0	ADD (1) H2 FIXTURE		0.00	283.70
	05/02/16	19	0	ADD (1) TYPE B FIXTURE		0.00	881.25
13	05/13/16	20	0	ADD PER RICHARDS QUOTE 2156816-00 ATTACHED		0.00	372.60
						CO Subtotal	**15,379.25**

Tax Exempt Project	$0.00
PO TOTAL	$324,229.75

Confirming to: ANDY PRESTON

Authorized By: Michael Hendrixson **Purchasing Agent**
MICHAEL HENDRIXSON
LAKE ERIE ELECTRIC, INC - DAYTON OFFICE

ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING LISTS AND CORRESPONDENCES FOR PAYMENT. TWO (2) INVOICE COPIES ARE REQUIRED. ALL MATERIAL TO BE UL LISTED.

Purchase Order No. 10151009-1007559
Change Order No. 13

CHANGE ORDER # 5

4696 Devitt Drive · Cincinnati, Ohio 45246
Phole 513.454.3741

ELECTRICAL CONTRACTORS

Pick Up	Deliver	Vendor No.	Vendor
		1	M-Pact
		2	
		3	
		4	

No. 6111501ST- 20875

Ship to Martin Dining
Bulletin #7

Date 1-13-2016

Page ol pages

Tag NO TAX

Requested by Doug

Quantity	Description	Source Job	Source Stock	Source Buy	Vendor Number 1	2	3	4	Unit Cost	Total Cost
—	Add ceiling FANS									5,385.00
—	Add fixture trim color:									
—	Change Fixtures									
—	Add H4 fixtures (dimmed)									
									SUB TOTAL	5,385.00
									Previous Amount	$156,321
									New Amount	$161,706.00

Please invoice in duplicate. All shipments to be prepaid freight.

Conditions: Materials purchased are subject to our inspection and approval and if rejected will be held at vendor's risk and returnable at vendor's expense.

By

M-PACT CORPORATION

5005 Winton Road
Cincinnati, Ohio 45232
P (513) 679-2023 F (513) 679-2032

QUOTATION

Date: 7/22/15

Quoted To: ESI Inc.

Quoted By: Michael J. Griffie

Job Name: MIAMI U- MARTIN HALL

Type	Quantity	Vendor	Description	Unit or Lot#	Unit Price	Ext Price
C1	54	HUBBELL	K4 232 EPU ADVIOP 1PK CSWG4 MW KHC			
	108	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
C2	4	HUBBELL	XEM4 232 RA EPUADVIOP			
	8	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
C3	2	HUBBELL	LCL4 40ML EU CSHC			
CV1	1	PHIL9531	COLOR KINETIC ASSEMBLY			
D	0	HUBBELL	KL4 232 U EPU ADVIOP 1PK KLWG4 MW KHC			
	2	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
D2	12	WAC LIGH	PER PLANS AND SPECS.			
E	3	LUMINAIR	TSL94 50WHP 40K M7 120-277 CP WHT			
G	74	INTENSE	ICRLS6 700 409 W SF			
H	44	HUBBELL	LTRE22 40MLG RFA ESDU			

G-1 16 Bulletin #13

M-PACT CORPORATION

5005 Winton Road
Cincinnati, Ohio 45232
P (513) 679-2023 F (513) 679-2032

QUOTATION

Job Name: MIAMI U- MARTIN HALL

Type	Quantity	Vendor	Description	LOT #	Unit Price	Ext Price
H1	113	HUBBELL	LTRE22 40MLG RFA EDU	Changed to 2x4		
H2-2FT	3	PINNACLE	EW 1T5 2 GXG 120 1C W			
	3	Stock	GEL F14W/T5/841/ECO 46673 FLUORESCE			
			Per item quantity: 1			
H3-4FT	25	PINNACLE	EW 1T5 4 GXG 120 1C W			
	25	Stock	GEL F28W/T5/841/ECO 46706 FLUORESCE			
			Per item quantity: 1			
H3-5FT	0	PINNACLE	EW 1T5 5 GXG 120 1C W			
	1	Stock	GEL F28W/T5/841/ECO 46706 FLUORESCE			
			Per item quantity: 1			
L	20	PINNACLE	E4A 2T8 4 GXG 120 1C W RS			
	40	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
L2	24	PINNACLE	E4SA 2T8 6 GXG 120 1C W	Build <17 TOTAL (17)		
	24	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 1			
	24	Stock	GEL F17T8/SPX41/ECO 45749 FLUORESCE			
			Per item quantity: 1			
	48	Stock	GEL F25T8/SPX41/ECO 45757 FLUORESCE			
			Per item quantity: 2			
N2 change to OCL	3	DELUX CU	4772-24			
	3	Stock	GEL F28W/T5/841/ECO 46706 FLUORESCE			
			Per item quantity: 1			
N3	4	DELUX CU	4772-36			
	4	Stock	GEL F39W/T5/835/ECO 46745 FLUORESCE			
			Per item quantity: 1			
N4	4	DELUX CU	4772-48			
	4	Stock	GEL F54W/T5/841/ECO 46761 FLUORESCE			
			Per item quantity: 1			
N5	0	DELUX CU	4772-60			
	1	Stock	GEL F80W/T5/841/ECO 46804 FLUORESCE			
			Per item quantity: 1			
P	31	CORELITE	AP WP 3T8 1D UNV PP48 ER XX, DIMMING			
	93	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			

M-PACT CORPORATION

5005 Winton Road
Cincinnati, Ohio 45232
P (513) 679-2023 F (513) 679-2032

QUOTATION

Job Name: MIAMI U- MARTIN HALL

Type	Quantity	Vendor	Description	LOT #	Unit Price	Ext Price
			Per item quantity: 3			
P2	6		NO QUOTE- CAN NOT IDENTIFY FIXUTRE			
S1	5	DELRAY L	6704 W CW C2RD S			
UC2	6	H E WILL	PER PLANS AND SPECS.			
UC3	0	H E WILL	PER PLANS AND SPECS.			
UC4	0	H E WILL	PER PLANS AND SPECS.			
W2	6	MAXLITE	MLLWP40-LED50-DSMS4			
W3	6	LITHONIA	TWR1 LED 2 40K MVOLT DDB			
Z2	4	PINNACLE	E4A 40 2 GX 120 1C W			
Z3	1	PINNACLE	E4A 40 3 GX 120 1C W			
Z4	16	PINNACLE	E4A 40 4 GX 120 1C W			
Z6	2	PINNACLE	E4A 40 6 GX 120 1C W			
X1	11	HUBBELL	LECSRXWAM			
X2	5	HUBBELL	LECDRXWA			
X3	17	HUBBELL	EVEURW-UNIVERSAL MOUNT AC ONLY EXIT			
X4	6	HUBBELL	EVEURW-UNIVERSAL MOUNT AC ONLY. EXIT			
EM1	1	HUBBELL	PGF1P-WHITE NOT AVAILABLE. QUOTING PLATINUM SILVER			
CONTROLS	1		LOT OF CONTROLS PER PLANS AND SPECS.			
SPARE LAMPS	1		LOT OF SPARE LAMPS			
BALLAST	1		LOT OF SPARE BALLAST			

CHANGE ORDER # 2

4696 Devitt Drive · Cincinnati, Ohio 45246
Phone 513.454.3741

ELECTRICAL CONTRACTORS

Pick Up	Deliver	Vendor No.	Vendor
		1	FDL
		2	
		3	
		4	

BR

No. 6|1|1|5|0|4 - 20880

Ship to BRANDON HALL

Date 12-9-15

Page of pages

Tag NO TAX

Requested by

Quantity	Description	Source: Job	Source: Stock	Source: Buy	Vendor Number: 1	2	3	4	Unit Cost	Total Cost
Lot	Change in fixture manufacturer. as listed Delete X-1									3,013
					Sub TOTAL					3,013
					Previous Amount					164,951
					New Amount					$167,964
	Please Proceed.									

Please invoice in duplicate. All shipments to be prepaid freight.

Conditions: Materials purchased are subject to our inspection and approval and if rejected will be held at vendor's risk and returnable at vendor's expense.

By

Equal Opportunity Employer · Conforming with Title VII of the Civil Rights Act of 1964 and Executive Order 11246

F.D. LAWRENCE ELECTRIC CO.
ELECTRICAL DISTRIBUTION, AUTOMATION AND LIGHTING EQUIPMENT

Expiration Date: 07/04/15

Quotation

TO:
THE F.D. LAWRENCE ELECTRIC CO.
3450 BEEKMAN STREET
CINCINNATI, OH 45223

Project Info:
Project: MIAMI UNIV- BRANDON HALL
Job #: #BU-042815-5610
Bid Date: 06/04/15
Bid Time: 02:00 PM EDT
Quoter: STEVE RUSCHER

Type	Quantity	Vendor	Description	Unit or Lot#	Unit Price	Ext Price
B	89	SCOTT LA	MUDR 71JM WH MOD 2C LED 4000K			
C1	59	HUBBELL	K4 232 EPU ADVIOP 1PK CSWG4 MW KHC			
	118	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
C2	0	HUBBELL	XEM4 232 RA EPUADVIOP			
	2	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
C3	8	HUBBELL	LCL4 40ML EU CSHC			
C4	0	HUBBELL	ST814 232G FSA12125 EPUADVIOP FO841			
			W/-LAMPS INCLUDED			
C5	2	EUREKA L	PER PLANS & SPECS.			
	4	Stock	GEL F39BXSPX35RS10PK 15867 CFL OTHE			
			Per item quantity: 2			
D	0	HUBBELL	KL4 232 U EPU ADVIOP 1PK KLWG4 MW KHC			
	2	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			

From:
THE F.D. LAWRENCE ELECTRIC CO.
MAIN 513-542-1100
3450 BEEKMAN STREET
CINCINNATI, OH 45223
Printed By: THERESA HILL

Notes

Project: MIAMI UNIV- BRANDON HALL

Expiration 07/04/15

Type	Quantity	Vendor	Description	LOT #	Unit Price	Ext Price
D1	3	TARGETTI	PUL 172 1/26W/32W/CF GX24Q 3 120/277 OPAL			
	3	Stock	GEL F26TBX/841/A/ECO 97617 PLUG IN			
			Per item quantity: 1			
D2	2	HUBBELL	PRES LF6SQLEDG4 6SQLED5G435KDL B24			
E	2	LUMINAIR	TSL94 50WHP 40K M7 120-277 CP WHT			
G	128	INTENSE	ICRLS6 700 409 W SF			
G1	50	PHILIPS	LOL PER PLANS AND SPECS.			
G2	6	PHILIPS	LOL PER PLANS AND SPECS.			
H	81	HUBBELL	LTRE22 30MLG RFA ESDU			
H1	14	HUBBELL	LTRE22 30MLG RFA EDU			
H2	59	PINNACLE	E2R 1T5 4 GXG 120 1C W			
	59	Stock	GEL F28T5/841/WM/ECO 71644 FLUORESC			
			Per item quantity: 1			
H2-ALT	0	HUBBELL	LTRE22 30HLG RFA EDU			
H3	11	PINNACLE	EW 1T5 4 GXG 120 1C W			
	1	Stock	GEL F28W/T5/841/ECO 46706 FLUORESCE			
L	24	PINNACLE	E4A 2T8 4 GXG 120 1C W RS			
	48	Stock	GEL F28T8/XLSPX41ECO 72866 FLUORESC			
			Per item quantity: 2			
N2	7	DELUX CU	4772-24			
	7	Stock	GEL F28W/T5/841/ECO 46706 FLUORESCE			
			Per item quantity: 1			
N3	12	DELUX CU	4772-36			
	12	Stock	GEL F39W/T5/835/ECO 46745 FLUORESCE			
			Per item quantity: 1			
N4	9	DELUX CU	4772-48			
	9	Stock	GEL F54W/T5/841/ECO 46761 FLUORESCE			
			Per item quantity: 1			

Project: MIAMI UNIV- BRANDON HALL

Expiration **07/04/15**

Type	Quantity	Vendor	Description	LOT #	Unit Price	Ext Price
N5	0	DELUX CU	4772-60			
	1	Stock	GEL F80W/T5/841/ECO 46804 FLUORESCE Per item quantity: 1			
S	4	BRUCK LI	PER PLANS AND SPECS.			
S1	6	EUREKA L	3800 36 LED 40 40 120V DV RDP WHM WHM 3981C			
UC2	0	H E WILL	PER PLANS AND SPECS.			
UC3	0	H E WILL	PER PLANS AND SPECS.			
UC4	0	H E WILL	PER PLANS AND SPECS.			
W1	0	ARCHITEC	PROV T2 32LED 3K 450 BLK HSS WMA56			
W2	0	MAXLITE	MLLWP40-LED50-DSMS4			
X1	10	HUBBELL	LECSRXWAM			
X2	4	HUBBELL	LECDRXWA			
X3	23	HUBBELL	EVEURW-UNIVERSAL MOUNT AC ONLY EXIT			
X4	3	HUBBELL	EVEURW-UNIVERSAL MOUNT AC ONLY EXIT			
EM1	1	HUBBELL	PGF1P-WHITE NOT AVAILABLE. QUOTING PLATINUM SILVER			
CONTROLS	1		LOT OF CONTROLS PER PLANS AND SPECS.			
SPARE LAMPS	1		LOT OF SPARE LAMPS			
BALLAST	1		LOT OF SPARE BALLAST			

Project: MIAMI UNIV- BRANDON HALL

Expiration **07/04/15**

Type	Quantity	Vendor	Description	LOT #	Unit Price	Ext Price
LENS	1		LOT OF SPARE LENSES			

From:
THE F.D. LAWRENCE ELECTRIC CO.
MAIN 513-542-1100
3450 BEEKMAN STREET
CINCINNATI, OH 45223
Printed By: THERESA HILL

Total	169,520.00

Notes

CHANGE ORDER

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560008
Change Order: 00000003
Date: 07/23/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

THIS P/O HAS BEEN CHANGED

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**
DESTINATION			HANSE

ATTN: MARK GROTHAUS

THE FOLLOWING IS TO MEET OR EXCEED ALL REQUIREMENTS OF THE PLANS,SPECIFICATIONS,ADDENDA,SUBMITTALS AND ALL ASSOCIATED DOCUMENTS AS
ISSUED BY WHITING TURNER AND INCLUSIVE OF ALL SUPPLEMENTAL DOCUMENTS ISSUED BY CR ARCHITECTURE AND DESIGN AND BRUNER CORPORATION
PROJECT NUMBER 3556.

PLEASE PACK SEP AND MARK THE FOLLOWING:
ALL COMMENTS & NOTES MUST APPEAR ON THE PACKING SLIP.

MCFARLAND HALL

QUANTITY	ITEM	DESCRIPTION	UOM	UNIT COST	AMOUNT
0.000		HX-1		0.00000	0.00
	****CHANGED****				
1.000		B&G Model - P20 DW		5,940.00000	5,940.00
	****CHANGED****				
		Plate Heat Exchanger Consisting of 0mm frame with 2 x 0.4 mm AISI316 TM heat transfer plates and NITRILE HT gaskets, STL header plates, SS carry bar, SS guide bar, OSHA approved ALUMINUM splash guard," 2" 316SS male npt (Hot side). " 2" 316SS male npt (Cold side). ASME construction with U1 stamp for 150 design pressure			
0.000		HWP-3		0.00000	0.00
	****CHANGED****				
1.000		B&G In-Line Pump Series 80		2,121.00000	2,121.00
	****CHANGED****				
		Model 2-1/2 x 2-1/2 x 91/2 B, BF, 7.5 HP, 1800 RPM, with 8.75" Impeller, Standard Seal, BG Choice, ODP, Energy Efficient, 208230/460/3/60 Motor, 186 GPM, 60 FT TDH			
0.000				0.00000	0.00
	****CHANGED****				
1.000		HWP-3 TDV		794.00000	794.00
	****CHANGED****				
		3DS-4B BALANCED Type Triple Duty Valve Straight Pattern 4 IN.			
0.000		HEATING WATER AIR SEPE[ARATOR		0.00000	0.00

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

CHANGE ORDER

Purchase Order: 35560008
Change Order: 00000003
Date: 07/23/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

QUANTITY	ITEM	DESCRIPTION	UOM	UNIT COST	AMOUNT
	CHANGED				
1.000		RF-5 5" W/STRAINER		1,174.00000	1,174.00
	CHANGED				
1.000	107A	HIGH CAPCITY AIR VENT 3/4 113076		236.00000	236.00
	CHANGED				
1.000		791F-AH-4 DUPLEX BASKET STRAIN		3,860.00000	3,860.00
	ADDED				

Sub Total:	$14,125.00
Sales Tax:	$289.50
Freight:	$0.00
P/O Total:	$14,414.50

Original Purchase Order:	$6,323.00
Total Change Orders to Date:	$8,091.50
Original + Change Orders:	$14,414.50

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

Purchase Order

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560027
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**

QUANTITY	DESCRIPTION	UOM	UNIT COST	AMOUNT
1.000	B&G P47DW HEAT EXCHANGER HX-1		8,146.00000	8,146.00
1.000	MUELLER 791-AH-4 DUPLEX STR HX-1		3,860.00000	3,860.00
2.000	B&G E1510-4EB 25HP P-1 & P-2		3,211.00000	6,422.00
2.000	B&G E-1510-3BD 15HP P-3 & P-4		2,352.00000	4,704.00
2.000	B&G ECOCIRCXL 65-130 P-5 & P-6		2,100.00000	4,200.00
2.000	B&G 3DS-6B TRIPLE DUTY VALVES P-1 & P-2		1,283.00000	2,566.00
2.000	B&G 3DS-5B TRIPLE DUTY VALVES P-3 & P-4		941.00000	1,882.00
2.000	B&G GF-3X SUCTION DIFFUSERS P-1 & P-2		580.00000	1,160.00
2.000	B&G FE-3X SUCTION DIFFUSERS P-3 & P-4		454.00000	908.00
4.000	METRAFLEX MMCC-6 FLEX CONN P-1 & P-2		128.00000	512.00
4.000	METRAFLEX MMCC-5 FELX CONN P-3 & P-4		108.00000	432.00
1.000	B&G R-6F AIR SEPARATOR HEATING WATER		1,406.00000	1,406.00
1.000	B&G R-5F AIR SEPARATOR CHILLED WATER		1,174.00000	1,174.00
2.000	B&G 107A AIR VENT AIR SEPARATORS		236.00000	472.00
1.000	B&G B300 EXPANSION TANK CHILLED WATER		1,371.00000	1,371.00
1.000	B&G TPV1FM TANK PURGE VALVE EXP TANK		33.00000	33.00
1.000	B&G 87 AIR VENT EXP TANK		52.00000	52.00
2.000	B&G 790-125 RELIEF VALVE		72.00000	144.00
2.000	B&G CB-5F CIRCUIT SETTER		913.00000	1,826.00
2.000	JL WINGERT 5 GAL BAG FILTER		700.00000	1,400.00
2.000	ABB ACH550 25HP VFDS P-1 & P-2		6,144.00000	12,288.00
2.000	ABB ACH550 15HP VFDS P-3 & P-4		4,638.00000	9,276.00
			Sub Total:	$64,234.00
			Sales Tax:	$4,817.62
			Freight:	$0.00
			P/O Total:	$69,051.62

BRUNER

www.brunercorp.com

3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order

Purchase Order: 35560027
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

Purchase Order

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560028
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**

QUANTITY	DESCRIPTION	UOM	UNIT COST	AMOUNT
1.000	B&G P47DW HEAT EXCHANGER HX-1		8,146.00000	8,146.00
1.000	MUELLER 791-AH-4 DUPLEX STR HX-1		3,860.00000	3,860.00
2.000	B&G E-1510-4EB, 25HP P-1 & P-2		3,211.00000	6,422.00
2.000	B&G E-1510-4BD, 15HP P-3 &P-4		2,420.00000	4,840.00
2.000	B&G ECOCIRCXL 65-130 P-5 & P-6		2,100.00000	4,200.00
1.000	B&G ECOCIRCXL 55-45 p-7		1,670.00000	1,670.00
4.000	B&G 3DS-6B TRIPLE DUTY VALVES P-1 THRU P-4		1,283.00000	5,132.00
4.000	B&G GF-3X SUCTION DIFFUSERS P-1 THRU P-4		580.00000	2,320.00
8.000	METRAFLEX MMCC-6 FLEX CONN P-1 THRU P-4		128.00000	1,024.00
2.000	B&G R-6F AIR SEPARATOR HEATING WATER		1,406.00000	2,812.00
2.000	B&G 107A AIR VENT AIR SEPARATORS		236.00000	472.00
1.000	B&G B300 EXPANSION TANK CHILLED WATER		1,371.00000	1,371.00
1.000	B&G TPV1FM TANK PURGE VALVE EXP TANK		33.00000	33.00
1.000	B&G 87 AIR VENT EXP TANK		52.00000	52.00
2.000	B&G 790-125 RELIEF VALVE		72.00000	144.00
2.000	B&G CB-6F CIRCUIT SETTER		1,232.00000	2,464.00
2.000	JL WINGERT 5 GAL BAG FILTER		700.00000	1,400.00
2.000	ABB ACH550 25HP VFDS P-1 & P-2		6,144.00000	12,288.00
2.000	ABB ACH550 15HP VFDS P-3 & P-4		4,638.00000	9,276.00
			Sub Total:	$67,926.00
			Sales Tax:	$5,094.48
			Freight:	$0.00
			P/O Total:	$73,020.48

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

Purchase Order

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560030
Change Order: 00000001
Date: 08/19/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**

QUANTITY	DESCRIPTION	UOM	UNIT COST	AMOUNT
1.000	B&G P14DW HEAT EXCHANGER HX-1		6,015.00000	6,015.00
1.000	MUELLER 791-AH-4 DUPLEX STR HX-1		3,860.00000	3,860.00
2.000	B&G E-1510-3BD 15HP P-1 & P-2		2,352.00000	4,704.00
2.000	B&G E-1510-2.5BB 7.5HP P-3 & P-4		1,743.00000	3,486.00
1.000	B&G ECOCIRCXL 65-130 P-5		2,100.00000	2,100.00
2.000	B&G ECOCIRCXL 20-140 P-6 & P-7		1,875.00000	3,750.00
2.000	B&G 3DS-5B TRIPLE DUTY VALVES P-1 & P-2		941.00000	1,882.00
2.000	B&G 3DS-4B TRIPLE DUTY VALVES P-3 & P-4		794.00000	1,588.00
2.000	B&G FE-3X SUCTION DIFFUSERS P-1 & P-2		454.00000	908.00
2.000	B&G ED-3X SUCTION DIFFUSERS P-3 & P-4		350.00000	700.00
4.000	METRAFLEX MMCC-5 FLEX CONN P-1 & P-2		108.00000	432.00
4.000	METRAFLEX MMCC-4 FLEX CONN P-3 & P-4		69.00000	276.00
1.000	B&G R-5F AIR SEPARATOR HEATING WATER		1,174.00000	1,174.00
1.000	B&G R-4F AIR SEPARATOR CHILLED WATER		917.00000	917.00
2.000	B&G 107A AIR VENT AIR SEPARATORS		236.00000	472.00
1.000	B&G B300 EXPANSION TANK CHILLED WATER		1,371.00000	1,371.00
1.000	B&G TPV1FM TANK PURGE VALVE EXP TANK		33.00000	33.00
1.000	B&G 87 AIR VENT EXP TANK		52.00000	52.00
2.000	B&G 790-125 RELIEF VALVE		72.00000	144.00
2.000	B&G CB-4 CIRCUIT SETTER		514.00000	1,028.00
2.000	JL WINGERT 5 GAL BAG FILTER		700.00000	1,400.00
2.000	ABB ACH550 15HP VFDS P-1 & P-2		4,638.00000	9,276.00
2.000	ABB ACH550 7.5HP VFDS P-3 & P-4		3,870.00000	7,740.00

Sub Total:	$53,308.00
Sales Tax:	$0.00
Freight:	$0.00
P/O Total:	$53,308.00

Original Purchase Order:	$53,308.00
Total Change Orders to Date:	$0.00
Original + Change Orders:	$53,308.00

BRUNER

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3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order

Purchase Order: 35560030
Change Order: 00000001
Date: 08/19/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

Purchase Order

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560029
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**

QUANTITY	DESCRIPTION	UOM	UNIT COST	AMOUNT
1.000	B&G P47DW HEAT EXCHANGER HX-1		8,146.00000	8,146.00
1.000	MUELLER 791-AH-4IN DUPLEX STR HX-1		3,860.00000	3,860.00
2.000	B&G E-1510-4BD, 20HP P-1 & P-2		2,727.00000	5,454.00
2.000	B&G E-1510-3BD, 10HP P-3 & P-4		1,974.00000	3,948.00
2.000	B&G ECOCIRCXL 65-130 P-5 & P-6		2,100.00000	4,200.00
2.000	B&G 3DS-6B TRIPLE DUTY VALVES P-1 & P-2		1,283.00000	2,566.00
2.000	B&G 3DS-5B TRIPLE DUTY VALVES P-3 & P-4		941.00000	1,882.00
2.000	B&G GF-3X SUCTION DIFFUSERS P-1 & P-2		580.00000	1,160.00
2.000	B&G FE-3X SUCTION DIFFUSERS P-1 & P-4		454.00000	908.00
4.000	METRAFLEZ MMCC-6 FLEX CONN P-1 & P-2		128.00000	512.00
4.000	METRAFLEX MMCC-5 FLEX CONN P-3 & P-4		108.00000	432.00
1.000	B&G R-6F AIR SEPARATOR HEATING WATER		1,406.00000	1,406.00
1.000	B&G R-5F AIR SEPARATOR CHILLED WATER		1,174.00000	1,174.00
2.000	B&G 107A AIR VENT AIR SEPARATORS		236.00000	472.00
1.000	B&G B300 EXPANSION TANK CHILLED WATER		1,371.00000	1,371.00
1.000	B&G TPV1FM TANK PURGE VALVE EXP TANK		33.00000	33.00
1.000	B&G 87 AIR VENT EXP TANK		52.00000	52.00
2.000	B&G 790-125 RELIEF VALVE		72.00000	144.00
1.000	B&G CB-6F CIRCUIT SETTER		1,232.00000	1,232.00
1.000	B&G CB-5F CIRCUIT SETTER		913.00000	913.00
2.000	JL WINGERT 5 GAL BAG FILTER		700.00000	1,400.00
2.000	ABB ACH550 20HP VFD'S P-1 & P-2		5,160.00000	10,320.00
2.000	ABB ACH550 10HP VFD'S P-3 & P-4		4,062.00000	8,124.00

Sub Total:	$59,709.00
Sales Tax:	$4,478.24
Freight:	$0.00
P/O Total:	$64,187.24

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Purchase Order

Purchase Order: 35560029
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

Purchase Order

BRUNER
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3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560026
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**

QUANTITY	DESCRIPTION	UOM	UNIT COST	AMOUNT
1.000	B&G P20DW HEAT EXCHANGER HX-1		4,600.00000	4,600.00
1.000	MUELLER 791-AH-4 DUPLEX STR HX-1		3,860.00000	3,860.00
2.000	B&G E-1510-3BD 15HP P-1 & P-2		2,352.00000	4,704.00
2.000	B&G E-1510-2.5BB 7.5HP P-3 & P-4		1,743.00000	3,486.00
1.000	B&G ECOCIRCZL 65-130 P-5		2,100.00000	2,100.00
1.000	B&G ECOCIRCXL 55-45 P-6		1,670.00000	1,670.00
2.000	B&G 3DS-5B TRIPLE DUTY VALVES P-1 & P-2		941.00000	1,882.00
2.000	B&G 3DS-4B TRIPLE DUTY VALVES P-3 & P-4		794.00000	1,588.00
2.000	B&G FE-3X SUCTION DIFFUSERS P-1 & P-2		454.00000	908.00
2.000	B&G ED-3X SUCTION DIFFUSERS P-3 & P-4		350.00000	700.00
4.000	METRAFLEX MMCC-5 FLEX CONN P-1 & P-2		108.00000	432.00
4.000	METRAFLEX MMCC-4 FLEX CONN P-3 & P-4		69.00000	276.00
1.000	B&G R-5F AIR SEPARATOR HEATING WATER		1,174.00000	1,174.00
1.000	B&G R-4F AIR SEPARATOR CHILLED WATER		917.00000	917.00
2.000	B&G 107A AIR VENT AIR SEPARATORS		236.00000	472.00
1.000	B&G B300 EXPANSION TANK CHILLED WATER		1,371.00000	1,371.00
1.000	B&G TPV1FM TANK PURGE VALVE EXP TANK		33.00000	33.00
1.000	B&G 87 AIR VENT EXP TANK		52.00000	52.00
2.000	B&G 790-125 RELIEF VALVE		72.00000	144.00
2.000	B&G CB-4 CIRCUIT SETTER		514.00000	1,028.00
2.000	JL WINGERT 5 GAL BAG FILTER		700.00000	1,400.00
2.000	ABB ACH550 15HP VFDS P-1 & P-2		4,638.00000	9,276.00
2.000	ABB ACH550 7.5HP VFDS P-3 & P-4		3,870.00000	7,740.00

Sub Total:	$49,813.00
Sales Tax:	$3,736.02
Freight:	$0.00
P/O Total:	$53,549.02

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Purchase Order

Purchase Order: 35560026
Date: 08/03/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER

CHANGE ORDER

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

Purchase Order: 35560008
Change Order: 00000003
Date: 07/23/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

TO STEFFENS-SHULTZ INC
P.O. BOX 28430
COLUMBUS, OH 43228

SHIP TO BRUNER CORPORATION
3637 LACON ROAD
HILLIARD, OH 43026

THIS P/O HAS BEEN CHANGED

SHIP VIA	TERMS	DATE REQUIRED	FREIGHT TERMS
BESTWAY	NET 30		FREIGHT PREPAID
F.O.B	**INSTRUCTIONS**		**GIVEN TO**
DESTINATION			HANSE

ATTN: MARK GROTHAUS

THE FOLLOWING IS TO MEET OR EXCEED ALL REQUIREMENTS OF THE PLANS,SPECIFICATIONS,ADDENDA,SUBMITTALS AND ALL ASSOCIATED DOCUMENTS AS
ISSUED BY WHITING TURNER AND INCLUSIVE OF ALL SUPPLEMENTAL DOCUMENTS ISSUED BY CR ARCHITECTURE AND DESIGN AND BRUNER CORPORATION
PROJECT NUMBER 3556.

PLEASE PACK SEP AND MARK THE FOLLOWING:
ALL COMMENTS & NOTES MUST APPEAR ON THE PACKING SLIP.

MCFARLAND HALL

QUANTITY	ITEM	DESCRIPTION	UOM	UNIT COST	AMOUNT
0.000		HX-1		0.00000	0.00
	****CHANGED****				
1.000		B&G Model - P20 DW		5,940.00000	5,940.00
	****CHANGED****				
		Plate Heat Exchanger Consisting of 0mm frame with 2 x 0.4 mm AISI316 TM heat transfer plates and NITRILE HT gaskets, STL header plates, SS carry bar, SS guide bar, OSHA approved ALUMINUM splash guard," 2" 316SS male npt (Hot side). " 2" 316SS male npt (Cold side). ASME construction with U1 stamp for 150 design pressure			
0.000		HWP-3		0.00000	0.00
	****CHANGED****				
1.000		B&G In-Line Pump Series 80		2,121.00000	2,121.00
	****CHANGED****				
		Model 2-1/2 x 2-1/2 x 91/2 B, BF, 7.5 HP, 1800 RPM, with 8.75" Impeller, Standard Seal, BG Choice, ODP, Energy Efficient, 208230/460/3/60 Motor, 186 GPM, 60 FT TDH			
0.000				0.00000	0.00
	****CHANGED****				
1.000		HWP-3 TDV		794.00000	794.00
	****CHANGED****				
		3DS-4B BALANCED Type Triple Duty Valve Straight Pattern 4 IN.			
0.000		HEATING WATER AIR SEPE[ARATOR		0.00000	0.00

BRUNER
www.brunercorp.com
3637 Lacon Road • Hilliard, Ohio • 614-334-9000 • 614-334-9001 (fax)

CHANGE ORDER

Purchase Order: 35560008
Change Order: 00000003
Date: 07/23/2015
Vendor Code: STEFF
Job: 3556
MIAMI U NORTH QUAD

QUANTITY	ITEM	DESCRIPTION	UOM	UNIT COST	AMOUNT
	CHANGED				
1.000		RF-5 5" W/STRAINER		1,174.00000	1,174.00
	CHANGED				
1.000	107A	HIGH CAPCITY AIR VENT 3/4 113076		236.00000	236.00
	CHANGED				
1.000		791F-AH-4 DUPLEX BASKET STRAIN		3,860.00000	3,860.00
	ADDED				

Sub Total:	$14,125.00
Sales Tax:	$289.50
Freight:	$0.00
P/O Total:	$14,414.50

Original Purchase Order:	$6,323.00
Total Change Orders to Date:	$8,091.50
Original + Change Orders:	$14,414.50

BRUNER CORPORATION

By _____
ROCKY CARR
PURCHASING MANAGER