

**Division 15000
Mechanical**

**New England Air Systems
43 Krupp Drive
PO Box 525
Williston, VT 05495**

Randy Chicoine

Tel: 802-264-1239 Fax: 802-864-3904

Information Includes:

**See Table of Contents on the following page
for a full list of items included**



Submittal Reply Form

Client: University of Vermont

Date: February 11, 2008

Project name: Delehanty Cosmogenic Nuclide Lab

Location: Burlington, VT

IDC project number: 364972

To: ReArch Company

From: Elsa Yost/CH2M Hill

Attention: Bert DeLaBruere

Reference Specification Section 15440

With reference to your Submittal No. 001-000

Submittals are dated Feb. 7, 2008, we are taking the following action.

Description	No Exceptions Noted	Make Corrections Noted	Revise and Resubmit	Submit Specified Item
1. Plumbing Fixtures and Eyewash/showers		XXXX		
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Remarks:

See attached sheet(s) for additional comments.

cc: File

By:

Elsa Yost

RECEIVED

FEB 07 2008

CH2M HILL PGH

Submittal Transmittal:
Cover Sheet



UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont

Project #07210

Date: 2/7/08

Transmitted To Transmitted By

Michael Warren
IDC Architects

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext. 2
Fax: 802-863-8734

Package Transmitted For Delivered Via

Review/ Approval

Email

Submittal Information

Specification Section	15440
Intended Use	Plumbing Fixtures and Eyewash/ Showers
Purchase Order #	
Owner's tag or identification number	
Date	2/6/08

Date	Qty	Description
2/6/08	1	Plumbing Fixtures and Eyewash/ Showers

CC: Company Contact Name Copies Notes

University of Vermont	Myron Wheeler	1	
IDC Architects	Elsa Yost	1	
University of Vermont	Michael Stevens	1	

Remarks

RECEIVED

FEB 07 2008

CH2M HILL PGH



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 09

DATE: 2/6/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

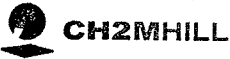
SUPPLIER: Blodgett Supply

MANUFACTURER: Varies

PRODUCT DESCRIPTION: Plumbing Fixtures and Eyewash/Showers

MODEL NUMBER: _____

SECTION NUMBER AND TITLE: 15440

<input type="checkbox"/> NO EXCEPTIONS NOTED <input checked="" type="checkbox"/> MAKE CORRECTIONS NOTED <input type="checkbox"/> REVISE AND RESUBMIT <input type="checkbox"/> SUBMIT ITEMS AS NOTED Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any Action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the jobsite, fabrication processes and techniques of construction, coordination of the work with that of all other trades and the satisfactory performance of the work. By: <u>[Signature]</u> Dated: <u>02/11/08</u> 

PRODUCT DEVIATIONS: Eyewash/shower

REVISION/RESUBMITTAL IDENTIFICATION: ReArch Company

At the request of Dr Bierman we changed the eyewash/showers

[Signature] 2/6/08
 CONTRACTOR

Submittal and Shop Drawings

Received 2/6/08

Reviewed

[Signature]
 Signature, Title

2/6/08
 Date

\\DEXTER\shared\shj\jobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 09 fixtures -eyewash.doc

American Standard



BARRIER FREE

LV-1

**LUCERNE™
WALL-HUNG LAVATORY**

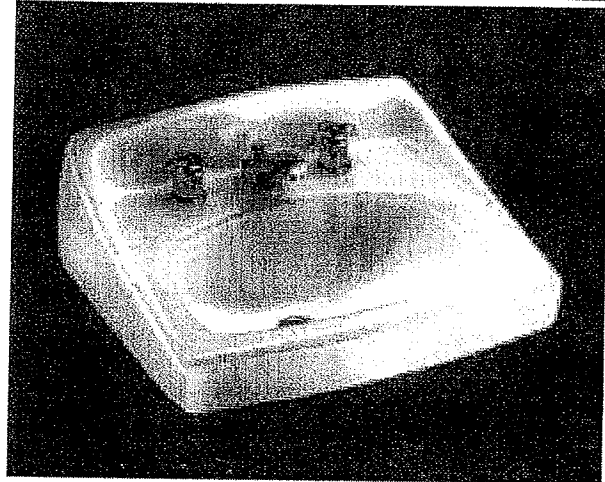
VITREOUS CHINA

LUCERNE™ WALL-HUNG LAVATORY

- Vitreous china
- Front overflow
- D-shaped bowl
- Self-draining deck area with contoured back and side splash shields
- Faucet ledge

Faucet holes on 203mm (8") centers (illus.):

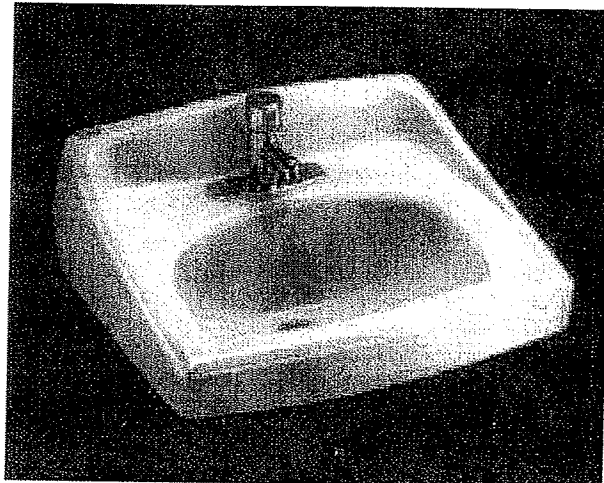
- 0356.028** For exposed bracket support
Shown with 4801.862 Amarillis Heritage faucet with Triune Cross handles (not included)
- 0356.015** For wall hanger (included) or concealed arms support
- 0356.037** For wall hanger (included) or concealed arms support
 - Extra right-hand hole
- 0356.073** For wall hanger (included) or concealed arms support
 - Extra left-hand hole



0356.028

Faucet holes on 102mm (4") centers:

- 0355.027** For exposed bracket support
- 0355.012** For wall hanger (included) or concealed arms support
- 0355.034** For wall hanger (included) or concealed arms support
 - Extra right-hand hole
- 0355.056** For wall hanger (included) or concealed arms support
 - Extra left-hand hole



0356.041

Single center faucet hole (illus.):

- 0356.041** for exposed bracket support
Shown with 1340.000 metering faucet (not included)
- 0356.421** for wall hanger (included) or concealed arms support
- 0356.137** For wall hanger (included) or concealed arms support
 - Extra right-hand hole
- 0356.115** For wall hanger (included) or concealed arms support
 - Extra left-hand hole

Nominal Dimensions:
521 x 464mm (20-1/2" x 18-1/4")

Bowl sizes:
381mm (15") wide, 254mm (10") front to back,
165mm (6-1/2") deep

Compliance Certifications -

Meets or Exceeds the Following Specifications:

- ASME A112.19.2 for Vitreous China Fixtures



Top of front rim mounted 864mm (34") from finished floor.
MEETS THE AMERICAN DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USEABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.

To Be Specified

- Color: White Bone Silver Black
 - Shell
- Faucet*: Faucet Finish:
- Supplies: 1-1/4" Trap:
- Nipple:
- Bracket Support (by others):
- Concealed Arms Support (by others):

* See faucet section for additional models available

NOTE: Roughing-in information shown on reverse side of page

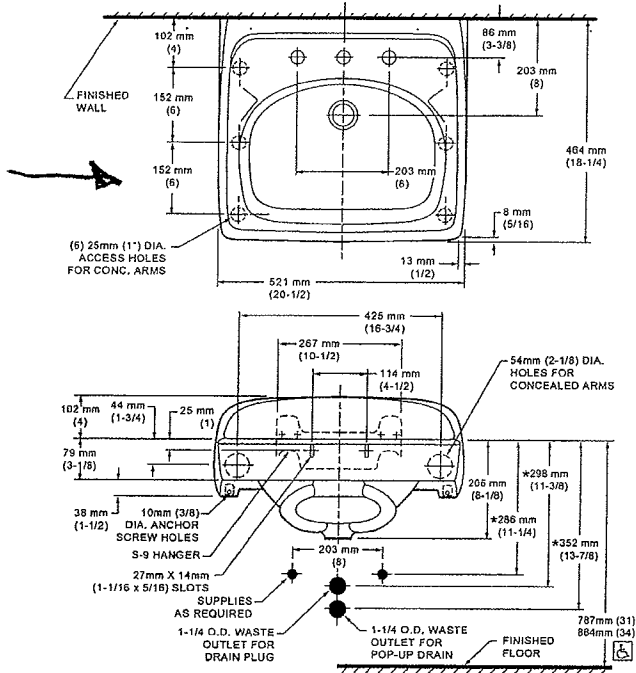
American Standard

 **BARRIER FREE**

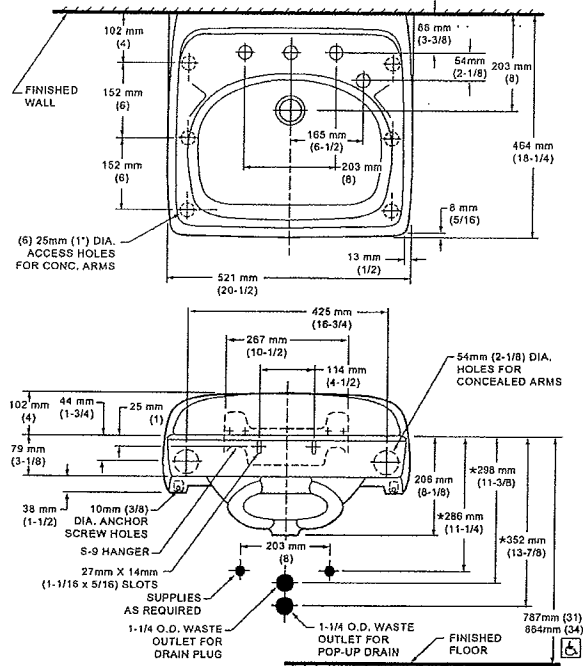
**LUCERNE™
WALL-HUNG LAVATORY**

VITREOUS CHINA

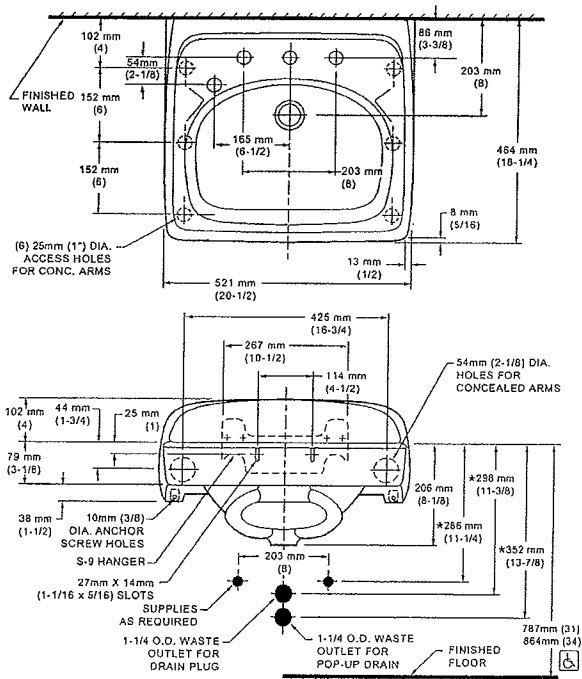
0356.015 8" CTRS FOR WALL HANGER OR CONCEALED ARMS



0356.037 8" CTRS FOR WALL HANGER OR CONCEALED ARMS
EXTRA RIGHT HAND HOLE




0356.073 8" CTRS FOR WALL HANGER OR CONCEALED ARMS
EXTRA LEFT HAND HOLE



NOTES:

* DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND "P" TRAP ARE SUGGESTED.

 LAVATORY DESIGNED TO MEET ADA HANDICAPPED GUIDELINES WITH MOUNTING HEIGHT SET AT 864MM (34") ABOVE FINISHED FLOOR. PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS. FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY. CONCEALED ARM SUPPORT AS REQUIRED TO BE FURNISHED BY OTHERS. IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

LV-1



T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690



REG. #A2601
ISO #9001

Model No.

B-2850

Item No.

Travelers Rest, SC: 800-476-4103 Simi Valley, CA: 800-423-0150 Fax: 864-834-3518 www.tsbrass.com

This Space for Architect/Engineer Approval

Job Name _____ Date _____

Model Specified _____ Quantity _____

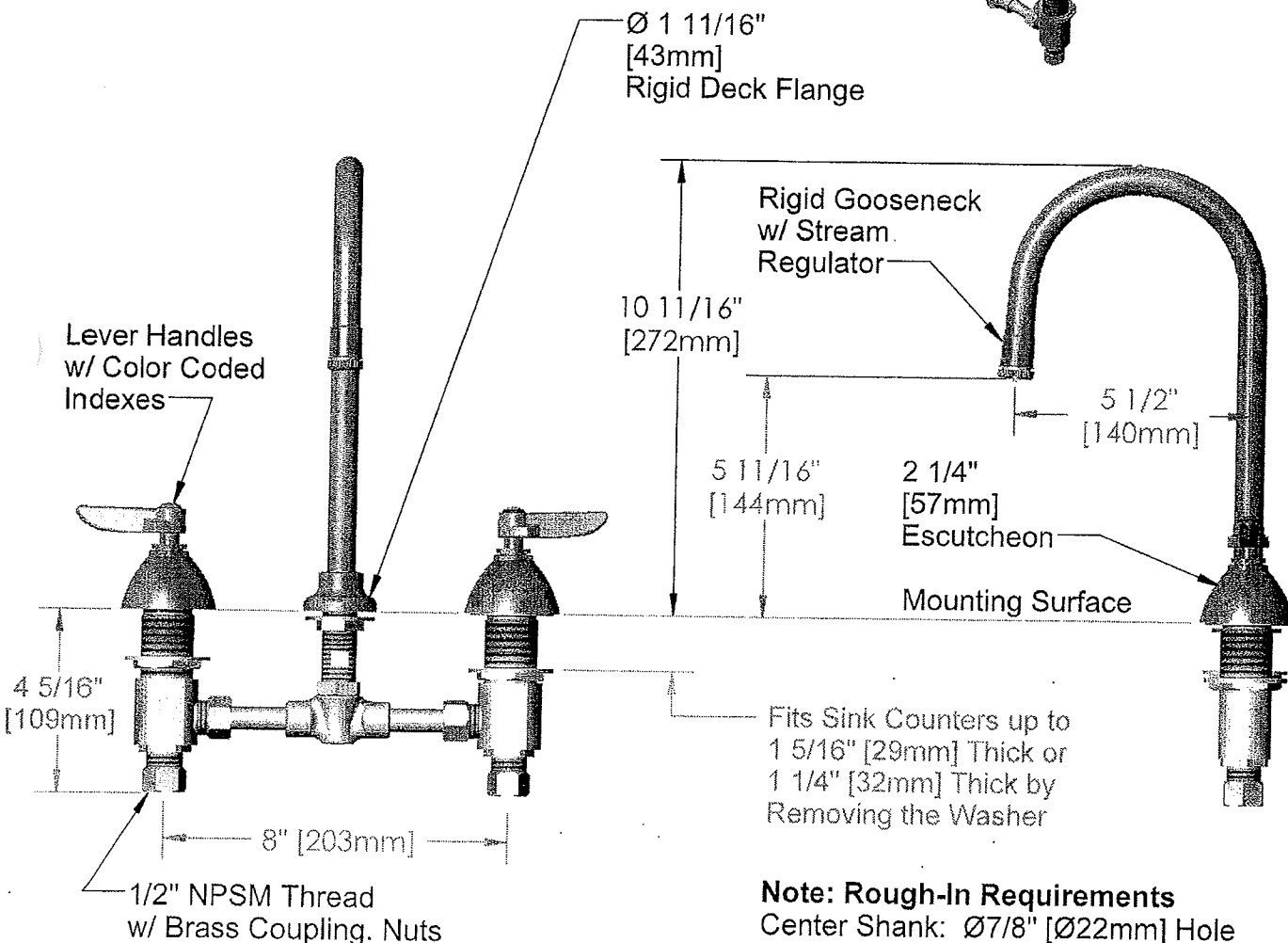
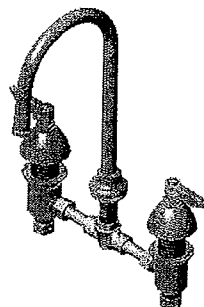
Customer/Wholesaler _____

Contractor _____

Architect/Engineer _____



ADA Compliant



Note: Rough-In Requirements
Center Shank: Ø7/8" [Ø22mm] Hole
Hot/Cold Bodies: Ø1 1/2" [Ø38mm] Hole
(Ø1 1/4" [Ø32mm] Minimum)

Product Specifications:

1/2" Deck Mount Widespread Faucet
w/ Eterna Cartridges, Lever Handles, Rigid
Gooseneck w/ Stream Regulator

Drawn	Checked	Approved
DHL	MAV	JHB

Scale:	Date:
1:4	4/20/07



T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690



REG. #A2601
ISO #9001

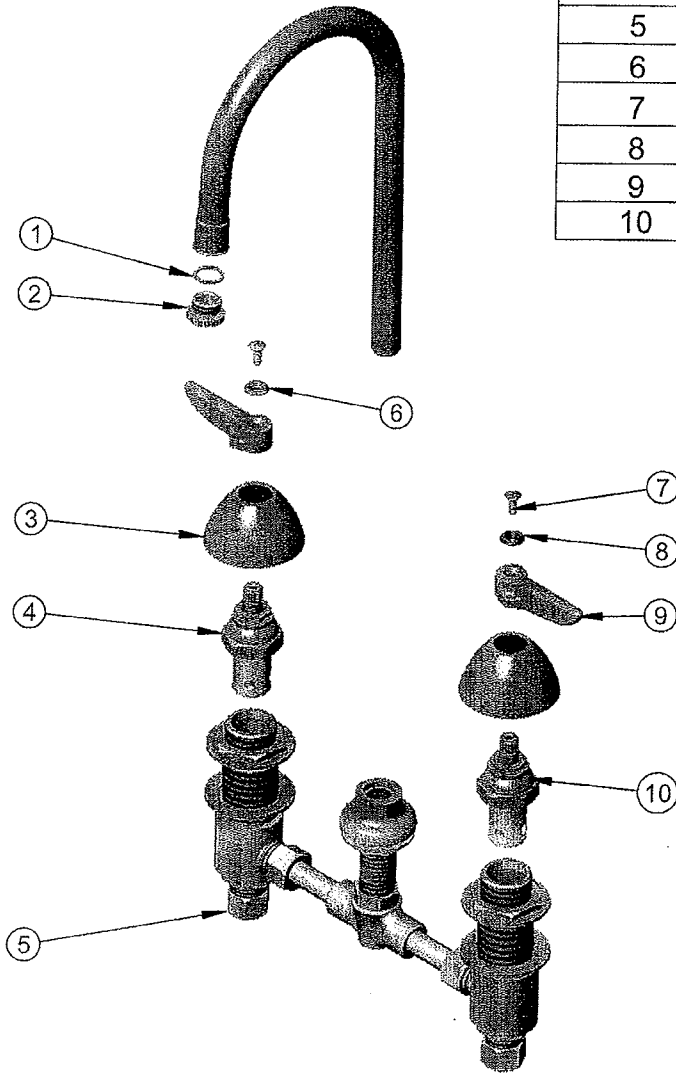
Model No.

B-2850

Item No.

Travelers Rest, SC: 800-476-4103 Simi Valley, CA: 800-423-0150 Fax: 864-834-3518 www.tsbrass.com

ITEM NO.	SALES NO.	DESCRIPTION
1	009636-45	Washer
2	B-LT	Stream Regulator
3	001257-40	Bell Escutcheon
4	006478-40	Cartridge Asm, Hot
5	000958-20	Coupling Nut
6	001661-45	Red Index-HW
7	000922-45	Lever Handle Screw
8	001660-45	Blue Index-CW
9	001638-45	Lever Handle
10	006477-40	Cartridge Asm, Cold



Product Specifications:

8" Deck Mount Widespread Faucet
w/ Cerma Cartridges, Lever Handles, Rigid
Gooseneck w/ Stream Regulator

Drawn DHL	Checked MAV	Approved JHB
Scale: 1:4	Date: 4/20/07	



T&S BRASS AND BRONZE WORKS, INC.
 2 SADDLEBACK COVE / P.O. BOX 1088 / TRAVELERS REST, SC 29690
 PHONE 800-476-4103 FAX 864- 834-3518



Model No.

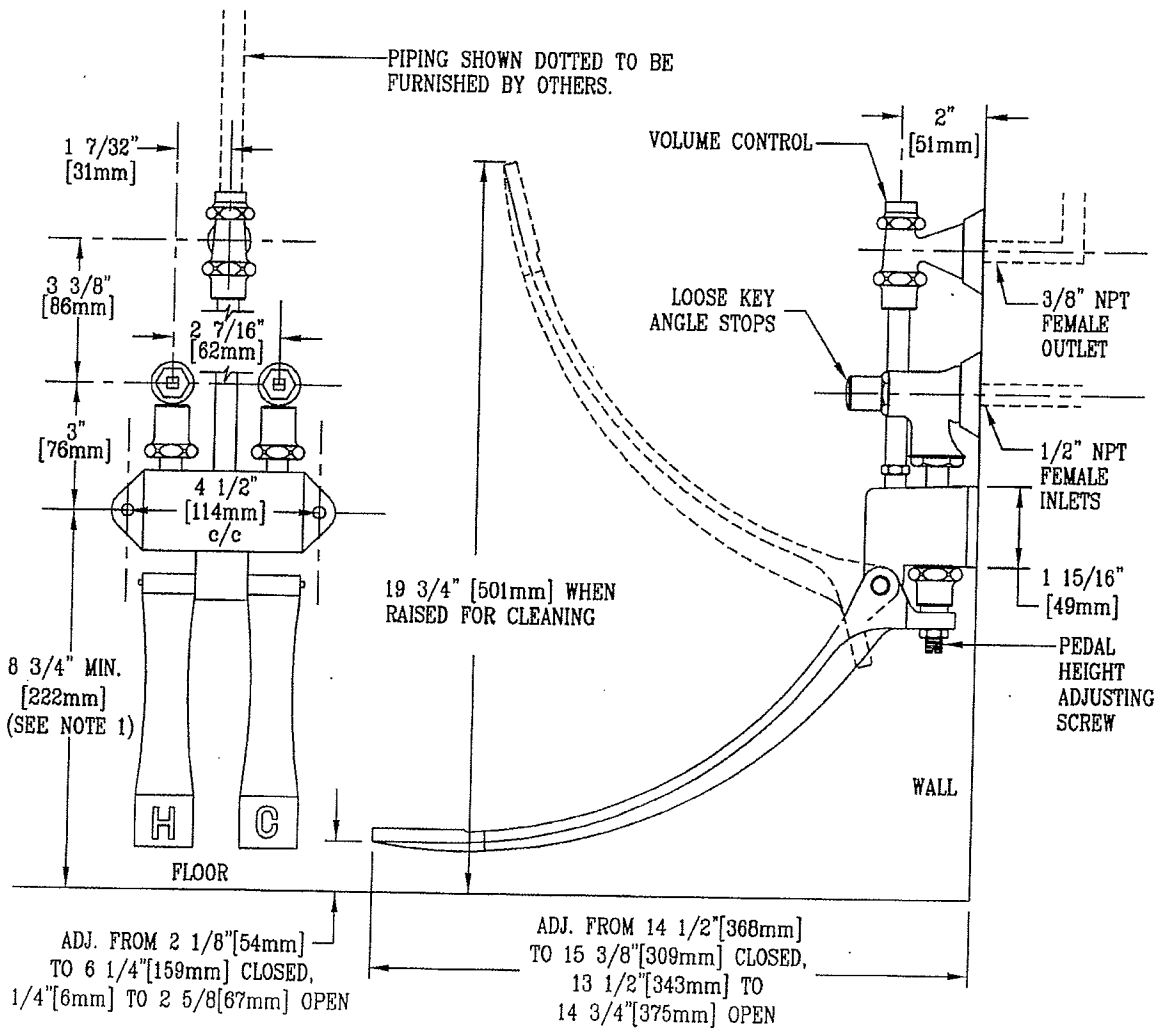
B-0504-01

Item No.:

Job Name:

Architect/Engineer Approval:

Notes:



NOTE 1. ALL PEDAL POSITION DIMENSIONS ARE BASED ON A RECOMMENDED MIN. MTG. HEIGHT OF 8 3/4" [222mm] ABOVE FIN. FLOOR

NOTE 2. FURNISHED WITH (2) WOOD MOUNTING SCREWS

Product Description:

DOUBLE PEDAL VALVE WITH LOOSE KEY ANGLE STOPS & ANGLE VOLUME CONTROL

Drawn:

TME

Checked

MVW

Scale:

1:4

Approved

MVW

Date:

10/13/98

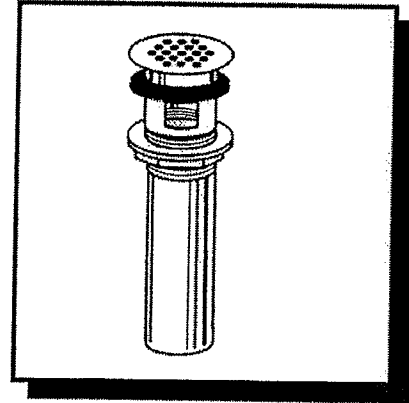
LV-1

db Dearborn®
Brass

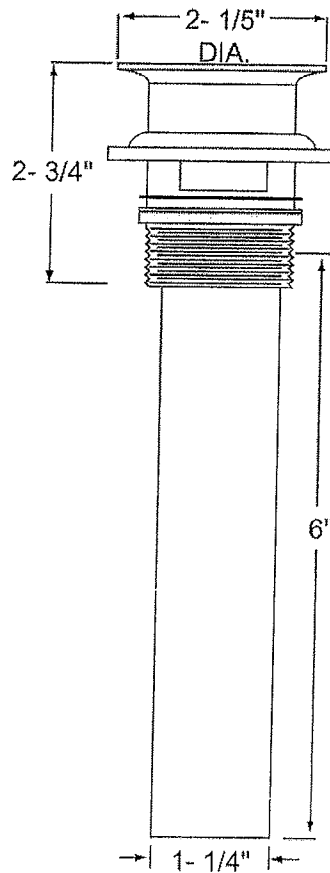
Specifications

DESCRIPTION

- Cast Grid P.O. Plug with 1-1/4" x 6" 17 gauge Tailpiece, Chrome finished
- Includes: (1) Cast Grid, (1) P.O. Plug with nuts and washers, (1) 17 gauge Tailpiece
- Designed for installation in most commercial applications



**CAST GRID P.O. PLUG
760-1**



LV-1

Lavatory Carriers

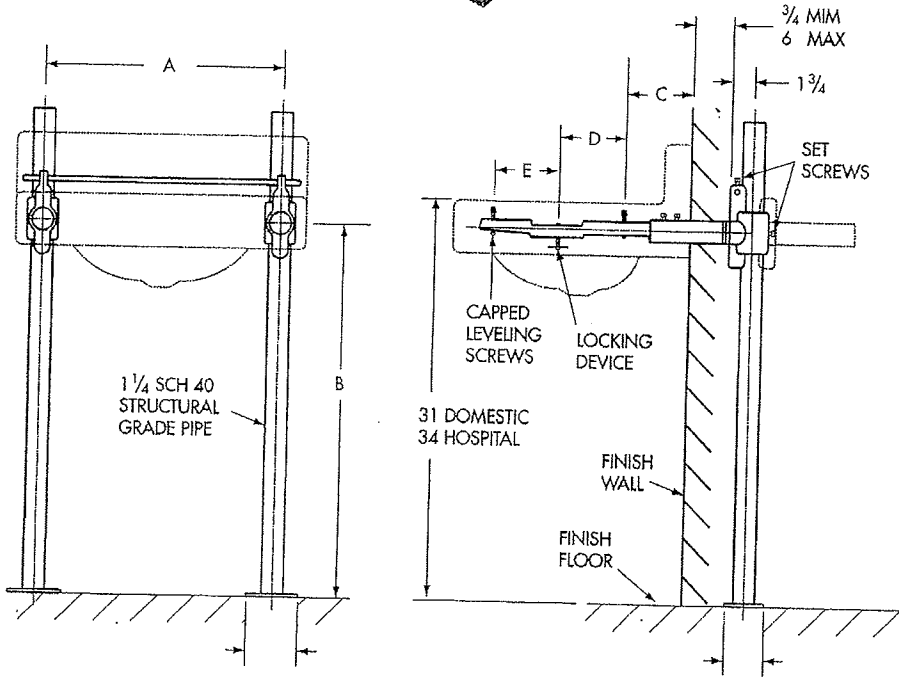
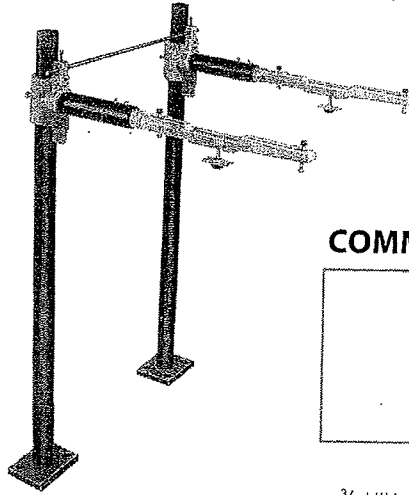
WADE

520 Single concealed arm lavatory carrier with non-slip locking devices. For lavatories with back for walls up to 6" thick.

TAG:

Letter Dimensions Vary According to Fixture Used.

COMMENTS:



Cat. No.	Type	Wt. Lbs.
<input type="checkbox"/> 520	Single	36
<input type="checkbox"/> 520D	Double	45

Note: Refer to carrier selector for applications to specific fixtures.
 Arm Suffixes: 05, 07, 08, 09. Refer to page 2-8 for details.

MODIFICATIONS

Suffix	Description
<input type="checkbox"/> M19	Eye bolts and hardware for C.I. lavatories
<input type="checkbox"/> M23	Escutcheons for slab type lavatories
<input type="checkbox"/> M24	Extended arm supports for wheelchair lavatories
<input type="checkbox"/> M25	Extra long rear leveling screws for high-back lavatories
<input type="checkbox"/> AM27	Valve support plate on upright
<input type="checkbox"/> M36	Rectangular Uprights

Arm Assemblies For Lavatories & Sinks

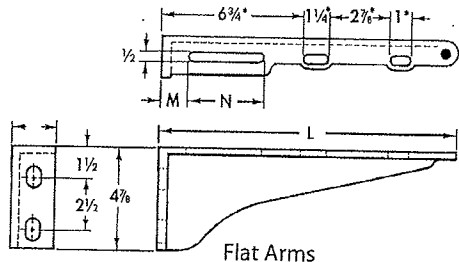
WADE

Exposed Arms For Lavatories

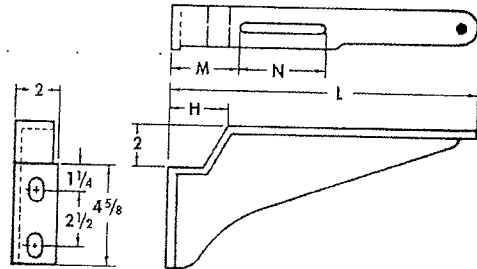
Carriers: 510, 520, 572

Note: Refer to carrier selector for applications to specific fixtures.

TAG:



Suffix	L	M	N
-02	14	1 1/4	3 Ø
-03	15 3/4	1 1/4	5

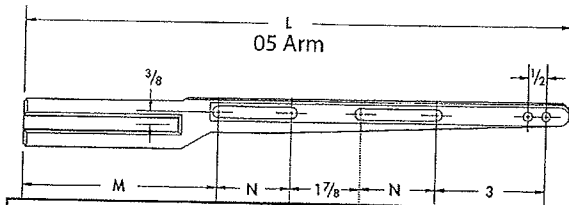


Suffix	L	M	N	H
-NR	14	3	4	2 1/2
-KG	14	3 1/2	2 3/4	3 1/4

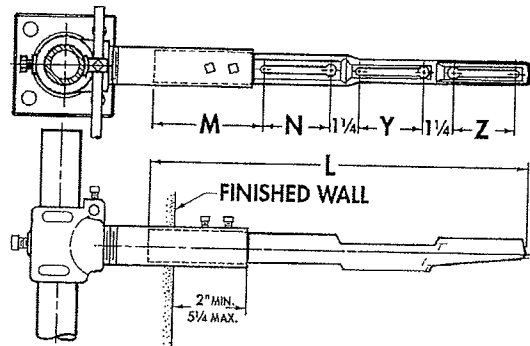
Concealed Arms For Lavatories

Carriers: 520, 571, 572, 573, 574

Note: Refer to carrier selector for applications to specific fixtures.



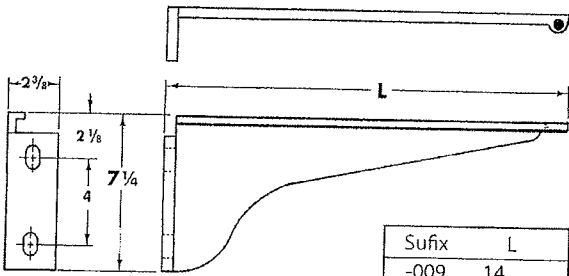
Suffix	L	M	N	Y	Z
-05	14 1/2	5 1/4	2	-	-
-07	16	4 3/4	2 3/4	2 3/4	2 1/4
-08	17 1/4	4 3/4	2 3/4	2 3/4	4
-09	19	4 1/4	4 1/4	3 1/4	3 1/4



Exposed Arms For Sinks

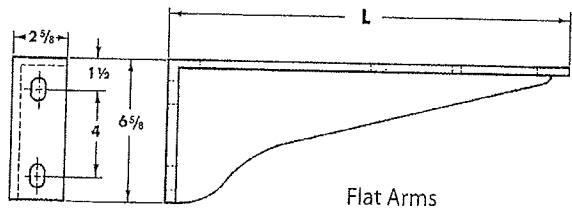
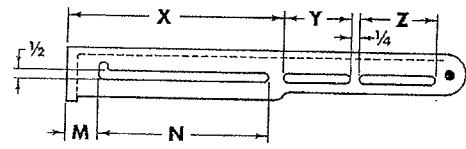
Carriers: 610, 620

Note: Refer to carrier selector for applications to specific fixtures.



Narrow Arms

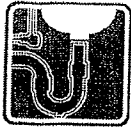
Suffix	L
-009	14
-011	11 1/4
-014	14



Flat Arms

Suffix	L	M	N	X	Y	Z
-01	12 1/2	1 1/2	5 1/4	7 3/4	3 1/4	...
-02	16	1 1/2	7 1/4	10 1/4	3 1/4	...
-03	19	1 1/2	7 1/4	10 1/4	3 1/4	3 1/4

LV-1



LAV GUARD²
FAST FIT UNDERSINK PIPING COVERS

All New
E-Z Series

ADA-compliant undersink protection

Submittal Sheet



General Description:

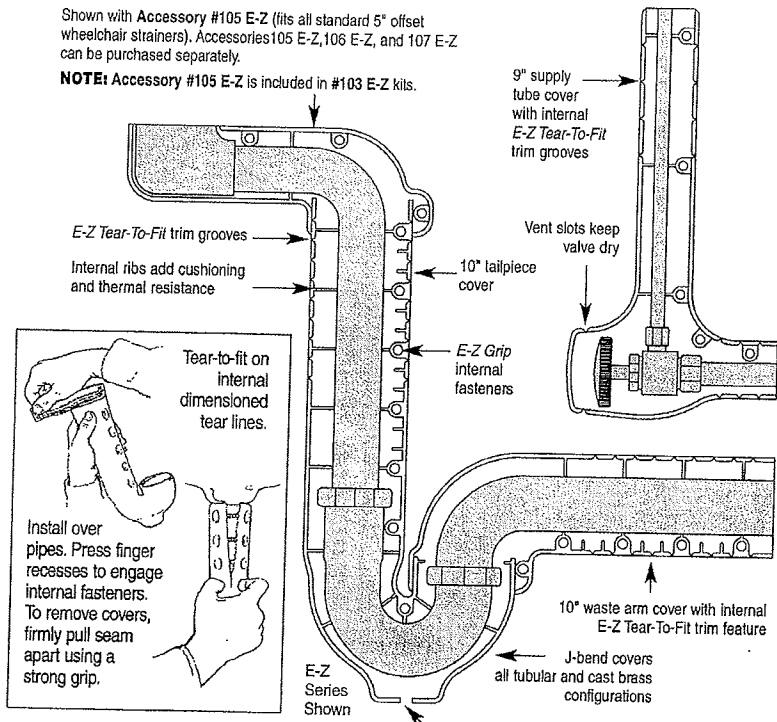
LAV GUARD² E-Z Series waste and supply piping covers satisfy ADA compliance requirements. Built-in E-Z Grip internal fasteners and internal, E-Z Tear-To-Fit trimming feature allow for fast installation without tools. Series #100 E-Z kits are designed to fit on all tubular and cast brass P-trap assemblies. Series #400 kits are the "original" LAV GUARD design and fit schedule 40 ABS and PVC P-trap assemblies — regardless of their geometry or rotational offset. Valve cover completely encloses angle valve and supply tube for both handed and keyed type water stops.

Material	Molded vinyl
Nominal Wall	1/8" constant
Durometer	70-80 - Shore A
UV Protection	Will not fade or discolor
Durability	Virtually indestructible
Trimming (E-Z Series)	Internal, E-Z Tear-To-Fit trim feature
Fasteners (E-Z Series)	Internal E-Z Grip fasteners (reusable)
Color	China white
Paintability	Apply Latex paint
Burning Characteristics ASTM D-635	Self extinguished 0 sec (ATB) 0 mm (AEB)
Bacteria/Fungus Resistance	ASTM G21 and G22/ Result: 0 growth
Maintenance	Use common detergents

Manufactured under one or more of the following U.S. or Canadian patents. Other patents pending.
5,303,730 5,360,031 5,524,669 5,564,463 5,678,598 5,699,828 5,915,412
5,915,413 5,901,739 5,960,820 2,075,324 2,119,427 2,136,027 2,158,083

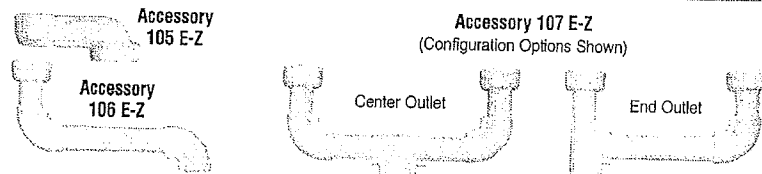


IPS Corporation, 202 Industrial Park Lane, Collierville, TN 38017
(901) 853-5001 (800) 340-5969 FAX: (901) 853-5008
e-mail: info@truebro.com Internet: http://www.truebro.com



#100 E-Z Series (shown above right) for tubular and cast brass P-trap assemblies.
#400W* Series (original design) for schedule 40 P-trap assemblies.

- | | | |
|---|---|--|
| <input type="checkbox"/> Model #99 E-Z
One angle valve and supply cover | <input type="checkbox"/> Model #102 E-Z
One P-trap cover, two angle valves and covers | <input type="checkbox"/> Accessory #105-K
Kohler 6" offset |
| <input type="checkbox"/> Model #100 E-Z
One P-trap cover | <input type="checkbox"/> Model #402W*
One P-trap cover, two angle valves and covers | <input type="checkbox"/> Accessory #106 E-Z
One basket strainer cover and offset waste cover (adjustable to 18") |
| <input type="checkbox"/> Model #400W*
One P-trap cover | <input type="checkbox"/> Model #103 E-Z
One P-trap cover, two angle valves and supply covers, one 5" offset tailpiece wheelchair strainer cover | <input type="checkbox"/> Accessory #107 E-Z
Two basket strainer covers and center or end outlet waste cover (adjustable) |
| <input type="checkbox"/> Model #101 E-Z
One P-trap cover, one angle valve cover | <input type="checkbox"/> Accessory #105 E-Z
One 5" offset tailpiece wheelchair strainer assembly | <input type="checkbox"/> Accessory #Ex99 E-Z
One 16" extension for water supply |
| <input type="checkbox"/> Model #401W*
One P-trap cover, one angle valve cover | <input type="checkbox"/> Accessory #Ex100 E-Z
One 16" extension for drain waste arm or tailpiece | |
- *All #400W series items are the "original" LAV GUARD² design and construction. Specifications may change without notice.



Job/Location _____
Designer _____

TRUEBRO reserves the right to make product and material changes at any time without notice.

SK-1



STYLIS GROUP

SPECIFICATION

Seamless die-drawn construction of type 304, 18-8 stainless steel. Interior and top surfaces polished to a non-porous Hand-Blended Just Finish with highlighted bowl rim. Fully coated underside insulates for sound, and reduces condensation. Straight-sided compartment with 1 3/4" radius corners provides greater capacity. Self-rimming top mount Grip-Rim Plus with 300 series stainless steel mounting channels. Conforms to ASME/ANSI A112.19.3M. Drain punch #35 centered for Just J-35 unless otherwise specified.

TYPE 316 STAINLESS STEEL (Check if applicable)

To be specified :

Faucet hole punching:

(1) Hole Centered

(2) Holes on 4" centers

(3) Holes on 4" centers (illustrated)

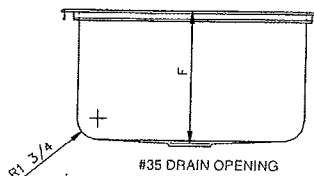
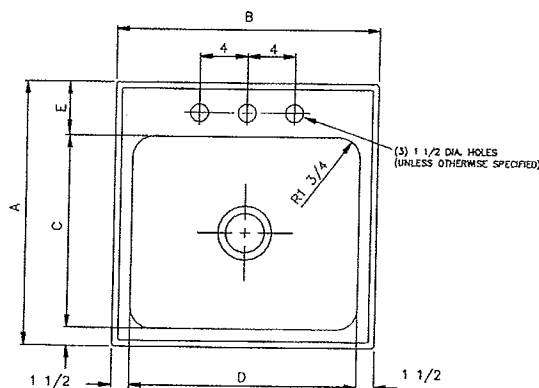
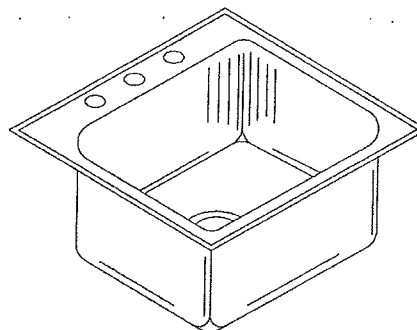
Alternate Punching:

Faucet Model: _____

Punching required: _____

SLX - SLXD - SERIES - A - 18 GA.

GENEROUS CAPACITY - EXTRA DEEP
LEDGE TYPE - SINGLE BOWL



MODEL NO.	A	B	C	D	E	F	CUTOUT*
SLX-2217-A-G	22	17	16	14	4-1/2	10-1/2	21-1/4 x 16-1/4
SLX-2219-A-GR	22	19	16	16	4-1/2	10-1/2	21-1/4 x 18-1/4
SLX-2222-A-GR	22	22	16	19	4-1/2	10-1/2	21-1/4 x 21-1/4
SLXD-2217-A-G	22	17	16	14	4-1/2	12	21-1/4 x 16-1/4
SLXD-2219-A-GR	22	19	16	16	4-1/2	12	21-1/4 x 18-1/4
SLXD-2222-A-GR	22	22	16	19	4-1/2	12	21-1/4 x 21-1/4

* Cutout dimensions shown (Front-to-Back) x (Left-to-Right) - corners may be square or up to 1/2" radius.

FUNCTIONAL DESIGN, QUALITY, AND SPECIFICATIONS LISTED DESCRIBE THE JUST STANDARD OF QUALITY. WHEN MAKING COMPARISONS WITH OTHER OFFERINGS, INSIST ON THE JUST QUALITY OF CONSTRUCTION. FOR ADDITIONAL INFORMATION REGARDING THE COMPLETE LINE OF JUST SINKS, FAUCETS AND DRAINS, VISIT OUR WEB SITE AT www.justmfg.com

Job Name _____

Customer _____

Architect/Engineer _____

APPROVED FOR MANUFACTURING

MODEL NO. _____ QTY. _____

COMPANY _____

TITLE _____ DATE _____

SIGNATURE _____

REVISED-6/2004

JUST MANUFACTURING COMPANY

9233 KING STREET . FRANKLIN PARK . ILLINOIS . 60131-2111

PH: 847-678-5150

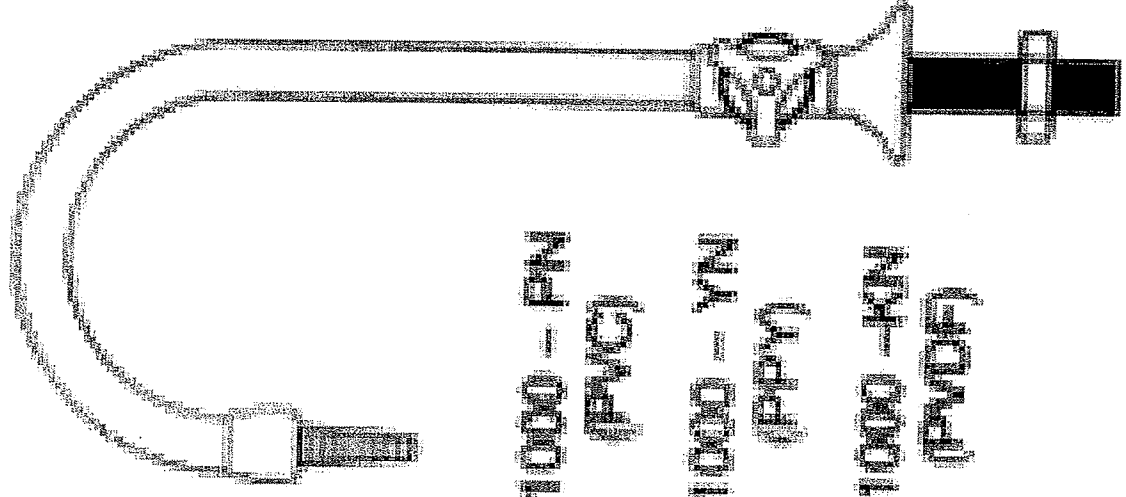
FAX: 847-678-6817

E-MAIL: custserv@justmfg.com

www.justmfg.com

54-1

DECK MOUNT



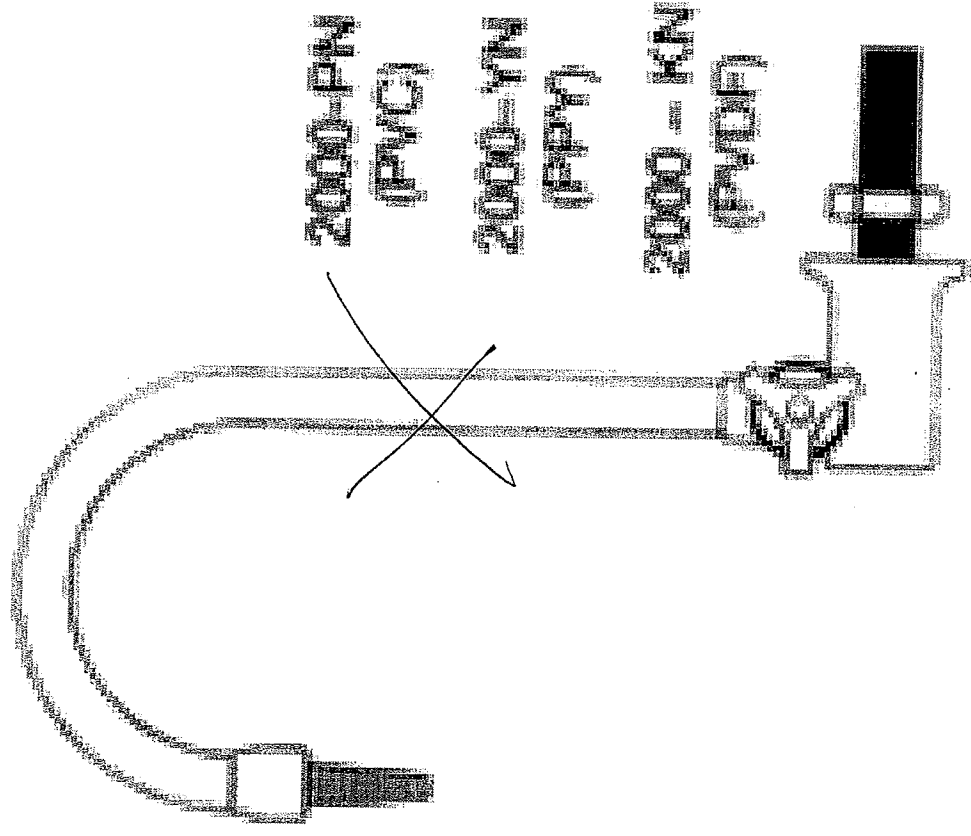
1000 - PH
(PVC)

1000 - YN
(PPN)

1000 - KN
(PVDF)



PANEL MOUNT



2000 - PH
(PVC)

2000 - YN
(PPN)

2000 - KN
(PVDF)



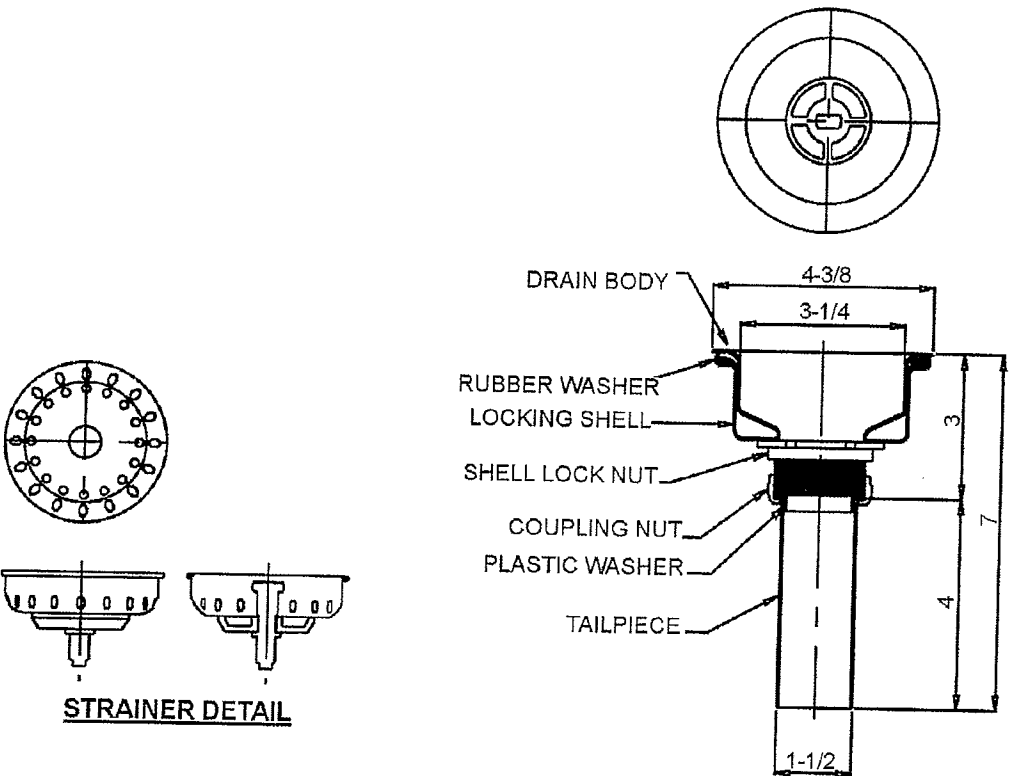
FITTINGS GROUP

SK-1

J-35

**Stainless Steel Drain
with
Crumb Cup Strainer**

SUBMITTAL DATA



STRAINER DETAIL

TECHNICAL DATA

DRAIN:
Body of Type 304 stainless steel
Strainer and post of Type 304 stainless steel
Stopper of rubber

TAILPIECE:
Chrome plated brass

LOCK NUT:
Die-cast zinc

COUPLING NUT:
Die-cast

VARIANTS
Brass coupling nuts

Job Name _____	
Customer _____	
Architect/Engineer _____	
APPROVED FOR MANUFACTURING	
MODEL NO. _____	QTY. _____
COMPANY _____	
TITLE _____	DATE _____
SIGNATURE _____	

FUNCTIONAL DESIGN, QUALITY, AND SPECIFICATIONS LISTED DESCRIBE THE JUST STANDARD OF QUALITY. WHEN MAKING COMPARISONS WITH OTHER OFFERINGS, INSIST ON THE JUST QUALITY OF CONSTRUCTION. FOR ADDITIONAL INFORMATION REGARDING THE COMPLETE LINE OF JUST SINKS, FAUCETS AND DRAINS, VISIT OUR WEB SITE AT www.justmfg.com

JUST MANUFACTURING COMPANY	
9233 KING STREET . FRANKLIN PARK . ILLINOIS . 60131-2111	
PH: 847-678-5150 . FAX: 847-678-6817	
E-MAIL: custserv@justmfg.com . www.justmfg.com	

REVISED-5/2004

SK. 1

LET. DATE PER BY
C 10/9/03 RDG KAK REVISED & UPDATED CHANG

61-6 B
COMP. NUT

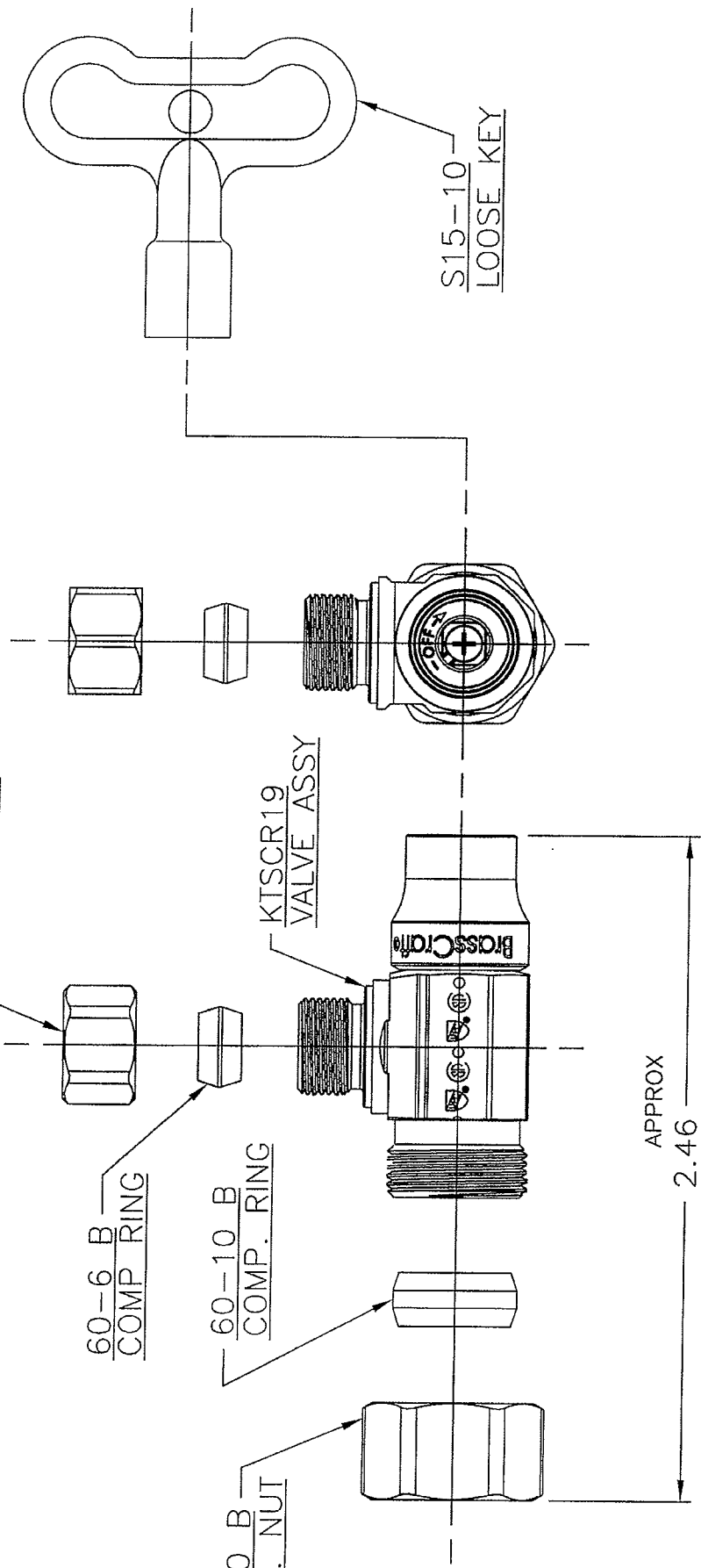
60-6 B
COMP RING

60-10 B
COMP. RING


61-10 B
COMP. NUT

KTSCR19
VALVE ASSY

S15-10
LOOSE KEY



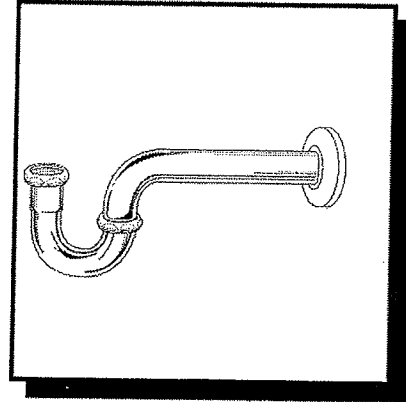
APPROX
2.46
ASSEMBLED

 <p>BrassCraft A Masco Company NOVI, MICHIGAN</p>		<p>DESCRIPTION 1/2 NOM COMP X 3/8 OD COMP 1/4 TURN BALL VALVE W/LOOSE KEY (SUBMITTAL)</p>	<p>DRAWING NO. VPA0835C</p>
<p>DRAWN KLIMKIE</p>	<p>DATE: 10/9/03</p>	<p>MATERIAL</p>	<p>ITEM DESCRIPTION KTSCR19</p>
<p>CHK'D. Green</p>	<p>DATE: 12/04/2003</p>	<p>VOLUME</p>	<p>ITEM ID KTSCR19 C</p>
<p>APP'D.</p>	<p>NOTE: UNLESS OTHERWISE SPECIFIED TWO PLACE DECIMALS +/- .010 THREE PLACE DECIMALS +/- .005 ANGULARITY</p>	<p>UNITS A</p>	<p>SCALE: (UNLESS NOTED) FULL</p>
<p>CLASS SYMBOL</p>	<p>KPC (KEY PRODUCT CHARACTERISTICS) <input type="checkbox"/></p> <p>STPC (STANDARD PRODUCT CHARACTERISTICS) <input type="checkbox"/></p> <p>PRODUCT MARKINGS <input type="checkbox"/></p>	<p>SIZE</p>	<p>REV. C</p>

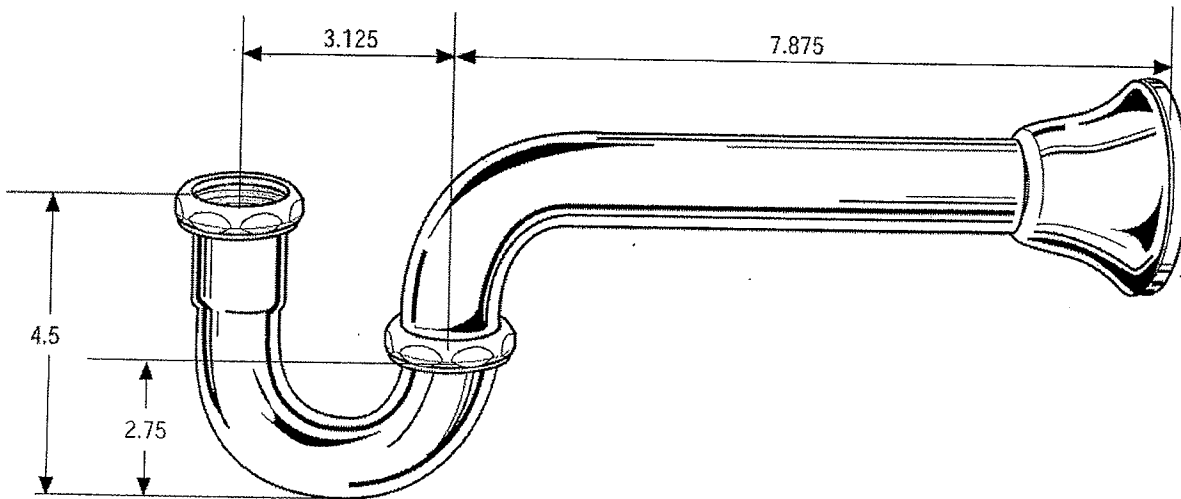
This drawing and all data contained herein is the confidential and exclusive property of BrassCraft Manufacturing, and shall not be disclosed to others without the written consent of BrassCraft. This drawing must be returned to BrassCraft if requested.

DESCRIPTION

- P-Trap, 1-1/4" -17 gauge with Ground Joint, Deep Flange and (2) Brass Nuts
- Also includes: (1) Rubber Washer
- Chrome Plated Finish



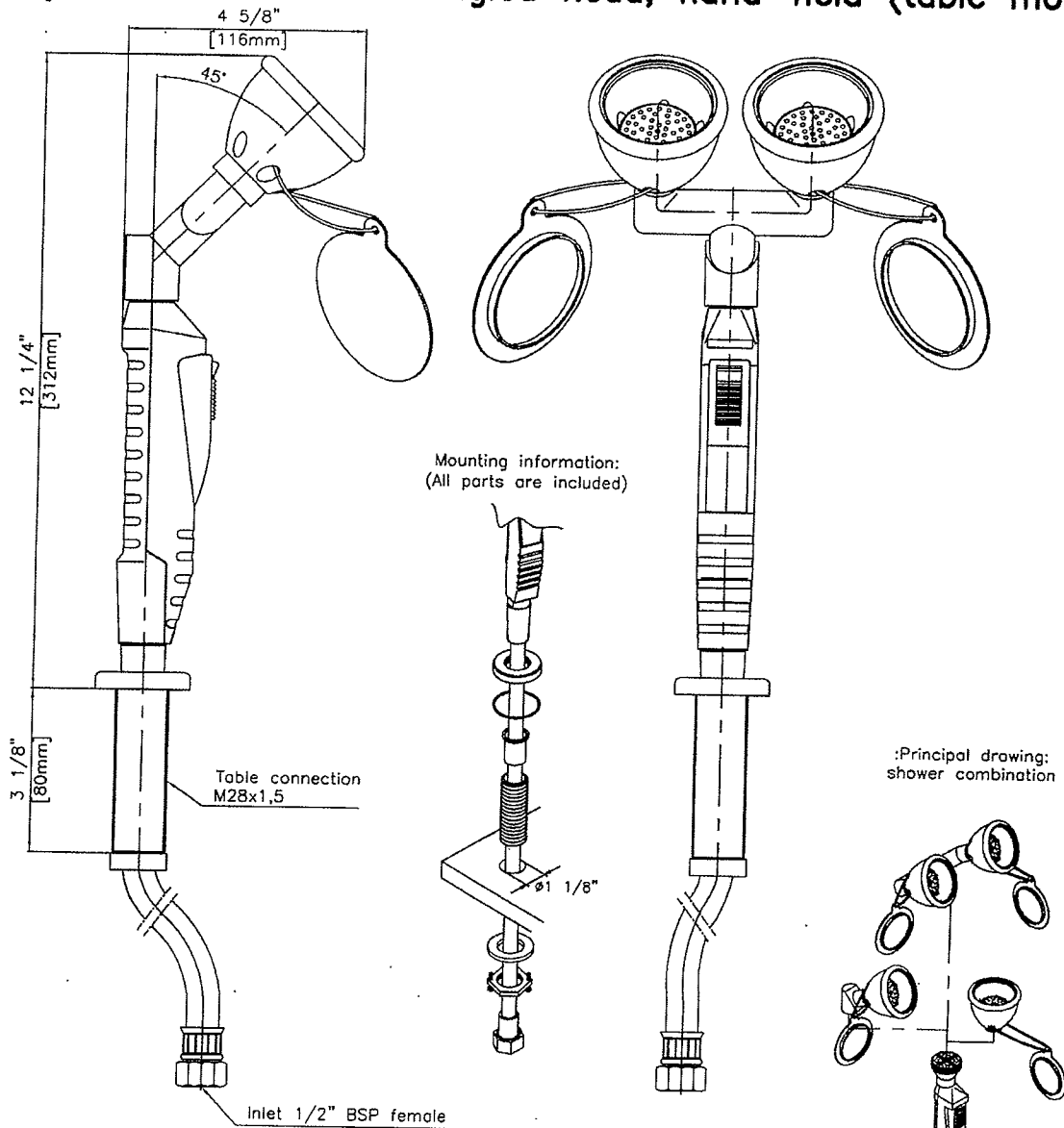
**P-TRAP
701GDFBN-1**



BROEN

17714000

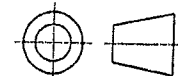
REDLINE Eye shower with two angled head, hand-held (table mount.)



Specifications:

- | | |
|-------------------------------|---|
| Working pressure: | Min.: 22 psi - Max.: 102 psi. |
| Opening / closing function: | Trigger operated. |
| Flow: | Built-in FLOWFIX 1,6gpm (Upper limit contained by flowfix). |
| Overall material: | Polyaryamide, reinforced with glassfibres. |
| Materials with water contact: | |
| Metals: | Brass, CW 614N. |
| Eyecups: | EPDM rubber. |
| Dustcaps: | POM. |
| Inlet: | Female 1/2" BSP |
| Hose: | 1/2" EPDM with stainless steel wiremesh |

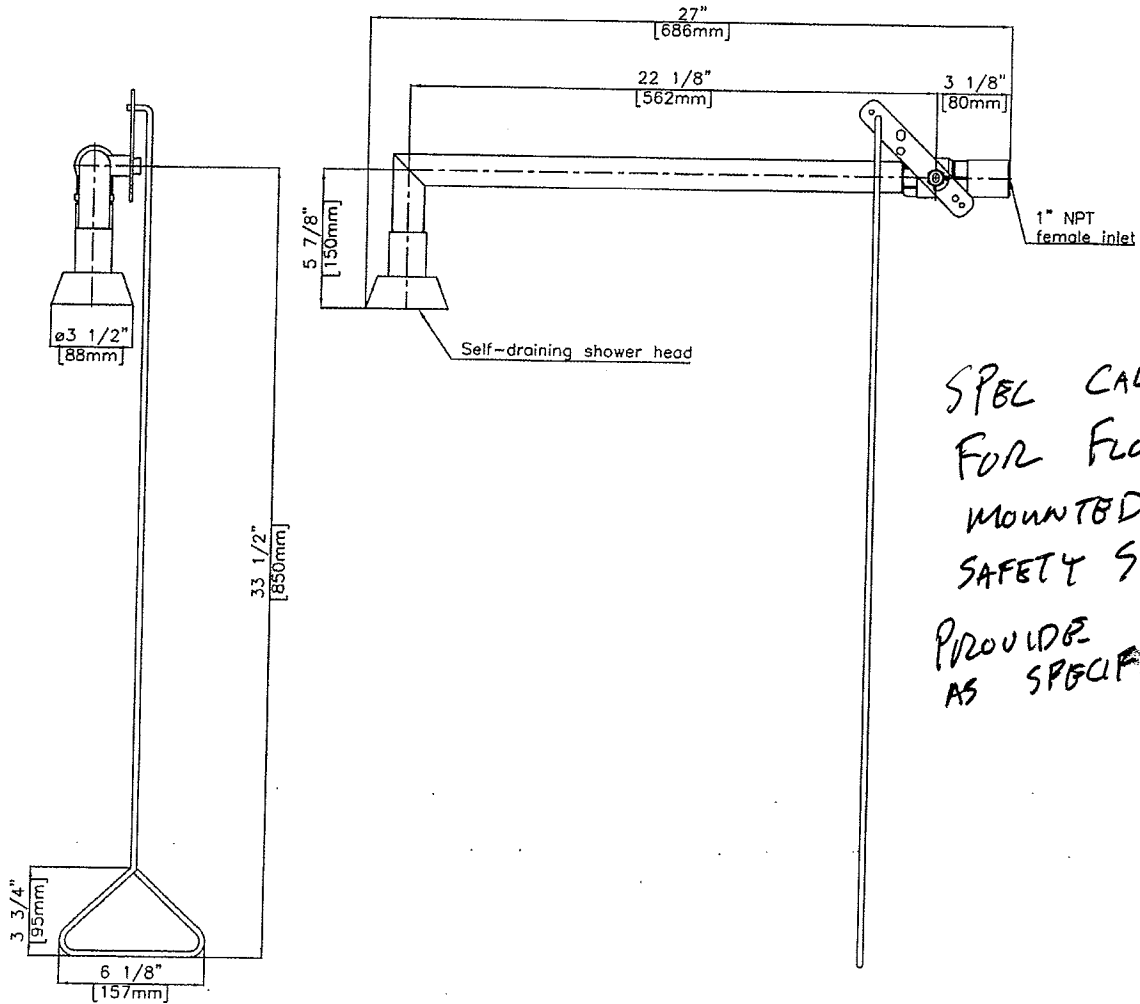
REDLINE showers is designed in accordance with ANSI Z 358.1-1998



BROEN

17932909

REDLINE Body shower, wall mounted, modular

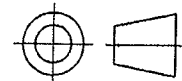


*SPEC CALLS
FOR FLOOR
MOUNTED
SAFETY SHOWER
PROVIDE
AS SPECIFIED.*

:Specifications:

- Working pressure: Min.: 14,7 psi – Max.: 147 psi.
- Surface treatment: Chemical resistant BROEN Polycoat.
- Materials with water contact: Brass CW 614N and Stainless steel.
- Metals: PPO.
- Shower head: Female 1" NPT.
- Inlet:

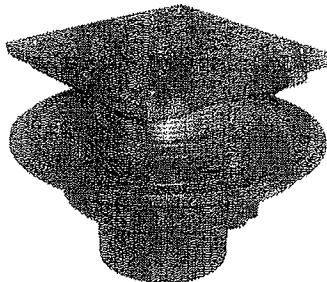
REDLINE showers is designed in accordance with ANSI Z 358.1-1998



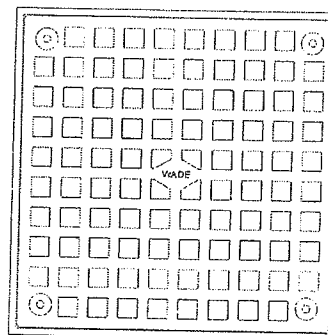
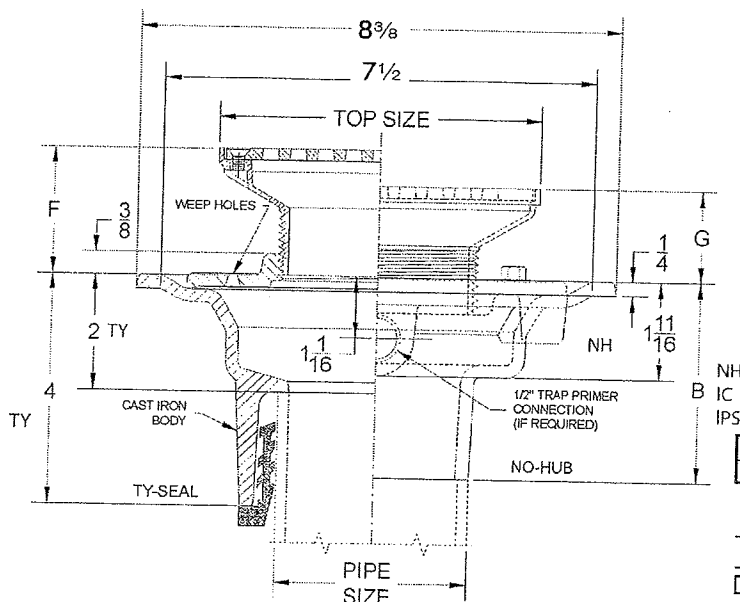
Floor Drains with Adjustable Strainers

WADE

1100G Cast iron floor drain with flange, integral clamping collar, seepage openings, 1/2" plugged primer tap, and adjustable _____ x _____ " square nickel bronze strainer with vandal proof screws.



TAG:



OUTLET	NO-HUB	INSIDE CAULK	THREADED
B	3 1/2	4 1/4	2 3/4

OPTIONS

- | Suffix | Description |
|--------------------------|---|
| <input type="checkbox"/> | 27Sediment Bucket |
| <input type="checkbox"/> | 31Backwater Valve |
| <input type="checkbox"/> | 39Galvanized Iron Parts |
| <input type="checkbox"/> | 94Extension Adaptor |
| <input type="checkbox"/> | 94Extension Adaptor, Galvanized |
| <input type="checkbox"/> | 179Security Screws |
| <input type="checkbox"/> | EF4-14" Dia. Funnel |
| <input type="checkbox"/> | EF6-16" Dia. Funnel |
| <input type="checkbox"/> | EG6-12 1/2"x6 1/8" Elongated Funnel (NB Only) |
| <input type="checkbox"/> | EG8-13 1/2" x 8 1/4" Elongated Funnel |

COMMENTS:

Cat. No.	Pipe Size	Top Size	ANSI* Load Class	Flow Rate (GPM)	Free Area Sq. In.	Wt. Lbs.	F		G	
							Min.	Max.	Min.	Max.
<input type="checkbox"/> 1102G4	2	4x4	L.D.	28	5.4	12	7/8	1 3/4	9/16	1 1/4
<input type="checkbox"/> 1103G5	3	5x5	L.D.	33	6.9	13	1 3/8	2 1/4	3/4	1 5/8
<input type="checkbox"/> 1103G6	3	6x6	L.D.	39	11.1	15	1 1/2	2 3/8	7/8	1 3/4
<input type="checkbox"/> 1103G8	3	8x8	L.D.	44	16.0	17	1 1/8	2 1/4	3/4	1 5/8
<input type="checkbox"/> 1104G6	4	6x6	L.D.	51	11.1	15	1 1/2	2 3/8	7/8	1 3/4
<input type="checkbox"/> 1104G8	4	8x8	L.D.	62	16.0	17	1 3/8	2 1/4	3/4	1 5/8

For optional strainers see pages 3-12, thru 3-18.
*L.D.= Light Duty (Under 2000 lbs.)

OUTLET:

- (TY) Ty-Seal
- (NH) No-Hub
- (IC) Inside Caulk
- (IPS) Threaded



Precision Plumbing Products

"Specify with Confidence - Install with Pride"

PRIME-RITE TRAP PRIMER VALVE

www.pppinc.net

"... Automatically maintains a constant water seal in floor drain traps."

Just the facts:

This innovative trap priming system automatically primes up to four floor drain traps using our patented water distribution system. The PRIME-RITE requires no adjustment but must be installed on a cold water line of 1 1/2" (38mm) diameter or less and must serve a frequently used fixture such as a urinal or a water closet. The priming valve is automatically activated when it senses a pressure drop of 5 to 10 PSIG (35 to 70 kpa). The valve's operating range is 35 to 75 PSIG (245 to 525kpa).

PRIME-RITE TRAP PRIMING VALVE SPECIFICATIONS:

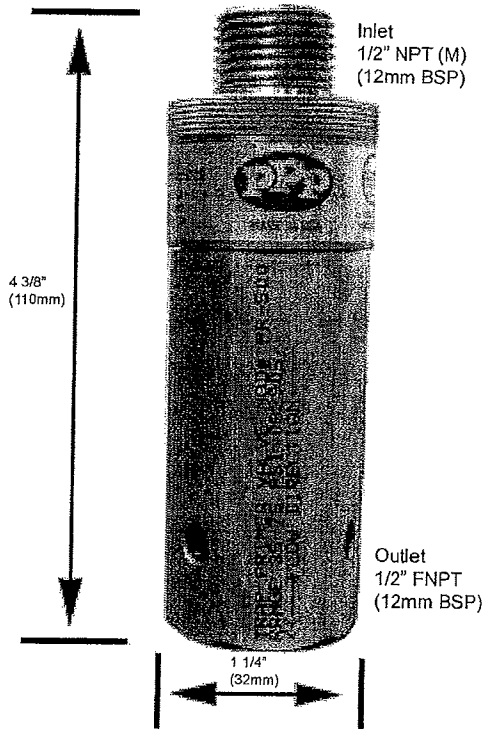
PPP Model #PR-500 is machined from CDA 360 corrosion resistant brass.

PPP Model # PR-500 AUS is machined from DZR corrosion resistant brass.

PPP Model #PR-500AUS approved to Australian Standards Lic. #IP92.

This priming valve contains: No springs, diaphragms, or plastic parts.

NO Adjustment Required!



PART NO: PR-500/PR-500AUS

PROJECT SUBMITTAL

Project: _____

Contractor: _____

Engineer: _____

Date Submitted: _____

Prepared By: _____

PATENT NO. 4,497,337



TRAP PRIMER DISTRIBUTION UNITS

SPECIFICATIONS: Distribution Units DU-4 & DU-U.

A metered amount of water from the floor drain trap primer is distributed to as many as four (4) floor drain traps by means of the patented distribution unit. The distribution units are fully guaranteed on a money back basis when installed per manufacturers recommendations. The priming valve must have a minimum elevation of 12" inches (305mm) above the finished floor.

FLOOR DRAIN TRAP PRIMER DISTRIBUTION CHART		
# of Drains	Supply Tube	Distribution Units
1	N/A	N/A
2	N/A	DU-4/DU-U
3	N/A	DU-4/DU-U
4	N/A	DU-4/DU-U
5	N/A	DU-4/DU-U
Max. water delivery based upon pressure drop.		
Primer Model: PR-500 PRIME-RITE		

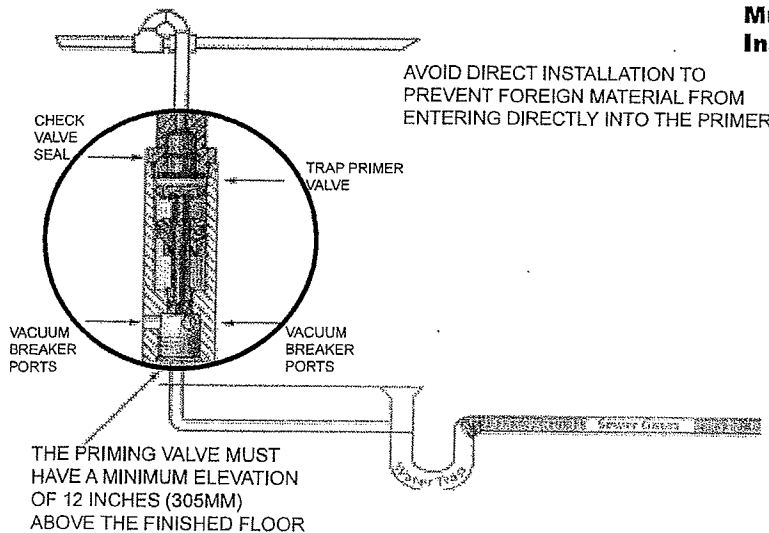
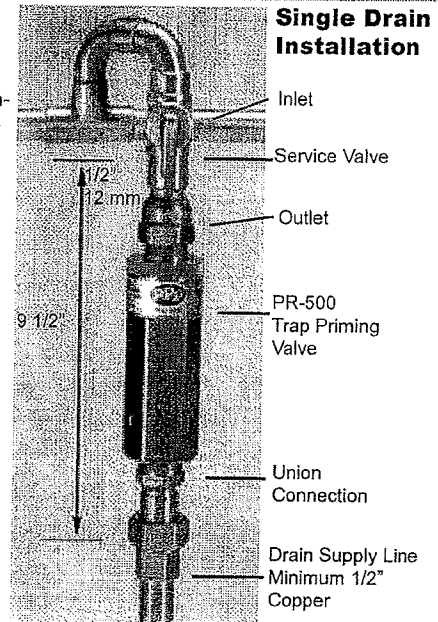
DISTRIBUTION UNIT INSTALLATION:

Must be installed level.

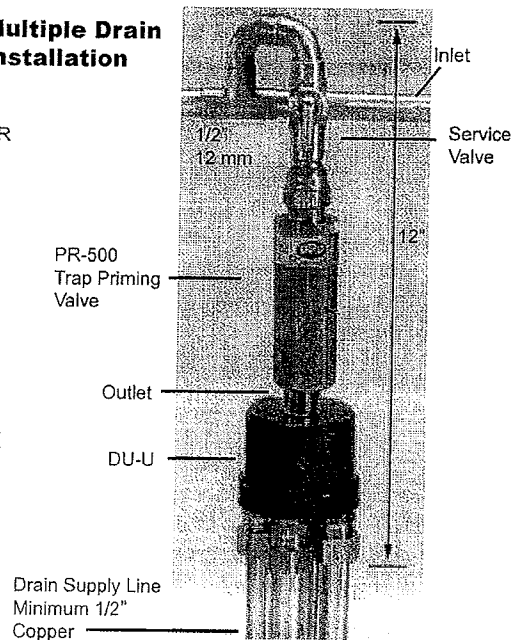
Must be installed with clear plastic cover.

Must be installed with access for periodic inspection.

For further detail see information sheet specific for the distribution units.



Multiple Drain Installation



NOTE: Consult plumbing inspector prior to installing distribution units.

Precision Plumbing Products

Division of JL Industries, Inc.

Airport Business Center
6807 NE 79th Court, Suite E
Portland, Oregon 97218

T (503) 256-4010

F (503) 253-8165

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JL Industries, Inc.

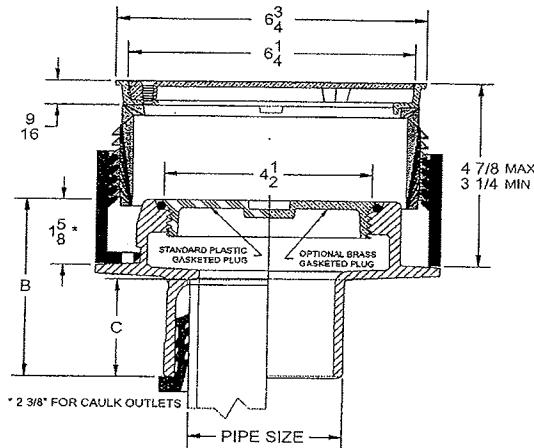
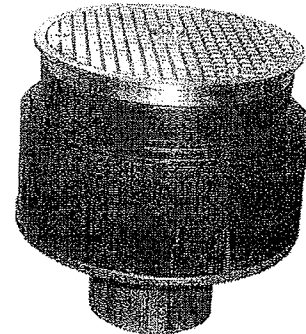
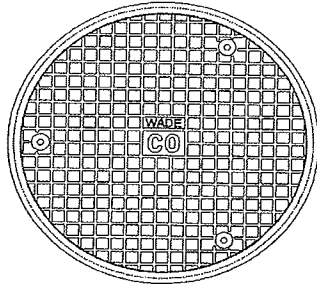
Floor Cleanouts

WADE

6000 (SV Hub Outlet, Spigot Outlet)

Cast iron cleanout with threaded adjustable housing, flanged ferrule and round secured nickel bronze top.
ANSI Load Class (Standard Top)
Light Duty (Under 2,000 lbs)

TAG:



* 2 3/8" FOR CAULK OUTLETS

PIPE SIZE	TY-SEAL		NO-HUB		CAULK	
	B	C	B	B	B	B
2	4 1/4	2 3/8	4 1/4	6 1/2		
3	4 1/4	2 3/8	4 1/4	6 1/2		
4	4 1/4	2 1/2	4 1/4	6 1/2		
5	4 1/4	2 1/2	4 1/4	N/A		
6	4 3/8	2 5/8	4 1/4	N/A		

COMMENTS:

OPTIONS

Suffix	Description
<input type="checkbox"/> 39	Galvanized Iron Parts
<input type="checkbox"/> 75	Bronze Plug
<input type="checkbox"/> 153	304 S/S Top
<input type="checkbox"/> 179	Security Screws

Cat. No.	Pipe Size	B	Wt. Lbs.
<input type="checkbox"/> 6002,1	2	2 1/2	16
<input type="checkbox"/> 6003,1	3	2 3/4	17
<input type="checkbox"/> 6004,1	4	3	18
<input type="checkbox"/> 6005,1	5	3	19
<input type="checkbox"/> 6006,1	6	3	21

OUTLET

Suffix	Description
<input type="checkbox"/> TY	Ty-Seal
<input type="checkbox"/> NH	No-Hub
<input type="checkbox"/> IC	Inside Caulk (2", 3", 4")

TOP VARIATIONS

Suffix	Description	ANSI Load Class
<input type="checkbox"/> CF	Carpet Flange	(LD)
<input type="checkbox"/> CM	Carpet Marker	
<input type="checkbox"/> D	Wide Flange	(HD)
<input type="checkbox"/> S	Standard Square Top	
<input type="checkbox"/> T	Tile Top	(LD)
<input type="checkbox"/> TS	Square Tile Top	(LD)
<input type="checkbox"/> U	Terrazzo	(LD)
<input type="checkbox"/> US	Square Terrazzo	(LD)
<input type="checkbox"/> X	Heavy Duty Top	
<input type="checkbox"/> XS	Square Heavy Duty Top	

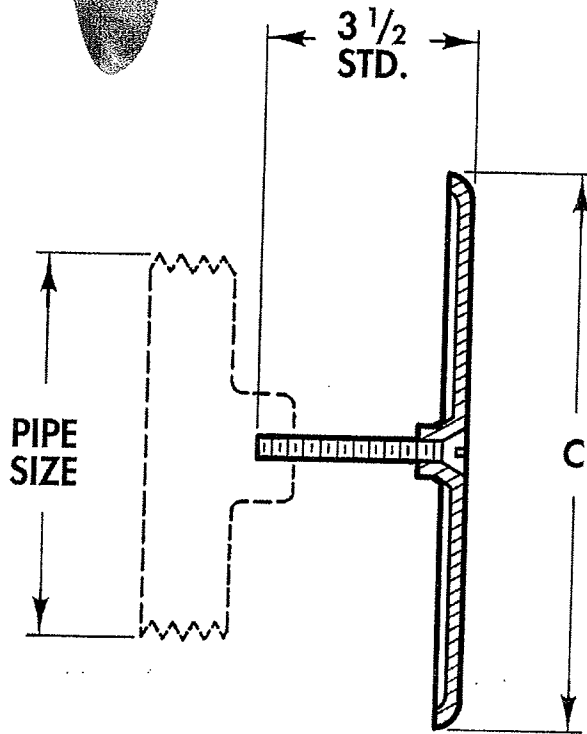
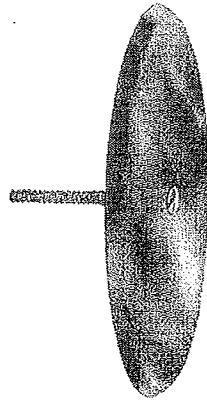
Wall Access Covers

WADE

8480R Round stainless steel access cover with 1/4"-20x3 1/2" center screw.

TAG:

COMMENTS:



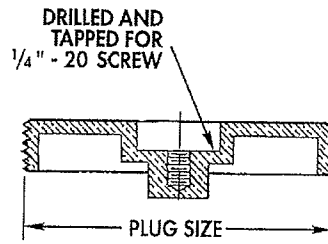
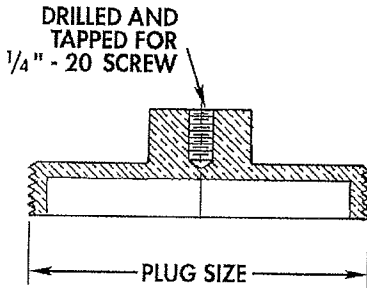
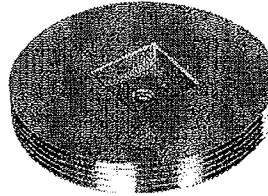
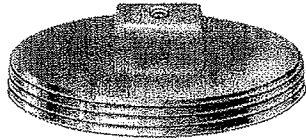
Cat. No.	C	Plug Size	Wt. Lbs.
8480R6	6	1 1/2 to 3 1/2	1/2
8480R8	8	4, 5 and 6	3/4
8480R10	10	8	3/4

Cleanout Plugs

WADE

8590 (B or E) Threaded brass raised head, or countersunk plug drilled and tapped for 1/4" - 20 screw.

TAG:



Cat. No.	Plug Size	Wt. Lbs.
<input type="checkbox"/> 8591 1/2	1 1/2	.25
<input type="checkbox"/> 8592	2	.25
<input type="checkbox"/> 8593	3	.50
<input type="checkbox"/> 8593 1/2	3 1/2	.50
<input type="checkbox"/> 8594	4	.75
<input type="checkbox"/> 8595	5	1.00
<input type="checkbox"/> 8596	6	2.00

PLUG TYPE

Suffix	Description
<input type="checkbox"/> BRaised Head Brass Plug (Not Available 6")
<input type="checkbox"/> ECountersunk Brass Plug

COMMENTS:

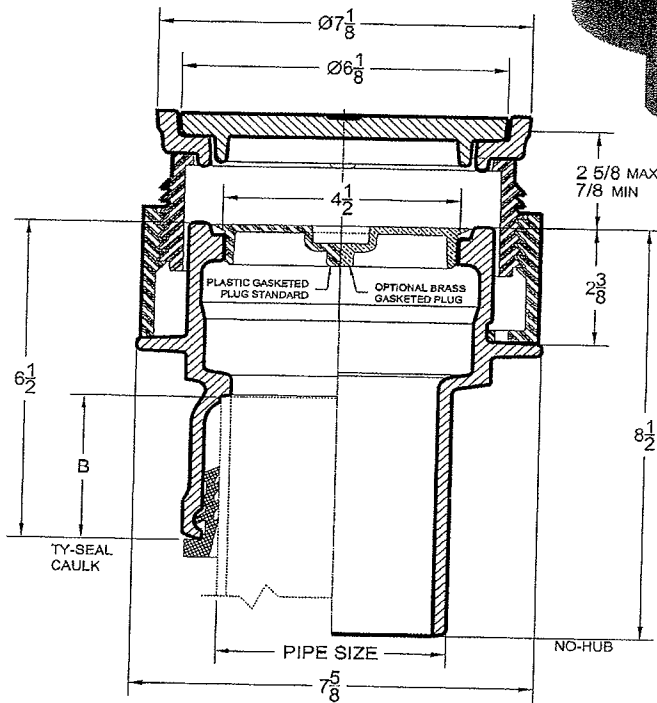
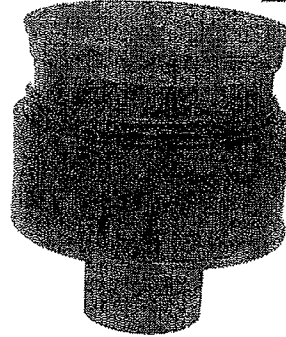
Floor Cleanouts

WADE

6000Z (Spigot Outlet, SV Hub Outlet)

Cast iron cleanout with threaded adjustable housing, flanged ferrule with round scoriated cast iron or with nickel bronze veneer tractor type cover.
ANSI Load Class - Special Duty
(Over 10,000 lbs)

TAG:



COMMENTS:

OUTLET

Suffix	Description
TY.....	Ty-Seal
NH.....	No-Hub
IC.....	Inside Caulk (2", 3", 4")

OPTIONS

Suffix	Description
1	Nickel Bronze Veneer
39	Galvanized Iron Parts
75	Bronze Plug
179.....	Security Screws

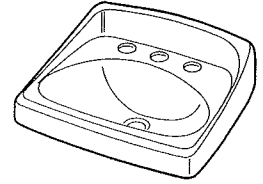
Cat. No.	Pipe Size	B	Wt. Lbs.
6002Z	2	2 1/2	16
6003Z	3	2 3/4	17
6004Z	4	3	18
6005Z	5	3	19
6006Z	6	3	21

LV-1

American Standard

INSTALLATION INSTRUCTIONS

Wall Hung Bathroom Sink



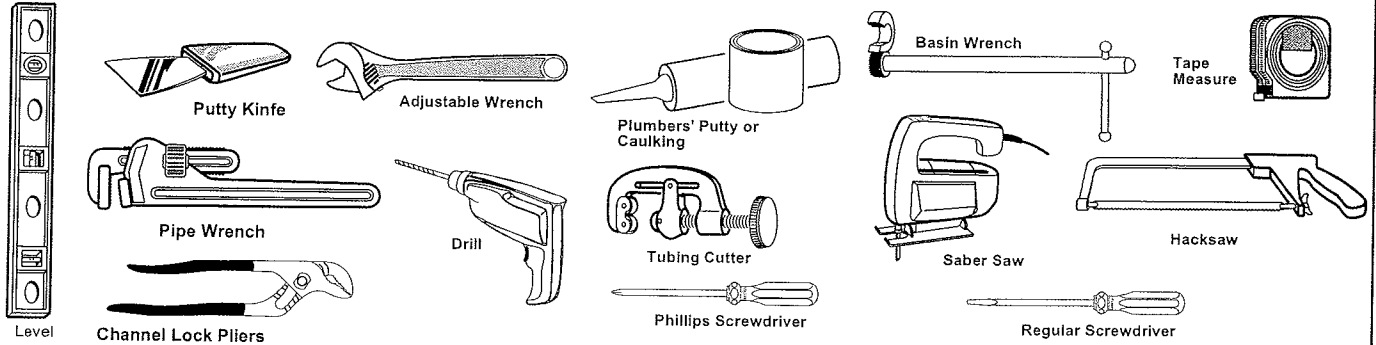
***NOTE:** For installation of models using concealed or exposed arms, follow instruction provided by arms manufacturer.

Introduction: Thank you for selecting our products...products which have been the benchmarks of fine quality for years. To help insure that the installation process will proceed smoothly, please read these instructions carefully before you begin. Also, review the recommended tools and materials list; carefully unpack and examine your new plumbing fixture.

CAUTION: PRODUCT IS FRAGILE. TO AVOID BREAKAGE AND POSSIBLE INJURY HANDLE WITH CARE!

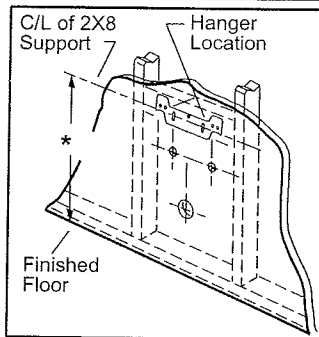
NOTE: Pictures may not exactly define contour of china and components.

Recommended Tools & Materials



1 Provide suitable reinforcement behind finished wall for lavatory hanger mounting screws. *Determine horizontal center line location of support from the table listed in Step 2. (Make sure support bottom extends to lavatory back wall bottom.)

NOTE: If replacing an existing sink be certain to shut off water supply before removing old sink.

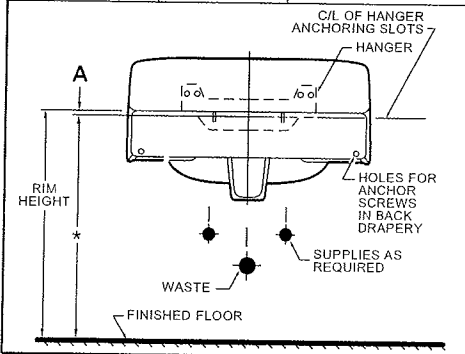


3 Position hanger according to Step 2, making sure its center is aligned with the waste hole centerline. Mark the hanger screw locations through its mounting holes.

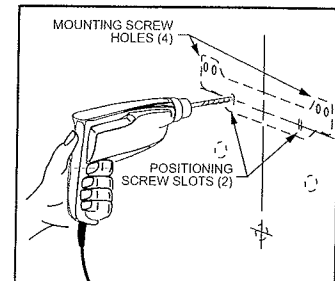
2 Determine the desired rim height (for example 32") then select from the Table at right the height of the hanger mounting bolts centerline

TABLE		
Part #	Model	Distance "A"
0124	Comrade	- 2-1/2" (64mm)
0321	Declyn	- 2-3/4" (70mm)
0355/0356	Lucerne	- 1" (25mm)
0372/0373	Penlyn	- 1/8" (3mm)
4300	Ledgewood	+ 2-7/8" (73mm)
4867/4869	Regalyn	+ 2-3/4" (70mm)
5300	Ledgemere	+ 2-1/2" (64mm)

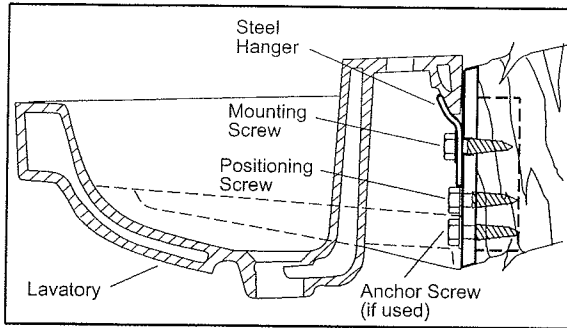
EXAMPLE:
For Lucerne:
 $32" - 1" = 31"$
For Ledgewood:
 $32" + 2-7/8" = 34-7/8"$



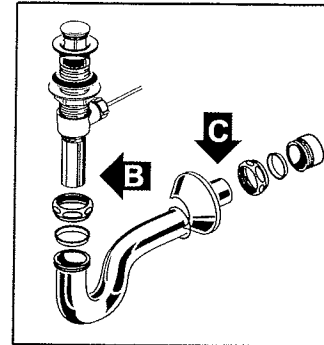
4 Drill pilot holes in positioning screw slots of hanger. (Note: Some models are supplied with anchor screws, or steel hangers for lavatory installations. Other models are not provided with mounting hardware which can be purchased at local hardware outlets. Lavator-ies with bottom anchor screw holes should be secured with anchor screws in addition to hangers.



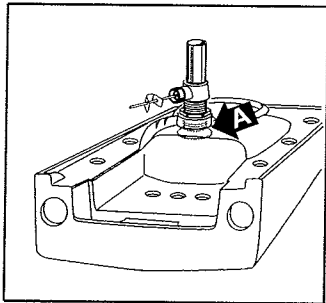
5 Affix hanger to wall (hand tighten only). Mount lavatory for positioning, level the deck, and mark bottom anchor screw holes (if applicable). Remove lavatory, tighten the hanger positioning screws and drill pilot holes for anchor screws and 4 mounting screws. Install and tighten the mounting screws.



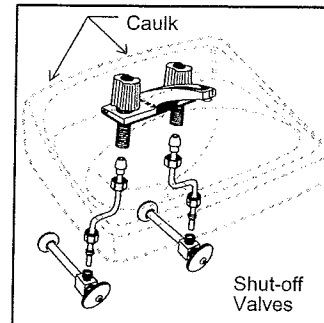
7 Return the fitted lavatory to the installed position. Connect trap to drain assembly hand tight to check alignment. It may be necessary to cut off part of the tailpiece (area "B") or part of the horizontal leg of the trap (area "C").



6 Following manufacturers instructions, install faucet and drain assembly. (Not included). Be certain to apply a bead of sealing putty on the underside of the drain (Part "A") in order to ensure a watertight seal between the lavatory and drain. Remove excess putty after installing drain on lavatory.



8 Secure lavatory on hanger as shown in 5. Insert and tighten anchor screws if applicable. Connect hot and cold supply lines to the shut-off valves. Tighten trap joints for watertight assembly. Apply a bead of caulk around the edge which contacts the wall as shown.



American Standard

Ideal Standard

Inesa Standard

Sadona Standard

Cedexca

Saniwares

AMERICAN STANDARD ONE-YEAR LIMITED WARRANTY

If inspection of this American Standard plumbing product, within one year after its initial installation, confirms that it is defective in materials or workmanship, American Standard will repair or, at its option, exchange the product for a similar model.

This limited warranty **does not apply** to local building code compliance; since local building codes vary considerably, the purchaser of this product should check with a local building or plumbing contractor to insure local code compliance before installation.

This warranty **shall be void** if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damage; if it was not installed in accordance with American Standard's instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard.

American Standard's option to repair or exchange the product under this warranty does not cover any labor or other costs of removal or installation, **nor shall American Standard be responsible for any other incidental or consequential damages attributable to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this warranty.** (Some states or provinces do not allow the exclusion or limitation of implied warranties, so this exclusion may not apply to you.)

This warranty gives you specific legal rights. You may have other statutory rights that vary from state to state or from province to province, in which case this warranty does not affect such statutory rights.

For service under this warranty, it is suggested that a claim be made through the contractor or dealer from or through whom the product was purchased, or that a service request (including a description of the product model and of the defect) be sent to the following address:

In the United States:
American Standard, Inc.
One Centennial Ave.
Piscataway, New Jersey 08855
Attention: Director of Consumer Affairs

Toll Free: (800) 442-1902

In Canada:
American Standard, Inc.
2480 Stanfield Rd.,
Mississauga, Ontario
Canada L4Y 1S2
Toll Free: (800) 387-0369

In Mexico:
Customer Service Manager
American Standard, Inc.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico

LV-1



T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690



REG. #A2601
ISO #9001

Model No.

B-2850

Item No.

Travelers Rest, SC: 800-476-4103 Simi Valley, CA: 800-423-0150 Fax: 864-834-3518 www.tsbrass.com

This Space for Architect/Engineer Approval

Job Name _____ Date _____

Model Specified _____ Quantity _____

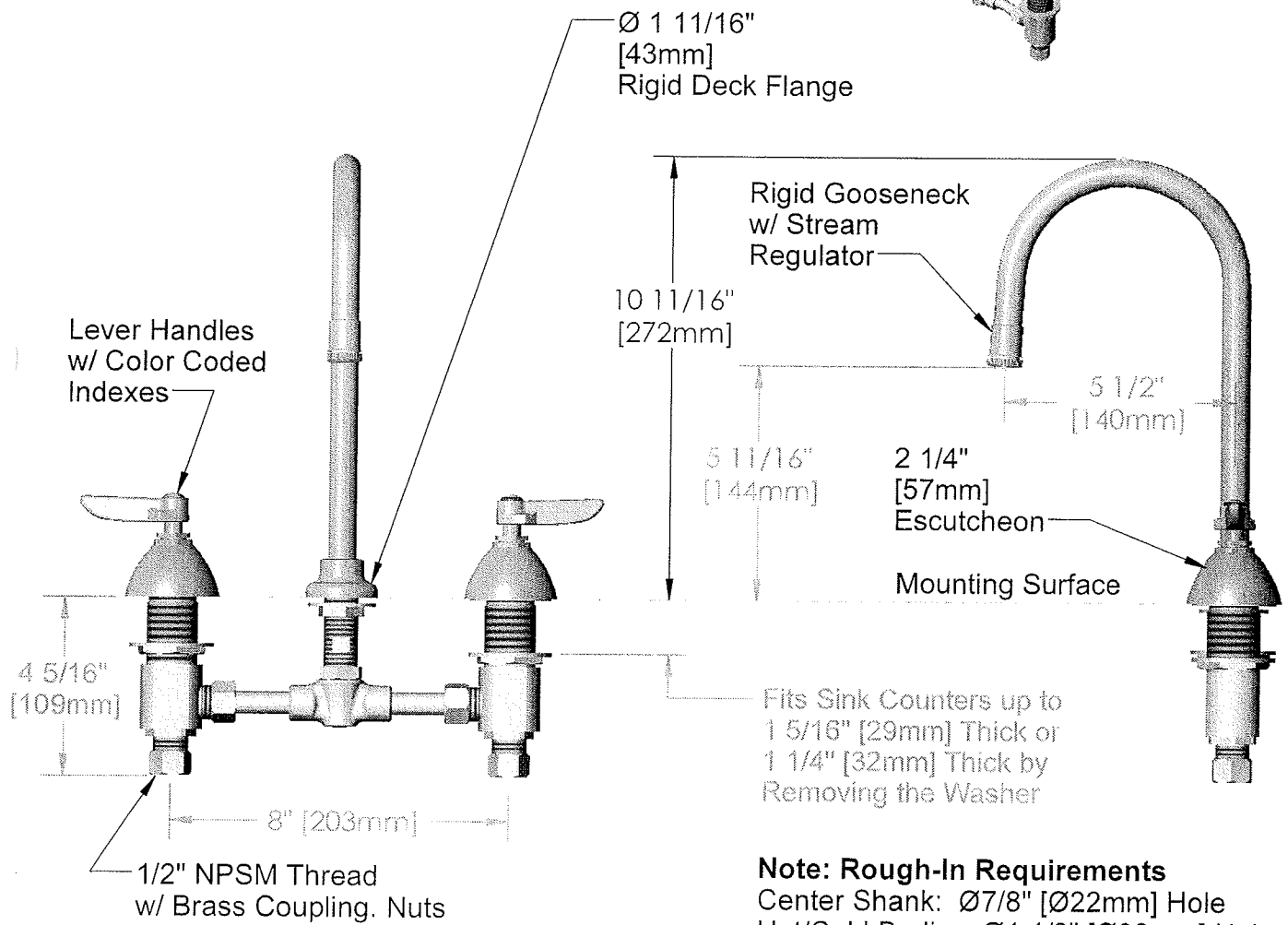
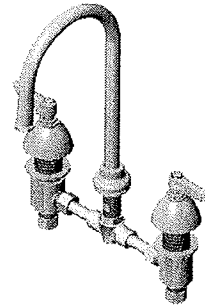
Customer/Wholesaler _____

Contractor _____

Architect/Engineer _____



ADA Compliant



Note: Rough-In Requirements

Center Shank: Ø7/8" [Ø22mm] Hole
Hot/Cold Bodies: Ø1 1/2" [Ø38mm] Hole
(Ø1 1/4" [Ø32mm] Minimum)

Product Specifications:

3" c/c Deck Mount Widespread Faucet
Eterna Cartridges, Lever Handles, Rigid Gooseneck w/ Stream Regulator

Drawn DHL	Checked MAV	Approved JHB
Scale: 1:4	Date: 4/20/07	



T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690



Model No.

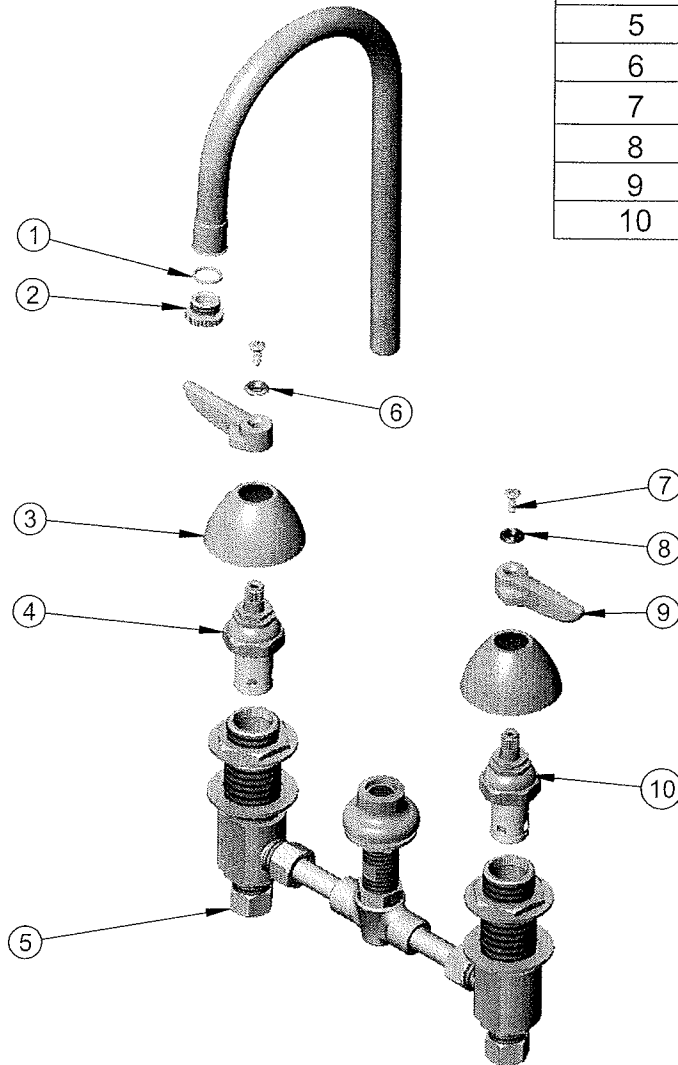
B-2850

REG. #A-2601
ISO #9001

Item No.

Travelers Rest, SC: 800-476-4103 Simi Valley, CA: 800-423-0150 Fax: 864-834-3518 www.tsbrass.com

ITEM NO.	SALES NO.	DESCRIPTION
1	009636-45	Washer
2	B-LT	Stream Regulator
3	001257-40	Bell Escutcheon
4	006478-40	Cartridge Asm, Hot
5	000958-20	Coupling Nut
6	001661-45	Red Index-HW
7	000922-45	Lever Handle Screw
8	001660-45	Blue Index-CW
9	001638-45	Lever Handle
10	006477-40	Cartridge Asm, Cold



Product Specifications:

c/c Deck Mount Widespread Faucet
Eterna Cartridges, Lever Handles, Rigid
Gooseneck w/ Stream Regulator

Drawn DHL	Checked MAV	Approved JHB
Scale: 1:4	Date: 4/20/07	



Limited One Year Warranty

T&S warrants to the original purchaser (other than for purposes of resale) that such product is free from defects in material and workmanship for a period of one (1) year from the date of purchase. During this one-year warranty period, if the product is found to be defective, T&S shall, at its options, repair and/or replace it. To obtain warranty service, products must be returned to...

*T&S Brass and Bronze Works, Inc.
Attn: Warranty Repair Department
2 Saddleback Cove
Travelers Rest, SC 29690*

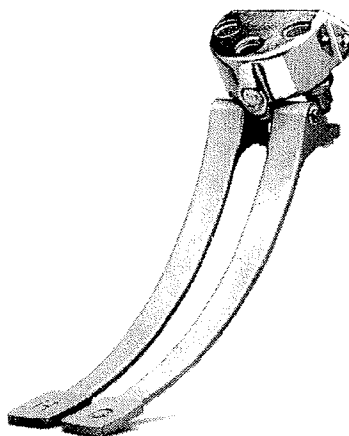
Shipping, freight, insurance, and other transportation charges of the product to T&S and the return of repaired or replaced product to the purchaser are the responsibility of the purchaser. Repair and/or replacement shall be made within a reasonable time after receipt by T&S of the returned product. This warranty does not cover items which have received secondary finishing or have been altered or modified after purchase, or for defects caused by physical abuse to or misuse of the product, or shipment of the products.

Any express warranty not provided herein, and any remedy for Breach of Contract which might arise, is hereby excluded and disclaimed. Any implied warranties of merchantability or fitness for a particular purpose are limited to one year in duration. Under no circumstances shall T&S be liable for loss of use or any special consequential costs, expenses or damages.

Some states do not allow limitations on how long and implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. Specific rights under this warranty and other rights vary from state to state.

P/N: 098-003116-45 Rev 3
Date: 11-08-01
Drawn: TEH
Checked: DLT 11-27-01
Approved: MVW 12-11-01

Installation and Maintenance Instructions



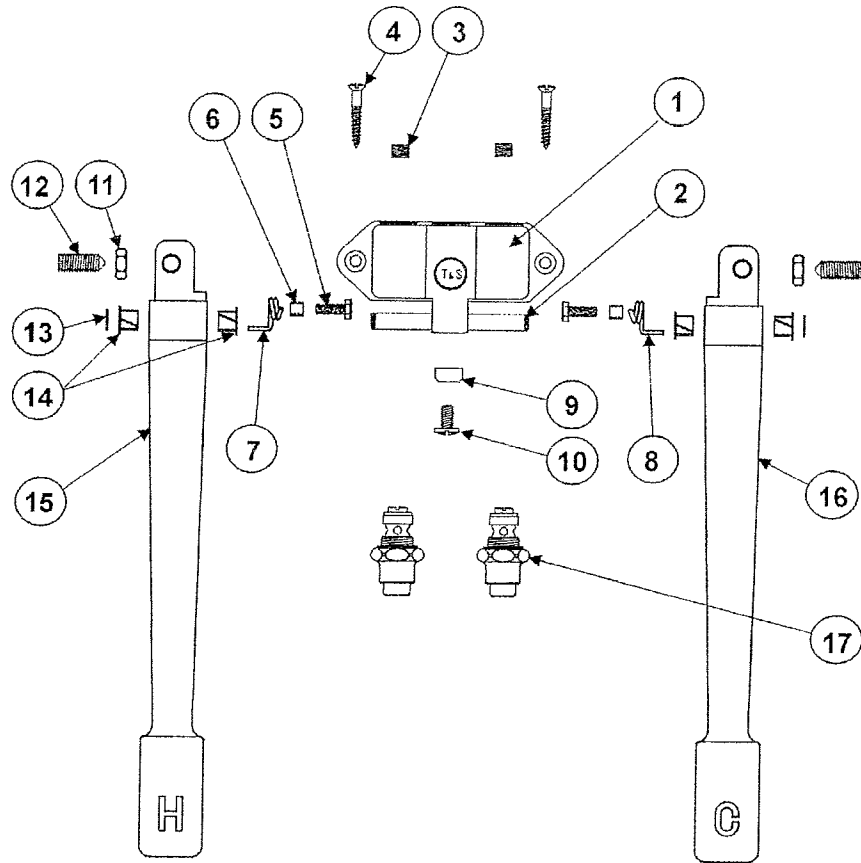
WALL MOUNTED FOOT PEDAL VALVE B-0504 and B-0508

Deutsch: Installations- und
Wartungsanleitungen

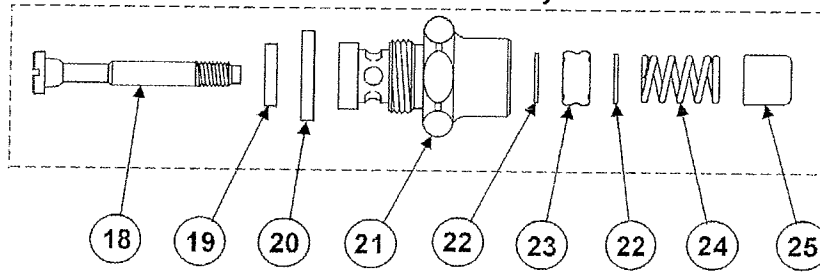
Español: la Instalación y las
Instrucciones de
Mantenimiento

Français: les Instructions
d'Installation et
d'Entretien

Exploded View



Bonnet Assembly



* Some items are listed for instructional purposes and may not be sold as separate parts.

Part Number Guide

Double Pedal Valve Assembly

1	Body, Double Pedal	*
2	Shaft	*
3	Socket Plug	*
4	Screw, Mounting	003749-45
5	Screw, S.S. Pedal Spring Retain	*
6	Spacer, Pedal Spring	*
7	Spring, LH Pedal Hot	000886-45
8	Spring, RH Pedal Cold	000887-45
9	Pad, Nylon	*
10	Screw, Nylon Pad	012523-45
11	Nut, Adjustable Screw Lock	000952-45
12	Set Screw, Adjustable	001123-45
13	Snap-Ring, Shaft	012512-45
14	Bushing	001602-45
15	Foot Pedal, L.H. Hot	*
16	Foot Pedal, R.H. Cold	*
17	Asm, Bonnet	005312-40

Bonnet Assembly - 005312-40

18	Stem, Valve	009306-20
19	Seat Washer	012915-45
20	Washer, Bonnet Binding	*
21	Bonnet	000608-25
22	Washer	000974-45
23	Packing Stem	001100-45
24	Spring	003690-45
25	Pushbutton	000753-25

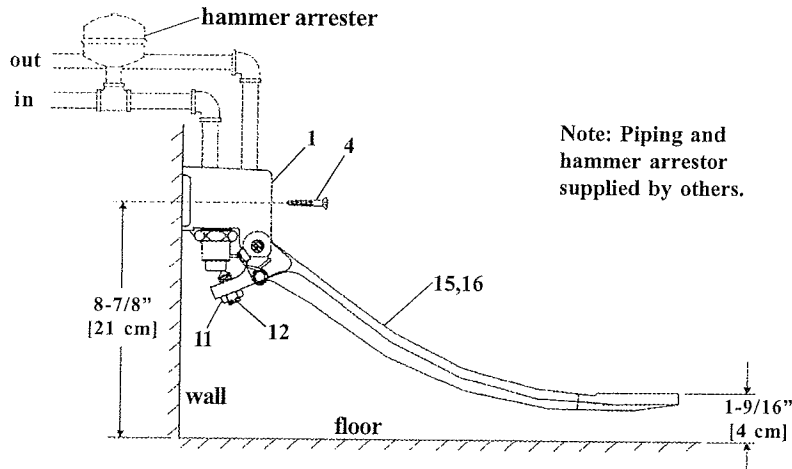
Note: Items 18-20 and 22-24 are included in the B-50-P parts kit.
Each item with a quantity of 4.

General Instructions

Installation:

1. Shut off water supply and drain lines.
2. Mount no. 1 assembly to wall with two no. 4's, no more than 8-7/8" [21 cm] from floor to center of mounting holes. (See illustration.)

Note: It is strongly recommended that each supply line be equipped with a hammer arrester installed per manufacturer's instructions. A typical installation is shown:



3. No. 15 and no. 16 can be raised to desired height by adjusting no. 12 with a screwdriver.

Note: Approximate height of no. 15 and no. 16 should be 1-9/16" [4 cm] from floor.

4. Apply Teflon Tape or pipe joint compound to threads of supply lines. Install two (2) inlets (hot and cold sides) and one (1) outlet. Connect supply lines with 1/2" NPT piping.
5. Turn on water and check for leaks.

Note: To order replacement parts for the bonnet assembly, order the B-50-P parts kit. (For repair of no. 17)

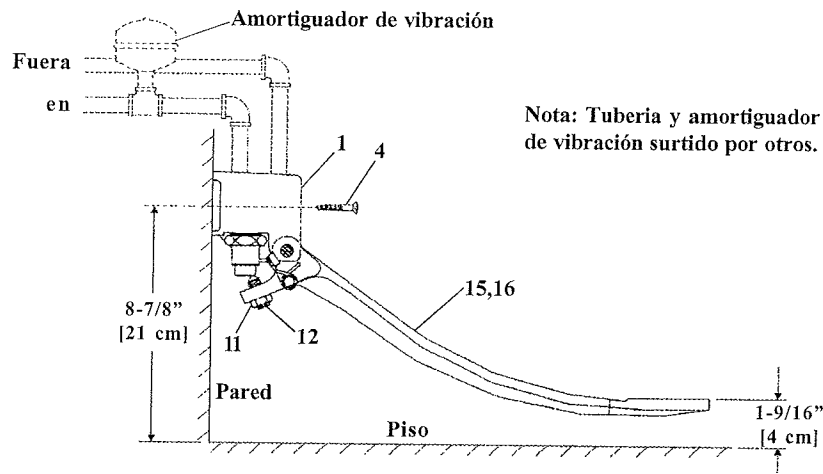
Most pedal valve installations will be similar, except B-0508 Single Pedal Valve has (1) one 1/2" NPT female inlet, and (1) one 1/2" NPT female outlet.

Instrucciones Generales

Instalación:

1. Cierre el surtido de agua y desagüe las tuberías.
2. Monte el ensamble No.1 a la pared con dos partes No.4, a una distancia de no más de 8-7/8" [21 cm] de el piso hasta el centro de los huecos de montadura. (Vea la ilustración)

Nota: Es altamente recomendado que cada línea de surtido sea equipada con amortiguador de vibración. Una instalación típica esta demostrada:



3. Las partes No.15 y No.16 se pueden levantar a una altura deseable ajustando la parte No.12 con un destornillador.

Nota: La altura aproximada de las partes No.15 y No.16 debe ser 1-9/16" [4 cm] de el piso.

4. Aplique cinta de Teflon ó compuesto de coyuntura a las roscas de las líneas de surtido. Instale (2) dos entradas (lados caliente y frío) y uno (1) de salida. Conecte las líneas de surtido con tubería de 1/2" NPT.

5. Abra el agua e inspeccione por filtraciones.

Nota: Para ordenar repuestos del ensamble de la cubierta, ordene el estuche de partes B-50-P. (Para el reparo de la parte No.17.)

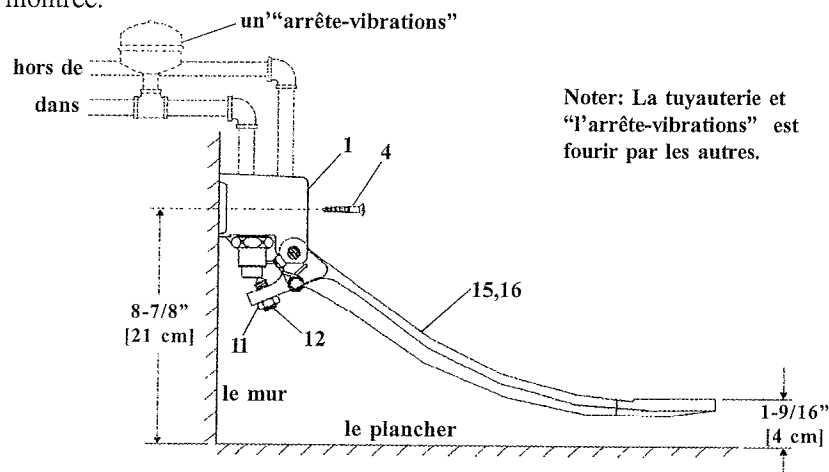
La instalación de la mayoría de las válvulas de pedal serán semejantes, excepto B-0508 válvula de pedal singular tiene (1) una entrada femenina de 1/2" NPT y (1) una salida femenina de 1/2" NPT.

Instructions Générales

L'Installation:

1. Fermer la réserve de l'eau et égoutter la tuyauterie.
2. Monter l'assemblage N°.1 au mur avec deux N°.4's, pas plus de 21cm du plancher au centre des trous montants. (Voir l'illustration).

Noter: On lui recommande vivement que chaque canalisation d'alimentation devrait être équipée d'un "arrête-vibrations". Une installation typique est montrée.



3. On peut lever N°.15 et N°.16 à la hauteur désirée en réglant N°.12 avec un tournevis.

Noter : La hauteur approximative de N°.15 et N°.16 doit être 4 cm du plancher.

4. Appliquer le ruban en Téflon ou le composé pour les tuyaux aux filets des tuyaux qui fournissent l'eau. Installer deux (2) arrivées (les côtés chauds et froids) et une (1) sortie. Brancher les tuyaux qui fournissent l'eau avec la tuyauterie 1/2" NPT.

5. Recommencer l'eau et vérifier s'il y a des fuites.

Noter: Pour commander les parties remplacements pour l'assemblage du capot, commander la trousse B-50-P (pour réparer N°.17).

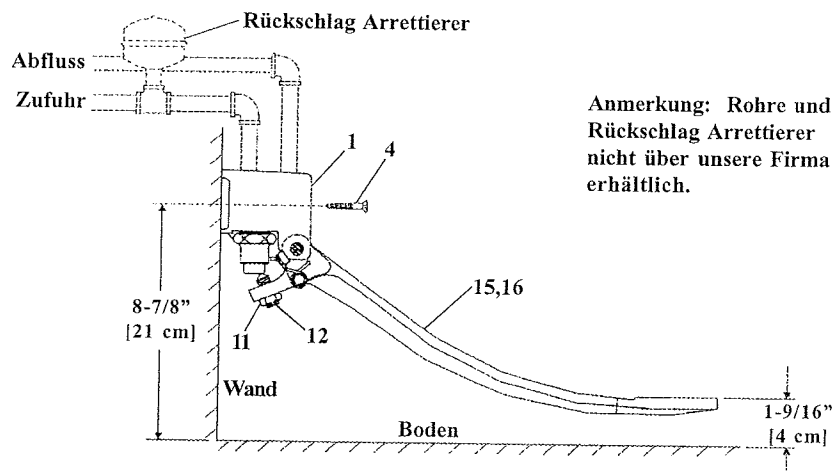
La plupart des installations des soupapes pédales aller être semblable, sauf la soupape pédale B-508 qui avoir (1) une arrivée féminine 1/2" NPT et (1) une sortie féminine 1/2" NPT.

Allgemeine Anleitungen

Installation:

1. Wasserzulauf absperrn und Leitungen entleeren.
2. Garnitur Nr. 1 mit zwei Schrauben Nr. 4 nicht höher als 21 cm vom Fußboden bis zur Mitte der Montagelöcher anbringen (siehe Abbildung).

Achtung: Es empfiehlt sich in jeder Wasserleitung einen Rückschlag Arretierier einzubauen. Typisch erfolgt der Einbau wie abgebildet:



3. Nr. 15 und Nr. 16 können auf die gewünschte Höhe angehoben werden, indem Nr. 12 mit einem Schraubendreher justiert wird.

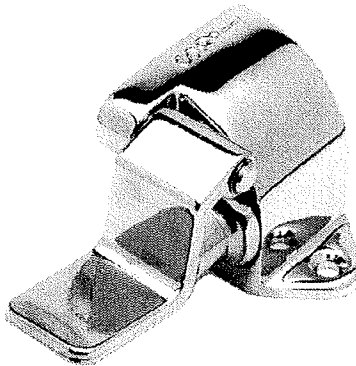
Anmerkung: Nr. 15 und Nr. 16 sollten ungefähr 4 cm vom Fußboden entfernt sein.

4. Teflonband oder Rohrdichtungsmasse auf das Gewinde der Zuflußleitungen auftragen. Zwei Zulaufrohre (warm und kalt) und ein Auslaufrohr installieren. Die Zuflußrohre mit 1,25 cm NPT-Rohren verbinden.
5. Wasserzulauf andrehen und auf Dichtigkeit prüfen.

Anmerkung: Ersatzteile für die Haubengarnitur sind in dem Ersatzteilsatz B-50-P enthalten (für die Reparatur von Nr. 17).

(Die meisten Pedalventilanlagen sind ähnlich mit der Ausnahme, daß das Pedalventil von B-0508 einen 1,25 cm NPT-Zulauf mit Innengewinde und einen 1,25 cm NPT-Auslauf mit Innengewinde hat.

RELATED T&S BRASS PRODUCT LINE



**B-0507
SINGLE PEDAL VALVE,
FLOOR MOUNTED**

T&S BRASS AND BRONZE WORKS, INC.

A firm commitment to application-engineered plumbing products

2 Saddleback Cove, P.O. Box 1088,
Travelers Rest, SC 29690

Phone: (864) 834-4102

Fax: (864) 834-3518

E-mail: tsbrass@tsbrass.com

T & S Brass-Europe
'De Veenhoeve'

Oude Nieuwveenseweg 84

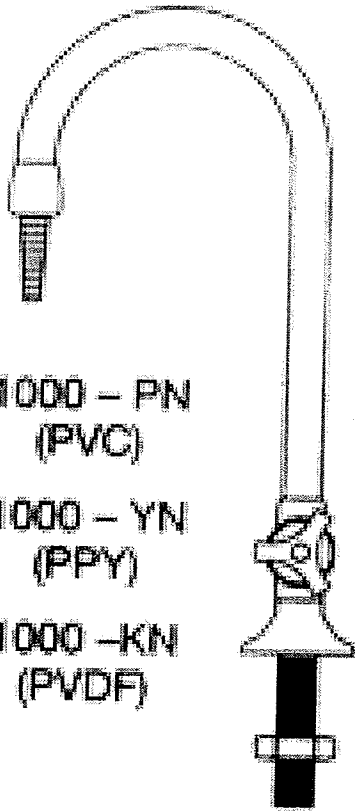
2441 CW Nieuwveen

The Netherlands



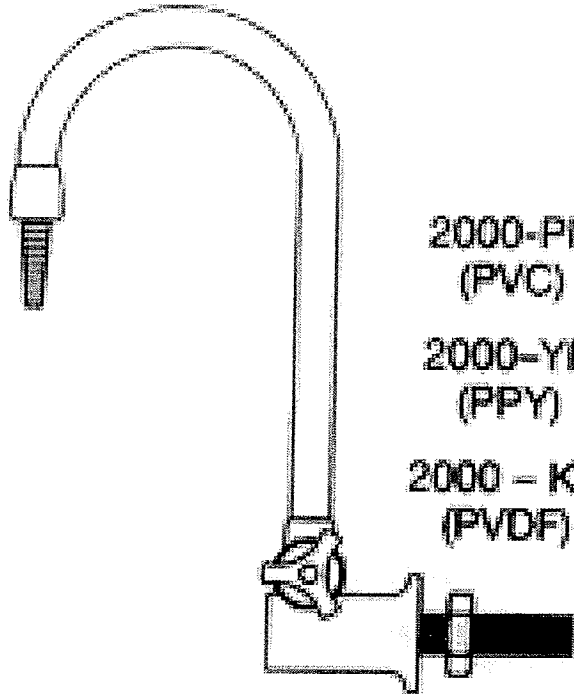
RELIABILITY BUILT IN™

DECK MOUNT



- 1000 - PN
(PVC)
- 1000 - YN
(PPY)
- 1000 - KN
(PVDF)

PANEL MOUNT

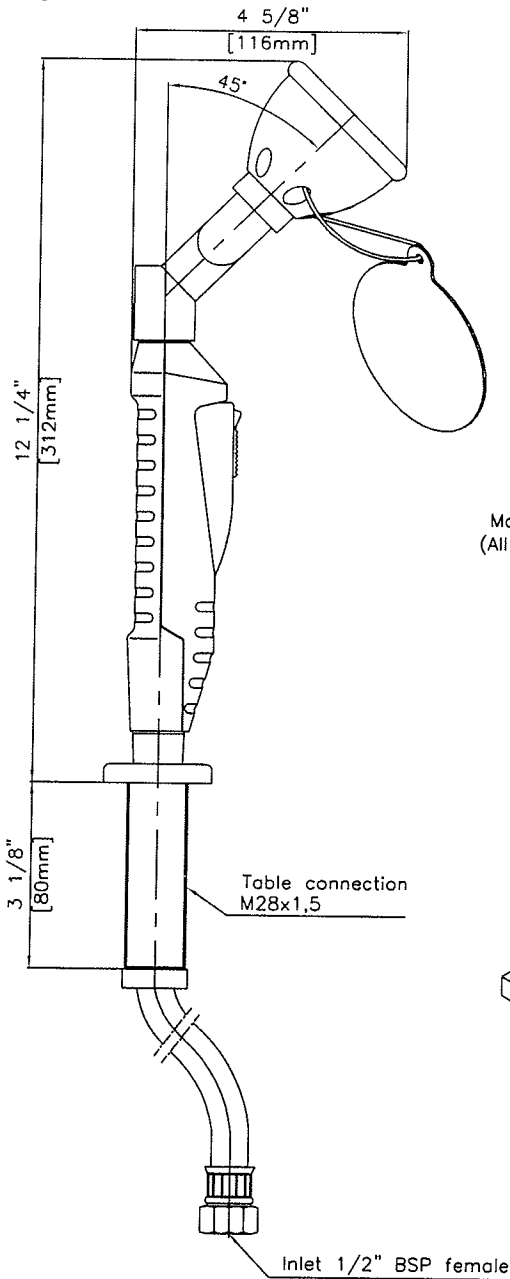


- 2000-PN
(PVC)
- 2000-YN
(PPY)
- 2000 - KN
(PVDF)

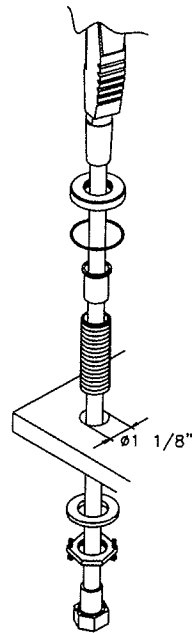
BROEN

17714000

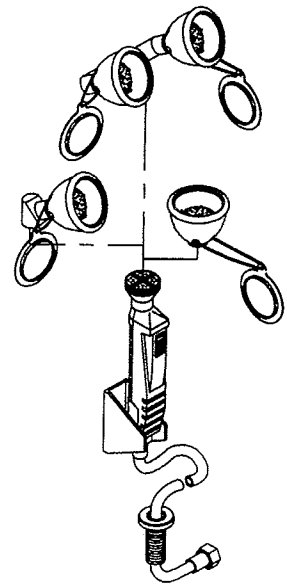
REDLINE Eye shower with two angled head, hand-held (table mount.)



Mounting information:
(All parts are included)



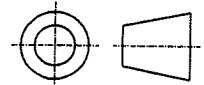
:Principal drawing:
shower combination



:Specifications:

Working pressure:	Min.: 22 psi – Max.: 102 psi.
Opening / closing function:	Trigger operated.
Flow:	Built-in FLOWFIX 1,6gpm (Upper limit contained by flowfix).
Overall material:	Polyaryamide, reinforced with glassfibres.
Materials with water contact:	
Metals:	Brass, CW 614N.
Eyecups:	EPDM rubber.
Dustcaps:	POM.
Inlet:	Female 1/2" BSP
Hose:	1/2" EPDM with stainless steel wiremesh

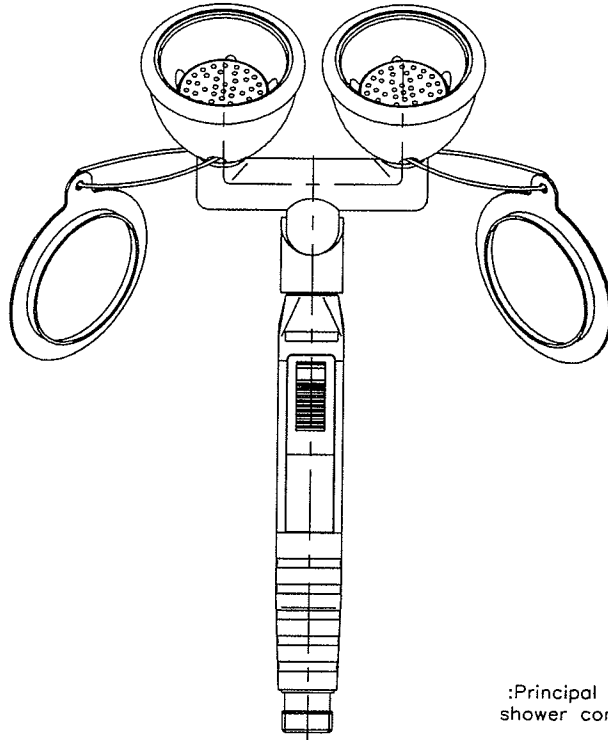
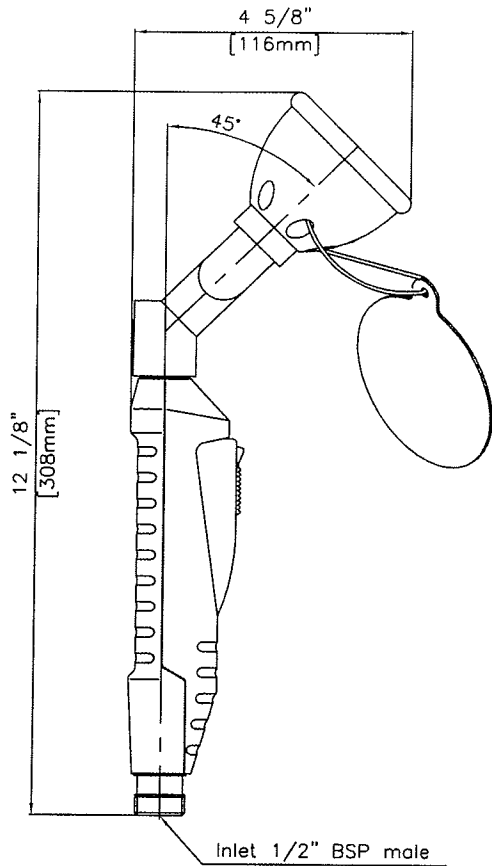
REDLINE showers is designed in accordance with ANSI Z 358.1-1998



BROEN

17715500

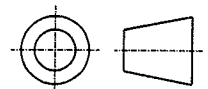
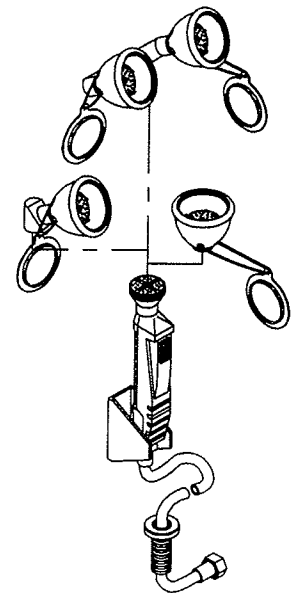
REDLINE Eye shower with two angled head, hand-held



:Principal drawing:
shower combination

:Specifications:

Working pressure:	Min.: 22 psi - Max.: 102 psi.
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Overall material:	Polyaryamide, reinforced with glassfibres.
Materials with water contact:	
Metals:	Brass, CW 614N.
Eyecups:	EPDM rubber.
Dustcaps:	POM.
Inlet:	Male 1/2" BSP



REDLINE showers is designed in accordance with ANSI Z 358.1-1998



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 09 A

DATE: 2/25/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: Blodgett Supply

MANUFACTURER: Varies

PRODUCT DESCRIPTION: Emergency Shower

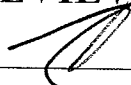
MODEL NUMBER: Haws 8100

SECTION NUMBER AND TITLE: 15440

PRODUCT DEVIATIONS: _____

REVISION/RESUBMITTAL IDENTIFICATION: _____

CONTRACTOR

REVIEWED BY NEASI	
PM	
DATE	_____

Drench Showers



8100

Check out the Haws 8100 drench shower with its use of an ABS showerhead ensures water is distributed at an optimal rate for the irrigation process. Outfitted with such safety features as the universal emergency sign and high visibility stripe this drench shower is easily spotted in emergency situations.

A great addition to multiple unsafe environments where the body may be exposed to corrosive materials.

Requires minimal maintenance and is equipped with test card to record weekly testing.

Reduces installation time because valve assembly is pre-built.

Solid construction from Schedule 40 hot-dipped galvanized steel make for one sturdy piece of corrosive resistant equipment.

Certified by CSA to meet the ANSI Z358.1 Standard for Emergency Eyewash and Shower Equipment.

Components:

Shower Head: Model 8129FC green ABS plastic 10-5/8" showerhead with integral 20 gpm flow control.

Shower Valve: Model SP260 chrome-plated brass stay-open ball valve, equipped with a stainless steel ball and stem. Full flow occurs with pull on lever. 1" IPS.

Pull Rod: Model SP200, 28" long stainless steel pull rod with triangular handle.

Mounting: Model SP75 gray powder-coated cast-iron 9" diameter floor flange with 1-1/4" IPS hot-dipped galvanized tee.

Universal Sign: Model SP177 vertical universal emergency shower sign. Size: 8" x 10-3/4".

High-Visibility Stripe: Model SP185 self-adhesive high visibility 21" long stripe in Safety Green and bright yellow.

Test This Week Tag: SP170 is a green waterproof test card with space for date and initials of inspector. Used to record weekly testing of emergency equipment.

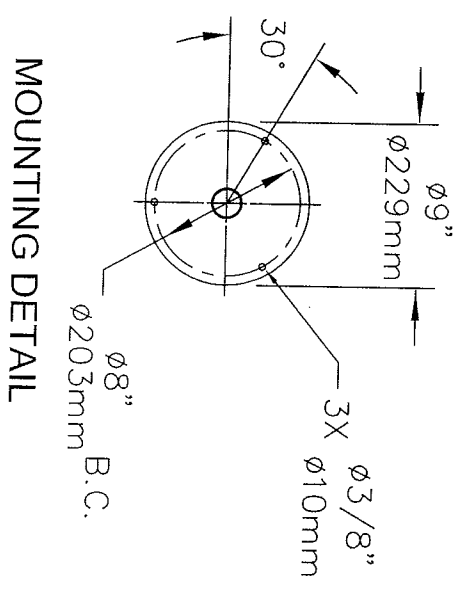
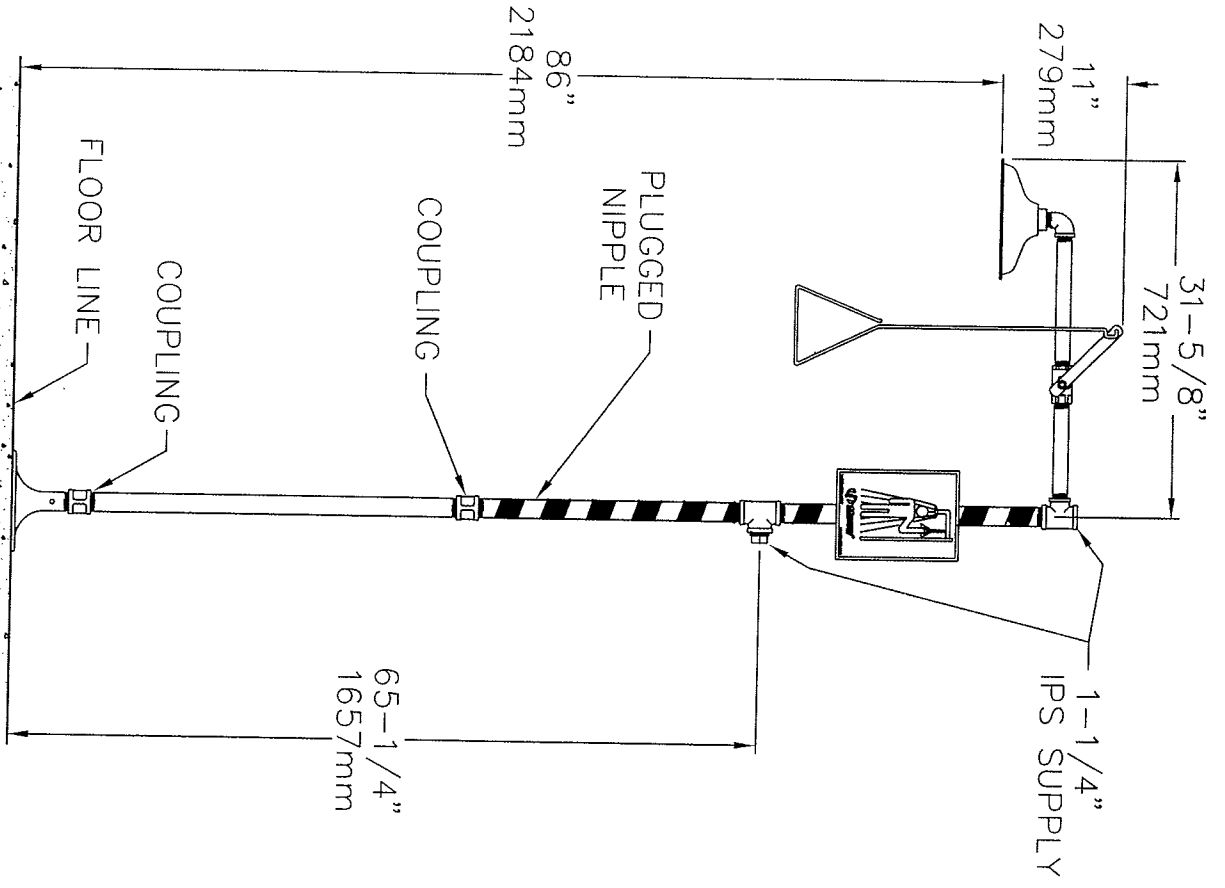


DISCLAIMER: Continued product improvements make specifications subject to change without notice. Check www.hawsco.com for the latest product information and updates.

1455 Kleppe Lane, Sparks, NV 89431
v.775.359.4712 f.775.359.7424
e. info@hawsco.com website. www.hawsco.com

25 February, 2008

THIS DOCUMENT IS TRUE AND CORRECT AT TIME OF PUBLICATION. CONTINUED PRODUCT IMPROVEMENTS MAKE SPECIFICATIONS AND MEASUREMENTS SUBJECT TO CHANGE WITHOUT NOTICE.



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Haws Corporation		INFO FAX : 1-888-FAX-HAWS (1-888-329-4297)	
1455 Kleppe Ln, Sparks, NV, 89431		Phone: 775-359-4712 Fax: 775-359-7424	
Haws Ag, Bochrweg 3 CH-3401 Burgdorf, Switzerland		Haws Mfg Pte Ltd 74 Sungei Kodul Loop Singapore 729531	
e-mail: HOWS@HOWSCO.COM		website: WWW.HOWSCO.COM	
FOR NO.:	REVISION:	MODEL(S):	DATE:
8100 DRENCH SHOWER	8100 DRENCH SHOWER	8100 DRENCH SHOWER	00020R0105.D
SCALE: 1/8"	SCALE: 1/8"	SCALE: 1/8"	SCALE: 1/8"
DATE: 09/01	DATE: 09/01	DATE: 09/01	DATE: 09/01
DESIGNER:	DESIGNER:	DESIGNER:	DESIGNER:
SCALE: 1/8"	SCALE: 1/8"	SCALE: 1/8"	SCALE: 1/8"
DATE: 09/01	DATE: 09/01	DATE: 09/01	DATE: 09/01
REV: 1	REV: 1	REV: 1	REV: 1



INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

1455 Kleppe Lane ♦ Sparks, NV 89431-6467 ♦ (775) 359-4712 ♦ Fax (775) 359-7424
HAWS AG ♦ Bachweg 3 ♦ CH-3401 Burgdorf ♦ Switzerland
Haws Mfg. Pte Lt. ♦ 2A Sungei Kadut Drive ♦ Singapore 729554
Avlis-Avenida Senador, Testonio Vilela ♦ 505 Jardim Aeroporto ♦ Itu, S.P. 13304-550 ♦ Brasil
E-mail: haws@hawsco.com ♦ website: www.hawsco.com

No. 2080105 (6)

Model 8100 Drench Shower

NOTE TO INSTALLER: Please leave this information with the Maintenance Department.

LIMITED WARRANTY

HAWS® warrants that all of its products are guaranteed against defective material or poor workmanship for a period of **one year from date of shipment**. HAWS liability under this warranty shall be discharged by furnishing without charge F.O.B. HAWS Factory any goods, or part thereof, which shall appear to the Company upon inspection to be of defective material or not of first class workmanship, provided that claim is made in writing to company within a reasonable period after receipt of the product. Where claims for defects are made, the defective part or parts shall be delivered to the Company, prepaid, for inspection. HAWS will not be liable for the cost of repairs, alterations or replacements, or for any expense connected therewith made by the owner or his agents, except upon written authority from HAWS, Sparks, Nevada. HAWS will not be liable for any damages caused by defective materials or poor workmanship, except for replacements, as provided above. Buyer agrees that Haws has made no other warranties either expressed or implied in addition to those above stated, except that of title with respect to any of the products or equipment sold hereunder and that HAWS shall not be liable for general, special, or consequential damages claimed to arise under the contract of sale.

The emergency equipment manufactured by HAWS is warranted to function if installation and maintenance instructions provided are adhered to. The units also must be used for the purpose, which they were intended. This product is intended to supplement first-aid treatment. Due to widely varying conditions HAWS cannot guarantee that the use of this emergency equipment will prevent serious injury or the aggravation of existing or prior injuries.

NO OTHER WARRANTIES EXPRESSED OR IMPLIED ARE AUTHORIZED, PROVIDED OR GIVEN BY HAWS.

SHOULD YOU EXPERIENCE DIFFICULTY WITH THE INSTALLATION OF THIS MODEL, PLEASE CALL:

1-800-766-5612

FOR PARTS CALL:

1-800-758-9378

(U.S.A. AND CANADA ONLY) MONDAY-THURSDAY: 6:00 A.M. – 4:00 P.M. PST
FRIDAY: 6:00 A.M – 1:00 P.M. PST

LOCATION OF UNIT: The Model 8100 Emergency Shower should be installed in close proximity to potential accident areas. It should be clearly identified, free from obstructions and easy to access.

SUPPLY LINE: The minimum recommended line size is 1-1/4 NPT with 30-90 psi (2-6 ATM) flowing pressure. Where sediment or mineral content is a problem, an inlet filter is recommended.

PLUMBING CONNECTIONS: Inlet supply connection is female 1-1/4 NPT.

INSTALLATION PROCEDURE

Refer to Installation Drawing for clarification. Check parts list to insure all required parts are included. Use pipe joint sealant PST #565 (Loctite) on all connections.

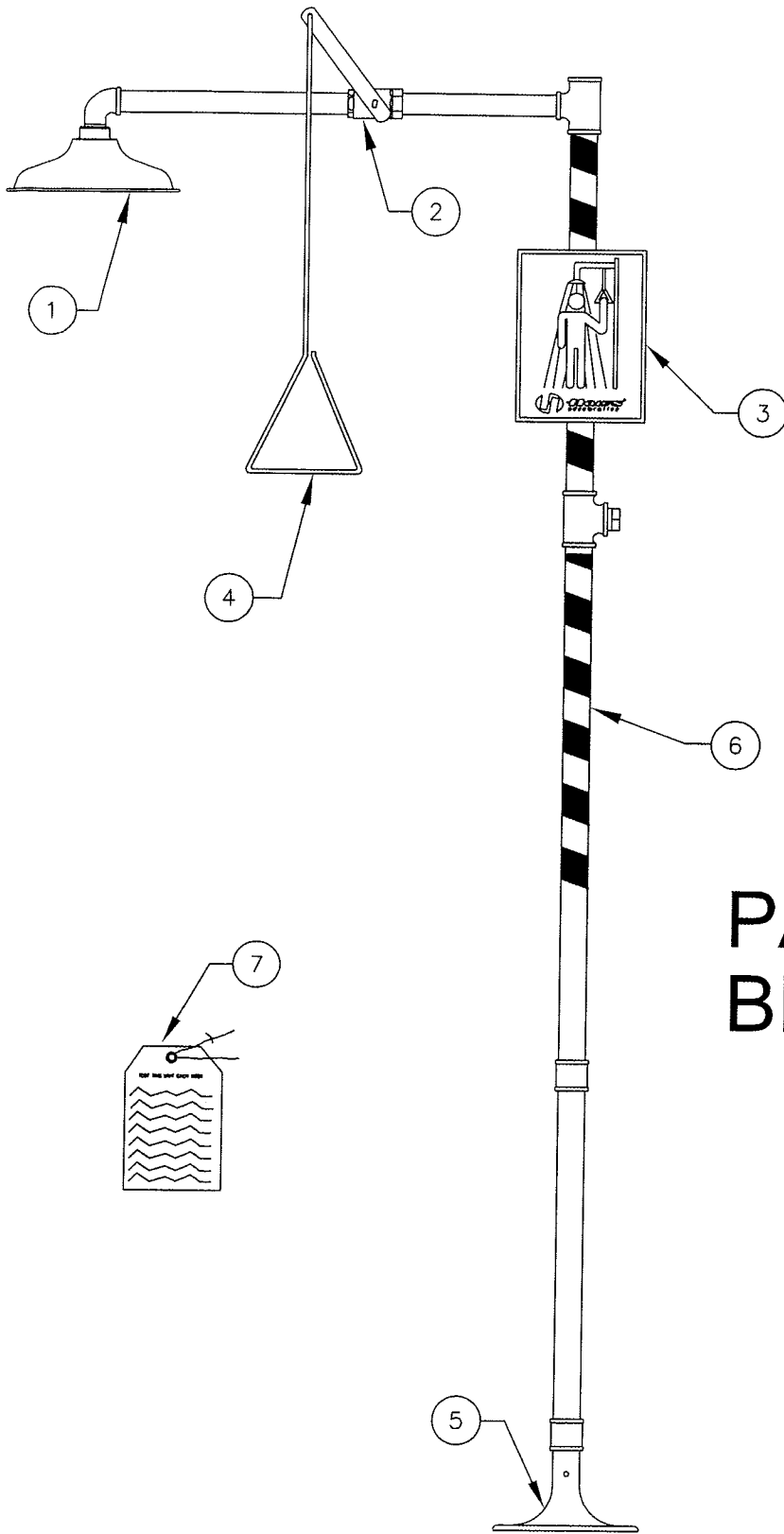
- STEP 1:** Prepare the emergency shower foundation by using the floor flange assembly as a template. Locate the three holes for the 3/8-16 UNC x 6 anchor bolts (not supplied). They should extend 1 above the floor level.
- STEP 2:** Once the concrete foundation is ready (dry), assemble the floor flange assembly to the anchor bolts; then securely fasten with 3/8-16 UNC Hex Nuts and 3/8 washers (not supplied). Seal and tighten floor flange and coupling making certain the foot control holes are facing side to side.
- STEP 3:** Assemble nipple (1-1/4 x 33) to the floor flange assembly and tighten with a pipe wrench.
- STEP 4:** Assemble in the following order:
Attach intermediate coupling to nipple (1-1/4 x 33)
Attach plugged nipple (1-1/4 x 24) and tee (1-1/4) onto the coupling.
Attach nipple (1-1/4 x 24) onto the tee.
Attach tee (1-1/4 x 1-1/4 x 1) onto nipple.
Attach nipple (1 x 9) valve assembly onto tee (1-1/4 x 1-1/4 x 1)
Attach street elbow (1) and nipple (1 x 12-1/2) onto valve.
- STEP 5:** Attach the showerhead onto street elbow (1).
- STEP 6:** Assemble the sign onto the unit. Use the strap, screws, washers and nuts provided to mount the sign onto the upright. The sign should be positioned for maximum visibility
- STEP 7:** Insert the galvanized plug into the optional supply line tee that is not used. Before connecting the supply water line to the emergency shower, **FLUSH THE LINE THOROUGHLY.**

TROUBLESHOOTING	
PROBLEM	REPAIR CHECKLIST
1. No flow.	1. Check the main shut-off valve.
2. Water leak between joints or fittings.	2. Tighten loose connections. If leak persists, the application of hot water will sometimes reseal improperly applied joint compound. After 30 minutes wait and retest, a persistent leak will necessitate reassembly and additional sealant.
3. Insufficient water flow at shower.	3. a. Verify minimum 30 psi (2 ATM) flowing supply line pressure. b. Probable clogging of flow control inside showerhead. Unscrew showerhead off of elbow and clean rubber flow control.
4. Water does not drain properly.	4. Check your drain system for debris. Check the main waste line of your building to see if it does handle the capacity required for the entire drainage system.

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THIS DOCUMENT IS TRUE AND CORRECT AT TIME OF PUBLICATION. CONTINUED PRODUCT IMPROVEMENTS MAKE SPECIFICATIONS AND MEASUREMENTS SUBJECT TO CHANGE WITHOUT NOTICE.

ITEM	DESCRIPTION
1	8129FC SHOWER HEAD
2	SP260 VALVE ASSEMBLY
3	SP177 SHOWER SIGN
4	SP200 PULL ROD
5	SP75 FLOOR FLANGE
6	SP185 STRIPED POLE TAPE
7	SP170 TEST TAG



PARTS BREAKDOWN

WHEN ORDERING PARTS PLEASE SPECIFY YOUR MODEL NUMBER

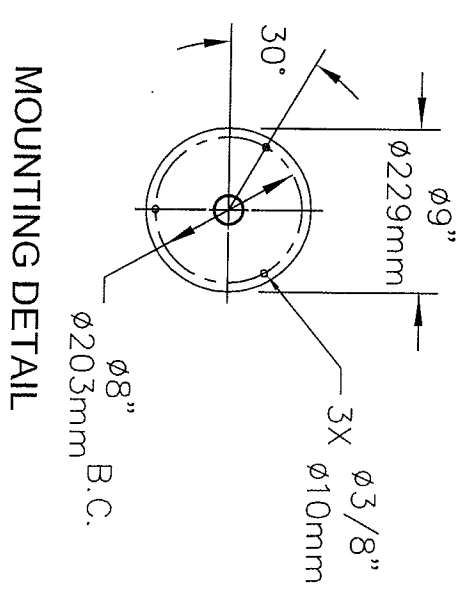
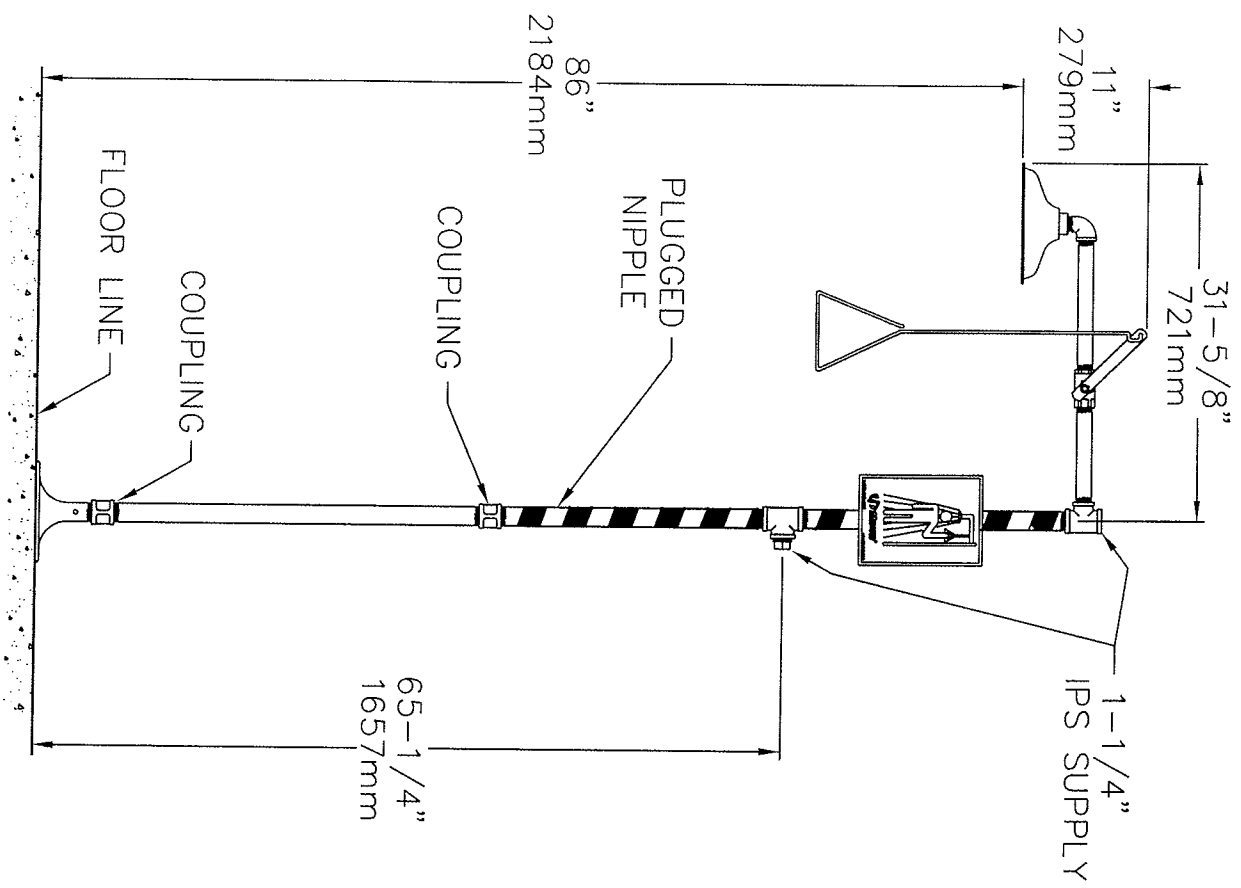


1455 KLEPPE LANE
SPARKS, NEVADA

BACHWEG 3
CH3401 BURGDORF
SWITZERLAND

DRAWN BY: CLF	DATE: 03/08/93	CHECK BY:	APPROV BY:	SCALE: 1/8
TITLE: 8100 DRENCH SHOWER			PART NUMBER: 0002080105	
DRAWING TYPE: PARTS BREAKDOWN			DRAWING NUMBER: 11471C00	
				REV: 6

REV	DESCRIPTION	ECN	DATE	BY/APVD
REVISIONS				

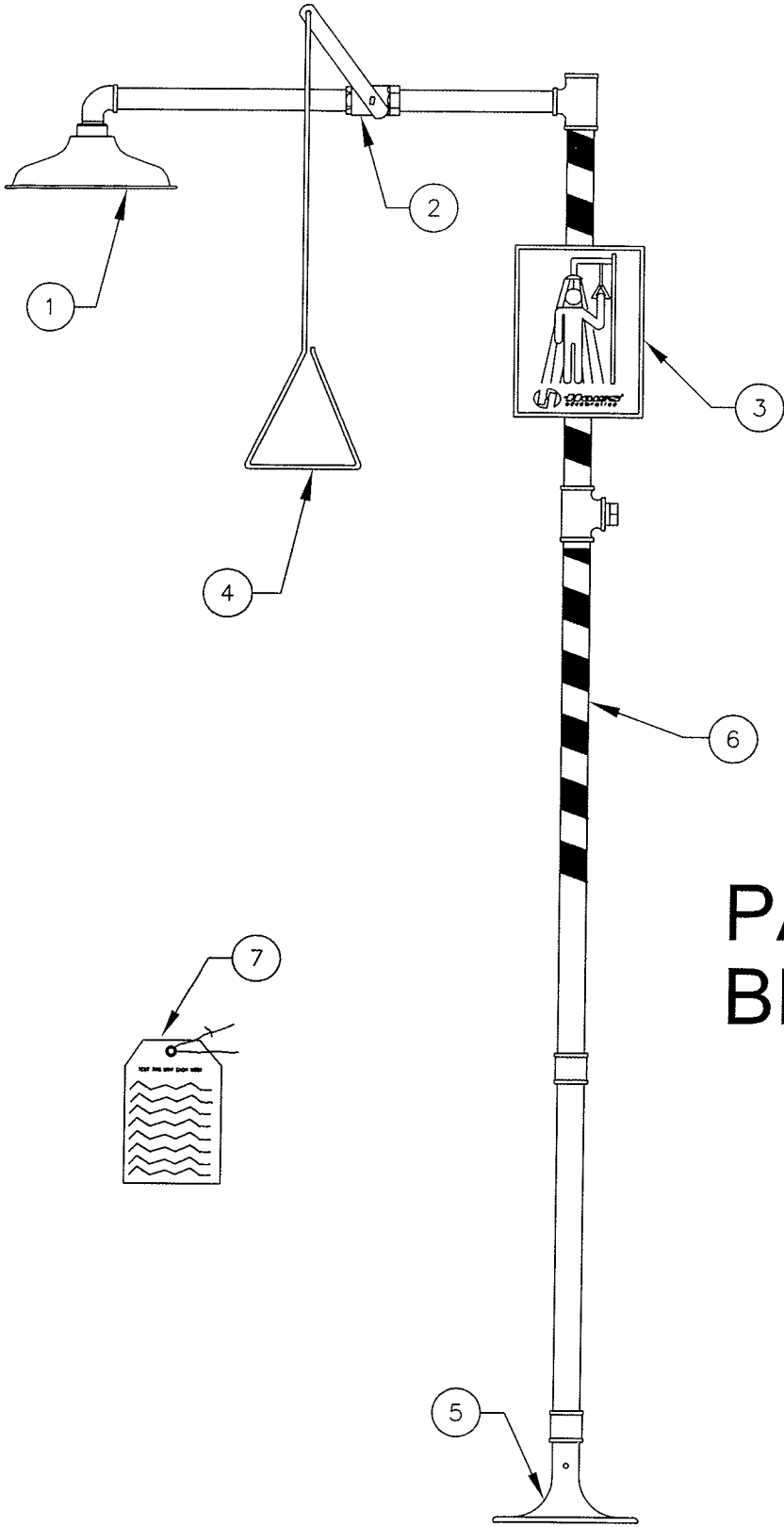


DOC NO 09458A00


HAWS corporation		INFO FAX : 1-888-FAX-HAWS (1-888-329-4297)	
1453 Kleppe Ln, Sparks NV, 89431		Phone: 775-359-4712 Fax: 775-359-7424	
Haws Mg Pte Ltd 74 Sungei Kodut Loop Singapore 729531		Haws Mg Pte Ltd 74 Sungei Kodut Loop Singapore 729531	
e-mail: Haws@hawsco.com		e-mail: Haws@hawsco.com	
www.hawsco.com		www.hawsco.com	
FOR INFO	FOR ORDER	FOR ORDER	FOR ORDER
PHONE	PHONE	PHONE	PHONE
FAX	FAX	FAX	FAX
MODEL(S)	MODEL(S)	MODEL(S)	MODEL(S)
8100 DRENCH SHOWER	8100 DRENCH SHOWER	8100 DRENCH SHOWER	8100 DRENCH SHOWER
SCALE: 3/16	SCALE: 3/16	SCALE: 3/16	SCALE: 3/16
DATE	DATE	DATE	DATE
08/91	08/91	08/91	08/91
REV	REV	REV	REV
01	01	01	01
092	092	092	092
1 OF 1	1 OF 1	1 OF 1	1 OF 1

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2	SP260 VALVE ASSEMBLY
3	SP177 SHOWER SIGN
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6	SP185 STRIPED POLE TAPE
7	SP170 TEST TAG



PARTS BREAKDOWN

WHEN ORDERING PARTS PLEASE SPECIFY YOUR MODEL NUMBER			1455 KLEPPE LANE SPARKS, NEVADA	BACHWEG 3 CH-3401 BURGDORF SWITZERLAND	
	DRAWN BY: CLF	DATE: 03/08/93	CHECK BY:	APPROV BY:	SCALE: 1/8
	TITLE: 8100 DRENCH SHOWER			PART NUMBER: 0002080105	
DRAWING TYPE: PARTS BREAKDOWN			DRAWING NUMBER: 11471C00		REV. 6

**Submittal Transmittal
Cover Sheet**



**UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont**

Project #07210

Date: 2/13/08

Transmitted To

Randy Chicoine
New England Air System

Transmitted By

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext. 2
Fax: 802-863-8734

Package Transmitted For

15440

Delivered Via

Mail

**Submittal Information
Specification Section**

15440

Intended Use

Foot Valve and Owner Sink

Purchase Order #

Owner's tag or identification number

Date

2/7/08

Date	Qty	Description
2/7/08	1	Foot Valve and Owner Sink

CC: Company

Contact Name

Copies Notes

University of Vermont	Myron Wheeler	1
IDC Architects	Elsa Yost	1
University of Vermont	Michael Stevens	1

Remarks

Please find 15440 Foot Valve and Owner Sink Submittal- Make Corrections Noted.



CH2MHILL

Submittal Reply Form

Client: University of Vermont

Date: February 11, 2008

Project name: Delehanty Cosmogenic Nuclide Lab

Location: Burlington, VT

IDC project number: 364972

To: ReArch Company

From: Elsa Yost/CH2M Hill

Attention: Bert DeLaBruere

Reference Specification Section 15440

With reference to your Submittal No. 002-000

Submittals are dated Feb. 8, 2008, we are taking the following action.

Description	No Exceptions Noted	Make Corrections Noted	Revise and Resubmit	Submit Specified Item
1. Foot Valve and Owner Sink		XXXX		
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Remarks:

See attached sheet(s) for additional comments.

cc: File

By:

Elsa Yost

Submittal Transmittal
Cover Sheet



UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont

Project #07210

Date: 2/8/08

Transmitted To

Michael Warren
IDC Architects

Transmitted By

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext. 2
Fax: 802-863-8734

RECEIVED

FEB 08 2008

CH2M HILL PGH

Package Transmitted For

Review/ Approval

Delivered Via

Email

Submittal Information

Specification Section 15440
Intended Use Foot Valve and Owner Sink
Purchase Order #
Owner's tag or identification number
Date 2/7/08

Date	Qty	Description
2/7/08	1	Foot Valve and Owner Sink

CC: Company	Contact Name	Copies	Notes
University of Vermont	Myron Wheeler	1	
IDC Architects	Elsa Yost	1	
University of Vermont	Michael Stevens	1	

Remarks

RECEIVED

FEB 08 2008

CH2M HILL PGH



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

- NO EXCEPTIONS NOTED
- MAKE CORRECTIONS NOTED
- REVISE AND RESUBMIT
- SUBMIT ITEMS AS NOTED

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any Action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the jobsite, fabrication processes and techniques of construction, coordination of the work with that of all other trades and the satisfactory performance of the work.

By: *[Signature]*
 Dated: 02/11/08



SUBMITTAL # 11
 DATE: 2/7/08
 PREVIOUS SUBMISSION DATE: N/A
 PROJECT NUMBER: O-200212
 PROJECT NAME: UVM Delehanty Hall
 CONTRACTOR: ReArch Company
 SUPPLIER: FFV

MANUFACTURER: FFV

PRODUCT DESCRIPTION: Foot Valve for SK-1 & owners lab sinks

ReArch Company

MODEL NUMBER: FFV-2000

SECTION NUMBER AND TITLE: 15440 3.0

Submittal and Shop Drawings

Received 2/8/08

Reviewed

PRODUCT DEVIATIONS: N/A

REVISION/RESUBMITTAL IDENTIFICATION: _____

[Signature]
Signature, Title

2/08/08
Date

CONTRACTOR _____

REVIEWED BY NEASI

PM *[Signature]*

DATE 2/7/08

\\DEXTER\shared\shjjobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 11 Foot valve.doc



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 11

DATE: 2/7/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: FFV

MANUFACTURER: FFV

PRODUCT DESCRIPTION: Foot Valve for SK-1 & owners lab
sinks

MODEL NUMBER: FFV-2000

SECTION NUMBER AND TITLE: 15440 3.0

PRODUCT DEVIATIONS: N/A

REVISION/RESUBMITTAL IDENTIFICATION: _____

CONTRACTOR

REVIEWED BY NEASI

PM [Signature]

DATE 2/7/08

\\DEXTER\shared\shjjobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 11 Foot valve.doc

Faucet Foot-Valve FFV-2000

SPECIFICATIONS:

Faucet Foot-Valve FFV-2000 is made of tumbled aluminum with an inner core of high density polyethylene.

Separate pedals for hot and cold water.

Dimensions: 1 1/2"L x 3 5/16"W x 1 3/4"H.

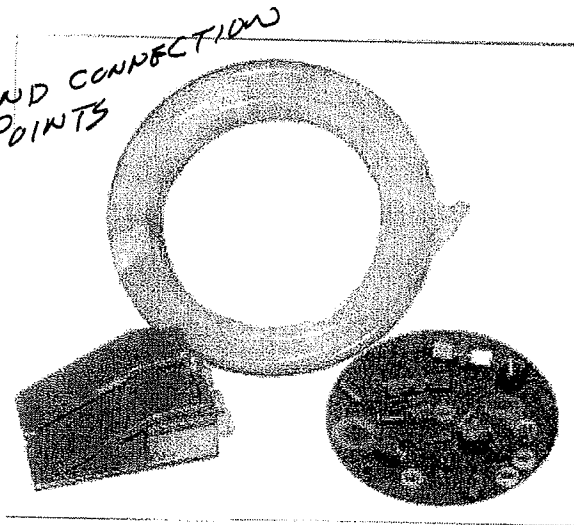
Water pressure activated.

Tubing is 1/8 inch of low density polyethylene.

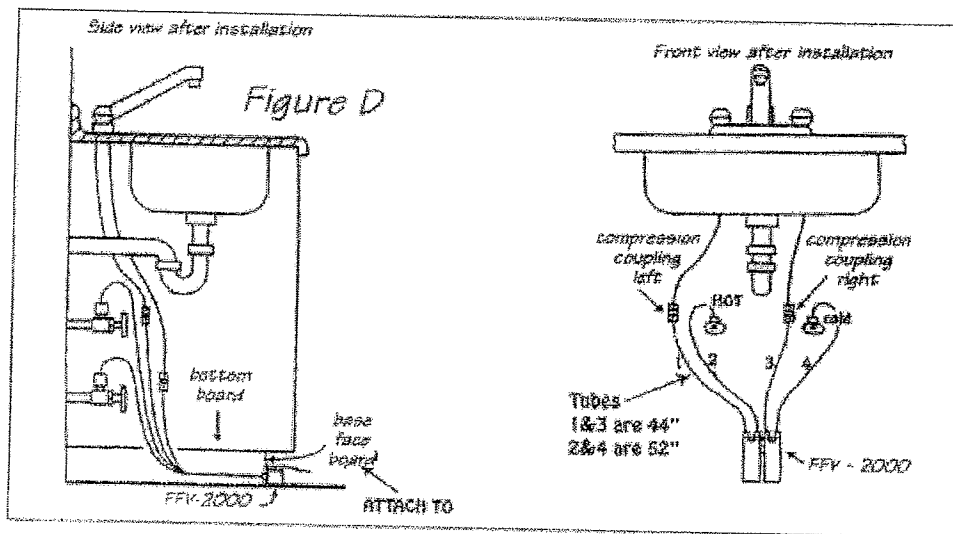
Hardware is brass.

Limited three year warranty.

Hot / Cold water supply:
Minimum water pressure 30 PSI
Maximum water pressure 100 PSI

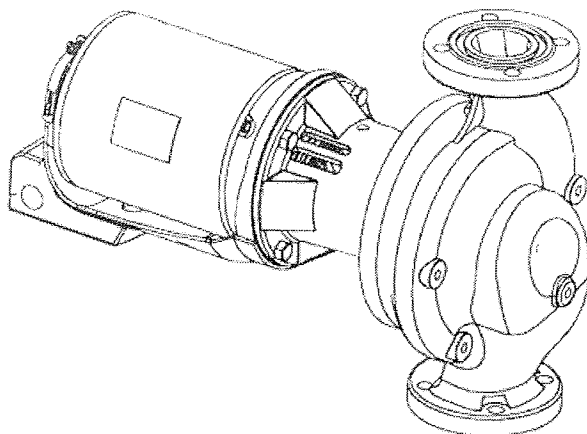


When the FFV-2000 is installed, the water pressure brings the valves up. To turn the water on, step on the valve, to stop -- step off, water stops immediately. Water keeps the valve lubricated so there is nothing to wear out. Water flow is regulated by the pressure of your foot. Saves between 20 to 50 percent of your water use, depending on the size of the office or family.



Manufactured by: Stream Industries
Distributed by: Water Saving Foot Pedals, 1961 Wildflower Lane, Clarkdale, AZ. 86324-3620
Phone 928-254-1083

The picture to the right shows the FFV-2000 installed under the sink inside a cabinet. You don't lose any cabinet space since everything is kept out of the way. Easy to install and it takes about an hour. The tubing is 3/8's low density polyethylene. **Click on the picture to enlarge it.**



Series 60[®] In-Line Centrifugal Pumps Maintenance Free

Installation, Operation and Service Instructions

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

DESCRIPTION

The Series 60 Maintenance Free pump is the culmination of compact design, quiet operation and, of course, Bell & Gossett quality. The compact design of the Series 60 centrifugal pump facilitates direct in-line mounting. Permanently lubricated pump and motor bearings enable years of maintenance free operation. The back pull-out design eases all service operations. The combination of these features make the Series 60 ideal for many primary and secondary applications.

The Series 60 is available in sizes from 1" to 2" to meet a range of system pipe specifications. Equally versatile is the Series 60's availability at several power levels – ranging from 1/4 to 3 HP at 1750 RPM.



Your Series 60 Pump should have this warning label affixed to the motor near the conduit box cover. If this warning is missing or illegible, contact your local Bell & Gossett Representative for a replacement.

SAFETY INSTRUCTION

This safety alert symbol will be used in this manual and on the pump instruction decal to draw attention to safety related instructions. When used, the safety alert symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.

OPERATIONAL LIMITS

Unless special provisions have been made for your pump by Bell & Gossett, the operational limits for Series 60 Pumps are as follows:

Maximum Working Pressure:
175 PSI.

Pump Construction:
Bronze Fitted or All Bronze
Standard Mechanical Seal

Motors:
208-230/460 Volts – Three Phase
115/230 Volts – Single Phase
(w/built-in overload protection)


Mechanical Seal:
Standard: Buna/Carbon/Ceramic – PH Limitations 7-9;
Temperature Range: -20 to +225°F
Optional: EPR/Carbon/Tungsten – PH Limitations 7-11;
Temperature Range: -20 to +250°F
Optional: Viton/Carbon/Ceramic – PH Limitations 7-9;
Temperature Range: -20 to +225°F


PUMP APPLICATION

Bell & Gossett Centrifugal Pumps may be used for hydronic heating and cooling systems, domestic water, industrial applications and general service operations. Bell & Gossett recommends that all bronze constructed pumps be used for pumping potable water. This pump is for indoor use only.


SAFETY REQUIREMENTS


ELECTRICAL SAFETY

 **WARNING: Electrical Shock Hazard**
Electrical connections are to be made by a qualified electrician in accordance with all applicable codes, ordinances and good practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.


 **WARNING: Electrical Overload Hazard**
Three phase motors must have properly sized heaters to provide overload and under voltage protection. Single phase motors have built-in overload protectors. Failure to follow these instructions could result in serious personal injury, death and/or property damage.


THERMAL SAFETY


 **WARNING: Extreme Temperature Hazard**
If the pump, motor, or piping are operating at extremely high or low temperatures, guarding or insulation is required. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

 **WARNING: Hot Water Hazard**
When disassembling a gasketed joint, always use a new gasket upon reassembly. NEVER RE-USE OLD GASKETS. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

MECHANICAL SAFETY

 **WARNING: Unexpected Startup Hazard**
Disconnect and lockout power before servicing. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

 **WARNING: Excessive System Pressure Hazard**
The maximum working pressure of the pump is listed on the nameplate – DO NOT EXCEED THIS PRESSURE. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

 **WARNING: Excessive Pressure Hazard – Volumetric Expansion**
The heating of water and other fluids causes volumetric expansion. The associated forces may cause failure of system components and release of high temperature fluids. This will be prevented by installing properly sized and located compression tanks and pressure relief valves. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

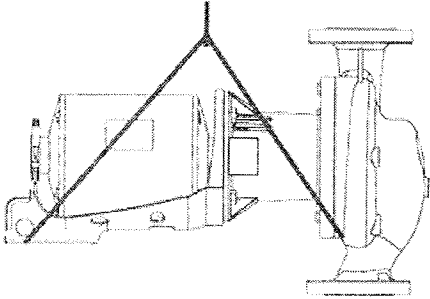
PUMP INSTALLATION

PUMP SUPPORT AND LOCATION

The Bell & Gossett Series 60 pump should be installed where there will be sufficient room for future inspection and service. It is highly recommended that service (isolation) valves be installed on each side of the pump to facilitate servicing or replacing the pump without draining the system. If the pump is to be located near a noise sensitive area, consult a sound specialist. Special precautions should be taken to avoid sound and vibration transmission.

IMPORTANT: Do not support the pump by placing hangers or floor supports on the motor. Shaft misalignment may occur.

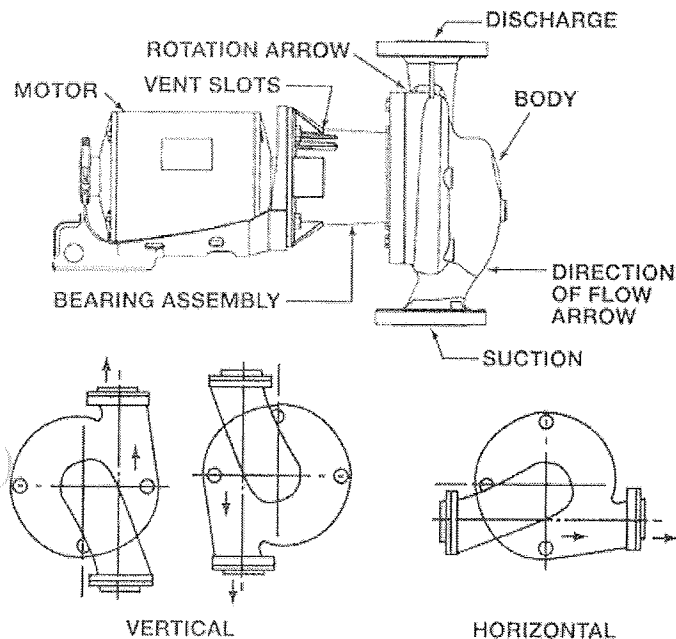
If it is required to lift the entire pump, do so with slings placed around the pump assembly as shown:



IMPORTANT: In closed systems, do not install and operate Bell & Gossett pumps, 3D valves, suction diffusers, etc., without properly sized safety and control devices. Such devices include properly sized and located pressure relief valves, compression tanks and pressure, temperature, and flow controls. If the system is not equipped with these devices, consult the responsible engineer or architect before operating.

PUMP ORIENTATION

B&G Series 60 In-Line pumps can be installed to discharge up, down, left or right. The pump body can be repositioned by removing the body bolts and rotating the body about the bearing assembly. Pumps should only be installed with the motor shaft horizontal. The bearing assembly vent slots/coupler access window must always face up. Do not reposition the motor on the bearing assembly. THE ARROW ON THE PUMP BODY MUST POINT IN THE DIRECTION OF THE FLOW.



SYSTEM PIPING

Always install a straight length of pipe between the suction side of the pump and the first elbow. The length of this pipe should be equal to five times the diameter of the suction pipe size. This reduces turbulent flow into the pump suction by straightening the liquid flow path.

Air must be kept out of the system. On an open system always place the end of the suction pipe at least three feet (3') below the surface of the water in the suction well to prevent air from being drawn into the pump. Avoid air pockets in the suction line and ensure that each section of the suction pipe is absolutely air tight.

If high temperature variations are anticipated, expansion fittings should be installed to help reduce pump strain.

Install the suction and discharge flanges on the pipe ends using teflon tape sealer or high quality thread sealant. Minimize strain on the pump by supporting the suction and discharge piping with pipe hangers near the pump. **Do not support the pump by placing hangers or floor supports on the motor.** This could lead to shaft misalignment and subsequent premature coupler breakage and bearing wear. Line up the vertical and horizontal piping so that the bolt-holes in both the pump and pipe flanges are aligned. **DO NOT ATTEMPT TO SPRING THE SUCTION OR DISCHARGE LINES INTO POSITION. THIS MAY RESULT IN UNWANTED STRESS IN THE PUMP BODY, FLANGE CONNECTIONS AND/OR PIPING.** The code for pressure piping, ANSIB31.1, lists types of supports available for various applications.

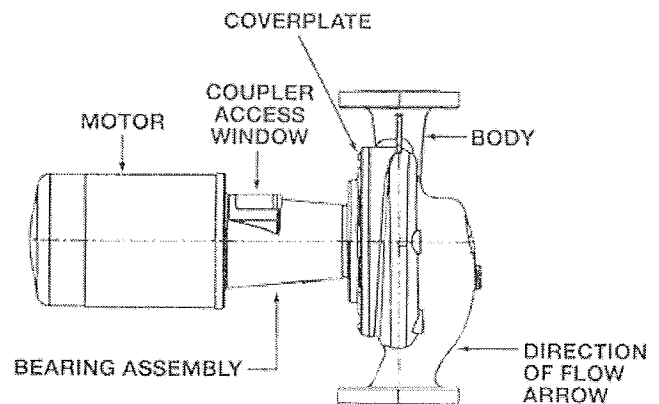
Ordinary wire or band hangers are not adequate to maintain alignment. It is very important to provide strong, rigid support for the suction and discharge lines.

New Bell & Gossett flange gaskets must be installed between the flanges of the pump body and suction and discharge pipes. The gaskets should be clean and grease-free; old gaskets should never be reused. Suitable fasteners for this connection are supplied in the B&G fastener pack. Apply a torque of 8-11 ft. lbs. to each of the flange bolts. Both the suction and discharge flanges must be torqued to the same level.



WARNING: Hot Water Leakage Hazard

Make certain that the flange bolts have been adequately torqued. Failure to follow these instructions could result in serious personal injury and/or property damage.



WIRING INSTRUCTIONS

WARNING: Electrical Shock Hazard
 Disconnect and lockout the power before making electrical connections. Failure to follow these instructions could result in serious personal injury or death.

Remove the screws securing the conduit box cover (wiring compartment) and lift off the cover. Attach the appropriate size connector to the hole in the side of the conduit box.

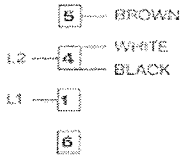
Important: The motor should run **clockwise** when viewed from the back of the motor.

Note: The wiring diagrams shown are typical and may not be representative for all motor types. Refer to the motor or motor nameplate for specific diagrams.

I. SINGLE PHASE MOTORS

Single phase motors can operate at low voltage (115V) as well as high voltage (230V). Select the voltage at which you want to operate your B&G pump, and make wiring connections according to the following diagrams (these diagrams are also found on the motor nameplate):

LOW VOLTAGE

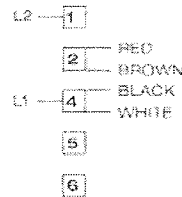


HIGH VOLTAGE

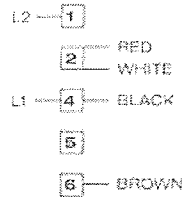


FOR 1 HP, 1 PHASE MOTORS ONLY

LOW VOLTAGE



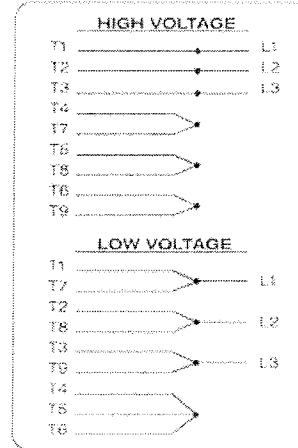
HIGH VOLTAGE



NOTE: Bell & Gossett Single Phase Motors are protected with inherent overheating devices and do not require external overload protection.

II. THREE PHASE MOTORS

Series 60 three phase motors can operate at either low voltage (208-230V) or at high voltage (460V). Select the voltage at which you want to operate your B&G pump and make wiring connections according to the following diagrams (these diagrams are also found on the motor nameplate):



WARNING: Be certain that all connections are secure and the conduit box cover is closed before electrical power is connected. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

OPERATING INSTRUCTIONS

SYSTEM PREPARATION

Prior to pump start up, closed heating and cooling systems should be flushed and drained. The system should then be filled.

LUBRICATION

Standard Series 60 pumps with K99 or later date codes do not need to be relubricated. The pumps are provided with sealed, permanently lubricated pump and motor bearings. However, if a pump was ordered with a special motor (explosion proof, TEFC, etc.) that requires relubrication, then refer to the motor nameplate for motor lubrication instructions.

ROTATION

Pump rotation is clockwise when viewed from the back of the motor. An arrow is provided to show the rotational direction.

PRIMING AND STARTING

CAUTION: Seal Damage Hazard
 Do not run the pump dry, seal damage may occur. Failure to follow these instructions could result in moderate personal injury and/or property damage.

Before starting, the Series 60 pump must be filled with water. Manual priming may be necessary if the system does not fill the pump body automatically. Vent plugs are provided on the pump body to vent the air.

WARNING: Hot Water Leakage Hazard
 Pressurize the pump body slowly while checking for leaks at all gasketed joints. Failure to follow these instructions could result in serious personal injury and/or property damage.

The pump should be started with the discharge valve closed and the suction valve fully open. After the pump is at operating speed, the discharge valve should be opened gradually.

SERVICE INSTRUCTIONS

GENERAL INSTRUCTIONS

1. Inspect the pump regularly for leaking seals, worn gaskets, and loose or damaged components. Repair or replace as required.
2. Drain the pump if there is a chance that the system will freeze.

MOTOR REPLACEMENT

Motor Removal

1. Turn off and lock out power to the motor.

WARNING: Electrical Shock Hazard
 Disconnect and lockout the power before making electrical connections. Failure to follow these instructions could result in serious personal injury or death.

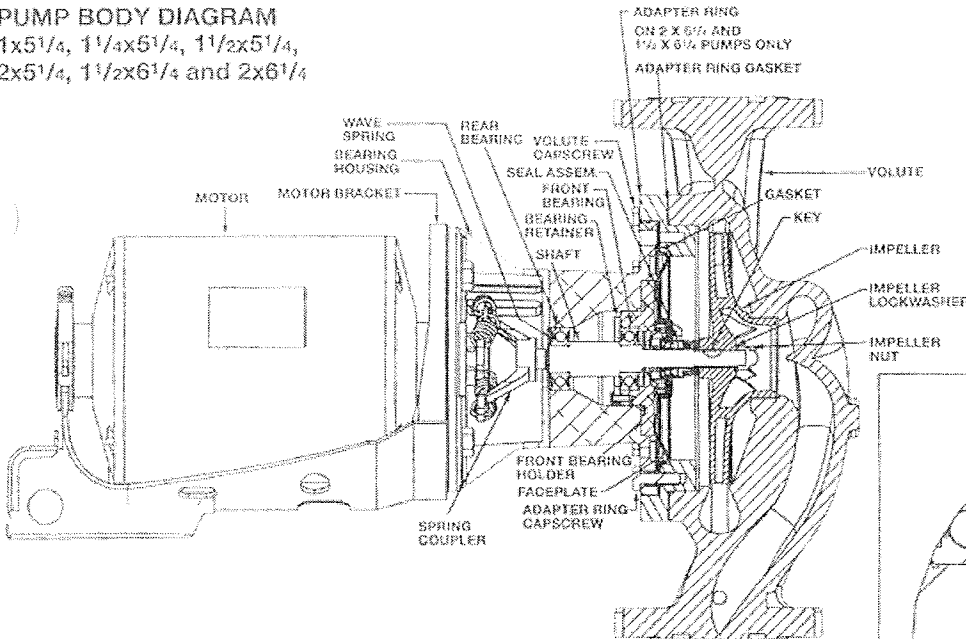
WARNING: Unexpected Startup Hazard
 Disconnect and lockout power before servicing. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

2. Remove conduit box cover.
3. Disconnect power leads from motor leads.
4. Remove conduit and power leads from conduit box.
5. Support the motor, and then remove the four screws that hold the motor to the bearing assembly.
6. Pull the motor off the bearing assembly. **Note:** On pumps with spring type couplers it will be necessary to remove the motor side coupler half from the motor shaft before the motor can be pulled completely away from the bearing assembly. Remove the coupler setscrew(s), and then sliding the coupler half off the motor shaft.

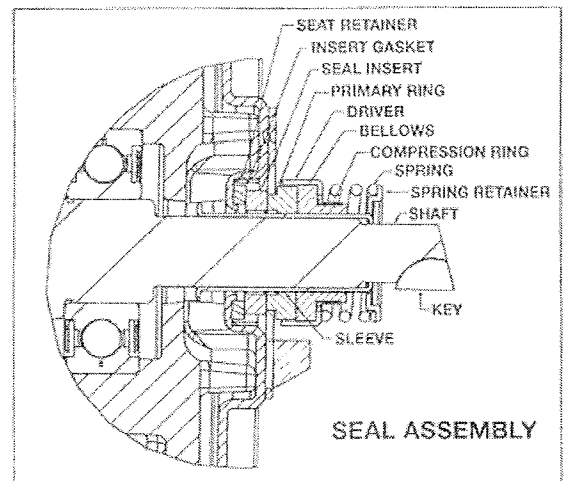
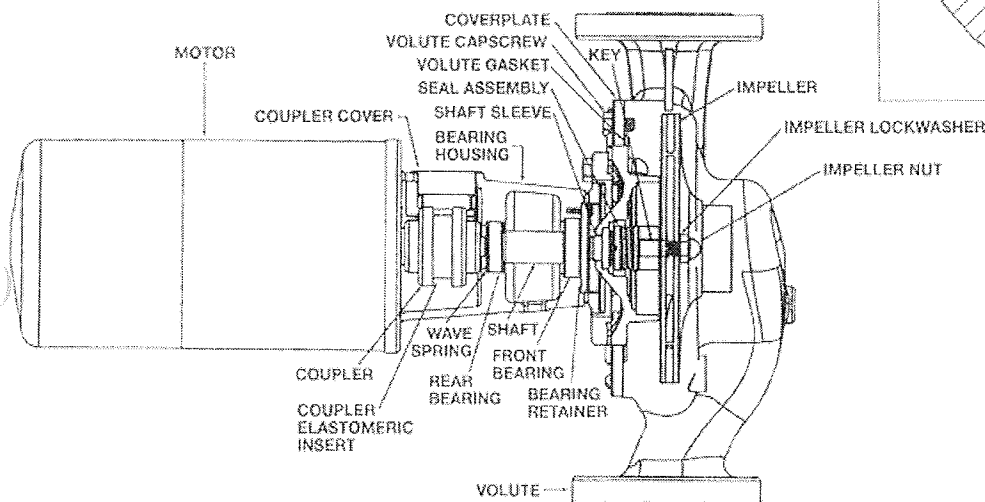
Motor Installation

1. Install the coupler and motor as outlined in the "Spring or Elastomeric Type Coupler Replacement" sections under the heading "Coupler Installation," starting with step #2. **Note:** Check for proper motor rotation after the motor has been reconnected. The proper rotation is clockwise when viewed from the back of the motor.

PUMP BODY DIAGRAM
 1x5¹/₄, 1¹/₄x5¹/₄, 1¹/₂x5¹/₄,
 2x5¹/₄, 1¹/₂x6¹/₄ and 2x6¹/₄



PUMP BODY DIAGRAM
 1¹/₂x7 and 2x7



SPRING TYPE COUPLER REPLACEMENT

Coupler Removal

1. Remove the motor as outlined in the section titled "Motor Removal."
 1. Remove old coupler from the pump shaft by almost completely backing-out the setscrew located in the pump side coupler half.

Coupler Installation

1. Install the new coupler on the pump shaft. Ensure the coupler set screw is seated in the shaft dimple.
2. Lift the motor into position and attach the motor side coupler half. Ensure the coupler set screw is seated in the shaft dimple.
3. Complete the installation by reversing the steps outlined in the section titled "Motor Removal," starting with step #5. **Note:** Check for proper motor rotation after motor has been reconnected.

ELASTOMERIC TYPE COUPLER REPLACEMENT

Coupler Removal

1. Remove the motor as outlined in the section titled "Motor Removal."
2. Loosen the coupler setscrew(s), some contain two setscrews, and remove the coupler halves from the pump and motor shafts.

Coupler Installation

1. Position the coupler half on the pump shaft as follows:
 - a. On pump shafts that contain a dimple: Locate the coupler half on the shaft so that a coupler set screw is positioned over the dimple. Tighten the set screw making sure it seats in the dimple. Tighten the other set screw if there is one.
 - b. For a keyed pump shaft with a size 3J coupler: Slide the coupler half onto the shaft. Do not tighten the set screws.
 - c. For a keyed pump shaft with a size 4J coupler: Slide the coupler half onto the shaft so that the shaft end extends $1/4$ " past the coupler half flange face. Tighten the set screws.
 - d. For a keyed pump shaft with a size 5J coupler: Slide the coupler half onto the shaft so that the shaft end is flush with the coupler half flange face. Tighten the set screws.
2. Position the coupler half on the motor shaft as follows:
 - a. On motor shafts that contain a dimple: Locate the coupler half on the shaft so that a coupler set screw is positioned over the dimple. Tighten the set screw making sure it seats in the dimple. Tighten the other set screw if there is one.
 - b. For couplers going on keyed motor shafts: Slide the coupler half onto the motor shaft. Do not tighten the set screws.
3. Place the new insert in the pump side coupler half.
4. Lift the motor into position, align the insert and motor coupler half, then bolt the motor in place.
5. Proceed as follows:
 - a. On pumps where the motor and pump shafts both contain a dimple:
 1. Complete the procedure by reversing the steps outlined in the section titled "Motor Removal," starting with step #4. **Note:** Check for proper motor rotation after motor has been reconnected.

- b. On motor shafts that contain a dimple used with keyed pump shafts:
 1. Use a screwdriver to slide the pump side coupler over the insert as far as possible.
 2. Gap the coupler by sliding the pump coupler half back $1/16$ ". **Important:** When an elastomeric type coupler is used with a keyed pump and/or motor shaft, **do not** leave the insert compressed between the coupler halves. There needs to be a gap between the ends of the insert and the coupler flanges to accommodate shaft expansion and contraction. If the insert is not gapped, the pump and motor bearings will be subjected to excessive loads, which will lead to their premature failure. However, it is possible to have too large a gap. The gap is considered excessive when the insert teeth are not completely engaged in the coupler halves.
 3. Tighten the set screws.
 4. Complete the procedure by reversing the steps outlined in the section titled "Motor Removal," starting with step #4. **Note:** Check for proper motor rotation after motor has been reconnected.
- c. For keyed motor shafts with either dimpled or keyed pump shafts:
 1. Use a screwdriver to slide the motor side coupler over the insert as far as possible.
 2. Gap the coupler by sliding the motor coupler half back $1/16$ ". **Important:** When an elastomeric type coupler is used with a keyed pump and/or motor shaft, **do not** leave the insert compressed between the coupler halves. There needs to be a gap between the ends of the insert and the coupler flanges to accommodate shaft expansion and contraction. If the insert is not gapped, the pump and motor bearings will be subjected to excessive loads, which will lead to their premature failure. However, it is possible to have too large a gap. The gap is considered excessive when the insert teeth are not completely engaged in the coupler halves.
 3. Tighten the set screws.
 4. Complete the procedure by reversing the steps outlined in the section titled "Motor Removal," starting with step #4. **Note:** Check for proper motor rotation after motor has been reconnected.

BEARING ASSEMBLY REPLACEMENT

1. Shut the system off and allow it to cool to at least 100°F before servicing the pump.
2. Close the system fill valve.
3. If there are service (isolation) valves located on either side of the pump, close them. If not, drain the system by opening the system drain valve and a vent located near the top of the system. Ensure the water drains to a safe location.
4. Remove the motor as outlined in the section titled "Motor Removal."



WARNING: Hot Water Hazard

Before draining the system, allow water to cool to at least 100°F, open the drain valve (take precautions against water damage) and leave the drain valve open until servicing is complete. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

5. Remove the eight capscrews that hold the bearing assembly or adapter ring to the volute.



WARNING: High Pressure Hazard

Pressure may be present in the pump body. This pressure can be relieved by loosening the eight volute capscrews and shifting the bearing assembly slightly to allow the pressurized water to escape. Failure to follow these instructions could result in serious personal injury or death.

6. Remove the bearing assembly.
7. Insert a long punch between the impeller vanes or grasp the impeller with a strap wrench to prevent the impeller from turning, then loosen the impeller nut.
8. Remove the impeller nut, lock washer, impeller, and adapter ring (if present).
9. If used, install the adapter ring and gasket on the new bearing assembly.
10. Install the impeller on the new bearing assembly. Use the new impeller nut and lock washer provided with the new bearing assembly.
11. Insert a long punch between the impeller vanes or grasp the impeller with a strap wrench to prevent the impeller from turning, then torque the impeller nut to 96 – 144 lb.-in. for nuts used on $\frac{3}{8}$ " fine threaded shafts, or 204-264 lb.-in. for nuts used on $\frac{7}{16}$ " fine threaded shafts.
12. Clean the old body gasket from the volute.
13. Put a new body gasket on the assembly, and then install the assembly on the pump body.



WARNING: Hot Water Hazard

Whenever the bearing assembly is removed from the piping, use a new gasket when reinstalling. Failure to follow these instructions could result in serious personal injury and/or property damage.

14. Install the eight volute capscrews, tighten them per the torque spec shown in Table 1.
15. Install the coupler and motor as described in the "Coupler Installation" section for the particular coupler used on the pump.
16. Fill and bleed the system, check for leaks, then start system.



WARNING: Hot Water Leakage Hazard

Pressurize the pump body slowly while checking for leaks at all joints with gaskets. Failure to follow these instructions could result in serious personal injury and/or property damage.

SEAL REPLACEMENT

1. Remove the bearing assembly and the impeller as outlined in the section titled "Bearing Assembly Replacement," steps #1 through #8.
2. Remove the spring retainer and seal spring.
3. Pry the compression ring off the seal boot.
4. Insert a standard screwdriver under the seal head and carefully pry the seal head off the shaft. Do not scratch the shaft sleeve.

5. Use a small screwdriver to loosen and remove the seal seat and gasket.

6. If the seat retainer is in good condition, leave it in the faceplate. If not, pry it out and replace it with the new one provided in the seal kit.
7. Clean the shaft sleeve and seal seat recess. Crocus cloth can be used to polish the sleeve. Do not scratch or gouge the recess or sleeve.
8. Install the seat gasket and seat into the seat recess in the faceplate or coverplate. **Important:** On ceramic seats there are two dimples located on one of the faces. The dimples indicate the side of the seat that mates against the seat gasket. Tungsten carbide faces can be inserted with either face against the gasket.
9. Lubricate the seal boot with soapy water, then slide the complete seal head (carbon ring, seal boot, driver, and compression ring) over the shaft. Do not attempt to install the seal head by placing the components on the shaft individually.
10. Slide the seal head on until the carbon ring contacts the seat. Ensure the protrusions in the driver have remained engaged in the notches in the carbon.
11. Using the flat face of a screwdriver, firmly press on the top edge of the compression ring at several locations to ensure the seal head is sitting flat against the seat.
12. Place the spring then spring retainer on top of the seal head.
13. Install the impeller, lockwasher, and impeller nut.
14. Torque the impeller nut to 96 – 144 lb.-in. of torque for nuts used on $\frac{3}{8}$ " fine threaded shafts, or 204-264 lb.-in. for nuts used on $\frac{7}{16}$ " fine threaded shafts.
15. Clean the old body gasket and any other debris from the volute and the bearing assembly.
16. Place a new body gasket on the bearing assembly, and then install the bearing assembly on the pump body.



WARNING: Hot Water Hazard

Whenever the bearing assembly is removed from the pump, use a new gasket when re-installing. Failure to follow these instructions could result in serious personal injury and/or property damage.

17. Install the eight volute capscrews, tighten them per the torque spec shown in Table 1.
18. Install the coupler and motor as described in the "Coupler Installation" section for the particular coupler used on the pump.
19. Fill and bleed the system, check for leaks, then start system.



WARNING: Hot Water Leakage Hazard





Pressurize the pump body slowly while checking for leaks at all joints with gaskets. Failure to follow these instructions could result in serious personal injury and/or property damage.

ADDITIONAL PUMP REPAIR

Refer to the following manual for further repair instructions for the Bell & Gossett Series 60 pump:

Coupler & Motor Mount Replacement ... #P06452

TABLE 1 – TORQUE CHART

CAPSCREW TYPE	HEAD MARKING	CAPSCREW TORQUE (FOOT-POUND)								
		CAPSCREW DIAMETER								
		1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
SAE Grade 2		6	13	25	38	60	120	190	210	300
Brass Stainless Steel	 or 	4	10	17	27	42	83	130	200	300
SAE Grade 5		10	20	35	60	90	180	325	525	800

DEALER SERVICING

If your pump requires further repair, contact your local B&G Representative. Having the following information at hand will facilitate your representative's ability to assist you:

1. Complete data from nameplate.
2. Suction and discharge pipe pressure gauge readings.
3. Ampere draw of the motor.
4. A sketch of the pumping system (include pipes, valves, etc.).

AUTHORIZED REPRESENTATIVE



Bell & Gossett

USA
Bell & Gossett
8200 N. Austin Avenue
Morton Grove, IL 60053
Phone: (847) 966-3700
Facsimile: (847) 966-9052
<http://www.bellgossett.com>



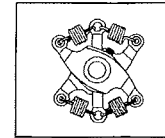
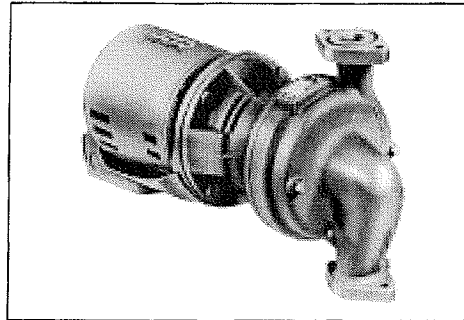
INTL.
Bell & Gossett / Export Dept.
8200 N. Austin Avenue
Morton Grove, IL 60053
Phone: (847) 966-3700
Facsimile: (847) 966-8366
Cable: BELGOSSETT

CANADA
Fluid Products Canada
55 Royal Road
Guelph, Ontario,
N1H 1T1, Canada
Phone: (519) 821-1900

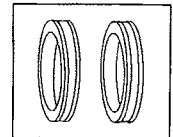
Series 60® In Line Centrifugal Pump

INSTRUCTIONS FOR:

SERVICE REPLACEMENT –
COUPLER ASSEMBLY &
RING MOTOR MOUNTS



1. Spring Coupler
2. Sleeve Coupler
3. Ring Motor Mounts



SAFETY INSTRUCTIONS

This safety alert symbol will be used in this manual and on the pump instructions decal to draw attention to safety related instructions. When used, the safety alert symbol means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.**



Your Booster Pump should have this warning label affixed to the pump near the conduit box cover. If this warning is missing or illegible, contact your local Bell & Gossett Representative for a replacement.

REMOVING THE MOTOR

REPLACEMENT OF THE COUPLER AND MOTOR MOUNTS DOES NOT REQUIRE REMOVAL OF THE BEARING ASSEMBLY OR PUMP BODY. IT IS NOT NECESSARY TO CLOSE THE SERVICE VALVES OR DISCONNECT THE WATER SUPPLY FOR THIS OPERATION.



WARNING: ELECTRICAL SHOCK HAZARD

Disconnect and lock out the power before servicing. Failure to follow these instructions could result in serious personal injury or death.

1. The electrical supply must be turned off before disconnecting the motor from the pump.



WARNING: ELECTRICAL SHOCK HAZARD. Be certain the electrical power is not present at the motor leads before continuing. Failure to follow these instructions could result in serious personal injury or death.



WARNING: UNEXPECTED START UP HAZARD

Single phase motors are equipped with automatic reset overload protectors. The pump can restart without warning. Disconnect and lockout power before servicing. Failure to follow these instructions could result in serious personal injury or death.

2. Loosen the conduit box cover screw and remove the cover. Follow this procedure with the removal of the wire nuts and the flexible conduit connector.

NOTE: There are two types of couplers used on Series 60 pumps. The type of coupler is dependent on the size of the pump. All AA size pumps use B&G spring coupler assemblies. All A size pumps with FRACTIONAL HP ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$) use B&G spring couplers whereas A size pumps with HP GREATER THAN 1 ($1\frac{1}{2}$, 2) use Woods sleeve couplers. The F size pumps also use the Woods sleeve couplers. Lovejoy jaw type couplers are compatible with the Woods sleeve couplers and can therefore be used interchangeably wherever the Woods is used.

For motors with Woods or Lovejoy type couplers, skip step 3 and continue with step 4. Only pumps with spring couplers require step 3 operations for disassembly.

3. Release the coupler from the pump shaft by loosening the set screw with an Allen wrench. The set screw rests in a blind hole along the shaft; the set screw must therefore be backed off at least $\frac{1}{8}$ " before attempting to remove the coupler. If stuck, a screwdriver may be used to gently pry the coupler from the shaft (before prying, be certain that the set screw has cleared the depth of the blind hole – usually three full turns of the wrench will clear the hole).
4. Separate the motor from the bearing assembly by removing the four cap screws from the cover plate.

REPLACING THE COUPLER

1. Similar to its removal from the pump shaft, the spring coupler is also separated from the motor shaft by loosening the set screw with an Allen wrench. If the coupler is found to be broken completely or if excessive wear is observed, replace the entire coupler – never replace individual components of the coupler assembly. Neither the springs or the coupler arms should ever be replaced. Replacing individual springs will only result in repeated breakage due to spring imbalance caused by the tensile strength being greater in new springs than in used springs.

WOODS/LOVEJOY: If a Woods or Lovejoy coupler is in use and it is necessary to replace worn coupler halves, then use an Allen wrench to unseat the set screws from the pump and motor shafts. If the coupler halves do not require replacement, then it is not necessary to remove the halves from the shaft – the rubber spider (sleeve) can be replaced without removing the coupler halves.

NOTE: Noisy coupler operation or coupler failure are generally strong indicators of the need to replace the motor mounts. Refer to the next section, **REPLACING THE MOTOR MOUNTS**, for service instructions.

2. New couplers can be installed by reversing the removal operation. The set screw must be seated in the shaft recess to prevent slipping.

When replacing either the Woods or Lovejoy type coupler, provide about $\frac{1}{8}$ " end clearance between the sleeve and the two coupler halves. This space will allow the coupler to accommodate misalignment and thermal expansion.

REPLACING THE RING MOTOR MOUNTS

Before beginning this procedure, follow the instructions under **REMOVING THE MOTOR** from the front side of this page.

1. The under bracket must be removed prior to servicing the motor mounts. The bracket can be separated by loosening the clamp screw found at the end opposite the motor shaft. By loosening this screw, the clamp can be removed and the motor will no longer be fastened to the bracket.
2. Visually inspect the motor mounts before removing them from the end plates. An in-place inspection may give some indication to the cause of an operational problem or failure. Many times excessive oil can cause a ring motor mount to fail. Always replace both motor mounts when either one begins to show signs of deterioration. Never replace one mount at a time. Single replacements will only result in the misalignment of the pump and motor shafts.
3. Remove the mount's outer ring by placing a proper prying device between the front mounting and the end plate such that the head is angled inward toward the rubber section.

Tap the prying device with a hammer to force it through the rubber. Now, use the device to pry against the inner ring to remove the outer ring. Care should be taken to prevent damage to the motor shaft or end plate.

4. The inner ring will require an additional effort to remove. B&G suggests the use of either a cold chisel to cut through the inner ring or a means of prying the ring from the end plate. In both cases, however, care must be taken to prevent damage to the motor.
5. Set the new mount squarely on the boss of the motor end plate. Orient the mount so that the split along its outer diameter is aligned to the bottom of the motor (direction opposite the oil tube). With the mount positioned and aligned properly, use a hammer to tap around the mount until it sits flush against the end plate. Repeat the procedure for the rear mount.
6. Wipe any debris or oil that may have settled on the motor bracket. Set the motor, with oil tubes pointing upward, into the bracket by guiding the shaft through the bore in the front of the bracket. The rear mount should seat in the semi-circular section of the bracket.
7. Replace the clamp by mating the hooks of the mount to the slots of the clamp. Tighten the clamp so the motor is secured in the bracket. It should not be possible to rotate the motor once it is mounted in the bracket. **DO NOT OVER-TIGHTEN** – over-tightening will only deform the mount and cause premature failure.
8. Connect the coupler to the motor and pump shafts by seating the set screw in the shaft recesses.
9. Position the motor with the bearing assembly and evenly tighten the four cap screws.

WIRING INSTRUCTIONS



WARNING: ELECTRICAL SHOCK HAZARD
Disconnect and lockout the power before making electrical connections. Failure to follow these instructions could result in serious personal injury or death.

The Series 60 pump can be equipped with either a single phase or three phase motor. Both motor types can operate at either high or low voltage. The single phase motor can operate at 115 V or 230 V whereas the three phase motor can operate at 208-230 V or at high voltage 460 V. Determine the voltage at which our B&G pump has been operating and make wiring connections according to the diagrams found in the conduit box cover.

Unlock the power and return to service.

Ensure Quality and Performance with ...

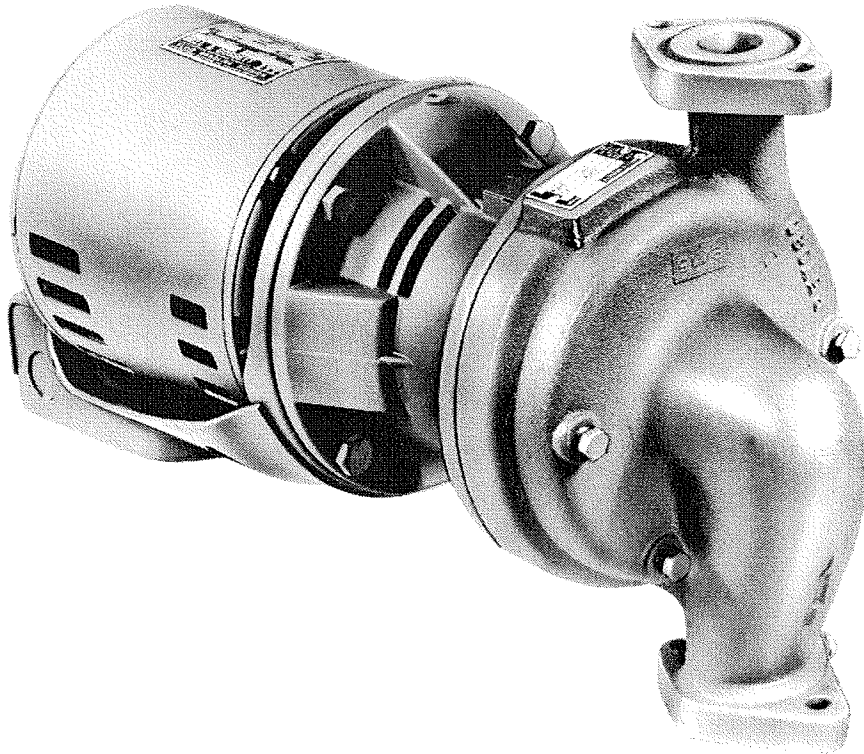
GENUINE BELL & GOSSETT REPLACEMENT PARTS

For further information, contact ITT Bell & Gossett, 8200 N. Austin Avenue, Morton Grove, IL 60053, Phone (847) 966-3700 – Facsimile (847) 966-9052.

ITT Bell & Gossett
Morton Grove, IL, U.S.A.



Bell & Gossett®
Parts List CP-105G-PL

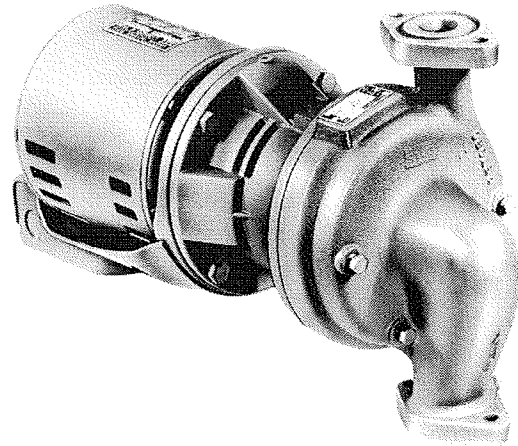


SERIES 60

Replacement Parts for
**Series 60® Sleeve Bearing
In-Line Mounted
Centrifugal Pumps**

Engineered for life



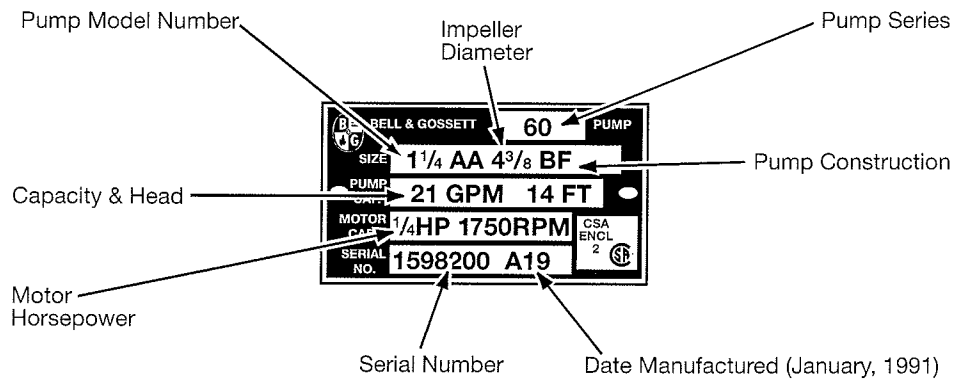


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How to use this PARTS LIST

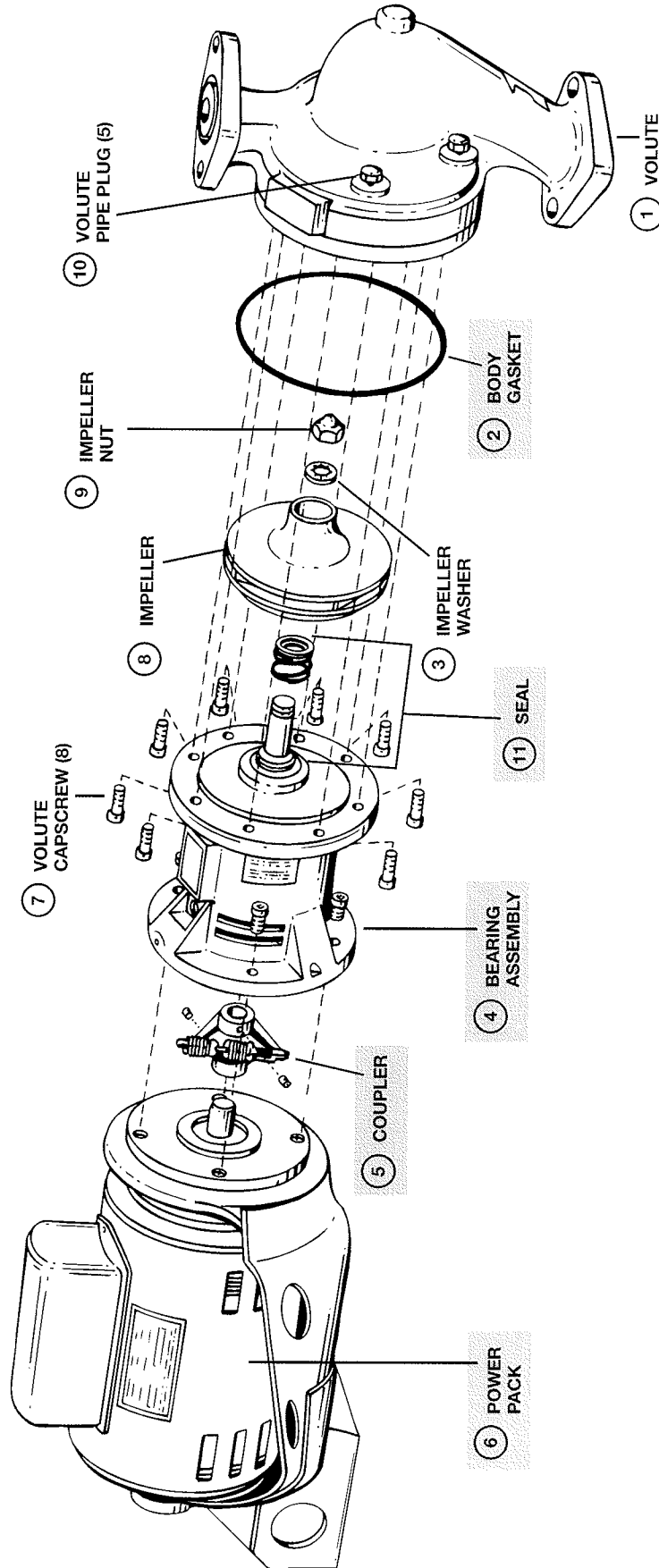
The pump nameplate identifies the pump by model number, pump construction and impeller diameter as shown below.



The nameplate above identifies the pump as a Series 60, 1 1/4AA in bronze fitted (BF) construction. The impeller diameter is 4 3/8" and is capable of pumping 21 GPM at 14 FT. The motor horsepower is 1/4, the RPM is 1750. The serial number specifically identifies the unit for future reference. **DO NOT REMOVE THE NAMEPLATE.** It is important when ordering replacement parts to furnish complete nameplate data.

The following procedure will result in proper parts selection.

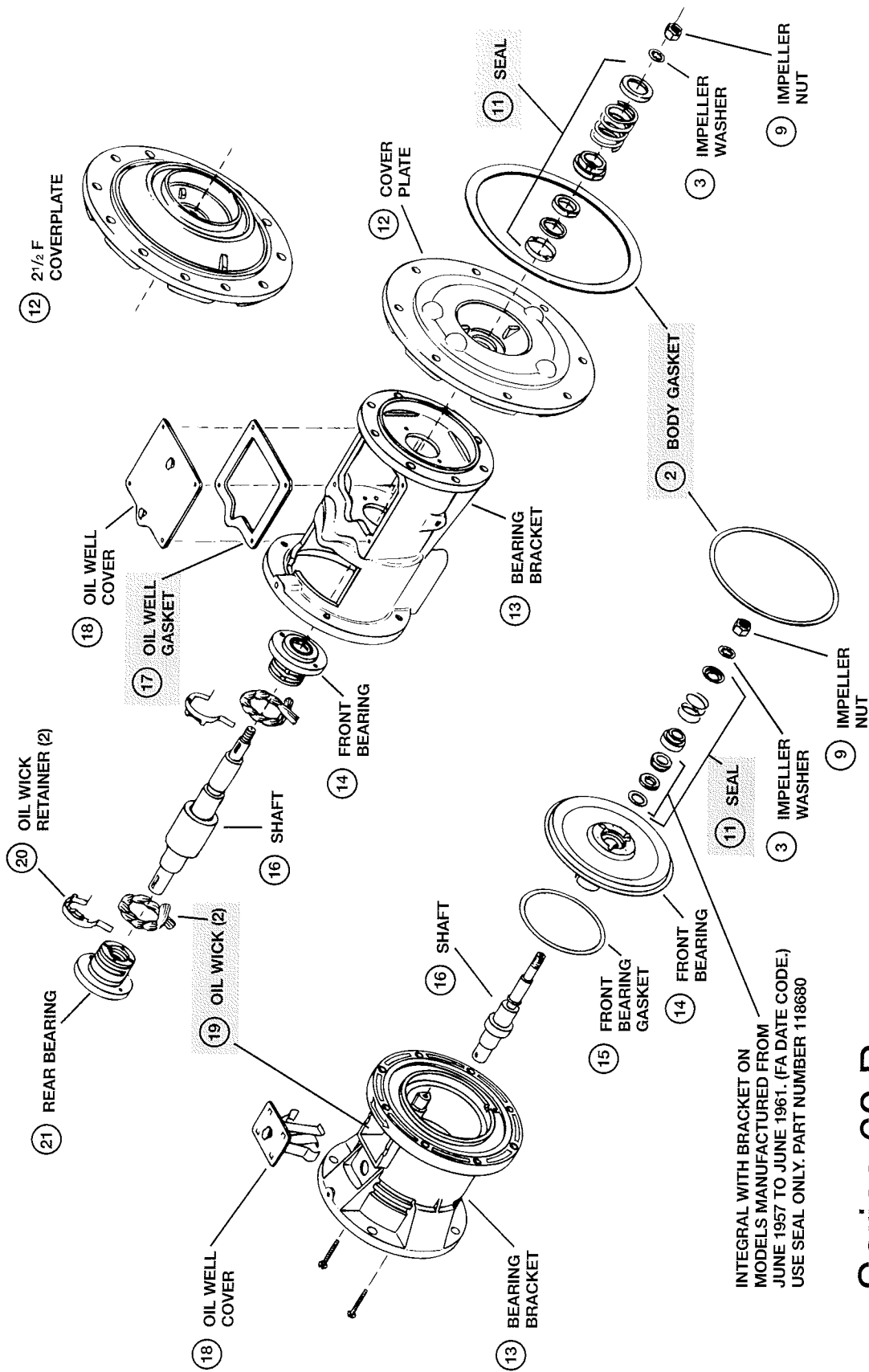
1. Determine from the nameplate the model number, pump construction and impeller diameter.
2. Refer to the index for the page number of the parts breakdown for the specific model pump.
3. Find the proper column in the parts breakdown for the pump construction involved.
4. Select part numbers using the numbered drawings on pages 4 & 5 for identification.



Series 60 Pump

Exploded View

— Factory recommended spare part



INTEGRAL WITH BRACKET ON
 MODELS MANUFACTURED FROM
 JUNE 1957 TO JUNE 1961. (FA DATE CODE.)
 USE SEAL ONLY. PART NUMBER 118680

Series 60 Pump

SLEEVE BEARING ASSEMBLY

Exploded View

— Factory recommended spare part

NOTE: USE LIQUID SEALANT IN PLACE OF BEARING GASKET ON "A" SIZES AND 2 1/2 F

STANDARD SIZE DESIGNATIONS

STANDARD PUMP SIZE	EQUIVALENT SIZE	HP	(6) SLEEVE BEARING POWER PACK		(5)	IMPELLER DIAMETER	(8)
			1 PHASE 115/230	3 PHASE 208-230/460	COUPLER		IMPELLER
60-1S & 60-1T	1"AA	1/4	169035+	169037	118473	5/4"	186359
60-2S & 60-2T	1 1/4"AA	1/3	169038	169039	118473	5/4"	186359
60-3S & 60-3T	1 1/2"AA	1/2	111044	111046	118473	5/4"	186368
60-4S & 60-4T	2"AA	3/4	111047	111049	118473	5/4"	118626
60-5S & 60-5T	1 1/2"A	1/2	111044	111046	186410	5 3/4"	P57447
60-6S & 60-6T	1 1/2"A	3/4	111047	111049	186410	6 1/2"	P57445*
60-7S & 60-7T	1 1/2"A	1	N/A	N/A	186004	7"	P57445
60-8S & 60-8T	2"A	3/4	111047	111049	186410	5 5/8"	P57452*
60-9S & 60-9T	2"A	1	N/A	N/A	186004	6 1/8"	P57451*
60-10T	2"A	1-1/2	-	N/A	186003	6 3/4"	P57450*
60-10S	1"AA	1/4	169035+	-	118473	5/4"	186359
60-11S & 60-11T	1 1/4"AA	1/4	169035+	169037	118473	5 3/16"	186360
60-B11S	1 1/4"AA	1/4	169035+	-	118473	5 3/16"	186360
60-13S & 60-13T	1 1/2"AA	1/2	111044	111046	118473	5/4"	186368
60-B13S & 60-B13T	1 1/2"AA	1/2	111044	111046	118473	5/4"	186368
60-14S & 60-14T	2"AA	3/4	111047	111049	118473	5/4"	118626
60-B14S & 60-B14T	2"AA	3/4	111047	111049	118473	5/4"	118626
60-15S & 60-15T	1 1/2"A	1/2	111044	111046	186410	5 3/4"	P57447
60-16S & 60-16T	1 1/2"A	3/4	111047	111049	186410	6 3/8"	P57446
60-17S & 60-17T	1 1/2"A	1	N/A	N/A	186004	7"	P57445
60-19S & 60-19T	2"A	1	N/A	N/A	186004	6"	P57452
60-20S & 60-20T	2"A	1-1/2	N/A	N/A	186003	6 1/2"	P57451
60-21T	2"A	2	-	N/A	186003	7"	P57450
60-22T	2 1/2"F	3	-	169221	P77279	7 3/4"	P57584

+ 115V only. For 230V, use 169036.

* Trim impeller to diameter shown.

N/A – No longer available. See note below.

– Factory recommended spare parts.

NOTE: Sleeve bearing power packs and maintenance-free ball bearing power packs are interchangeable. Refer to the Power Pack Cross Reference chart on page 14.

1AA

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	186384	186385	186384
10	Volute Pipe Plug (5)	P39020	P39470	P39020
7	Volute Capscrew (8)	P10620	P01850	P10620
8	Impeller (State Diameter)	P56550	P56550	P60350*
	Flange (2)	P01510	P00836	P01510
	Fastener Package w/ Flange Gaskets	P64910	P64900	P64910
	Flange Gasket Set	118368	118368	118368
4	Sleeve Bearing Assembly	186863	186863	186865
	Consisting of:			
13	Bearing Bracket	P77179	P77179	P77179
14	Front Bearing	P77216	P77216	P77215
15	Front Bearing Gasket	P80816	P80816	P80816
16	Shaft Assembly	189035	189035	P81960
11	Seal Kit	118681	118681	186681
2	Body Gasket	P57410	P57410	P57410
	Impeller Key	P04940	P04940	P04940
9	Impeller Nut	P44200	P44200	P04670
3	Impeller Washer	P57000	P57000	P04650
18	Oil Well Cover	P81239	P81239	P81239
19	Oil Wick	118395	118395	118395

*Steel Impeller


COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	1/2"	-	B&G	1/2"	118473	P77234
5	1/2"	-	56	5/8"	118709	118635

SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1/4	169035+	169037	118228
6	1/3	169038	169039	118228
6	1/2	111044	111046	118228

+115V only. For 230V, use part number 169036.

 — Factory recommended spare parts.

1-1/4AA

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	186386	186931	186386
10	Volute Pipe Plug (5)	P39020	P39470	P39020
7	Volute Capscrew (8)	P10620	P01850	P10620
8	Impeller (State Diameter)	P56550	P56550	P60350*
	Flange (2)	P03250	P00837	P03250
	Fastener Package w/ Flange Gaskets	P64910	P64900	P64910
	Flange Gasket Set	118368	118368	118368
4	Sleeve Bearing Assembly	186863	186863	186865
	Consisting of:			
13	Bearing Bracket	P77179	P77179	P77179
14	Front Bearing	P77216	P77216	P77215
15	Front Bearing Gasket	P80816	P80816	P80816
16	Shaft Assembly	189035	189035	P81960
11	Seal Kit	118681	118681	186681
2	Body Gasket	P57410	P57410	P57410
	Impeller Key	P04940	P04940	P04940
9	Impeller Nut	P44200	P44200	P04670
3	Impeller Washer	P57000	P57000	P04650
18	Oil Well Cover	P81239	P81239	P81239
19	Oil Wick	118395	118395	118395

*Steel Impeller

COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	1/2"	-	B&G	1/2"	118473	P77234
5	1/2"	-	56	5/8"	118709	118635

SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1/4	169035+	169037	118228
6	1/3	169038	169039	118228
6	1/2	111044	111046	118228

+115V only. For 230V, use part number 169036.

— Factory recommended spare parts.

1-1/2AA

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	186389	186932	186389
10	Volute Pipe Plug (5)	P39020	P39470	P39020
7	Volute Capscrew (8)	P10620	P01850	P10620
8	Impeller (State Diameter)	P56740	P56740	P61010*
	Flange (2)	P03410	P06690	P03410
	Fastener Package w/ Flange Gaskets	P64940	P64930	P64940
	Flange Gasket Set	118373	118373	118373
4	Sleeve Bearing Assembly	186863	186863	186865
	Consisting of:			
13	Bearing Bracket	P77179	P77179	P77179
14	Front Bearing	P77216	P77216	P77215
15	Front Bearing Gasket	P80816	P80816	P80816
16	Shaft Assembly	189035	189035	P81960
11	Seal Kit	118681	118681	186681
2	Body Gasket	P57410	P57410	P57410
	Impeller Key	P04940	P04940	P04940
9	Impeller Nut	P44200	P44200	P04670
3	Impeller Washer	P57000	P57000	P04650
18	Oil Well Cover	P81239	P81239	P81239
19	Oil Wick	118395	118395	118395

*Steel Impeller

COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	1/2"	-	B&G	1/2"	118473**	P77234
5	1/2"	-	56	5/8"	118709	118635

** Use 185329 sleeve-type coupler with 3/4 HP maintenance-free ball bearing motors

SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1/4	169035+	169037	118228
6	1/3	169038	169039	118228
6	1/2	111044	111046	118228
6	3/4	111047	111049	118228

+115V only. For 230V, use part number 169036.

— Factory recommended spare parts.

2AA

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	186392	186933	186392
10	Volute Pipe Plug (5)	P39020	P39470	P39020
7	Volute Capscrew (8)	P10620	P01850	P10620
8	Impeller (State Diameter)	P56810	P56810	P61550*
	Flange (2)	F14200	F54200	F14200
	Fastener Package w/ Flange Gasket (2)	P65030	P65031	P65030
	Flange Gasket Set	118378	118378	118378
4	Sleeve Bearing Assembly	186863	186863	186865
	Consisting of:			
13	Bearing Bracket	P77179	P77179	P77179
14	Front Bearing	P77216	P77216	P77215
15	Front Bearing Gasket	P80816	P80816	P80816
16	Shaft Assembly	189035	189035	P81960
11	Seal Kit	118681	118681	186681
2	Body Gasket	P57410	P57410	P57410
	Impeller Key	P04940	P04940	P04940
9	Impeller Nut	P44200	P44200	P04670
3	Impeller Washer	P57000	P57000	P04650
18	Oil Well Cover	P81239	P81239	P81239
19	Oil Wick	118395	118395	118395

*Steel Impeller

COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	1/2"	-	B&G	1/2"	118473**	P77234
5	1/2"	-	56	5/8"	118709	118635

** Use 185329 sleeve-type coupler with 3/4 HP maintenance-free ball bearing motors

SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1/4	169035+	169037	118228
6	1/3	169038	169039	118228
6	1/2	111044	111046	118228
6	3/4	111047	111049	118228

+115V only. For 230V, use part number 169036.

— Factory recommended spare parts.

1-1/2A

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	186390	186934	186390
10	Volute Pipe Plug (5)	P39020	P39470	P39020
7	Volute Capscrew (8)	P40020	P52310	P40020
8	Impeller (State Diameter)	P57445	P57445	P57500
	Flange (2)	P03410	P06690	P03410
	Fastener Package w/ Flange Gaskets	P64940	P64930	P64940
	Flange Gasket Set	118373	118373	118373
4	Sleeve Bearing Assembly	185260	185262	185261
	Consisting of:			
13	Bearing Bracket	P57282	P57282	P57282
12	Coverplate	P57246	P57248	P57246
14	Front Bearing*	185241	185241	185241
21	Rear Bearing	185240	185240	185240
16	Shaft Assembly	118469	118469	P08725
	Coupler Key	H32400	H32400	H32400
11	Seal Kit	186499	186499	186433
2	Body Gasket	P57700	P57700	P57700
	Impeller Key	P49358	P49358	P49358
9	Impeller Nut	P45910	P08480	P45910
3	Impeller Washer	P11150	P11220	P11150
18	Oil Well Cover	P57302	P57302	P57302
17	Oil Well Gasket	P57300	P57300	P57300
19	Oil Wick (2)	P04883	P04883	P04883
20	Oil Wick Retainer (2)	P12422	P12422	P12422

*Includes P57303 Lip Seal

COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	5/8"	1/2, 3/4	B&G	1/2"	186410	P77237
5	5/8"	1	56	5/8"	186004	186004
5	5/8"	1	143TZ	5/8"	186004	186004
5	5/8"	1-1/2	56	5/8"	186003	186003
5	5/8"	1-1/2	145TZ	5/8"	186003	186003

SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1/2	111044	111046	118228
6	3/4	111047	111049	118228
6	1	N/A	N/A	118848**
6	1-1/2	N/A	N/A	118848**

** For 3 phase only. Motor mounts for single phase power packs not available.

NOTE: Sleeve bearing power packs and maintenance-free ball bearing power packs are interchangeable. Refer to the Power Pack Cross Reference chart on page 14.

— Factory recommended spare parts.

N/A – Not Available.

2A

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	186937	186938	186937
10	Volute Pipe Plug (5)	P39020	P39470	P39020
7	Volute Capscrew (8)	P40020	P52310	P40020
8	Impeller (State Diameter)	P57450	P57450	N/A
	Flange (2)	F14200	F54200	F14200
	Fastener Package w/ Flange Gasket (2)	P65030	P65031	P65030
	Flange Gasket Set	118378	118378	118378
4	Sleeve Bearing Assembly	185260	185262	185261
	Consisting of:			
13	Bearing Bracket	P57282	P57282	P57282
12	Coverplate	P57246	P57248	P57246
14	Front Bearing*	185241	185241	185241
21	Rear Bearing	185240	185240	185240
16	Shaft Assembly	118469	118469	P08725
	Coupler Key	H32400	H32400	H32400
11	Seal Kit	186499	186499	186433
2	Body Gasket	P57700	P57700	P57700
	Impeller Key	P49358	P49358	P49358
9	Impeller Nut	P45910	P08480	P45910
3	Impeller Washer	P11150	P11220	P11150
18	Oil Well Cover	P57302	P57302	P57302
17	Oil Well Gasket	P57300	P57300	P57300
19	Oil Wick (2)	P04883	P04883	P04883
20	Oil Wick Retainer (2)	P12422	P12422	P12422

*Includes P57303 Lip Seal

COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	5/8"	1/2, 3/4	B&G	1/2"	186410	P77237
5	5/8"	1	56	5/8"	186004	186004
5	5/8"	1	143TZ	5/8"	186004	186004
5	5/8"	1-1/2, 2	56	5/8"	186003	186003
5	5/8"	1-1/2, 2	145TZ	5/8"	186003	186003

SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1/2	111044	111046	118228
6	3/4	111047	111049	118228
6	1	N/A	N/A	118848**
6	1-1/2	N/A	N/A	118848**
6	2	-	N/A	118848

** For 3 phase only. Motor mounts for single phase power packs not available.

NOTE: Sleeve bearing power packs and maintenance-free ball bearing power packs are interchangeable. Refer to the Power Pack Cross Reference chart on page 14.

— Factory recommended spare parts.

2-1/2F

ITEM NO.	DESCRIPTION	BRONZE FITTED	ALL BRONZE	ALL IRON
1	Volute	P57232	P57234	NOT AVAILABLE
10	Volute Pipe Plug (5)	P39040	P39480	
7	Volute Capscrew (12)	P03470	S04180	
8	Impeller (State Diameter)	P57583	P57583	
4	Sleeve Bearing Assembly	185264	185265	
	Consisting of:			
13	Bearing Bracket	P57282	P57282	
12	Coverplate	P57242	P57244	
14	Front Bearing*	185241	185241	
21	Rear Bearing	185240	185240	
16	Shaft Assembly	118469	118469	
	Coupler Key	H32400	H32400	
11	Seal Kit	186499	186499	
2	Body Gasket	P57701	P57701	
	Impeller Key	P49358	P49358	
9	Impeller Nut	P45910	P08480	
3	Impeller Washer	P11150	P11220	
18	Oil Well Cover	P57302	P57302	
17	Oil Well Gasket	P57300	P57300	
19	Oil Wick (2)	P04883	P04883	
20	Oil Wick Retainer (2)	P12422	P12422	

*Includes P57303 Lip Seal

COUPLER SELECTION

ITEM NO.	PUMP SHAFT SIZE	HP	FRAME SIZE	MOTOR SHAFT SIZE	STANDARD COUPLER	EXPLOSION PROOF COUPLER
5	5/8"	1-1/2, 2	145TZ	5/8"	186003	186003
5	5/8"	3	145TC	7/8"	P77279	P77279
5	5/8"	3	182TC	1-1/8"	P77281	P77281


SLEEVE BEARING POWER PACK SELECTION

ITEM NO.	HP	1 PHASE 115/230V	3 PHASE 208-230/460V	RING MOUNTS
6	1-1/2	N/A	N/A	118848**
6	2	-	N/A	118848
6	3	-	169221 (145TC)	NONE
6	3	-	169223+ (182TC)	NONE

+For 200V only, use part number 169222.

** For 3 phase only. Motor mounts for single phase power packs not available.

NOTE: Sleeve bearing power packs and maintenance-free ball bearing power packs are interchangeable. Refer to the Power Pack Cross Reference chart on page 14.

 - Factory recommended spare parts.

N/A - Not Available.

MAINTENANCE-FREE BALL BEARING POWER PACKS

POWER PACK CROSS REFERENCE

HP	PH	SLEEVE BEARING			MAINTENANCE-FREE BALL BEARING		
		VOLTAGE	MOTOR MOUNTS	POWER PACK PART NO	VOLTAGE	MOTOR MOUNTS	POWER PACK PART NO.
1/4	1	115/230	118228	169035/169036	115/208-230	118228	169224
1/4	3	208-230/460	118228	169037	208-230/460	118228	169225
1/3	1	115/230	118228	169038	115/208-230	118228	169226
1/3	3	208-230/460	118228	169039	208-230/460	118228	169227
1/2	1	115/230	118228	111044	115/208-230	118228	169228
1/2	3	208-230/460	118228	111046	208-230/460	118228	169229
3/4	1	115/230	118228	111047*	115/208-230	118228	169230*
3/4	3	208-230/460	118228	111049*	208-230/460	118228	169231*
1	1	115/230	N/A	N/A**	115/208-230	118848	169232**
1	3	208-230/460	118848	N/A**	208-230/460	118848	169233**
1-1/2	1	115/230	N/A	N/A	115/208-230	NONE	169236
1-1/2	3	208-230/460	118848	N/A	208-230/460	NONE	169237
2	3	208-230/460	118848	N/A	208-230/460	NONE	169238
3	3	208-230/460	NONE	169221	208-230/460	NONE	169234

* When replacing the sleeve bearing motor with the maintenance-free ball bearing motor, the 118473 spring-type coupler must be changed to the 185329 sleeve-type coupler.

** When replacing the old sleeve bearing motor with the new maintenance free ball bearing motor, the 5/8" x 5/8" coupler part number 186004 must be changed to the 5/8" x 1/2" coupler part number 185330.

NOTE: Sleeve bearing power packs and maintenance-free ball bearing power packs are interchangeable.

When replacing a sleeve bearing power pack with a ball bearing power pack, the old motor bracket must be removed from the pump and discarded. The ball bearing power pack is bolted directly to the bearing assembly.

RECOMMENDED — Factory recommended spare parts.

N/A — Not Available.

XL-11™ BEARING ASSEMBLIES

BEARING ASSEMBLY CROSS REFERENCE

SLEEVE BEARING			XL-11™ BEARING	
PUMP SIZE	PUMP TYPE	BEARING ASSEMBLY PART NO.	BEARING ASSEMBLY PART NO.	SIZE
AA	BF or AB	186863	185332*	SMALL
A	BF	185260	185333**	LARGE
A	AB	185262	185334**	LARGE
F	BF	185264	N/A	N/A
F	AB	185265	N/A	N/A

NOTE: Sleeve bearing assemblies and XL-11 bearing assemblies are interchangeable.

* The 185332 Bearing Assembly is 5/8" longer than the AA sleeve bearing frame

** When replacing a sleeve bearing assembly with a new XL-11 bearing assembly on an "A" size pump that has the original factory-installed 7" power pack, an adapter kit is required.

ADAPTER KIT FOR XL-11™ MAINTENANCE-FREE BEARING RETROFIT

MOTOR HP	MOTOR PHASE	ADAPTER KIT PART NUMBER
1	1	185350
1	3	185351
1-1/2	1	185352
1-1/2	3	185353
2	3	185354

XL-11™ BEARING ASSEMBLIES

ITEM NO.	DESCRIPTION	SIZE		
		SMALL	LARGE	
11	Seal Kit	185332	185333	185334
	XL-11™ Bearing Frame Repair Kit†	118681	186499	186499
2	Volute Gasket	185335	185337	185337
	Coverplate	P57410	P57700	P57700
12	Coupler Cover	NONE	P57246	P57248
		NONE	P03982	P03982

† Includes pre-assembled shaft, sleeve and bearings, wave spring and volute gasket.

— Factory recommended spare parts.

N/A – Not Available.



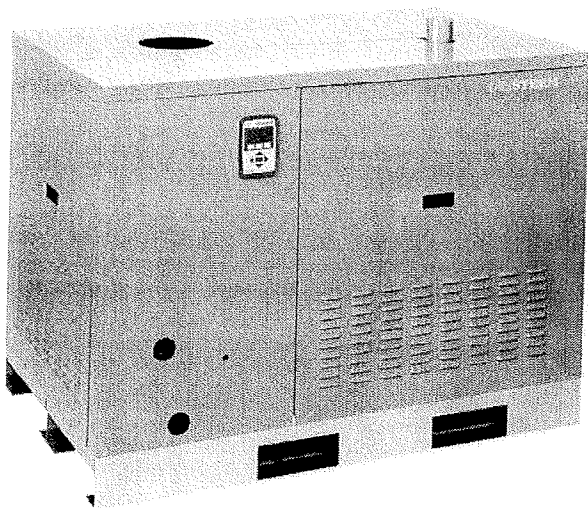
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H-1

DRISTEEM®



GTS®
Gas-to-Steam Humidifier
**Installation, Operation,
and Maintenance Manual**

WARNING!

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

**WHAT TO DO
IF YOU SMELL GAS**

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from an off-site phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

For toll-free technical support call:
1-800-328-4447

from the Humidification Experts



ATTENTION INSTALLER

Read this manual before installing.
Leave manual with product owner.

DRISTEEM technical support

800-328-4447

Where to find more information

On our Web site:

The following related documents can be viewed, printed or ordered from our web site, www.dristeem.com

- Catalogs (include dispersion nonwetting distance graphs):
 - GTS®
 - Ultra-sorb®
- Installation, Operation, and Maintenance manuals:
 - Ultra-sorb
 - Vapor-logic3® (includes sensor placement recommendations and troubleshooting information)
- *DRISTEEM Design Guide* (includes steam loss tables and general humidification information)

In Dri-calc:

Dri-calc® is our humidification system sizing and selection software, which can be ordered at www.dristeem.com.

Included in Dri-calc:

- A comprehensive library of installation guide documents, including:
 - Rapid-sorb installation instructions for vertical airflows
 - Recommended dispersion placement within a duct or air handler
 - Recommended sensor placement

Or call us at 800-328-4447

While obtaining documents from our web site or from Dri-calc is the quickest way to review our literature, we will also mail to you any literature you need.

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Safety precautions

WARNING!

The humidifier must be installed by a qualified technician and meet the requirements of all governing codes. Failure to follow these instructions could cause severe bodily injury or death.

READ AND SAVE THIS MANUAL

Read this manual before installing.
Leave manual with product owner.

WARNING!



If you do not follow the instructions in this manual exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

For your safety, read this entire manual before installing or operating the GTS humidifier.

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner.
Do NOT try to light the burner by hand.
- B. **Before operating**, smell all around the appliance area for gas. Be sure to smell next to the floor because gas can be heavier than air and settle on the floor.

FOR YOUR SAFETY: WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- C. Do not use this appliance if any part has been under water. Immediately call a qualified gas appliance service technician to inspect the appliance and to replace any part of the control system and any gas control that has been under water.

More safety precautions are on the next page ►

Safety precautions (continued)

Safe operating instructions

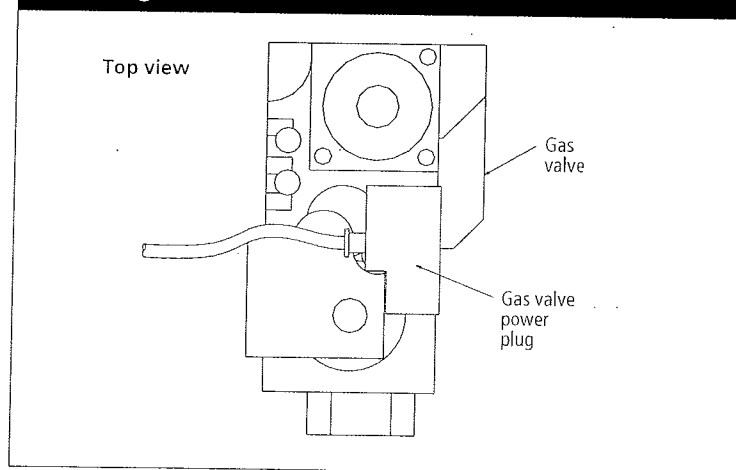
1. **STOP! Read the safety information on the previous page.**
2. Set the humidistat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device that automatically lights the burner. Do not try to light the burner by hand.
5. Remove control access panel.
6. Unplug the black power plug on the gas valve (see Figure 3-1).
7. Wait five minutes to clear out any gas.
If you then smell gas, STOP! Follow "B" in the safety information on the previous page.
If you don't smell gas, go to the next step.
8. Plug the black power plug back into the gas valve.
9. Replace control access panel.
10. Turn on all electric power to the appliance.
11. Set humidistat to desired setting.
12. If the appliance will not operate, follow the instructions on this page titled, "To turn off gas to appliance," and call your service technician or gas supplier.

More safety precautions are on the next page ►

To turn off gas to appliance

1. Set the humidistat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Unplug the black power plug on the gas valve.
5. Replace control access panel.

Figure 3-1:
Detail of gas valve



Safety precautions (continued)

WARNING!

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified installer or agency must use only factory authorized and listed kits or accessories when modifying this product. A failure to follow this warning can cause electrical shock, fire, personal injury, or death.

- Inspect humidifier and accessories upon arrival for damaged, missing, or improper parts. If there is a problem, call DRISTEEM.
- Application of this humidifier should have special attention given to vent sizing and material, gas input rate, and unit sizing. Improper installation or misapplication of the humidifier can cause excessive servicing or permanent component failure.
- When working on equipment, observe precautions in literature, tags, and labels attached to or shipped with the unit and observe other safety precautions that may apply. Wear safety glasses and work gloves. Have a fire extinguisher available during start-up, adjustment procedures, and service calls.
- Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control that has been under water.
- Do not lift humidifier by gas controls, gas manifold, fire box, or shroud.
- Should overheating occur, or the gas supply fail to shut off, shut off the manual gas valve to the appliance before shutting off the electrical supply.

More safety precautions are on the next page ►

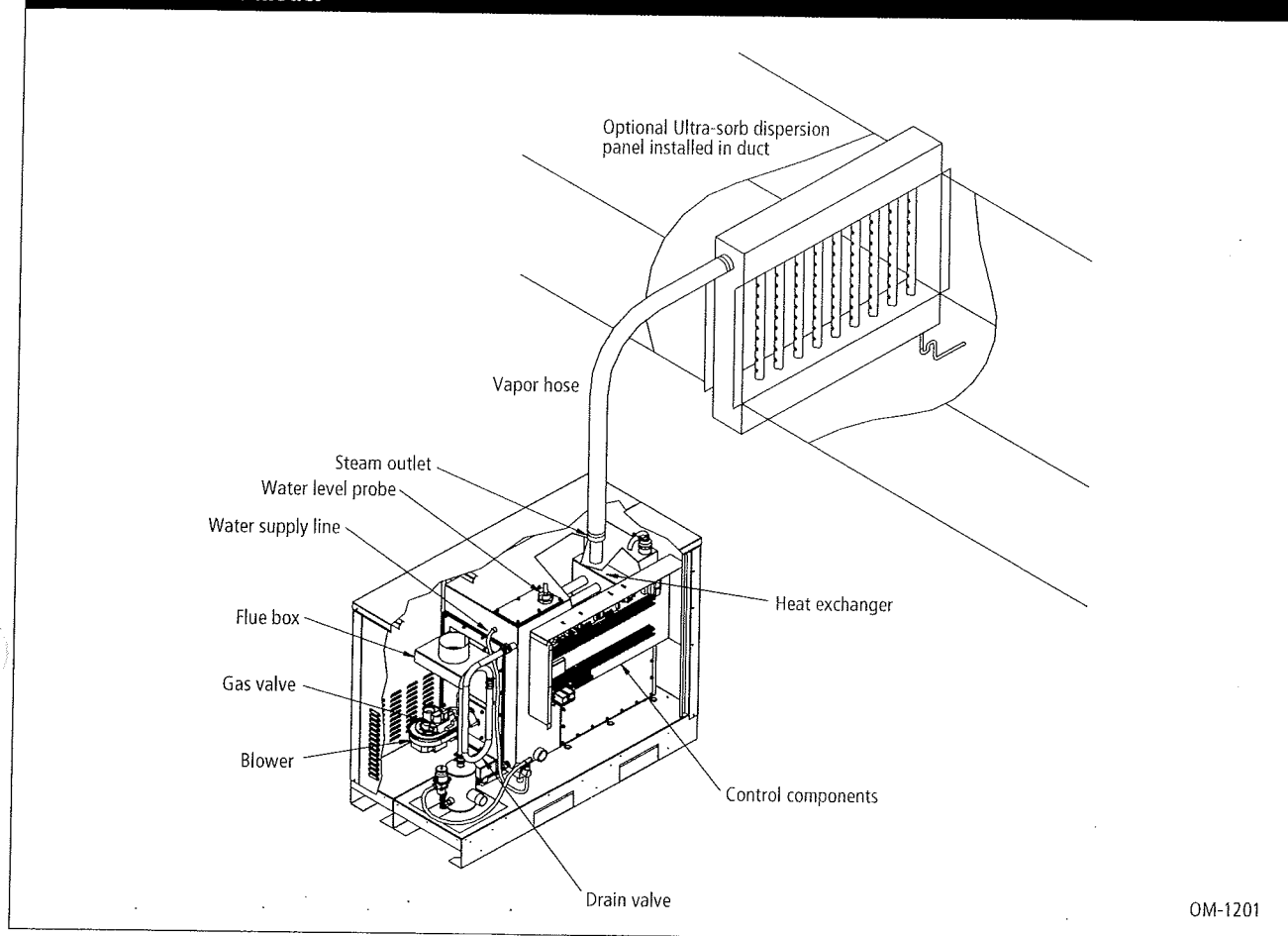
Safety precautions (continued)

WARNING!

- Installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1 (latest edition). In Canada, the installation of this unit must comply with local plumbing or waste water codes and other applicable codes and with the current code CAN/CGS-B149.1, "Installation Code for Natural Gas Burning Appliances and Equipment," or CAN/CGA-B149.2, "Installation Code for Propane Burning Appliances and Equipment."
 - Do not install in potentially explosive or flammable atmospheres laden with grain dust, sawdust, or similar airborne materials.
 - Installation of humidifier in high humidity or salt water atmospheres causes accelerated corrosion, reducing the normal life-span of the unit.
 - To prevent premature heat exchanger failure, do not locate any gas-fired unit in areas where chlorinated, halogenated, or acid vapors are present in the atmosphere.
 - Locate the humidifier in an area clear of combustible materials, gasoline, and other flammable vapors and liquids.
 - With the exception of sealed combustion units, do not locate units in tightly sealed rooms or small compartments without provision for adequate combustion air and venting. Room air combustion must be supplied through a minimum of two permanent openings in the wall, with at least one near the bottom. The openings should provide one square inch of free area per 1000 Btuh (1055 kJ/h) input rating of the unit, with a minimum of 100 square inches (645 cm²) for each opening. See the table and information on Page 30 for additional information.
 - Remove all shipping brackets and materials before operating the humidifier.
 - Do not locate humidifier in a negative pressure space. Combustion products could be suctioned from the venting.
 - Humidifier flue gases must be vented to the outside atmosphere.
 - Power supply disconnect switch must be in the off position while making wiring connections to prevent electrical shock and equipment damage. All units must be wired in strict accordance with the wiring diagram furnished with this unit.
 - Turn off all gas while installing the gas piping and manual shutoff valve for the humidifier.
 - The appliance and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures exceeding 0.5 psig (3.5 kPa).
-

Product overview

Figure 6-1:
GTS standard water model



Notes:

- GTS standard water models can be converted in the field for use with deionized/reverse osmosis (DI/RO) water. GTS-DI models can be converted in the field for use with potable or softened water.
- Damage caused by chloride corrosion is not covered by your DRISTEEM warranty.

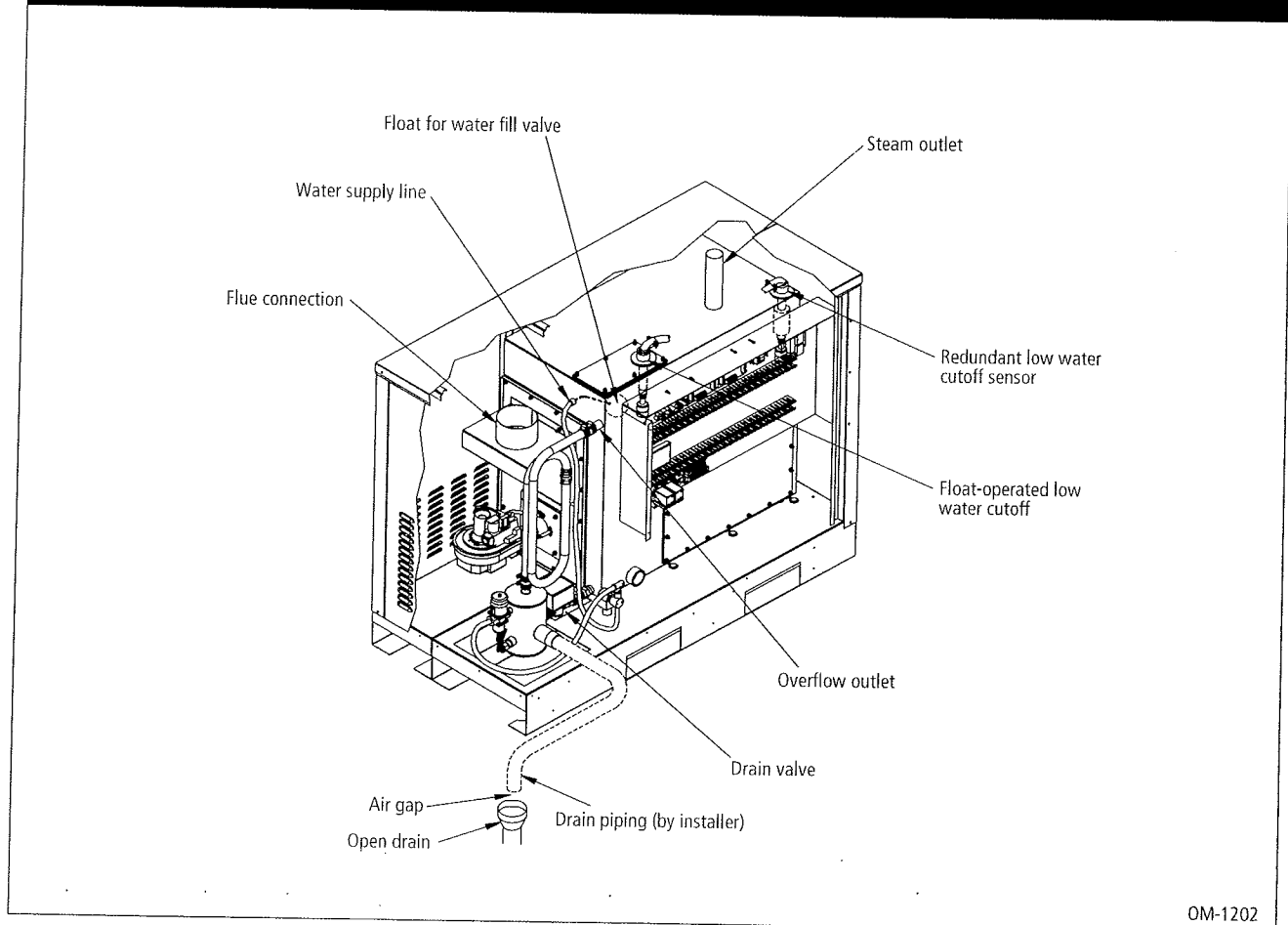
GTS standard water models

GTS standard water gas-fired humidifiers burn either natural or propane gas to heat potable or softened fill water into steam for humidification. The unit has from one to four burners that fire into a heat exchanger submerged in a tank of water. When there is a call for humidity, the burners fire and generate steam until the call for humidity ends. A probe monitors water level, requiring water conductivity to be at least 100 $\mu\text{S}/\text{cm}$ to operate properly. Therefore, GTS standard water models do not operate with demineralized water (deionized or reverse osmosis treated water). For demineralized water operation, use the GTS-DI model (described on next page).

All GTS models are compatible with DRISTEEM's dispersion panels Rapid-sorb and Ultra-sorb.

Product overview (continued)

**Figure 7-1:
GTS-DI (DI/RO water model)**



GTS-DI models

GTS-DI humidifiers burn either natural or propane gas to heat deionized (DI) or reverse osmosis (RO) fill water into steam for humidification. GTS-DI models control water level using a float valve.

GTS-DI models are virtually maintenance-free and require very little or no downtime.

All GTS models are compatible with DRISTEEM's dispersion panels Rapid-sorb and Ultra-sorb.

The GTS-DI model is available for use with deionized or reverse osmosis water. This unit produces chemical-free steam and reliable, accurate humidification control.

Notes:

- GTS standard water models can be converted in the field for use with deionized/reverse osmosis (DI/RO) water. GTS-DI models can be converted in the field for use with potable or softened water.
- Damage caused by chloride corrosion is not covered by your DRISTEEM warranty.

Specifications, capacities, and weights (North American models only)

Table 8-1:
GTS specifications, capacities, and weights for North American models only

GTS model	Maximum steam capacity		Input		Water usage at maximum capacity		Tank volume		GTS				GTS with outdoor enclosure				120 V 60 Hz full load amps*
									Operating weight		Shipping weight		Operating weight		Shipping weight		
	lbs/hr	kg/h	MBh	kW	gals/hr	litres/hr	gals	litres	lbs	kg	lbs	kg	lbs	kg	lbs	kg	
GTS-100	75	34	100	29	10	37.9	33	124.9	700	320	375	170	800	365	500	230	1.8
GTS-200	150	68	200	59	20	75.7	33	124.9	700	320	375	170	800	365	500	230	1.8
GTS-300	225	102	300	88	30	113.6	41	155.2	850	385	450	205	1000	455	600	270	3.0
GTS-400	300	136	400	117	40	151.4	41	155.2	850	385	450	205	1000	455	600	270	3.0
GTS-600	450	204	600	176	60	227.1	64	242.3	1100	500	600	270	1450	660	950	430	4.5
GTS-800	600	272	800	234	80	302.8	73	276.3	1400	635	700	320	1750	795	1050	475	6.0

Note:

* Add 15 full load amps for outdoor enclosure heater load on all GTS models

Important: See Pages 76-77 for European model specifications and capacity notes.

Table 8-2:
High altitude derate

Altitude		Input derate %
feet	meters	
0-2000	0-610	0
2001-2500	610-765	2
2501-3000	765-915	4
3001-3500	915-1065	6
3501-4000	1065-1220	8
4001-4500	1220-1370	10
4501-5000	1370-1525	12
5001-5500	1525-1675	14
5501-6000	1675-1830	16
6001-6500	1830-1980	18
6501-7000	1980-2135	20
7001-7500	2135-2285	22
7501-8000	2285-2440	24

Capacity notes

- At sea level, approximately 137 Btu are required to raise the temperature of one pound of water from 75 °F to 212 °F. (At sea level, approximately 318 kJ are required to raise the temperature of one kilogram of water from 24 °C to 100 °C.)
- An additional 970 Btu are required to change the state of one pound of 212 °F water to vapor. (An additional 2257 kJ are required to change the state of one kilogram of 100 °C water to vapor.)
- Another factor to consider is condensation steam loss from piping. Use the following general steam loss guidelines:
 - Vapor hose: 0.15 lbs/hr/ft (0.22 kg/h/m)
 - Insulated pipe: 0.05 lbs/hr/ft (0.07 kg/h/m)
 - Hard pipe and dispersion tubes: 0.50 lbs/hr/ft (0.7 kg/h/m)

For more detailed information about condensation steam loss, see the DRISTEEM Design Guide or our software program, Dri-calc.

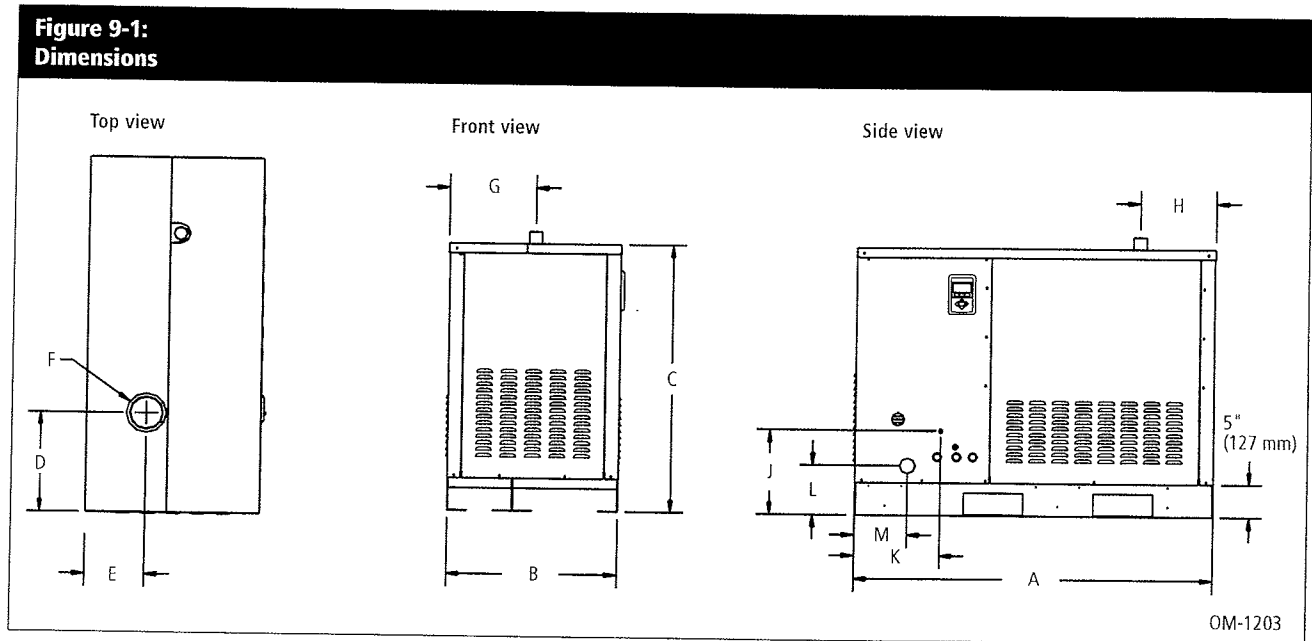
LP gas

All models operate at rated MBh/kW input.

High altitude

A derate in MBh/kW input exists when operating units at a high altitude. See Table 8-2 for high altitude derate information.

Dimensions



**Table 9-1:
Dimensions**

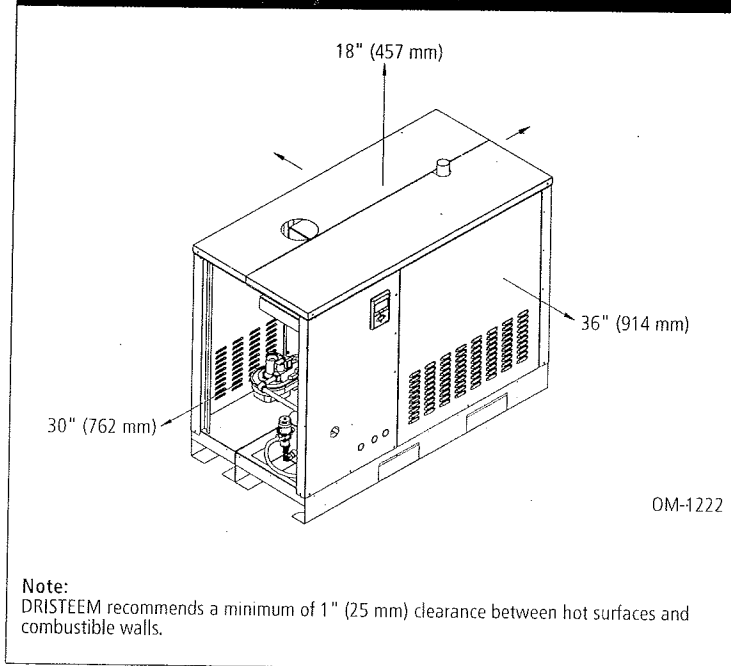
	Description	GTS-100 GTS-200		GTS-300 GTS-400		GTS-600		GTS-800	
		inches	mm	inches	mm	inches	mm	inches	mm
A	Overall length	54.35	1380	54.35	1380	54.35	1380	54.35	1380
B	Overall width	26.38	670	32.38	822	42.38	1076	48.38	1229
C	Shroud height	41.00	1040	41.00	1040	41.00	1040	41.00	1040
D	Flue position	18.00	457	17.00	432	17.00	432	16.25	413
E		13.00	330	15.63	397	18.63	475	21.00	533
F	Flue diameter	5.00	127	7.00	178	8.00	203	10.00	254
G	Steam outlet position	14.00	356	20.50	521	29.25	743	35.25	895
H		11.63	295	11.63	295	11.63	295	11.63	295
J	Fill valve connection position	13.00	330	13.00	330	13.00	330	13.00	330
K		13.00	330	13.00	330	13.00	330	13.00	330
L	Drain position	7.63	194	7.63	194	7.63	194	7.63	194
M		8.00	203	8.00	203	8.00	203	8.00	203

Locating the humidifier and clearance recommendations

Locating the humidifier

- Provide a level, solid foundation for the humidifier.
- Locate the humidifier as near as possible to a chimney or outside wall so that the flue pipe from the humidifier is short and direct.
- Locate the unit so it and its electrical components are protected from water during humidifier operation and service.
- Install the humidifier in a location away (and protected) from drafts. If installed in a separate room, follow the instructions concerning combustion and ventilation air.
- Locate the humidifier in an area where leakage from the tank or its connections will not result in damage to the adjacent structure or to lower floors of the structure. When such locations cannot be avoided, install a suitable drain pan (adequately drained) under the humidifier. The pan must not restrict combustion airflow.
- Do not install the humidifier on carpeting, tile or other combustible material other than wood flooring (indoor application only).
- If located in an insulated space, keep the humidifier free and clear of insulating materials. Insulating material can be combustible. Inspect the humidifier area when the humidifier is installed or when insulation is added.

Figure 10-1:
GTS clearance recommendations

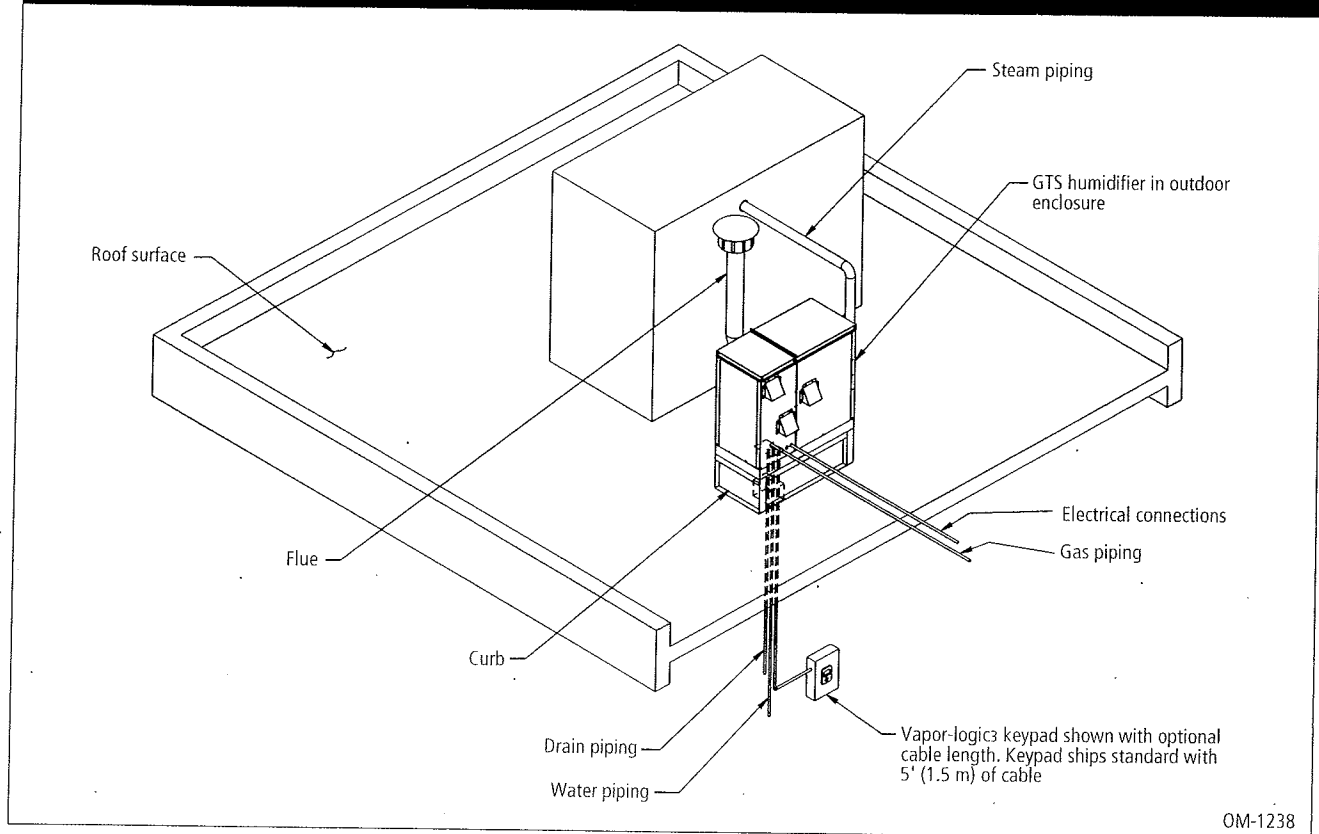


Outdoor enclosure mounting

Outdoor enclosure mounting option

The outdoor enclosure option is used when the GTS is installed outdoors. The following information is not intended to supersede any requirements of federal, state, or governing codes having jurisdiction; prior to locating the unit, authorities having jurisdiction should be consulted.

Figure 11-1:
Outdoor enclosure typical installation overview



Outdoor enclosure mounting (continued)

Handling

- The GTS outdoor enclosure is designed for handling by two methods. In both cases it must be lifted from the bottom base in a fashion that holds it level and keeps it from tipping, falling, or twisting. If the unit is severely twisted during handling, permanent damage can occur. It is the installer's responsibility to verify the handling equipment's capability to safely handle the unit.
- The preferred method of lifting is by forklift. This is only possible if forks extend across the entire unit. Forks that do not extend across the entire unit could cause tipping resulting in unsafe conditions or damage to the unit.
- The alternative method of handling is from under the unit and/or by using special lifting lug hooks installed on the unit. All lifting operations must be accomplished with a load spreader of sufficient width to ensure that the lifting cables clear the side of the unit. If this type of spreader is not available, insert wood strips between the cables and unit where necessary.

Outdoor enclosure mounting (continued)

Location

- The GTS outdoor enclosure must be level and located so there is enough clearance for opening the access panels.
- Verify that the position of pad or curb properly supports the unit and that support structure dimensions coincide with unit dimensions.
- Locate unit so air intakes are not too close to exhaust fan outlets, gasoline storage, or other contaminants that potentially could cause dangerous situations. Using and storing gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.
- When located on the roof, the air intakes must be a minimum of 14" (360 mm) off the roof to prevent intake of snow or splashed rain. The unit should be located so prevailing winds do not blow into the air intakes.
- An emergency drain is provided. In case of any water leak, water drains onto the roof through this emergency drain.
- A keypad with standard 5' (1.5 m) cable ships mounted to the subpanel in the GTS outdoor enclosure. The keypad must not come in contact with the strip heaters or block the intake ventilation hood.
- If constant monitoring of the unit is desired, or if the unit is located in a severe climate, install a remote mount keypad. Additional cable lengths up to 500' (152 m) are available as an option for this mounting configuration.
- Curbs (optional) are shipped knocked down for ease of transporting to the roof. Curbs are manufactured of 14-gauge galvanized steel and shipped with all hardware for bolt-together assembly. All holes are matched before leaving the factory. Curb is to be a minimum of 14" (360 mm) high. A closed-cell curb gasket with adhesive on one side is supplied with hardware. An installation drawing also is included. To prevent moisture from leaking into the building from either driving rain or melting snow, install the gasket between the top of the curb and the base surface of the unit.

Outdoor enclosure mounting (continued)

Before you begin

- Prior to installing the unit, remove all packaging.
- During the transit, unloading, and setting of the unit, bolts and nuts may become loose. Check that all nuts are tightened as required.
- There are three knockouts located on the right and left side of the enclosure. DRISTEEM recommends running electrical power into the enclosure at these knockouts.
- When unit is mounted on an outdoor curb, there must be a gasket between the top of the curb and the base surface of the unit to prevent moisture from leaking into the building from either driving rain or melting snow.
- The outdoor enclosure has two available steam distribution configurations. The standard configuration has a steam outlet at the back of the outdoor enclosure for connecting to steam dispersion unit piping. The optional internal steam distribution configuration routes steam within the outdoor enclosure and down through the pipe chase into a building. See drawings on Pages 15 and 16.

Important: A pipe chase is located inside the burner section of the enclosure. DRISTEEM recommends using this pipe chase for both the supply water piping and drain piping. Use insulation to completely fill the area around the pipes to maintain proper enclosure pressure.

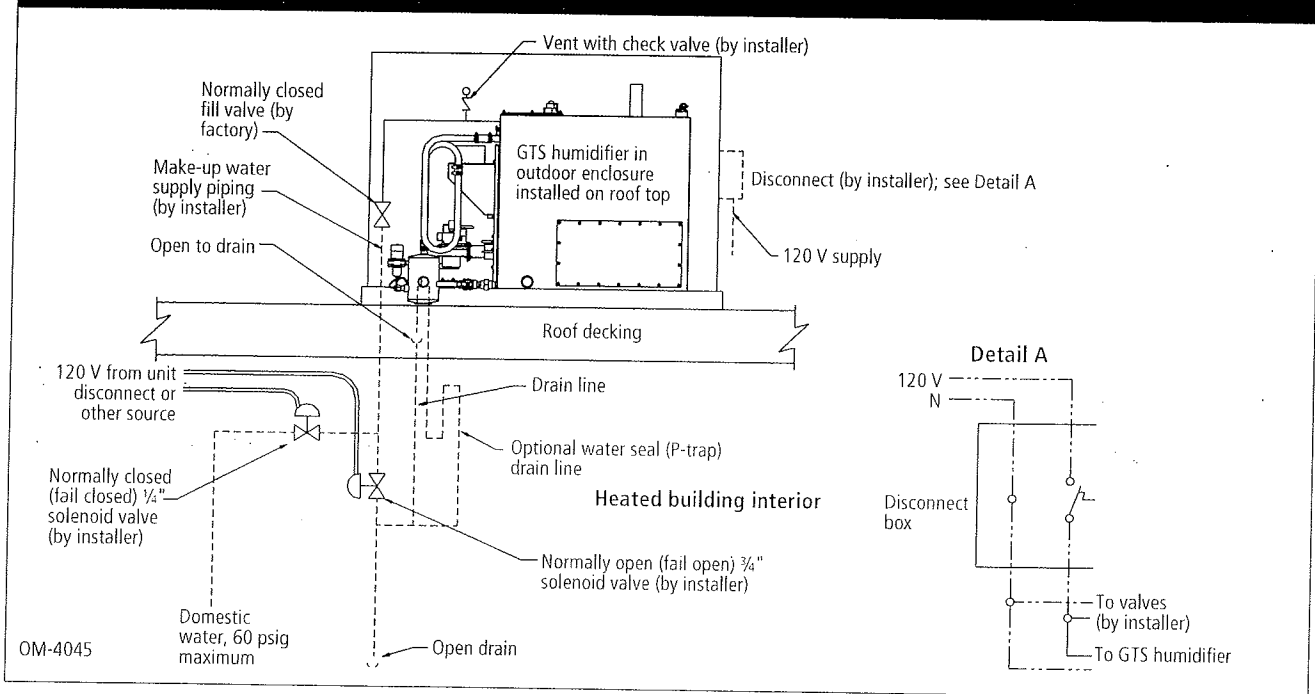
- The heater package has two thermostat-controlled heaters: one strip heater is located in the control section, and one strip heater is located in the burner section to keep the enclosure at a constant minimum temperature.
- Refer to the installation section of this manual for directions on installing electrical, gas, flue, drain, and water connections. A separate electrical service connection for the outdoor GTS is recommended. Insulation and/or heat taping of water piping is recommended.

Outdoor enclosure mounting (continued)

Piping

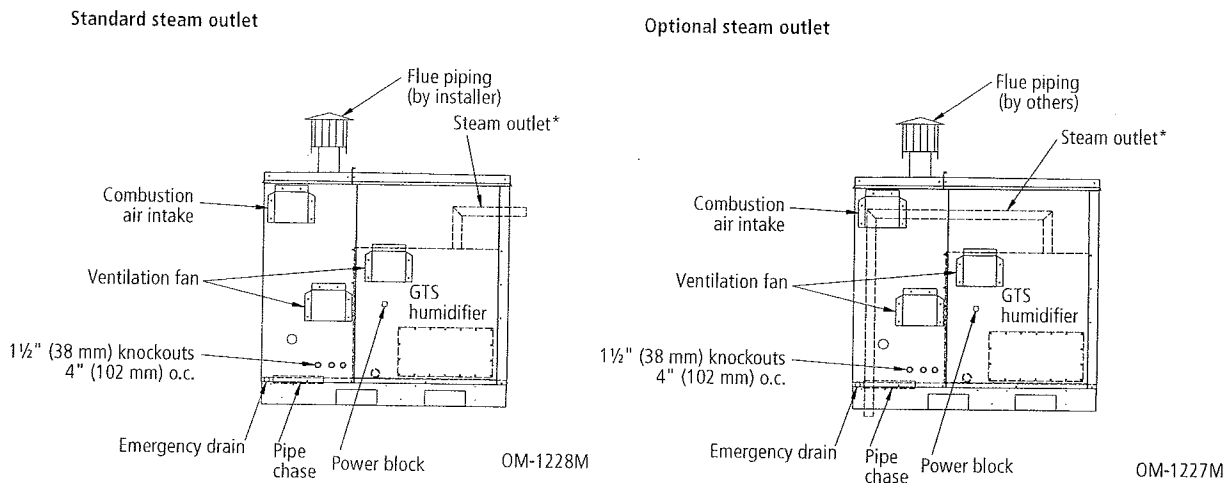
- Insulate supply water piping to avoid dripping from condensation. To ensure that water does not remain in the fill line and freeze if there is a loss of power, DRISTEEM recommends field installing additional valves upstream of the fill valve in a conditioned space. Power these valves on the same circuit as the GTS; if the power goes off, water drains out of the fill line to prevent freezing (see Figure 15-1).
- When pad-mounted or when the pipe chase cannot be used, the supply water and drain piping can be run through the knockouts, although preferably on the opposite side from the gas and electric.
- Sealed combustion air is piped directly from the outside of the enclosure to the burner, so no conditioned air is removed from the space below. This is factory piped and no assembly is required. Check tightness of pipe clamps.
- External flue piping shall be provided by installers and field installed. The flue of the outdoor enclosure exits out the left side of the unit and a vertical stack must be constructed. The stack must be a minimum of 5–10 feet (1.5–3.0 m) above the top of the roof. However, the exact height varies depending on unit size, climate, etc. Governing codes prevail. A UL/C-UL (or equivalent) listed cap must be used and a drip tee included.

Figure 15-1:
Outdoor enclosure installation detail



Outdoor enclosure mounting (continued)

Figure 16-1:
GTS outdoor enclosure with standard or optional steam outlet, elevation view



Notes:

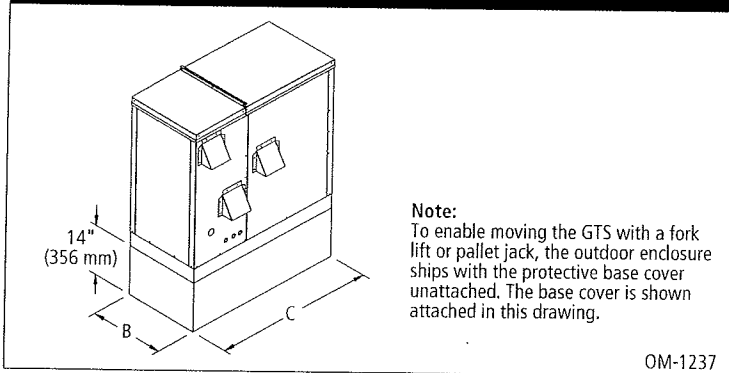
1. The outdoor enclosure has two available steam distribution configurations. The standard configuration has a steam outlet at the back of the outdoor enclosure for connecting to steam dispersion unit piping. The optional internal steam distribution configuration routes steam within the outdoor enclosure and down through the enclosure pipe chase into a building.
2. There are three knockouts located on the right and left side of the enclosure. Run the electrical power and gas piping into the enclosure at these knockouts.
3. Piping from the GTS unit to the steam outlet is stainless steel pipe. Piping from the steam outlet to the dispersion assembly is provided by the installer. Choose interconnecting steam piping material that is appropriate for the application (e.g., for high-purity steam applications, consider using stainless steel interconnecting steam piping). See Page 22 for steam outlet sizes.
4. The GTS housed in an outdoor enclosure will operate properly in operating temperature of -40°F to 122°F (-40°C to 50°C).

Outdoor enclosure mounting (continued)

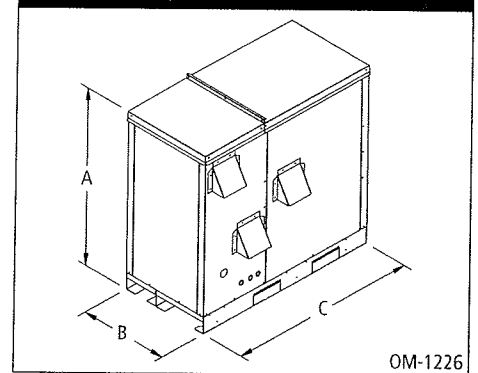
**Table 17-1:
Outdoor enclosure dimensions**

	Description	GTS-100 GTS-200		GTS-300 GTS-400		GTS-600		GTS-800	
		inches	mm	inches	mm	inches	mm	inches	mm
A	Enclosure height	52.00	1321	52.00	1321	52.00	1321	52.00	1321
B	Enclosure width	26.38	670	32.38	822	42.38	1076	48.38	1229
C	Enclosure length	54.35	1380	54.35	1380	54.35	1380	54.35	1380

**Figure 17-1:
Outdoor enclosure mounted on a curb**



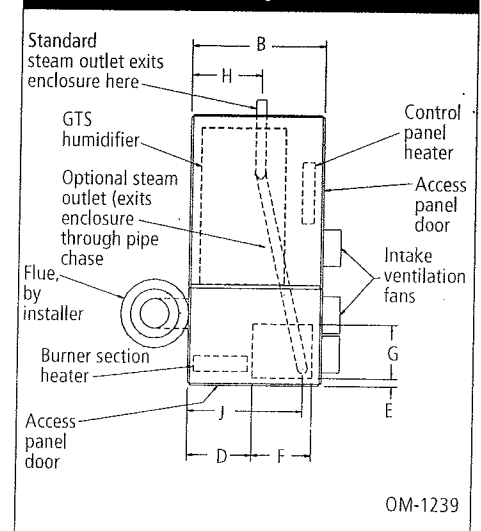
**Figure 17-2:
Outdoor enclosure mounted flush**



**Table 17-2:
Outdoor enclosure top view dimensions**

	Description	GTS-100 GTS-200		GTS-300 GTS-400		GTS-600		GTS-800	
		inches	mm	inches	mm	inches	mm	inches	mm
B	Enclosure width	26.38	670	32.38	822	42.38	1076	48.38	1229
D	Pipe chase position	12.88	327	18.88	480	28.88	734	34.88	886
E	Pipe chase position	2.00	51	2.00	51	2.00	51	2.00	51
F	Pipe chase size	12.00	305	12.00	305	12.00	305	12.00	305
G	Pipe chase size	11.00	280	11.00	280	11.00	280	11.00	280
H	Steam pipe position	14.12	359	20.12	511	30.12	765	36.12	917
J	Steam pipe position	21.00	533	27.00	686	37.00	940	43.00	109

**Figure 17-3:
Outdoor enclosure top view**



Outdoor enclosure operation

GTS outdoor enclosure sequence of operation

- Power is applied to the outdoor enclosure.
- If the ambient temperature in the enclosure is below 50 °F (10 °C), the strip heaters are powered up. If the enclosure temperature reaches 35 °F (2 °C), power is allowed to the GTS subpanel and the GTS unit is enabled. The strip heaters remain on until the enclosure reaches 50 °F (10 °C) to ensure that the temperature inside the enclosure does not drop below the freezing point.
- When the enclosure temperature is at or above 50 °F (10 °C), the GTS tank heats the enclosure. When there is no call for humidity, an aquastat maintains tank temperature at the factory default of 70 °F (21 °C). This temperature can be reset in the field to be from 40-180 °F (4-82 °C).
- When the ambient temperature in the enclosure reaches 85 °F (29 °C), two ventilation fans turn on to cool the electronic components. A high limit is also provided to power down the GTS if the enclosure temperature reaches 150 °F (66 °C). In a high limit situation, the ventilation fans continue to run and once the enclosure temperature falls below 130 °F (54 °C), the GTS automatically resumes normal operation.
- A normally open drain valve is provided on the GTS outdoor enclosure to drain the tank in the event of a power loss.

Wiring: Electrical connections

WARNING!

The electrical subpanel must have an uninterrupted or unbroken ground according to National Electrical Code, ANSI/NFPA 70 and Canadian Electrical Code, CSA C22.1, or according to governing codes, to minimize personal injury if an electrical fault should occur. This ground can consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground.

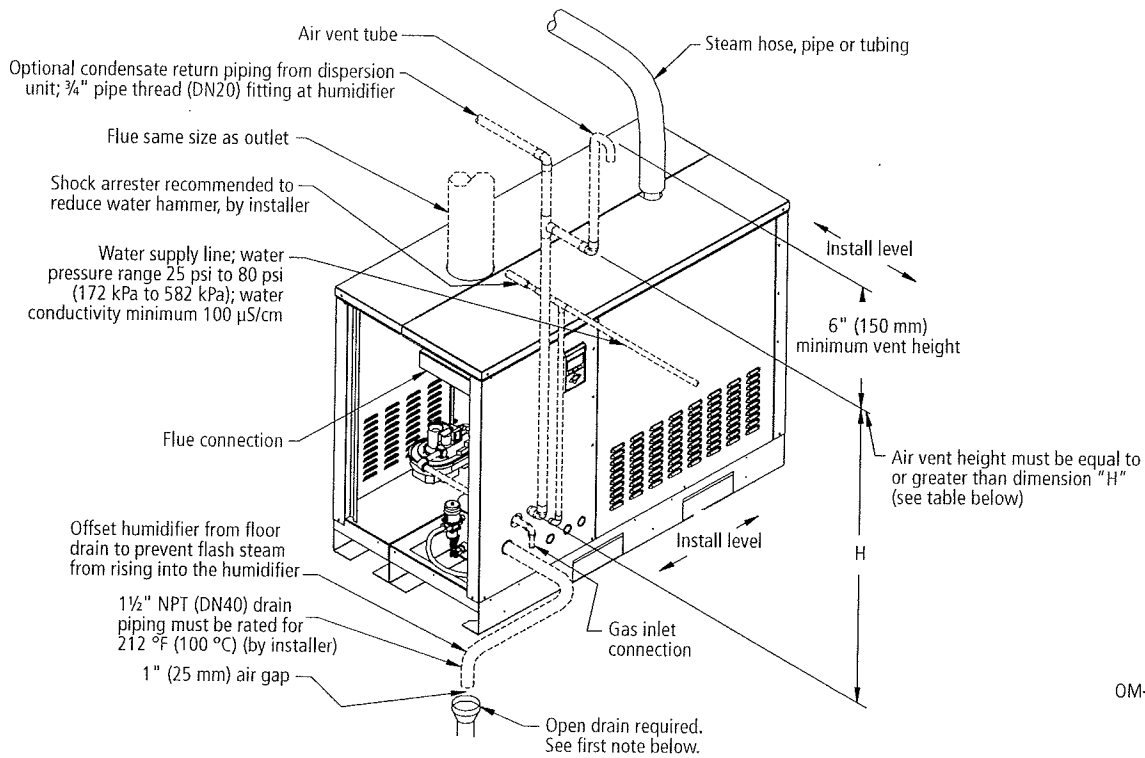
-
- GTS humidifiers must be supplied with 120-volt AC, 60-Hz (North American models) or 230-volt AC, 50-Hz (European models) separately fused electrical service. The GTS humidifier is equipped with a transformer to step down the voltage to 24 VAC control voltage.
 - When installed, the GTS humidifier must be electrically grounded in accordance with governing codes or, in the absence of governing codes, in accordance with the National Electrical Code ANSI/NFPA No. 70-1987. The electrical conductors shall be Type MTW (105 °C) AWG #14 wire for line voltage (120V), with BLACK WIRE for HOT, WHITE WIRE for NEUTRAL, GREEN AND YELLOW WIRE for GROUND, and #18 gauge for control wiring. All electrical components and wiring must be protected from mechanical damage and water. The control system requires an earth ground for proper operation.
 - The GTS humidifier is adjusted for correct performance. Only a qualified gas appliance technician may alter throttle setting.
 - Check the electric current characteristics and capacity requirements against the nameplate. All wiring must be in accordance with all governing codes and with the GTS wiring diagram located inside the control cabinet. See table on Page 8 for information on the various models.
 - Refer to the *Vapor-logic3 Installation and Operation Manual* for additional information on the controller furnished with this GTS humidifier.

WARNING!

Do not connect aluminum wire between disconnect switch and humidifier. Use only copper wire. Failure to follow these instructions could cause a fire, resulting in severe bodily injury, death, or significant property damage.

GTS piping, standard water models

Figure 20-1:
Field piping overview for GTS standard water models



OM-1208

Notes:

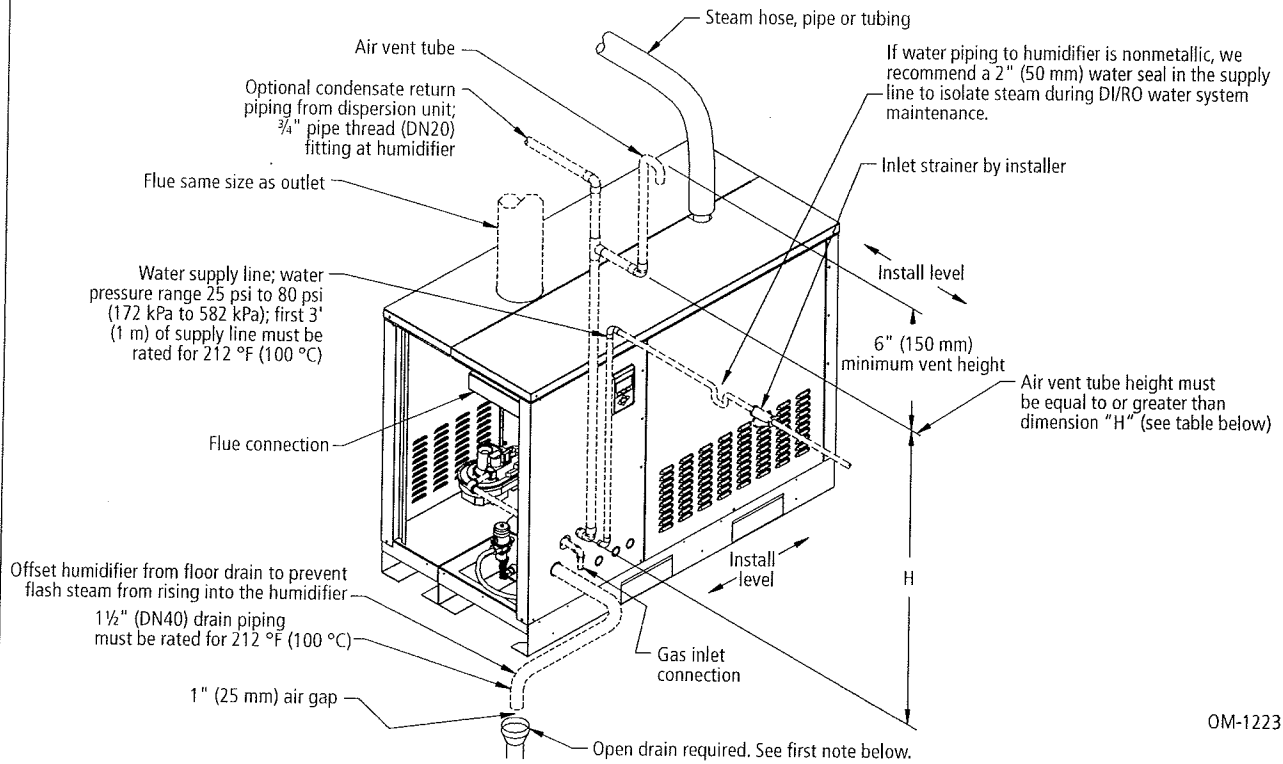
- Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam; otherwise, condensation may form on nearby surfaces. Refer to governing codes for drain pipe size and maximum discharge water temperature.
- Dashed lines indicate provided by installer.
- Humidifier flue gases must be vented to the outside atmosphere.
- The water supply inlet is more than 1" (25 mm) above the skim/overflow port, eliminating the possibility of backflow or siphoning from the tank. No additional backflow prevention is required; however, governing codes prevail.
- Damage caused by chloride corrosion is not covered by your DRISTEEM warranty.
- See the next page for recommended water supply piping for DI/RO water models.

Table 20-1:
Height required to overcome GTS internal pressure (H)

GTS model number	H = Height required to overcome humidifier internal pressure	
	inches	mm
100	35	889
200	35	889
300	41	1041
400	41	1041
600	41	1041
800	41	1041

GTS piping, DI/RO water models

Figure 21-1:
Field piping overview for GTS DI/RO water models



OM-1223

Table 21-1:
Height required to overcome GTS-DI internal pressure (H)

GTS-DI model number	H = Height required to overcome humidifier internal pressure	
	inches	mm
100	35	889
200	35	889
300	41	1041
400	41	1041
600	41	1041
800	41	1041

Notes:

- Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam; otherwise, condensation may form on nearby surfaces. Refer to governing codes for drain pipe size and maximum discharge water temperature.
- Dashed lines indicate provided by installer.
- Humidifier flue gases must be vented to the outside atmosphere.
- The water supply inlet is more than 1" (25 mm) above the overflow port, eliminating the possibility of backflow or siphoning from the tank. No additional backflow prevention is required; however, governing codes prevail.
- Damage caused by chloride corrosion is not covered by your DRISTEEM warranty.
- In order to minimize DI/RO water use, disconnect factory piping to the water tempering device and pipe directly to tap water.
- See the previous page for recommended water supply piping for standard water models.

Supply water and drain overflow connections

Supply water and drain overflow connections

Regardless of the type of water used, the following general instructions MUST be followed:

- Make union connections at the humidifier on the make-up water supply and drain/overflow lines.
- Provide a shutoff valve in the supply water line to isolate the humidifier from the water system while servicing.
- Shock arrester, provided by installer, is recommended to reduce water hammer.
- A 1" (25 mm) opening is provided in the humidifier tank to accommodate skim and/or overflow protection. (Note: Follow governing code requirements regarding size of drain pipe.)
- Use insulating unions or bushings to make connections between copper and other dissimilar metal fittings, such as galvanized steel. These insulating fittings are required to minimize electrolytic corrosion, which results from the direct connection of dissimilar metals in a water system.
- Before beginning ignition sequence of the humidifier at a new installation, make sure the humidifier tank is full of water and the water is free to flow into the tank.
- If planning to use heated supply water, disconnect the water supply line to the water tempering device at the fill manifold and reconnect it to a cold water supply. This will ensure that the water tempering device operates properly.

**Table 22-1:
Connection sizes**

Description	GTS-100 GTS-200		GTS-300 GTS-400		GTS-600		GTS-800	
	inches	DN	inches	DN	inches	DN	inches	DN
Gas supply	½ (pipe thread)	15	1 (pipe thread)	25	1 (pipe thread)	25	¾ (pipe thread)	32
Sealed combustion piping (optional)	4	100	4	100	4	100	4	100
Flue vent	5	125	7	180	8	200	10	250
Water supply to fill valve and tempering device	¾ (pipe thread)	10	¾ (pipe thread)	10	¾ (pipe thread)	10	¾ (pipe thread)	10
Drain	1½ (pipe thread)	40	1½ (pipe thread)	40	1½ (pipe thread)	40	1½ (pipe thread)	40
Steam outlet	2 (pipe thread or hose)	50	3 (flange)	80	4 (flange)	100	4 (flange)	100
Condensate return (recommended)	¾ (pipe thread)	20	¾ (pipe thread)	20	¾ (pipe thread)	20	¾ (pipe thread)	20

Water supply piping

Water supply piping general instructions

The GTS humidifier has a 1" (25 mm) internal air gap to prevent back siphoning into a potable water system. However, some governing codes may require additional protection such as a vacuum breaker or backflow preventer.

The supply water pressure range must be 25 psi to 80 psi (172 kPa to 552 kPa). When nonmetallic water piping is used, it must be rated to withstand 212 °F (100 °C) or greater temperature. If not, the final three feet of piping connected to the humidifier should be metallic and should not be insulated.

DRISTEEM recommends installing a shock arrester to reduce water hammer (see Figure 20-1).

GTS (standard water) water supply piping

The water supply assembly has a 3/8" pipe thread (DN10) connection. Since the primary component of the water supply assembly is a solenoid valve, there may be noise issues that surface during a fill cycle.

During a fill cycle, the supply water drops the water temperature in the tank and may collapse the steam, which can cause a low rolling sound. To diminish this, install a needle valve between the fill valve and tank to decrease the water fill rate and/or use hot supply water.

In cases where water hammer occurs when the fill solenoid closes, a shock arrester is recommended. Reducing the supply water pressure (minimum 25 psi [172 kPa]) or using flexible tubing (rated for 212 °F [100 °C] minimum continuous operating temperature) may diminish the noise, but installing a shock arrester is the best solution.

The minimum water conductivity for the GTS standard water model is 100 µS/cm.

Water supply piping (continued)

Important: Damage caused by chloride corrosion is not covered by your DRISTEEM warranty.

GTS-DI water supply piping

GTS-DI models control water level with a float valve, and have a 3/8" pipe thread (DN10) connection. For DI models with the end-of-season drain option, a solenoid valve is added on the inlet of the float valve. The end-of-season feature shuts off the fill water supply and drains the tank when there is no demand for humidity for 72 hours. (This length of time is a default setting and is user-adjustable. See the *Vapor-logic3 Installation and Operation Manual* for more information.)

When using nonmetallic tubing for supply water, it must be rated for 212 °F (100 °C) minimum continuous operating temperature. DRISTEEM recommends installing a 3' (1 m) piece of noninsulated stainless steel pipe directly off the humidifier prior to connecting to the nonmetallic tubing. When using nonmetallic tubing, DRISTEEM recommends the installer place a 2" (50 mm) water seal/loop in the supply line to isolate steam during DI/RO water system maintenance. (See Figure 21-1 on page 21.)

DRISTEEM recommends installing a strainer in the water supply line to prevent clogging of the solenoid valve or float valve orifice. A strainer is highly recommended when the humidifier has the end-of-season drain option. The strainer prevents particulate from collecting at the solenoid valve seat.

In order to minimize DI/RO water use, disconnect factory piping to the water tempering device and pipe directly to tap water.

WARNING!

If the GTS-DI humidifier is supplied with tap water, the float valve assembly will become clogged and particulate will accumulate on the low water cutoff switch (float switch). This will cause failure of a critical safety circuit and the potential for a dry tank fire. A dry tank fire can cause heat exchanger, vapor hose, and wire insulation failure, severe property damage, severe personal injury, or death.

Drain piping

The drain line piped from the humidifier must be run to an approved sanitary waste or suitable drain. Although the GTS humidifier is equipped with integral water tempering, if nonmetallic drain pipe or hose is used, DRISTEEM recommends it be rated for 212 °F (100 °C) minimum continuous operating temperature.

Minimum drain pipe size is 1½" (DN40) inside diameter. If the length of the drain piping exceeds 10' (3 m), increase the pipe size.

Do not locate the humidifier directly above a floor drain — skim and drain water dumped into the drain will cause flash steam. This steam will rise and saturate electrical components, adversely affecting component life and performance.

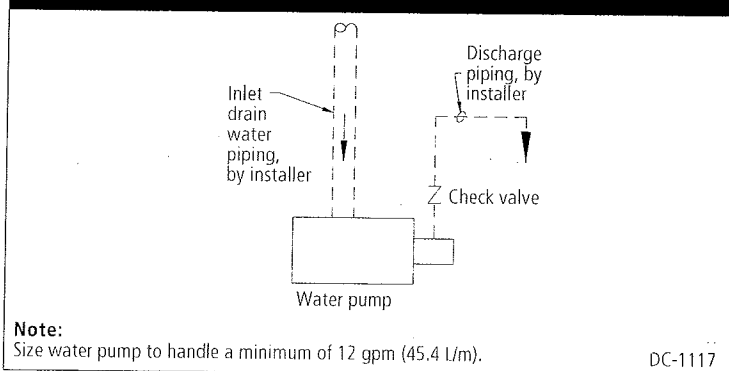
An open drain with a 1" (25 mm) air gap between the drain piping and the drain is required. Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam; otherwise, condensing on nearby surfaces may occur.

Drain piping after the water seal must be pitched a minimum of 1/8"/ft (1%) toward the drain. Governing codes may require more pitch.

If the proximity of a drain requires the humidifier drain and skim water to be lifted, use a water pump with capacity of at least 12 gallons per minute (gpm) or 45.4 litres per minute (L/m). A check valve is required on the discharge of the pump (see Figure 25-1). Electrical power for the pump is independent of the humidifier.

The GTS humidifier has an auxiliary 1½" (DN40) drain outlet located below the subpanel. This drain outlet can be hard-piped during installation to enable rapid tank draining before maintenance. This outlet can also provide access for removing scale from the tank bottom.

**Figure 25-1:
Lifting drain water**



Integral water tempering chamber

Governing codes may require that the 212 °F (100 °C) drain and skim/overflow water from the humidifier be tempered before it is discharged into the building drain piping. The GTS humidifier has an integral water tempering chamber that tempers 6 gpm (22.7 L/m) of 212 °F (100 °C) water to 140 °F (60 °C). The water tempering sequence of operation is:

1. Hot water discharged from the humidifier enters the water tempering chamber from either the skim/overflow port or the tank drain.
2. Cold water enters the water tempering chamber through a temperature-actuated valve to mix with the hot discharged water.
3. Tempered water at 140 °F (60 °C) maximum exits through the water tempering chamber side outlet for safe discharge into a municipal sewer system or PVC pipe.

**Table 25-1:
Integral water tempering
specifications**

Water type	Maximum low rate		Maximum temperature	
	U.S. gpm	L/m	°F	°C
Hot water inflow	6	22.7	212	100
Cold water inflow*	6	22.7	70	21
Tempered water outflow	12	45.4	140	60

Note:
* Cold water inflow pressure must be between 25 psi and 80 psi (172 kPa and 552 kPa).

Gas piping

Caution! Supply the humidifier only with the gas type (natural gas or LP gas) listed on the humidifier name plate or burner failure will result. To convert the humidifier to natural gas or LP gas, contact DRISTEEM technical support or your DRISTEEM representative/distributor.

Caution! Gas pressure to the humidifier controls must never exceed 24" wc (6 kPa, 60 mbar) or the gas valve will become damaged and require replacement. Immediately install a 1/8" pipe thread (DN6) plugged tapping, accessible for test gauge connection, upstream of the gas supply connection to the appliance.

Important: For North American models, the recommended supply pressure is 7" wc (1.75 kPa) for natural gas or 11" wc (1.83 kPa) for LP gas.

For European models, the required supply pressure is 20 or 25 mbar for natural gas and 30, 37, or 50 mbar for propane gas.

Gas piping guidelines

- After threading and reaming the ends of the pipes, inspect piping and remove loose dirt and chips.
- Support piping so there are no strains imposed on unit or controls.
- Use two wrenches when connecting piping to unit or controls.
- Provide a drip pocket before each unit and in the line where low spots cannot be avoided.
- Takeoff to unit should come from top or side of main to avoid trapping condensate.
- Piping that is subject to wide temperature variations should be insulated.
- Pitch piping up toward unit at least ¼" (6 mm) per 15' (4.5 m) of horizontal run.
- Compounds used on threaded joints of gas piping must be resistant to the harmful action of liquefied petroleum gases.

WARNING!

Purge air before lighting unit by disconnecting piping at gas control. In no case should line be purged into heat exchanger. Failure to follow these instructions could cause an explosion or fire resulting in bodily injury, death, or significant property damage.

- After installation, check field piping and humidifier gas train for gas leaks.
- Do not use soap solution or open flame on humidifier gas train. A gas leak detector is recommended.
- Install a ground joint union and a manual shutoff valve immediately upstream of the unit. Install a plugged tapping upstream of the shut-off valve, accessible for test gauge connection. Pressure tappings for test gauges are located on all gas valves.
- Allow at least 5' (1.5 m) of piping between any high pressure regulator and unit pipe connection.
- Piping installation must be in accordance with governing codes, and ANSI Z233.1, "National Fuel Gas Code," or CAN/CGA-B149 in Canada. Do not use flexible connectors.

More gas piping instructions on the next page ►

Gas piping (continued)

- Piping to units should conform with local and national requirements for type, volume, and gas handled and for pressure drop allowed in the line. Refer to the tables on this page to determine the gas flow in ft³/hr or m³/hr for the type of gas and size of unit to install. Using this value and the length of pipe necessary, determine the pipe diameter. Where several units are served by the same main, the total capacity, gas flow, and length of main must be considered. Avoid pipe sizes smaller than ½" (DN15). Table 27-2 below allows for the usual number of fittings with a 0.3" wc (0.07 kPa) pressure drop.
- When the specific gravity of the gas is other than 0.60 for natural gas or 1.53 for propane, use Table 27-1.

Table 27-2:
Gas pipe capacities for gas pressures of 0.5 psig (3.45 kPa) or less

Length of pipe		Gas flow in piping in ft ³ /hr and m ³ /hr at pressure drop of 0.3" wc (0.07 kPa) Specific gravity = 0.60									
		Nominal iron pipe diameter in inches (DN)									
		½" (DN15)		¾" (DN20)		1" (DN25)		1¼" (DN32)		1½" (DN40)	
ft	m	ft ³ /hr	m ³ /hr	ft ³ /hr	m ³ /hr	ft ³ /hr	m ³ /hr	ft ³ /hr	m ³ /hr	ft ³ /hr	m ³ /hr
10	3	132	3.7	278	7.9	520	14.7	1050	29.7	1600	45.3
20	6	92	2.6	190	5.4	350	9.9	730	20.7	1100	31.1
30	9	73	2.1	152	4.3	285	8.1	590	16.7	890	25.2
40	12	63	1.8	130	3.7	245	6.9	500	14.2	760	21.5
50	15	56	1.6	115	3.3	215	6.1	440	12.5	670	19.0
60	18	50	1.4	105	3.0	195	5.5	400	11.3	610	17.3
70	21	46	1.3	96	2.7	180	5.1	370	10.5	560	15.9
80	24	43	1.2	90	2.5	170	4.8	350	9.9	530	15.0
90	27	40	1.1	84	2.4	160	4.5	320	9.1	490	13.9
100	30	38	1.1	79	2.2	150	4.2	305	8.6	460	13.0

See example on page 28.

Table 27-1:
Specific gravity conversion factors

Natural gas	
Specific gravity	Factor
0.55	1.04
0.60	1.00
0.65	0.962
Propane gas	
Specific gravity	Factor
1.50	0.633
1.53	0.626
1.60	0.612

Note:
Use the above multiplying factor with Table 27-2 when the specific gravity of gas is other than 0.60 (natural gas) or 1.53 (propane).

More gas piping instructions on the next page ►

Gas piping (continued)

Gas leak testing

- When leak-testing the gas supply piping system, disconnect the humidifier and its gas shutoff valve during any pressure in excess of 24" wc (6 kPa). Isolate the humidifier from the gas supply piping system by closing its field-installed manual shutoff valve during any pressure not equal to 24" wc (6 kPa).
- With all burners running, check gas supply pressure at the inlet pressure tap of the combination gas control valve.

For North American models, the recommended supply pressure is 7" wc (1.75 kPa) for natural gas or 11" wc (1.83 kPa) for LP gas. Perform gas piping purging as described in ANSI Z223.1 (latest edition) or in Canada, CAN/CGA-B149 codes. The minimum supply pressure is 6" wc (1 kPa) for natural gas or LP gas.

For European models, the required supply pressure is 20 or 25 mbar for natural gas and 30, 37, or 50 mbar for propane gas.

Example

For this example, refer to the tables on the previous page.

To determine gas piping size, begin by calculating the cubic feet/hour (ft³/hr) or m³/hr using the following formula:

$$\frac{\text{Btuh (kW) input}}{\text{Calorific value of gas}}$$

Calorific values are:

- Natural gas: 1025 Btu/ft³ (10.6 kW-hr/m³)
- Propane: 2500 Btu/ft³ (25.9 kW-hr/m³)

For example, if you have a GTS-400 operating on natural gas, calculate the ft³/hr or m³/hr as follows:

$$\frac{400,000 \text{ Btuh}}{1025 \text{ Btu/ft}^3} = 390 \text{ ft}^3/\text{hr}$$

$$\frac{117.2 \text{ kW}}{10.6 \text{ kW-hr/m}^3} = 11.5 \text{ m}^3/\text{hr}$$

If you need to run your gas piping 60 feet (18 m), see Table 27-2 on the previous page and look horizontally across the 60 ft (18 m) row until you locate the next highest value above your calculated ft³/hr or m³/hr. In this example, you are looking for the next highest value above 390 ft³/hr (11.05 m³/hr), which is 400 ft³/hr (11.3 m³/hr) and indicates the use of a 1¼" (DN32) pipe for this application.

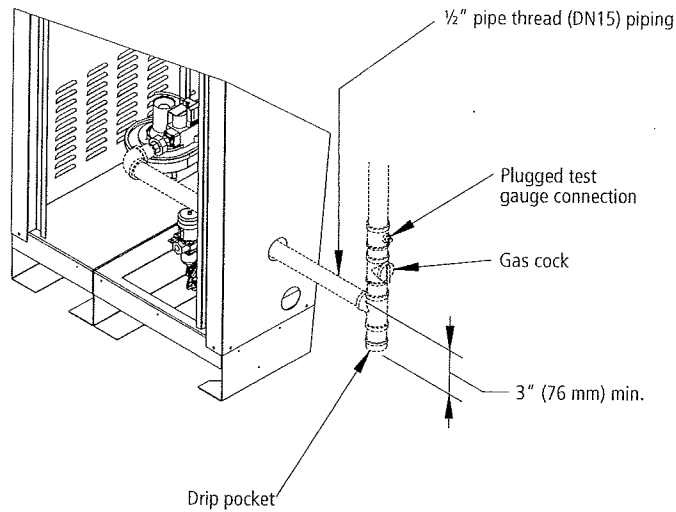
Using the same example, if the specific gravity of your natural gas was 0.55 (instead of the 0.60 standard), see Table 27-2 for an adjustment factor. In this case, the factor would be 1.04, which you multiply by the 390 ft³/hr (11.05 m³/hr) value. This gives you a new value of 406 ft³/hr (11.49 m³/hr). Referring again to the gas pipe capacities table (Table 27-2), you see that for the same 60 ft (18 m) length, you now need to use 1½" (DN40) pipe due to the change in the specific gravity of the gas.

More gas piping instructions on the next page ►

Gas piping (continued)

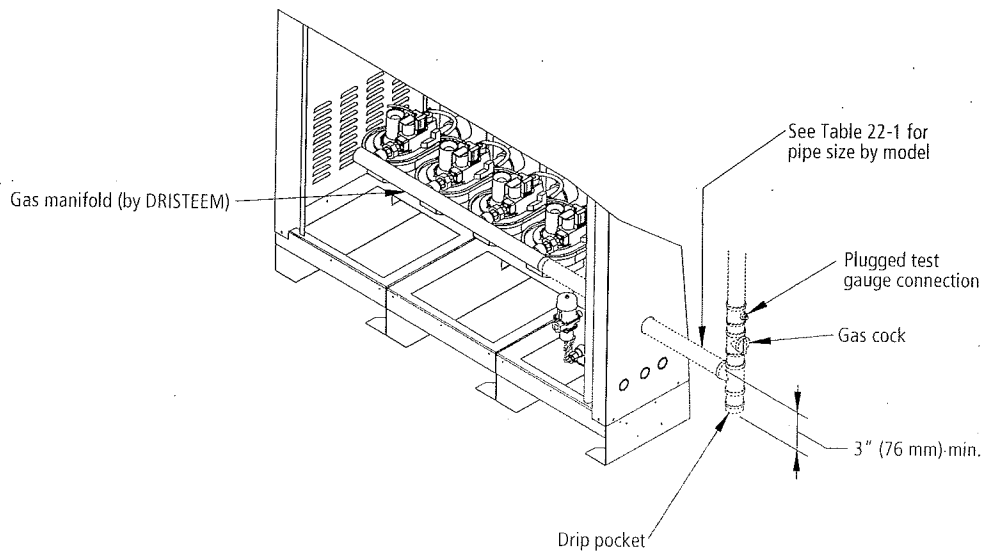
Figure 29-1:
GTS gas piping

GTS or GTS-DI models 100, 200



OM-1236

GTS or GTS-DI models 300-800



OM-1235

Note:
Dashed lines indicate supplied by installer

Combustion and ventilation air

WARNING!

Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

When the GTS is located in an environment with negative pressure or toxic air, it must have sealed combustion.

Failure to follow these instructions could cause severe bodily injury or death.

Note:

GTS outdoor enclosures are always provided with a sealed combustion connection.

Combustion and ventilation air

The GTS supports both room air and sealed combustion. Requirements and recommendations for each follow.

Room air combustion

- All fuel burning equipment must be supplied with air for combustion of the fuel. Sufficient air **must** be provided to ensure there is not a negative pressure in the equipment room or space.
- Provide adequate combustion and ventilation air in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-1988 or applicable provisions of governing codes. Canadian installations must be installed in accordance with sections 7.2, 7.3, and 7.4 of the CAN/CGA.B149 Installation Codes and all authorities having jurisdiction.
- For proper and safe operation this appliance needs air for combustion and ventilation. **Do not** block or obstruct air openings on the appliance, spaces around the appliance, or air openings communicating with the appliance area.
- Do not locate in a dusty environment.
- **Do not** block the flow of combustion and ventilation air. To provide for necessary oxygen for proper combustion, openings must be provided to allow outside air to enter the space where the humidifier is located. Enclosed spaces, such as equipment rooms, must be vented for combustion air. The size of air openings must be based on all gas-burning equipment installed in the space involved. Table 30-1 outlines four types of locations, and the requirements of each.

More instructions on the next page ►

**Table 30-1:
Location of humidifier and required air openings**

Location description	Required air opening
Confined space with all air from inside the building; conventional frame, brick or stone construction with normal infiltration (Note: this location rarely provides enough air for higher capacity units.)	Two openings, 1 sq. in. (6.5 cm ²) per opening per 1000 Btu/hr (293 W) input The minimum free area of all openings combined is 100 sq. in. (645 cm ²).
Confined space with all air from outside the building through air ducts	Two openings, 2 ducts, 1 sq. in. (6.5 cm ²) per opening per 2000 Btu/hr (586 W) input*
Confined space with all air from outside the building from through-wall openings only (no ducts)	Two openings, 1 sq. in. (6.5 cm ²) per opening per 4000 Btu/hr (1172 W) input*
Unconfined space with all air from outside the building	Same as confined space; all air from outside the building
Note: * The minimum dimension of any opening is 3" × 3" (76 mm × 76 mm).	

Combustion and ventilation air (continued)

Sealed combustion

The GTS supports sealed combustion using 4" (DN100) PVC or CPVC piping (see Figure 31-1). All GTS models have a single point connection to the blower below the humidifier shroud.

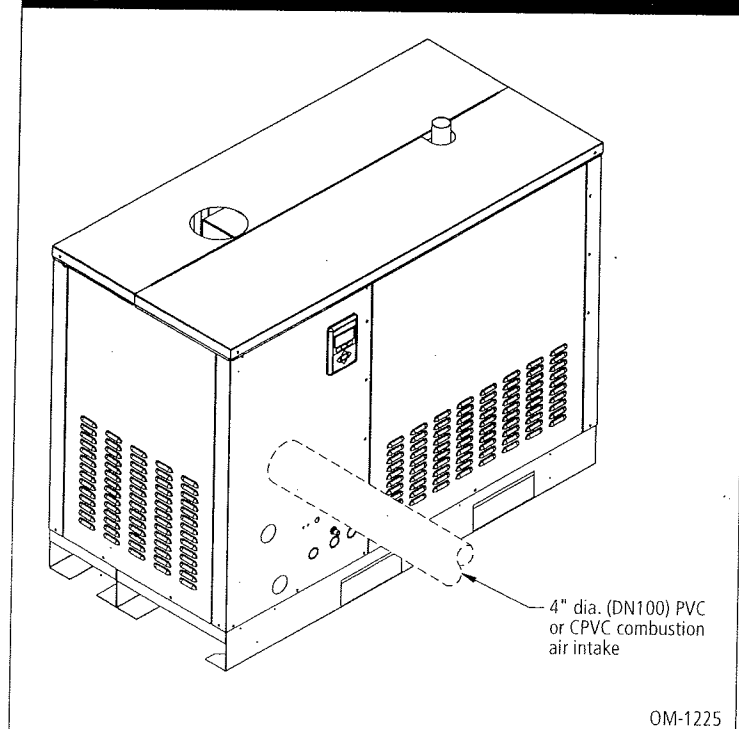
When running PVC or CPVC piping for sealed combustion, the maximum allowable distance to the outdoor air source is 70' (21.3 m) including 7' (2.1 m) equivalent length for each elbow. The outside air source can be either a final connection outside the building or a connection to an outdoor air plenum within the building. When the combustion air origination point is outside the building, the opening must be covered with a large mesh screen to prevent the introduction of unwanted materials without restricting airflow.

If sealed combustion piping is less than 20 ft (6 m), we recommend insulating piping to prevent condensation.

WARNING!

When installing sealed combustion piping for more than one GTS humidifier, do not commonly manifold multiple sealed combustion piping runs without having the manifold sized for the specific installation by a licensed engineer. Failure to follow these instructions could starve the GTS humidifier of combustion air resulting in either the unit not being able to light or high carbon monoxide (CO) levels, which may cause severe personal injury or death.

Figure 31-1:
GTS optional sealed combustion connection



Vertical and horizontal venting

WARNING!

The humidifier must be installed by a qualified technician and meet the requirements of all governing codes. Failure to follow these instructions could cause severe bodily injury or death.

Note:

For European models, contact your distributor for horizontal venting parts.

Vertical and horizontal venting guidelines (stack connection)

- The GTS is a Fan Assisted Category I (natural draft) Appliance. Installations where the vent terminates in a side wall of the building, or where the overall horizontal run exceeds the overall vertical run require a power venter. See Page 34.
- Maximum flue temperature is 400 °F (205 °C) + ambient.
- Flue draft negative pressure greater than 0.2" wc (50 Pa) may cause unacceptable post ignition.
- Vent piping must be UL or UL/CSA listed type B, B-W, or any other vent type approved for a Category I appliance.
 - Type B: Double wall construction, inner wall aluminum, outer wall galvanized steel
 - Type B-W: Same as type B except fabrication in oval shapes only

Do not use more than one type of venting per application
Required clearance for Type B and B-W vent piping is 1" (25 mm).

- Do not use vent equipment from more than one manufacturer.
- When connecting the humidifier to a gas vent or chimney, installation must be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1, or Section 7, Venting Systems and Air Supply Appliances, of the CAN/CGA B149 Installation Codes, governing codes, and the vent manufacturer's instructions.
- When applying the codes, reference also the venting manufacturer's instructions, the service gas supplier's regulations, and the specific instructions provided in this manual.

CAUTION! Install a drip tee or flue box condensate port for start-up flue condensate removal. Failure to follow these instructions could cause water to accumulate in the flue box.

- The purpose of venting the gas humidifier is to completely remove all products of combustion and ventilation gases to the outside air.
- For vertical vent pipe terminations only: Do not reduce the vent diameter and avoid short turns in the vent piping. Use the same size stack as the vent furnished with the humidifier. Maintain a minimum upward slope of ¼" per linear foot (2%) on all horizontal runs. Maintain proper support of vent connections and joints. Observe clearances (in accordance with applicable codes) from all combustible materials and install an approved cap for the stack outlet. The bottom of the cap must be one stack diameter above the top of the stack.
- Inspect for proper and tight construction. Remove any restrictions or obstructions. An existing chimney may require cleaning.
- For vertical vent pipe terminations only: Extend chimney or vent at least 3' (1 m) above its passage through a roof and at

More instructions on the next page ►

Vertical and horizontal venting (continued)

least 2' (0.6 m) above any ridge within 10' (3 m) of the chimney (governing codes apply).

- Do not connect this humidifier to a chimney flue servicing a separate appliance designed to burn solid fuel.
- Never connect this humidifier to a chimney serving a fireplace, unless the fireplace opening is permanently sealed off.
- Code prohibits venting into an unlined masonry or concrete chimney.
- If this humidifier is connected to a lined, masonry chimney, the chimney must be sized and installed according to the provisions of the National Fuel Gas Code or Canadian CAN/CGA.B149 requirements, or governing codes.
- Vent connector serving this appliance shall not be connected into any portion of mechanical draft systems operating under positive pressure.
- Add insulation to any roof or wall penetration vent connector that is exposed to ambient temperatures of 30 °F (0 °C) or less, especially any application using single-wall vent pipe as a connector.
- Do not insulate vent pipe exposed to outdoor weather conditions (e.g., above roof lines).
- Install vent piping as direct as possible, with a minimum number of turns or elbows.
- Rigidly support the vent pipe every 5' (1.5 m) or less with hangers or straps to ensure there is no movement after installation. The humidifier vent box should not support the weight of the vent piping.
- No portion of the vent system should extend into, or pass through, any circulation air duct or plenum.
- The vent system must terminate above the roof surface per the National Fuel Gas Code or CAN/CGA.B149 requirements or governing codes, and must include a UL or C-UL listed vent cap or roof assembly, unless prohibited by governing codes.
- For vertical vent pipe terminations only: This humidifier may be commonly-vented with other listed Category I gas-fired appliances. Total input rates of all appliances determines the vent size.
- Install and fire-stop all vent pipe passing through floors, ceilings, and walls with the proper clearances from combustible material according to the National Fuel Gas Code requirements and Canadian Standards CAN/CGA.B149 or governing codes.
- In replacement installation where an existing vent system may be used, inspect the vent system for condition, size, type of vent material, and height to meet the requirements in these instructions. When connecting the humidifier to a gas vent or chimney, the installation must be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1, or Section 7, Venting Systems and Air Supply Appliances, of the CAN/CGA B149 Installation Codes, governing building codes, and the vent manufacturer's instructions.

WARNING!

For applications where the vent pipe terminates in a vertical position, the horizontal length of the vent and vent connector must not exceed the height of the vent system unless a power vent is used. Failure to follow these instructions could cause flue gases to exit the vent piping causing severe personal injury or death.

Vertical and horizontal venting (continued)

**Table 34-1:
Equipment required for horizontal venting**

Item	Field controls model number for GTS or GTS-DI models 100, 200, 300, 400	Field controls model number for GTS or GTS-DI models 600 and 800
Power venter	PVO-600 (5")	PVE-1200 (8")
Barometric damper	MG-1 (5")	MG-1 (8")
Vent hood	SWH-1-5 (5")	SWH-8
Electrical ratings	120 VAC 60 Hz 2.1 A	120 VAC 60 Hz 2.5 A

Note:

For European models, contact your distributor for horizontal venting parts.

**Table 34-2:
Recommended minimum vent sizes**

Model	Minimum vent size			
	Vertical vent		Horizontal vent	
	inches	mm	inches	mm
GTS-100	5	130	5	130
GTS-200	5	130	5	130
GTS-300	7	180	5*	130
GTS-400	7	180	5*	130
GTS-600	8	205	8	205
GTS-800	10	255	8*	205

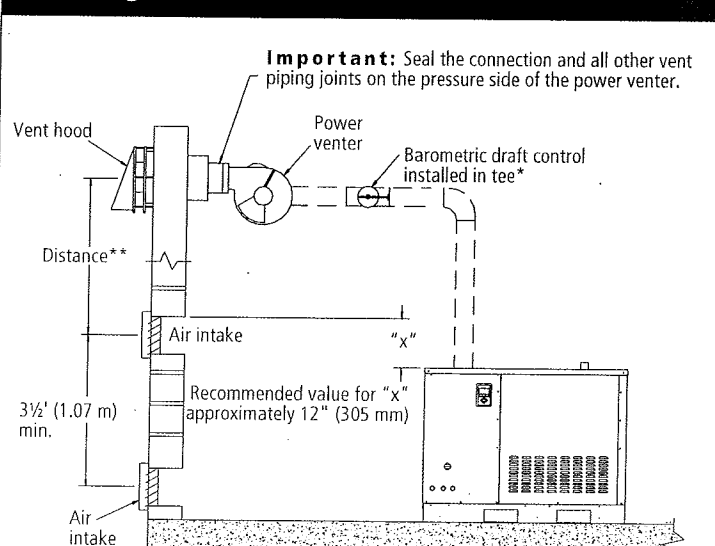
Note:

* For best results, make transition to smaller vent diameter as close to the power venter as possible.

Special horizontal venting requirements

- Ensure that distances from the vent terminal to adjacent public walkways, buildings, and openable windows and building openings are consistent with the National Fuel Gas Code, ANSI Z223.1, CAN/CGA B149 Installation Codes, or governing codes.
- In areas accessible to the public, the vent terminal must be at least 7' (2.1 m) above ground level to prevent burns from the hot terminal surface.
- The vent terminal and air intake locations must be at sufficient height above ground level to prevent blocking by expected snowfall.
- Building materials must be protected from degradation by flue gases.
- A minimum horizontal clearance of 4' (1.22 m) from electric meters, gas meters, regulators, and relief equipment must be maintained.
- Maximum equivalent length of vent pipe is 100' (30 m). Minimum equivalent length of vent pipe is 10' (3 m). See power venter installation manual for equivalent lengths of fittings.
- Vent box pressure must be $-0.01''$ wc (-2.5 Pa). Set by adjusting power venter and barometric damper, with all burners running (see manufacturer's instructions included with power venter and damper).

**Figure 34-1:
GTS venting**



Notes:

* Install a tee after the first elbow from the humidifier as shown. Use the open end of this tee for the location of the barometric damper.

** Required distance between air intake and vent hood is defined by the National Fuel Gas Code, ANSI Z223.1, and/or CAN/CGA B149 Installation Codes.

Refer to power venter manual for clearance requirements relative to combustion air openings.

Dispersion: General instructions

Selecting the dispersion assembly location

- For each dispersion device, DRISTEEM documents distances required for absorption to occur. If you have questions about absorption distances, see the absorption tables in the GTS catalog, available for viewing, printing, or ordering at www.dristeem.com
- It is important that the dispersion assembly is positioned where the water vapor being discharged is carried off with the airstream and is absorbed before it can cause condensation or dripping in the duct.
- In general, the dispersion assembly is best placed where the air can most readily absorb the moisture being added without causing condensation at or after the unit. This normally is after the heating coil or where the air temperature is highest.
- Place the dispersion assembly so that absorption occurs before the intake of a high efficiency filter. The filter can remove the visible moisture and become waterlogged.
- Place the dispersion assembly so absorption occurs before coming in contact with any metal surface.
- Place the dispersion assembly so absorption occurs before fire or smoke detection devices.
- Place the dispersion assembly so absorption occurs before a split in the duct. Otherwise, the dispersion assembly may direct more moisture into one duct than the other.
- When draining dispersion condensate to an open drain, provide a 1" (25 mm) gap between the condensate drain piping and the drain. Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam; otherwise, condensing on nearby surfaces may occur.

Where to find more information

On our Web site:

The following documents can be viewed, printed or ordered from our web site, www.dristeem.com

- Catalogs (include dispersion nonwetting distance graphs):
 - GTS
 - Ultra-sorb
- Installation, Operation and Maintenance manuals:
 - Ultra-sorb
 - Vapor-logics (includes sensor placement recommendations and troubleshooting information)
- *DRISTEEM Design Guide* (includes steam loss tables and general humidification information)

In Dri-calc:

Dri-calc is our humidification system sizing and selection software, which can be ordered at www.dristeem.com.

Included in Dri-calc:

- A comprehensive library of installation guide documents, including:
 - Rapid-sorb installation instructions for vertical airflows
 - Recommended dispersion placement within a duct or air handler
 - Recommended sensor placement

Or call us at 800-328-4447

While obtaining documents from our Web site or from Dri-calc is the quickest way to review our literature, we will also mail to you any literature you need.

Dispersion: Interconnecting piping requirements

CAUTION!

Failure to follow the recommendations in this section can result in excessive back pressures on the humidifier. This will result in unacceptable humidification system performance such as leaking gaskets, blown water seals, erratic water level control, and spitting condensate from the dispersion tube(s).

Connecting humidifier to dispersion assembly with vapor hose

- Always support vapor hose to prevent sags or low spots and to maintain a minimum pitch of 2"/ft (15%) back to the humidifier.
- See the maximum steam carrying capacity table on the next page.
- Use DRISTEEM vapor hose. Other manufacturers of vapor hose may use unacceptable release agents or material mixes that can affect humidifier system performance adversely. Using hose from alternative manufacturers increases the possibility of tank foaming and accelerated aging. Foaming causes condensate discharge at the dispersion assembly.
- Do not use vapor hose in outdoor applications.
- Do not insulate vapor hose. Insulation causes accelerated heat aging, causing the vapor hose to become hard and susceptible to failure due to cracks.
- The steam outlet on the humidifier is sized to the output of the humidifier. DO NOT use hose with an inside diameter (ID) smaller than the humidifier steam outlet.
- If the humidifier must be located above the dispersion assembly, use the recommended installation as shown on Page 38.
- For single tube applications, see the hose kit sizing table on Page 39.

Connecting humidifier to dispersion assembly with tubing or pipe

- See the table on Page 40 for interconnecting tubing and pipe pitch requirements for single tube and multiple tube applications. See the table on Page 45 for interconnecting tubing and pipe pitch requirements for Rapid-sorb applications.
- The steam outlet on the humidifier is sized to the output of the humidifier. DO NOT use interconnecting tubing or pipe with an inside diameter (ID) smaller than the humidifier steam outlet.

CAUTION! Reducing the inside diameter of the interconnecting piping will result in the internal humidifier system pressure exceeding the parameters for acceptable performance.

- Steam supply adapters are available from DRISTEEM. These adapters convert a tubing outlet on the humidifier to threaded pipe, allowing a pipe connection.
- 90° elbows are not recommended; use two 45° elbows, 1' (0.3 m) apart.
- Thin wall tubing heats up faster and causes less start-up loss than heavy wall pipe.

More on the next page ►

Dispersion: Interconnecting piping requirements (continued)

Connecting humidifier to dispersion assembly with tubing or pipe (continued)

- Insulating hard pipe reduces the loss in output caused by condensation.
- When using hard pipe, take care to remove ALL traces of lubricants used to thread the pipe. This minimizes the possibility of tank foaming. Denatured alcohol or mineral spirits work best for removing lubricant.
- If the humidifier must be located above the dispersion assembly, use the recommend installation as shown on Page 38.
- See the maximum steam carrying capacity table below.

**Table 37-1:
Maximum steam carrying capacity and length of interconnecting vapor hose, tubing, and pipe***

Vapor hose ^{***}						Copper or stainless steel tubing and Schedule 40 steel pipe					
Hose I.D.		Maximum capacity		Maximum length ^{**}		Tube or pipe size ^{***}		Maximum capacity		Maximum developed length [†]	
inches	DN	lbs/hr	kg/h	ft	m	inches	DN	lbs/hr	kg/h	ft	m
1½	40	150	68	10	3	1½	40	150	68	20	6
2	50	250	113	10	3	2	50	220	100	30	9
						3"	80"	450	204	80	24
						4"	100"	750	340	100	30
						5"	125"	1400	635	100	30
						6"	150"	2300	1043	100	30

* Based on total maximum pressure drop in hose, tubing, or pipe of 5" wc (1244 Pa)

** Maximum recommended length for vapor hose is 10' (3 m). Longer distances can cause kinking or low spots.

*** To minimize loss of capacity and efficiency, insulate tubing and pipe.

† Developed length equals measured length plus 50% of measured length to account for pipe fittings.

** Requires flange connection

*** When using vapor hose, use DRISTEEM vapor hose for best results. Field-supplied hose may have shorter life and may cause foaming in the evaporating chamber resulting in condensate discharge at the dispersion assembly. Do not use vapor hose for outdoor applications.

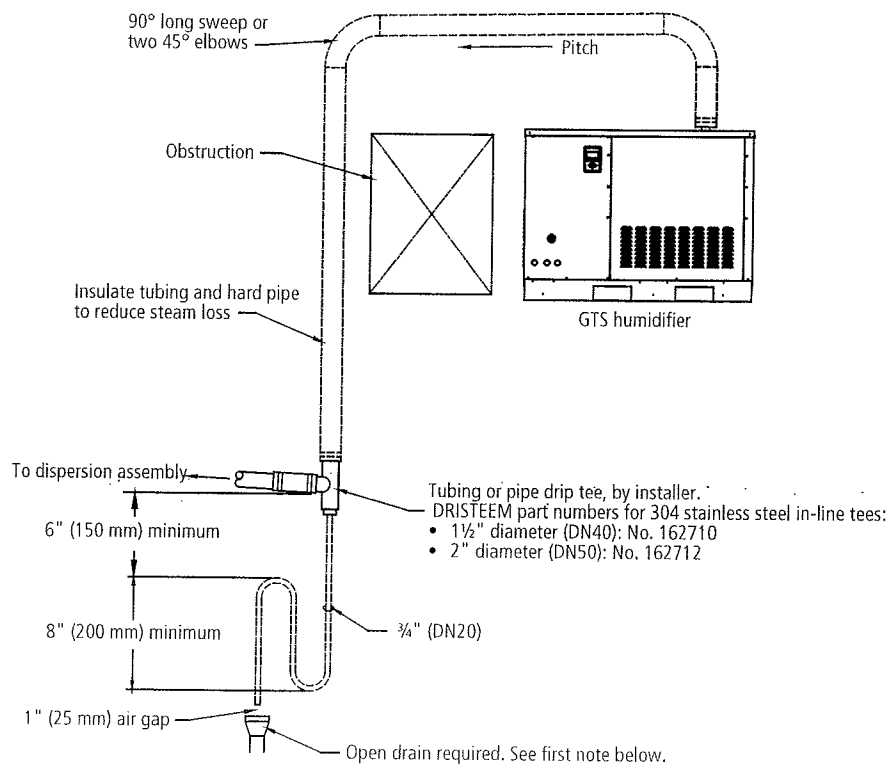
Dispersion: Drip tee installation

Install a drip tee as shown below

- When the humidifier is mounted higher than the dispersion assembly
- When interconnecting hose or piping needs to go over an obstruction
- When interconnecting piping runs are long

Important: Vapor hose must be supported to prevent sagging or low spots.

Figure 38-1:
Drip tee installation (piping over an obstruction)



OM-1210

Notes:

- Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam, or condensing on nearby surfaces may occur. Refer to governing codes for drain pipe size and maximum discharge water temperature.
- Support vapor hose so there are no sags or low spots
- Dashed lines indicate provided by installer

Dispersion: Single tube and multiple tube

Installation

- See the following pages for detailed drawings and notes for installing single tube and multiple tube dispersion assemblies.
- See the hose kit sizing table on this page for single tube applications.

Dispersion tube mounting

- Orient dispersion tube(s) so that tubelets (steam orifices) point up.
- See the table on the next page for dispersion tube pitch requirements.
- When mounting the humidifier above the level of the dispersion tube(s), see the drip tee installation drawing on Page 38.

Condensate drain piping

- Minimum diameter (ID) for draining from one or two dispersion tubes: ¾" (DN20)
- Minimum diameter (ID) for draining from three or more dispersion tubes: 1" (DN25)
- Condensate drain piping must be rated for 212 °F (100 °C) continuous operating temperature.
- Condensate drain line must be piped as shown in the figures on the following pages. Provide a 6" (152 mm) drop prior to a 5" (127 mm) water seal to:
 - Ensure drainage of condensate from the header
 - Keep steam from blowing out of the drain line
- After the water seal, run the drain line to an open drain with a 1" (25 mm) vertical air gap. Cut the drain line at a 45° angle on the end above the drain to permit a direct stream of water into the drain pipe while maintaining a 1" (25 mm) air gap. Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam, or condensing on nearby surfaces may occur.
- All drain lines must be installed and sized according to governing codes.

CAUTION!

Failure to follow the recommendations in this section can result in excessive back pressures on the humidifier. This will result in unacceptable humidification system performance such as leaking gaskets, blown water seals, erratic water level control, and spitting condensate from the dispersion tube(s).

**Table 39-1:
Hose kit sizing by capacity**

Maximum tube capacity		Hose kit (vapor hose, dispersion tube, and hardware)
lbs/hr	kg/h	
28.4	13	1½" (DN40) without drain
56.8	25.8	1½" (DN40) with drain
		2" (DN50) without drain
85.2	38.6	2" (DN50) with drain
> 85.2	>38.6	These models require multiple tube assemblies and cannot use a single hose kit.

Dispersion: Single tube and multiple tube (continued)

**Table 40-1:
Pitch of dispersion tube(s) and interconnecting piping for single tube or multiple tube evaporative dispersion units***

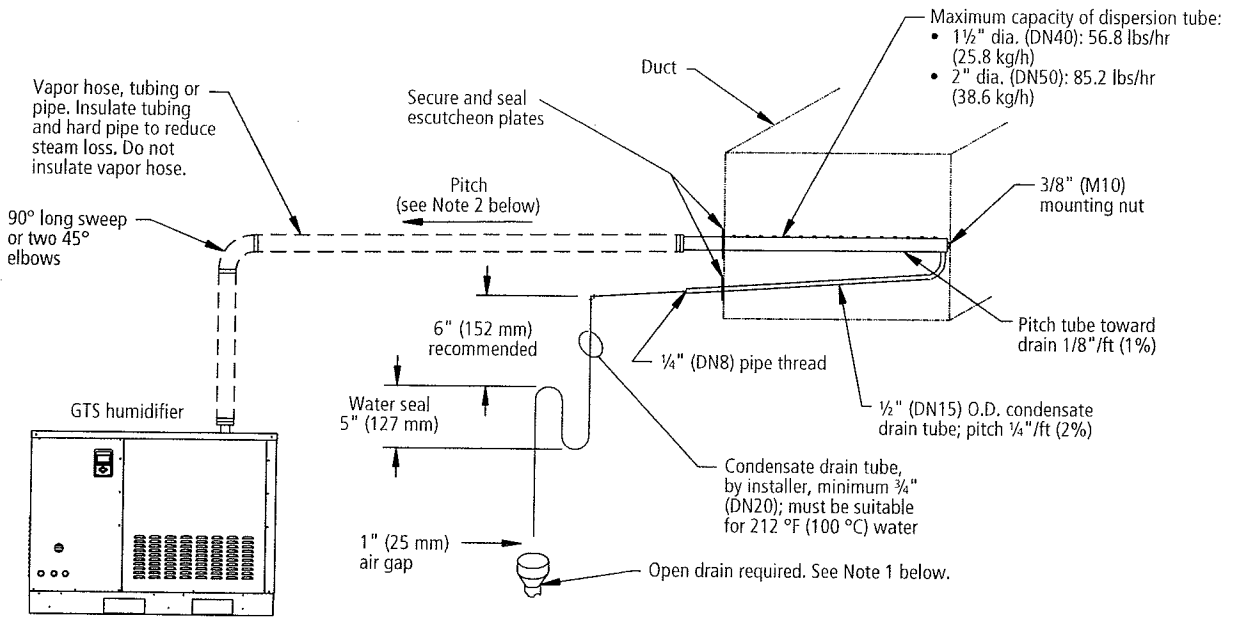
Condensate drain	Type of interconnecting piping	Diameter of dispersion tube and interconnecting piping	Pitch of interconnecting piping	Pitch of dispersion tube(s)	Pitch of condensate drain
Without drain	Vapor hose	1½" (DN40)	2"/ft (15%) toward humidifier	2"/ft (15%) toward humidifier	No drain
		2" (DN50)			
	Tubing or pipe	1½" (DN40)	1/8"/ft (1%) toward humidifier		
		2" (DN50)			
With drain	Vapor hose	1½" (DN40)	2"/ft (15%) toward humidifier	1/8"/ft (1%) toward condensate drain	¼"/ft (2%) toward floor drain or toward humidifier if humidifier is below dispersion unit
		2" (DN50)			
	Tubing or pipe	1½" (DN40)	½"/ft (5%) toward humidifier		
		2" (DN50)			

Note:

* When piping over an obstruction, see the drip tee installation illustration on Page 38.

Dispersion: Single tube and multiple tube (continued)

Figure 41-1:
Single tube dispersion with condensate wasted to floor drain



Notes:

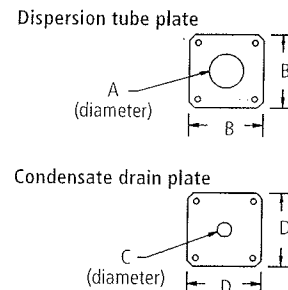
- 1 Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam, or condensing on nearby surfaces may occur. Refer to governing codes for drain pipe size and maximum discharge water temperature.
- 2 Pitch vapor hose, tubing or pipe toward humidifier:
 - 2"/ft (15%) when using vapor hose
 - ½"/ft (5%) when using 1½" tubing or pipe
 - ¼"/ft (2%) when using 2" tubing or pipe
- 3 Dashed lines indicate provided by installer

OM-1212a

Table 41-1:
Dispersion tube and condensate drain escutcheon plate dimensions

	for 1½" tube		for 2" tube	
	inches	mm	inches	mm
A	1.51	38	2.03	52
B	3.25	83	5.00	127
C	0.75	19	0.75	19
D	3.25	83	3.25	83

Figure 41-2:
Dispersion tube and condensate drain escutcheon plates



OM-351c

Dispersion: Single tube and multiple tube (continued)

Figure 42-1:
Single tube with condensate returned to humidifier

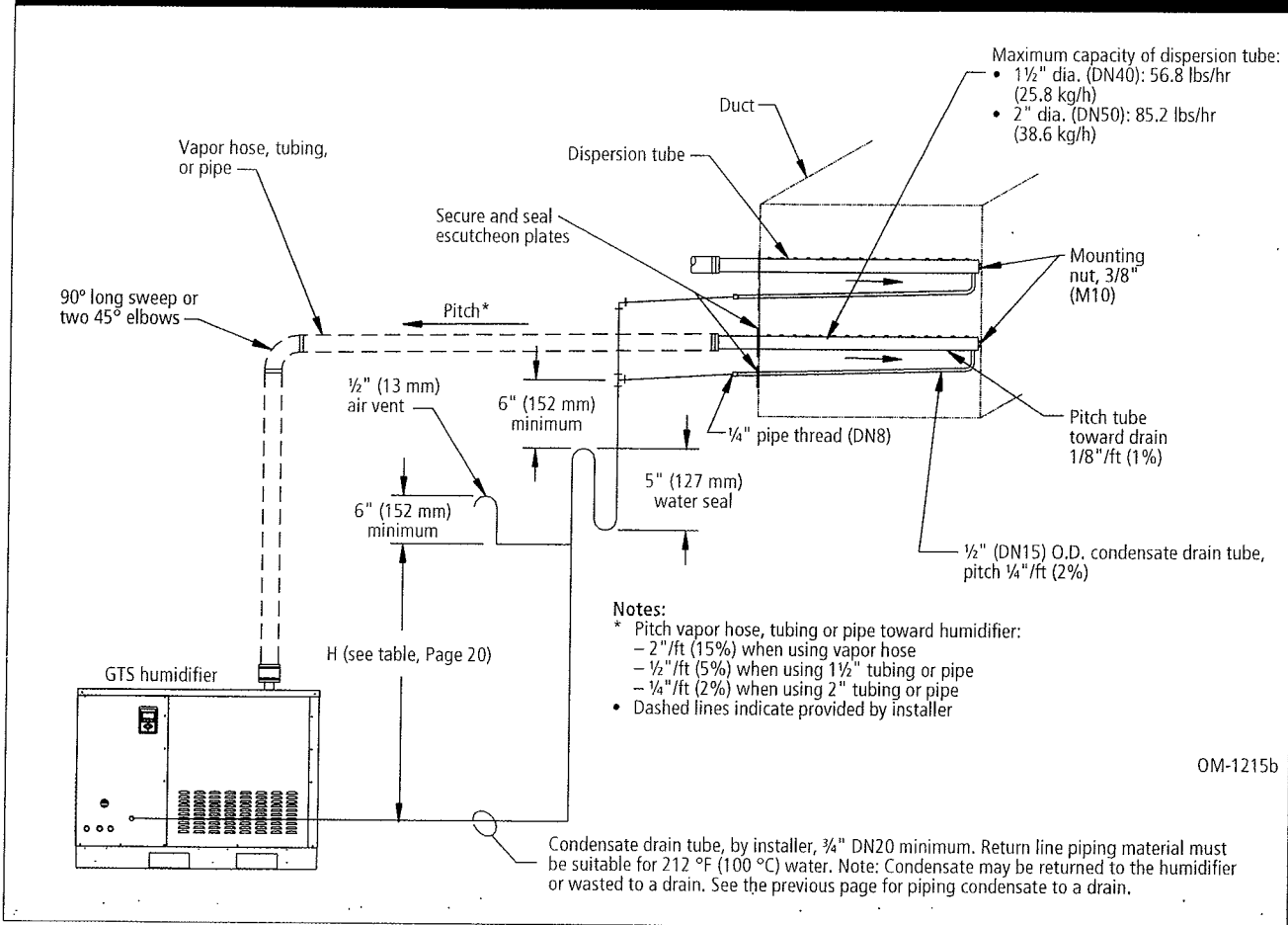
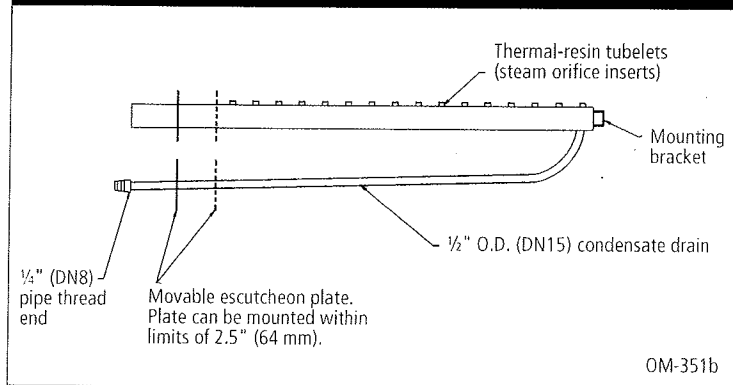
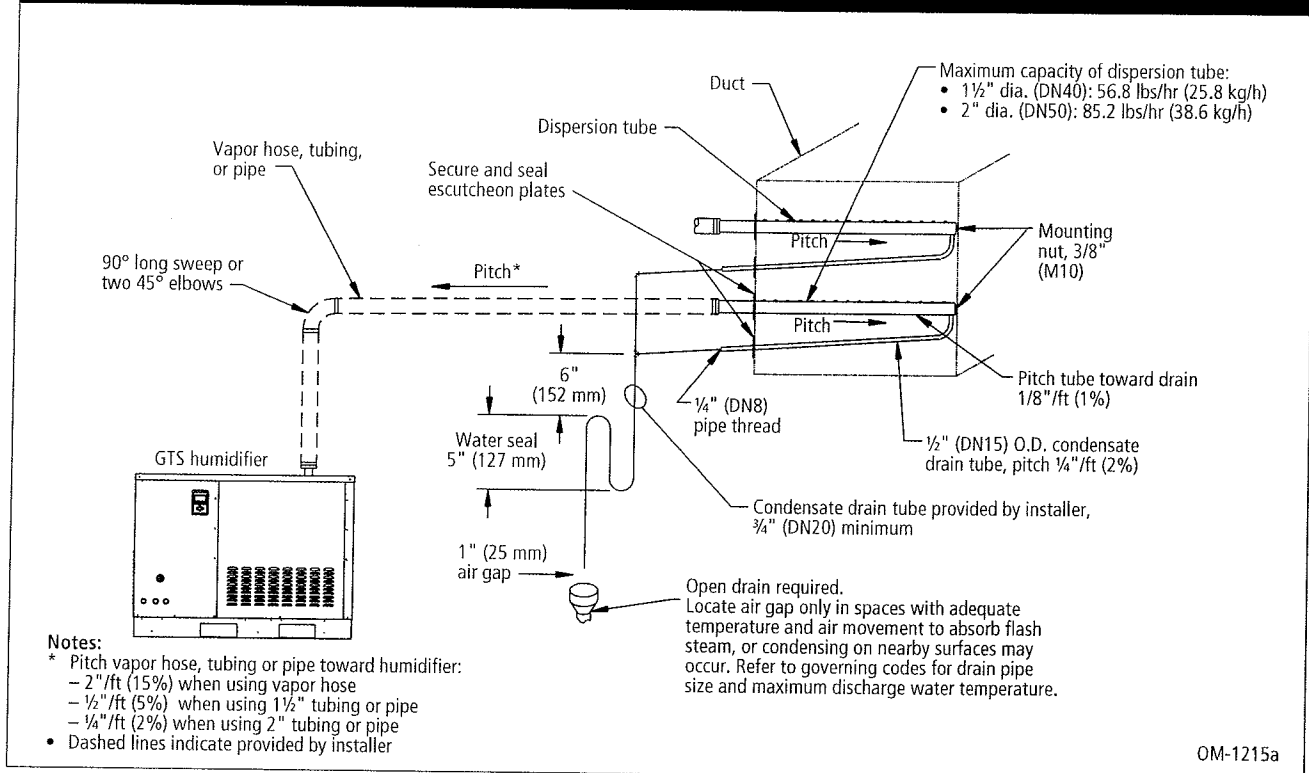


Figure 42-2:
Single tube dispersion with condensate drain



Dispersion: Single tube and multiple tube (continued)

Figure 43-1:
Multiple tubes with condensate wasted to floor drain



Dispersion: Rapid-sorb

CAUTION!

Failure to follow the recommendations in this section can result in excessive back pressures on the humidifier. This will result in unacceptable humidification system performance such as leaking gaskets, blown water seals, erratic water level control, and spitting condensate from the dispersion tube(s).

**Table 44-1:
Rapid-sorb dispersion tube capacities**

Tube capacity		Tube diameter	
lbs/hr	kg/h	inches	DN
≤ 35	≤ 16	1½	40
36-70	17-32	2	50

**Table 44-2:
Rapid-sorb header capacities**

Header capacity		Header diameter	
lbs/hr	kg/h	inches	DN
≤ 250	≤ 113	2	50
251-500	114-227	3	80
501-800	228-363	4	100

General Rapid-sorb installation instructions

- Before you begin installation, read all dispersion instructions in this manual.
- Before you begin installation, unpack shipment and verify receipt of all Rapid-sorb components with packing list. Report any shortages to DRISTEEM factory immediately. The components typically include the following:
 - Multiple dispersion tubes
 - Header
 - ¾" × 2" (19 mm × 51 mm) L-bracket
 - A single duct escutcheon plate the size of the header
 - Slip couplings or hose cuffs and clamps.
 - Accessories such as duct plates, slip couplings, or hose cuffs are in a plastic bag.
 - The bolts and washers for mounting the dispersion tubes to the bracket will be in the end of the tubes or packaged in a bag with the other accessories.
 - The tubes, header, and L-bracket are tagged with the customer requested identification number written on each component.
- When choosing a location for installation, select a location that provides necessary access in and around the ductwork or air handler.
- The Rapid-sorb typically is installed centered side to side in a duct, or is installed across the face of a coil in an air handler.
- The center line of the outer dispersion tubes should never be closer than 4.5" (114 mm) from the side of the ductwork or air handler wall.
- Rapid-sorbs are provided with an L-bracket for installation:
 - L-brackets that are 50" (1270 mm) or less in length have a hole 4" (102 mm) in from each end to mount the L-bracket to the duct or air handler wall.
 - L-brackets that are greater than 50" (1270 mm) in length have an additional hole in the center of the L-bracket.
 - **Important:** Before marking and drilling holes in the duct or air handler, refer to ALL pitch requirements for the Rapid-sorb assembly you received (see the table on Page 45). The size, quantity, and location of penetrations are determined by the specific dimensions and configuration of the Rapid-sorb assembly you received.
 - **Note:** The hardware for mounting the L-bracket to the duct or air handler wall and the hardware for the header support bracket is not provided.
- The Rapid-sorb instructions that follow are for the most typical Rapid-sorb installations — installed in a duct horizontal airflow with Rapid-sorb header either inside or outside the duct. See the Dri-calc Installation Guides library or contact your representative/distributor or DRISTEEM for installation instructions for air handler or vertical airflow applications.

Dispersion: Rapid-sorb (continued)

Rapid-sorb pitch requirements

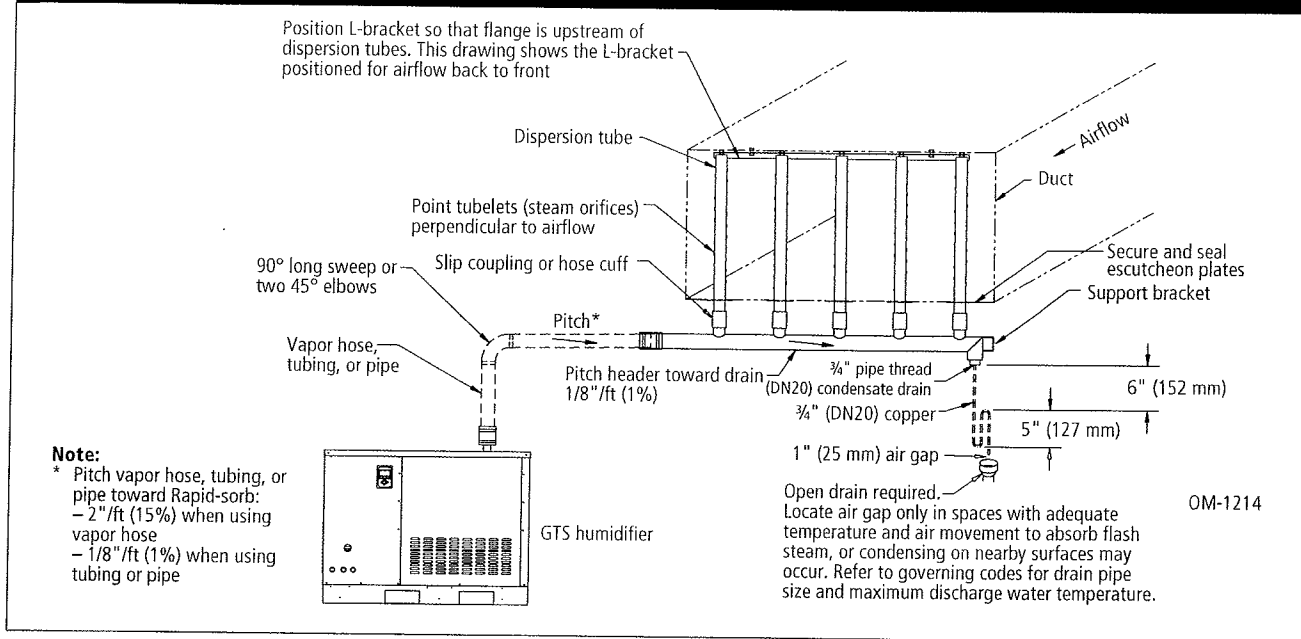
- When installing Rapid-sorb with the header outside a horizontal airflow duct, consider the following pitch issues:
 - For 1½" (DN40) dispersion tubes, use a fastener of sufficient length to accommodate the 1/8"/ft (1%) pitch requirements toward the ¾" pipe thread (DN20) header drain fitting.
 - For 2" (DN50) dispersion tubes, the bracket can be mounted flush to the ductwork. The 1/8"/ft (1%) pitch typically can be accomplished in the length of the hose cuffs used to connect the tubes to the header.
- See the table below and the drawings on the following pages for pitch requirements.

**Table 45-1:
Pitch of interconnecting piping, dispersion tubes, and headers for Rapid-sorb evaporative dispersion units**

Airflow	Type of interconnecting piping	Diameter of interconnecting piping	Pitch of interconnecting piping	Pitch of dispersion tubes	Pitch of header
Horizontal	Vapor hose	1½" (DN40), 2" (DN50)	2"/ft (15%) toward Rapid-sorb	Vertically plumb	1/8"/ft (1%) toward condensate drain
	Tubing or pipe	1½" (DN40), 2" (DN50), 3" (DN80), 4" (DN100), 5" (DN125), 6" (DN150)	1/8"/ft (1%) toward Rapid-sorb		
Vertical	Vapor hose	1½" (DN40), 2" (DN50)	2"/ft (15%) toward Rapid-sorb	2"/ft toward header	1/8"/ft (1%) toward condensate drain
	Tubing or pipe	1½" (DN40), 2" (DN50), 3" (DN80), 4" (DN100), 5" (DN125), 6" (DN150)	1/8"/ft (1%) toward Rapid-sorb		

Dispersion: Rapid-sorb (continued)

Figure 46-1:
Rapid-sorb installed in a horizontal airflow with header outside the duct



Assembly and installation instructions for a Rapid-sorb installed with header outside the duct (horizontal airflow)

1. Locate and cut the holes in the ductwork for the dispersion tubes. Use the L-bracket as a template to locate the holes on the duct floor.
2. Temporarily, loosely suspend or support the header below the final location — the vertical balance point of the dispersion tube length dictates where the header should be suspended or supported temporarily.
3. Mount the dispersion tubes to the header with the provided connector, either a slip coupling or a hose cuff.
 - When installing slip couplings for 1 1/2" (DN40) dispersion tubes, take care not to shear the O-rings.
 - Set the slip coupling on the header stub or dispersion tube so the O-ring is resting on the face of the tubing.
 - Rotate the slip coupling as you push it on to the tubing.
 - The O-rings are lubricated at the factory. If additional lubrication is necessary, DO NOT use a petroleum-based lubricant.
4. Position the flange of the L-bracket so it is upstream of the tubes when the assembly is raised and fastened into position. Fasten the L-bracket to the end of the dispersion tubes with the provided bolt, lock washer, and flat washer.

More on next page ►

Dispersion: Rapid-sorb (continued)

Assembly and installation instructions for a Rapid-sorb installed with header outside the duct (continued)

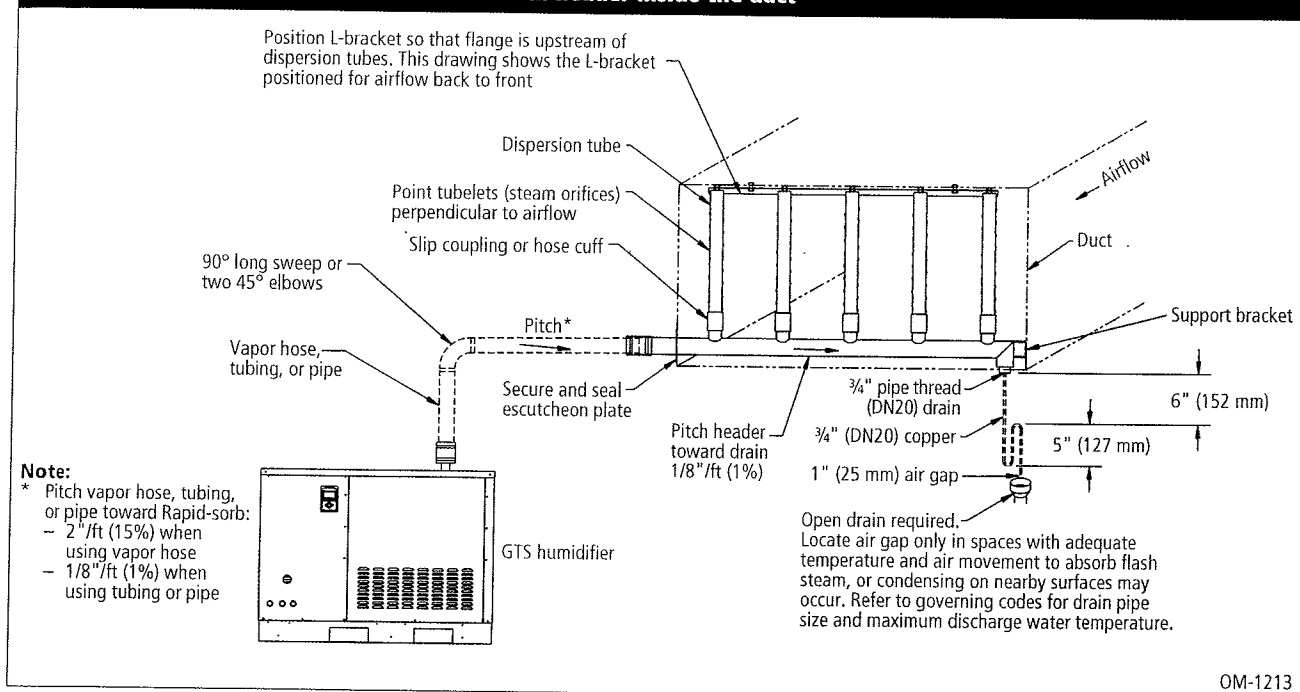
5. Before tightening the L-bracket bolts to the dispersion tubes follow these instructions:
 - For 1½" (DN40) dispersion tubes:
 - The dispersion tube will rotate in the slip coupling. Verify that the dispersion tube orifices are directed perpendicular to the airflow.
 - The dispersion tube and slip coupling must be fully engaged on to the header stub for the O-rings to provide a seal.
 - For 2" (DN50) dispersion tubes:
 - Before securing the hose cuff in place with the hose clamps on the dispersion tube and the header stub, verify that the dispersion tube orifices are directed perpendicular to the airflow.
6. Slide the assembly up until the L-bracket aligns with the mounting holes in the duct.
 - For 1½" (DN40) dispersion tubes:
 - The header pitch is duplicated in the L-bracket.
 - The dispersion tube and slip coupling must be fully engaged on to the header stub for the O-rings to provide a seal.
 - The high end of the L-bracket can be fastened tight to the duct or air handler.
 - On the low end of the L-bracket, the fastener must be long enough to compensate for the pitch, and a nut should be provided and secured on both sides of the L-bracket and the duct or air handler for stability.
 - For 2" (DN50) dispersion tubes:
 - Fasten the bracket to the top of the duct and use the hose cuffs to compensate for the pitch of the header.
 - Before securing the hose cuff in place with the hose clamps on the dispersion tube and the header stub, verify that the header pitch, 1/8"/ft (1%) toward drain, is maintained.
7. Permanently secure both ends of the header and verify that the header pitch, 1/8"/ft (1%) toward drain, is maintained.
8. Verify that all fasteners are secure:
 - L-bracket to duct
 - Dispersion tubes to L-bracket
 - Hose clamps on 2" (DN50) tubes
9. Secure and seal the dispersion tube escutcheon plate and condensate drain tube escutcheon plate around the respective tubes, if applicable.

Note:

See Page 46 for steam supply and condensate drain line connection instructions.

Dispersion: Rapid-sorb (continued)

Figure 48-1:
Rapid-sorb installed in a horizontal airflow with header inside the duct



Assembly and installation instructions for a Rapid-sorb installed with header inside the duct (horizontal airflow)

1. Locate and cut the holes in ductwork or air handler for steam header penetration, condensate drain piping, and header support bracket fastener. Allow 1/8"/ft (1%) header pitch toward the support bracket when you drill the hole for the header support bracket fastener.
2. Loosely fasten the header in place.
3. Rotate the header 90° so the header stubs point horizontally in the duct.
 - When installing in an air handler, the rotation of the header is often less than 90°. Typically, due to the condensate drain piping requirements, the header can be set on the floor of the air handler, assembled in the vertical position, and then raised and mounted in place.
4. Mount the dispersion tubes on the header with the slip couplings or hose cuffs.
 - When installing slip couplings for 1½" (DN40) dispersion tubes, take care not to shear the O-rings.
 - Set the slip coupling on the header stub or dispersion tube so the O-ring is resting on the face of the tubing.

More on next page ►

Dispersion: Rapid-sorb (continued)

Assembly and installation instructions for a Rapid-sorb installed with header inside the duct (continued)

- Rotate the slip coupling as you push it on to the tubing.
 - The O-rings are lubricated at the factory. If additional lubrication is necessary, DO NOT use a petroleum-based lubricant.
5. Allow the dispersion tubes to rest against the bottom of the duct.
 6. Position the flange of the L-bracket so it is upstream of the tubes when the assembly is rotated into position. Fasten the L-bracket to the end of the dispersion tubes with the provided bolt, lock washer, and flat washer.
 7. Rotate the assembly up until the L-bracket aligns with the mounting holes in the duct or air handler.
 - 1½" (DN40) dispersion tubes
 - The header pitch is duplicated in the L-bracket.
 - The dispersion tube and slip coupling must be fully engaged on to the header stub for the O-rings to provide a seal.
 - The high end of the L-bracket can be fastened tight to the duct or air handler.
 - On the low end of the L-bracket, the fastener must be long enough to compensate for the pitch, and a nut should be provided and secured on both sides of the L-bracket and the duct or air handler for stability.
 - 2" (DN50) dispersion tubes
 - Fasten the bracket to the top of the duct or air handler and use the hose cuffs to compensate for the pitch of the header.
 - Before securing the hose cuff in place, with the hose clamps on the dispersion tube and the header stub, verify that the dispersion tube orifices are directed perpendicular to the airflow.
 8. Verify that all fasteners are secure:
 - L-bracket to duct
 - Dispersion tubes to L-bracket
 - Hose clamps on 2" (DN50) tubes
 - Header support bracket fastener
 9. Secure and seal the header escutcheon plate around the header.
 10. See page 48 for steam supply and condensate drain line connection instructions.

Dispersion: Rapid-sorb (continued)

Steam supply connections to the Rapid-sorb header

1. Connect the steam supply interconnecting piping from the humidifier to the Rapid-sorb. The steam supply piping requires a minimum of 1/8"/ft (1%) pitch toward the header.
2. If multiple humidifiers are supplying one Rapid-sorb, a multiple steam supply connector is provided.
 - Typically, the multiple steam supply connector attaches to the Rapid-sorb header supply end with hose cuff and clamps.
 - Route the necessary number of steam supplies from the humidifier tanks to the steam supply connector.
 - Position the steam supply connector to accept the steam supplies while maintaining the necessary pitch.
 - Make sure the hose clamps on the steam supply connector and header are tight.

Condensate drain connections to the Rapid-sorb header

1. Piping must be minimum $\frac{3}{4}$ " I.D. (DN20) and rated for 212 °F (100 °C) minimum continuous operating temperature.
2. Condensate drain line must be piped as shown in the figures on the previous pages. Provide a 6" (152 mm) drop prior to a 5" (127 mm) water seal to:
 - Ensure drainage of condensate from the header
 - Keep steam from blowing out of the drain line
3. After the water seal, run the drain line to an open drain with a 1" (25 mm) vertical air gap. Cut the drain line at a 45° angle on the end above the drain to permit a direct stream of water into the drain pipe while maintaining a 1" (25 mm) air gap. Locate air gap only in spaces with adequate temperature and air movement to absorb flash steam, or condensing on nearby surfaces may occur.
4. All drain lines must be installed and sized according to governing codes.

Dispersion: Area-type fan

Area-type™ fan dispersion

The table on the following page lists the Area-type steam minimum rise, spread, and throw nonwetting dimensions. Surfaces or objects located within this minimum dimension can cause condensation and dripping.

- Rise: The minimum nonwetting height above the steam chute
- Spread: The minimum nonwetting width from the steam chute
- Throw: The minimum nonwetting horizontal distance from the steam chute

The greater the space relative humidity, the higher and farther the discharged steam will carry and rise in the space until becoming absorbed.

The Area-type fan, brackets, and wiring are factory installed on the humidifier.

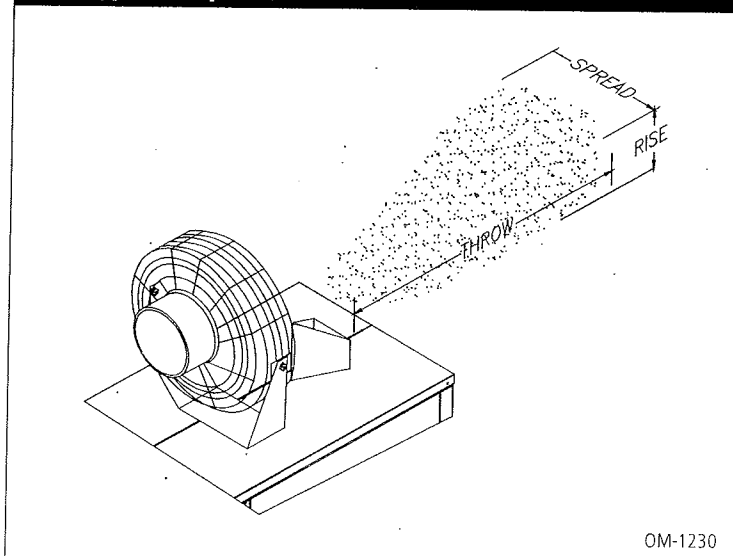
Table 51-1:
Area-type electric fan specifications

Motor	120 V, 50/60 Hz
Blade diameter	18" (457 mm)
Speeds	3
Control	Rotary switch
cfm (high speed)	5350
m ³ /s (high speed)	2.52
rpm (high speed)	1500
Amps (high speed)	1.52

Note:

For European models, contact your distributor for Area-type parts.

Figure 51-1:
Area-type rise, spread, throw



Dispersion: Area-type fan (continued)

**Table 52-1:
Area-type (evaporative steam) minimum non-wetting distances***

Maximum steam capacity		60 °F (16 °C)																	
		30% RH						40% RH						50% RH					
		Rise		Spread		Throw		Rise		Spread		Throw		Rise		Spread		Throw	
lbs/hr	kg/h	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
50	20	1.0	0.3	2.0	0.6	6.0	1.8	1.0	0.3	2.0	0.6	6.0	1.8	1.0	0.3	2.5	0.8	6.0	1.8
75	34	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	4.0	1.2	8.0	2.4
100	45	4.0	1.2	4.0	1.2	10.0	3.1	4.0	1.2	4.0	1.2	10.0	3.1	4.0	1.2	5.0	1.5	10.0	3.1
150	68	6.0	1.8	5.0	1.5	12.0	3.7	6.0	1.8	5.0	1.5	12.0	3.7	6.0	1.8	5.0	1.5	12.0	3.7
200	90	7.0	2.1	7.0	2.1	13.0	4.0	8.0	2.4	7.0	2.1	14.0	4.3	8.0	2.4	7.0	2.1	14.0	4.3
225	102	7.0	2.1	7.0	2.1	13.0	4.0	8.0	2.4	7.0	2.1	14.0	4.3	8.0	2.4	7.0	2.1	14.0	4.3
250	110	8.0	2.4	8.0	2.4	15.0	4.6	9.0	2.7	9.0	2.7	16.0	4.9	9.0	2.7	9.0	2.7	16.0	4.9
285	130	9.0	2.7	9.0	2.7	17.0	5.2	10.0	3.1	10.0	3.1	18.0	5.5	10.0	3.1	10.0	3.1	18.0	5.5
300	136	9.0	2.7	9.0	2.7	17.0	5.2	10.0	3.1	10.0	3.1	18.0	5.5	10.0	3.1	10.0	3.1	18.0	5.5

Maximum steam capacity		70 °F (21 °C)																	
		30% RH						40% RH						50% RH					
		Rise		Spread		Throw		Rise		Spread		Throw		Rise		Spread		Throw	
lbs/hr	kg/h	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
50	20	1.0	0.3	1.5	0.5	4.0	1.2	1.0	0.3	2.0	0.6	4.0	1.2	1.0	0.3	2.0	0.6	4.0	1.2
75	34	2.0	0.6	2.0	0.6	6.0	1.8	2.0	0.6	2.5	0.8	6.0	1.8	2.0	0.6	2.5	0.8	6.0	1.8
100	45	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	3.0	0.9	8.0	2.4
150	68	4.0	1.2	4.0	1.2	10.0	3.1	4.0	1.2	4.0	1.2	11.0	3.4	4.0	1.2	4.0	1.2	11.0	3.4
200	90	5.0	1.5	5.0	1.5	11.0	3.4	5.0	1.5	5.0	1.5	12.0	3.7	5.0	1.5	5.0	1.5	12.0	3.7
225	102	5.0	1.5	5.0	1.5	11.0	3.4	5.0	1.5	5.0	1.5	12.0	3.7	5.0	1.5	5.0	1.5	12.0	3.7
250	110	6.0	1.8	6.0	1.8	12.0	3.7	6.0	1.8	6.0	1.8	13.0	4.0	6.0	1.8	6.0	1.8	14.0	4.3
285	130	7.0	2.1	7.0	2.1	14.0	4.3	7.0	2.1	7.0	2.1	15.0	4.6	7.0	2.1	7.0	2.1	16.0	4.9
300	136	7.0	2.1	7.0	2.1	14.0	4.3	7.0	2.1	7.0	2.1	15.0	4.6	7.0	2.1	7.0	2.1	16.0	4.9

Notes:

- * With fan on high speed
- Rise: Minimum non-wetting height above the steam chute
- Spread: Minimum non-wetting width from the steam chute
- Throw: Minimum non-wetting horizontal distance from the steam chute

Start-up procedure

After the system is installed and connected to gas, electrical, water supplies, and controls, you can begin start-up procedures.

1. Verify that the GTS humidifier, controls, piping, electrical connections, steam supply, and dispersion unit(s) are installed according to the following:
 - Installation instructions in this manual
 - *Vapor-logic3 Installation and Operation Manual*
 - Installation section
 - Installation checklist
 - Ladder style wiring diagram (shipped inside unit)
 - External connections wiring diagram (shipped inside unit)
 - Gas connection instructions in this manual
 - Mounting instructions in this manual
 - All governing codes
2. **Piping (gas)**—Verify that all field and humidifier gas piping has been tested for leaks. (Soap and water are not recommended near gas valves.)

Piping (steam, drain, water supply)—Verify that all piping connections have been completed as recommended and that water pressure is available.
3. **Electrical**—Verify that all wiring connections have been made in accordance with all governing codes and the GTS wiring diagrams.
4. **Controls**—Before proceeding with start-up and operation, verify that all control wiring has been completed as specified and required for correct and safe operation of the GTS humidifier. Refer to the Vapor-logic3 manual that was enclosed with the product shipment.

More on the next page ►

WARNING!

Only qualified electrical personnel should perform the start-up procedure.

Note:

The *Vapor-logic3 Installation and Operation Manual* is a comprehensive operation manual. Refer to it for information regarding the following features:

- Keypad display setup and menu information
- Control input signals and functions
- Drain, flush, and skim features
- Safety features
- Alarm screens and fault messages

The Vapor-logic3 manual was shipped with your humidifier. Additional copies can be viewed, printed, or ordered at www.dristeem.com

Start-up procedure (continued)

5. Verify that the humidifier tank is securely installed and level before filling with water (see the operating weights table in this manual).
6. Verify that the humidifier tank is level front to back and side to side after it is full of water.
7. Refer to the following sections in the *Vapor-logics Installation and Operation Manual*:
 - Operation section
 - Start-up checklist (it is critical that the installer follow this checklist)
8. During start-up, do not leave the humidifier unattended.
9. Monitor humidifier operation through multiple fill cycles. The humidifier operating status appears on the keypad/display.
10. On standard water units, water skims from the humidifier after every fill cycle. Adjust the amount of skim by increasing or decreasing the skim time (see the *Vapor-logics Installation and Operation Manual*). However, at start-up, DRISTEEM recommends initially running the humidifier with the factory default setting for skim time. (See the operation information section in this manual.)

Operation: Safety systems

Safety systems

The GTS humidifier has a number of systems and safeguards to ensure proper operation.

- When there is a call for humidity, all of the combustion blowers must start. Each combustion blower sends a signal to the microprocessor relaying its current speed. If this actual speed is different from the demand speed, the GTS will not operate.
- The negative pressure gas valves used on the GTS are designed to keep a constant ratio of air and gas throughout the operating range of the blower. If the flue becomes blocked or the blower fails to run, the gas valve will not pass any gas to the burner and will shut down the humidifier.
- During operation, the water level in the tank is monitored by a probe system for standard water units and by a low water float for DI/RO units. These water monitors tie into the Vapor-logic3 controller. If the water level drops below a safe point, the humidifier shuts down.
- In standard water applications, the water level in the tank is also monitored by a redundant low-water system that runs independently of the Vapor-logic3. This system is tied directly into the power source for the gas valves. If this system detects a low water condition, the humidifier shuts down.
- In addition to monitoring the water level, there is a temperature sensor located near the top of the heat exchanger. If the water level drops too low and both the main and redundant low water sensors fail to detect it, the temperature sensor shuts down the humidifier before an unsafe condition occurs.
- For standard water systems, an additional low water safety system exists. The microprocessor keeps track of approximately how much water leaves the tank in the form of steam. If the total amount exceeds a preset limit without energizing the fill valve, a low water condition is assumed and the humidifier shuts down. Each time the fill valve energizes, the total steam produced amount resets to zero. (This system is not implemented on a DI/RO humidifier because the float valve is not an electric-solenoid type. On a DI/RO humidifier, a mechanical fill valve maintains the proper water level. This fill valve runs independently of the microprocessor. Therefore, there is no way to reset the steam total to zero as the tank fills.)

Operation: Start-up commissioning checklist

Visit date _____ Job site representation: _____
Model # _____
Serial # _____
Tag # _____
Job name _____
Program code _____
DRISTEEM rep _____

Supply water

- DI
- RO
- Soft
- Potable
- Grains hardness _____
- Hot*
- Cold
- Water pressure _____ psi
(must be between 25 and 90 psi [172 and 620 kPa])
- Water supply piping is 1/4" pipe thread minimum
Float adjustments (DI system) _____

Note: *If using heated supply water, disconnect the water supply line to the water tempering device at the fill manifold and reconnect it to a cold water supply. This will ensure that the water tempering device operates properly.

Gas supply

- Natural
- LP
- Manifold pressure _____ inches wc (_____ kPa)
- Gas valve outlet pressure _____ inches wc (_____ kPa)
- Supply shutoff valve distance _____
- Supply line size _____

Flue piping

- Class _____
- Size _____
- Rise _____
- Run _____
- Slight pitch toward drip tee
- Termination point capped and covered
- Power venter location _____
- Barometric damper location _____

Required clearances

- Top cover removal 18" (457 mm)
- Distance vent box to combustibles 30" (762 mm)
- Cleanout plate side 36" (914 mm)

Wiring

- Control transmitter
Gauge _____
 Shield
- High limit duct humidistat
Gauge _____
 Shield
- Airflow proving switch
- Power vent
- Combustion air damper
- Area-type fan
- External fault contact
- Twisted pair connection between boards
(for multiple units only)

Steam pipe

- Outlet size _____
- Flange
- Hard pipe
- Insulated
- Rise _____
- Run _____
- Pitched back to humidifier
- 45° angles used in piping

More checklist on next page ...

Operation: Start-up commissioning checklist (continued)

Dispersion

- Ultra-sorb
- Rapid-sorb
- Single tube
- Single tube with drain

Safety testing to verify function

Low water test _____
 High humidity limit test _____
 Airflow test _____
 Aquastat test _____

Condensate/drain piping

Water seal height of dispersion system _____

- Air gap
- Condensate return to tank
- Drane-kooler

Additional comments

Cold-start burner ignition

Burner 1 lights after: First try
 Second try
 Third try

Burner 1 color after 15 minutes:
 Blue
 Orange
 Red-orange

Burner 2 lights after: First try
 Second try
 Third try

Burner 2 color after 15 minutes:
 Blue
 Orange
 Red-orange

Burner 3 lights after: First try
 Second try
 Third try

Burner 3 color after 15 minutes:
 Blue
 Orange
 Red-orange

Burner 4 lights after: First try
 Second try
 Third try

Burner 4 color after 15 minutes:
 Blue
 Orange
 Red-orange

Maintenance: For both GTS and GTS-DI models

Both GTS and GTS-DI models

Inspection recommendations:

- User inspection every 30 days.
- Appliance system inspected once a year by a qualified service person.

During inspection, verify the following:

- Proper field operation of burner. To verify, measure carbon monoxide (CO) level in the flue. If CO level is greater than 400 ppm, immediately shut down the GTS unit and consult the factory.
- Flue passageways external to the appliance, such as vent connector and chimney, are clear and free of obstructions.
- Vent connector is in place, sloping upward and is physically sound without holes or excessive corrosion.
- Physical support of the appliance is sound without sagging cracks or gaps between floor stand legs or tank flanges.
- There are no obvious signs of deterioration of the appliance.
- Burner flame is blue or orange in color — up to a $\frac{1}{4}$ " (6 mm) from the surface of the burner.
- See "Clean the probes" and "Clean low water cutout probe" on Page 62 and 63.

Inspecting burner assemblies and heat exchanger tubes

This is not a regular maintenance item, but if the heat exchanger tubes contain carbon deposits, soot, or other residue, clean as follows:

- Turn off gas, electrical power, and water supply.
- Remove gas train shroud.
- Disconnect wiring to blowers, flame sensors, gas valves, and ignition controllers and remove burner assemblies (each assembly is mounted with four bolts).
- Remove vent box.
- Use a 6" (150 mm) flue brush with a 24" (600 mm) extension and reversible drill. Work brush in and out of all combustion chambers. **Note:** Disconnecting components from one burner assembly at a time and then cleaning the corresponding combustion chamber and burner will ease reassembly.

More on next page ►

Maintenance: both GTS and GTS-DI models (continued)

- Remove loose deposits and residue that falls into rear header with a vacuum cleaner and hose extension.
- Inspect 1½" (DN40) return tubes and clean if necessary.
- Run thin brush between turbulator and tube wall on all four sides.
- Reinstall burner assemblies and gaskets; vent box and gasket; all electrical wiring; gas train shroud; and pressure switch connections.

Burner maintenance

Under normal use conditions, the burner(s) should not need cleaning for a minimum of five years. However, depending on the operating environment, the burner(s) may require periodic cleaning to remove accumulated materials. Failure to clean burners may result in reduced unit capacity or unacceptable CO levels in the flue. Use sealed combustion in dirty environments. See burner maintenance instructions below.

Burner maintenance instructions

To service the burner system, clean both the blower and the burner. Remove the blower(s) from the system and clean dust from the wheel. Remove the burner(s) for cleaning. Removing and cleaning one burner at a time eases reassembly. To dislodge particulate matter from the burner surface matrix, use **compressed air** (100 psig [700 kPa] maximum). Keep the air nozzle about 2" (50 mm) from the burner's surface, blowing air perpendicular to the burner surface while moving the nozzle back and forth lengthwise. This dislodges particles trapped in the matrix, pushing them back inside the burner. Avoid blowing air across the surface, which tends to have a destructive effect on the burner surface. Allow particulate matter to fall from the burner through the air/gas inlet. To assist in removing the particulate matter, use a vacuum at the burner's air/gas inlet.

Replacement parts

When servicing or repairing this equipment, use only DRISTEEM approved service replacement parts. Complete replacement part lists are on Pages 68–77. Refer to the rating plate on the unit for complete unit model number, serial number, and company address. Any substitution of parts or controls not approved by DRISTEEM will be at owner's risk and will void the warranty.

Note:

Soot and carbon deposits may indicate a combustion problem that needs to be corrected. Consult the factory.

WARNING!

When cleaning burners with compressed air, wear appropriate respiratory protection. Failure to do so may cause severe bodily injury.

Maintenance: GTS standard water models

GTS standard water quality recommendations

The best way to determine how often your particular system needs maintenance is to remove the tank cover and inspect it for mineral deposits after three months of duty. Potable water carries a variety of minerals and other materials in a mix that varies from location to location. This variation in water quality, combined with the hours of operation and duty cycle, will determine your own unique maintenance schedule.

Water quality makes a difference

- Light to moderately hard water (2 to 10 grains hardness per gallon [35 mg/L to 170 mg/L]) requires:
 - Annual cleaning
 - Regular skimming
- High mineral content water (more than 10 grains hardness per gallon [more than 170 mg/L]) requires:
 - Cleaning frequency determined by use and water quality
 - Regular skimming
 - Periodic drain and flush cycles
- Softened water dramatically reduces mineral accumulation inside standard water models.
(Note: Solids, like silica, are not removed in the softening process.)

Adjusting skim duration

The skim time duration determines the quantity of water skimmed with each fill cycle. Skim time is field adjustable using the Vapor-logic3 keypad.

Each time the GTS refills, it fills to an elevation near the lip of the skim/overflow fitting. A portion of the refill water then flows to the drain carrying most of the minerals left by the previous evaporating cycle. This reduces the mineral concentration, thereby reducing the frequency of cleaning needed.

The heated water that flows to the drain is an operational cost. Cleaning the humidifier also is an operational cost. Therefore, DRISTEEM recommends that the user observe and adjust the skimming quantity to achieve a balance between minimizing mineral buildup and conserving heated water.

Maintenance: GTS standard water models (continued)

Cool down humidifier before beginning maintenance

Before performing any maintenance, allow the tank to cool down.

- Insulated and uninsulated tanks will have hot surfaces.
- Verify that there is no call for humidity and that the aquastat set point (adjusted using the keypad/display Set Up screens) is less than room temperature (default setting is 40 °F [4 °C]) so that the heaters do not energize while cooling down the tank.
- For models with a standard drain valve:
 - Manually open the drain valve by moving the valve lever located on the back of the drain valve to the manual open position.
 - The fill valve eventually opens.
 - Let the fill water run until the tank is cooled; then shut off the field-installed manual supply water shut-off valve.
 - Let the tank drain; then manually close the drain valve.
- For models with optional drain valves:
 - For drain valves without the manual open lever, use the keypad to perform the cool down process.
 - Go to the control modes screen and select Manual Drain.
 - Allow approximately half the water to drain out of the tank.
 - In the Control Modes screen select Auto; the fill valve opens and the humidifier cools down.
 - When the fill valve closes, select Manual Drain in the Control Modes screen and let the tank drain dry. The humidifier should be cool enough to work on.
 - For more information about using the keypad, see the *Vapor-logics Installation and Operation Manual*.

WARNING!

When performing maintenance on the GTS humidifier, always switch the keypad control mode to Standby, place all power disconnects in OFF position and lock in OFF position, close the field installed manual water supply and gas shut-off valves. Failure to follow these instructions may cause severe bodily injury or death from electric shock.

Maintenance: GTS standard water models (continued)

Inspection and maintenance

1. Annually (also recommended when maintenance is performed)

- Inspect tank, piping, and gaskets for water and gas leaks.
- All safety devices in the control circuit should be cycled on and off to verify they are functioning. These include:
 - High limit switch
 - Airflow proving switch
 - Low water level probe. Pull out probe plugs; valve should de-energize.

2. Seasonally (or as required, depending on water quality)

- Clean tank
 - Remove cleanout plate and dispose of any loose scale that has collected in the tank. Do this before the scale buildup reaches the bottom of the heat exchanger.
 - Inspect the area inside the tank in front of the drain valve fitting and thoroughly clean all scale and mineral buildup from that area.
- Clean the probes
 - Access the probe assembly either from the electrical panel or by removing the roof panel above the electrical area.
 - Disconnect the probe plug and cable assembly and unscrew the probe rod assembly from the humidifier probe housing.
 - Inspect the probe housing and clean, ensuring that all the housing passageways are clear. Remove the housing from the tank by removing the cover plate from the tank.
 - The scale should flake off easily from the probe assembly rods.
 - The bottom 3/8" (10 mm) of each rod is the sensing portion; clean these areas with a wire brush, abrasive pad, or steel wool.
 - Inspect the composite plastic probe rod assembly for any signs of cracking, roughness, or deterioration. If found, replace probe assembly.
 - Reassemble the probe assembly.

More on next page ►

Maintenance: GTS standard water models (continued)

Inspection and maintenance (continued)

- Clean the skim/overflow port
 - Water should drain from the skimmer drain pipe after each fill cycle. This should be verified visually by a weekly inspection.
 - Loosen deposits in and around the skimmer/overflow port with a long tool such as a screwdriver.
 - If flow through the water seal/P-trap is diminished due to mineral accumulation:
 - Remove the water seal piping from the humidifier and flush out.
 - Replace the water seal with new piping if the minerals have hardened in the water seal.
- Clean low water cutout probe — Remove the shroud cover and inspect the probe rod for mineral accumulation. The rod is located on the top of the tank near the back. Use stainless steel wool to clean the probe .
- Inspect blower motor — A lubrication port is not provided, therefore lubrication is not required.
- Remove dust — Using a vacuum, remove all dust from areas around the motor, vent fan(s), and louvers that allow air to the shrouded area.

More on next page ►

WARNING!

When performing maintenance on the GTS humidifier, always switch the keypad control mode to Standby, place all power disconnects in OFF position and lock in OFF position, close the field installed manual water supply and gas shut-off valves. Failure to follow these instructions may cause severe bodily injury or death from electric shock.

Important:

Minimum water supply pressure is 25 psi (172 kPa).

Maintenance: GTS standard water models (continued)

- When the maintenance requirements are complete:
 - Replace cleanout plate and tighten the nuts on the plate.
 - Verify that the probe rod holder is secure and that the probe plug and cable assembly are plugged into the probe rod holder.
 - Verify that the drain valve assembly is in the closed position.
 - Replace and secure all covers and doors.
 - Turn on the water supply.
 - Turn on the electrical power.
 - Turn on gas.
 - Do not leave humidifier unattended. Allow the humidifier to cycle through multiple fill cycles and verify that the humidifier cover, cleanout plate, and probe holder gasket are not leaking.

3. Off-season maintenance

- Perform complete inspection and cleaning of the following:
 - Probe rods
 - Skimmer port and water seal
 - Humidifier tank
 - Heat exchanger
- After cleaning, the humidifier should remain empty until humidification is required.

Maintenance: GTS-DI models

GTS-DI models DI water quality recommendations

- Verify regularly that water processing equipment is operating correctly. The presence of chlorides in improperly processed DI water can cause pitting and failure of the tank and heat exchanger. Your DRISTEEM warranty does not cover damage caused by chloride corrosion.
- GTS-DI models do not require regular cleaning, although regular inspections are advised.
- GTS-DI models do not require skimming or draining and flushing to remove precipitated minerals. However, at the end of a humidification season, drain all DI humidifiers either by manually opening the drain valve or by programming the humidifier to automatically drain at end-of-season (electric fill and drain valve required).

Cool down humidifier before beginning maintenance

Before performing any maintenance, allow the tank to cool down.

- Tanks will have hot surfaces.
- Verify that there is no call for humidity and that the aquastat set point (adjusted using the keypad/display Set Up screens) is less than room temperature (default setting is 40 °F [4 °C]) so the unit does not fire-up while cooling down the tank.
- For models with a standard drain valve:
 - Manually open the drain valve.
 - The float valve opens.
 - Let the fill water run until the tank is cooled; then shut off the field-installed manual supply water shut-off valve.
 - Let the tank drain; then manually close the drain valve.
- For models with end-of-season drain option:
 - Use the keypad to perform the cool down process.
 - Select Manual Drain in the control modes screen.
 - Allow approximately half the water to drain out of the tank.
 - Select Auto in the control modes screen; the fill valve opens and the humidifier cools down.
 - When the fill valve closes, select Manual Drain in the control modes screen and allow the tank to drain completely dry. The humidifier should be cool enough to work on.
 - For more information about using the keypad, see the *Vapor-logics Installation and Operation Manual*.

WARNING!

When performing maintenance on the GTS humidifier, always switch the keypad control mode to Standby, place all power disconnects in OFF position and lock in OFF position, close the field installed manual water supply and gas shut-off valves. Failure to follow these instructions may cause severe bodily injury or death from electric shock.

Maintenance: GTS-DI models (continued)

WARNING!

When servicing controls, before disconnecting, label all areas. Wiring errors can cause explosion or fire, resulting in severe bodily injury, death, or significant property damage.

Inspection

1. **Annually** (also recommended when maintenance is performed)
 - Inspect tank and gaskets for leaks.
 - All safety devices in the control circuit should be cycled on and off to verify they are functioning. These include:
 - High limit switch
 - Airflow proving switch
 - Low water cutoff switch
 - Verify that the float valve is closing off. If the float valve will not shut off, there may be particulate on the valve seat, or the stopper may be worn and need replacing.
 - As long as mineral-free water is used in the GTS, no cleaning or flushing of the humidifier should be necessary.
2. **Seasonally** (or as required, depending on water quality)
 - Inspect blower motor. Since a lubrication port is not provided, lubrication is not required.
 - Remove dust — Using a vacuum, remove all dust from areas around the motor, vent fan(s), and louvers that allow air to the shaded area.
3. **Off-season maintenance**
 - Perform a complete inspection of the following:
 - Float valve
 - Low water cutoff switch
 - Humidifier tank and gaskets
 - Heat exchanger
 - Drain humidifier tank and rinse.
 - After inspection, the humidifier should remain empty until humidification is required.

GTS troubleshooting

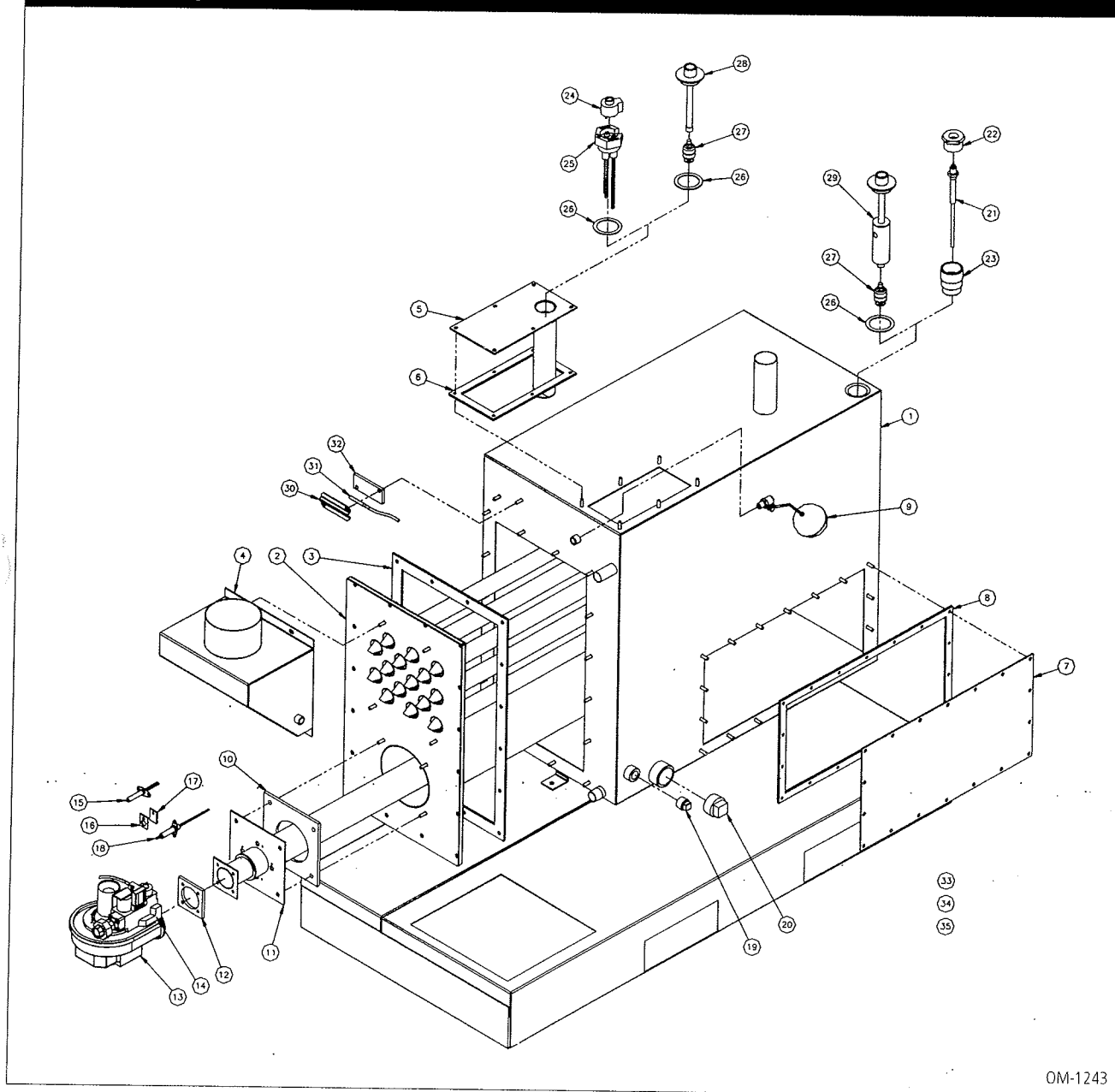
The *Vapor-logics Installation and Operation Manual* that shipped with your humidifier is a comprehensive operation manual. Refer to it for troubleshooting information.

Download DRISTEEM literature

Most DRISTEEM product manuals can be downloaded, printed and ordered from our web site: www.dristeem.com

GTS replacement parts

Figure 68-1:
GTS replacement parts



OM-1243

GTS replacement parts

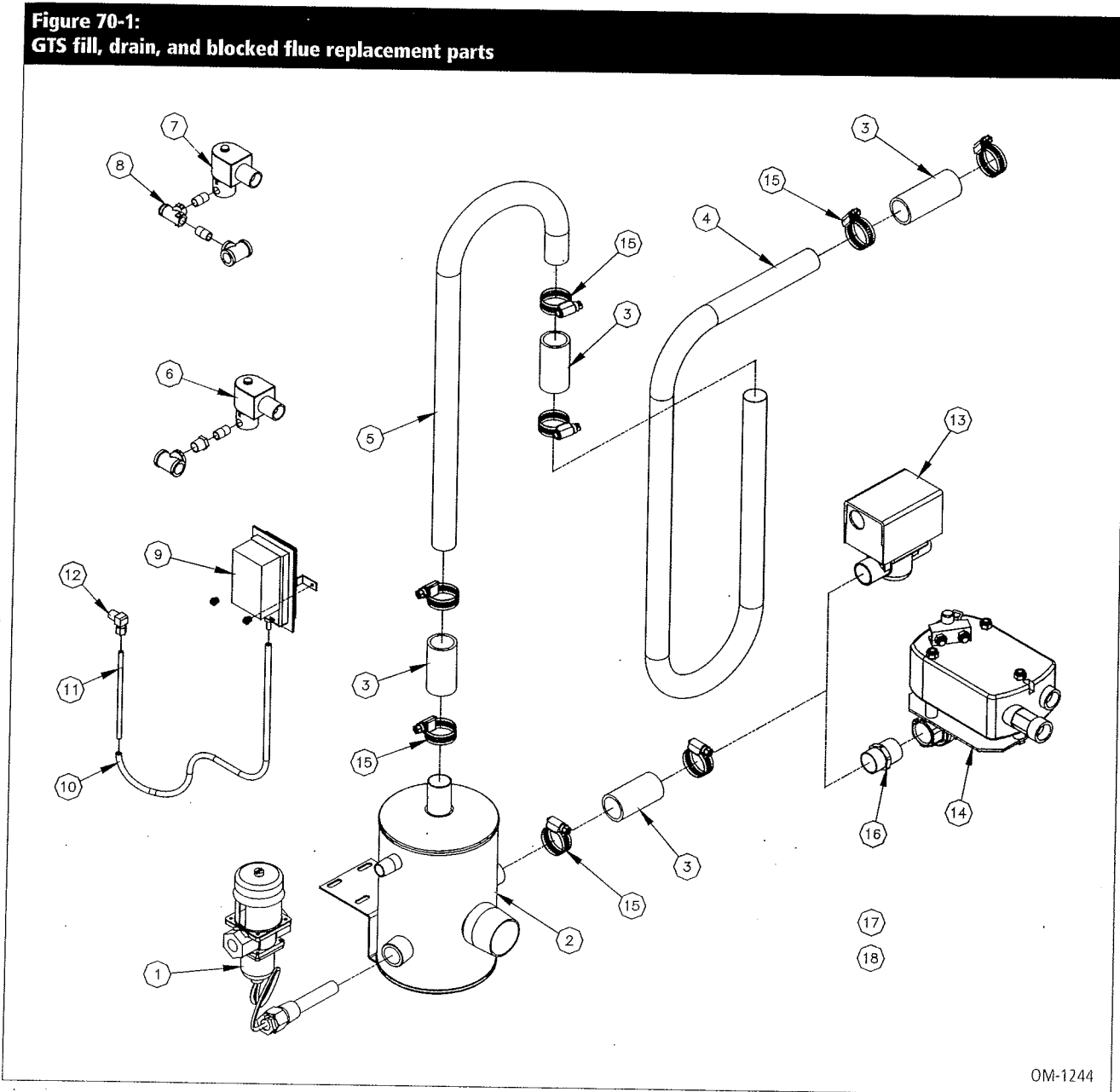
**Table 69-1:
GTS replacement parts**

No.	Description	Part no.	No.	Description	Part no.
1	Tank	Consult factory	19	Plug, 3/4"	250192-002
2	Heat exchanger	Consult factory	20	Plug, 1 1/2"	250681-002
3	Heat exchanger gasket	Consult factory	21	Redundant probe *	405726-001
4	Flue box	Consult factory	22	Bushing, 1 1/4" x 1/2" *	405800-015
5	Probe plate	165302-005	23	Adapter weld *	168010-005
6	Probe plate gasket	308235-006	24	Probe plug *	406050-100
7	Cleanout plate	165479-001	25	Probe assembly *	406303-010
8	Cleanout plate gasket	308235-005	26	Probe gasket	309750-004
9	DI float valve assembly **	Consult factory	27	DI float switch **	408420-002
10	Burner gasket	308230-006	28	DI float weld **	167789
11	Burner	Consult factory	29	Redundant DI float weld **	167789-002
12	Blower gasket	308230-007	30	Temperature sensor bracket	128666-001
13	Blower	405800-003	31	Temperature sensor	405760
14	Gas valve	405800-007	32	Temperature sensor gasket	308230-011
15	Ignitor	405719	33	Gas manifold weld ***	Consult factory
16	Sight glass bracket	128661	34	Sealed combustion assembly ***	Consult factory
17	Sight glass	405720	35	Pallet/shroud components ***	Consult factory
18	Flame sensor	405725			

Notes:
 * Standard water models only
 ** DI models only
 *** Not shown

GTS fill, drain, and blocked flue replacement parts

Figure 70-1:
GTS fill, drain, and blocked flue replacement parts



OM-1244

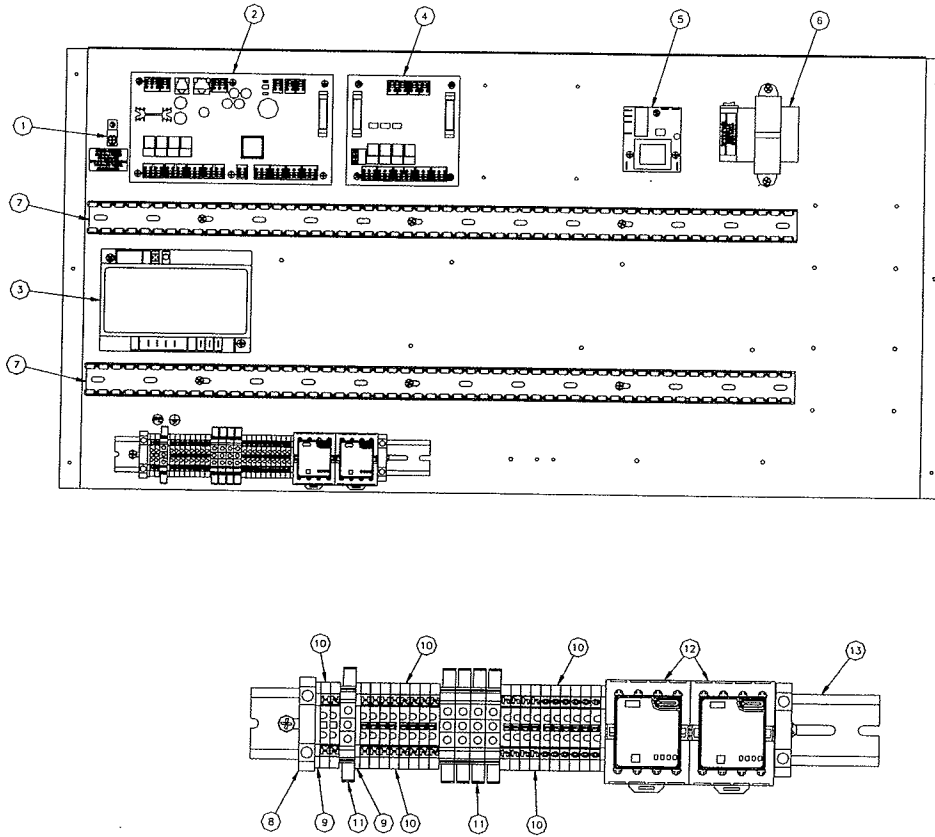
GTS fill, drain, and blocked flue replacement parts

**Table 71-1:
GTS fill, drain, and blocked flue replacement parts**

No.	Description	Part no.
1	Water tempering valve	505090-001
2	Water tempering tank	167001-035
3	Drain hose cuff	Consult factory
4	Top water seal tube	204812-201
5	Bottom water seal tube	204812-202
6	Fill valve, DI EOS models **	505086
7	Fill valve, standard water models *	505084
8	Strainer *	300050
9	Blocked flue sensor	406190
10	Flexible tubing	405722
11	Copper tubing	100038-025
12	Compression elbow	405723
13	Drain valve, standard water models *	505075
14	Drain valve, DI-EOS models **	193458
15	Hose clamp	700560-100
16	Adapter, NPT x C	204700
17	Fill hose ***	Consult factory
18	Water tempering hose ***	307021-002
Notes:		
* Standard water models only		
** DI models only		
*** Not shown		

GTS electrical replacement parts

Figure 72-1:
GTS electrical replacement parts



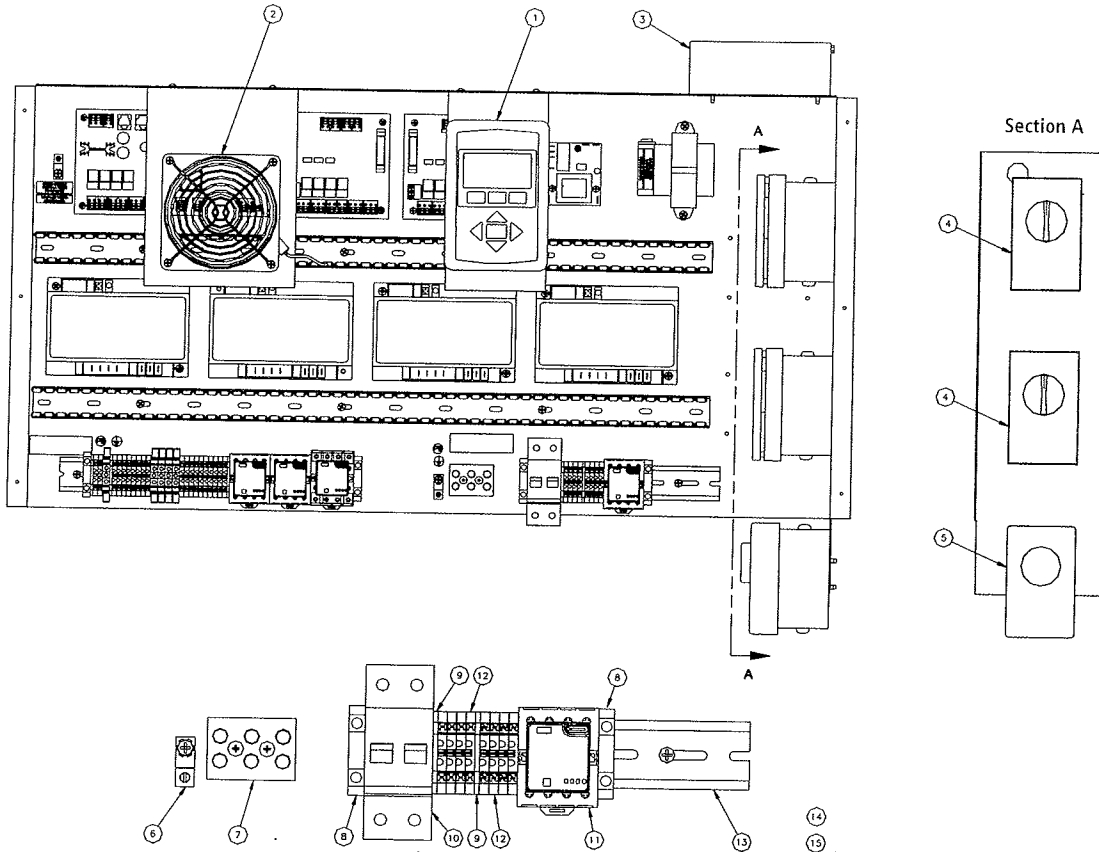
OM-1241

GTS electrical replacement parts

Table 73-1: GTS electrical replacement parts		
No.	Description	Part no.
1	Ground wire lug	409250-003
2	Vapor-logic3 main board	408491-001
3	Ignition module	405800-006
4	Vapor-logic3 GTS expansion board	408490-004
5	Low water board *	405726 *
6	Transformer	408965-001
7	Wire channel, 1"	408999-001
8	DIN-rail end bracket	408252-006
9	DIN-rail end cap	408252-005
10	DIN-rail terminal	408252-001
11	DIN-rail ground terminal	408252-010
12	Relays, sockets, time delay	Consult Factory
13	DIN-rail	167765-012
Note: * Standard water models only		

Outdoor enclosure electrical replacement parts

Figure 74-1:
Outdoor enclosure electrical replacement parts



OM-1242

Outdoor enclosure electrical replacement parts

**Table 75-1:
Outdoor enclosure electrical replacement parts**

No.	Description	Part no.
1	Vapor-logics display	408491-002
2	Fan assembly	185110-001
3	High limit stat	405800-065
4	Fan/low limit stat	405800-067
5	Heater stat	405800-066
6	Ground wire lug	409250-003
7	Power block	408300-002
8	DIN-rail end bracket	408252-006
9	DIN-rail end cap	408252-005
10	Circuit breaker	406775-005
11	Relays, sockets, time delay	Consult factory
12	DIN-rail terminal	408252-001
13	DIN-rail	167765-008
14	Heater assembly, 500W ***	Consult factory
15	Heater assembly, 1100W ***	Consult factory
Note: *** Not shown		

Information for European models only

Electrical warning label



Location: Control cover, shroud

Definition: Electrical shock hazard

This equipment has been tested by the Canadian Standards Association International to the Low Voltage, Gas Appliance, and EMC directives and has been certified by AFNOR for use in all EU countries.

Important:

This equipment is for use with second family (G20, G25) natural gases; and third family (G30, G31) propane gas. Contact your distributor before converting to another group or supply pressure.

Authorized countries of destination

The GTS and GTS-DI humidifiers bearing the CE mark are authorized for use in the European countries listed below.

Austria AT	Greece.....GR
Belgium. BE	Ireland.....IE
Switzerland. CH	Iceland.....IS
Germany. DE	Italy.....IT
Denmark. DK	Luxembourg.....LU
Spain ES	Netherlands.....NL
Finland FI	Norway.....NO
France FR	Portugal.....PT
United Kingdom . . . GB	Sweden.....SE

Appliance category

In relation to the country of destination, this humidifier is classified under one of the following boiler categories: category I_{2H} , I_{2L} , I_{2E} , I_{2E+} , I_{2LL} , I_{2ES} , I_{2F} , I_{2ER} , $I_{3B/P}$, I_{3P} .

See the unit data plate for the specific category of your appliance.

Table 76-1:
Gas specifications for European models

Humidifier model	Volumetric flow rate by gas category					Average flue temperature	Minimum draught requirement	Mass flow rate of combustion products
	2H-G20-20 mbar 2E-G20-20 mbar 2Es-G20-20 mbar	2L-G25-25 mbar 2LL-G25-20 mbar 2Ei-G25-25 mbar	2E+G20/G25-20/25 mbar 2ER-G20/G25-20/25 mbar	3B-G30-30 mbar 3B-G30-50 mbar	3P-G31-30 mbar 3P-G31-37 mbar 3P-G31-50 mbar			
GTS-100	2.31 m ³ /h	2.82 m ³ /h	2.31-2.82 m ³ /h	1.31 m ³ /h	1.49 m ³ /h	121 °C	-0.025 mbar	6.9 g/s
GTS-200	4.62 m ³ /h	5.64 m ³ /h	4.62-5.64 m ³ /h	2.62 m ³ /h	2.98 m ³ /h	163 °C	-0.025 mbar	13.8 g/s
GTS-300	6.92 m ³ /h	8.46 m ³ /h	6.92-8.46 m ³ /h	3.93 m ³ /h	4.47 m ³ /h	191 °C	-0.025 mbar	20.7 g/s
GTS-400	7.62 m ³ /h	9.31 m ³ /h	7.62-9.31 m ³ /h	4.32 m ³ /h	4.92 m ³ /h	218 °C	-0.025 mbar	22.8 g/s
GTS-600	13.85 m ³ /h	16.92 m ³ /h	13.85-16.92 m ³ /h	7.86 m ³ /h	8.94 m ³ /h	218 °C	-0.025 mbar	41.4 g/s
GTS-800	18.47 m ³ /h	22.56 m ³ /h	18.47-22.56 m ³ /h	10.48 m ³ /h	11.92 m ³ /h	218 °C	-0.025 mbar	55.2 g/s

Information for European models only

**Table 77-1:
GTS specifications, capacities, and weights for European models**

Model number	Steam capacity per hour in kg*	P = (kW)	Q = (kW)	Steam outlet	Recommended flue size (Class B)	Operating weight in kg	Shipping weight in kg	Full load amps
GTS-100	34	0-24	0-29	DN50 (2") BSPT or DN50 hose	DN125 (5")	320	170	2.8
GTS-200	68	0-48	0-59	DN50 (2") BSPT or DN50 hose	DN125 (5")	320	170	2.8
GTS-300	102	0-72	0-88	DN80 (3") flange	DN180 (7")	385	205	4.0
GTS-400	136	0-80	0-117	DN80 (3") flange	DN180 (7")	385	205	4.0
GTS-600	204	0-144	0-176	DN100 (4") flange	DN200 (8")	500	270	5.5
GTS-800	272	0-192	0-234	DN100 (4") flange	DN250 (10")	635	320	7.0

Note:

* The maximum steam capacities listed may be as much as 10% lower than the given values due to local variations in the Wobbe index of G20 and G25 gases.

Capacity notes

- At sea level, 402 kJ are required to raise the temperature of one kilogram of water from 4 °C to 100 °C.
- An additional 2257 kJ are required to change the state of one kilogram of 100 °C water to vapor.
- Another factor to consider is condensation steam loss from hoses and tubes. Use the following steam loss guidelines:
 - Vapor hose: 0.22 kg/m/h
 - Insulated pipe: 0.07 kg/m/h
 - Dispersion tubes: 0.7 kg/m/h

Caution! Gas pressure to the humidifier controls must never exceed 6 kPa (60 mbar) or the gas valve will become damaged and require replacement. Immediately install a DN6 pipe thread plugged tapping, accessible for test gauge connection, upstream of the gas supply connection to the appliance.

LP gas

All models operate at rated kW input.

Operating characteristics

- Unit is capable of operating in ambient conditions of 5 °C to 40 °C.
- Unit is capable of operating in ambient conditions between 30% RH and 95% RH (noncondensing).
- NOx class 5

Gas supply pressure

- 20 or 25 mbar for natural gas (depending on gas group), and 30, 37 or 50 mbar for propane gas (depending on gas group)

PMS (all units)

- 7.0 bar

Electric supply

- 230V, 667W to 2415W (see data plate)

Max inlet water temperature

- 90 °C

Expect quality from the industry leader

For more than 40 years, DRISTEEM has been leading the industry with creative and reliable humidification solutions. Our focus on quality is evident in the construction of the GTS, which features cleanable, stainless steel construction, and an industry-leading two year warranty that covers all parts.

For more information

www.dristeem.com
sales@dristeem.com

DRISTEEM Corporation

An ISO 9001:2000 certified corporation and a subsidiary of Research Products Corporation

Continuous product improvement is a policy of DRISTEEM Corporation; therefore, product features and specifications are subject to change without notice.

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Form No. GTS-IOM-0105-global
Part No. 890000-101 Rev B

Two-year limited warranty

DRISTEEM Corporation ("DRISTEEM") warrants to the original user that its products will be free from defects in materials and workmanship for a period of two (2) years after installation or twenty-seven (27) months from the date DRISTEEM ships such product, whichever date is the earlier.

If any DRISTEEM product is found to be defective in material or workmanship during the applicable warranty period, DRISTEEM's entire liability, and the purchaser's sole and exclusive remedy, shall be the repair or replacement of the defective product, or the refund of the purchase price, at DRISTEEM's election. DRISTEEM shall not be liable for any costs or expenses, whether direct or indirect, associated with the installation, removal or reinstallation of any defective product.

DRISTEEM's limited warranty shall not be effective or actionable unless there is compliance with all installation and operating instructions furnished by DRISTEEM, or if the products have been modified or altered without the written consent of DRISTEEM, or if such products have been subject to accident, misuse, mishandling, tampering, negligence or improper maintenance. Any warranty claim must be submitted to DRISTEEM in writing within the stated warranty period.

DRISTEEM's limited warranty is made in lieu of, and DRISTEEM disclaims all other warranties, whether express or implied, including but not limited to any IMPLIED WARRANTY OF MERCHANTABILITY, ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, any implied warranty arising out of a course of dealing or of performance, custom or usage of trade.

DRISTEEM SHALL NOT, UNDER ANY CIRCUMSTANCES BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, REVENUE OR BUSINESS) OR DAMAGE OR INJURY TO PERSONS OR PROPERTY IN ANY WAY RELATED TO THE MANUFACTURE OR THE USE OF ITS PRODUCTS. The exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory, even if DRISTEEM has notice of the possibility of such damages.

By purchasing DRISTEEM's products, the purchaser agrees to the terms and conditions of this limited warranty.

READ AND SAVE THESE INSTRUCTIONS

This manual must be left with the owner and should be accessible for reference.

ULTRA-SORB[®]

STEAM DISPERSION TUBE HUMIDIFIER PANEL

For Applications
Using Steam From A Boiler
or
From Any DRI-STEEM
Steam Generating Humidifier.

User's/Installation Instructions
and
Maintenance Operations Manual

DRI STEEM[®]
HUMIDIFIER COMPANY



TABLE OF CONTENTS

TO THE PURCHASER AND INSTALLER

Thank you for purchasing our ULTRA-SORB® steam dispersion tube humidifier panel. We have designed and built this equipment to give you complete satisfaction and trouble-free service for many years. Familiarizing yourself with this manual will help ensure you proper operation of the equipment for years to come.

DRI-STEEM Humidifier Company

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FIELD ASSEMBLY OF ULTRA-SORB® LH

ULTRA-SORB Model LH Field Assembly

Table 3-1: ULTRA-SORB Humidifier Components

Please Read Instructions While Assembling

STEP 1 - Unpack

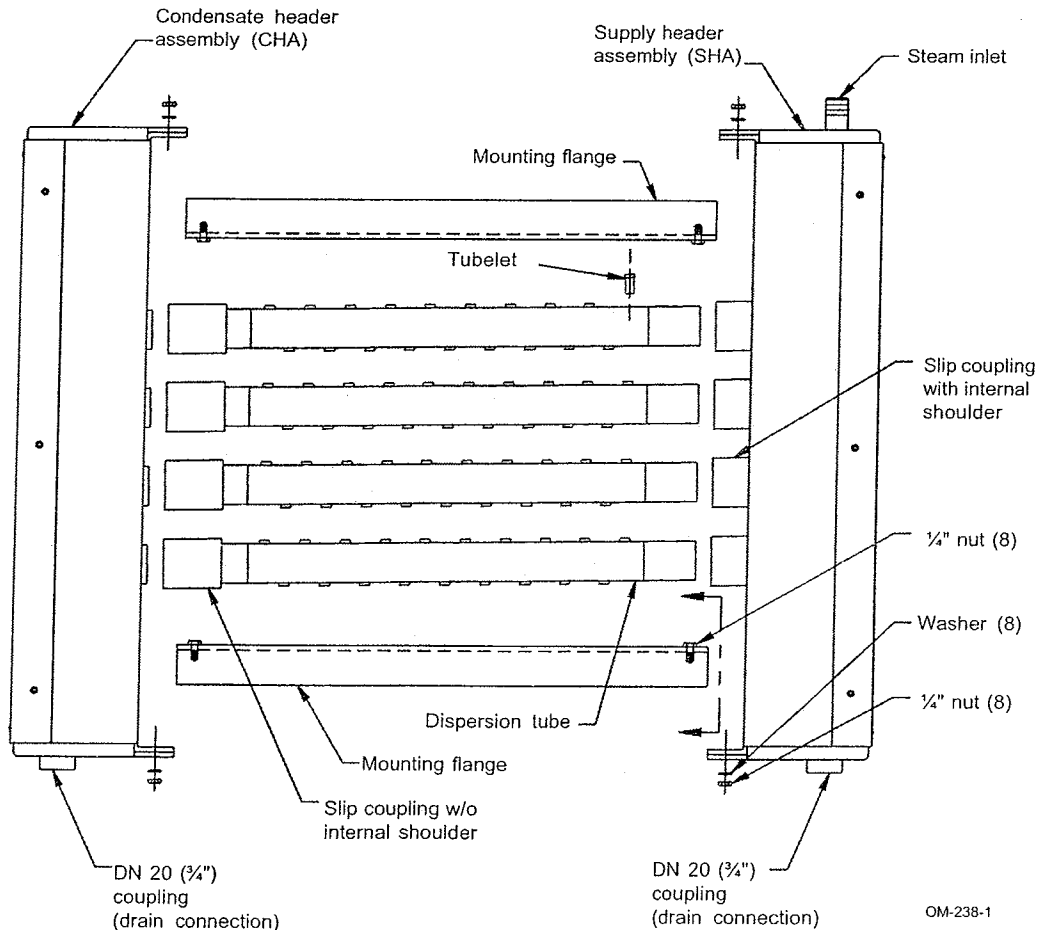
Unpack the ULTRA-SORB components and verify that all items checked off as shipped on the packing list have been received by you.

Note that both the Supply Header Assembly (SHA) and the Condensate Header Assembly (CHA) have a DN 20 (3/4") half coupling for drain connection at one end (the SHA also has a steam inlet - nipple or tubing) for steam supply connection at the other end.

Description	Qty.
Supply Header Assembly (SHA) with Internal Shouldered Slip Couplings	1
Condensate Header Assembly (CHA)	1
Mounting Flange	2
Dispersion Tubes with Slip Couplings	varies
1/4" x 3/4" Bolt	8
1/4" Nut	8
1/4" lock Washer	8

Refer to Figure 3-1 and arrange the components on the floor or some other large flat working surface, positioning them as indicated in Figure 3-1 with the SHA at the right and the CHA at the left.

Figure 3-1: ULTRA-SORB Model LH



OM-238-1

FIELD ASSEMBLY OF ULTRA-SORB® LH

STEP 2 - Bolt the Mounting Flanges to the Supply Header Assembly (SHA)

Refer to Figures 4-1 and 4-2 below. Attach the two mounting flanges to the SHA as indicated using 1/4" bolts with the nuts only finger tightened.

Figure 4-1

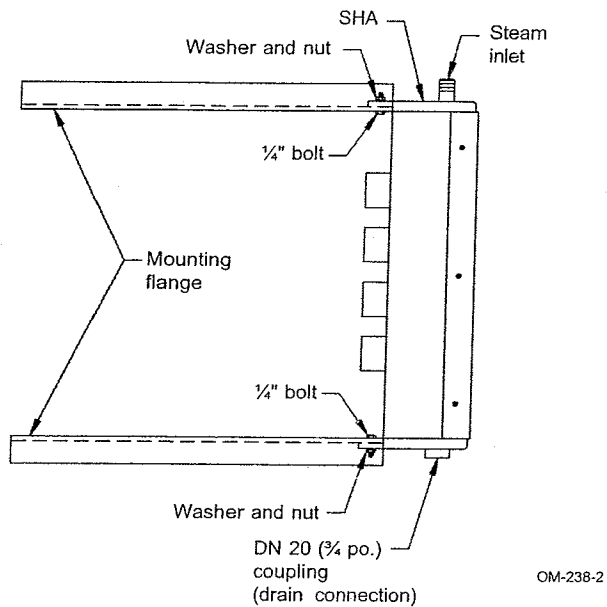
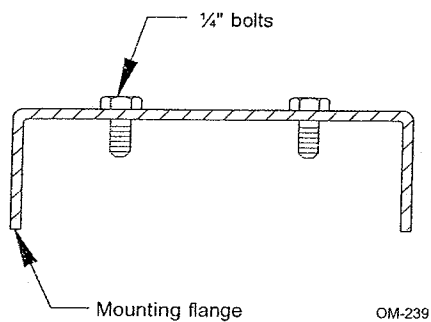


Figure 4-2: Detail View of Mounting Flange



STEP 3 - Insert the Dispersion Tubes

Refer to Figure 4-3. Insert the plain ends of the dispersion tubes into the slip couplings already mounted on the SHA (they are factory lubricated internally and if well aligned during insertion no further lubrication should be needed). Push and twist the tube in until it bottoms out on the internal shoulder stop of the adapter. See Figure 4-4 below. CAUTION: Use care to avoid cutting the internal O-rings of the adapters.

Figure 4-3

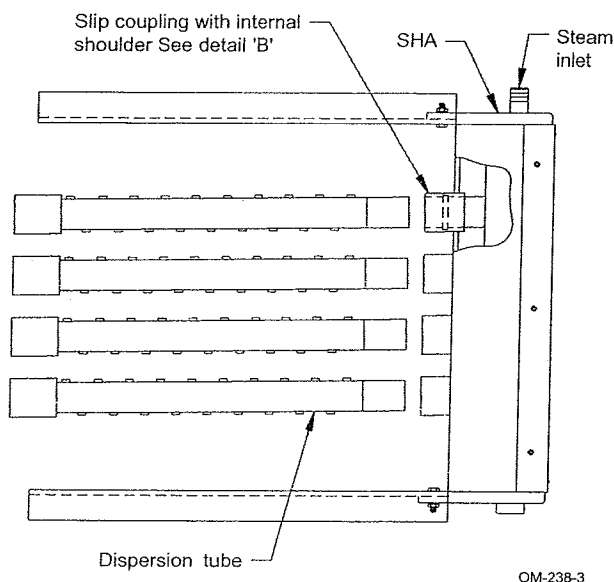
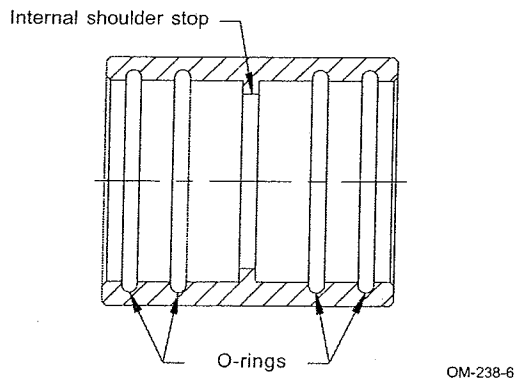


Figure 4-4: Detail View of Slip Coupling

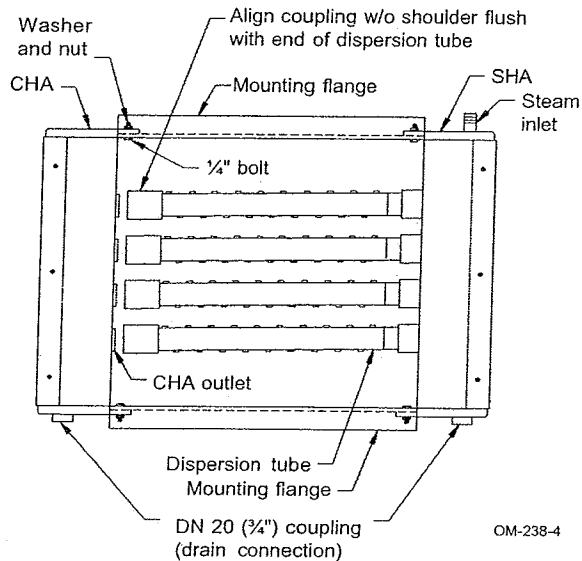


FIELD ASSEMBLY OF ULTRA-SORB® LH

STEP 4 - Bolt the Mounting Flanges to the CHA

Refer to Figure 5-1 below. First make sure that the slip couplings are pushed far enough onto the dispersion tubes to be at least flush with the tube ends and the DN 20 (¾") drain half coupling is properly oriented. Attach the mounting flanges using ¼" bolts and leave the nuts finger tightened.

Figure 5-1



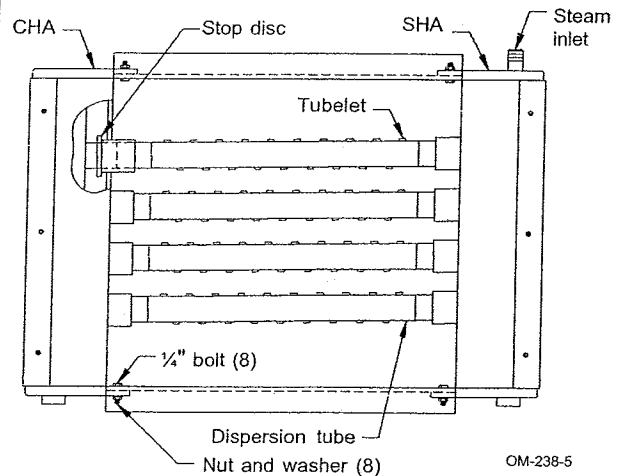
STEP 5 - Slide the slip couplings onto the CHA outlets and orient the tubelets

SUGGESTION: Gripping the DN 20 (¾") drain connection with vise grip pliers and applying a back and forth rolling motion to the header will assist in sliding the slip couplings into place.

Refer to Figure 5-2. It may be necessary to push and twist the slip couplings onto the outlets. Again care must be taken to avoid cutting the internal O-rings. Slide the slip couplings on until they bottom out against the **stop disc**. The steam discharge orifices must be aimed so that they discharge the steam across (perpendicular to) the airstream. Rotate the tubes as needed to accomplish this.

After tightening the ¼" bolts at all 4 corners the ULTRA-SORB panel is ready for installation. See page 9.

Figure 5-2



FIELD ASSEMBLY OF ULTRA-SORB® LV

ULTRA-SORB Model LV Field Assembly

Please Read Instructions While Assembling

STEP 1 - Unpack

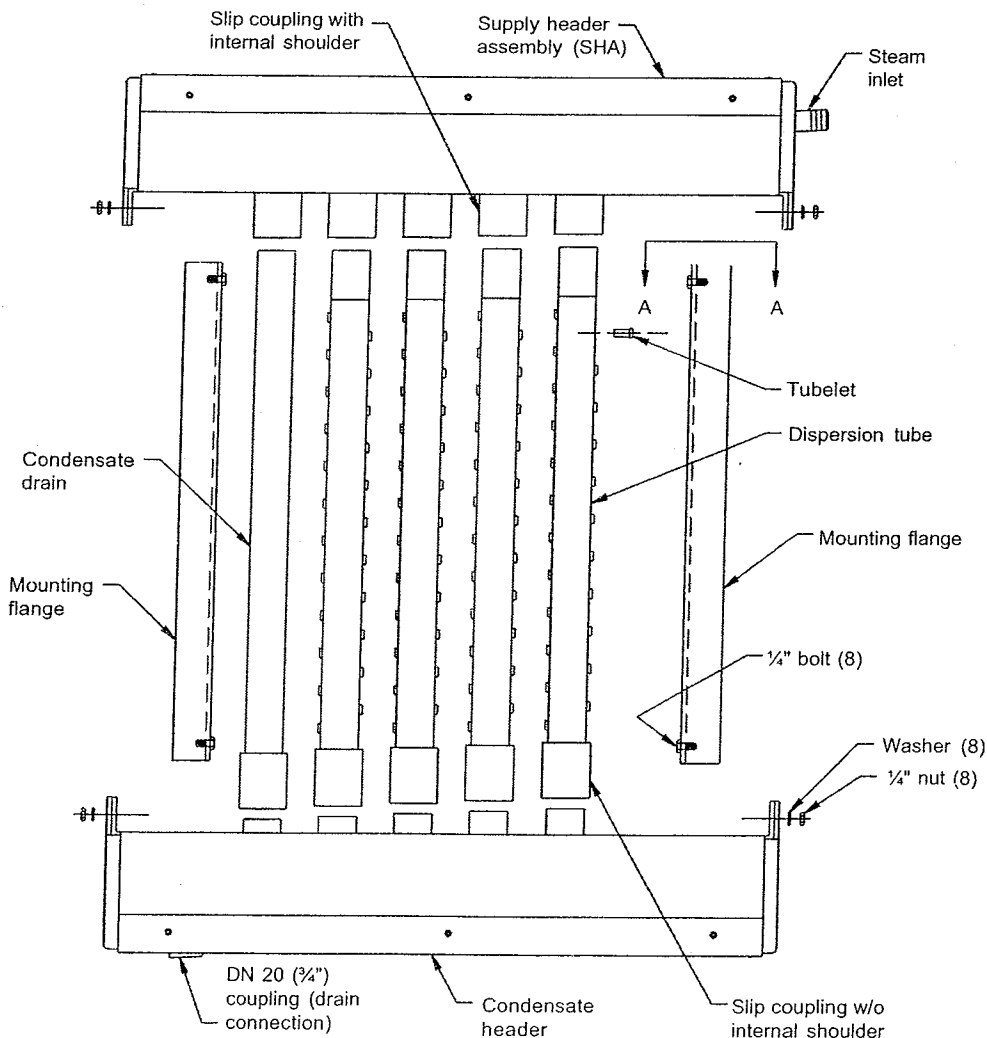
Unpack the ULTRA-SORB components and verify that all items checked off as shipped on the packing list have been received by you.

Lay the components on a flat surface as shown in Figure 6-1. Note: Reference positioning of the header assemblies to the DN 20 (3/4") coupling on the Condensate Header Assembly (CHA). Place this assembly with the DN 20 (3/4") drain half coupling on your left. The Supply Header Assembly (SHA) has a steam inlet (nipple or tubing) on one end. Place this assembly as shown with the steam connection nipple or tubing pointing to the right.

Table 6-1: ULTRA-SORB Humidifier Components

Description	Qty.
Supply Header Assembly (SHA) with Internal Shouldered Slip Couplings	1
Condensate Header Assembly (CHA)	1
Mounting Flange	2
Dispersion Tubes with Slip Couplings	varies
1/4" x 3/4" Bolt	8
1/4" Nut	8
1/4" lock Washer	8

Figure 6-1: ULTRA-SORB Model LV



OM-260-1

FIELD ASSEMBLY OF ULTRA-SORB® LV

STEP 2 - Bolt the Mounting Flanges to the Supply Header Assembly (SHA)

Refer to Figure 7-1 and 7-2 below. Attach the two mounting flanges as indicated using 1/4" bolts with the nuts only finger tightened.

Figure 7-1

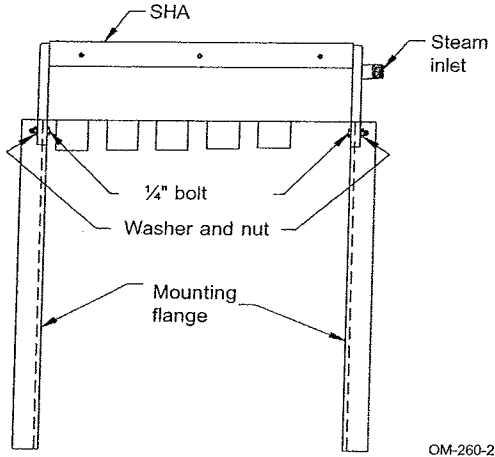
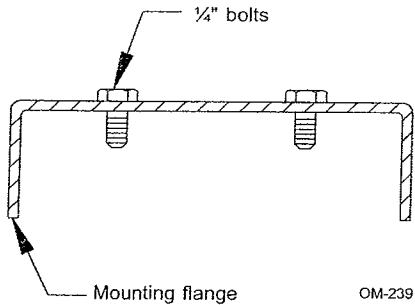


Figure 7-2: Detail View of Mounting Flange



STEP 3 - Insert the Dispersion Tubes

Refer to Figure 7-3. Insert the plain ends (less slip coupling) of the dispersion tubes into the slip coupling already mounted on the SHA (they are factory lubricated internally and if well aligned during insertion no further lubrication should be needed). Push and twist the tube in until it bottoms out on the internal shoulder stop of the adapter. See Figure 7-4 below. **CAUTION:** Use care to avoid cutting the internal O-rings of the adapters.

Figure 7-3

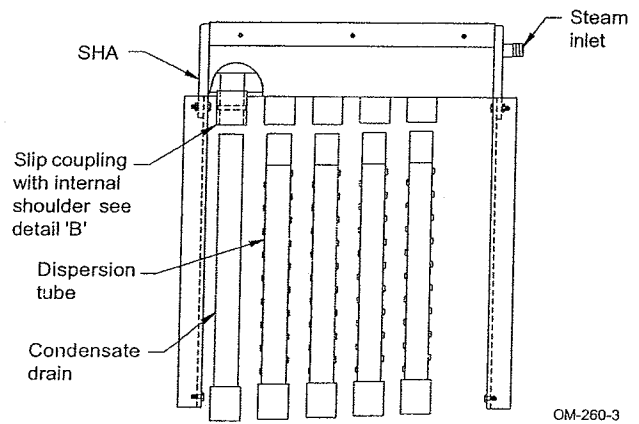
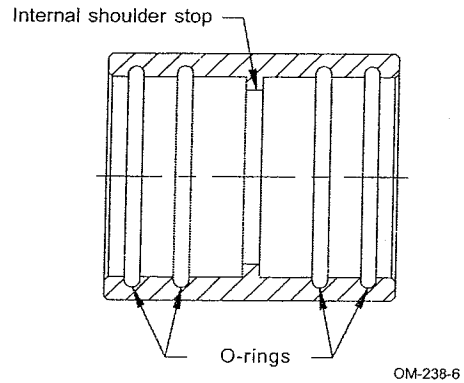


Figure 7-4: Detail View of Slip Coupling

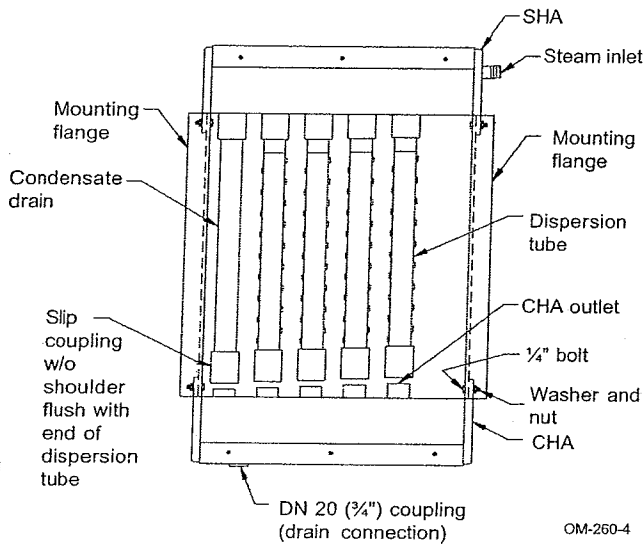


FIELD ASSEMBLY OF ULTRA-SORB® LV

STEP 4 - Bolt the Mounting Flanges to the CHA

Refer to Figure 8-1. First make sure that the slip couplings are pushed far enough onto the dispersion tubes to be at least flush with the tube ends and the DN 20 (3/4") drain half coupling is properly oriented. Attach the mounting flanges using 1/4" bolts and leave the nuts finger tightened.

Figure 8-1



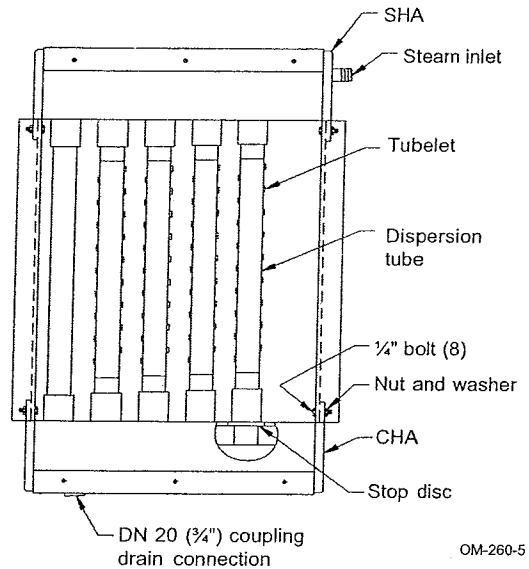
STEP 5 - Slide the slip couplings onto the CHA outlets and orient the tubelets

Refer to Figure 8-2. SUGGESTION: Gripping the DN 20 (3/4") drain connection with vise grip pliers and applying a back and forth rolling motion to the header will assist in sliding the slip couplings into place.

It may be necessary to push and twist the slip couplings onto the outlets. Again care must be taken to avoid cutting the internal O-rings. Slide the slip couplings on until they bottom out against the **stop disc**. The steam discharge orifices must be aimed so that they discharge the steam across (perpendicular) to the airstream. Rotate the tubes as needed to accomplish this.

After tightening the 1/4" bolts at all 4 corners the ULTRA-SORB panel is ready for installation. See page 9.

Figure 8-2



INSTALLATION

Selecting the Location

To put ULTRA-SORB® dispersion tube panels to work, you need to provide a steam supply and a method to remove condensate generated within the ULTRA-SORB panel.

When selecting the location, first consideration should be given to rapid, thorough absorption of the steam. The warmest air will most readily absorb the steam.

The distance that unabsorbed steam will travel within a given airstream is predictable and can be determined by referring to Table 19-1 on page 19.

A. It is very important that the **Field Assembly of ULTRA-SORB** panel be located where the water vapor being discharged will be absorbed by the airstream.

B. In general, the ULTRA-SORB panel should be placed where the air temperature is capable of absorbing steam being discharged without causing condensation at or after the unit. This will normally be downstream of the heating coil or where the air temperature is warmest.

C. Do not place in an outside air intake unless the air is tempered with a preheat coil.

D. Do not place the unit too near to the entrance of a high efficiency filter. The filter will remove the visible moisture and become waterlogged. See Note 4 on page 19 for absorption distance.

E. Do not place the ULTRA-SORB panel where discharged visible mist will impinge directly on a metal surface.

INSTALLATION

Placement of the Humidifier Within a System

Because of its rapid absorption characteristics the ULTRA-SORB® dispersion tube panel is the problem solver for previously troublesome humidification applications. The following comments are presented to assist the installer in judging the alternatives in some of the most common situations. The first rule is to choose the warmest part of the airstream.

Example 1: Placement in an Air Handling Unit

Location "A" is usually the first choice, assuming there are no "in duct" solid objects such as dampers or coils immediately downstream on which steam could condense.

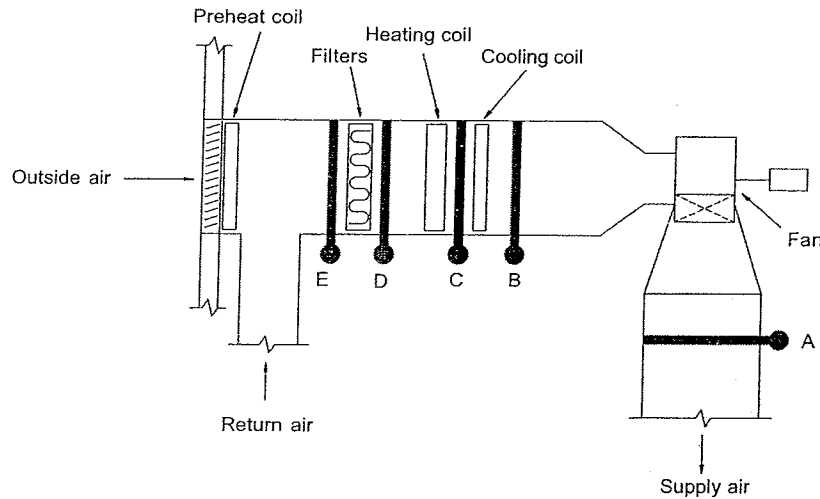
Location "B" may be the next choice, assuming that steam absorption can be completed prior to entering the fan, otherwise the fan may be damaged by rusting.

Location "C" is a possibility. However, when and if the heating coil is cold, it will condense some of the humidifying vapor. In the absence of a drain pan or waterproof floor, this may not be acceptable. If the coil is *always* heated during the humidifying season, the warmer air decreases the absorption distance to better protect the fan.

Location "D" is a poorer location than "C" because the cooling coil will act as a moisture eliminator. Cooling coils have drain pans below them so water accumulation is not a danger. However, the condensed vapor represents a waste. Sometimes, even more important, is the fact that condensed steam can sometimes be very corrosive to the cooling coil. Minimal absorption distance requirements are shown in Table 19-1.

Location "E" would be an extremely poor choice because the air is cold and the filters would become saturated and/or covered with ice.

Figure 10-1



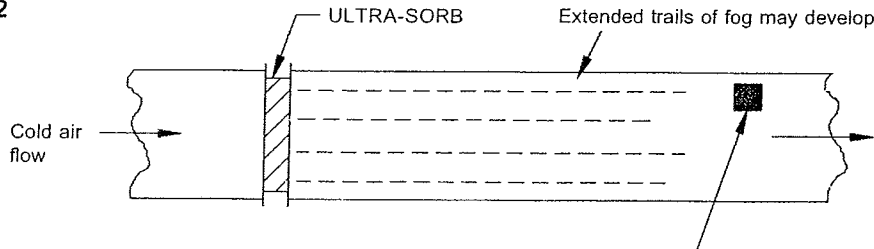
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Example 2: Installation in Cold Air Stream

When a humidifier is installed in a duct that will carry cold air periodically, the dew point temperature should be determined.

If the psychrometric chart reveals that saturation may occur, protection should be provided. A high limit humidistat or thermostat, set to cut off the humidifier at a safe temperature can be used for this purpose.

Figure 10-2

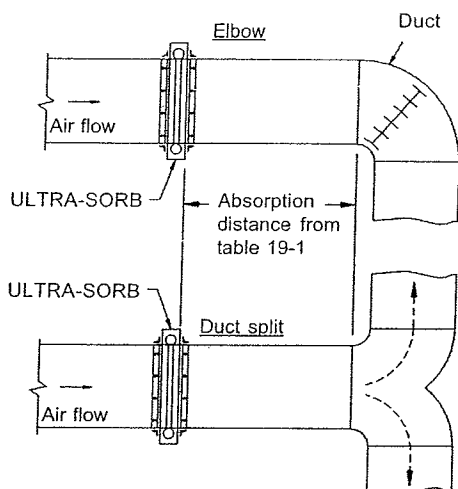


High limit duct humidistat to be mounted
3 to 4.5 metres downstream of ULTRA-SORB

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INSTALLATION

Figure 11-1

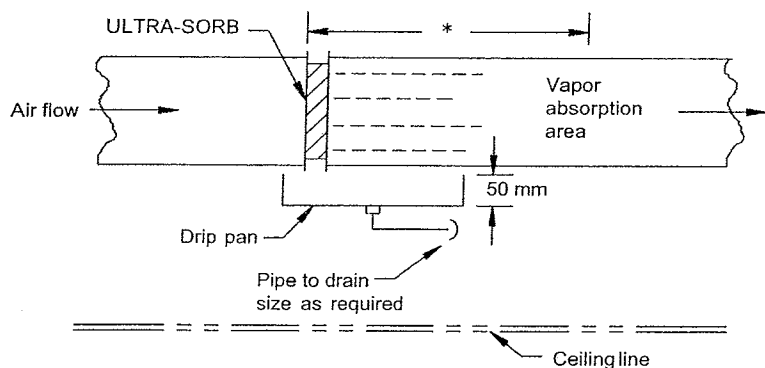


OM-178

Example 3: Placement Upstream of an Elbow or Duct Split

Due to the rapid steam absorption performance of the ULTRA-SORB® dispersion tube panel, these types of installations can be made with confidence. However, all mechanical equipment is subject to accidental failure. Therefore, if the installation is above expensive or irreplaceable objects a drip pan should be provided to prevent accidental spillage.

Figure 11-2



OM-198

Example 4: Installation Above Valuable Equipment

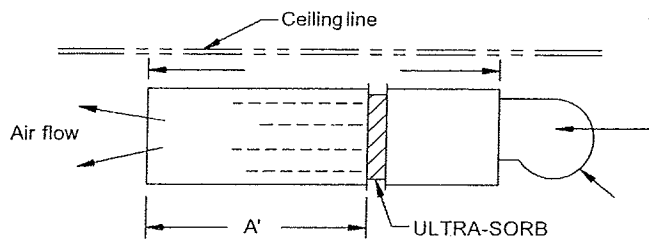
Water piping and humidifiers preferably should not be installed above expensive apparatus or equipment. A broken water pipe, leaking valve gland, condensation or other accidental water spillage may occur causing serious damage and costly repairs to the equipment below.

When this type of installation cannot be avoided install a drip pan constructed of galvanized sheet steel under the humidifier, valve, etc. to catch and drain away the spill.

The condensate from the ULTRA-SORB panel should be piped as per piping diagrams and should not be discharged into the pan.

* The length of duct should have sealed seams. This dimension should be at least three times the height of the ULTRA-SORB.

Figure 11-3



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Example 5: Recirculation Unit

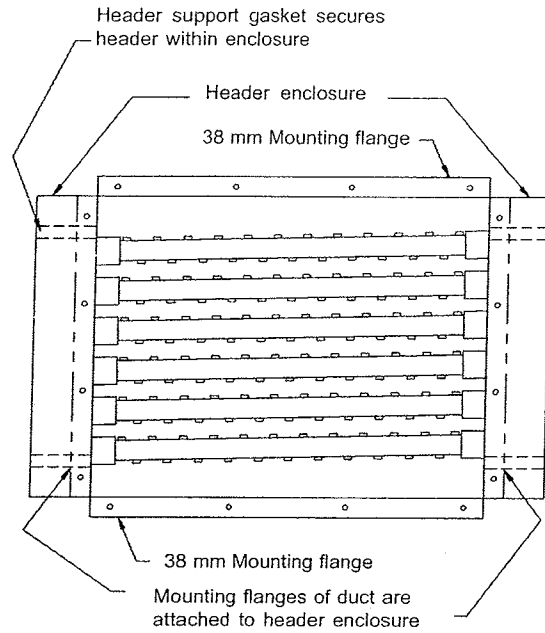
In an application where no duct system exists, or if the duct air is too cool for proper humidity absorption, a recirculation fan can be used. The fan circulates room temperature air across the humidifier and discharges humidified air into the space. The point of air discharge should be carefully selected to avoid condensation on surfaces of the building or equipment.

INSTALLATION

Mounting ULTRA-SORB® in Duct Section

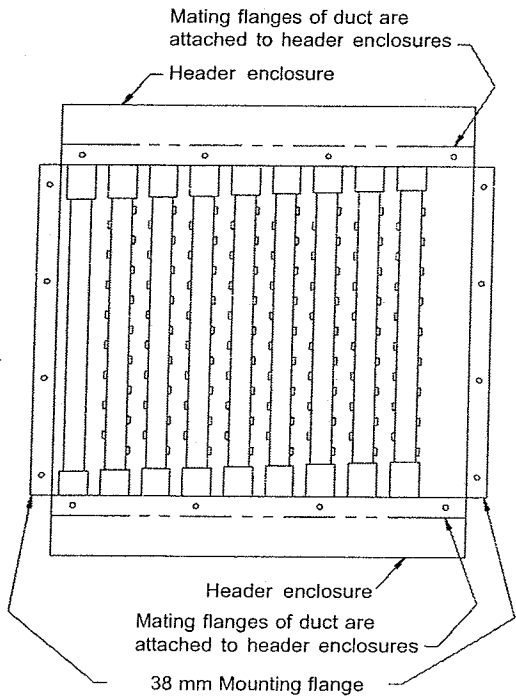
The ULTRA-SORB panel is contained within a mounting frame. A mounting flange 38 mm wide is provided on all four sides of the unit. The 38 mm wide portion of the header enclosure highlighted in the drawings below is intended to be a mounting flange. A matching flange or metal frame is required on the ductwork for connection to the ULTRA-SORB flanges. The recommended fastener is a 20 mm self drilling and tapping screw, spacing not to exceed 300 mm. If an angle iron frame is provided on the duct section, a longer screw may be required. **Note: Screw penetration into header enclosure should not exceed 19 mm to avoid puncturing header.**

Elevation View - Model LH



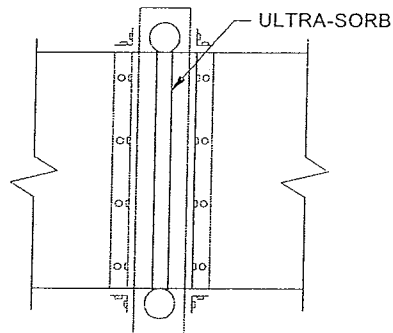
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Plan View - Model LV



OM-203

Elevation



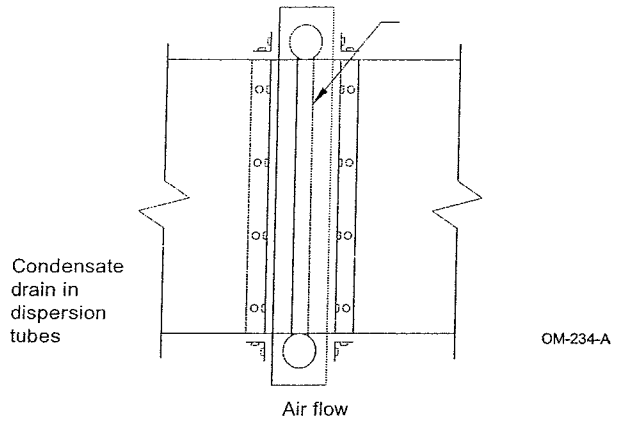
OM-234

INSTALLATION

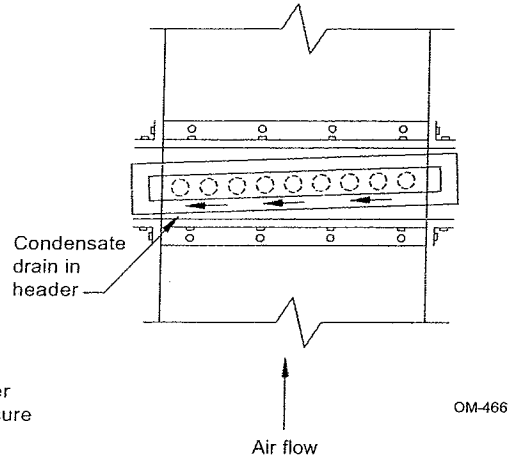
Mounting ULTRA-SORB® in Vertical Duct Section

The ULTRA-SORB panel is contained within a mounting frame. A mounting flange 38 mm wide is provided on all four sides of the unit. The 38 mm wide portion of the header enclosure highlighted in the drawings below is intended to be a mounting flange. A matching flange or metal frame is required on the ductwork for connection to the ULTRA-SORB flanges. The recommended fastener is a 20 mm self drilling and tapping screw, spacing not to exceed 300 mm. If an angle iron frame is provided on the duct section, a longer screw may be required. **Note: Screw penetration into header enclosure should not exceed 19 mm to avoid puncturing header.** Vertical airflow model must be ordered for this application. Headers and tubes are pitched accordingly to accommodate vertical mounting method.

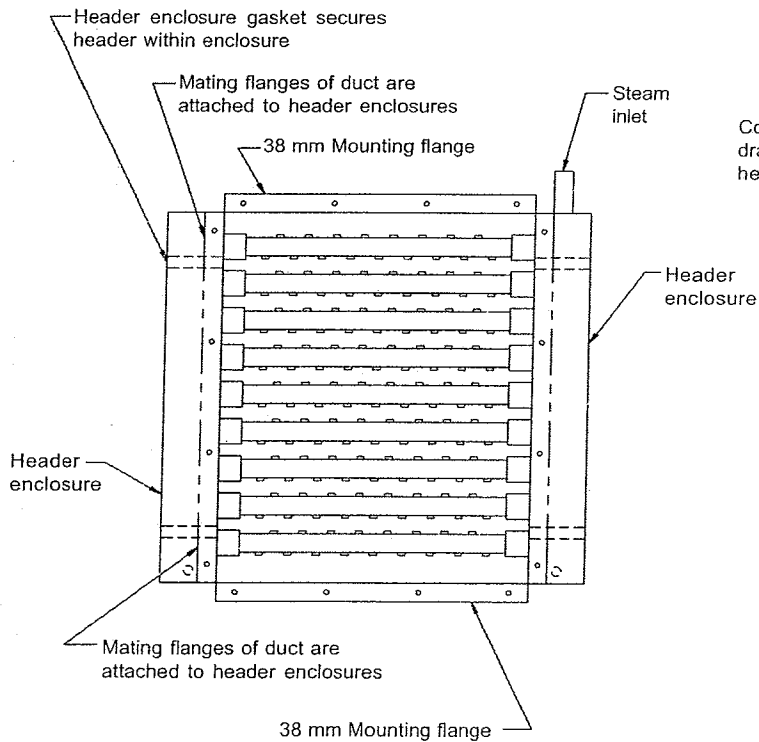
Elevation View - Model VAF



Side View - Model VAF



Plan View - Model VAF



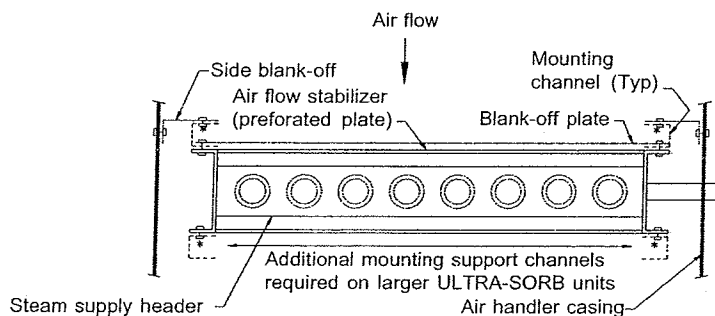
INSTALLATION

ULTRA-SORB® Installation Inside An Air Handler

The preferred location for an ULTRA-SORB panel in an AHU is immediately downstream of a heating or cooling coil. When so mounted, uniform air flow across the face of the ULTRA-SORB is assured.

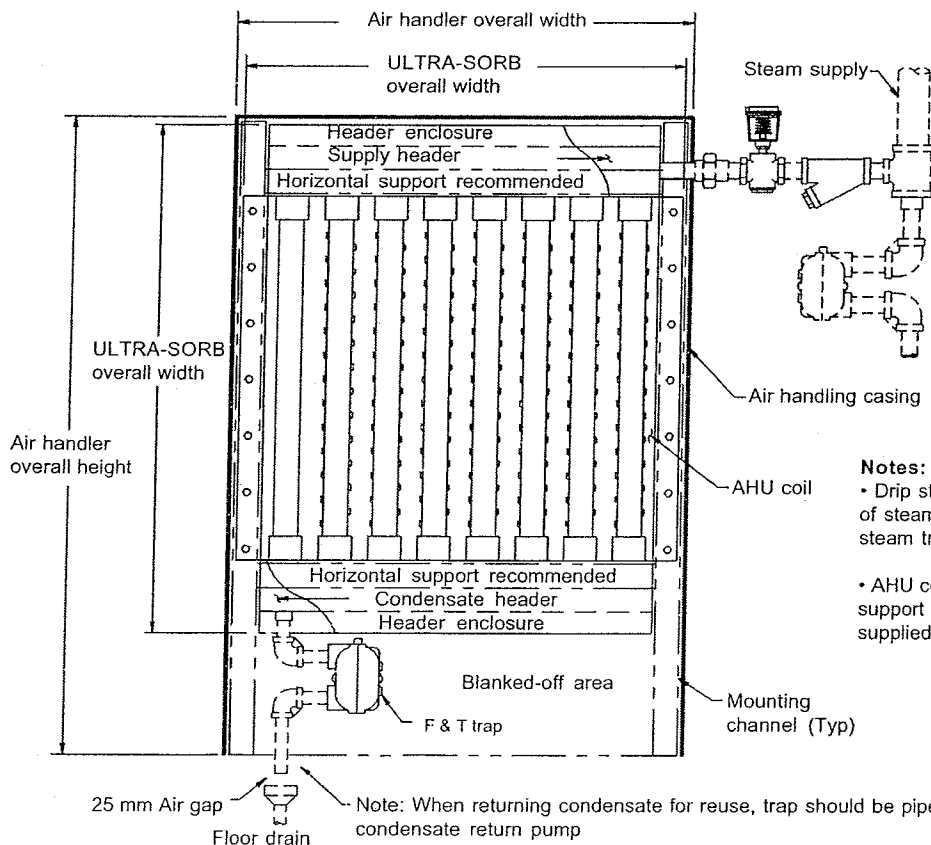
The metal support frame should be anchored to the air handler casing. Recommended fasteners for mounting the ULTRA-SORB to a metal support frame are ¼" nuts and bolts or self drilling and tapping screws. Due to the possible forces exerted on this application, DRI-STEEM recommends fastener spacing not to exceed 150 mm. On larger ULTRA-SORB installations, vertical channels may be required on both the inlet and outlet of the humidifier to provide proper support, shown by Figure A.

Figure A



OM-199

Figure B



- Notes:**
- Drip steam supply ahead of steam valve through steam trap (as shown)
 - AHU coil are mounting support channels not supplied by DRI-STEEM

OM-183

PIPING

When Supplying Steam From A Boiler

ULTRA-SORB® panels using boiler steam are provided with a NPT pipe nipple which extends outside the framework for steam supply connection. The steam supply line should be dripped immediately ahead of the steam valve through a steam trap.

Recommended Drip Trap Type:

Low pressure: Less than 200 kPa - Float and Thermostatic

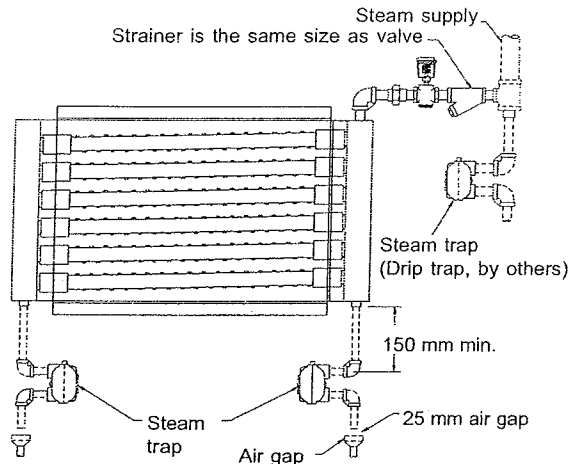
High pressure: More than 200 kPa - Inverted Bucket

A Y-strainer should be installed ahead of the steam valve.

Two DN 20 (¾") float and thermostatic traps, one for each header, are required on a horizontal dispersion tube (Model LH) ULTRA-SORB. One float and thermostatic trap is required on the lower header of the vertical tube (Model LV) ULTRA-SORB.

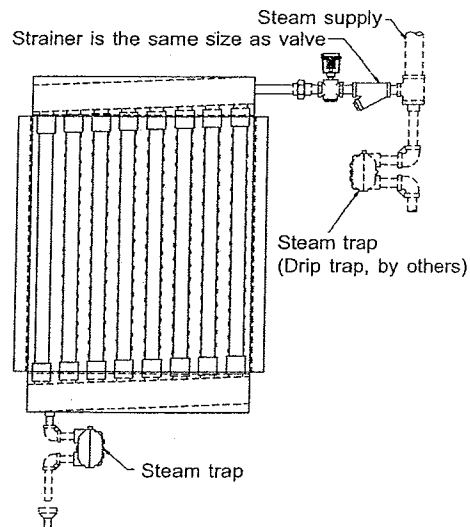
1. Humidifier steam supply should be taken off the top of the steam main (instead of side or bottom) to ensure driest steam.
2. Air flow proving switch is recommended to prevent steam valve from opening unless air is moving in duct.
3. High limit (duct mounted) humidistat 3 metres or more downstream and set at 80-90% is recommended when duct air is below 21 °C to prevent over saturating duct airstream.
4. Steam discharge from dispersion tube tubelets must be pointed at right angles to airstream for best absorption results.

Model LH (Horizontal Dispersion Tubes)



OM-200

Model LV (Vertical Dispersion Tubes)



OM-184

PIPING

When Supplying Steam From An Evaporative Humidifier

Hard Pipe or Tubing

Standard steam hose connections on DRI-STEEM evaporative humidifiers are 38 mm stainless steel tubing. Fifty millimetre tubing connections are available as an option on the higher capacity evaporative units. Hose cuffs can be provided to connect hard pipe to the tubing connection on the vaporizing humidifier and to the ULTRA-SORB®, see Figure 16-2. If specified DRI-STEEM can also provide threaded connections on the vaporizing humidifier and on the ULTRA-SORB as indicated in Figure 16-3.

When non-threaded pipe is used, connections at both ends are completed with rubber vapor hose. Due to the difference in O.D. of pipe and tubing compared to I.D. of hose, multiple hose clamps may be required.

Vapor Hose

- Vapor hose must be supported to prevent sags or low spots and hose must be pitched a minimum of 165 mm per metre back to the humidifier.

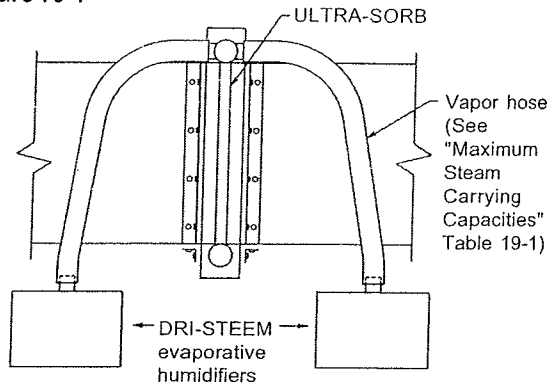
Vapor Rigid Piping (when used)

- A minimum pitch of 165 mm per metre back to the humidifier should be maintained.
- 90° elbows are not recommended, two 45° elbows 30 cm apart are recommended instead. See Figure 16-2 and 16-3.

Failure to follow the above recommendation may result in excessive back pressures being imposed on the vaporizing humidifier. This in turn may lead to loss of water seal or leaking gaskets. When distance between the ULTRA-SORB and the vaporizing humidifier exceeds 7 metres consult factory for special recommendations.

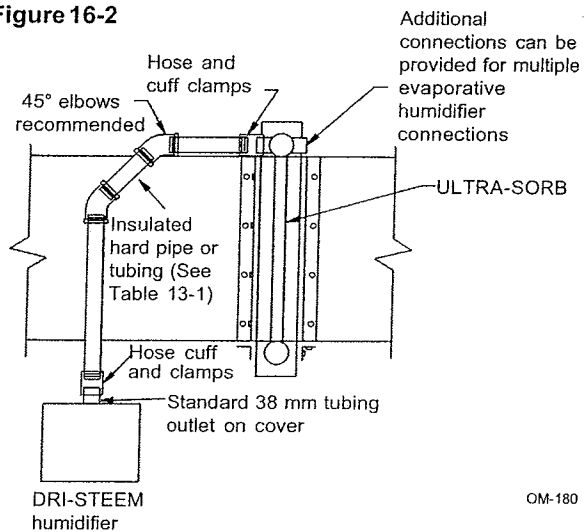
- Thin wall tubing will heat up with less start up heat loss than heavy wall pipe
- Insulating the tubing will reduce the loss in output caused by condensation in the tubing or piping

Figure 16-1



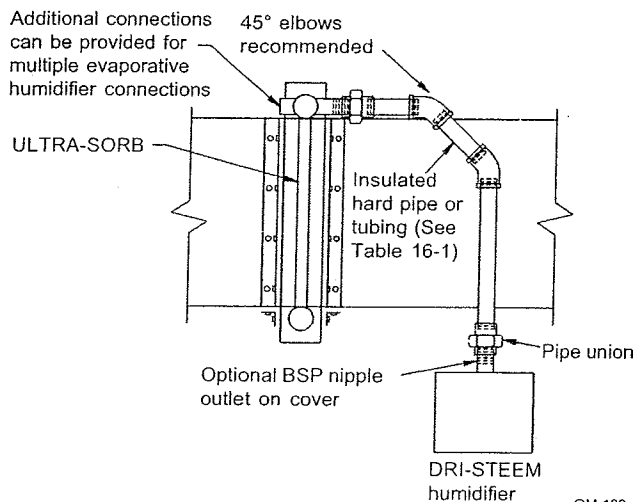
OM-155

Figure 16-2



OM-180

Figure 16-3



OM-180

Table 16-1: Pipe Sizing

Nom. Dia.	O.D. of Pipe and Tubing			I.D. of Hose
	Standard Pipe	Tubing Copper	Tubing SST	
DN 30 (1½")	42	35		
DN 40 (1½")	48	41	38	38
DN 50 (2")	60	54	51	51
DN 65 (2½")	73	67	76	76

Note: BSP x tubing adapters and flange x tubing adapters are available from DRI-STEEM.

PIPING

Condensate Drainage

Since ULTRA-SORB® operates with virtually zero internal pressure the condensate cannot be piped directly into a return main and should either be wasted to a floor drain or else piped into a small condensate pump, which, in turn, would return it to the steam source. In either case the drain connection of the ULTRA-SORB must be at an elevation that will permit gravity drainage.

To prevent steam from escaping from the drain line, either a steam trap (F&T trap) or a water seal can be provided in the drain line. The water seal must be of sufficient height to contain the pressure developed within the humidifier. This pressure is the sum of the flow resistance in the ULTRA-SORB and vapor hose (usually about 250 mm W.C.) plus the air static pressure of the duct system).

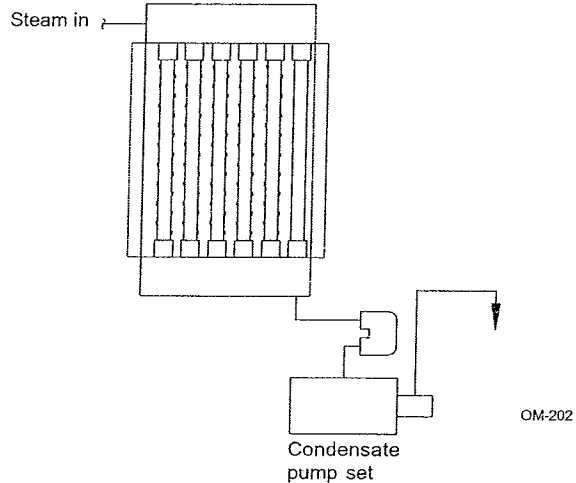
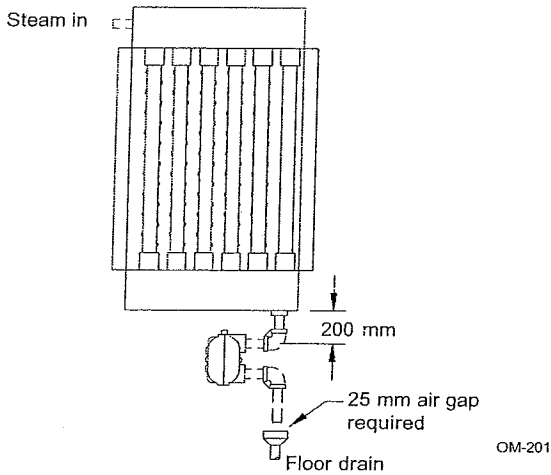
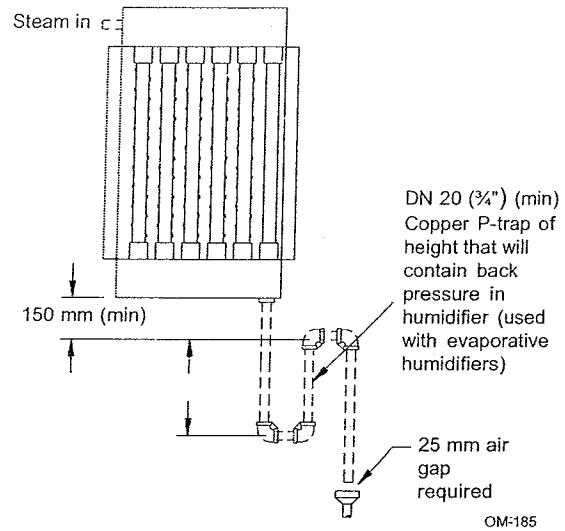


Table 17-1*: Maximum Steam Carrying Capacity in kg/h

Vapor Hose		Copper or Stainless Steel Tubing and Schedule 40 Steel Pipe	
Nominal Hose I.D.	Developed Length of 3.0 metres**	Tube or Pipe Size	Based on Developed Length of 6 metres**
40 mm	68 kg	DN 40	64 kg
50 mm	113 kg	DN 50	95 kg
		DN 76	186 kg
		DN 100	318 kg
		DN 127	590 kg
		DN 150	953 kg

Notes:

* Based on total pressure drop in piping/hose of 12.65 mm W.C.

** For developed length add 50% to measured length for pipe fittings.

To minimize loss of humidifier capacity and efficiency, it is recommended that tubing/piping be insulated.

MOUNTING

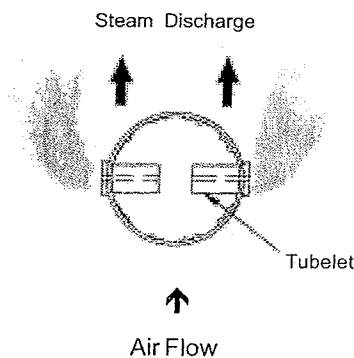
The ULTRA-SORB® can operate with air flow in either direction however, the perforated plate, when required, must be on the air entering side of the ULTRA-SORB. To accommodate field conditions the perforated plate can be moved from one side of the ULTRA-SORB to the other. The steam supply must be connected to the top of the assembly, condensate must be removed from the bottom of the assembly.

Note: The perforated plate is supplied only with ULTRA-SORB panels installed in duct with face velocities less than 2.5 m/s. ULTRA-SORB installations in air handlers with coils do not require a perforated plate.

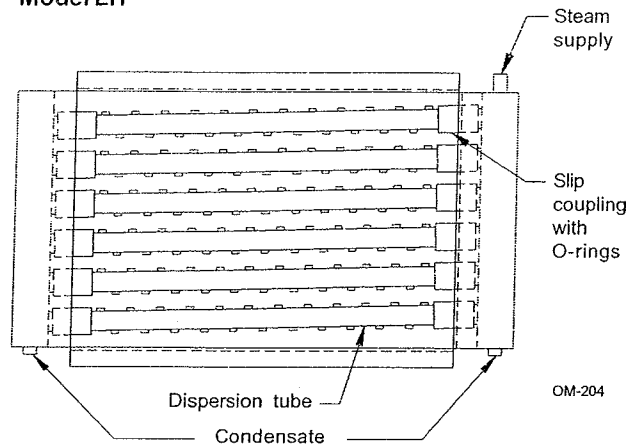
The duct section and ULTRA-SORB panel must be properly supported to carry the weight of the assembly. The weight of the piping must be supported by the building structure rather than by the ULTRA-SORB unit. Otherwise, the weight may impose stress on the connections, causing them to fracture and leak. Before start up, installer must verify that all steam discharge tubelets are pointed perpendicular to the airstream, see drawings at right. This can be accomplished by simply rotating the dispersion tubes. The O-ringed slip couplings provide easy adjustment for proper tubelet orientation.

When removing and reinstalling slip couplings verify that O-rings are seated in grooves and lubricated. Slide tube into coupling being careful not to cut the O-rings when inserting tubes.

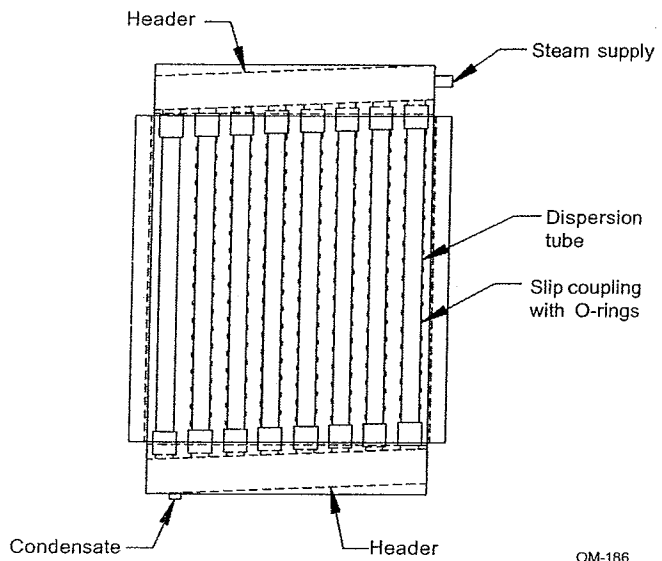
Proper Dispersion Tube Orientation



Model LH

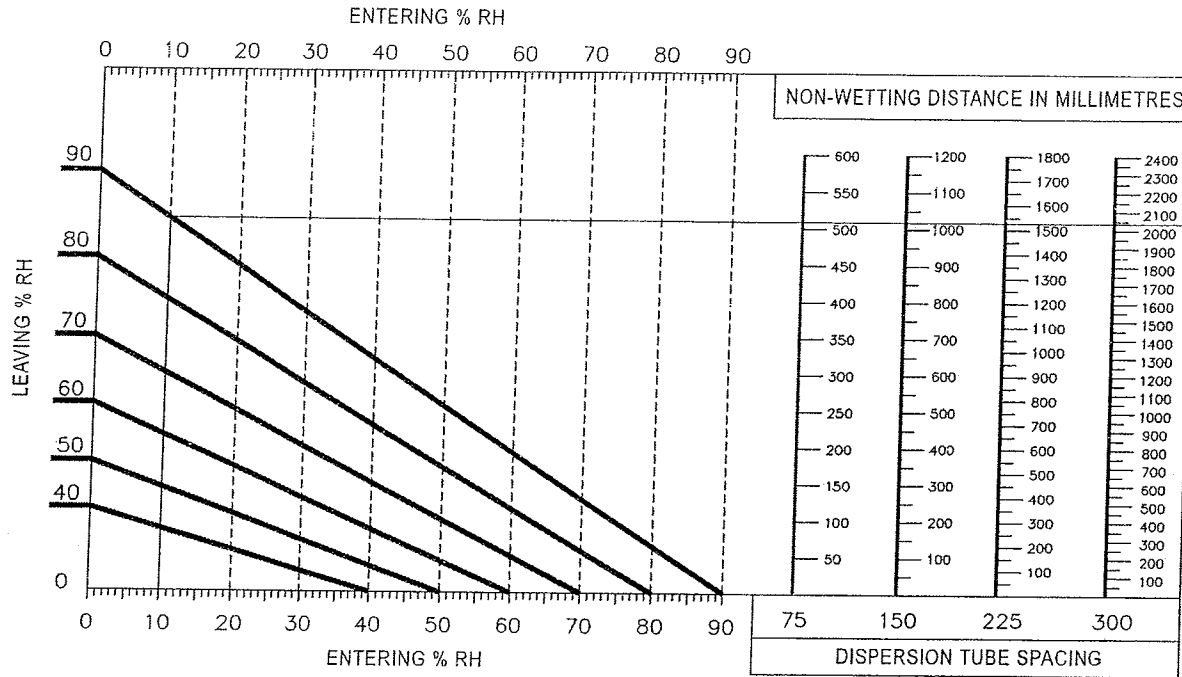


Model LV



PERFORMANCE DATA

Table 19-1: ULTRA-SORB® Absorption/Non-Wetting Distances



Note: The above absorption data applies to all air velocities up to 10 m/s.

Formula 19-1: Mixed Air Inlet kg/100 m³/s

$$\% \text{ Outside Air} \times \text{Moisture Content} + \% \text{ Return Air} \times \text{Moisture Content} = \text{Mixed Air Inlet kg/100 m}^3/\text{s}$$

1. This performance data is based on air leaving the zone of humidification at conditions of 13 °C and stated % RH.
2. "Absorption or Non-wetting Distance" is the dimension downstream from the leaving side of the ULTRA-SORB panel to the point where condensed steam has been re-evaporated to the extent that wetting will not occur, although wisps may be present. Solid objects at duct air temperature such as coils, dampers, fans etc. downstream of this dimension will remain dry.
3. Note that the "rise" in RH (the difference between entering and leaving RH) has a direct bearing on the absorption distance. The greater the "rise" (the lower the entering RH for a given leaving RH) the greater the absorption distance.

4. CAUTION: When installing upstream of high efficiency filters, visible condensed steam wisps entering the filter bank can result in a wetted filter. If it is necessary to install an ULTRA-SORB in this manner, consult factory for recommendations.

5. To assure that absorption will take place, as stated in these guidelines, air duct design shall permit uniform air flow over the cross section of the ULTRA-SORB. Uneven air flow will result in non-uniform mixing of steam with air which, in turn, will adversely affect the absorption distance.

6. ULTRA-SORB air pressure loss in pascals.

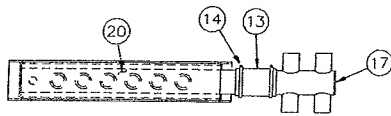
	75 mm spacing	150 mm spacing
2.5 m/s	5 Pa	2 Pa
5 m/s	20 Pa	6 Pa
7.6 m/s	42 Pa	12 Pa

Note: 225 mm and 300 mm spacing have no measurable air pressure loss.

REPLACEMENT PARTS

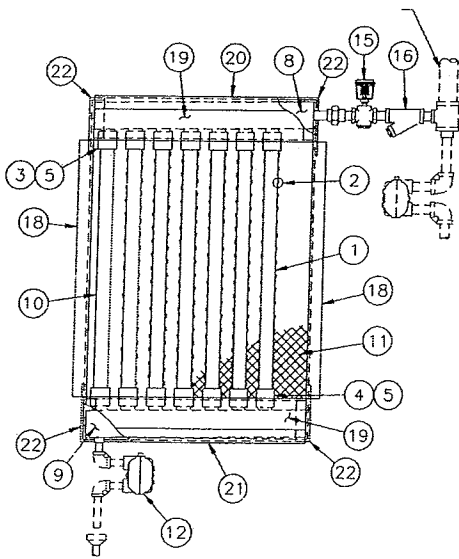
No.	Description	Qty.	Part No.
1	38 mm Dispersion Tube, LH		162730-tab
1	38 mm Dispersion Tube, LV		162732-tab
2	Tubelet .063		310160-001
2	Tubelet .078		310160-002
2	Tubelet .094		310160-003
3	Slip Coupling w/shoulder, 38 mm		310300
4	Slip Coupling w/o shoulder, 38 mm		310305
5	O-rings		300400-004
6	76 mm Dia. Supply Header - LH	1	per order
7	76 mm Dia. Condensate Header - LH	1	per order
8	76 mm Dia. Supply Header - LV	1	per order
9	76 mm Dia. Condensate Header - LV	1	per order
10	38 mm Dia. Condensate Drain Line	1	124435-tab
11	Air Flow Stabilizer	1	162760
12	F & T Trap		300000
13	Hose Cuff, 76 mm dia x 150 mm		305560-002
14	Hose Clamp Size		700690-002
15	Steam Valve	1	per order
16	DN 15 (1/2") y-strainer	1	300100-001
16	DN 20 (3/4") y-strainer	1	300100-002
16	DN 25 (1") y-strainer	1	300100-003

No.	Description	Qty.	Part No.
16	38 mm y-strainer	1	300100-005
16	50 mm y-strainer	1	300100-006
16	63 mm y-strainer	1	300100-007
16	76 mm y-strainer	1	300100-008
17	Steam Connector	1	162765-tab
18	Mounting Flange, LH-LV	2	129600-tab
18	Mounting Flange, SH	2	129605-tab
19	Header Enclosure, LH	2	per order
19	Header Enclosure, LV	2	per order
19	Header Enclosure, SH	2	per order
20	Header Cover, LH-LV	2	129620-tab
20	Header Cover, SH	2	129625-tab
21	Cond. Header Cover, LV	1	129621-tab
22	Header Enclosure Cap, LH-LV		129630-tab
22	Header Enclosure Cap, SH		129635-tab



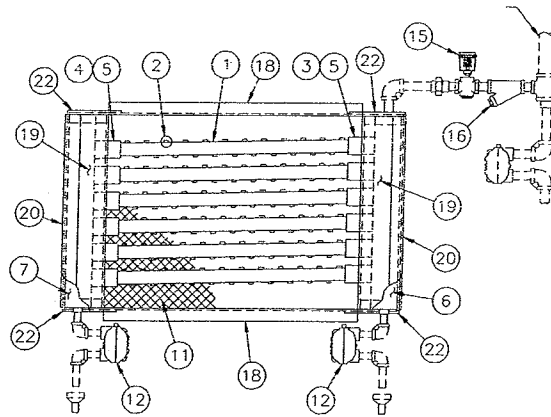
OM-205

Large Vertical ULTRA-SORB



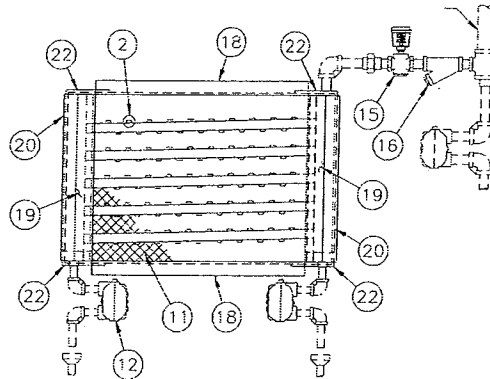
OM-207

Large Horizontal ULTRA-SORB



OM-206

Small Horizontal ULTRA-SORB



OM-187

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
Humidifier Discharges Water in Duct	<ul style="list-style-type: none"> • Steam main overloaded with water due to boiler discharging water with steam (priming). • Steam trap not draining properly. • Humidifier improperly piped. • Surges of condensate in steam supply due to condensate collecting at low, undripped points in steam main. • Inadequate steam trap capacity. 	<ul style="list-style-type: none"> • Locate cause of priming and correct. • Replace trap or repair or clean as required. • If condensate return main is overloaded find an alternative method for drainage. • Correct the piping as shown in manual. Steam inlet should be at the top of the assembly and condensate outlet at the bottom of the assembly. • Install drips and steam traps as required. • Replace with larger trap.
Slip Couplings Leak Water	<ul style="list-style-type: none"> • Defective O-rings in slip couplings. 	<ul style="list-style-type: none"> • Replace O-rings.
Humidity Exceeds Setting of Humidistat	<ul style="list-style-type: none"> • Automatic valve not fully closing. • Control system malfunctioning due to: <ul style="list-style-type: none"> • Incorrect control voltage. • Incorrect control signal. • Improper wiring connections. • Incorrect humidity sensor (Siebe). • Humidity controller out of calibration. • Electric control system malfunctioning. • Faulty or inaccurate humidity controller. • Poor location of control components. • Incompatible control components. • Automatic valve is hunting. • Excessive outside air volume. 	<ul style="list-style-type: none"> • Foreign matter holding valve open, clean valve. • Valve spring broken, replace spring. • Valve stem packing adjusted too tightly, loosen and/or replace packing. • Steam pressure exceeds close off rating of valve spring, replace actuator or valve spring with one that is compatible with the higher steam pressure. • Valve installed backwards, remount. • Adjust valve linkage. • Replace transformer. • Replace components. • Rewire. • Replace. • Recalibrate. • Calibrate or replace. • Relocate per catalog recommendations. • Replace component(s). • Humidifier capacity is oversized, change to smaller valve. • Pressure reducing valve is not accurately controlling steam pressure, repair or replace. • Boiler pressure is swinging too widely, adjust. • Check fans, dampers, VAV, etc.

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
Space Humidity Will Not Rise to Humidistat Set Point	<ul style="list-style-type: none"> • Steam pressure is too low. • Manual steam valve is partially closed. • Strainer screen is partially clogged. • Boiler pressure is too low. • Pressure reducing valve is not accurately controlling steam pressure. • Boiler pressure is swinging too widely. • Piped incorrectly. • Steam piping is undersized. • Humidifier is undersized. • Automatic steam valve is not opening fully. • Electric control system is malfunctioning. • Incorrect control circuit voltage. • Incorrect control signal. • Improperly wired. • Incorrect humidity sensor (Siebe units only). • Humidity controller out of calibration or malfunctioning. • Malfunctioning humidifier temperature switch not allowing humidifier valve to open. • Pneumatic control system malfunctioning. • Humidity controller out of calibration or malfunctioning. • Obstructed air line. • Malfunctioning pneumatic temperature switch. • Air leak in actuator. • Compressed air pressure is too low. 	<ul style="list-style-type: none"> • Open. • Open. • Clean. • Adjust control. • Repair or replace. • Adjust controls. • Repipe. • Replace. • Replace valve with larger capacity valve. • Replace with larger humidifier. • Add additional humidifier. • Valve packing is adjusted too tightly, loosen and /or replace packing. • Adjust valve linkage. • Recalibrate humidistat. • Change transformer. • Replace component(s) to make all components compatible. • Rewire. • Replace sensor. • Repair or replace. • Replace or readjust. • Repair or replace. • Remove obstruction. • Replace switch. • Repair or replace diaphragm. • Adjust pressure.
Condensate in Duct	<ul style="list-style-type: none"> • Foreign matter preventing valve from closing. • Humidifier is mounted too close to internal devices (dampers, turning vanes, etc.) in duct. • Non-insulated duct passing through unheated area (duct surface temperature too low). 	<ul style="list-style-type: none"> • Clean or replace valve. • Move humidifier tubes to a point further upstream of internal devices. • Add more dispersion tubes for shorter absorption distance. Consult DRI-STEEM Humidifier Company to determine the total number of tubes required. • Insulate ductwork.
Air Cannot Absorb Steam Quantity Being Discharged.	<ul style="list-style-type: none"> • Humidifier operates when blower is off. • Valve is "hunting". • Air temperature in duct is too low for steam quantity being emitted. 	<ul style="list-style-type: none"> • Provide interlock. • See previous page. • Raise temperature.
Humidifier is Noisy	<ul style="list-style-type: none"> • Steam pressure is too high. • Header is vibrating within header shell 	<ul style="list-style-type: none"> • Reduce pressure • Secure header - See details page 4

MAINTENANCE PROCEDURE

- 1. STRAINER** - When the system is new the screen should be inspected at least twice during the first year. If found fouled, more frequent inspection and cleaning should be provided.
- 2. STEAM TRAP** - At least twice a year verify that the steam trap is functioning properly. A blocked steam trap will be cold. A "blowing" steam trap will be hot and noisy and the discharge pipe from it will be hot for a continuous distance up to thirty feet. A properly operating steam trap will be hot and make noise at intervals and the discharge pipe from it will be progressively cooler beginning at the trap.
- 3. VALVE (Pneumatic)** - Should be inspected annually to be sure that: 1. the valve closes off steam tight, 2. the stem packing is not leaking steam, and 3. the diaphragm in the actuator is not leaking air.
VALVE (Electric Modulating) - Should be inspected annually to be sure that the valve operates freely, closes off steam tight and that the stem packing is not leaking.
VALVE (Solenoid Type) - Inspect annually to verify proper functioning with steam tight shut off.
- 4. O-RINGS - (Sliding Couplings)** - Inspect after two or three years of service, replace if necessary.

TWO-YEAR LIMITED WARRANTY

DRI-STEEM Humidifier Company ("DRI-STEEM") warrants to the original user that its products will be free from defects in materials and workmanship for a period of two (2) years after installation or twenty-seven (27) months from the date DRI-STEEM ships such product, whichever date is the earlier.

If any DRI-STEEM product is found to be defective in material or workmanship during the applicable warranty period, DRI-STEEM's entire liability, and the purchaser's sole and exclusive remedy, shall be the repair or replacement of the defective product, or the refund of the purchase price, at DRI-STEEM's election. DRI-STEEM shall not be liable for any costs or expenses, whether direct or indirect, associated with the installation, removal or reinstallation of any defective product.

DRI-STEEM's limited warranty shall not be effective or actionable unless there is compliance with all installation and operating instructions furnished by DRI-STEEM, or if the products have been modified or altered without the written consent of DRI-STEEM, or if such products have been subject to accident, misuse, mishandling, tampering, negligence or improper maintenance. Any warranty claim must be submitted to DRI-STEEM in writing within the stated warranty period.

DRI-STEEM's limited warranty is made in lieu of, and DRI-STEEM disclaims all other warranties, whether express or implied, including but not limited to any IMPLIED WARRANTY OF MERCHANTABILITY, ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, any implied warranty arising out of a course of dealing or of performance, custom or usage of trade.

DRI-STEEM SHALL NOT, UNDER ANY CIRCUMSTANCES BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, REVENUE OR BUSINESS) OR DAMAGE OR INJURY TO PERSONS OR PROPERTY IN ANY WAY RELATED TO THE MANUFACTURE OR THE USE OF ITS PRODUCTS. The exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory, even if DRI-STEEM has notice of the possibility of such damages.

By purchasing DRI-STEEM's products, the purchaser agrees to the terms and conditions of this limited warranty.

DRI-STEEM[®]
HUMIDIFIER COMPANY



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E-Mail: sales@dristeem.com • Web: www.dristeem.com



Printed on recycled paper.
Minimum 10% Post Consumer Waste.

Continuous product improvement is a policy of DRI-STEEM Humidifier Company therefore, product features and specifications are subject to change without notice.

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TEFLON is a Registered Trademark of DuPont.



CH2MHILL

Submittal Reply Form

Client: University of Vermont

Date: February 11, 2008

Project name: Delehanty Cosmogenic Nuclide Lab

Location: Burlington, VT

IDC project number: 364972

To: ReArch Company

From: Elsa Yost/CH2M Hill

Attention: Bert DeLaBruere

Reference Specification Section 15761

With reference to your Submittal No. 001-000

Submittals are dated Feb. 11, 2008, we are taking the following action.

Description	No Exceptions Noted	Make Corrections Noted	Revise and Resubmit	Submit Specified Item
1. Heating Coils Specifications	XXXX			
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Remarks:

See attached sheet(s) for additional comments.

cc: File

By:

Elsa Yost

Submittal Transmittal
Cover Sheet



UVM - Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont

Project #07210

Date: 2/11/08

Transmitted To

Michael Warren
IDC Architects

Transmitted By

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext 2
Fax: 802-863-8734

Package Transmitted For

Review/ Approval

Delivered Via

Email

Submittal Information

Specification Section

15761

Intended Use

Heating Coils

Purchase Order #

Owner's tag or identification number

Date

2/8/08

Date	Qty	Description
2/8/08	1	Heating Coils Specifications

CC: Company

University of Vermont
IDC Architects
University of Vermont

Contact Name

Myron Wheeler
Elsa Yost
Michael Stevens

Remarks

Approved
 Rejected
 Pending
 Other

Description: Heating Coils Specifications
 The drawings are to be used for the design and construction of the heating coils. The drawings are subject to the requirements of the plans and specifications. The drawings are for information only and are not to be used for construction.

Copies: _____
 Notes: _____
 Jeffrey Welton
 2/11/08

ReArch Company
 Received and Shop Drawings
 Received 2/11/08
 Reviewed
 Date



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 14

DATE: 2/8/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: RF Peck

MANUFACTURER: Coil Co

PRODUCT DESCRIPTION: Heating Coils

MODEL NUMBER: _____

SECTION NUMBER AND TITLE: 15761
M-2

PRODUCT DEVIATIONS: _____

REVISION/RESUBMITTAL IDENTIFICATION: _____

CONTRACTOR

REVIEWED BY NEASI	
PM	<u>[Signature]</u>
DATE	<u>2/8/08</u>

\\Dexter\shared\shop\UVM Delehanty Hall\0200212\Submittals\SUBMITTAL 14 Heating coils.doc

43 Krupp Drive • PO Box 525 • Williston, VT 05495 • 802-864-3800 • www.neair.com



General Information:

Project Name : -
Coil Item No :
Coil Tag : RHC:28
Date : 02/07/2008 16:10:24
Model No : HC12A1002804000008R

Coil Construction

Coils/Bank : 1
Fin Type : 12 1.25 x 1.08 Waffle
Fin Height : 40 Inch
Fin'd Length : 28 Inch
Rows Deep : 1
Fins/Inch : 10
Circuiling : Custom (8 Feeds)
Tube Material : Copper
Tube Thick : 0.016 Inch
Fin Material : Aluminum
Fin Thick : 0.0073 Inch
Allow OppEnd : No

Air Side

Airflow : 4500 SCFM
Altitude : 0 Feet
Ent DBWB : 55.0 / ✓ °F
Cap Req'd : Btu/Hr
LDB/LWB Req'd : 80.0 / ✓ °F

Fluid Side

Fluid : Water
Ent Fluid Temp : 160 ✓ °F
Lvg Fluid Temp : °F
Fluid Flow Rate : 12.4 GPM

Coil Performance

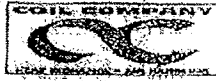
Model No. : HC12A1002804000008R
Rows / FPI : 1 / 10
Circuiling : Custom (8 Feeds)
Total Cap : 137,033 Btu/Hr
Sone Cap : 137,033 Btu/Hr
Lvg DBWB : 82.8 ✓ °F
Face Velocity : 678.8 ✓ SFPM
Standard APD : 0.08 ✓ In. W.C.
Lvg Fluid : 157.3 °F
Fluid Flow : 12.4 GPM
Flux PD : 1.85 ✓ R 1120
Fluid Velocity : 2.82 ✓ FPS
Coil Size : (1) 1.25" ✓
Dry Weight : 34 Lbs

Additional Construction Notes

Coil Coating : None
Casing Matl : 304 Stainless Steel ✓
Casing Type : Flanged ✓
Conn. Matl : Copper ✓
Conn. Type : MPT ✓

Special Notes:

Coil Rated in Conformance with ARI Standard 410.
Coil not within ARI Certified Directory.



Fluid Selection Program
Version 3.2.2 V1

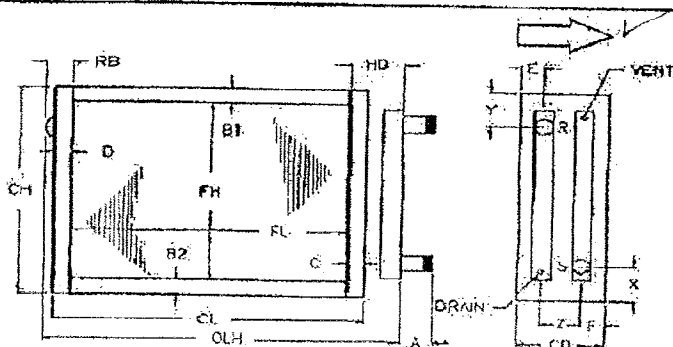
General Information

Project Name :
Coil Item No. :
Coil Tag : ZHC-26 ✓
Date : 02/08/2008 15:11:08
Model No. : HC12A100280100000AR

Coil Construction

Fin Type : 12.125 x 1.08 Waffle
Rows : 1
FPI : 10
Tube Material : Copper
Tube Thick : 0.016 Inch
Fin Material : Aluminum
Fin Thick : 0.0050 Inch
Coil Coating : None
Casing Matl : Galvanized Steel
Casing Type : Flanged
Connections : Copper MPT
Circuiting : Custom (8 Feeds)

Coil Dimensions



FH	FL	CH	CL	CD	HD	OLH	A	X	F
40.00	28.00	43.00	31.00	8.00	4.38	84.13	3.00	2.38	1.42
Y	E	C	D	B1	B2	RB	Z	Supply	Retrn.
2.99	1.42	1.50	1.50	1.50	1.60	1.75	2.16	1.25	1.25
Drawing									
WTRRHSTC									

Special Notes:



Fluid Selection Program
Version 3.2.2.0

General Information:

Project Name :
Coil Item No :
Coil Tag : RHC-27
Date : 02/07/2008 18:12:31
Model No : HC5BA0702801200001R

Coil Construction:

Cops/Bank : 1
Fin Type : 58 1.50 x 1.3 Waflte
Fin Height : 12 Inch
Fin'd Length : 28 Inch
Rows Deep : 1
Fins/Inch : 7
Circuiting : Custom (1 Feeds)
Tube Material : Copper
Tube Thkck : 0.020 Inch
Fin Material : Aluminum
Fin Thck : 0.0076 Inch
Allow OppEnd : No

Airside:

Airflow : 1200 SCFM
Altitude : 0 Feet
Ent. DB/WB : 55.0 / ✓ °F
Cap Req'd :
LDB/LWB Req'd : 80.0 / °F

Fluid Side:

Fluid : Water
Ent Fluid Temp : 180 ✓ °F
Lvg Fluid Temp : °F
Fluid Flow Rate : 3.3 ✓ GPM

Coil Performance:

Model No : HC5BA0702801200001R
Rows (FPI) : 177
Circuiting : Custom (1 Feeds)
Total Cap : 35.017 Btu/Hr
Sens Cap : 35.017 Btu/Hr
Lvg DB/WB : 81.7 ✓ °F
Face Velocity : 514.3 ✓ SFPM
Standard APD : 0.07 ✓ in.w.c.
Lvg Fluid : 158.2 °F
Fluid Flow : 3.3 GPM
Fluid PD : 2.94 ✓ ft H2O
Fluid Velocity : 3.61 ✓ FPS
Cond Size :
Dry Weight : 17 Lbs

Additional Construction Notes:

Coil Coating : None
Casing Matl : 304 Stainless Steel ✓
Casing Type : Flanged ✓
Conn. Matl : Copper ✓
Conn. Type : MPT

Special Notes:

Coil Certified and Rated in Accordance with ARI Standard 410.



Fluid Selection Program
Version 3.2.2 VJ

General Information

Project Name :
Coil Item No. :
Coil Tag : RHC-28
Date : 02/07/2008 18:13:13
Model No. : HGSBA0502800900001R

Coil Construction

Coils/Bank : 1
Fin Type : 58 1.50 x 1.3 Waffle
Fin Height : 8 inch
Fin'd Length : 28 inch
Rows Deep : 1
Fin's/Inch : 5
Circuiting : Custom (1 Feeds)
Tube Material : Copper
Tube Thick : 0.020 inch
Fin Material : Aluminum
Fin Thick : 0.0100 inch
Allow OppEnd : No

Air Side

Airflow : 470 SCFM
Altitude : 0 Feet
Ent. DBWB : 55.0 °F
Cap Req'd : Btu/Hr
LDB/LWB Req'd : 80.0 °F

Fluid Side

Fluid : Water
Ent Fluid Temp : 130 °F
Lvg Fluid Temp : °F
Fluid Flow Rate : 1.3 GPM

Coil Performance

Model No. : HGSBA0502800900001R
Rows/FP : 1.5
Circuiting : Custom (1 Feeds)
Total Cap : 13,448 Btu/Hr
Sens Cap : 13,448 Btu/Hr
Lvg DBWB : 81.2 °F
Face Velocity : 208.6 SFPM
Standard APD : 0.02 in. w.c.
Lvg Fluid : 158.7 °F
Fluid Flow : 1.3 GPM
Fluid PD : 0.41 ft H₂O
Fluid Velocity : 1.42 FPS
Cono Size :
Dry Weight : 15 Lbs

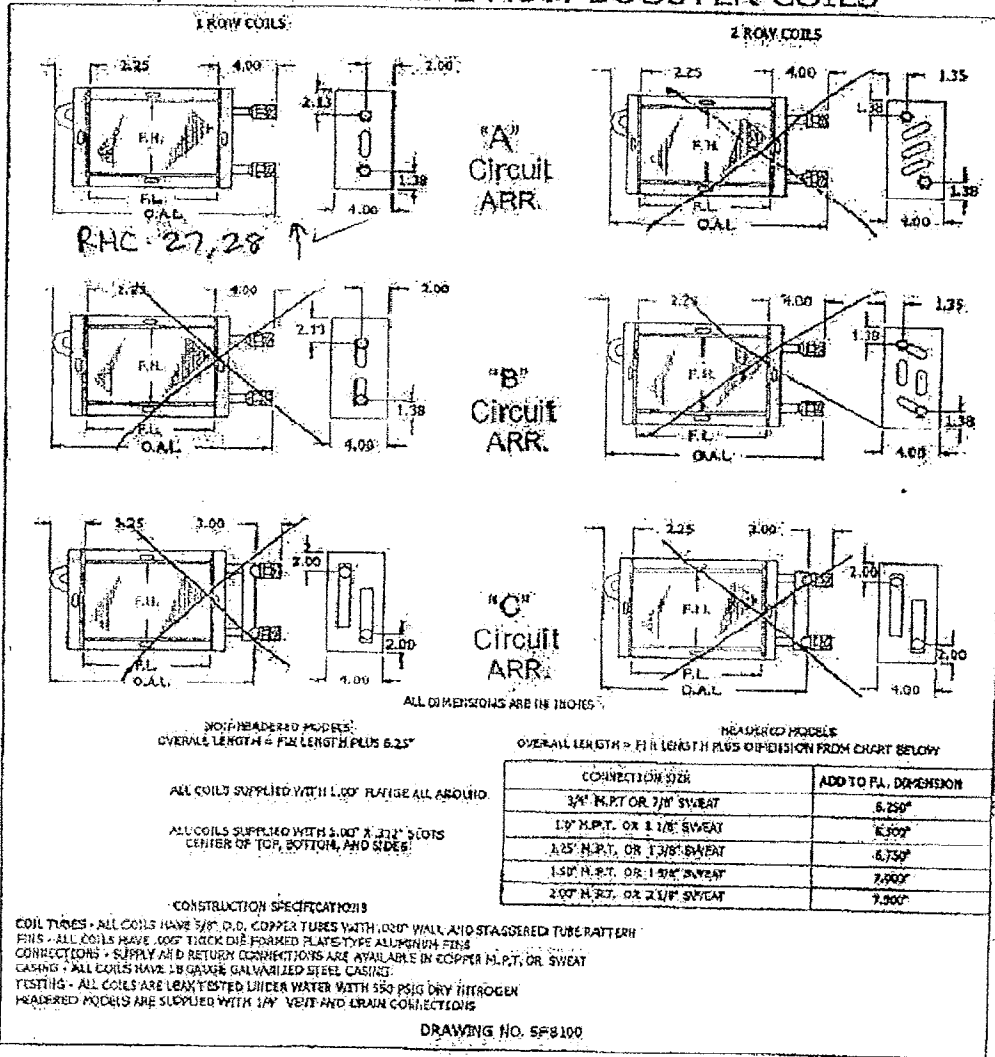
Additional Construction Notes

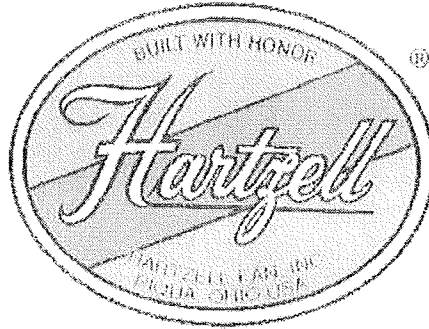
Coil Coating : None
Casing Matl : 304 Stainless Steel
Casing Type : Flanged
Conn. Matl : Copper
Conn. Type : MPT

Special Notes:

Coil Certified and Rated in Accordance with ARI Standard 410.

5/8" TUBE 1 AND 2 ROW BOOSTER COILS





INSTALLATION, OPERATION,
& MAINTENANCE
MANUAL

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HARTZELL FAN, INC., PIQUA, OH 45356
Phone# 937-773-8494
Fax# 937-773-8994

HARTZELL WARRANTY

LIMITED WARRANTIES

Hartzell represents to Buyer that any goods to be delivered hereunder will be produced in compliance with the requirements of the Fair Labor Standards Act of 1938 as amended.

Hartzell also warrants to Buyer its goods to be free from defects in workmanship and material under normal use and service for one (1) year after tender of delivery by Hartzell. No warranty extends to future performance of goods and any claims for breach of warranty or otherwise accrues upon tender of delivery.

The foregoing constitute Hartzell's sole and exclusive warranties and are in lieu of all other warranties, whether written, oral, express, implied or statutory.

LIMITATION OF LIABILITY FOR BREACH OF WARRANTY

Hartzell's obligation for any breach of warranty is limited to repairing or replacing, at its option, without cost to Buyer at its factory any goods which shall, within such a warranty period, be returned to it with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been defective. Any request for repair or replacement should be directed to Hartzell Fan, Inc., P.O. Box 919, Piqua, Ohio 45356. Hartzell will not pay for any repairs made outside its factory without its prior written consent. This does not apply to any such Hartzell goods which have failed as a result of faulty installation or abuse, or incorrect electrical connections or alterations, made by others, or use under abnormal operating conditions or misapplication of the goods.

LIMITATION OF LIABILITY

To the extent the above limitation of liability for breach of warranty is not applicable, the liability of Hartzell on any claim of any kind, including negligence, for any loss or damage arising out of or connected with, or resulting from the sale and purchase of the goods or services covered by these Terms and Conditions of Sale or from the performance or breach of any contract pertaining to such sale or purchase or from the design manufacture, sale, delivery, resale, installation, technical direction installation, inspection repair, operation or use of any goods or services covered by these Terms and Conditions shall, in no case exceed the price allocable to the goods or services which gave rise to the claim and shall terminate one year after tender of delivery of said goods or services.

In no event whether as a result of breach of contract, or warranty or alleged negligence, defects, incorrect advice or other causes, shall Hartzell be liable for special or consequential damages, including, but not limited to, loss of profits or revenue, loss of use of the equipment or any associated equipment, cost of substitute equipment, facilities or services, down time costs, or claims of customers of the Buyer for such damages. Hartzell neither assumes nor authorizes any person to assume for it any other liability in connection with the sale of its goods or services.

NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS

HARTZELL DOES NOT WARRANT THAT SAID GOODS ARE OF MERCHANTABILITY QUALITY OR THAT THEY ARE FIT FOR ANY PARTICULAR PURPOSE. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY AND THERE IS NO IMPLIED WARRANTY OF FITNESS.

Safety Accessories, Application and Use Warning

The safe installation and operation of equipment supplied by Hartzell Fan, Inc. is the responsibility of the system designer, installer, maintainer, and user. Since the application and use of its equipment can vary greatly, Hartzell Fan, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. Hartzell Fan, Inc. sells its equipment with and without safety accessories, and accordingly, it can supply such safety accessories only upon receipt of an order. The need for safety accessories will frequently depend upon the type of system, fan location and operating procedures being employed. The proper protective safety accessories to meet company standards, local codes, and the requirements of the Occupational Safety and Health Act must be determined by the user since safety requirements may vary depending on the location and application of the equipment. If applicable local conditions, standard, codes or OSHA rules require the addition of the safety accessories, the user should specify and obtain the required safety accessories from Hartzell Fan, Inc. and should not allow the operation of the equipment without them.

Owners, employers, users, and installers should read "RECOMMENDED SAFETY PRACTICES FOR USERS AND INSTALLERS OF INDUSTRIAL AND COMMERCIAL FANS" published by the Air Movement Control Association, Inc., 30 West University Drive, Arlington Heights, Illinois 60004. A copy of this publication is enclosed with each fan shipped from Hartzell Fan, Inc., and is available upon request at Hartzell's office in Piqua, Ohio 45356 (937-773-7411).

Please contact Hartzell Fan, Inc. or your local Hartzell representative for more information on product types, safety accessories, and sound performance estimates.

Remember, the selection of safety accessories and the safe installation, application and operation of equipment supplied by Hartzell Fan, Inc. is your responsibility. This warning supersedes all previous editions.

INSTALLATION, OPERATION, & MAINTENANCE MANUAL

INTRODUCTION:

The purpose of this manual is to aid in the proper installation and operation of fans manufactured by HARTZELL FAN, INC. These instructions are intended to supplement good general practices and are not intended to cover detailed instruction procedures, because of the wide variety and types of fans manufactured by HARTZELL FAN INC.

The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user. From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas, which require some special attention, include system design, layout and construction, fan performance specifications, foundation and installation details, storage procedures, start-up and commissioning procedures, operation, maintenance, and repair.

Handling and installation should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury.

Contact your local Hartzell representative for further assistance.

SHIPMENT AND RECEIVING:

All equipment shipped from Hartzell Fan, Inc. is prepared for shipment in accordance with the requirements of the commercial carrier and/or any special considerations required by the nature of the product.

The Bill of Lading or Express Receipt is an acknowledgement by the Transportation Company of the receipt in GOOD CONDITION, meeting the above requirements for the shipment covered by our invoice.

Our responsibility for this shipment has now ceased. We will not be responsible for loss or damage when you give the Transportation Company a clear receipt. (Standard conditions of sale are F.O.B. factory, unless other terms have been quoted and purchased.)

Thoroughly inspect all shipments as soon as received. Keep a record of all equipment received, including inspection details and date of receipt, because of the possibility of partial shipments.

If any of the items called for in this Bill of Lading or Express Receipt are short or damaged, do not accept them until the Freight or Express Agent makes a Damage or Short Shipment Notification on your freight bill or express receipt.

If any concealed loss or damage is discovered, **NOTIFY YOUR FREIGHT OR EXPRESS AGENT AT ONCE** and request an inspection. This is absolutely necessary. Unless you do this, the transportation companies will not entertain any claim for loss or damage. If the agent will not make an inspection, then you should make An Affidavit to the effect that you notified the agent on that particular date and the agent failed to show up. This, with your aforementioned documentation, will properly support your claim.

We will assist you in every possible manner in collecting claims for loss or damage, however this does not make us responsible for collection of claims or replacement of material.

HANDLING:

Handle your equipment with care. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps or well-padded chains and cables, which protect the fan's coating and housing. Spreader bars should be used when lifting large parts.

Axial fans should be lifted by using straps around the fan housing only. **DO NOT LIFT AXIAL FANS BY THE MOTOR, MOTOR BASE, PROP OR FLANGES.**

Centrifugal fans are best lifted using one strap under the fan's scroll and another strap around the bearing base. **DO NOT LIFT CENTRIFUGAL FANS BY THE FAN SHAFT, WHEEL, FLANGES OR INLET SUPPORT.**

Roof ventilators should be lifted by using straps around the fan housing or base only. Spreader bars should also be used to avoid damage to stack caps or hoods. **DO NOT LIFT ROOF VENTILATORS BY THE STACK CAP OR HOOD.**

STORAGE:

If fans are stored for any length of time, they should be stored in a clean, dry location to prevent rust and corrosion. Outdoor storage is not recommended. When outdoor storage is necessary, they should be protected from the elements. Cover the fan inlet and outlet, grease the bearings, and keep motors dry and clean.

EXTENDED STORAGE:

Fans are to be stored in their original containers or equivalent protection and should be kept in a clean, dry, protected warehouse where exercised control over temperature, dust, dew point, shock, and vibration is reasonably maintained.

- A) Temperatures: Between 50 degrees F and 120 degrees F.
- B) Maximum relative humidity of 60%
- C) Shock or vibration: 2 mils maximum to prevent bearings from brinelling.
Exceeding this limit will require vibration-dampening material under the units.

Motor bearings (and fan bearings on belt drive units) are to be greased at the time of going into extended storage. Motor shaft (and fan shaft on belt drive units) are to be manually rotated every month and additional grease added, purging some of that in the bearing cavity every six (6) months. *Grease in bearings is to be purged at time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity. Grease used must be compatible with that already in motor and fan bearings. (See Page 14)*

All motors with space heaters are to have the heaters connected if storage conditions exceed 60% relative humidity and/or if temperatures are below 50 degrees F.

Motor windings should be meggered at the time the equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Contact Hartzell Fan, Inc., Warranty and Service Department, if the motor resistance is less than 50% of the initial reading. **NOTE: Motors in storage may absorb moisture in their windings resulting in a significant loss of insulation resistance. THE APPLICATION OF POWER TO A MOTOR WITH INSUFFICIENT INSULATION RESISTANCE MAY RESULT IN DAMAGE TO THE MOTOR OR OTHER EQUIPMENT.**

Storage records complying with the above requirements should be maintained.

If an extended warranty is desired, contact your local sales representative for charges and details.

INSTALLATION:

Centrifugal Fans should always be mounted to a flat, level, and rigid structure. The fan base should be shimmed and leveled. Gaps between the foundation and fan base should be grouted. This will ensure permanent alignment and a smooth-running, vibration-free fan, as well as minimize maintenance costs. Failure to properly install the fan base can contribute to excessive vibration.

Poured concrete foundations are recommended, wherever practical, for floor mounted fans. If vibration isolators are required, they should be installed between the fan and the foundation. Tighten all mounting bolts securely with lock washers and lock nuts.

Fans mounted off ground level should be rigidly mounted to a structural platform and be placed as near as possible to or over, a solid wall or column. Supports for suspended fans must be crossbraced for live load support to prevent side sway.

For roof mounted fans, place the fan curb panel on the roof curb, level, and then anchor the unit to the curb using lag screws, neoprene washers, and flat washers. *It is recommended that stacks be independently mounted to the roof and use guy wires to prevent side sway. AVOID SUPPORTING A STACK DIRECTLY ON THE FAN FLANGE.*

In both axial and centrifugal fans, inlet and outlet ducts should be independently supported, and never supported by the fan flanges. Flexible duct connections are recommended. These connections will also minimize noise. The independent mounting of stacks and ducts to the fan flanges will assure that the fan will not be subjected to external forces which may twist or deform fan housing. This also will ensure that the impeller will not strike the housing or cause misalignment of the sheaves and bearings.

It is recommended that access doors be placed in ductwork just ahead of the fan inlet and just behind the fan outlet for ease of inspection and maintenance. Access doors in a duct system should never be opened with the fan running, to avoid possible equipment damage and personal injury.

No turns in duct should be closer than two and one half fan diameters away from the inlet or outlet of a fan. Walls or flat surfaces should also not be closer than one fan diameter from the inlet side.

Branch entries into the main duct should be spaced such that they do not enter directly opposite each other. A maximum of 45 degree angle between main branch and entering branch should be used as a guideline. *Avoid sudden changes in duct size.* Use a 14 degree included angle, or less, in reducing a duct to a fan, and not more than 30 degrees included angle to the discharge. Elbow turns should be kept to a centerline radius of at least one and one-half diameters of the duct.

Electrical connections for the fan motor must be connected by a qualified electrician, conforming to the National Electrical code and local codes and practices. When making electrical connections, the motor must be connected following electrical characteristics as indicated by the motor nameplate, and adhere to the wiring diagram on the motor nameplate or in the motor terminal box. *Motors may fail immediately if improperly connected.* It is also recommended that an overload device to protect the motor be installed between the current supply and the motor. Recommended tolerances for overload devices should be plus 10 % of the motor full load amperage rating, including the allowance for the motor service factor.

NOTE: *It is common for motors to draw several times full load amperage during startup, for approximately fifteen seconds. Larger sized fans may require twenty seconds or longer.*

STARTUP:

Lock out the primary and all secondary power sources.

A complete inspection should be made of all ductwork and the fan interior. Make certain there is no foreign material, which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures may include the use of goggles, respirators, or other personal protective devices.

Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices.

Check and tighten all bolts, fasteners, and set screws as necessary. **NOTE: Forces encountered during shipment, handling and rigging can disturb factory settings.**

Check the fan assembly and bearings for proper grounding to prevent static electrical discharge. **NOTE: Especially important when using FRP fans.**

Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.

Check bearings for recommended lubricant and lubrication amount.

Clearance should be checked between the impeller and fan housing. Spin the impeller to determine whether it rotates freely, without hitting anything, and is not grossly out of balance. **NOTE: Prior to shipment, all fans have been thoroughly inspected and have passed stringent operation and balance test.**

Inspect impeller for proper rotation for fan design. Arrows to show direction of rotation and airflow are attached to the fan housings.

Check alignment of drives and all other components.

Check the belt drive for proper sheave selection and installation and make sure the sheaves are not reversed (excessive speeds could develop).

Check for recommended belt tension.

Properly secure all safety guards.

Assure that all appropriate warnings have been put in place.

Secure all access doors to the fan and ductwork.

Restore power and momentarily energize the fan to check the direction of rotation. Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

Switch on the electrical supply and allow the fan to reach full speed. Check carefully for: (1) Excessive vibration (2) Unusual noise (3) Proper belt alignment and tension (4) Proper lubrication (5) Proper amperage, voltage, or power values. If any problem is indicated, **SWITCH OFF IMMEDIATELY.**

Lock out power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for cause of the trouble, correct as necessary, and repeat check list procedure. (Ref. Page 15 Trouble shooting chart)

NOTE: The fan should not need balancing, as it was balanced at the factory to be within stringent vibration levels before shipment. However, there are several things that may cause vibration, such as rough handling in shipment and erection, weak foundations, and alignments. It is recommended that the vibration levels be checked with a vibration analyzer to verify that the vibration is within levels recommended later in this manual. (See Page 13, Table 1.)

Even if the fan appears to be operating satisfactorily, shut it down after a brief period, lock out the power supply, and recheck startup procedures, as the initial start-up may have loosened the bolts, fasteners, and set screws.

STARTUP CONT:

The fan may now be put into operation, however during the first eight hours of operation, it should be closely observed and checked for excessive vibration and noise. At this time checks should be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacture's recommendations.

After eight hours of operation, the fan should be shut down and the power locked out. Recheck startup procedures and adjust, as necessary.

After twenty-four hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension. (See Page 12) **NOTE:** (*It is normal for belt drive fans to squeal briefly during startup.*)

MAINTENANCE:

Periodic inspection of all the fan parts is the key to good maintenance and trouble-free fan operation. Frequency of inspection must be determined by the user and is dependent upon the severity of the application. Prepare a maintenance schedule and make sure it is strictly adhered to.

NEVER SERVICE OR ADJUST ROTATING EQUIPMENT WHILE IT IS IN OPERATION. LOCK OUT THE POWER SOURCE BEFORE PERFORMING MAINTENANCE.

Regular fan maintenance should include the following:

- 1) Check the fan impeller for any buildup of foreign material or wear from abrasion. Both can cause excessive vibration which will lead to damage of the impeller and other fan components. Replace the impeller if excessive wear is noticed. Carefully clean the impeller of any foreign material.
- 2) Check V-belt drives for proper alignment, tension, and excessive wear.
- 3) Lubricate the fan and motor bearings.
- 4) Consult the trouble shooting guide for excessive vibration or noise, insufficient performance, or when the fan does not operate. (See Page 15 Trouble shooting chart)
- 5) Tighten all bolts and setscrews.

BEARINGS AND LUBRICATION:

All Hartzell belt drive fan bearings are heavy duty; self-aligning ball or roller type, depending on the fan size, motor horsepower, and performance, and are relubricable for continuous service.

Selection of the correct bearing grease and greasing intervals depends on several things. Extreme high or low temperatures, dirty or damp surroundings, and excessive vibration exceeding the "fair" levels in Table 1 are all things that will require more frequent greasing or special greases. (Refer to Page 14 for recommended greases and greasing intervals.)

The motor bearings and the fan bearings on the belt drive fans should be greased at regular intervals. Motor manufacturers' greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not overgrease. Use only 1 or 2 shots with a hand gun in most cases. Maximum hand gun rating 40 P.S.I. Rotate bearings during lubrication where good safety practice permits. **NOTE:** On motors with non-regreasable sealed bearings, no lubrication is required for the life of the bearings.

The most frequent cause of bearing failure is not greasing often enough, using incompatible greases or excessive belt tension. Excessive vibration, especially if the bearing is not rotating, will also cause bearings to fail. Bearings must also be protected from water and moisture to avoid internal corrosion.

NOTE: *It is typical for some anti friction bearings to exhibit a running surface temperature in excess of 140 deg. F. This surface will be too hot to touch, but is not cause for alarm.*

BEARING REPLACEMENT:

Fan bearings on belt drive fans should not need to be replaced for many years if the above recommendations are strictly adhered to. However, use the following procedure when bearing replacement is necessary.

1. Lock out power source.
2. Gain access to the fan bearings. On duct, ductaxial, and vaneaxial fans, the fan probably will have to be removed from the duct system. Remove the bearing cover, if any.
3. Loosen the belts by shifting the motor.
4. Remove the impeller and disconnect the lube tubes.
5. Remove the shaft and bearing assembly. Note the position of the bearings' shims.
6. Measure the location of the bearing to the impeller end of the shaft and the bearing spacing.
7. Loosen all bearing/shaft setscrews or other locking device.
8. Remove bearings (may have to be pressed off the shaft).
9. Polish the shaft with fine emery paper (240 Grit or finer) and file the setscrew dimples smooth.
10. Install new bearings on the shaft, making sure that the collars are together, (i.e., facing each other on the shaft) and set screws are in line with each other. Lightly seat one setscrew on each bearing to hold in the approximate position from #5) above.
11. Mount the shaft/bearing assembly in the fan, on shims, with bolts. Do not tighten yet. Just snug up. Loosen setscrews.
12. Center the shaft in the housing (both ends) as closely as possible and shim where necessary. The fan impeller may need to be temporarily installed to get its clearances equal.
13. Tighten the bearing mounting bolts.
14. With a soft-faced mallet, tap the shaft between the bearings while turning the shaft by hand to seat the bearing races. The shaft must turn freely. Tighten all bearing setscrews. Spin the shaft again. Is it free?
15. Reinstall the lube tubes.
16. While rotating shaft purge bearings with fresh grease (Ref. Page 14).
17. Install bearing cover, impeller, and belts, and adjust the motor to get proper belt tension. Also, make sure that the sheaves are properly aligned. (See V-belt drives, Page 10 & 11).
18. If a new shaft is supplied, then ignore items #6 through #8.

Carefully following this procedure will ensure trouble-free service.

V-BELTS DRIVES:

V-belts on Hartzell belt drive fans are oil, heat, and static resistant type, and oversized for continuous duty. With proper installation and maintenance, years of operating efficiency can be added to the life span of the V-belt drive.

V-belt drives should be completely guarded.

A noisy V-belt indicates the need for attention. V-belt noise can be caused by the slapping of the belts against the drive guard or other obstruction. Check for an improperly installed guard, loose belts, buildup of foreign material in the sheave grooves, or excessive vibration. The cause of excessive vibration should be determined and corrected. **NOTE: It is normal for belts to squeal briefly at startup.**

Check belt tension often. Ideal tension is the tension at which the belt will not slip under peak load conditions. Over-tensioning shortens belt and bearing life. Keep belts free from foreign material which may cause slipping. The use of belt dressing is not recommended. (See Page 12 for recommended tensioning.)

Inspect sheaves often. Keep all sheaves' grooves smooth and uniform. Burrs and rough spots along the sheave rim can damage belts. Dust, oil, and other foreign matter can lead to pitting and rust, and should be avoided as much as possible. Badly worn grooves or a shiny groove bottom indicates that either the sheave, the belt, or both are badly worn. Replace either or both belts and worn sheaves.

Check sheave alignment. Sheaves that are not aligned properly cause excessive belt wear and sheave wear.

V-BELT DRIVE REPLACEMENT:

Whether you are just installing new belts or a completely new drive, worn bearings, bent shafts, or other components that might cause future problems should be replaced at this time. If installing belts only, check existing sheaves carefully for worn grooves or other damage.

Although alignment is not as critical in V-belt drives as in others, proper alignment is essential to long belt and sheave life. **NOTE: Loose belts or misalignment can cause fan vibration.**

First, make sure that drive shafts are parallel. **The most common causes of misalignment are nonparallel shafts and improperly located sheaves.** Where shafts are not parallel, belts on one side are drawn tighter and pull more than their share of the load. As a result, these belts wear out faster, requiring the entire set to be replaced before it has given maximum service. If misalignment is in the sheave, belts will enter and leave the grooves at an angle, causing excessive belt and sheave wear. (See Page 11, Figure 1).

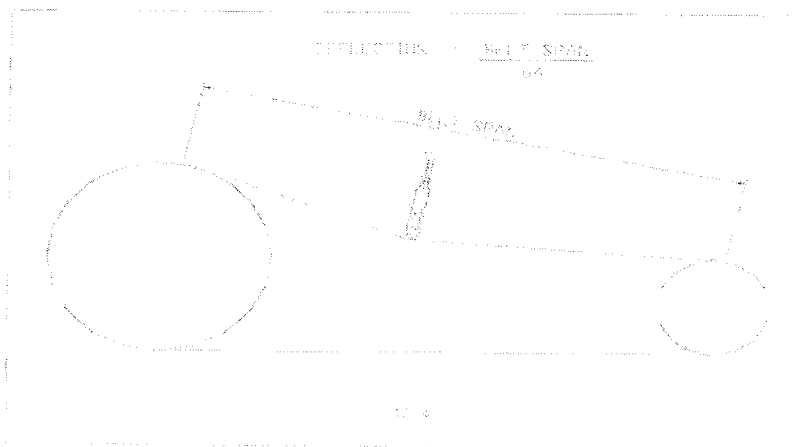
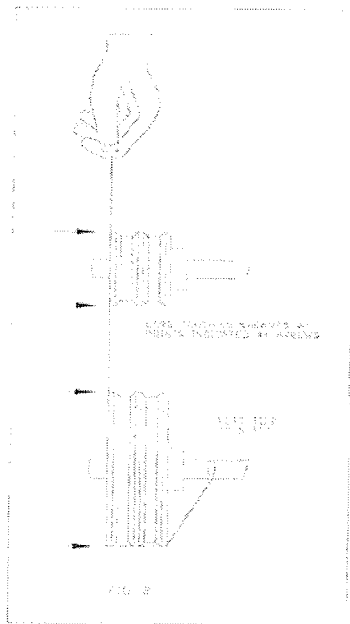
Shaft alignment can be checked by measuring the distance between the shafts at three or more locations. If the distances are equal, then the shafts will be parallel.

To check the location of the sheaves on the shaft, a straightedge or a piece of string can be used. If the sheaves are properly lined up, the string will touch them at the points indicated by the arrows (See Page 11, Figure 2). Rotating each sheave a half revolution will determine whether the sheave is wobbly or the shaft is bent. Correct any misalignment.

Always use matched belts and never mix new and used belts on a drive. Always replace belts with the right type of V-belt. Install belts correctly. When belts are forced into the sheave with a screwdriver or other wedge, the outer fabric is often ruptured and cords broken. It is well worth the time to move the driver unit closer so the V-belts can be slipped easily into the sheave groove without damage. Shorten the center distance between the driven and driver sheave so the belts can be put on without the use of force. While the belts are still loose on the drive, rotate the drive until all the slack is on one side. Then increase the center distance until the belts are snug. The drive is now ready for tensioning. Tension the belts as indicated on Page 12. **NOTE: Never "roll" or "pry" the belts into the sheave grooves.** This can damage the belt cords and lead to belt turnover, short life, or actual breakage. Moreover, it is both difficult and unsafe to install belts this way. Keep take-up rails, motor base, or other means of center distance adjustment free of dirt, rust, and grit. Lubricate adjusting screws and slide rails from time to time.

Tighten all sheave bolts and setscrews before reconnecting the power. **NOTE: All sheave bolts, setscrews, and belts should be checked and tightened if necessary after two days of initial operation.**

IMPORTANT: DO NOT INCREASE THE FAN SPEED BEFORE FIRST CONTACTING THE HARTZELL FACTORY. ARBITRARILY SPEEDING UP THE FAN CAN CAUSE MOTOR OVERLOAD, FAILURE, AND POTENTIAL IMPELLER FAILURE.



INSTALLING, TENSIONING AND CHECKING V-DRIVES

GENERAL DRIVE TENSIONING GUIDELINES:

1. IDEAL TENSION IS THE TENSION AT WHICH THE BELT WILL NOT SLIP UNDER PEAK LOAD CONDITIONS.
2. OVER TENSIONING SHORTENS BELT AND BEARING LIFE.
3. KEEP BELTS FREE FROM FOREIGN MATERIAL WHICH MAY CAUSE SLIPPING.
4. MAKE PERIODIC V-DRIVE INSPECTION, TENSION WHEN SLIPPING. THE USE OF BELT DRESSING IS NOT RECOMMENDED.
5. BEFORE INSTALLING A NEW SET OF V-BELTS, CHECK THE CONDITION OF THE SHEAVES. DIRTY OR RUSTY SHEAVES IMPAIR THE DRIVES EFFICIENCY AND ABRASE THE BELTS, RESULTING IN PREMATURE FAILURE. ALSO, WORN SHEAVES CAN SHORTEN THE BELT LIFE BY AS MUCH AS 50%.
6. DO NOT USE A NEW OR USED BELT AS REPLACEMENT FOR A UNIT OF A SET. IF A BELT BREAKS A NEW SET OF MATCHED BELTS IS NECESSARY. ALWAYS REPLACE BELTS WITH THE SAME KIND THAT WERE ON THE FAN BEFORE.
7. AFTER PROPERLY TENSIONING THE BELTS, DOUBLE-CHECK TO BE SURE THE SHEAVE GROOVES ARE CORRECTLY ALIGNED, AND THAT ALL SHAFTING IS PARALLEL.

INSTALLATION AND CHECKING METHODS:

I. VISUAL METHOD

1. WHEN INSTALLING BELTS, REDUCE THE CENTER DISTANCE SO THAT THE BELTS MAY BE PLACED IN THE SHEAVE GROOVES WITHOUT FORCING. ARRANGE THE BELTS SO THAT THE TOP AND BOTTOM SPANS HAVE ABOUT THE SAME AMOUNT OF SAG. APPLY TENSION TO THE BELTS BY INCREASING THE CENTER DISTANCE UNTIL BELTS ARE SNUG AND HAVE A LIVE SPRINGING ACTION WHEN STRUCK WITH THE HAND.
2. OPERATE THE DRIVE A FEW MINUTES TO SEAT THE BELTS IN THE SHEAVE GROOVES. OBSERVE THE OPERATION OF THE DRIVE UNDER ITS HIGHEST LOAD CONDITIONS (USUALLY STARTING). A SLIGHT BOWING OF THE SLACK SIDE OF THE DRIVE INDICATES ADEQUATE TENSION. EXCESSIVE BOWING OR SLIPPAGE INDICATES INSUFFICIENT TENSION. IF THE SLACK SIDE REMAINS TAUT DURING THE PEAK LOAD, THE DRIVE IS TOO TIGHT.
3. NEW DRIVE TENSION SHOULD BE CHECKED SEVERAL TIMES DURING THE FIRST 24 HOURS OF OPERATION, BY OBSERVING THE SLACK SIDE SPAN.

II. TENSIONING GAGE METHOD

WHEN A TENSION GAGE IS AVAILABLE AND THE CENTER OF THE BELT SPAN IS ACCESSIBLE, THE FOLLOWING METHOD MAY BE USED. TO DETERMINE THE POUNDS FORCE REQUIRED TO TENSION A DRIVE WITH A BELT TENSIONER, PROCEED AS FOLLOWS:

1. MEASURE THE BELT SPAN AS SHOWN AND CALCULATE THE DEFLECTION INCHES USING THE GIVEN EQUATION. SET LARGE O-RING FOR CALCULATED INCHES OF DEFLECTION.
2. SET SMALL O-RING AT 0 AND PRESS DOWN THE BELT TENSIONER AT CENTER OF BELT SPAN AS SHOWN.
 - A. ON A SINGLE BELT DRIVE, DEPRESS BELT TENSIONER UNTIL THE LARGE O-RING IS EVEN WITH BOTTOM OF A STRAIGHT EDGE PLACED ACROSS THE OUTSIDE EDGE OF THE TWO SHEAVES.
 - B. ON MULTIPLE BELT DRIVE, DEPRESS BELT TENSIONER UNTIL LARGE O-RING IS EVEN WITH THE TOP OF THE NEXT BELT. AVERAGE READINGS FROM ALL BELTS IS THE VALUE TO USE IN THE TABLES BELOW.
3. REMOVE TENSION GAGE AND OBSERVE THE NEW POSITION OF THE SMALL O-RING IS SET AT THE NUMBER OF DEFLECTION POUNDS FOR THE SET NUMBER OF INCHES.
4. COMPARE THIS READING, OR THE AVERAGE OF SEVERAL READINGS IN THE CASE OF MULTIPLE BELTS, TO THE NEW/USED VALUES IN THE TABLES BELOW FOR THE PROPER BELT CROSS SECTION. IF READINGS DO NOT FALL IN THIS RANGE, READJUST THE BELT TENSION AS DESCRIBED IN THE VISUAL METHOD AND REPEAT MEASUREMENT.

EXAMPLE:

1. BELT SPAN = 1625.6mm AND SMALL SHEAVE IS 203.2mm P.D. WITH COG BELTS.
2. 1625.6mm/64=25.4mm REQUIRED DEFLECTION.
3. SET LARGE O-RING AT 25.4mm ON GAGE INCH SCALE.
4. SET SMALL O-RING AT ZERO ON PLUNGER.
5. PRESS DOWN ON BELTS WITH GAGE UNTIL LARGE O-RING IS EVEN WITH THE NEXT BELT OR A STRAIGHT EDGE, WHICHEVER THE CASE MAY BE. WITH MULTIPLE BELTS, SEVERAL READINGS ARE NEEDED TO GET AN AVERAGE.
6. USE THE POUND FORCE READING OR AVERAGE OF SEVERAL READINGS REQUIRED FOR 25.4mm DEFLECTION IN THE TABLES BELOW.
7. THE "B" BELT TABLE FOR 203.2mm P.D. SMALL SHEAVE SHOULD HAVE A DEFLECTION FORCE BETWEEN 3.311kg AND 4.672kg.
8. INCREASE OR DECREASE THE TENSION ON BELTS UNTIL THE DEFLECTION FORCE IS BETWEEN 3.311kg AND 4.672kg.

(REF. Page 11)
(Figures 3 & 4)

CROSS SECTION	SMALLEST SHEAVE DIA. mm	RPM RANGE	BELT DEFLECTION FORCE			
			STD. BELTS		COG BELTS	
			USED	NEW	USED	NEW
A, AX	76.2-96.5	1000-2500	1.678	2.495	1.860	2.767
		2501-4000	1.270	1.905	1.542	2.268
	96.5-121.9	1000-2500	2.041	3.084	2.268	3.357
B, BX	86.4-106.7	1000-2500	2.041	3.084	2.268	3.357
		2501-4000	1.724	2.585	1.950	2.903
	127-177.8	1000-2500	2.449	3.629	2.535	3.810
C, CX	111.8-147.3	1000-2500	2.132	3.175	2.313	3.447
		2501-4000	2.404	3.583	2.223	3.266
	147.3-223.5	1000-2500	2.087	3.084	1.905	2.812
D	177.8-228.6	1000-2500	2.404	3.583	2.223	3.266
		2501-4000	2.041	3.039	3.221	4.128
	241.3-406.4	1000-2500	2.858	4.264	3.856	5.715
E	304.8-406.4	1000-2500	2.722	4.037	3.311	4.672
		2501-4000	5.216	7.711	6.668	9.888
	457.2-508	1000-2500	4.264	6.260	5.398	7.938
F	1741-3000	1000-2500	6.396	9.525	7.212	10.659
		2501-4000	5.670	8.391	6.713	9.798
	304.8-406.4	1000-2500	11.29	16.78	11.34	16.78
G	457.2-508	1000-2500	9.62	14.20	9.53	14.06
		2501-4000	13.79	20.50	13.65	20.41
	851-1500	1000-2500	11.70	17.24	11.34	17.24

CROSS SECTION	SMALLEST SHEAVE DIA. mm	RPM RANGE	BELT DEFLECTION FORCE			
			STD. BELTS		COG BELTS	
			USED	NEW	USED	NEW
3V, 3VX	55.9-61.0	1000-2500	N/R	N/R	1.497	2.223
		2501-4000	N/R	N/R	1.270	1.950
	72.4-97.8	1000-2500	1.633	2.313	1.905	2.359
5V, 5VX	104.6-175.3	1000-2500	1.361	1.996	1.724	2.540
		2501-4000	2.223	3.311	2.404	3.583
	111.8-170.2	1000-2500	1.996	2.994	2.223	3.311
8V	180.3-276.9	500-1749	N/R	N/R	4.827	6.895
		1750-3000	N/R	N/R	3.992	5.987
	299.7-406.4	3001-4000	N/R	N/R	2.540	3.856
8V	317.5-431.8	500-1740	5.761	8.573	6.713	10.024
		1741-3000	5.080	7.575	6.214	9.117
	457.2-569	500-1740	7.031	10.61	7.756	11.57
8V	457.2-569	1741-3000	5.622	9.888	7.620	11.34
		200-850	14.97	22.36	N/A	N/A
	851-1500	12.16	18.06	N/A	N/A	
8V	457.2-569	200-850	18.05	26.85	N/A	N/A
		851-1500	16.01	23.90	N/A	N/A

MOTORS:

The fundamental principle of electrical maintenance is KEEP THE MOTOR CLEAN AND DRY. This requires periodic inspection of the motor, the frequency of which depends upon the type of motor and the service.

Periodic checks of voltage, frequency, and current of a motor while in operation is recommended. Such checks assure the correctness of frequency and voltage applied to the motor, and yield an indication of the fan load. Comparison of this data with previous data will give an indication of the fan performance. Any serious deviations should be investigated and corrected.

Fractional motors usually have prelubricated sealed bearings with no grease fittings and are lubricated for life.

Lubricate integral horsepower motors per the motor manufacturer's recommendations. Lubrication frequency depends on the motor horsepower, speed, and service. Use compatible greases. (See Page 14). Do not overgrease.

If the motor is totally enclosed fan cooled (TEFC), nonventilated (TENV), or air over (TEAO), it is recommended that the condensation drain plugs be removed. This is not necessary with motors equipped with automatic drains, which should be left in place as received.

VIBRATION:

Excessive fan vibration can be caused by many things. **ALL POSSIBLE SOURCES OF THE EXCESSIVE VIBRATION MUST BE CHECKED OUT AND CORRECTIVE ACTION TAKEN IMMEDIATELY TO CORRECT THE PROBLEM.** See the fan trouble-shooting chart (Table 2) for possible causes of excessive fan vibration.

A vibration analyzer will be of great assistance in determining the amount of vibration. The following values give an indication of the fan vibration condition. Vibration readings should be taken on the fan bearings (if possible, on belt drive fans), or motor (on direct drive fans), or on the fan housing of duct, ductaxial, and vaneaxial fans. Horizontal, vertical, and axial readings should be taken.

<u>FAN RPM</u>	<u>TABLE 1</u> Vibration displacement in mils, "Double Amplitude"			
	<u>GOOD</u>	<u>FAIR</u>	<u>SLIGHTLY ROUGH</u>	<u>ROUGH</u>
870	1.7	3.3	6.5	above 6.5
1160	1.2	2.5	5.0	above 5.0
1750	.75	1.5	3.5	above 3.5
3450	.50	0.9	2.0	above 2.0

Interpolate for fan speeds other than shown above. The fan should not be operated unless the maximum vibration reading is in at least the "fair" range.

GREASE LUBRICATION SCHEDULE,

Lubrication guidelines for horizontal shaft, grease lubricated fan, blower or other high speed rotating equipment.
Lubrication guidelines for vertical shaft -- see note below.

Link-Belt Ball Bearing Units -- Series 200

Relubrication interval				6 mos	4 mos	2 mos	1 mo
Shaft size range		Amt. of Grease		Operating speed (RPM)			
Inches	MM	Cu. In.	Cu. Cm.				
1/2-1	17-25	0.12	2.0	3200	4800	7200	9600
1 1/16 - 1 7/16	30-35	0.30	4.9	2200	3400	5100	6800
1 1/2 - 1 3/4	40-45	0.45	7.4	1700	2600	4000	5300
1 7/8 - 2 3/4	50-55	0.52	8.5	1400	2100	3200	4300
2 1/4 - 2 7/16	60	0.56	9.2	1300	2000	3000	4000
2 1/2 - 3 (1)	65-75	1.36	22.3	1000	1600	2400	3200
3 1/16 - 3 1/2 (1)	85	2.24	36.7	900	1400	2100	2800
3 9/16 - 4 (1)	100	5.00	81.9	800	1200	1800	2300

Link-Belt Roller Bearing Units -- Series 22400H & B22500

Relubrication interval				6 mos	4 mos	2 mos	1 mo	2 wks
Shaft size range		Amt. of Grease		Operating speed (RPM)				
Inches	MM	Cu. In.	Cu. Cm.	Up to	Up to	Up to	Up to	Up to
3/4-1	25	0.4	6.4	1400	2200	3400	5000	6800
1 1/16-1 1/4	30	0.5	7.7	1150	1800	2800	4500	5600
1 5/16-1 1/2	35	0.6	9.2	1000	1550	2400	3800	4800
1 9/16-1 3/4	40	0.8	13.1	870	1350	2100	3300	4200
1 13/16 - 2	45-50	0.9	14.6	700	1100	1700	2700	3400
2 1/16-2 1/4	55	1.1	17.9	630	1000	1500	2400	3000
2 5/16-2 1/2	60	1.3	21	580	910	1400	2250	2800
2 9/16 - 3	65-75	2.4	40	460	730	1100	1800	2200
3 1/16-3 1/2	80-85	3.9	64	410	640	1000	1550	2000
3 9/16 - 4	90-100	5.7	94	350	550	850	1350	1700
4 1/16-4 1/2	110-115	6.5	106	300	470	740	1150	1500
4 9/16 - 5	125	10.0	164	280	440	680	1050	1400

Link-Belt Spherical Roller Bearing Units Series P-LB6800

Relubrication interval				6 mos	4 mos	2 mos	1 mo
Shaft size range		Amt. of Grease		Operating speed (RPM)			
Inches	MM	Cu. In.	Cu. Cm.	Up to	Up to	Up to	Up to
1 7/16 - 1 1/2	40	0.3	4.9	2400	3600	5000	5500
1 11/16 - 1 3/4	45	0.3	5.0	2200	3300	4500	5000
1 15/16 - 2	50	0.4	6.6	2000	3000	4000	4500
2 3/16 - 2 1/4	60	0.8	12.7	1700	2500	3400	3800
2 7/16 - 2 1/2	65	0.8	12.3	1450	2200	3000	3400
2 11/16 - 2 3/4	70	0.9	14.3	1350	2000	2800	3200
2 15/16 - 3	75	1.2	19.7	1300	1900	2600	3000
3 3/16 - 3 1/4	80	1.7	27.4	1200	1800	2400	2700
3 7/16 - 3 1/2	90	2.3	37.7	1100	1650	2200	2300
3 11/16 - 4	100	3.1	50	1000	1500	1950	2100
4 3/16 - 4 1/4	110	4.3	70	900	1350	1850	1900
4 7/16 - 4 1/2	115	5.5	90.1	840	1250	1700	1800
4 15/16 - 5	125	6.4	105	780	1150	1600	1700
Clean and repack intervals				5 yrs	3 yrs	2 yrs	1 yr

Link-Belt Ball Bearing Units -- Series 300

Relubrication interval				6 mos	4 mos	2 mos	1 mo
Shaft size range		Amt. of Grease		Operating speed (RPM)			
Inches	MM	Cu. In.	Cu. Cm.	Up to	Up to	Up to	Up to
3/4 - 1	20-25	0.3	4.1	2800	4400	6400	8400
1 1/16-1 7/16	30-35	0.7	10.7	2000	3100	4500	6000
1 1/2 - 1 3/4	40-45	1.0	16.4	1500	2400	3500	4600
1 13/16-2 3/16	50-55	1.7	28	1200	2000	2900	3800
2 1/4 - 2 7/16	60	2.1	34	1100	1800	2600	3500
2 11/16-2 15/16	70-75	3.3	54	900	1400	2100	2800
3 - 3 3/16	80	4.5	74	800	1300	2000	2600
3 7/16 - 3 1/2	85	6.6	108	800	1200	1800	2400
3 15/16	100	10	170	700	1100	1600	2100

Lubricate with a premium quality NLGI 2 or 3 multi-purpose ball bearing grease having corrosion inhibitors, anti-oxidant additives and mechanical stability for high speed operation. The grease should also have a minimum base oil viscosity of 500 SUS at 100° F and be suitable to operate continuously at 225° F. Do not use a heavy, long fibered grease.

The bearings on this fan shaft have been greased at the factory for the following application:

- General Purpose (Shell Oil-Shell Alvania EP#2)
- High Temperature (Shell Oil-Aeroshell #22 (-85° F. to 400° F.))
- Low Temperature (Shell Oil-Aeroshell #22 (-85° F. to 400° F.))
- Extreme Moisture (Shell Oil-Shell Alvania EP#2)
- Other: _____

These units are prelubricated(except Series P-LB6800) with a multi-purpose Lithium soap grease. When relubricating with greases of different types (especially synthetic soaps or oils), complete flushing is recommended.

The presence of dirt, moisture or chemical fumes around the bearings requires more frequent lubrication. Ambient temperatures below 20° F or above 200° F require special lubricants. Consult the machinery manufacturer for recommendations.

When vibration exceeds 0.15 in./sec., frequent lubrication is required and a need for equipment trim balancing may be indicated.

Fill bearings with lubricant prior to extended shutdown or storage. Rotate the shaft several revolutions each month during idle periods.

(1) If it is possible to dislodge the seals on these units if grease is added too fast. It is preferable to use a hand gun or a regulated automatic system

VERTICAL SHAFTS: For vertical applications more frequent relubrication is required. The above relubrication interval (and clean and repack interval for the Series P-LB 6800 bearings.) should be reduced by half.

TABLE 2	
FAN TROUBLE-SHOOTING CHART	
PROBLEM	POSSIBLE CAUSES
EXCESSIVE VIBRATION	<ul style="list-style-type: none"> -Accumulation of material on impeller -Worn or corroded impeller -Bent shaft -Impeller or sheaves loose on shaft -Motor out of balance -Impeller out of balance -Sheaves eccentric or out of balance -Bearing or drive misalignment -Mismatched belts -Belts too loose or too tight -Loose or worn bearings -Loose bearing bolts -Loose fan mounting bolts -Weak or resonant foundation -Foundation not flat and level -Structures not crossbraced -System pulsation (DANGER) - Fan operation in a stall -Blades at different angles on adjustable pitch fans
HORSEPOWER TOO HIGH	<ul style="list-style-type: none"> -Fan speed higher than design -Air density higher than design -Impeller rotating in the wrong direction -Angle set too high in adjustable pitch fans
AIRFLOW TOO LOW	<ul style="list-style-type: none"> -Impeller rotating in the wrong direction -Fan speed lower than design -Actual system is more restrictive (more resistance to flow) than expected. -Dampers or registers closed -Leaks or obstructions in duct work -Filters or coils are dirty or clogged -Inlet or outlet screens clogged -Restricted fan inlet or outlet -No straight duct at fan outlet -Sharp elbows near fan inlet or outlet -Improperly designed turning vanes
AIRFLOW TOO MUCH	<ul style="list-style-type: none"> -Actual system is less restrictive (less resistance to flow) than expected -Fan speed higher than design -Filter not in place -Registers, grilles and/or dampers not installed
FAN DOES NOT OPERATE	<ul style="list-style-type: none"> -Blown fuses -Broken belts -Loose pulleys -Electricity turned off or not wired properly -Wrong voltage -Motor too small and overload protector has broken circuit

(CONT.)

TABLE 2 (CONTINUED)	
FAN TROUBLE-SHOOTING CHART	
PROBLEM	POSSIBLE CAUSES
EXCESSIVE NOISE	<ul style="list-style-type: none"> -Accumulation of material on impeller -Worn or corroded impeller -Bent shaft -Impeller or sheaves loose on shaft -Impeller hitting housing -Impeller out of balance -Bearing or drive misalignment -Mismatched belts -Belts too loose or too tight -Belts hitting guard -Loose or worn bearings -Belts worn -Belts oily or dirty -Defective or bad bearings -Bearings need lubrication -Loose bearing bolts -Loose fan mounting bolts -System pulsation or surge -Electrical noises -Noise from high velocity air system <ul style="list-style-type: none"> -Duct work too small -Registers or grilles too small for application -Fan in stall condition (DANGER) -Rattle of components in high velocity airstream -Leaks in duct work -Vibrating duct work -Vibrating parts not isolated from building

It is recommended that the users and installers of this equipment familiarize themselves with AMCA publication #201, "Fans and Systems, and publication #202 "Trouble-Shooting", which are published by Air Movement and Control Association, 20 West University Drive, Arlington Heights, Illinois 60004.

SPARE PARTS:

Spare parts are not needed for the first year of operation. If spare parts are desired, then it is suggested that a spare motor and impeller be ordered for direct drive fans. For belt drive fans, in addition to the motor and impeller, it is suggested that a spare set of bearings, shaft, sheaves, and belts be ordered.

When ordering spare parts, specify the parts desired, the fan model number, and the fan serial number. Contact your local sales representative for price and delivery.

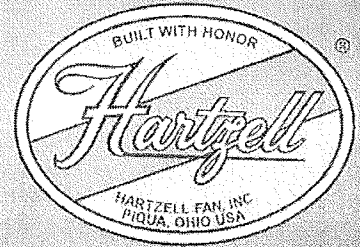
HARTZELL FAN, INC., PIQUA, OHIO 45356
 Phone# 937-773-8494
 Fax# 937-773-8994

Fiberglass Backward Curved Centrifugal Fans

Type FA

Series 41

Series 41P



AIR Industries

181 Hurricane Road
Falmouth, ME 04105

207-797-8571

HARTZELL®

Hartzell Fan, Inc., Piqua, Ohio 45356
www.hartzellfan.com

Bulletin A-160-C April 2005

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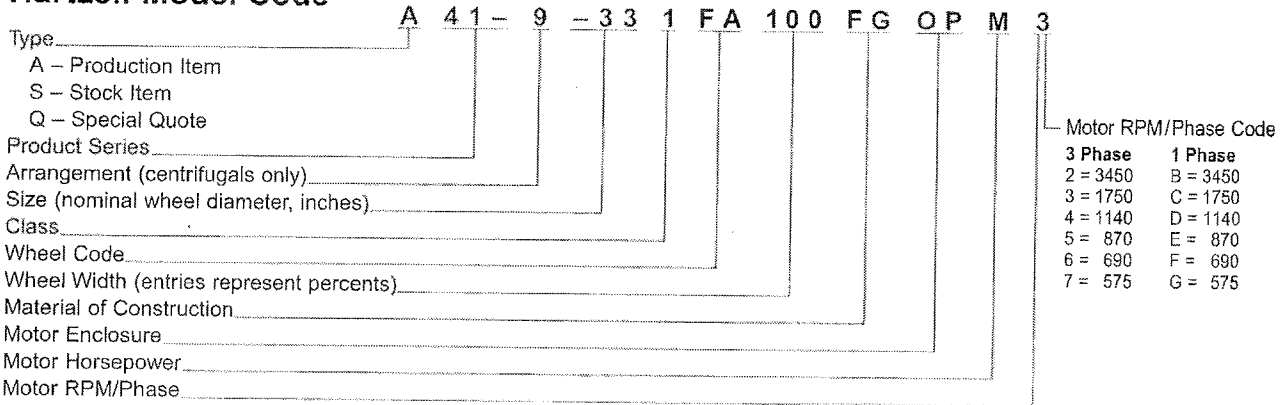
Certified Ratings for Air and Sound

Hartzell Fan, Inc. certifies that the Series 41, Fiberglass Backward Curved Centrifugal Fans, Type FA shown on pages 7–11 and 14–21, and Series 41P, Fiberglass Backward Curved Centrifugal Fan, Packaged, shown on pages 12–20, are licensed to bear the AMCA Seal for Air and Sound Performance. The ratings shown are based on tests and procedures performed in accordance with AMCA Standard 211 and AMCA Standard 311 and comply with the requirements of the AMCA Certified Ratings Program.

Sound Performance data is available upon request. Please contact the factory and ask for Engineering Publication #SD-160.

Hartzell Model Code Explanation

Hartzell Model Code



Motor Horsepower

Horsepower	1/4	1/3	1/2	3/4	1	1 1/2	2	3	5	7 1/2	10	15	20	25	30	40	50	60	75	100	125	150	200
Code Letter	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Example:

Assume a needed performance of 12,000 CFM at 5" SP, standard air. Reading the 33" rating table for 100% width on page 17, we find a fan RPM of 1,168 and brake horsepower (BHP) of 12.3. Required motor horsepower is 15. The model code can be constructed as follows: Type will be a production item (code A), product series for the Fiberglass Backward Curved Fans is 41, arrangement is 9 (code 9), size of the wheel is 33", class of construction is 1 (code 1), wheel code for this item

is FA, wheel width is 100% (code 100), material of construction is fiberglass (code FG), motor enclosure is open protected drip-proof (code OP), motor horsepower is 15 (code O), and motor RPM/phase is 1750 (code 3).

Note: All other informational fields must be filled with hyphens/dashes (-) if they are not applicable to the fan being considered.

This bulletin lists Hartzell's line of Fiberglass Backward Curved Centrifugal Fans, Type FA and accessories. More than 70 Hartzell offices can provide specific performance and installation data to meet your requirements. Call your Hartzell representative for assistance. Visit our website (www.hartzellfan.com) or call toll-free (1-800-336-3267) for the name of your Hartzell representative.

General Fiberglass Construction Features

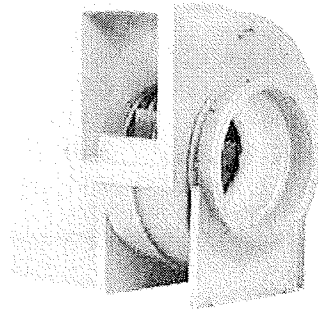
A variety of corrosion problems plague industry today. Fans and blowers made of coated steel or metals such as stainless and monel can handle some problem areas. Please refer to the corrosion resistance table on page 5 of this bulletin. Fiberglass centrifugal blowers can be used in most applications where corrosive elements exist in fume and vapor form. The resistance to corrosive elements is a major advantage, but the physical properties of fiberglass equipment offer these additional advantages:

- Fiberglass equipment is corrosion resistant.
- Fiberglass equipment weighs 25% less than comparable equipment made of carbon steel.
- Fiberglass has an extremely high strength-to-weight ratio, stronger than steel on a per-pound basis.
- Dimensional stability of fiberglass is excellent.
- Fiberglass air moving equipment will not become brittle at low temperatures and at 0°F the laminated fiberglass will be stronger than at room temperature.

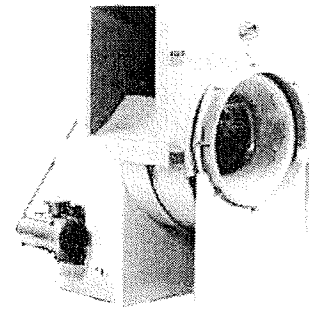
Hartzell Fan, Inc. conforms to ASTM D4167-97, Standard Specification for fiber-reinforced plastic fans and blowers, when optional surfacing veil, electrical grounding, and dynamic balancing to ASTM D4167-97 levels, are added to the fan.

The following are standard Hartzell fiberglass construction features:

- Corrosion resistant polyester resin, having a Class I flame spread rate of 25 or less is used for all housings. Vinylester resin having a Class I flame spread rate of 25 or less is used for all wheels.
- All structural parts in the airstream are fiberglass and resin. All fiberglass surfaces are protected with a minimum 10-mil thickness of chemical, flame, and ultraviolet resistant resin.
- Shafts are turned, ground, polished, and keyed at both ends with a fiberglass sleeve in the airstream. Shafts are sized to operate well below critical speed. 304 or 316 Stainless steel or monel shafting is available as an option at extra cost.
- Internal hardware (airstream) is Type 304 stainless steel. All internal hardware (airstream) is encapsulated. All external hardware (out of airstream) is zinc plated as standard. Where metal is subject to attack by the corrosive elements being handled, all metal parts can be resin-coated after assembly.
- A fiberglass and neoprene shaft seal is placed where the shaft leaves the housing along with a neoprene shaft slinger between the seal and wheel on belt drive units (seal is not gas tight).



Series 41P



Series 41

Fiberglass Centrifugal Fans

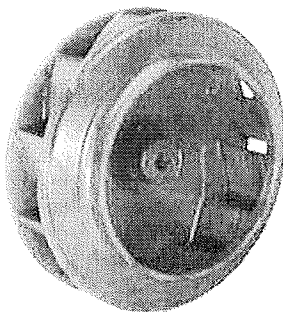
- Bearings on belt drive units are heavy duty, deep row radial ball or double row spherical roller type self-aligning and shielded in cast iron housings. Long inner races ensure even load distribution, providing a high radial and thrust load capacity.
- Bearings are relubricable for continuous service with lubrication tubes extended to the exterior of fan base as necessary.
- V-Belt Drives are oversized for long life and continuous duty as standard. Fixed pitch or variable pitch drives are available upon request. Belts are oil, heat, and static resistant type.

Type FA Wheel Features

The Type FA wheel is unique in the fan and blower industry. It is available in diameters from 12" to 60" in both clockwise and counter-clockwise rotations. The wheel is airfoil design and solid fiberglass die formed and coated with Dow Derakane 510-A corrosion resistant vinylester resin. The manufactured wheel is a single piece, removed from the pattern whole. This ensures each wheel is aerodynamically identical and provides reliable repeatable performance without the variability of hand made and taped components. The design is the result of a substantial investment in research, development, tooling, and manufacturing methods by Hartzell Fan, Inc.

The type FA wheel is highly efficient, with tapered inlet side and airfoil blades. It has non-overloading horsepower characteristic curve. When used in conjunction with a precision inlet cone it **efficiently moves large volumes of air at high pressures with low noise characteristics at low RPM.**

The fiberglass resin has a Class I flame spread rate of 25 or less. The wheel is electronically statically and dynamically balanced to the requirements of Fan Application Category BV-3 of AMCA ANSI Std. 204-96 and receives an Operational Test and Inspection before shipment. Special constructions are available for abrasive environments or extremely corrosive environments.



Type FA Wheel

Hartzell Selection Guide

The Hartzell Fiberglass Backward Curved Centrifugal Fan performances on the following pages are based on standard air conditions (sea level, 70°F, and 29.92 inches barometric pressure). Performance data does not include drive losses on belt drive units.

How to use Performance Tables

1. Select a model for a given air delivery and pressure by looking up the required flow vertically along the left column of the performance table and moving to the required pressure. The model is identified with each table.

2. Note the required RPM and BHP. Refer to page 2 Hartzell Model Code Explanation for additional details.

3. If non-standard temperature or altitude is involved, correct to standard air density (see Temperature/Altitude Applications).

When placing your order, be sure to specify the Hartzell Model Code. Be sure to include fan model, performance requirements, operating temperature, motor data (enclosure, voltage, mounting position, etc.), and a list of required accessory items. (See pages 22 and 23.) For selection assistance and additional data contact your local Hartzell Sales Representative for assistance.

Temperature/Altitude Applications

When a fan operates in ambient conditions, generally it is handling standard air at 70°F, 29.92" barometric pressure, weighing 0.075-lbs./cu. ft. For an application where the fan operates at other than ambient conditions (temperature, altitude, or both), correction factors must be applied to the selection of the fan. In addition, the standard construction of the fan must be modified.

Correction factors for temperatures and altitudes are provided in Table 1. When a fan operates at other than ambient conditions,

the correction factors in Table 1 will be required to correct static pressure and horsepower.

Table 2 shows the maximum safe operating speeds for each size fan wheel. At high temperatures, these maximum safe operating speeds should be derated.

Table 3 provides maximum safe speed correction factors by temperature and material construction. An example on the use of these tables appears at the bottom of this page.

Table 1 Altitude/Temperature Correction Factors

Temp. *(°F)	-50	-25	0	25	50	70	100	125	150	175	200	250
Factor	0.77	0.82	0.87	0.91	0.96	1.00	1.06	1.10	1.15	1.20	1.25	1.34

Ait.** (Ft.)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
Factor	1.00	1.04	1.08	1.12	1.16	1.20	1.25	1.30	1.35	1.40	1.46

Above table has inverted values. Actual density is the reciprocal of the above values.

*At sea level. **At 70°F.

For corrections involving both temperature and altitude, correction factors should be multiplied.

Example: 150°F at 7000 ft.: Temperature factor 1.15 x altitude factor 1.30 = 1.50 combined correction factor.

Table 2 Maximum Safe Speeds @70°F

Fan Size	100% Width	66% Width
12	4,520	5,320
15	3,600	4,340
18	2,990	3,610
22	2,440	2,950
24	2,240	2,710
27	2,000	2,410
30	1,840	2,220
33	1,670	2,020
36	1,530	1,850
40	1,370	1,660
44	1,240	1,500
49	1,130	1,360
54	1,020	1,230
60	920	1,110

Use of Correction Factors and Tables

First select size, RPM and BHP of the blower needed.

If temperature or altitude is involved, correct to standard air.

Example: Assume the required performance to be 12,000 CFM at 4.62" SP, 175°F and 2000 feet altitude.

1. Temperature factor 1.20 x altitude factor 1.08 = 1.30 combined correction factor.
2. Correct SP to standard 4.62" SP x 1.30 = 6" SP for 70°F at sea level.
3. A Series 41, size 33" class II 66% width belt drive backward curved centrifugal, selected from the rating tables (page 17) for the new condition shows 12,000 CFM at 6" SP, 1,398 RPM and 15.5 BHP.
4. Correct the horsepower and static pressure in item 3 to non-standard performance by dividing by factor: 6" SP divided by 1.30 = 4.62" SP; 15.5 BHP divided by 1.30 = 11.9 BHP.
5. Check the maximum safe speed. Maximum speed at 70°F for fan size 33" 66% width, 2,020 RPM. Using the maximum safe speed factor table for fiberglass construction yields a safe speed factor of .95. The maximum safe speed is 2,020 x .95 = 1,919 RPM; thus operation at 1,438 RPM at 175°F is satisfactory.
6. Final performance of the unit at the assumed conditions: 12,000 CFM at 4.62" SP, 1,398 RPM, 11.9 BHP at 175°F and 2000 feet altitude.
7. Size motor for cold startups and use a special high altitude motor if altitude exceeds 3300 feet.

Table 3 Maximum Safe Speed Correction Factors*

Temp. (°F)	0	70	100	150	175	200	225	250
FRP	1.00	1.00	1.00	0.98	0.95	0.91	0.82	0.70

* To correct maximum safe operating speeds (Table 2) for high temperatures, multiply those speeds by correction factors from Table 3.

Corrosion Resistance Guide

Temperature values shown are for immersion or condensate contact applications. Where temperature values are shown, resin is suitable for hood and duct type applications for the full operating temperature range of the product. See product specifications for materials of construction and maximum operating temperature limits.

Environment	Halon 603 Ashland F.	6694 Reichold F.	510A Dow F.	Environment	Halon 603 Ashland F.	6694 Reichold F.	510A Dow F.	Environment	Halon 603 Ashland F.	6694 Reichold F.	510A Dow F.
ACIDS				ALKALIES (Synthetic Veil)				SALTS (cont'd.)			
Acetic to 10%	180	200	210	Ammonium Bicarbonate to 50%	140	\$170	160	Sodium Ferricyanide	220	220	210
Acetic to 50%	90	160	180	Ammonium Carbonate	120	\$140	150	Sodium Fluoride		\$180	\$180
Acetic to 100%		NR	NR	Ammonium Hydroxide to 1%	590	\$180	\$180	Sodium Nitrate	220	220	210
Acetic to 25%		100	100	Ammonium Hydroxide to 16%	590	\$170	\$150	Sodium Nitrite		220	NR
Benzene Sulfonic to 25%	180	210	180	Ammonium Hydroxide to 29%	NR	\$130	\$100	Sodium Oxide	180	210	NR
Benzene Sulfonic 25% up	90	210	NR	Barium Carbonate	180	\$240	210	Sodium Sulfate (PH less than 1)	180	240	210
Benzene	250	220	210	Barium Hydroxide to 10%	NR	\$170	150	Sodium Sulfate	180	240	210
Boric	180	220	210	Calcium Hydroxide to 15%	160	\$210	\$180	Sodium Sulfite	*180	*220	*210
Butyric to 50%	150	150	210	Magnesium Carbonate	160	\$210	180	Sulfamic Chloride	200	*220	*210
Butyric 50% up		100	80	Potassium Bicarbonate to 10%	90	\$170	\$150	Sulfamic Chloride	200	*220	*210
Carbonic	160	220	NR	Potassium Carbonate to 10%	90	\$180	\$150	Zinc Oxide	180	220	210
Chloroacetic to 25%	NR	*180	*150	Potassium Hydroxide to 25%	NR	\$120	\$180	Zinc Nitrate	180	220	210
Chloroacetic 25% to 50%	NR	*150	*120	Sodium Bicarbonate to 10%	140	\$210	\$180	Zinc Sulfate	150	220	NR
Chromic to 5%	100	110	150	Sodium Carbonate to 5%	90	\$180	\$180				
Chromic to 10% to 20%		NR	150	Sodium Hydroxide to 10%	NR	\$160	\$150	SOLVENTS			
Citric	*200	*220	*210	Sodium Hydroxide to 25%	NR	\$150	\$180	Acetone to 10%	NR	180	180
Fluoric	*590	*\$220	*\$210	Sodium Sulfate	50	\$220	\$210	Benzene	90	80	NR
Glycolic up to 10%	\$100	\$180	\$180	Sodium Sulfite	50	\$220	\$210	Carbon Disulfide	NR	NR	NR
Formic up to 10%	200	180	180	Sodium Thiocyanate		\$170	210	Carbon Tetrachloride	NR	110	150
Gluconic to 50%	120	180	180					Chlorobenzene	NR	NR	NR
Hydrochloric to 25%	*160	*170	*180	SALTS				Ethyl Acetate	NR	NR	NR
Hydrochloric to 15%	*230	*210	*180	Aluminum Chloride	*120	*240	*210	Ethyl Chloride	NR	NR	NR
Hydrocyanic to 10%	200	170	210	Aluminum Potassium Sulfate	160	240	210	Ethylene Glycol	250	220	210
Hydrofluoric to 10%	**\$100	**\$150	**\$150	Ammonium Sulfate	250	240	210	n-Heptane	120	210	210
Hydrofluoric up to 10%	*\$180	*\$150	*\$180	Ammonium Chloride	*200	*220	*210	Hexane		150	160
Hypochlorous to 70%	90	110	NR	Ammonium Nitrate	200	220	220	Methyl Ethyl Ketone to 10%	NR	50	NR
Lactic	*200	*220	*210	Ammonium Persulfate	150	200	180	Naphthalene	200	210	180
Malic	170	210	210	Ammonium Sulfate, saturated	150	NR	NR	Nitrobenzene	130	220	210
Nitric to 5%	200	170	150	Ammonium Sulfate	200	220	220	Orthochlorophenol	NR	100	80
Nitric 5% to 20%		140	120	Ammonium Sulfate to 20%	150	220	210	Toluene	90	NR	80
Oxalic	200	220	210	Ammonium Sulfate, saturated	150	220	210	Xylene	90	60	80
Picolinic to 10%	*220	*220	*210	Barium Chloride	200	240	210				
Phosphoric	NR	*\$150	*\$150	Barium Sulfate	NR	\$210	180	BLEACHES			
Phosphoric, super	*220	*\$210	*\$210	Calcium Chloride	150	220	220	Calcium Chloride	180	220	220
Phthalic Anhydride	*150	*210	*210	Calcium Chloride	250	240	220	Calcium Hypochlorite	100	NR	\$160
Picric to 10%	160	170	NR	Calcium Sulfate	*200	*240	*210	Chlorine Bleach up to 15%		160	*200
Silicic		220	NR	Copper Chloride	*250	*220	*220	Chlorine Water	*125	*210	*200
Stearic	200	220	210	Copper Cyanide	90	\$220	210	Hydrogen Peroxide to 50%	120	100	150
Sulfamic to 25%	160	150	NR	Copper Fluoride	NR	\$170	NR	Sodium Chlorate	90	210	210
Sulfamic to 25%	*200	*220	*210	Copper Sulfate	250	240	210	Sodium Hypochlorite to 15%	NR	125	\$180
Sulfamic to 50%	*200	*200	*180	Ferric Chloride	*250	*220	*210				
Sulfamic to 70%	*150	*180	*100	Ferric Nitrate	170	220	210	OTHERS			
Sulfamic to 90%	NR	80	NR	Ferric Sulfate	200	220	210	Alum. Chloroacetate to 50%		220	210
Tannic	90	110	120	Lead Acetate	160	220	210	Ammonium Phosphate	150	210	210
Tartaric	220	220	210	Magnesium Chloride	200	240	210	Acid Rega	NR	NR	NR
Trichloroacetic to 50%	*90	*220	*200	Magnesium Hydroxide		\$210	210	Biogenic	120	170	150
				Magnesium Sulfate	200	210	210	Glycerol	200	220	210
				Mercuric Chloride	*210	*220	*210	Kerosene	120	210	180
				Mercurous Chloride	210	220	210	Phosphoric Solutions		80	NR
				Nickel Chloride	220	220	210	Pernitroethylene	NR	100	80
				Nickel Nitrate	220	220	210	Sodium Bicarbonate	180	5210	180
				Nickel Sulfate	220	220	210	Sodium Biphosphate	125	210	210
				Potassium Chloride	200	240	210	Sodium Arsenic Sulfonate		170	160
				Potassium Dichromate	200	220	210	Solvent Solutions	180	220	160
				Potassium Ferricyanide	500	220	210	Urea	90	170	150
				Potassium Nitrate	200	220	210	Urea Ammonium-Nitrate		120	120
				Potassium Permanganate	150	210	210	Fertilizer Formas	100	120	150
				Potassium Persulfate	90	220	210	Shell-D-E	NR	100	NR
				Potassium Sulfate	200	240	210	Steam Vapor	180	210	180
				Silver Nitrate	200	220	210				
				Sodium Acetate	150	220	210				
				Sodium Bisulfate	200	220	210				
				Sodium Chloride	200	240	180				
				Sodium Chloride to 10%	175	170	150				
				Sodium Cyanide	100	220	210				
				Sodium Dichromate	160	220	210				

Reference
C.R.G.1.1

NOTES: NR = Not Recommended S = Synthetic surfacing veil or mat required. Contact factory. "-" = No test data available
 * Special shaft and hardware required, contact factory.
 ** Special design considerations required (explosive environment), contact factory.
 *** Do not use HartKoate. Special shaft and hardware required, contact factory.
 For environments not shown, or when temperatures exceed the maximum listed, contact factory.
 Hydrocarbon fuel environments may require static grounding, contact factory.
 Do not use HartKoate (Alum. Oxide) with Hydrofluoric acid.

Hartzell Centrifugal Fan Classifications

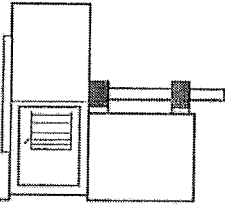
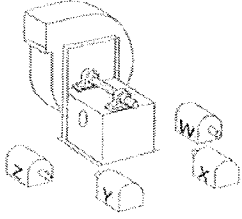
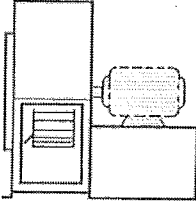
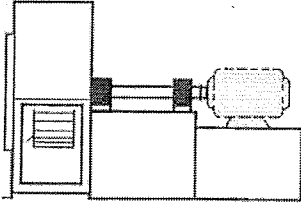
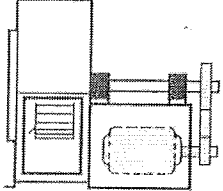
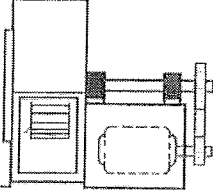
Hartzell Series 41 Fiberglass Backward Curved Centrifugal Fans, Type FA, 100% width, are designed and classified to perform within the centrifugal fan classification parameters established by AMCA Standard No. 2408; AMCA Publication 99. Hartzell Series 41 Fiberglass Backward Curved Centrifugal Fans, Type FA, 100%

width are available in Class I and II construction. Hartzell Series 41 in 66% width are available in Class I, II, and III construction. Series 41P are available in Class I construction only. See performance tables for specific ratings. These parameters are explained in the following table.

FAN CLASS	PERFORMANCE RANGE*	TABLE SHADING
I	5" @ 2300 FPM To 2 1/2" @ 3200 FPM	
II	8 1/2" @ 3000 FPM To 4 1/4" @ 4175 FPM	
III	13 1/2" @ 3780 FPM To 6 3/4" @ 5260 FPM	

* At standard air conditions (70°F, 29.92 in. HG barometric pressure, .075 lbs./ft.³). Static pressure shown in inches of water; outlet velocity shown in feet per minute. Performance Ranges apply only to 100% width construction.

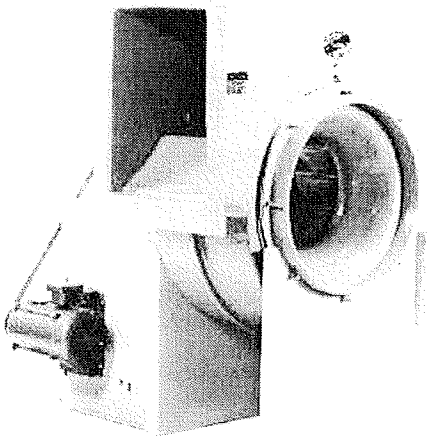
Centrifugal Fan Arrangements

 <p>Arrangement 1 Unit furnished with shaft and bearings, less motor and drive. Designed to be driven by a separately mounted motor. Impeller is overhung – two bearings on base. Temperature limitations: 250°F.</p>	 <p>Motor Position Designation Motor position designation is necessary when ordering the following for Arrangement 1 fans – 1 – V Belt Drive. 2 – Vibration Bases. 3 – Belt Guards.</p> <p>Note: Location of motor is determined by facing the drive side of the fan and designating the motor position by letters W, X, Y, or Z. Consider discharge location and height when specifying.</p>
 <p>Arrangement 4 Direct drive packaged unit, wheel is overhung and attached to the shaft of the electric motor. No bearings on fan. Temperature limitations: 200°F.</p>	 <p>Arrangement 8 Direct coupled configuration with motor mounted to common fan base. Impeller is overhung and supported by two bearings on fan base. Temperature Limitations: 250°F.</p>
 <p>Arrangement 9 Belt drive configuration with motor mounted on outside of bearing base support. Packaged unit, wheel is overhung, side rail motor base permits easy adjustment of belt tension. Available on either left or right hand side of base (when facing drive end of shaft). Temperature limitations: 250°F.</p>	 <p>Arrangement 10 Belt drive configuration with motor mounted inside base. Packaged unit, wheel is overhung. Temperature limitations: 250°F.</p>

Adapted from AMCA Standard 99-2404-03, *Drive Arrangements for Centrifugal Fans*, and AMCA Standard 99-2407-03, *Motor Positions for Belt or Chain Drive Centrifugal Fans*, with written permission from Air Movement and Control Association International, Inc.

Series 41 Backward Curved Centrifugal Fan, Type FA

Series 41 Hartzell Fiberglass Backward Curved Centrifugal Fans offers **non-overloading, high efficiency, low noise,** and economy for corrosive atmospheres. This fan is unique in the fan and blower industry. The fan incorporates the proven, highly efficient, backward curved, airfoil-bladed, solid fiberglass, Type FA wheel in a solid fiberglass housing. This design incorporates the airfoil centrifugal wheel, centrifugal fan housing, and inlet cone to produce a compact, highly efficient unit with low noise characteristics.

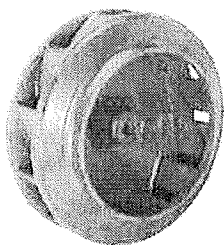


Series 41



Hartzell Fan, Inc. certifies that the Series 41, Fiberglass Backward Curved Centrifugal Fans, Type FA, shown herein are licensed to bear the AMCA seal for air and sound performance. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

Sound Performance data is available upon request. Please contact the factory and ask for Engineering Publication #SD-160.



Type FA Wheel

- **Applications** – Developed for compatible corrosive applications where it is advantageous to have fiberglass materials and have the motor out of the airstream with the versatility of a belt drive fan.
- **Performance** – Type FA fiberglass airfoil wheel with inlet cone and aerodynamically designed housing produces from **800 CFM to 90,000 CFM at pressures from free delivery to 14" W.G.** at high efficiencies with non-overloading horsepower, low noise, and low RPM. Maximum temperature capability is 250°F.

Features

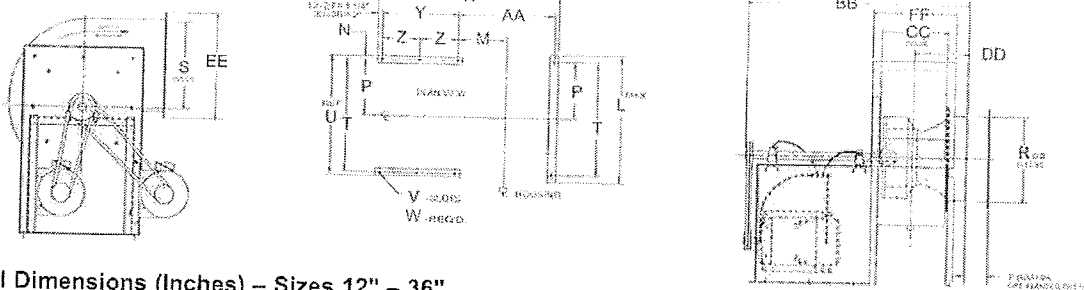
- **Sizes** – 12", 15", 18", 22", 24", 27", 30", 33", 36", 40", 44", 49", 54", and 60" wheel diameters. Available in Class I and II in 100% width and Class I, II, and III in 66% width. Available in Belt Drive Arrangements #1, #9, and #10, Direct Drive Arr. #4 and Direct Coupled Arr. #8. Contact Factory for Arr. #8 dimensions and for other arrangements.
- **FRP Materials** – Solid fiberglass wheel molded with Dow Derakane 510-A corrosion resistant vinylester resin having a Class I flame spread rate of 25 or less. The housing and other standard FRP components are constructed of fiberglass and Ashland Hertron 693 corrosive resistant polyester resin having a Class I flame spread rate of 25 or less. No metal parts are exposed in the airstream. See Corrosion Resistance Guide on page 5 for resin characteristics. Other resins are available.
- **Type FA Wheel** – High efficiency, airfoil design with **one-piece, solid fiberglass**, construction. Tapered inlet side design efficiently moves large volumes of air at high pressures. Wheel has non-overloading horsepower characteristic curve.
- **Rotation and Discharge Positions** – Available in both clockwise and counter-clockwise rotations and in all standard discharge positions. Housing discharge position can be changed on fan sizes 12" through 36". Larger size housings are non-rotatable.
- **Easy Installation and Maintenance** – Motor, drives, and bearings are readily accessible for ease in wiring, installation, adjustment, and lubrication.
- **Shafts** – Shafts are turned ground and polished, keyed at both ends with fiberglass sleeve in the airstream and sized to operate well below critical speed.
- **Bearings** – Bearings are heavy duty, self-aligning, ball or roller type, in cast iron pillow block housings, selected for minimum L-50 Life of 250,000 hours, and include extended lubrication fittings as standard.
- **Standard Shaft Seal** – A fiberglass and neoprene shaft seal is placed where the shaft leaves the housing along with a neoprene shaft slinger between the seal and wheel. Seal is not gas tight.
- **Hardware** – Airstream hardware is Type 304 stainless steel and encapsulated.
- **Motor Out of the Airstream** – Exterior mounting of Drip-Proof Protected motor on an adjustable motor slide base in belt drive models is standard. Motors can be furnished as TEFC, Mill and Chemical Duty, or to specifications upon request. Motor HP and frame size limits are identified in Dimensions and Material Specifications table.
- **Drives (Belt Drive Fans)** – V-Belt Drives are oversized for long life and continuous duty and are fixed pitch as standard option. Variable pitch drives are available upon request. Belts are oil, heat, and static resistant type.
- **Balancing** – The fan is electronically statically and dynamically balanced to the requirements of Fan Application Category BV-3 of AMCA ANSI Std. 204-96. All fans receive an inspection prior to shipment and, whenever possible, an operational test.
- **Flanged Duct Connections** – Outlet flange is standard, inlet flange is optional. Flange bolt holes are optional.
- **Bases** – Heavy gauge, welded, hot rolled steel with epoxy coating are standard.
- **Options and Accessories** – See pages 22 and 23.
- **Spark Resistant Construction and Protective Coatings** – Spark resistant construction for fiberglass equipment is optional, and for abrasive environments or extremely corrosive environments, special construction is available, see page 23.

Dimensions – Arrangements 1, 9 or 10

SERIES 41, Type FA

Sizes 12" Through 36", Rotatable Housing

Standard Construction – Classes I, II and III, Maximum Temperature – 250°F.



Principal Dimensions (Inches) – Sizes 12" – 36"

Fan Size	B			C	D	E	F	G	H	J	L	M		N
	A	Class I/II	Class III									100% Width	66% Width	
12	18 ¹ / ₂	15 ¹ / ₂	15 ¹ / ₂	13	11 ¹ / ₂	12 ¹ / ₄	20 ³ / ₈	10 ³ / ₄	10	11 ¹ / ₁₆	18 ³ / ₄	5 ³ / ₃₂	6 ³ / ₈	1
15	21 ¹ / ₂	18 ³ / ₈	19 ⁵ / ₈	16 ³ / ₁₆	15 ⁷ / ₈	16 ¹¹ / ₁₆	25 ¹ / ₂	14 ¹⁵ / ₁₆	14	13 ¹ / ₁₆	21 ³ / ₄	8 ³ / ₈	7 ¹¹ / ₁₆	1
18	24 ¹ / ₂	21 ¹⁵ / ₁₆	22 ⁷ / ₈	19	18 ⁷ / ₁₆	19 ⁹ / ₁₆	28 ¹ / ₂	17 ⁴ / ₁₆	16 ³ / ₁₆	15 ¹ / ₁₆	28 ³ / ₄	11 ³ / ₁₆	10 ³ / ₈	1
22	30	26 ³ / ₄	27 ⁷ / ₁₆	21 ¹ / ₈	22 ¹¹ / ₁₆	24 ¹ / ₁₆	34 ³ / ₈	21 ¹⁵ / ₁₆	19 ¹³ / ₁₆	18 ⁹ / ₁₆	29 ¹ / ₈	11 ¹ / ₈	10 ¹ / ₄	1
24	33 ¹⁵ / ₁₆	28 ⁷ / ₁₆	29 ¹ / ₄	23	24 ⁷ / ₁₆	25 ¹³ / ₁₆	37 ³ / ₈	22 ¹⁵ / ₁₆	21 ⁷ / ₁₆	19 ¹³ / ₁₆	31	11 ⁷ / ₈	10 ³ / ₄	1
27	32 ³ / ₈	32 ¹ / ₂	32 ¹ / ₂	24	27 ⁷ / ₁₆	29 ¹ / ₈	40 ¹ / ₁₆	25 ¹³ / ₁₆	24 ¹ / ₈	22 ⁷ / ₁₆	33 ¹ / ₃	13 ³ / ₁₆	11 ¹³ / ₁₆	1
30	37	35	35	28 ¹ / ₂	29 ⁹ / ₁₆	31 ³ / ₈	43 ⁷ / ₁₆	27 ³ / ₄	25 ¹⁵ / ₁₆	24 ¹ / ₈	38 ³ / ₈	17	15 ⁹ / ₈	2 ¹ / ₈
33	40	38 ³ / ₁₆	38 ³ / ₁₆	28 ¹¹ / ₁₆	33 ¹ / ₄	35 ¹ / ₄	47 ⁹ / ₁₆	31 ¹ / ₄	29 ¹ / ₄	27 ⁹ / ₁₆	38 ³ / ₈	18 ¹ / ₂	16 ⁵ / ₈	2 ¹ / ₈
36	42	41 ⁵ / ₁₆	41 ⁵ / ₁₆	31 ⁷ / ₁₆	35 ¹ / ₁₆	37 ¹ / ₄	51 ¹¹ / ₁₆	32 ⁷ / ₈	30 ¹¹ / ₁₆	28 ¹ / ₂	42 ³ / ₄	19 ¹ / ₄	17 ⁵ / ₈	2 ¹ / ₈

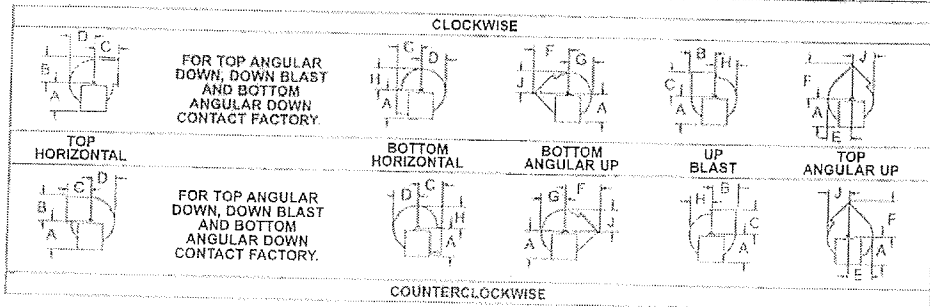
Fan Size	P	R	S	T	U	V	W	X		Y	Z	AA	
								100% Width	66% Width			100% Width	66% Width
12	8 ¹ / ₈	12 ¹ / ₄	12 ⁷ / ₈	16 ¹ / ₄	18 ¹ / ₄	1 ¹ / ₁₆ X 1 ¹ / ₁₆	5	28 ¹ / ₈	26 ³¹ / ₃₂	12 ³ / ₄	—	13 ¹ / ₈	11 ³¹ / ₃₂
15	9 ¹ / ₄	16 ¹ / ₂	16 ¹ / ₈	18 ³ / ₄	20 ³ / ₄	1 ¹ / ₁₆ X 1 ¹ / ₁₆	6	34	32 ³ / ₄	15 ³ / ₄	—	16	14 ⁹ / ₁₆
18	12 ¹¹ / ₁₆	19 ¹ / ₂	19 ³ / ₈	25 ³ / ₈	27 ¹ / ₄	1 ¹ / ₁₆ X 1 ¹ / ₁₆	8	41	39 ¹ / ₂	18 ³ / ₄	9 ³ / ₈	20	18 ¹ / ₄
22	12 ¹¹ / ₁₆	23 ⁷ / ₈	23 ⁵ / ₈	25 ⁵ / ₈	27 ³ / ₈	1 ¹ / ₁₆ X 1 ¹ / ₁₆	8	44 ¹ / ₁₆	42 ³ / ₈	20 ¹ / ₄	10 ¹ / ₄	21 ⁹ / ₁₆	19 ¹ / ₂
24	12 ¹¹ / ₁₆	25 ³ / ₄	25 ³ / ₄	25 ³ / ₈	27 ³ / ₈	1 ¹ / ₁₆ X 1 ¹ / ₁₆	8	47 ⁷ / ₈	46	22 ¹ / ₂	11 ¹ / ₄	23 ¹ / ₈	20 ⁷ / ₈
27	11	28 ¹ / ₄	29	22	24	1 ¹ / ₁₆ X 1 ¹ / ₁₆	8	50 ³ / ₁₆	48 ³ / ₁₆	22 ¹ / ₂	11 ¹ / ₄	25 ¹³ / ₁₆	23 ³ / ₁₆
30	16 ¹ / ₂	31 ¹ / ₁₆	31 ¹ / ₂	33 ³ / ₄	35	1 ¹ / ₁₆ X 1 ¹ / ₄	8	57 ¹ / ₁₆	54 ⁷ / ₈	22 ³ / ₄	11 ³ / ₈	30 ¹³ / ₁₆	28 ¹ / ₄
33	16 ⁷ / ₈	34 ³ / ₁₆	34 ¹¹ / ₁₆	33 ³ / ₄	38	1 ³ / ₁₆ X 1 ¹ / ₄	8	62 ⁷ / ₁₆	59 ⁷ / ₁₆	25 ³ / ₄	12 ⁷ / ₈	33 ³ / ₁₆	30 ⁷ / ₁₆
36	16 ⁷ / ₈	37 ¹³ / ₁₆	37 ¹³ / ₁₆	33 ³ / ₄	38	1 ³ / ₁₆ X 1 ¹ / ₄	8	64 ¹¹ / ₁₆	61 ⁷ / ₁₆	25 ³ / ₄	12 ⁷ / ₈	35 ⁷ / ₁₆	32 ⁷ / ₁₆

Fan Size	BB		CC		DD		EE				FF			
	100% Width	66% Width	100% Width	66% Width	100% Width	66% Width	100% Width		66% Width		100% Width		66% Width	
	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III
12	33 ¹ / ₈	31 ³¹ / ₃₂	9 ⁹ / ₃₂	8 ⁷ / ₈	8	7 ⁷ / ₁₆	18 ¹ / ₈	18 ¹ / ₈	18 ¹ / ₈	18 ¹ / ₈	14 ³ / ₈	14 ³ / ₈	13 ¹ / ₂	13 ¹ / ₂
15	38 ³ / ₄	37 ³ / ₁₆	11 ¹¹ / ₁₆	10 ⁷ / ₁₆	9 ⁹ / ₁₆	8 ⁹ / ₁₆	21 ¹ / ₁₆	23 ¹ / ₁₆	21 ¹ / ₁₆	23 ¹ / ₁₆	16 ⁷ / ₈	18 ¹¹ / ₁₆	15 ¹ / ₄	17 ⁹ / ₁₆
18	45 ³ / ₄	43 ¹³ / ₁₆	14	12 ⁷ / ₁₆	10 ¹ / ₂	9 ⁹ / ₁₆	24 ¹ / ₂	25 ³ / ₈	24 ¹ / ₂	25 ³ / ₈	19 ¹ / ₁₆	21	17 ³ / ₈	19 ¹ / ₁₆
22	49 ³ / ₈	47 ³ / ₁₆	17 ¹ / ₈	15 ¹ / ₁₆	12 ¹ / ₈	11	28 ³ / ₄	30 ⁵ / ₈	28 ³ / ₄	30 ⁵ / ₈	22 ¹ / ₄	24 ¹ / ₈	20 ⁹ / ₁₆	22 ¹ / ₁₆
24	54 ¹ / ₈	51 ¹¹ / ₁₆	18 ³ / ₈	16 ³ / ₈	12 ¹⁵ / ₁₆	11 ¹ / ₁₆	30 ¹¹ / ₁₆	32 ³ / ₄	30 ¹¹ / ₁₆	32 ³ / ₄	26 ³ / ₈	23 ¹ / ₁₆	25 ⁵ / ₈	21 ⁷ / ₁₆
27	56 ³ / ₄	53 ³ / ₁₆	21	18 ¹ / ₂	14 ¹ / ₈	12 ⁷ / ₈	36	36	36	36	28	28	25 ¹ / ₂	23 ³ / ₈
30	63 ¹ / ₁₆	60 ¹ / ₈	22 ¹³ / ₁₆	20 ¹ / ₁₆	15 ¹ / ₁₆	13 ¹¹ / ₁₆	38 ¹ / ₂	38 ¹ / ₂	38 ¹ / ₂	38 ¹ / ₂	29 ¹³ / ₁₆	29 ¹³ / ₁₆	27 ¹ / ₁₆	27 ¹ / ₁₆
33	69 ³ / ₈	65 ³ / ₁₆	25 ¹ / ₈	22 ¹ / ₈	16 ¹ / ₄	14 ³ / ₄	41 ¹¹ / ₁₆	41 ¹¹ / ₁₆	38 ¹ / ₂	38 ¹ / ₂	32 ¹ / ₂	32 ¹ / ₂	29 ¹ / ₈	29 ¹ / ₈
36	72 ¹ / ₁₆	69 ¹ / ₁₆	27 ³ / ₈	24 ¹ / ₈	17 ³ / ₈	15 ³ / ₄	44 ¹³ / ₁₆	44 ¹³ / ₁₆	41 ¹¹ / ₁₆	41 ¹¹ / ₁₆	34 ³ / ₈	34 ³ / ₈	29 ¹ / ₈	31 ¹ / ₈

Dimensions and specifications are subject to change. Clockwise Rotation is shown. Certified prints are available.

Fan Discharges

TAD, BAD, and DB discharge must have discharge extension. Contact factory.

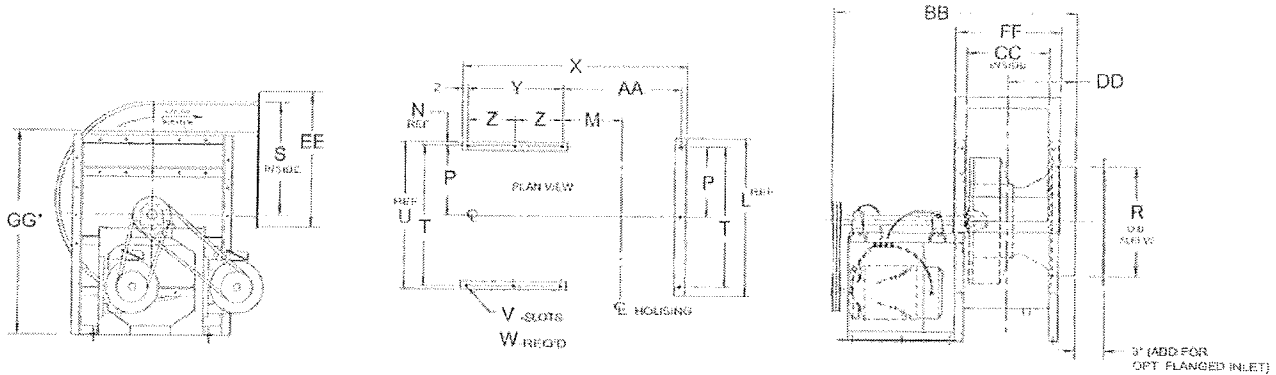


Dimensions – Arrangements 1, 9 or 10

SERIES 41, Type FA

Sizes 40" Through 60", Fixed Housing

Standard Construction – Classes I, II and III, Maximum Temperature – 250°F.



Principal Dimensions (Inches) – Sizes 40" – 60"

Fan Size	A				B	C	D	E	F	G	H	J	L	M	
	TAU-TH	TAD	BH	BAU-UB										100% Width	66% Width
40	47	47	47	47	46 ^{13/16}	35 ^{7/8}	40 ^{1/2}	42 ^{3/4}	58 ^{13/16}	37 ^{3/4}	35 ^{1/4}	32 ^{1/2}	65 ^{1/4}	21 ^{3/16}	19 ^{3/8}
44	51 ^{1/4}	51 ^{1/4}	51 ^{1/4}	51 ^{1/4}	52 ^{3/8}	39 ^{11/16}	45 ^{1/2}	48 ^{3/4}	65 ^{1/2}	42 ^{3/4}	40	37 ^{3/16}	59 ^{3/8}	22 ^{3/8}	20 ^{7/8}
49	56 ^{1/2}	56 ^{1/2}	56 ^{1/2}	56 ^{1/2}	57 ^{1/8}	43 ^{11/16}	49 ^{1/16}	52 ^{1/8}	71 ^{11/16}	46	42 ^{11/16}	39 ^{3/8}	71 ^{1/2}	24 ^{3/16}	22 ^{3/8}
54	54 ^{1/4}	47 ^{3/4}	64	61	62 ^{7/8}	48 ^{3/8}	54 ^{3/8}	57 ^{3/4}	78 ^{11/16}	51	47 ^{9/16}	44 ^{1/4}	69 ^{3/8}	27 ^{3/8}	24 ^{13/16}
60	60	52 ^{1/2}	70	67 ^{1/2}	69 ^{1/16}	53 ^{1/2}	59 ^{7/8}	63 ^{3/4}	86 ^{11/16}	56 ^{7/8}	52 ^{3/8}	48 ^{5/8}	75 ^{1/2}	29 ^{3/8}	26 ^{13/16}

Fan Size	N	P	R	S	T	U	V	W	X		Y	Z	AA	
									100% Width	66% Width			100% Width	66% Width
40	2	22	42 ^{3/8}	43 ^{9/16}	44	48	13 ^{1/16} X 1 ^{1/4}	9	70 ^{3/8}	66 ^{1/2}	27 ^{3/4}	13 ^{7/8}	38 ^{7/8}	35 ^{1/4}
44	2	22	47 ^{1/8}	47 ^{7/8}	44	48	13 ^{1/16} X 1 ^{1/4}	9	73 ^{7/16}	69 ^{1/16}	27 ^{3/4}	13 ^{7/8}	42 ^{3/16}	38 ^{3/8}
49	2 ^{1/2}	22 ^{1/2}	51 ^{7/8}	52 ^{7/8}	45	50	13 ^{1/16} X 1 ^{1/4}	9	81 ^{1/8}	77 ^{1/16}	32 ^{3/4}	16 ^{3/8}	45 ^{3/8}	41 ^{3/16}
54	2	27	57 ^{3/16}	58 ^{3/8}	54	58	13 ^{1/16} X 1 ^{1/4}	9	86 ^{1/16}	81 ^{1/8}	32	16	50 ^{3/16}	45 ^{3/8}
60	2	27	63 ^{3/16}	64 ^{9/16}	54	58	13 ^{1/16} X 1 ^{1/4}	9	90 ^{1/2}	85 ^{1/16}	32	16	55	49 ^{9/16}

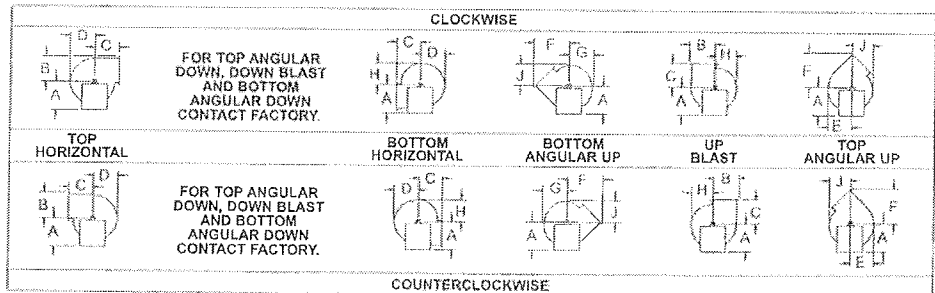
Fan Size	BB		CC		DD		EE	FF		GG*
	100% Width	66% Width	100% Width	66% Width	100% Width	66% Width		100% Width	66% Width	
40	78 ^{13/16}	75 ^{7/16}	31 ^{3/8}	27 ^{3/4}	19 ^{1/2}	17 ^{11/16}	50 ^{5/16}	38 ^{3/8}	34 ^{3/4}	-
44	82 ^{7/16}	78 ^{7/16}	34 ^{11/16}	30 ^{11/16}	21 ^{1/4}	19 ^{1/4}	56 ^{7/8}	43 ^{11/16}	39 ^{11/16}	-
49	90 ^{7/8}	86 ^{7/16}	38 ^{1/8}	33 ^{11/16}	22 ^{15/16}	20 ^{3/4}	61 ^{3/8}	47 ^{1/8}	42 ^{11/16}	-
54	94 ^{13/16}	89 ^{1/8}	42 ^{7/16}	37 ^{3/8}	25	22 ^{9/16}	67 ^{3/8}	51 ^{3/16}	46 ^{3/8}	98 ^{1/4}
60	99 ^{5/16}	93 ^{1/8}	46 ^{3/4}	41 ^{5/16}	27 ^{1/4}	24 ^{3/16}	73 ^{5/16}	55 ^{3/4}	50 ^{7/16}	107 ^{3/8}

Dimensions and specifications are subject to change. Clockwise Rotation is shown. Certified prints are available.

Fan Discharges

TAD, BAD, and DB discharge must have discharge extension. Contact factory.

* For top angular up discharge on 54" and 60" only, dimension is for location of removable split scroll to allow for shipping. Assembly required in field.

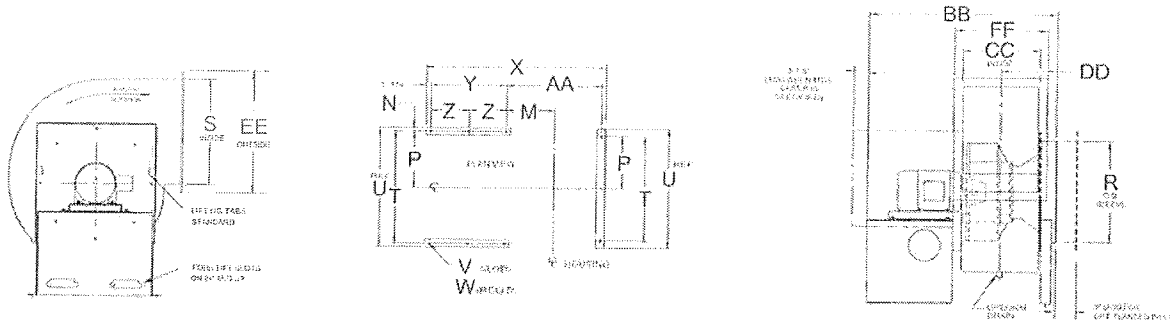


Dimensions – Arrangement 4

SERIES 41, Type FA

Sizes 12" Through 33", Rotatable Housing

Standard Construction – Classes I, II and III, Maximum Temperature – 200°F.



Principal Dimensions (Inches) – Sizes 12" – 33"

Fan Size	A	B		C	D	E	F	G	H	J	M		N
		Class I/II	Class III								100% Width	66% Width	
12	16	15 ¹ / ₂	15 ¹ / ₂	13	11 ¹ / ₂	12 ¹ / ₄	20 ¹ / ₈	10 ³ / ₄	10	11 ¹ / ₁₆	8 ⁷ / ₁₆	7 ⁷ / ₈	5 ⁵ / ₈
15	18 ³ / ₄	18 ³ / ₈	19 ⁵ / ₈	16 ³ / ₁₆	15 ⁷ / ₈	16 ¹¹ / ₁₆	25 ¹ / ₂	14 ¹ / ₁₆	14	13 ¹ / ₁₆	9 ¹¹ / ₁₆	9	5 ⁵ / ₈
18	22	21 ¹⁵ / ₁₆	22 ¹ / ₈	19	18 ⁷ / ₁₆	19 ⁹ / ₁₆	28 ¹ / ₂	17 ⁹ / ₁₆	16 ⁹ / ₁₆	15 ¹ / ₁₆	10 ⁸ / ₁₆	10 ¹ / ₈	5 ⁵ / ₈
22	26 ³ / ₄	26 ¹ / ₄	27 ¹ / ₁₆	21 ¹ / ₈	22 ¹¹ / ₁₆	24 ¹ / ₁₆	34 ³ / ₈	21 ³ / ₁₆	19 ¹⁵ / ₁₆	18 ⁹ / ₁₆	12 ⁷ / ₈	11 ⁹ / ₁₆	5 ⁵ / ₈
24	28 ¹ / ₂	28 ³ / ₁₆	29 ¹ / ₄	23	24 ⁷ / ₁₆	25 ⁹ / ₁₆	37 ³ / ₁₆	22 ¹⁵ / ₁₆	21 ⁷ / ₁₆	19 ¹¹ / ₁₆	13 ³ / ₈	12 ¹ / ₄	4 ⁷ / ₈
27	32 ¹ / ₄	32 ¹ / ₂	32 ¹ / ₂	24	27 ¹ / ₁₆	29 ¹ / ₈	40 ³ / ₁₆	25 ¹ / ₁₆	24 ¹ / ₈	22 ¹ / ₁₆	14 ³ / ₈	13 ³ / ₈	4 ⁷ / ₈
30	34 ³ / ₄	35	35	28 ¹ / ₂	29 ⁹ / ₁₆	31 ³ / ₈	43 ⁷ / ₁₆	27 ³ / ₄	25 ¹ / ₁₆	24 ¹ / ₁₆	15 ¹ / ₁₆	14 ³ / ₁₆	4 ⁷ / ₈
33	38	38 ³ / ₁₆	38 ³ / ₁₆	28 ¹¹ / ₁₆	33 ¹ / ₄	35 ¹ / ₄	47 ⁹ / ₁₆	31 ¹ / ₄	29 ¹ / ₄	27 ³ / ₁₆	16 ³ / ₁₆	15 ⁵ / ₁₆	4 ⁷ / ₈

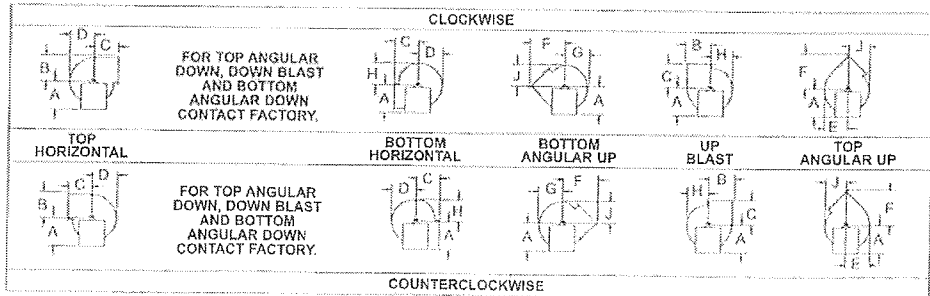
Fan Size	P	R	S	T	U	V	W	X		Y	Z	AA	
								100% Width	66% Width			100% Width	66% Width
12	9 ¹ / ₈	12 ¹ / ₄	12 ¹ / ₈	18 ¹ / ₄	19 ¹ / ₂	9 ¹ / ₁₆ x 1 ¹ / ₁₆	6	26 ⁷ / ₁₆	25 ³ / ₃₂	9 ¹ / ₂	—	14 ¹¹ / ₁₆	13 ¹ / ₃₂
15	10 ³ / ₈	16 ¹ / ₂	16 ¹ / ₈	21 ¹ / ₂	22 ³ / ₈	9 ¹ / ₁₆ x 1 ¹ / ₁₆	6	36	34 ⁷ / ₈	16 ¹ / ₂	—	17 ¹ / ₄	15 ¹ / ₁₆
18	12 ³ / ₈	19 ¹ / ₂	19 ³ / ₈	24 ³ / ₄	27 ³ / ₄	9 ¹ / ₁₆ x 1 ¹ / ₁₆	6	40 ⁹ / ₁₆	39 ¹ / ₂	19	—	19 ¹ / ₁₆	18
22	14 ¹ / ₂	23 ¹ / ₈	23 ³ / ₈	29	30 ¹ / ₄	9 ¹ / ₁₆ x 1 ¹ / ₁₆	6	44 ¹ / ₄	42 ⁹ / ₁₆	19	—	23	21
24	15 ⁷ / ₁₆	25 ⁷ / ₈	25 ³ / ₄	31 ³ / ₄	33 ¹ / ₂	1 ¹ / ₁₆ x 1 ³ / ₁₆	6	45 ¹³ / ₁₆	43 ³ / ₈	19	—	24 ⁹ / ₁₆	22 ³ / ₈
27	17 ³ / ₈	28 ³ / ₄	29	35 ¹ / ₄	37	1 ¹ / ₁₆ x 1 ³ / ₁₆	6	48 ¹ / ₂	46	19	—	27 ¹ / ₄	24 ³ / ₄
30	18 ⁷ / ₈	31 ¹ / ₁₆	31 ¹ / ₂	37 ³ / ₄	39 ¹ / ₂	1 ¹ / ₁₆ x 1 ³ / ₁₆	8	52 ³ / ₁₆	50 ⁷ / ₄	21 ¹ / ₂	10 ³ / ₄	29 ⁹ / ₁₆	26 ¹ / ₈
33	20 ³ / ₈	34 ³ / ₁₆	34 ¹¹ / ₁₆	41 ¹ / ₄	43	1 ¹ / ₁₆ x 1 ³ / ₁₆	8	57 ¹ / ₂	54 ⁹ / ₁₆	23 ³ / ₄	11 ¹ / ₈	31 ¹ / ₂	28 ³ / ₁₆

Fan Size	BB		CC		DD		EE				FF			
	100% Width	66% Width	100% Width	66% Width	100% Width	66% Width	100% Width		66% Width		100% Width		66% Width	
	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III	Class I/II	Class III
12	27 ³ / ₁₆	25 ¹ / ₃₂	9 ⁹ / ₃₂	8 ³ / ₈	8	7 ⁷ / ₁₆	18 ¹ / ₈	18 ¹ / ₈	18 ¹ / ₈	18 ¹ / ₂	14 ³ / ₈	14 ³ / ₈	13 ¹ / ₂	13 ¹ / ₂
15	36 ¹ / ₁₆	35 ¹ / ₄	11 ¹ / ₁₆	10 ⁶ / ₁₆	9 ¹ / ₄	8 ¹ / ₂	21 ¹ / ₁₆	23 ³ / ₈	21 ¹ / ₁₆	23 ¹ / ₈	16 ³ / ₈	18 ¹¹ / ₁₆	15 ¹ / ₄	17 ³ / ₁₆
18	41 ⁹ / ₈	39 ³ / ₄	14	12 ⁵ / ₁₆	10 ¹ / ₁₆	9 ³ / ₈	24 ¹ / ₈	26 ³ / ₈	24 ¹ / ₂	26 ³ / ₈	19 ¹ / ₁₆	21	17 ³ / ₈	19 ¹ / ₁₆
22	45 ¹ / ₈	42 ¹⁹ / ₁₆	17 ¹ / ₈	15 ¹ / ₁₆	12	11	28 ³ / ₄	30 ³ / ₈	28 ³ / ₄	30 ³ / ₈	22 ¹ / ₈	24 ¹ / ₈	20 ⁹ / ₁₆	22 ¹ / ₁₆
24	45 ⁷ / ₁₆	44 ³ / ₁₆	18 ³ / ₈	16 ³ / ₈	12 ³ / ₁₆	11 ¹¹ / ₁₆	30 ¹ / ₁₆	32 ³ / ₄	30 ³ / ₁₆	32 ³ / ₄	23 ¹¹ / ₁₆	25 ⁵ / ₈	21 ⁷ / ₁₆	23 ³ / ₈
27	49	46 ¹ / ₂	21	18 ¹ / ₂	14 ¹ / ₈	12 ⁷ / ₈	36	36	36	36	28	28	25 ¹ / ₂	25 ¹ / ₂
30	53 ¹ / ₂	50 ³ / ₄	22 ¹⁹ / ₁₆	20 ¹ / ₁₆	15 ¹ / ₁₆	13 ¹ / ₁₆	38 ¹ / ₂	38 ¹ / ₂	38 ¹ / ₂	38 ¹ / ₂	29 ¹³ / ₁₆	29 ¹³ / ₁₆	27 ¹ / ₁₆	27 ¹ / ₁₆
33	58 ¹ / ₁₆	52 ¹³ / ₁₆	26 ¹ / ₈	22 ¹ / ₈	16 ¹ / ₄	14 ¹ / ₄	41 ¹ / ₁₆	41 ¹ / ₁₆	41 ¹ / ₁₆	41 ¹ / ₁₆	32 ³ / ₈	32 ³ / ₈	29 ¹ / ₈	29 ¹ / ₈

Dimensions and specifications are subject to change. Clockwise rotation is shown. Certified prints are available.

Fan Discharges

TAD, BAD, and DB discharge must have discharge extension. Contact factory.



Material Specifications/Weights

Series 41

Class	Fan Size	Flanges				Shaft & Bearings		FA Type Wheel WR ² (Lbs.-Ft. ²)	Motor Frames			Installation Weights (Lbs. Less Motor)	
		Inlet		Outlet					Minimum Arr. #4	Maximum Arr. #4	Maximum Arr. #9 & #10	Arr. #4	Arr. #9 & #10
		Thickness	Holes	Thickness	Holes								
I	12	1/8	7/16 X 8	1/4	7/16 X 10	1 7/16	P3U219	1.6	56	184T	182T	160	193
	15	3/16	7/16 X 8	1/4	7/16 X 14	1 3/16	P3U219	4.7	143T	215T	184T	235	230
	18	1/2	7/16 X 8	1/4	7/16 X 14	1 1/16	P3U223	11	143T	256T	213T	350	355
	22	3/4	7/16 X 8	1/4	7/16 X 18	1 7/16	P3U223	29	182T	286T	215T	490	490
	24	1/4	7/16 X 8	1/4	7/16 X 18	1 7/16	P3U223	44	182T	286T	254T	580	605
	27	5/16	7/16 X 8	3/8	7/16 X 18	2 3/16	P3U235	78	182T	286T	254T	660	770
	30	3/16	7/16 X 8	3/8	7/16 X 18	2 7/16	P3U239	119	213T	326T	256T	935	975
	33	1/2	7/16 X 8	3/8	7/16 X 22	2 7/16	P3U239	160	254T	365T	284T	1145	1185
	36	5/16	7/16 X 8	3/8	7/16 X 22	2 11/16	P3U243	251	---	---	286T	---	1550
	40	3/8	7/16 X 8	1/2	7/16 X 26	2 15/16	P3U247	423	---	---	324T	---	2015
	44	1/2	7/16 X 8	1/2	7/16 X 30	2 15/16	P3U247	717	---	---	324T	---	2515
	49	3/8	1 1/16 X 16	1/2	7/16 X 34	2 15/16	P3U247	1180	---	---	326T	---	2940
	54	1/2	1 1/16 X 16	1/2	7/16 X 34	2 15/16	PB22447	1810	---	---	364T	---	3340
	60	1/2	1 1/16 X 16	1/2	7/16 X 38	2 15/16	PB22447	2875	---	---	365T	---	3670
	II	12	3/8	7/16 X 8	1/4	7/16 X 10	1 7/16	P3U223	1.6	56	184T	184T	160
15		1/2	7/16 X 8	1/4	7/16 X 14	1 7/16	P3U223	4.7	143T	215T	215T	235	235
18		3/16	7/16 X 8	1/4	7/16 X 14	1 11/16	P3U227	11	143T	256T	256T	350	355
22		1/4	7/16 X 8	1/4	7/16 X 18	1 11/16	PB22427	29	182T	286T	256T*	490	505
24		1/4	7/16 X 8	1/4	7/16 X 18	1 11/16	PB22427	44	182T	286T	286T*	580	625
27		5/16	7/16 X 8	3/8	7/16 X 18	2 7/16	PB22435	78	182T	286T	286T*	660	800
30		3/16	7/16 X 8	3/8	7/16 X 18	2 7/16	PB22439	119	213T	326T	286T*	935	995
33		1/2	7/16 X 8	3/8	7/16 X 22	2 7/16	PB22439	160	254T	365T	326T*	1145	1195
36		5/16	7/16 X 8	3/8	7/16 X 22	2 11/16	PB22443	251	---	---	326T*	---	1620
40		3/8	7/16 X 8	1/2	7/16 X 26	2 15/16	PB22447	423	---	---	365T*	---	2060
44		1/2	7/16 X 8	1/2	7/16 X 30	2 15/16	PB22447	717	---	---	365T*	---	2560
49		3/8	1 1/16 X 16	1/2	7/16 X 34	2 15/16	PB22447	1180	---	---	405T*	---	3040
54		1/2	1 1/16 X 16	1/2	7/16 X 34	2 15/16	PB22447	1810	---	---	405T*	---	3480
60		1/2	1 1/16 X 16	1/2	7/16 X 38	2 15/16	PB22447	2875	---	---	405T*	---	3670
III		12	1/8	7/16 X 8	1/4	7/16 X 10	1 11/16	P3U227	1.6	56	184T	184T	160
	15	3/16	7/16 X 8	1/4	7/16 X 14	1 11/16	P3U227	4.7	143T	215T	215T*	235	250
	18	1/2	7/16 X 8	1/4	7/16 X 14	1 15/16	P3U231	11	143T	256T	256T*	350	375
	22	3/4	7/16 X 8	1/4	7/16 X 18	1 15/16	PB22431	29	182T	286T	256T*	490	525
	24	1/4	7/16 X 8	1/4	7/16 X 18	1 15/16	PB22431	44	182T	286T	286T*	580	635
	27	5/16	7/16 X 16	3/8	7/16 X 18	2 7/16	PB22435	78	182T	286T	286T*	660	820
	30	3/16	7/16 X 16	3/8	7/16 X 18	2 7/16	PB22439	119	213T	326T	286T*	935	1040
	33	1/2	7/16 X 16	3/8	7/16 X 22	2 7/16	PB22439	160	254T	365T	326T*	1145	1210
	36	5/16	7/16 X 16	3/8	7/16 X 22	2 11/16	PB22443	251	---	---	326T*	---	1630
	40	3/8	7/16 X 16	1/2	7/16 X 26	2 15/16	PB22447	423	---	---	365T*	---	2080
	44	1/2	7/16 X 16	1/2	7/16 X 30	2 15/16	PB22447	717	---	---	365T*	---	2580
	49	3/8	1 1/16 X 16	1/2	7/16 X 34	2 15/16	PB22447	1180	---	---	405T*	---	3110
	54	1/2	1 1/16 X 16	1/2	7/16 X 34	2 15/16	PB22447	1810	---	---	405T*	---	3500
	60	1/2	1 1/16 X 16	1/2	7/16 X 38	2 15/16	PB22447	2875	---	---	405T*	---	3800

* Motor Frames exceeding these values must be Arrangement 9M, Arrangement 1, or Arrangement 8. For other Arrangement maximum motor frame size and dimensions, please contact factory.

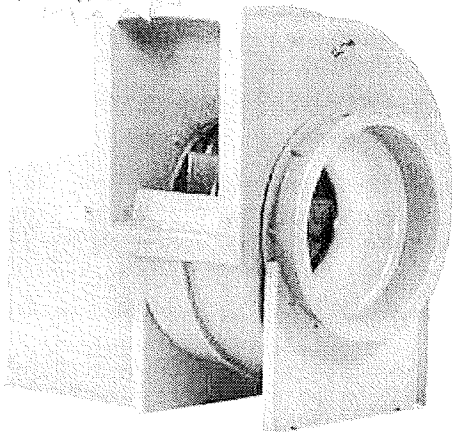
Series 41P

Class	Fan Size	Flanges				Shaft & Bearings			FA Type Wheel WR ² (Lbs.-Ft. ²)	Maximum Motor Frame Arr. #10	Installation Weights (Lbs. Less Motor)
		Inlet		Outlet							
		Thickness	Holes	Thickness	Holes						
II	12	1/8	7/16 X 8	1/4	7/16 X 10	1 11/16	P3U-227	P3U-227	1.6	215T	188
	15	3/16	7/16 X 8	1/4	7/16 X 14	1 11/16	P3U-227	P3U-227	4.7	215T	215
	18	1/2	7/16 X 8	1/4	7/16 X 14	1 15/16	P3U-231	P3U-231	11	254T	309
	22	3/4	7/16 X 8	1/4	7/16 X 18	1 11/16	P3U-227	P3U-227	29	256T	397
	24	1/4	7/16 X 8	1/4	7/16 X 18	1 15/16	P3U-231	P3U-231	44	256T	554
	27	5/16	7/16 X 8	3/8	7/16 X 18	2 3/16	P3U-235	P3U-235	78	286T	728
	30	3/16	7/16 X 8	3/8	7/16 X 18	2 7/16	PB-22435	P3U-235	119	324T	878
	33	1/2	7/16 X 8	3/8	7/16 X 22	2 7/16	P3U-235	P3U-235	160	324T	1013
	36	5/16	7/16 X 8	3/8	7/16 X 22	2 7/16	P3U-235	P3U-235	251	326T	1131

Series 41P Backward Curved Centrifugal Fan, Packaged, Type FA

Series 41P Hartzell Fiberglass Backward Curved Centrifugal Fan, Packaged, offers **non-overloading, high efficiency, low noise, and economy** for corrosive atmospheres in a **compact packaged Class II design**. This fan is unique in the fan and blower industry. The fan incorporates the proven, highly efficient, backward curved, airfoil-bladed, solid fiberglass, Type FA wheel in a solid fiberglass housing. This design incorporates the airfoil centrifugal wheel, centrifugal fan housing, and inlet cone to produce a compact, highly efficient unit with low noise characteristics.

Stock Models Available in Hartzell's HRS Program.

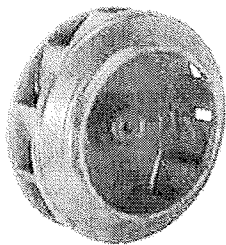


Series 41P
Shown with optional accessories



Hartzell Fan, Inc. certifies that the Series 41P, Fiberglass Backward Curved Centrifugal Fan, Packaged, shown herein is licensed to bear the AMCA seal for air and sound performance. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

Sound Performance data is available upon request. Please contact the factory and ask for Engineering Publication #SD-160.



Type FA Wheel

- **Applications** – Developed to perform throughout the entire **Class II Performance Range** for compatible corrosive applications where it is advantageous to have fiberglass materials and have the motor out of the airstream with the versatility of a belt drive fan.
- **Performance** – Type FA fiberglass airfoil wheel with inlet cone and aerodynamically designed housing produces from **800 CFM to 30,000 CFM** at pressures from **free delivery to 12" W.G.** at **high efficiencies** with non-overloading horsepower, low noise, and low RPM. Max. temperature capability is 250°F.

Features

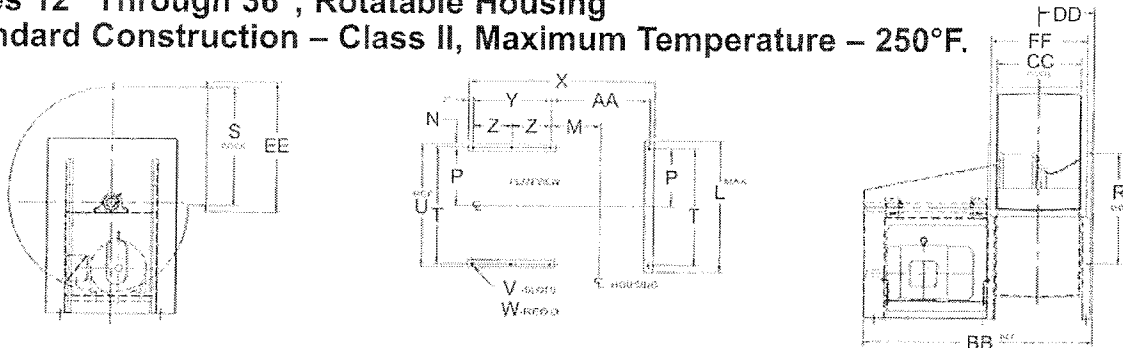
- **Sizes** – 12" through 36" wheel diameters. Packaged Class II construction, Arrangement #10 Belt Drive with weather cover. Available in both 100% and 66% widths.
- **FRP Materials** – Solid fiberglass wheel molded with Dow Derakane 510-A corrosion resistant vinylester resin having a Class I flame spread rate of 25 or less. The housing and other standard FRP components are constructed of fiberglass and Ashland Hertron 693 corrosive resistant polyester resin having a Class I flame spread rate of 25 or less. No metal parts are exposed in the airstream. See Corrosion Resistance Guide on page 5 for resin characteristics. Other resins are available.
- **Type FA Wheel** – High efficiency, airfoil design with **one-piece, solid fiberglass**, construction. Tapered inlet side design efficiently moves large volumes of air at high pressures. Wheel has non-overloading horsepower characteristic curve.
- **Rotation and Discharge Positions** – Available in both clockwise and counter-clockwise rotations and in all standard discharge positions. Housing discharge position can be changed on fan sizes 12" through 36".
- **Easy Installation and Maintenance** – Motor, drives and bearings are readily accessible for ease in wiring, installation, adjustment, and lubrication. Weather cover and guards are available.
- **Shafts** – Shafts are turned ground and polished, keyed at both ends with fiberglass sleeve in the airstream and sized to operate well below critical speed.
- **Bearings** – Bearings are heavy duty, self-aligning, ball or roller type, in cast iron pillow block housings, selected for long life at maximum Class II construction limits, and include extended lubrication fittings as standard.
- **Standard Shaft Seal** – A fiberglass and neoprene shaft seal is placed where the shaft leaves the housing along with a neoprene shaft slinger between the seal and wheel. Seal is not gas tight.
- **Hardware** – Airstream hardware is Type 304 stainless steel and encapsulated.
- **Motor Out of the Airstream** – Exterior mounting of Drip-Proof Protected motor on an adjustable motor pivot base is standard. Motors can be furnished as TEFC, Mill and Chemical Duty, or to specifications upon request. Motor HP and frame size limits are identified in Dimensions and Material Specifications table.
- **Drives (Belt Drive Fans)** – V-Belt Drives are oversized for long life and continuous duty and are fixed pitch as standard. Variable pitch drives for sizes 24" through 36" are available upon request. Belts are oil, heat, and static resistant type.
- **Balancing** – The fan is electronically statically and dynamically balanced to the requirements of Fan Application Category BV-3 of AMCA ANSI Std. 204-96. All fans receive an inspection prior to shipment and, whenever possible, an operational test.
- **Flanged Duct Connections** – Outlet flange is standard, inlet flange is optional. Flange bolt holes are optional.
- **Bases** – Heavy gauge, welded, hot rolled steel with epoxy coating are standard. Base is sized to accept maximum motor frame size required for Class II operation.
- **Options and Accessories** – See pages 22 and 23.
- **Spark Resistant Construction and Protective Coatings** – Spark resistant construction for fiberglass equipment is optional, and for abrasive environments or extremely corrosive environments, special construction is available, see page 23.

Dimensions – Series 41P, Arrangement 10

SERIES 41P, Type FA

Sizes 12" Through 36", Rotatable Housing

Standard Construction – Class II, Maximum Temperature – 250°F.



Principal Dimensions (Inches) – Sizes 12" – 36"

Fan Size	A	B	C	D	E	F	G	H	J	L	M		N
											100% Width	66% Width	
12	17	15 1/2	13	11 1/2	12 3/8	20 1/8	10 7/8	10 1/8	11 1/16	20 3/4	7 15/16	7 5/8	5 1/8
15	17	18 3/8	16 3/16	14 1/2	15 7/16	24 3/8	13 3/16	12 3/8	13 1/4	20 3/4	9 3/16	8 7/16	5 3/8
18	20	21 15/16	19	17 1/2	18 3/8	28 15/16	16 3/8	15 1/4	15 1/4	24 3/4	9 3/16	8 1/2	5 3/8
22	24 3/4	26 1/4	21 1/8	21 7/16	22 11/16	33 1/2	19 13/16	18 3/16	17 7/16	29 3/4	10 7/8	9 1/8	5 3/8
24	27	28 3/16	23	23 3/8	24 3/8	36 3/16	21 11/16	20 3/16	18 11/16	31 1/8	11 3/8	10 1/2	5 3/8
27	28 1/2	32 1/2	24	26	27 11/16	39 9/16	24 3/16	22 5/8	20 15/16	34 3/8	13 1/16	11 7/16	13 1/16
30	30 1/2	35	28 1/2	28 1/4	30 1/16	44 15/16	26 3/8	24 7/16	22 3/4	37 3/4	14	12 3/8	13 1/16
33	37	38 3/16	28 11/16	31	33	47 1/4	29	27	24 15/16	41 3/8	15 1/8	13 3/8	13 1/16
36	37	41 3/16	31 1/4	33 3/4	36	51 3/16	31 3/8	29 3/8	27 7/16	44 1/8	16 1/4	14 3/8	13 1/16

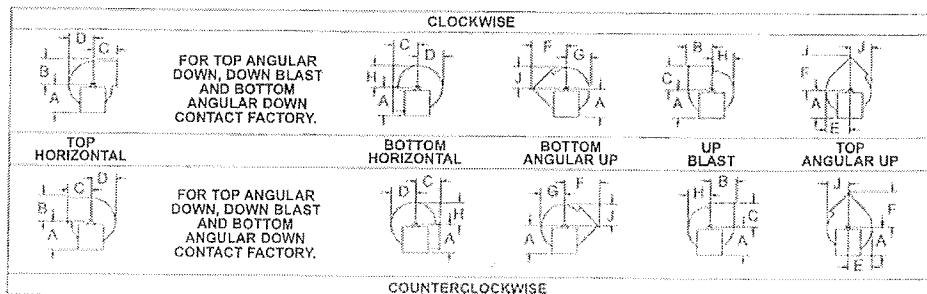
Fan Size	P	R	S	T	U	V	W	X		Y	Z	AA	
								100% Width	66% Width			100% Width	66% Width
12	9 3/4	12 1/4	12 7/8	19 1/2	20 3/4	9 1/16 X 1	6	36 11/16	36	19 3/4	—	14 7/16	13 3/8
15	9 3/4	16 3/8	16 1/8	19 1/2	20 3/4	9 1/16 X 1	6	39 1/16	37 3/8	19 3/8	—	16 7/16	15
18	10 1/2	19 3/4	19 3/8	21	22 1/4	9 1/16 X 1	6	45 1/8	44 3/8	25 1/4	—	17 7/8	16 1/8
22	11 1/8	23 3/4	23 11/16	22 1/4	23 1/2	9 1/16 X 1	6	49 1/4	47 1/8	25 1/4	—	21	18 7/8
24	10 1/2	25 3/4	25 3/4	21	22 1/4	9 1/16 X 1	6	50 3/4	48 1/2	25 1/4	—	22 1/2	20 1/4
27	13 3/16	28 3/8	29	26 3/8	28	11 1/16 X 1 1/2	8	58	55 7/16	29 3/8	14 13/16	25 3/8	22 13/16
30	13 7/8	31 1/16	31 1/2	27 3/4	29 3/8	11 1/16 X 1 1/2	8	63 3/16	60 1/16	33	16 1/2	27 3/16	24 7/16
33	13 7/8	34 1/16	34 11/16	27 3/4	29 3/8	11 1/16 X 1 1/2	8	65 3/16	62 1/2	33	16 1/2	29 9/16	26 1/2
36	13 7/8	37 1/16	37 15/16	27 3/4	29 3/8	11 1/16 X 1 1/2	8	67 13/16	64 1/2	33	16 1/2	31 13/16	28 1/2

Fan Size	BB		CC		DD		EE	FF	
	100% Width	66% Width	100% Width	66% Width	100% Width	66% Width		100% Width	66% Width
12	37 3/8	37	9 3/16	8 11/16	8 1/8	7 13/16	18 1/8	14 7/8	13 3/4
15	40 1/8	38 3/8	11 11/16	10 7/16	9 5/16	8 7/8	21 1/16	16 3/8	15 1/4
18	47 1/16	45 3/8	14	12 3/16	10 9/16	9 11/16	24 1/2	19 13/16	17 3/8
22	50 3/16	48 1/8	17 1/8	15 1/16	12 1/8	11 1/16	28 3/4	22 1/4	20 3/16
24	51 3/4	49 1/2	18 11/16	16 3/8	12 15/16	11 3/4	30 13/16	23 11/16	21 1/2
27	59	56 1/2	21	18 3/8	14 3/16	13 1/16	36	28	25 1/2
30	64 3/16	61 1/2	22 13/16	20 1/8	15 1/4	13 7/8	38 1/2	29 13/16	27 1/8
33	65 3/16	63 3/16	25 1/8	22 1/8	16 1/16	14 15/16	41 3/8	32 1/8	29 1/8
36	68 13/16	65 3/16	27 1/16	24 1/8	17 3/16	15 13/16	44 13/16	34 3/8	31 1/8

Dimensions and specifications are subject to change. Clockwise rotation is shown. Certified prints are available.

Fan Discharges

Scrolls are rotatable. BH and BAU rotations require a 3" tall height adjusting sub-base. TAD, BAD and DB discharge must have discharge extension. Contact factory.



Performance Data

Class I Class II Class III

A41- -12_FA100FG or A41PO-122FA100FG

Wheel Diameter: 12.25 in.
Outlet Area: 0.87 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1000	1149	1691	0.27	2078	0.50	2418	0.75										
1200	1379	1873	0.36	2219	0.61	2529	0.89	2814	1.20	3083	1.54						
1400	1609	2066	0.48	2370	0.76	2665	1.06	2929	1.39	3177	1.74	3414	2.12				
1600	1839	2260	0.62	2527	0.93	2816	1.26	3066	1.61	3297	1.98	3517	2.38	3934	3.23	4324	4.18
1800	2069	2451	0.78	2747	1.15	2987	1.50	3218	1.87	3436	2.27	3643	2.69	4034	3.57	4404	4.54
2000	2299	2646	0.98	2941	1.39	3169	1.77	3367	2.17	3585	2.60	3784	3.04	4155	3.97	4504	4.96
2200	2529	2846	1.21	3137	1.67	3359	2.10	3558	2.52	3751	2.97	3937	3.43	4291	4.41		
2400	2759	3052	1.48	3326	1.97	3554	2.46	3745	2.92	3924	3.38	4100	3.87	4437	4.91		
2600	2989	3263	1.80	3518	2.32	3750	2.87	3937	3.37	4109	3.86	4272	4.37				
2800	3218	3477	2.18	3714	2.70	3941	3.30	4131	3.86	4298	4.40	4466	4.93				
3000	3448	3694	2.61	3913	3.14	4132	3.78	4328	4.41	4492	4.98						
3200	3678	3912	3.10	4115	3.64	4324	4.30	4520	4.99								

A41- -12_FA-66FG or A41PO-122FA-66FG

Wheel Diameter: 12.25 in.
Outlet Area: 0.73 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
800	1095	2144	0.46	2472	0.71	2777	1.00	3062	1.31	3328	1.66						
1000	1370	2359	0.62	2646	0.87	2914	1.17	3168	1.50	3412	1.85	3668	2.64				
1200	1644	2593	0.81	2861	1.11	3101	1.40	3329	1.74	3549	2.11	3966	2.92	4359	3.83	4729	4.81
1400	1918	2838	1.03	3094	1.39	3320	1.73	3528	2.07	3728	2.44	4109	3.28	4470	4.21	4818	5.21
1600	2192	3095	1.29	3333	1.70	3553	2.11	3751	2.49	3937	2.88	4288	3.72	4623	4.66	4943	5.70
1800	2466	3362	1.59	3583	2.05	3791	2.51	3985	2.97	4164	3.41	4494	4.28	4805	5.23	5105	6.29
2000	2740	3637	1.95	3843	2.46	4038	2.97	4224	3.48	4399	3.99	4718	4.96	5011	5.94	5291	6.98
2200	3014	3918	2.38	4112	2.92	4294	3.48	4470	4.04	4638	4.60	4951	5.72	5233	6.77		
2400	3288	4205	2.89	4386	3.45	4558	4.05	4724	4.67	4884	5.28	5187	6.50				
2600	3562	4494	3.48	4666	4.06	4829	4.69	4986	5.35	5137	6.02						
2800	3836	4784	4.17	4950	4.76	5104	5.42	5264	6.11								
3000	4110	5084	4.96	5237	5.56												

A41- -15_FA100FG or A41PO-152FA100FG

Wheel Diameter: 15.375 in.
Outlet Area: 1.3 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1500	1154	1516	0.38	1615	0.68	1874	1.03										
1800	1385	1462	0.51	1725	0.85	1965	1.22	2184	1.64	2384	2.08						
2100	1615	1615	0.68	1852	1.05	2073	1.46	2277	1.90	2467	2.38	2645	2.88				
2400	1846	1755	0.87	1995	1.30	2193	1.75	2384	2.22	2563	2.73	2733	3.26	3047	4.39		
2700	2077	1894	1.08	2146	1.60	2326	2.08	2509	2.59	2671	3.13	2832	3.69	3134	4.89	3411	6.17
3000	2308	2038	1.34	2300	1.95	2473	2.48	2632	3.02	2791	3.59	2943	4.19	3230	5.45	3498	6.79
3200	2538	2193	1.66	2444	2.33	2625	2.93	2774	3.51	2919	4.12	3063	4.75	3336	6.07	3593	7.48
3600	2769	2358	2.04	2578	2.73	2779	3.45	2924	4.08	3058	4.71	3191	5.38	3451	6.77		
3900	3000	2526	2.48	2716	3.19	2929	4.01	3077	4.71	3206	5.39	3326	6.08	3574	7.55		
4200	3231	2697	3.00	2861	3.71	3064	4.59	3231	5.41	3358	6.15	3476	6.88				
4500	3462	2870	3.58	3013	4.31	3199	5.22	3381	6.17	3511	6.98						
4800	3692	3044	4.25	3174	5.01	3338	5.92	3516	6.93								

A41- -15_FA-66FG or A41PO-152FA-66FG

Wheel Diameter: 15.375 in.
Outlet Area: 1.15 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
800	696	1512	0.38														
1000	1043	1642	0.54	1913	0.82	2155	1.12	2375	1.45	2578	1.83						
1200	1391	1820	0.75	2064	1.09	2284	1.44	2487	1.82	2676	2.21	3023	3.06	3238	4.00		
1400	1739	2026	1.03	2248	1.42	2451	1.83	2637	2.26	2812	2.71	3137	3.64	3436	4.63	3713	5.69
1600	2087	2250	1.39	2454	1.84	2641	2.31	2815	2.79	2979	3.29	3283	4.33	3564	5.43	3827	6.56
1800	2435	2487	1.84	2676	2.35	2849	2.88	3012	3.42	3166	3.98	3453	5.13	3718	6.33	3967	7.58
2000	2783	2734	2.40	2909	2.97	3071	3.56	3223	4.16	3368	4.77	3640	6.04	3892	7.35	4129	8.71
2200	3130	2989	3.08	3150	3.71	3303	4.37	3446	5.03	3583	5.70	3840	7.08	4080	8.51	4307	9.98
2400	3478	3250	3.90	3400	4.59	3542	5.31	3678	6.04	3807	6.77	4051	8.27	4280	9.81		
2600	3826	3517	4.88	3655	5.53	3788	6.40	3916	7.19	4040	7.99	4272	9.61				
2800	4174	3787	6.04	3915	6.84	4040	7.66	4161	8.51	4278	9.38						
3000	4522	4060	7.39	4181	8.24	4298	9.12										

Performance shown is for installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 #/ft.3). Performance ratings do not include the effects of appurtenances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Performance Data

Class I Class II Class III

A41-18 FA100FG or A41PO-182FA100FG

Wheel Diameter: 18.5 in.
Outlet Area: 1.89 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2000	1064	1030	0.46	1288	0.85	1530	1.34										
2500	1330	1154	0.64	1383	1.19	1586	1.60	1781	2.17	1970	2.81						
3000	1595	1288	0.87	1496	1.40	1681	1.97	1851	2.57	2013	3.21	2176	3.93				
3500	1862	1417	1.15	1622	1.77	1792	2.40	1949	3.07	2096	3.76	2237	4.48	2516	6.10	2784	7.91
4000	2128	1544	1.47	1756	2.22	1917	2.91	2059	3.65	2197	4.41	2328	5.18	2577	6.83	2821	8.67
4500	2394	1680	1.87	1892	2.75	2043	3.53	2179	4.51	2309	5.14	2431	5.99	2665	7.74	2885	9.60
5000	2660	1825	2.37	2017	3.51	2176	4.24	2307	5.09	2428	5.97	2545	6.89	2767	8.79	2973	10.7
5500	2926	1978	2.97	2143	3.96	2314	5.04	2441	5.99	2556	6.93	2666	7.90	2876	9.93		
6000	3191	2133	3.69	2275	4.68	2439	5.87	2576	6.99	2689	8.02	2793	9.05	2993	11.2		
6500	3457	2290	4.52	2414	5.54	2564	6.78	2711	8.09	2824	9.23	2926	10.3				
7000	3723	2449	5.49	2561	6.55	2693	7.81	2835	9.21	2959	10.6						
7500	3989	2609	6.59	2712	7.70	2828	8.97	2960	10.4								

A41-18 FA-66FG or A41PO-182FA-66FG

Wheel Diameter: 18.5 in.
Outlet Area: 1.89 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1500	904	1315	0.68	1542	1.06	1750	1.48										
2000	1205	1442	0.91	1649	1.36	1832	1.83	2002	2.34	2161	2.87						
2500	1506	1584	1.30	1779	1.72	1952	2.26	2109	2.84	2255	3.43	2527	4.69	2780	6.04	3023	7.50
3000	1807	1741	1.67	1921	2.14	2086	2.76	2236	3.41	2374	4.07	2630	5.47	2864	6.93	3084	8.48
3500	2108	1911	2.05	2076	2.67	2229	3.34	2372	4.06	2507	4.80	2751	6.34	2974	7.95	3182	9.62
4000	2410	2089	2.60	2241	3.31	2384	4.05	2518	4.81	2646	5.62	2883	7.31	3098	9.06	3297	10.9
4500	2711	2273	3.29	2415	4.08	2548	4.98	2674	5.71	2794	6.56	3021	8.38	3231	10.3	3424	12.2
5000	3012	2464	4.11	2595	4.97	2720	5.86	2838	6.75	2952	7.67	3167	9.58	3369	11.6	3559	13.7
5500	3313	2659	5.07	2780	6.01	2897	6.98	3009	7.96	3117	8.94	3321	11.0	3514	13.1		
6000	3614	2858	6.19	2970	7.22	3079	8.26	3185	9.31	3288	10.4	3482	12.5				
6500	3916	3060	7.49	3164	8.60	3267	9.71	3366	10.8	3463	12.0						
7000	4217	3264	8.99	3362	10.2	3457	11.4	3551	12.6								

A41-22 FA100FG or A41PO-222FA100FG

Wheel Diameter: 22.625 in.
Outlet Area: 2.81 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3200	1139	843	0.70	1051	1.30	1253	2.02										
4000	1423	931	0.95	1131	1.67	1294	2.43	1455	3.29	1616	4.25						
4800	1708	1027	1.28	1225	2.14	1374	2.99	1511	3.90	1643	4.87	1779	5.95				
5600	1993	1144	1.73	1311	2.65	1467	3.67	1593	4.65	1711	5.71	1826	6.81	2056	9.23	2284	11.9
6400	2278	1266	2.30	1400	3.25	1558	4.42	1686	5.57	1796	6.70	1901	7.88	2103	10.4	2303	13.1
7200	2562	1393	2.99	1511	4.03	1642	5.22	1780	6.57	1890	7.85	1990	9.12	2176	11.8	2354	14.6
8000	2847	1520	3.82	1629	4.99	1736	6.18	1882	7.60	1985	9.11	2084	10.5	2261	13.4	2428	16.3
8800	3132	1650	4.81	1752	6.11	1848	7.38	1958	8.77	2067	10.4	2178	12.0	2355	15.1		
9600	3416	1781	5.97	1877	7.50	1966	8.78	2054	10.2	2153	11.8	2260	13.6				
10400	3701	1914	7.31	2004	8.89	2087	10.4	2169	11.9	2251	13.5	2346	15.2				
11200	3986	2047	8.86	2132	10.6	2211	12.2	2287	13.8	2363	15.5	2440	17.2				
12000	4270	2181	10.6	2261	12.5	2337	14.2	2409	16.0								

A41-22 FA-66FG or A41PO-222FA-66FG

Wheel Diameter: 22.625 in.
Outlet Area: 2.81 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2800	1129	1131	1.19	1308	1.80	1461	2.42	1603	3.10								
3500	1411	1230	1.54	1394	2.24	1542	2.98	1675	3.75	1797	4.53	2025	6.22				
4200	1694	1343	1.96	1494	2.75	1631	3.59	1759	4.47	1878	5.38	2092	7.22	2288	9.17		
4900	1976	1465	2.48	1604	3.36	1732	4.29	1852	5.26	1965	6.26	2175	8.36	2362	10.5	2535	12.7
5600	2258	1590	3.10	1723	4.09	1843	5.10	1955	6.16	2062	7.25	2262	9.54	2446	11.9	2616	14.4
6300	2540	1718	3.82	1847	4.93	1961	6.05	2067	7.19	2167	8.37	2357	10.8	2534	13.4	2699	16.1
7000	2823	1853	4.68	1973	5.89	2084	7.13	2185	8.37	2280	9.64	2460	12.3	2629	15.0	2788	17.9
7700	3105	1993	5.69	2102	6.99	2209	8.35	2307	9.70	2398	11.1	2470	13.9	2732	16.8	2884	19.9
8400	3387	2139	6.89	2236	8.25	2336	9.70	2433	11.2	2521	12.7	2686	15.7	2840	18.8		
9100	3669	2287	8.28	2374	9.71	2466	11.2	2558	12.8	2647	14.6	2806	17.7	2954	21.0		
9800	3952	2439	9.87	2517	11.4	2601	13.0	2687	14.6	2772	16.4	2929	19.8				
10500	4234	2591	11.7	2664	13.3	2740	14.9	2820	16.7	2900	18.6						

Performance shown is for Installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 #/ft.3). Performance ratings do not include the effects of appurtenances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Performance Data

Class I Class II Class III

A41- -24 FA100FG or A41PO-242FA100FG

Wheel Diameter: 24.625 in.
Outlet Area: 3.33 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	901	706	0.61	939	1.27												
4000	1201	794	0.89	980	1.62	1155	2.48										
5000	1502	877	1.22	1062	2.12	1207	3.05	1346	4.07	1483	5.27						
6000	1802	978	1.67	1154	2.73	1290	3.79	1411	4.90	1528	6.08	1643	7.35	1878	10.2		
7000	2102	1094	2.29	1234	3.39	1382	4.69	1496	5.92	1601	7.19	1702	8.53	1900	11.4	2103	14.7
8000	2402	1214	3.07	1330	4.23	1465	5.64	1588	7.11	1689	8.57	1781	9.96	1960	13.0	2132	16.2
9000	2703	1338	4.01	1442	5.32	1549	6.72	1673	8.38	1781	10.0	1871	11.6	2037	14.8	2195	18.3
10000	3003	1463	5.15	1559	6.61	1651	8.08	1754	9.75	1865	11.6	1964	13.5	2125	17.0		
11000	3303	1589	6.50	1679	8.14	1763	9.73	1848	11.4	1945	13.3	2047	15.3	2217	19.3		
12000	3604	1717	8.10	1802	9.91	1880	11.6	1956	13.4	2035	15.2	2128	17.4				
13000	3904	1846	9.85	1926	11.9	1999	13.8	2070	15.7	2141	17.6	2216	19.7				
14000	4204	1976	12.1	2050	14.2	2121	16.3	2188	18.3								

A41- -24 FA-66FG or A41PO-242FA-66FG

Wheel Diameter: 24.625 in.
Outlet Area: 2.94 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	1020	1008	1.28	1173	1.94	1320	2.65										
4000	1361	1113	1.74	1266	2.55	1403	3.42	1525	4.29	1639	5.21						
5000	1701	1237	2.34	1375	3.22	1501	4.28	1618	5.32	1728	6.40	1924	8.60	2104	10.9		
6000	2041	1373	3.10	1499	4.17	1615	5.30	1723	6.47	1826	7.68	2016	10.2	2189	12.8	2346	15.5
7000	2381	1512	4.03	1633	5.26	1740	6.52	1841	7.82	1936	9.16	2116	12.0	2282	14.9	2437	17.9
8000	2721	1658	5.16	1772	6.56	1874	7.97	1968	9.40	2058	10.9	2226	13.9	2384	17.1	2532	20.4
9000	3061	1812	6.56	1913	8.08	2013	9.67	2103	11.3	2187	12.9	2346	16.2	2496	19.6	2637	23.2
10000	3401	1973	8.25	2062	9.87	2153	11.6	2242	13.4	2323	15.1	2474	18.7	2616	22.4		
11000	3741	2138	10.3	2216	12.0	2298	13.8	2381	15.7	2462	17.7	2608	21.6				
12000	4082	2305	12.7	2376	14.5	2450	16.4	2526	18.5	2602	20.5						
13000	4422	2477	15.4	2540	17.4	2606	19.4	2675	21.5								
14000	4762	2649	18.6	2707	20.7												

A41- -27 FA100FG or A41PO-272FA100FG

Wheel Diameter: 27.625 in.
Outlet Area: 4.22 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4800	1137	687	1.05	857	1.95	1019	3.01										
6000	1422	762	1.45	921	2.52	1055	3.66	1186	4.93	1313	6.32						
7200	1706	835	1.93	999	3.24	1119	4.51	1231	5.87	1339	7.32	1449	8.91				
8400	1991	929	2.58	1075	4.06	1196	5.55	1297	7.04	1394	8.60	1488	10.2	1675	13.8	1866	17.8
9600	2275	1028	3.41	1143	4.95	1276	6.75	1375	8.42	1463	10.1	1549	11.9	1714	15.6	1877	19.7
10800	2559	1130	4.42	1228	6.08	1343	7.99	1455	9.99	1541	11.9	1621	13.8	1773	17.7	1919	21.9
12000	2844	1234	5.64	1323	7.46	1415	9.40	1525	11.6	1621	13.8	1700	15.9	1842	20.2	1978	24.6
13200	3128	1340	7.08	1422	9.08	1502	11.1	1593	13.4	1693	15.9	1780	18.3	1919	22.9		
14400	3412	1446	8.78	1524	11.0	1597	13.2	1671	15.4	1760	18.0	1851	20.8	1999	25.9		
15600	3697	1554	10.8	1627	13.1	1695	15.5	1762	17.9	1834	20.5	1918	23.3				
16800	3981	1662	13.0	1731	15.6	1795	18.1	1858	20.7	1921	23.3	1990	26.2				
18000	4265	1771	15.6	1836	18.3	1897	21.1	1956	23.8								

A41- -27 FA-66FG or A41PO-272FA-66FG

Wheel Diameter: 27.625 in.
Outlet Area: 3.73 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3600	965	870	1.50	1025	2.31												
4800	1287	959	2.06	1091	2.99	1213	4.00	1330	5.09								
6000	1609	1065	2.80	1185	3.89	1293	5.03	1395	6.23	1492	7.49	1679	10.2				
7200	1930	1169	3.73	1291	5.00	1392	6.29	1485	7.63	1573	9.02	1739	12.0	1898	15.1	2051	18.5
8400	2252	1281	4.86	1395	6.34	1499	7.81	1587	9.31	1669	10.8	1823	14.1	1967	17.4	2106	21.0
9600	2574	1405	6.22	1505	7.91	1602	9.60	1694	11.3	1773	13.0	1919	16.5	2054	20.1	2182	23.9
10800	2895	1536	7.85	1620	9.75	1709	11.7	1797	13.5	1891	15.4	2022	19.3	2151	23.2	2272	27.3
12000	3217	1669	9.80	1747	11.9	1823	14.0	1904	16.1	1984	18.2	2130	22.4	2255	26.7	2370	31.1
13200	3539	1806	12.1	1878	14.3	1947	16.7	2017	19.0	2091	21.3	2234	26.0	2362	30.6		
14400	3861	1943	14.8	2011	17.2	2076	19.7	2140	22.2	2204	24.8	2338	29.9				
15600	4182	2082	17.9	2147	20.5	2208	23.2	2267	25.9	2326	28.7						
16800	4504	2222	21.5	2284	24.3	2342	27.1	2398	30.0								

Performance shown is for installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 #/ft.3). Performance ratings do not include the effects of appurtenances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Performance Data

Class I Class II Class III

A41-30 FA100FG or A41PO-302FA100FG

Wheel Diameter: 30.0 in.
Outlet Area: 4.98 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	1205	651	1.35	801	2.45	943	3.71										
7500	1506	721	1.87	869	3.21	987	4.59	1101	6.11	1214	7.79	1322	9.58				
9000	1807	799	2.53	947	4.16	1055	5.74	1154	7.39	1249	9.14	1344	11.0	1530	15.1		
10500	2108	893	3.43	1014	5.20	1132	7.12	1234	8.95	1309	10.9	1392	12.8	1554	17.1	1716	21.9
12000	2410	992	4.55	1087	6.43	1205	8.65	1301	10.8	1381	12.9	1457	15.0	1603	19.6	1744	24.4
13500	2711	1093	5.95	1178	8.01	1271	10.3	1376	12.8	1469	15.2	1531	17.5	1666	22.4	1795	27.5
15000	3012	1195	7.64	1272	9.59	1349	12.3	1441	14.9	1534	17.8	1609	20.4	1738	25.7		
16500	3313	1298	9.54	1371	12.1	1440	14.7	1513	17.3	1599	20.4	1684	23.5	1815	29.3		
18000	3614	1403	12.0	1471	14.7	1535	17.4	1599	20.3	1669	23.3	1748	26.6				
19500	3915	1508	14.7	1573	17.7	1632	20.6	1691	23.6	1750	26.7	1817	30.1				
21000	4217	1615	17.9	1675	21.1	1732	24.3	1786	27.4	1841	30.7						
22500	4518	1722	21.5	1778	24.9	1833	28.3										

A41-30 FA-66FG or A41PO-302FA-66FG

Wheel Diameter: 30.0 in.
Outlet Area: 4.39 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	1025	814	1.87	952	2.85												
6000	1367	906	2.52	1024	3.76	1132	4.98	1236	6.30	1335	7.69						
7500	1708	1013	3.61	1120	4.95	1217	6.34	1308	7.81	1394	9.34	1560	12.6				
9000	2050	1112	4.85	1224	6.43	1316	8.03	1400	9.67	1479	11.4	1628	14.9	1768	18.8	1904	22.8
10500	2392	1225	6.37	1325	8.22	1421	10.1	1507	11.9	1577	13.8	1714	17.7	1843	21.8	1967	26.2
12000	2733	1331	8.21	1434	10.3	1522	12.4	1605	14.5	1681	16.7	1812	21.0	1933	25.4	2048	30.1
13500	3075	1480	10.4	1555	12.8	1629	15.2	1707	17.6	1783	19.9	1916	24.7	2031	29.5	2140	34.5
15000	3417	1612	13.1	1681	15.7	1747	18.3	1815	21.0	1885	23.6	2019	28.9	2135	34.2		
16500	3759	1746	16.3	1810	19.1	1871	22.0	1931	24.9	1993	27.8	2120	33.6				
18000	4100	1881	20.0	1942	23.1	1999	26.1	2054	29.3	2109	32.5	2225	38.8				
19500	4442	2018	24.4	2075	27.6	2129	30.9	2181	34.3								
21000	4784	2156	29.3	2209	32.8												

A41-33 FA100FG or A41PO-332FA100FG

Wheel Diameter: 33.0 in.
Outlet Area: 6.02 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	397	543	1.26	701	2.47												
8000	529	620	1.83	752	3.31	869	4.88	986	6.67								
10000	661	688	2.53	825	4.44	927	6.22	1023	8.14	1116	10.2	1210	12.4				
12000	793	778	3.70	899	5.80	1002	7.93	1086	10.1	1168	12.3	1246	14.6	1402	19.7	1554	25.4
14000	926	875	5.10	963	7.32	1079	9.94	1162	12.4	1236	14.8	1307	17.4	1443	22.8	1576	28.6
16000	1058	975	6.67	1055	9.31	1144	12.1	1240	15.1	1313	17.9	1379	20.7	1503	26.4	1622	32.6
18000	1190	1078	9.06	1160	11.8	1220	14.6	1305	17.9	1390	21.3	1457	24.4	1575	30.7		
20000	1322	1182	11.7	1248	14.7	1311	17.8	1376	21.0	1455	24.7	1532	28.5	1652	35.5		
22000	1454	1287	14.9	1349	18.2	1406	21.5	1463	25.0	1525	28.6	1597	32.7				
24000	1587	1393	18.5	1450	22.3	1504	25.9	1556	29.6	1609	33.3	1667	37.4				
26000	1719	1499	23.0	1553	27.6	1604	30.9	1653	34.8								
28000	1851	1607	28.1	1657	32.3												

A41-33 FA-66FG or A41PO-332FA-66FG

Wheel Diameter: 33.0 in.
Outlet Area: 5.32 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	1128	763	2.51	882	3.75	993	5.12										
7500	1410	836	3.41	941	4.72	1038	6.23	1130	7.84	1219	9.55						
9000	1692	914	4.32	1014	5.92	1103	7.60	1186	9.36	1265	11.2	1416	15.2				
10500	1974	991	5.52	1093	7.36	1177	9.24	1254	11.2	1327	13.2	1464	17.4	1595	22.0	1722	26.8
12000	2256	1073	6.95	1169	9.05	1255	11.2	1329	13.3	1398	15.5	1526	20.1	1647	24.9	1763	30.0
13500	2538	1164	8.63	1247	11.0	1331	13.4	1408	15.7	1474	18.1	1596	23.1	1710	28.3	1819	33.6
15000	2820	1259	10.5	1332	13.2	1409	15.9	1484	18.5	1553	21.1	1672	26.5	1780	32.0	1883	37.8
16500	3102	1356	12.9	1423	15.8	1491	18.7	1561	21.6	1629	24.5	1780	30.3	1865	36.2	1953	42.3
18000	3384	1456	15.6	1518	18.7	1579	21.9	1642	25.0	1705	28.2	1828	34.5	1933	40.9		
19500	3666	1556	18.7	1615	22.0	1672	25.4	1727	28.9	1786	32.3	1903	39.1	2019	46.0		
21000	3947	1657	22.2	1713	29.8	1767	29.4	1819	33.1	1871	36.8	1981	44.2				
22500	4229	1759	26.2	1813	30.9	1864	33.8	1913	37.7	1961	41.7						

Performance shown is for installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 #/ft.³). Performance ratings do not include the effects of appearances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Performance Data

Class I Class II Class III

A41- -36 FA100FG or A41PO-362FA100FG

Wheel Diameter: 36.0 in.
Outlet Area: 7.17 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	1395	565	2.43	684	4.18	782	5.98										
12000	1674	620	3.27	741	5.34	820	7.42	913	9.59	995	12.0						
14000	1953	682	4.35	796	6.76	887	9.14	963	11.6	1034	14.1	1104	16.7				
16000	2232	761	5.71	848	8.37	946	11.2	1020	13.9	1085	16.6	1149	19.5	1271	25.5		
18000	2510	857	7.39	911	10.3	996	13.4	1079	16.5	1143	19.5	1203	22.7	1315	29.0	1423	35.9
20000	2789	943	9.42	981	12.6	1053	15.9	1130	19.4	1202	22.9	1261	26.2	1367	33.2	1467	40.3
22000	3068	990	11.8	1054	15.2	1114	18.8	1182	22.6	1255	26.5	1320	30.7	1424	37.7	1519	45.4
24000	3347	1065	14.7	1128	18.3	1184	22.2	1239	26.2	1305	30.3	1372	34.6	1482	42.7		
26000	3626	1147	18.0	1204	21.9	1256	26.0	1307	30.2	1360	34.6	1423	39.2				
28000	3905	1226	21.8	1280	26.0	1330	30.3	1377	34.8	1424	39.4	1476	44.2				
30000	4184	1306	26.2	1357	30.6	1405	35.2	1449	39.9	1493	44.8	1538	49.8				
32000	4463	1386	31.2	1435	35.9	1481	40.7	1523	45.7								

A41- -36 FA-66FG or A41PO-362FA-66FG

Wheel Diameter: 36.0 in.
Outlet Area: 6.33 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5600	1043	668	2.67	777	4.02	879	5.49										
8800	1390	742	3.68	841	5.36	930	7.11	1010	8.91	1087	10.8						
11000	1738	824	5.02	916	6.94	999	9.02	1074	11.1	1145	13.3	1274	17.8	1397	22.6	1519	27.8
13200	2085	914	6.80	998	8.93	1076	11.2	1148	13.7	1215	16.2	1337	21.3	1449	26.7	1554	32.1
15400	2433	1010	8.90	1087	11.5	1159	14.0	1227	16.6	1290	19.4	1408	25.2	1514	31.2	1615	37.3
17600	2780	1110	11.4	1181	14.5	1248	17.4	1311	20.2	1371	23.1	1483	29.5	1587	36.1	1682	42.9
19800	3128	1215	14.4	1279	17.9	1341	21.3	1400	24.5	1457	27.7	1563	34.3	1663	41.5	1756	49.0
22000	3476	1322	18.1	1381	21.8	1438	25.6	1493	29.5	1547	33.0	1648	40.1	1743	47.6	1835	56.5
24200	3823	1432	22.5	1485	26.4	1538	30.6	1590	34.8	1640	39.0	1736	45.9	1827	54.7		
26400	4171	1544	27.6	1593	31.8	1641	36.2	1689	40.8	1727	45.4	1828	54.4				
28600	4518	1657	33.6	1702	38.1	1747	42.7	1792	47.6	1836	52.5						
30800	4866	1771	40.5	1813	45.2	1855	50.1										

A41- -40 FA100FG

Wheel Diameter: 40.25 in.
Outlet Area: 9.43 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12500	1326	506	3.03	611	5.18	700	7.47										
15000	1591	554	4.09	663	6.68	743	9.27	816	12.0	890	15.0						
17500	1856	615	5.44	712	8.44	794	11.4	861	14.5	924	17.6	987	20.9				
20000	2121	681	7.14	758	10.5	846	14.0	912	17.3	971	20.8	1027	24.3	1137	31.9		
22500	2386	748	9.23	815	12.8	891	16.7	965	20.6	1023	24.4	1076	28.3	1176	36.3	1273	44.8
25000	2651	817	11.8	877	16.7	939	19.9	1011	24.3	1075	28.6	1128	32.8	1223	41.5	1312	50.3
27500	2916	886	14.8	942	19.0	996	23.5	1057	28.2	1122	33.1	1180	37.8	1273	47.1	1358	56.2
30000	3181	955	18.4	1009	22.9	1059	27.7	1108	32.7	1168	37.9	1227	43.2	1326	53.4		
32500	3446	1026	22.5	1077	27.4	1123	32.5	1169	37.8	1217	43.3	1272	49.0				
35000	3712	1097	27.3	1146	32.5	1189	37.9	1232	43.5	1274	49.3	1321	55.3				
37500	3977	1168	32.8	1214	38.3	1256	44.0	1296	49.9	1336	56.0	1375	62.3				
40000	4242	1240	39.0	1283	44.8	1324	50.9	1362	57.1								

A41- -40 FA-66FG

Wheel Diameter: 40.25 in.
Outlet Area: 8.34 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	1199	639	4.11	730	6.06	811	8.09	887	10.2	962	12.5						
12500	1499	703	5.44	788	7.74	864	10.1	934	12.6	998	15.2	1120	20.5	1241	26.4		
15000	1799	773	7.22	852	9.72	924	12.5	990	15.3	1051	18.2	1164	24.3	1268	30.5	1368	37.0
17500	2098	848	9.42	921	12.2	989	15.2	1052	18.3	1111	21.6	1218	28.4	1317	35.4	1408	42.5
20000	2398	927	11.9	995	15.3	1058	18.5	1117	21.9	1173	25.4	1277	32.9	1372	40.6	1460	48.5
22500	2698	1010	14.9	1072	18.8	1131	22.6	1187	26.2	1240	29.9	1339	37.9	1431	46.3	1518	54.9
25000	2998	1095	18.4	1152	22.7	1207	27.1	1260	31.2	1310	35.2	1405	43.5	1494	52.5	1577	61.9
27500	3297	1183	22.5	1235	27.3	1286	32.1	1336	36.8	1383	41.3	1474	50.2	1559	59.5	1639	69.4
30000	3597	1272	27.6	1320	32.5	1367	37.6	1414	42.9	1459	48.1	1545	57.8	1627	67.5		
32500	3897	1363	33.3	1407	38.4	1451	43.9	1495	49.6	1537	56.3	1620	66.2				
35000	4197	1455	39.8	1495	45.3	1536	51.1	1577	57.1	1618	63.2						
37500	4496	1547	47.3	1585	53.1	1623	59.1										

Performance shown is for installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 #/ft.3). Performance ratings do not include the effects of appurtenances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.



Performance Data

Class I Class II Class III

A41-44 FA100FG

Wheel Diameter: 44.5 in.
Outlet Area: 11.53 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
15000	1301	454	3.60	549	6.15	630	8.97										
18000	1561	496	4.84	594	7.94	667	11.1	734	14.4	803	18.1						
21000	1821	550	6.41	639	10.0	712	13.5	773	17.3	831	21.0	889	25.1				
24000	2082	607	8.39	679	12.4	759	16.6	818	20.6	872	24.8	923	29.1	1024	38.3		
27000	2342	667	10.8	728	15.2	799	19.9	865	24.5	917	29.1	966	33.8	1057	43.4	1147	53.8
30000	2602	727	13.8	783	18.5	841	23.5	907	28.8	964	34.0	1011	39.0	1098	49.5	1179	60.2
33000	2862	788	17.3	840	22.4	890	27.8	947	33.5	1007	39.3	1058	44.9	1142	56.1	1220	67.7
36000	3122	850	21.4	899	26.9	945	32.7	992	38.7	1047	45.0	1101	51.3	1189	63.5		
39000	3382	913	26.3	959	32.1	1002	38.2	1044	44.6	1090	51.3	1142	58.1	1236	71.7		
42000	3643	975	31.6	1020	38.1	1060	44.6	1099	51.3	1138	58.3	1183	65.5				
45000	3903	1039	38.2	1083	44.8	1120	51.7	1156	58.8	1193	66.1	1229	73.7				
48000	4163	1102	45.3	1142	52.4	1180	59.6	1215	67.1								

A41-44 FA-66FG

Wheel Diameter: 44.5 in.
Outlet Area: 16.19 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	1178	574	4.92	657	7.27	730	9.72	800	12.3	869	15.1						
15000	1472	630	5.48	708	9.26	777	12.2	840	15.2	899	18.2	1010	24.7				
18000	1766	692	8.56	764	11.6	830	14.9	890	18.3	945	21.8	1048	29.1	1142	36.6	1235	44.6
21000	2061	758	11.1	825	14.5	887	18.1	944	21.9	997	25.9	1095	34.0	1185	42.5	1268	51.0
24000	2355	828	14.1	890	18.1	947	22.0	1002	26.0	1052	30.4	1147	39.4	1233	48.6	1314	58.2
27000	2650	901	17.6	958	22.3	1012	26.7	1063	31.1	1111	35.5	1202	45.3	1286	55.5	1363	65.8
30000	2944	976	21.7	1029	26.9	1079	32.1	1127	37.0	1173	41.8	1260	51.9	1340	62.8	1416	74.1
33000	3238	1054	26.6	1102	32.2	1149	37.9	1194	43.6	1238	48.9	1320	59.6	1398	70.9	1471	82.9
36000	3533	1133	32.3	1177	38.2	1220	44.4	1263	50.7	1305	56.9	1383	68.5	1458	80.2		
39000	3827	1213	38.9	1254	45.2	1294	51.8	1334	58.6	1374	65.4	1440	78.4				
42000	4122	1294	46.6	1332	53.1	1370	60.1	1407	67.3	1444	74.6						
45000	4416	1376	55.2	1412	62.2	1447	69.4	1482	77.1								

A41-49 FA100FG

Wheel Diameter: 49.0 in.
Outlet Area: 13.96 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	1144	383	3.49	478	6.32	562	9.69										
20000	1431	428	4.92	517	8.28	588	11.9	656	15.9	724	20.4						
24000	1717	479	6.65	556	10.8	628	14.8	688	19.1	745	23.7	801	28.7	914	39.7		
28000	2003	532	8.85	602	13.7	667	18.4	728	23.1	780	28.0	830	33.2	927	44.6	1023	57.2
32000	2289	585	11.6	653	17.0	710	22.6	767	28.0	820	33.3	868	38.8	955	50.5	1040	63.5
36000	2575	640	14.9	705	20.9	759	27.2	809	33.5	860	39.4	908	45.4	992	57.8	1070	71.1
40000	2861	696	19.0	757	25.5	810	32.3	856	39.4	902	46.3	948	53.0	1033	66.2	1107	80.2
44000	3147	755	23.7	810	30.9	852	38.3	907	45.9	949	53.6	990	61.3	1072	75.9		
48000	3433	814	29.3	854	37.2	914	45.1	959	53.2	999	61.6	1037	70.1	1113	86.4		
52000	3720	873	35.8	920	44.3	967	52.8	1011	61.5	1050	70.4	1087	79.5				
56000	4006	934	43.3	977	52.4	1021	61.6	1063	70.8	1103	80.2						
60000	4292	995	51.8	1034	61.6	1075	71.4	1116	81.2								

A41-49 FA-66FG

Wheel Diameter: 49.0 in.
Outlet Area: 12.36 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	971	489	4.95	577	7.53												
16000	1254	541	6.84	615	9.94	682	13.2	748	16.8	811	20.7						
20000	1613	597	9.01	659	12.0	730	16.7	786	20.7	840	24.8	944	33.8	1045	43.6		
24000	1942	661	11.8	724	15.1	784	20.7	838	25.4	887	30.0	979	39.6	1068	50.0	1154	61.1
28000	2265	728	15.3	786	20.1	841	25.2	893	30.5	942	36.0	1028	46.7	1108	57.8	1185	69.5
32000	2589	795	19.5	852	25.0	903	30.6	950	36.2	997	42.3	1083	54.7	1159	67.0	1230	79.5
36000	2913	865	24.4	920	30.7	968	36.8	1013	43.0	1055	49.4	1137	63.0	1214	77.0	1282	90.8
40000	3236	938	30.3	988	37.1	1036	44.1	1078	50.9	1118	57.8	1195	72.1	1268	87.4	1337	103
44000	3560	1012	37.3	1058	44.7	1103	52.3	1146	59.9	1184	67.4	1256	82.6	1325	98.6		
48000	3883	1089	45.5	1130	53.3	1172	61.5	1213	69.9	1252	78.2	1321	94.6				
52000	4207	1167	55.0	1204	63.5	1243	72.0	1282	81.0	1319	90.0						
56000	4531	1246	65.9	1280	74.7	1316	83.9	1352	93.4								

Performance shown is for installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 in./ft. 3). Performance ratings do not include the effects of appurtenances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Performance Data

Class I

Class II

Class III

A41-54 FA100FG

Wheel Diameter: 54.25 in.
Outlet Area: 17.13 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	1168	349	4.41	434	7.91	509	12.1										
25000	1459	391	6.24	470	10.4	535	14.9	595	19.8	659	25.3						
30000	1751	439	8.44	507	15.6	571	18.6	625	23.9	676	29.6	726	35.8	826	49.3		
35000	2043	487	11.1	550	17.3	608	23.3	662	29.1	710	35.1	754	41.6	840	55.6	925	71.1
40000	2335	536	14.8	597	21.6	648	29.6	679	35.5	746	41.9	790	48.7	868	63.3	943	79.2
45000	2627	587	19.1	645	26.6	693	34.4	738	42.3	783	49.8	826	57.2	903	72.6	972	89.0
50000	2919	639	24.3	693	32.5	741	41.0	782	49.6	822	58.5	863	66.9	943	83.4	1007	101
55000	3211	693	30.5	742	39.5	789	48.6	829	58.1	867	67.8	903	77.5	976	95.7		
60000	3503	748	37.7	793	47.5	837	57.4	877	67.5	913	78.0	947	88.5	1014	109		
65000	3795	803	46.1	844	56.7	886	67.4	925	78.2	961	89.3	993	101				
70000	4086	859	55.8	896	67.2	935	78.7	973	90.2	1009	102						
75000	4378	915	66.9	950	79.0	986	91.3										

A41-54 FA-66FG

Wheel Diameter: 54.25 in.
Outlet Area: 15.35 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
15000	990	444	6.19	522	9.50												
20000	1320	493	8.58	559	12.4	619	16.5	677	21.0	734	26.7						
25000	1650	545	11.3	609	16.1	664	21.0	714	25.8	762	31.0	855	42.0	945	54.0		
30000	1980	604	15.0	661	20.3	714	26.0	763	31.3	807	37.6	889	49.5	968	62.3	1045	76.0
35000	2310	665	19.4	718	25.4	767	31.7	813	38.3	857	45.1	935	58.6	1007	72.3	1075	86.7
40000	2640	728	24.7	780	31.7	824	38.5	867	45.6	908	53.1	986	68.5	1054	84.0	1118	99.5
45000	2970	793	31.1	842	38.9	885	46.6	925	54.3	963	62.2	1036	79.1	1105	96.6	1167	114
50000	3300	860	38.7	905	47.2	948	56.0	986	64.5	1022	73.1	1090	90.8	1155	110	1217	129
55000	3630	929	47.7	970	56.9	1010	66.4	1049	76.0	1083	85.4	1147	104	1209	124		
60000	3960	1001	58.4	1037	68.1	1074	78.3	1110	88.7	1145	99.2	1207	120				
65000	4290	1073	70.5	1105	81.0	1139	91.8	1174	103	1207	114						
70000	4620	1146	84.7	1176	95.7	1207	107										

A41-60 FA100FG

Wheel Diameter: 60.0 in.
Outlet Area: 20.9 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		1"		2"		3"		4"		5"		6"		8"		10"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
24000	1149	313	5.24	390	9.48	459	14.5										
30000	1435	350	7.38	422	12.4	481	17.8	536	23.8	591	30.5						
36000	1722	392	9.98	455	16.2	513	22.2	562	28.6	608	35.5	654	43.1	745	59.6		
42000	2010	434	13.3	492	20.6	545	27.7	595	34.6	637	42.0	678	49.8	757	66.9	836	85.7
48000	2297	478	17.4	533	25.5	580	34.0	626	41.9	670	49.9	709	58.2	780	75.8	850	95.2
54000	2584	523	22.4	576	31.4	620	40.8	661	50.2	702	59.2	741	68.1	811	86.7	874	107
60000	2871	569	28.5	618	38.3	661	48.5	700	59.1	737	69.5	774	79.5	844	99.3	904	120
66000	3158	616	35.8	662	46.4	704	57.4	741	68.9	775	80.5	809	91.9	875	114		
72000	3445	665	44.0	706	55.8	747	67.6	783	79.9	816	92.4	847	105	909	130		
78000	3732	714	53.8	752	66.5	790	78.3	826	92.2	858	106	888	119				
84000	4019	763	65.0	798	78.6	834	92.4	869	106	901	120						
90000	4306	813	77.6	845	92.4	879	107	912	122								

A41-60 FA-66FG

Wheel Diameter: 60.0 in.
Outlet Area: 16.53 sq. ft.

CFM	Outlet Velocity FPM	Static Pressure															
		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
24000	1295	442	10.3	502	14.9	557	19.9	611	25.3	662	31.0						
30000	1619	488	13.5	545	19.3	596	25.1	642	31.0	686	37.2	771	50.6	853	65.2		
36000	1943	545	17.7	592	24.2	641	31.1	684	38.1	725	45.0	800	59.4	872	75.0	942	91.6
42000	2267	595	23.0	642	30.2	687	37.7	729	45.8	769	54.0	840	70.1	905	86.7	968	104
48000	2590	650	29.2	696	37.5	737	45.7	776	54.3	814	63.4	884	82.1	946	100	1004	119
54000	2914	707	36.6	752	46.0	791	55.2	827	64.5	862	74.1	929	94.5	991	116	1047	136
60000	3238	766	45.5	807	55.7	846	66.2	881	76.4	914	86.7	976	108	1056	131	1092	154
66000	3562	827	55.9	864	67.0	901	78.4	946	89.9	967	101	1026	124	1082	148		
72000	3886	890	68.2	923	80.0	958	92.3	991	105	1023	117	1079	142				
78000	4209	954	82.5	984	95.0	1015	108	1047	122	1078	135						
84000	4533	1018	98.8	1045	112	1075	126	1104	140								
90000	4857	1083	117	1105	132												

Performance shown is for installation Type D: ducted inlet/ducted outlet. Power rating (BHP) does not include drive losses. Performance data is based on standard air conditions (0.075 #/ft.³). Performance ratings do not include the effects of apparances in the airstream. MOST EFFICIENT FAN SELECTION APPEARS IN BOLD PRINT. To complete model code, add arrangement, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Performance Data

Class I Class II Class III

A41-4- FA100FG

Size	Class	Motor		Motor (Fan)		Peak Fan BHP	Cubic Feet Per Minute vs. Static Pressure														Outlet Area	Wheel Dia. Inches
		HP	Code	HP	Code		0"	2"	4"	6"	8"	10"	12"	14"	16"	18"	20"					
12	1	½	E	1750	3	0.30	1509	1291	1068	750										0.37	12"	
	2	¾	K	3450	2	7.31	2976	2875	2775	2659	2529	2409	2294	2078	1820	1477						
15	1	¾	H	1750	3	0.89	2877	2693	2382	2124	1861	1503										
	2	7/8	M	3450	2	6.79	5663	5581	5494	5400	5298	5185	5034	4658	4380	4147	3856	3598	3254	2836	1.30	15"
18	1	¾	G	1160	4	0.65	3463	3082	2624	1980												
	1	¾	K	1750	3	2.24	5228	5007	4749	4344	3979	3658	3317								1.88	18"
22	1	2	J	1160	4	1.85	5536	6181	6709	5085	4253	3373										
	1	7/8	M	1750	3	6.34	10010	9714	9410	9097	8788	8464	8104	6934	5982						2.81	22"
24	1	5	K	1160	4	2.82	8558	8063	7557	7063	6077	5290	4182									
	2	10	N	1750	3	9.68	12907	12585	12256	11919	11578	11241	10885	9948	8671	7624					3.33	24"
27	1	2	J	870	5	2.19	9101	8452	7657	6303	5081											
	1	5	L	1160	4	5.18	12265	11711	11141	10564	9870	8690	7850								4.22	27"
30	1	3	K	870	5	3.30	11772	10974	10139	8904	7516	6924										
	1	7/8	M	1160	4	7.82	15696	15105	14494	13875	13215	12312	11032	9137							4.98	30"
33	1	3	R	1750	3	26.9	23679	23291	22899	22500	22093	21679	21272	20434	19509	18636	16429	15230	13937	12219		
	1	5	L	870	5	5.32	15668	14796	13859	12892	11129	9789	8099								6.02	33"

A41-4- FA-66FG

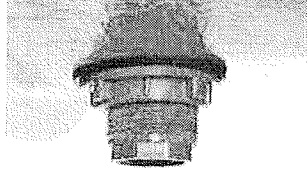
Size	Class	Motor		Motor (Fan)		Peak Fan BHP	Cubic Feet Per Minute vs. Static Pressure														Outlet Area	Wheel Dia. Inches
		HP	Code	HP	Code		0"	2"	4"	6"	8"	10"	12"	14"	16"	18"						
12	1	½	E	1750	3	0.25	1104	950	777	569												
	2	2	J	3450	2	1.94	2175	2101	2024	1945	1864	1781	1694	1612	1325	1065					0.73	12"
15	1	¾	G	1750	3	0.67	2389	2188	1965	1724	1452	1106										
	2	5	L	3450	2	5.14	4711	4611	4510	4407	4301	4192	4080	3848	3607	3355	3085	2793	2050		1.15	15"
18	1	¾	G	1160	4	0.48	2691	2312	1939	1590												
	1	2	J	1750	3	1.63	4090	3786	3555	3301	3027	2726	2391	1501							1.66	18"
22	1	1½	I	1160	4	1.29	4970	4626	4158	3629	3019	2263										
	1	5	L	1750	3	4.44	7498	7283	7048	6785	6467	6107	5755	5017	4128						2.48	22"
24	1	2	J	1160	4	1.97	6408	6040	5572	4989	4393	3693	2943									
	2	7/8	M	1750	3	6.78	9667	9435	9185	8913	8601	8239	7842	7075	6237	5238	4037				2.94	24"
27	1	1½	I	870	5	1.54	6990	6312	5667	4611	3605											
	1	5	L	1160	4	3.65	9320	8916	8305	7773	7097	6367	5700								3.73	27"
30	1	3	K	870	5	2.32	8952	8218	7459	6431	5455	4135										
	2	20	P	1750	3	18.9	18007	17647	17284	16917	16547	16178	15810	15040	14107	13012	12029	11066	8547		4.39	30"
33	1	5	L	870	5	3.74	11915	11110	10290	9323	8154	7077	5616									
	3	30	R	1750	4	30.5	23967	23571	23173	22771	22366	21958	21553	20737	19876	18834	17637	16497	14368	11977	5.32	33"

Performance shown is for installation Type D: ducted inlet/ducted outlet. Performance data is based on standard air conditions (0.075 #/ft³) and constant speed. Performance ratings do not include the effects of appurtenances in the airstream. To complete model code, add size, class of construction, motor enclosure code, motor horsepower code and motor speed code. Refer to page 2 for more information.

Options and Accessories

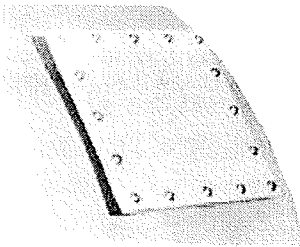
Drain

Fiberglass bulk head fitting assembled in housing, NPT female threaded fitting. 1" NPT on Series 41 and Series 41P.



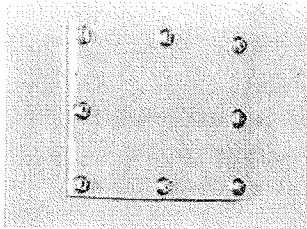
Access Door

Raised, bolted type door - held in place with zinc plated bolts and gasketed for a tight seal.



Inspection Door

Allows periodic visual inspection of wheel - fastened with stainless steel bolts and gasketed for tight seal.



Flanged Inlet

Fiberglass inlet flange is available. Flanges are drilled upon request. Flanged and drilled inlet is required when inlet control damper is furnished.

Disconnect Switch

On-off switch mounted to the unit to provide safety during maintenance.

V-Belt Drives

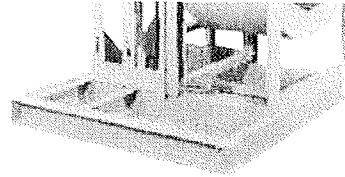
Constant speed (fixed pitch) or adjustable speed (variable pitch) oil, heat, and static resistant type V-Belt Drives, oversized for long life and continuous duty as standard, are available upon request.

Inlet Boxes

Solid fiberglass construction. Inlet box improves entry conditions and minimizes losses which are generally associated with duct elbows at the fan inlet. Inlet boxes are designed for specific applications. Contact factory.

Arrangement 1 Sub-Base

Common structural support for Arrangement 1 fan and motor. Specify motor mounting position (see page 6). Epoxy coated steel. Series 41 only.



Arrangements

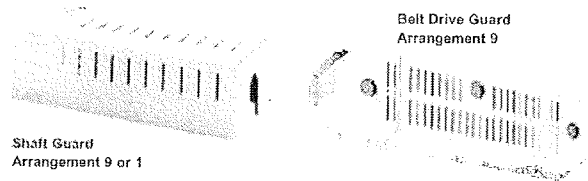
Arrangement 8 and other arrangements not shown are available, (see page 6). Contact factory.

Vibration Isolators

Rubber-in-shear or spring type isolators available on all models.

Drive Guards

Encloses the drive assembly while permitting circulation of ambient air. Standard features include: tach opening, belt tension openings and adjustable length. Series 41 only.

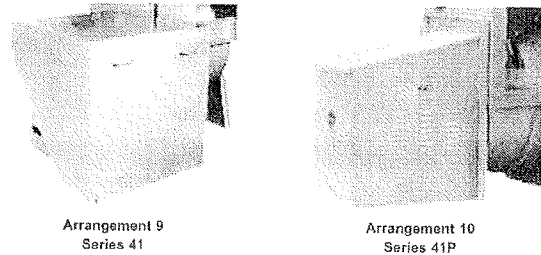


Inlet and Outlet Guards

Spiral ring guard offers protection on inlet side and a wire mesh guard can be furnished for the outlet side. Guards are epoxy coated steel.

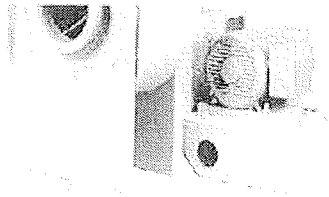
Combination Drive Guard and Weather Cover

Covers motor and shaft sheaves as well as belts. Combines guarding the drive as well as protection from the weather. Epoxy coated steel. Specify fan arrangement.



Arrangement 9M Motor Base

Accommodates a larger frame size motor than the standard arrangement 9 base. Series 41 only.



General Construction Options

Abrasive/Erosive Resistant Coating

HartKoate is an abrasive/erosive resistant coating developed by Hartzell Fan for application in environments where abrasive/erosive conditions may exist. HartKoate helps prevent premature deterioration of equipment in environments where uncoated fans may fail.

Impact resistant HartKoate is applied to a 50-60 mil thickness suitable for temperatures to 250°F.

HartKoate is particularly appropriate for use when water mist and/or abrasive particles exist in the airstream.

Contact your Hartzell representative for further details concerning the application of HartKoate coating to fiberglass fans in corrosive atmospheres.

Hi-Cor Construction

All airstream surfaces exposed to a corrosive environment will be protected with a layer of Synthetic (Nexus) surfacing veil. An additional final coat of resin will be applied for extra corrosion resistance.

When Hi-Cor construction is required, the factory should be consulted concerning the corrosive environment involved.

Electrostatically Grounded Fiberglass Fans

For applications in which fiberglass fans are handling gas fumes that are not only corrosive but also potentially explosive, the equipment should be specially constructed to control and remove static electricity. Interior airstream surfaces can be coated with a "carbon rich" resin coat and grounding straps secured from the side of the housing to the fan's steel base. All that remains to effectively ground the airstream is to ground the fan base at the time of installation.

SAFETY ACCESSORIES, APPLICATION AND USE WARNING

The safe application and use of equipment supplied by Hartzell Fan, Inc. is the responsibility of the installer, the user, the owner, and the employer. Since the application and use of its equipment can vary greatly, Hartzell Fan, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. Hartzell Fan, Inc. sells its equipment with and without safety accessories, and accordingly, it can supply such safety accessories only upon receipt of an order. The need for safety accessories will frequently depend upon the type of system, fan location and operating procedures being employed. The proper protective safety accessories to meet company standards, local codes, and the requirements of the Occupational Safety and Health Act must be determined by the user since safety requirements vary depending on the location and use of the equipment. If applicable local conditions, standards, codes or OSHA rules require the addition of the safety accessories, the user should specify and obtain the required safety accessories from Hartzell Fan, Inc. and should not allow the operation of the equipment without them.

Owners, employers, users and installers should read "RECOMMENDED SAFETY PRACTICES FOR USERS AND INSTALLERS OF INDUSTRIAL AND COMMERCIAL FANS" published by the Air Movement and Control Association International, Inc., 30 West University Drive, Arlington Heights, Illinois 60004. A copy of this publication is enclosed with each fan shipped from Hartzell Fan, Inc., and is available upon request at Hartzell's office in Piqua, Ohio 45356.

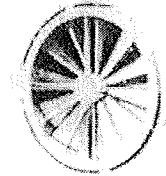
Please contact Hartzell Fan, Inc. or your local Hartzell representative for more information on product types, safety accessories, and sound performance estimates.

Remember, the selection of safety accessories and the safe application and use of equipment supplied by Hartzell Fan, Inc. is your responsibility.

Heavy-Duty Control Dampers

Inlet Control Damper

Dampers are mounted on the blower's drilled inlet flange to both increase the efficiency of the system and permit control of air volume. Dampers are epoxy coated or stainless steel construction.

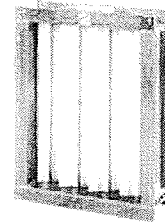


Outlet Dampers

Dampers are mounted directly on the blower outlet to control the volume of air delivered to the system. Opposed and parallel blade dampers are available in steel, stainless steel, coated steel and solid fiberglass.

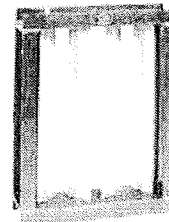
Parallel Blade Type

Best suited for applications requiring accurate air volume in a range from wide open to 75% of wide open. Usually used for balancing the system or for modulated control when pressure drop is variable.



Opposed Blade Type

Best suited for control over a broad range of air volume with more precise control.



Both types of outlet control dampers are available in three classifications:

- Class I – Maximum static pressure: 5" SP
Maximum velocity: 3900 FPM
- Class II – Maximum static pressure: 8½" SP
Maximum velocity: 5100 FPM
- Class III – Maximum static pressure: 20" SP
Maximum velocity: 6000 FPM

CONTACT YOUR LOCAL HARTZELL REPRESENTATIVE FOR ASSISTANCE.

1-800-336-3267

Hartzell Warranty

LIMITED WARRANTIES

Hartzell represents to Buyer that any goods to be delivered hereunder will be produced in compliance with the requirements of the Fair Labor Standards Act of 1938 as amended.

Hartzell also warrants to Buyer its goods to be free from defects in workmanship and material under normal use and service for one (1) year after tender of delivery by Hartzell, plus six months allowance for shipment to approved stocking dealers and distributors. No warranty extends to future performance of goods and any claims for breach of warranty or otherwise accrues upon tender of delivery.

The foregoing constitute Hartzell's sole and exclusive warranties and are in lieu of all other warranties, whether written, oral, express, implied or statutory.

LIMITATION OF LIABILITY FOR BREACH OF WARRANTY

Hartzell's obligation for any breach of warranty is limited to repairing or replacing, at its option, without cost to Buyer at its factory any goods which shall, within such a warranty period, be returned to it with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been defective. Any request for repair or replacement should be directed to Hartzell Fan, Inc., P.O. Box 919, Piqua, Ohio 45356. Hartzell will not pay for any repairs made outside its factory without its prior written consent. This does not apply to any such Hartzell goods which have failed as a result of faulty installation or abuse, or incorrect electrical connections or alterations, made by others, or use under abnormal operating conditions or misapplication of the goods.

LIMITATION OF LIABILITY

To the extent the above limitation of liability for breach of warranty is not applicable, the liability of Hartzell on any claim of any kind, including negligence, for any loss or damage arising out of or connected with, or resulting from the sale and purchase of the goods or services covered by these Terms and Conditions of Sale or from the performance or breach of any contract pertaining to such sale or purchase or from the design manufacture, sale, delivery, resale, installation, technical direction installation, inspection repair, operation or use of any goods or services covered by these Terms and Conditions shall, in no case exceed the price allocable to the goods or services which gave rise to the claim and shall terminate one year after tender of delivery of said goods or services, plus six months allowance for shipment to approved stocking dealers and distributors.

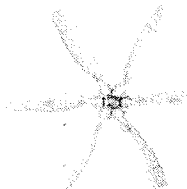
In no event whether as a result of breach of contract, or warranty or alleged negligence, defects, incorrect advice or other causes, shall Hartzell be liable for special or consequential damages, including, but not limited to, loss of profits or revenue, loss of use of the equipment or any associated equipment, cost of substitute equipment, facilities or services, down time costs, or claims of customers of the Buyer for such damages. Hartzell neither assumes nor authorizes any person to assume for it any other liability in connection with the sale of its goods or services.

NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS

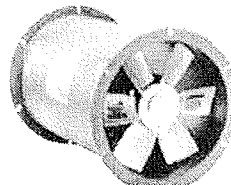
HARTZELL DOES NOT WARRANT THAT SAID GOODS ARE OF MERCHANTABLE QUALITY OR THAT THEY ARE FIT FOR ANY PARTICULAR PURPOSE. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY AND THERE IS NO IMPLIED WARRANTY OF FITNESS.



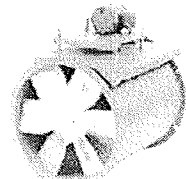
Propeller Fans



Cooling Tower &
Heat Exchanger Fans



Duct Fans



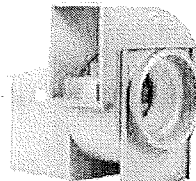
Duct Axial Fans



Vaneaxial Blowers



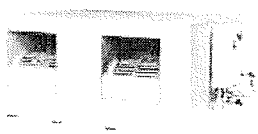
Cool Blast & Utility Fans



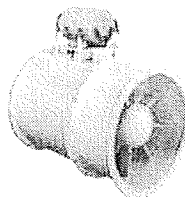
Steel Centrifugal Blowers



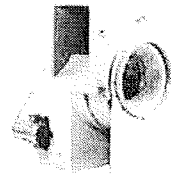
Roof Ventilators -
Steel & Fiberglass



Heating Equipment -
Gas & Steam



Fiberglass
Axial Flow Fans



Fiberglass Centrifugal Blowers



Marine -
Mine Duty Blowers

Hartzell Fan, Inc., Piqua, Ohio 45356 • Plants in Piqua, Ohio and Portland, Indiana

Litho in U.S.A. A-160-C 4/05 2.5M

HARTZELL FAN, INC.

EPOXY CHEMICAL RESISTANT COATING

PHYSICAL DATA

- 1. Product Class: Sherwin-Williams Waterbased Tile-Clad Epoxy
- 2. Mfg./Prod. #: B73-100 Series / B73V100 Hardener
- 3. Texture: Smooth
- 4. Color: Light Gray - Federal Standard #26373
- 5. Gloss: High-gloss
- 6. Weight per gal: 10.5 lbs.
- 7. Shelf life: 1 years at 77 deg. F. - unopened

APPLICATION DATA

- 1. Substrate: Steel and aluminum
- 2. Surface Preparation: Steel - minimum SSPC-SP1, phosphatized for in-factory application - minimum SSPC-SP2, for field use, plus 2 to 4 mils of Tile Clad Epoxy Primer
Galvanized, galvaneal, aluminum - minimum SSPC-SP1
Note: Do not use hydrocarbon solvents
Faint bare steel within 8 hours
- 3. Application: Spray, brush or roll.
- 4. Reduction: Not required - water as needed, 10% max.
- 5. Sweat-in: 30 min.
- 6. Cure: Air dry - do not force dry.
- 7. Drying Time: Recoat: 3 hrs. @ 50° F.
6 hrs. @ 77° F.
3 hrs. @ 100° F.
Maximum 30 days, then abrade before repainting
- 8. Min. Dry Film Thickness: Dry Hard: 7 days
3-4 mils
- 9. Pot Life: 3.5 hours (77° F./50% rh)
- 10. Cleaner: Water

TECHNICAL DATA

- 1. Surface Coverage: 260 sq. ft./gal. at 3.0 mils DFT
- 2. Viscosity: Not available
- 3. VOC: 1.65 lbs./gallon
- 4. Lead Content: 0%
- 5. Volume Solids: 44%
- 6. Temperature Limit: 250° F. dry

ENGINEERING STANDARD	EPOXY CHEMICAL RESISTANT COATING DATA	WRITTEN BY	DATE	ISS
		APPROVED BY	NUMBERS/ISSUE DATE	PAGE
		RLF	11/15/04	9.1.2
		TJG	12/3/02	1 of 1

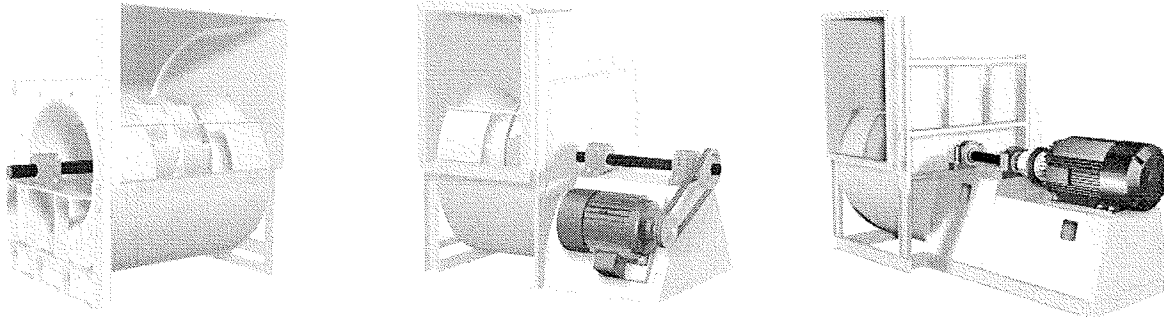
READ AND SAVE THESE INSTRUCTIONS

PN 463687

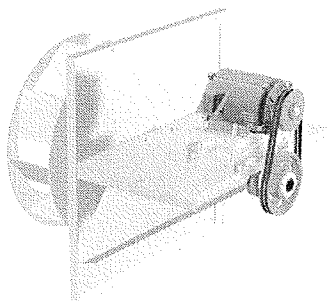


- CENTRIFUGAL (BISW, AFSW, BIDW, AFDW)
- INDUSTRIAL PROCESS (IPA, IPO, IPW)
- PLENUM (QEP)
- PLUG (PLG)

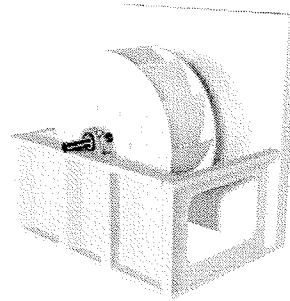
Installation, Operation and Maintenance Manual



CENTRIFUGAL AND INDUSTRIAL



PLUG



PLENUM

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Wheel and cone radial gap, overlap & alignment	6-7	WARRANTY	Backcover

Report any damaged equipment to the shipper immediately!

All Centrifugal, Industrial Process, Plenum and Plug fans are shipped on a skid or packaged to minimize damage during shipment. The transporting carrier has the responsibility for delivering all items in their original condition as received from Greenheck. The individual receiving the equipment is responsible for inspecting the unit for obvious or hidden damage, recording any damage on the bill of lading before acceptance and filing a claim (if required) with the final carrier.

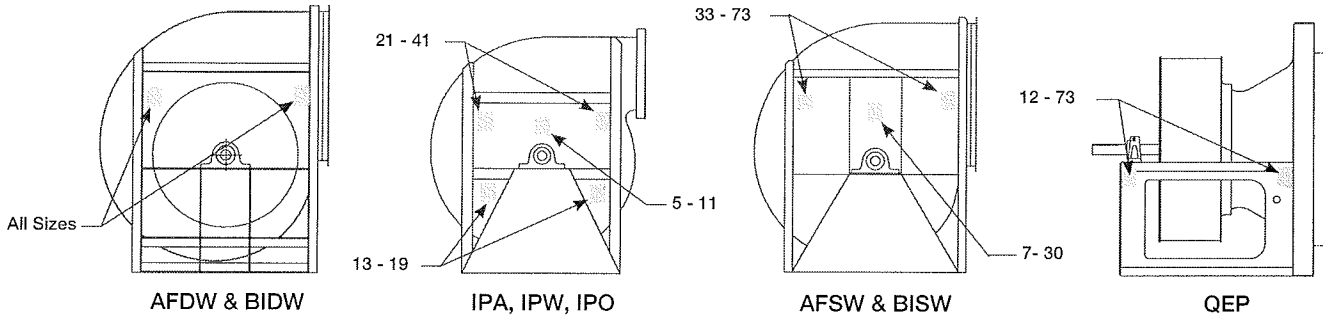
GENERAL INFORMATION

To insure a successful installation, the instructions in this manual should be read and adhered to. Failure to comply with proper installation procedures may void the warranty.

HANDLING

Fans are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. See figures below for proper lifting locations. Location of brackets varies by model and size. QEP plenum fans utilize holes located in the framework of the fan. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of fan to resist corrosion.

FANS SHOULD NEVER BE LIFTED BY THE SHAFT, HOUSING, MOTOR, BELT GUARD OR ACCESSORIES.



STORAGE

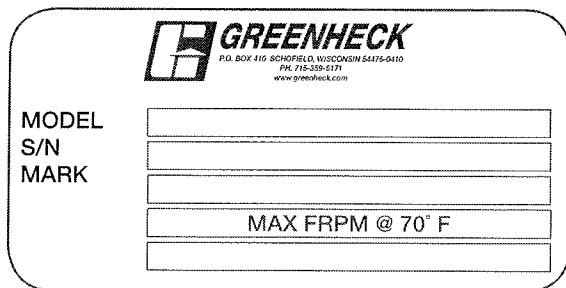
When a fan is not going to be in service for an extended amount of time, certain procedures should be followed to keep the fan in proper operating condition.

- Rotate fan wheel monthly and purge bearings once every three months
- Cover unit with tarp to protect from dirt and moisture (Note: do not use a black tarp as this will promote condensation)
- Energize fan motor once every three months
- Store belts flat to keep them from warping and stretching
- Store unit in location which does not have vibration
- After storage period, purge grease before putting fan into service

If storage of fan is in a humid, dusty or corrosive atmosphere, rotate the fan and purge the bearings once a month. Improper storage which results in damage to the fan will void the warranty.

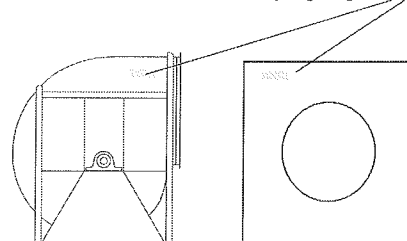
UNIT IDENTIFICATION

The tag below is an example of an identification label on the fan. The information provides general details about the fan, as well as containing specific information unique to the unit. When contacting your Greenheck representative with future needs or questions, please have the information on this label available.



Tags are mounted in an area which is clearly visible, usually near the fan outlet on the drive side of the fan. The exact tag location may differ due fan model and size.

Typical mounting locations for identifying tags



- Model - General description of fan
- S/N - Serial Number assigned by Greenheck, which is a unique identifier for every unit
- Mark - Customer supplied identification

CAUTION!

When installing a fan, ensure the proper protective devices are used to protect personnel from moving parts and other hazards. A complete line of protective accessories are available from Greenheck including: inlet guards, outlet guards, belt guards, shaft guards, protective cages and electrical disconnects.

Check local codes to ensure compliance for all protective devices.

For further details on safety practices involving industrial and commercial fans please refer to AMCA Publication 410.

ELECTRICAL DISCONNECTS

All fan motors should have disconnects located in close visual proximity to turn off electrical service. Service disconnects shall be locked out when maintenance is being performed.

MOVING PARTS

All moving parts must have guards to protect personnel. Refer to local codes for requirements as to the number, type and design. Fully secure fan wheel before performing any maintenance. The fan wheel may start "free wheeling" even if all electrical power has been disconnected. Before the initial start-up or any restart, check the following items to make sure that they are installed and secure.

GUARDS (BELT, SHAFT, INLET, OUTLET)

Do not operate fans without proper protective devices in place. Failure to do so may result in serious bodily injury and property damage.

ACCESS DOORS

Before opening access doors ensure the fan wheel has stopped moving and that the wheel has been secured from being able to rotate. Do not operate fan without access door in its fully closed position.

AIR PRESSURE AND SUCTION

In addition to the usual hazards associated with rotating machinery, fans also create a dangerous suction at the inlet. Special caution needs to be used when moving around a fan whether it is in operation or not. Before start-up, make sure the inlet area is clear of personnel and loose objects.

INSTALLATION

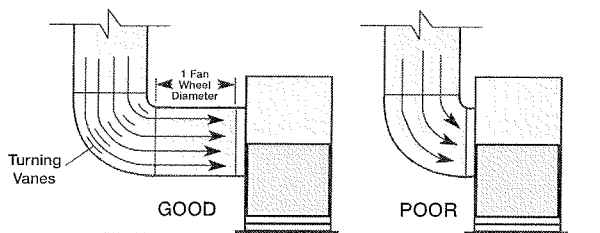
Installations with inlet or discharge configurations that deviate from this standard may result in reduced fan performance. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel yielding large system losses and increased sound levels. Free discharge or turbulent flow in the discharge ductwork will also result in system effect losses. Refer to the following diagrams for the most efficient installation conditions.

CENTRIFUGAL AND INDUSTRIAL PROCESS FANS - INSTALLATIONS

DUCTED INLET INSTALLATIONS

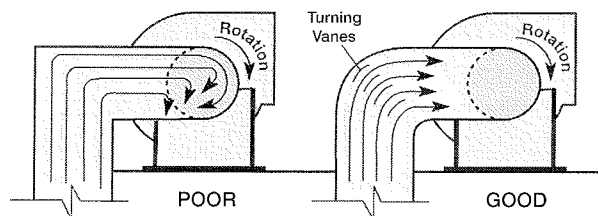
Inlet Duct Turns

Installation of a duct turn or elbow too close to the fan inlet reduces fan performance because air is loaded unevenly into the fan wheel. To achieve full fan performance, there should be at least one fan wheel diameter between the turn or elbow and the fan inlet.



Inlet Spin

Inlet spin is a frequent cause of reduced fan performance. The change in fan performance is a function of the intensity of spin and not easily defined. The best solution is proper duct design and airflow patterns.

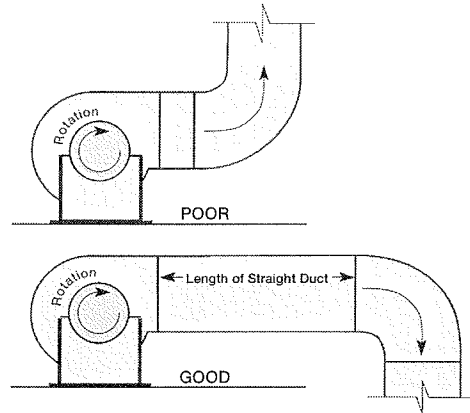


DUCTED OUTLET INSTALLATIONS

Discharge Duct Turns

Duct turns located near the fan discharge should always be in the direction of the fan rotation.

Fan performance is reduced when duct turns are made immediately off the fan discharge. To achieve cataloged fan performance there should be at least three equivalent duct diameters of straight ductwork between the fan discharge and any duct turns.



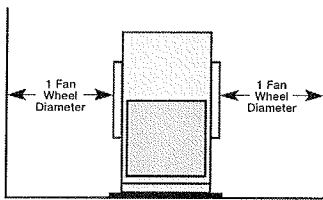
NON-DUCTED INSTALLATIONS

Non-Ducted Inlet Clearance

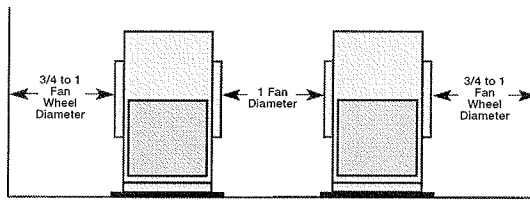
Installation of a fan with an open inlet too close to a wall or bulkhead will cause reduced fan performance. It is desirable to have one fan wheel diameter between parallel fan units and a minimum of three-fourths of a wheel diameter between the fan inlet and the wall.

Free Discharge

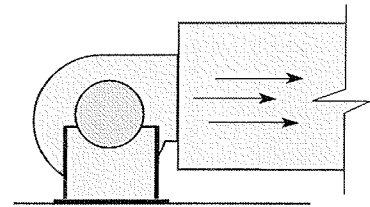
Free or abrupt discharge into a plenum results in a reduction in fan performance. The effect of static regain in discharge is not realized.



Single Fan Installation



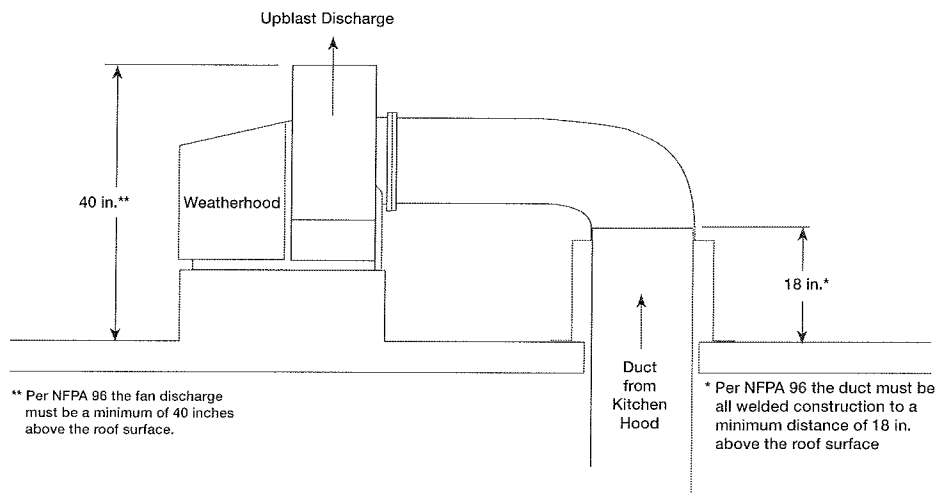
Parallel Fan Installation



CENTRIFUGAL - Outdoor Installation for UL/cUL 762 Listed Fans for Restaurant Exhaust

The UL/cUL 762 listing for restaurant exhaust is available on BISW model. Fans are listed for a maximum operating temperature of 375°F and include a bolted access door and 1 in. drain connection. An outlet guard is strongly recommended when the fan discharge is accessible. An upblast discharge is recommended. The fan discharge must be a minimum of 40 in. above the roof line and the exhaust duct must be fully welded to a distance of 18 in. above the roof surface.

This drawing is for dimensional information only. See the latest edition of NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations for detailed installation instructions, materials, duct connections and clearances.

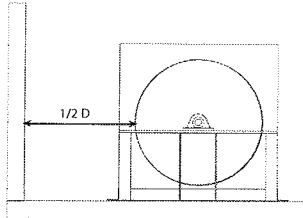


PLENUM AND PLUG FANS - INSTALLATIONS

UNHOUSED WHEELS

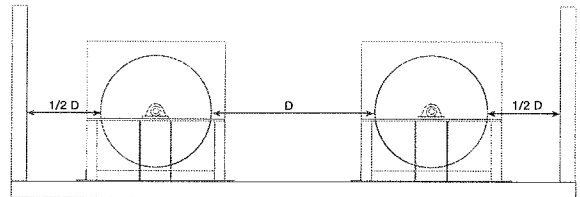
Adjacent Walls

The distance between the fan and walls or ceilings will effect the performance of the fan. The recommended distance between the fan wheel and any wall is a minimum of one-half wheel diameter. Multiple walls reduce the performance even more.



Side by Side

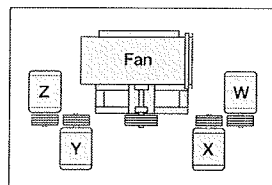
When two or more plenum fans are in parallel, there should be at least one fan diameter spacing between the wheels. Applications with less spacing will experience performance losses.



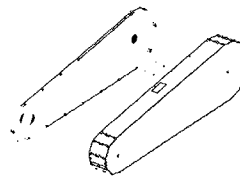
BELT GUARDS

Greenheck offers four types of customized belt guards dependent upon fan model, arrangement and motor position. The four types of belt guards are shown in illustrations to the right.

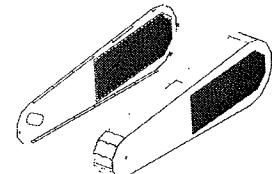
If the guard is not purchased from Greenheck, they must be supplied by the installer or owner.



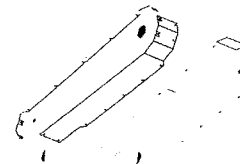
Motor position and fan rotation are determined from drive side



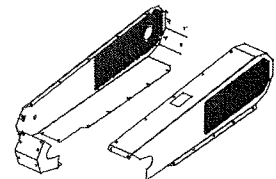
QEP & SW - Arr. 1, 3
(Mtr Pos. W / Z)
SW - Arr. 9, 10
PLG



DW - Arr. 3
(Mtr Pos. W / Z)

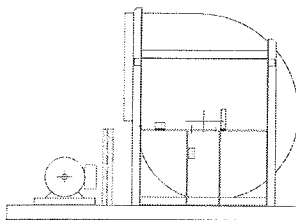


QEP & SW - Arr. 1, 3
(Mtr Pos. X / Y)

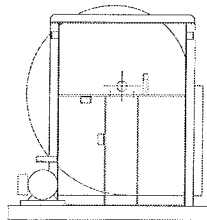


DW - Arr. 3
(Mtr Pos. X / Y)

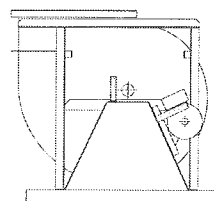
If the belt guard is not factory mounted or was not supplied by Greenheck, then it must be field mounted. **Brackets and mounting hardware are the responsibility of the installer.** The figures below illustrate suggested attachment points for belt guard mounting bracket locations. These locations vary with motor mounting position, arrangement, and fan type. The bearing supports and fan structure are used in most instances and when the motor is not mounted to the fan itself, a bracket should also be located near it. This information is intended as only a guide and actual field conditions may dictate another mounting location for the guard brackets. Refer to local codes for securing guarding.



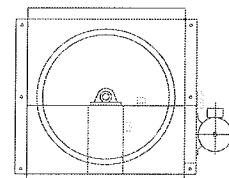
Mtr. Position: W/Z
Arr. - 1,3



Mtr. Position: X/Y
Arr. - 1,3



Mtr. Position: L/R
Arr. - 9



Mtr. Position: Side

Suggested Attachment Points

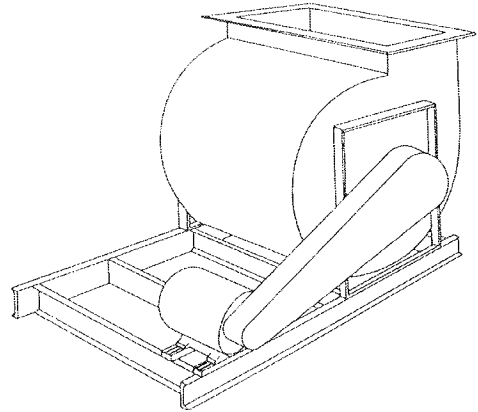
BASES

(FOUNDATION AND ISOLATION)

Critical to every fan installation is a strong, level foundation. A reinforced poured concrete pad with a structural steel base or inertia base provides an excellent foundation. Structural bases must be sturdy enough, with welded construction, to prevent flexing and vibration.

To eliminate vibration and noise from being transferred to the building, vibration isolators should be used. The fan is mounted directly on the isolation base and must be supported for the entire length of the fan base angle (Refer to the installation manual for structural bases if the base was supplied by Greenheck). Isolators are installed between the isolation base and the foundation.

After the fan, isolation base, and isolators are installed, the entire assembly must be leveled. Position the level on the isolation base, not the fan shaft, for proper leveling. Additionally, the motor and fan shafts must be level and parallel relative to each other for proper alignment.



Typical Fan on Isolation Base

ROTATABLE HOUSINGS

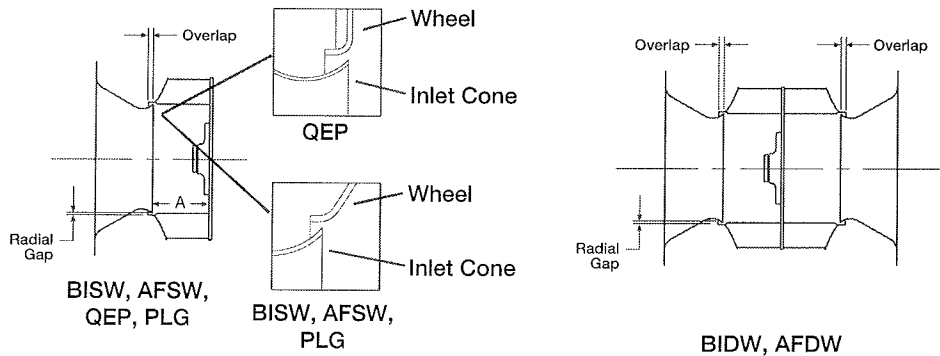
It may be necessary to rotate the scroll of the fan to achieve a different discharge position than what was originally supplied. Centrifugal fans models BISW, AFSW (sizes 7 - 30, arr. 1, 4, 8, 9, and 10, class I and II) and Industrial Process fans (sizes 5 - 19, standard and heavy duty) have the flexibility to be rotated in the field. This is accomplished by removing the housing bolts, rotating the housing to a new discharge position, and reinstalling the bolts.

RADIAL GAP, OVERLAP & WHEEL ALIGNMENT

Efficient fan performance can be maintained by having the correct radial gap, overlap and wheel alignment. These items should be checked after the fan has been in operation for 24 hours and before start-up after the unit has been serviced. Radial gap and overlap information applies to models: BISW, AFSW, BIDW, AFDW, QEP, and PLG.

Inlet Cone to
Backplate Distance
(inches)

Unit Size	"A" Dimension	
7 - 10	3 ⁵ / ₈	± 1/8
12	4	± 1/8
13	4 ⁷ / ₁₆	± 1/8
15	5	± 1/8
16	5 ⁷ / ₁₆	± 1/8
18	6 ³ / ₈	± 1/8
20	7	± 3/16
22	7 ¹³ / ₁₆	± 3/16
24	8 ⁵ / ₈	± 1/4
27	9 ⁷ / ₁₆	± 1/4
30	10 ⁹ / ₁₆	± 3/8
33	11 ⁷ / ₁₆	± 3/8
36	12 ³ / ₄	± 3/8
40	14 ³ / ₁₆	± 3/8
44	15 ⁹ / ₁₆	± 3/8
49	17 ¹ / ₈	± 1/2
54	18 ¹⁹ / ₁₆	± 1/2
60	20 ¹⁵ / ₁₆	± 1/2
66	22 ⁷ / ₈	± 1/2
73	25 ¹ / ₂	± 1/2



RADIAL GAP

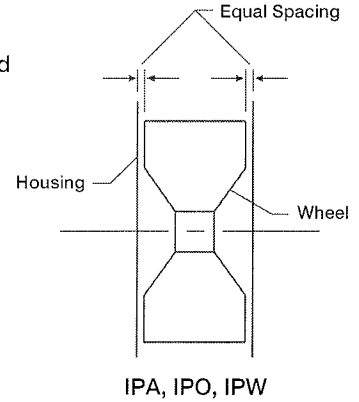
Radial gap is adjusted by loosening the inlet cone/ring bolts and centering the cone/ring on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering the wheel is acceptable as a secondary option.

OVERLAP

Overlap is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft. The transition between the inlet cone and wheel should be as shown; there is a smooth feel to the profile when moving from one component to the other. Overlap on double width fans is set by having equal spacing on each side of the wheel.

WHEEL ALIGNMENT CONTINUED

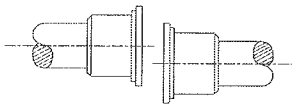
Correct wheel alignment for an industrial process fan (model IPA, IPO, or IPW) is achieved by centering the wheel in the housing.



FLEXIBLE COUPLINGS (ARR. 8 ONLY)

Check for misalignment between the coupling halves. Parallel and angular misalignment and separation gap are illustrated below. Refer to coupling manufacturer's installation instructions for allowable misalignment and separation gap tolerances. When correcting for misalignment using shims, the shims should only be located under the motor. Do not place shims under the shaft bearings.

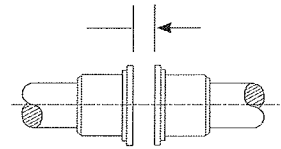
After aligning procedure, check for tightness of all coupling component pieces and ensure that they are clean from dirt and debris.



Parallel Misalignment



Angular Misalignment



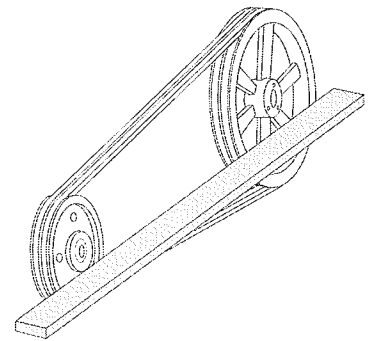
Separation Gap

V-BELT DRIVES

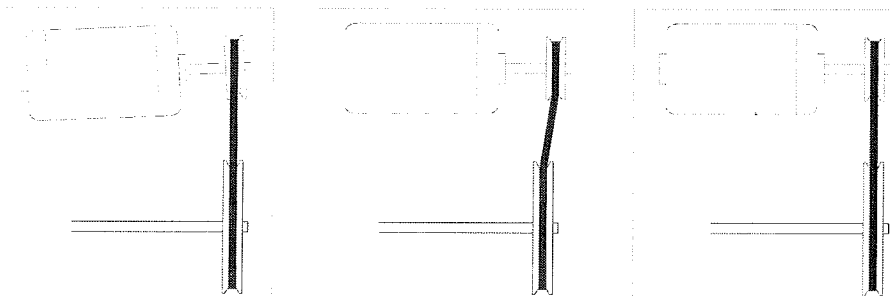
The V-belt drive components, when supplied by Greenheck Fan Corporation, have been carefully selected for this unit's specific operating condition. Caution: changing V-belt drive components could result in unsafe operating conditions which may cause personal injury or failure of the following components: 1. Fan Shaft, 2. Fan Wheel, 3. Bearings, 4. V-belt, 5. Motor.

V-BELT DRIVE INSTALLATION

1. Remove the protective coating from the end of the fan shaft and assure that it is free of nicks and burrs.
2. Check fan and motor shafts for parallel and angular alignment.
3. Slide sheaves on shafts - do not drive sheaves on as this may result in bearing damage.
4. Align fan and motor sheaves with a straight-edge or string, and tighten.
5. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.
6. Adjust the tension until the belts appear snug. Run the unit for a few minutes (see section on unit start-up) and allow the belts to seat properly.
7. With the fan off, adjust the belt tension by moving the motor base. (See belt tensioning procedures in the maintenance section of this manual). When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.



Aligning Sheaves with a Straight Edge



Improper Sheave Alignment

Proper Sheave Alignment

UNIT START UP

1. Disconnect and lock-out all power switches to fan. See warning below.
2. Check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness.
3. Rotate the fan wheel by hand and assure no parts are rubbing.
4. Check for bearing alignment and lubrication.
5. Check for coupling alignment (Arr. 8 only).
6. Check the V-belt drive for proper alignment and tension.
7. Check the all guarding (if supplied) for being securely attached and not interfering with rotating parts.
8. Check operation of variable inlet vanes or discharge dampers (if supplied) for freedom of movement.
9. Check all electrical connections for proper attachment.
10. Check housing and ductwork, if accessible, for obstructions and foreign material that may damage the fan wheel.

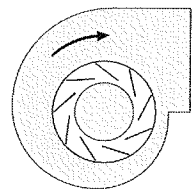
WARNING

Disconnect and secure to the "Off" position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

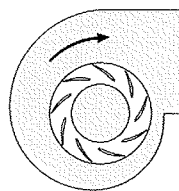
ADDITIONAL STEPS FOR INITIAL START-UP

1. Check for proper wheel rotation by momentarily energizing the fan. Rotation is always determined by viewing the wheel from the drive side and should correspond to the rotation decal affixed to the unit. One of the most frequently encountered problems with Centrifugal Fans is motors which are wired to run in the wrong direction. This is especially true with 3-phase installations where the motor will run in either direction, depending on how it has been wired. To reverse rotation of a 3-phase motor, interchange any two of the three electrical leads. Single phase motors can be reversed by changing internal connections as described on the motor label or wiring diagram.

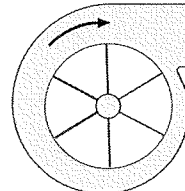
CW ROTATION



Centrifugal
Backward Inclined



Centrifugal
Airfoil



Industrial Process
Radial Blade

Always viewed from the drive side.

2. If the fan has inlet vanes, they should be partially closed to reduce power requirements. This is especially important if the fan is designed for a high temperature application and is being started at room temperature.
3. Fans with multi-speed motors should be checked on low speed during initial start-up.
4. Check for unusual noise, vibration or overheating of bearings. Refer to the "Troubleshooting" section of this manual if a problem develops.
5. Grease may be forced out of the bearing seals during initial start-up. This is a normal self-purging feature of this type of bearing.

VIBRATION

Excessive vibration is the most frequent problem experienced during initial start-up. Left unchecked, excessive vibration can cause a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed below.

1. Wheel Unbalance
2. Drive Pulley Misalignment
3. Incorrect Belt Tension
4. Bearing / Coupling Misalignment
5. Mechanical Looseness
6. Faulty Belts
7. Drive Component Unbalance
8. Poor Inlet/Outlet Conditions
9. Foundation Stiffness

Many of these conditions can be discovered by careful observation. Refer to the troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done providing there is access to the fan wheel. Any correction weights added to the wheel should be welded to either the wheel back (single-plane balance) or to the wheel back and wheel cone (two-plane balance).

Greenheck performs a vibration test on all centrifugal fans before shipping. Three vibration readings are taken on each bearing in the horizontal, vertical, and axial directions. The allowable maximum vibration for belt drive units is 0.15 in/sec. peak (0.08 in/sec. direct drive) velocity filter-in at the fan RPM per AMCA standard 204. These vibration signatures are a permanent record of how the fan left the factory and are available upon request.

Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. To eliminate this undesirable effect, the use of heavy canvas connectors is recommended. If fireproof material is required, Flexweave 1000 - type FN-30 can be used.

ROUTINE MAINTENANCE

Once the unit has been put into operation, a routine maintenance schedule should be set up to accomplish the following:

1. Lubrication of bearings and motor (see below).
2. Variable inlet vanes should be checked for freedom of operation and wear.
3. Wheel, housing, bolts and set screws on the entire fan should be checked for tightness.
4. Any dirt accumulation on the wheel or in the housing should be removed to prevent unbalance and possible damage.
5. Isolation bases should be checked for freedom of movement and the bolts for tightness. Springs should be checked for breaks and fatigue. Rubber isolators should be checked for deterioration.
6. Inspect fan impeller and housing looking for fatigue, corrosion, or wear.

When performing any service to the fan, disconnect the electrical supply and secure fan impeller.

CAUTION!

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.) consult Greenheck to determine if the unit can operate safely at the new conditions.

MOTORS

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease build up on the motor housing assists proper motor cooling. Never wash-down motor with high pressure spray. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations. When motor ambient temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time.

SHAFT BEARINGS

The bearings for Greenheck fans are carefully selected to match the maximum load and operating conditions of the specific class, arrangement, and fan size. The instructions provided in this manual and those provided by the bearing manufacturer, will minimize any bearing problems. Bearings are the most critical moving part of the fan, therefore special care is required when mounting them on the unit and maintaining them.

Refer to the following chart and the manufacturers instructions for grease types and intervals for various operating conditions. Never mix greases made with different bases. This will cause a breakdown of the grease and possible failure of the bearing.

Recommended Bearing Lubrication Schedule for Greenheck Fans								
Relubrication Schedule in Months*								
Fan RPM	Bearing Bore (inches)							
	1/2 - 1	1 1/8 - 1 1/2	1 1/2 - 1 7/8	1 15/16 - 2 1/16	2 1/16 - 3	3 1/16 - 3 1/2	3 15/16 - 4 1/2	4 15/16 - 5 1/2
To 250	6	6	6	6	6	5	4	3
500	6	6	6	5	4	3	3	2
750	6	5	4	3	3	2	2	1
1000	6	4	3	2	2	1	1	0.5
1250	5	3	2	1	1	0.5	0.5	0.25
1500	5	2	1	1	0.5	0.5	0.25	0.25
2000	5	1	1	0.5	0.25	0.25	0.25	0.25
2500	4	0.5	0.5	0.25	0.25	0.25		
3000	4	0.5	0.25	0.25	0.25			
4000	3	0.25	0.25	0.25	0.25			
5000	2	0.25	0.25	0.25				

* Suggested initial greasing interval is based on 12 hour per day operation and 150 degree F. maximum housing temperature. For continuous (24 hour) operation, decrease greasing interval by 50%.

- If possible relubricate with grease while in operation, without endangering personnel.
- For ball bearings (operating) relubricate until clean grease is seen purging at the seals. Be careful not to unseat the seal by over lubricating.
- For ball bearings (idle) add 1-2 shots of grease up to 2 inch bore sizes, and 4-5 shots of grease above 2 inch bore sizes with hand grease gun.
- For roller bearings relubricate with 4 shots of grease up to 2 inch bore size, 8 shots for 2 inch - 5 inch bore size, and 16 shots above 5 inch bore size with hand grease gun.
- Adjust lubrication frequency based on condition of purged grease.
- A high quality lithium base grease conforming to NLGI Grade 2 consistency, such as those listed below, should be used.

MOBILITH SHC 220	TEXACO MULTIFAK AFB2	SHELL ALVANIA #2
MOBILITH AW2	TEXACO PREMIUM RB	EXXON UNIREX N2

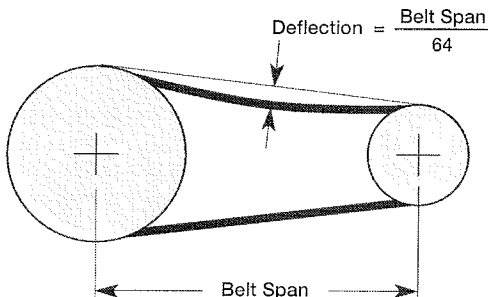
WARNING: Lubricate bearings prior to periods of extended shutdowns or storage and rotate shaft monthly to aid in preventing corrosion. If the fan is stored more than three months, the bearings should be purged with new grease prior to start-up.

V-BELT DRIVES

V-belt drives must be checked on a regular basis for wear, tension, alignment and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension, (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage, and overheated sheaves. Either excessively loose or tight belts may cause fan vibration.

When replacing V-belts on multiple groove drives all belts should be changed to provide uniform drive loading. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, insure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.



The proper tension for operating a V-belt drive is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection halfway between sheave centers is 1/64 in. for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be 1 inch using moderate thumb pressure at mid-point of the drive. Check belt tension two times during the first 24 hours of operation and periodically thereafter.

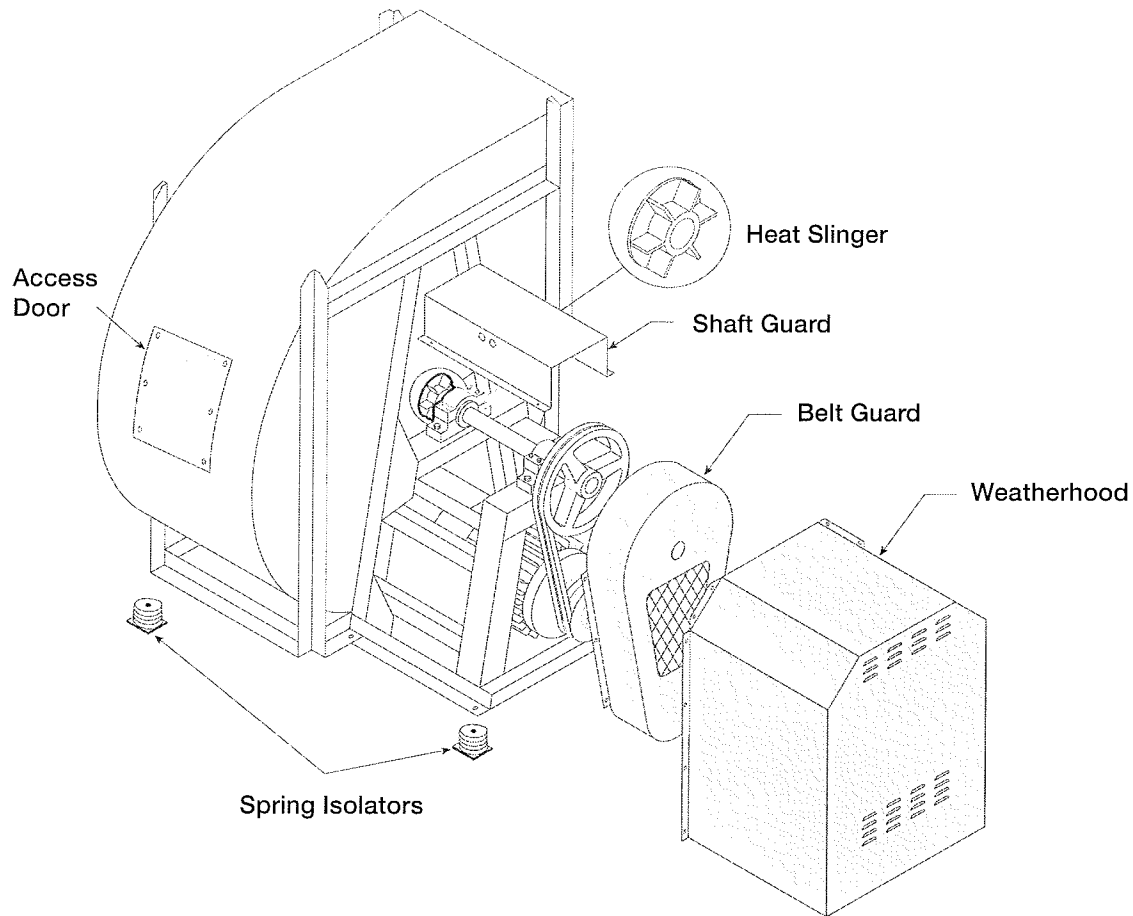
TROUBLESHOOTING

Problem	Cause	Corrective Action
Excessive Noise	Wheel Rubbing - Inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-Belt Drive	Tighten Sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see page 7). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel Unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
Low CFM	Fan	Check wheel for correct rotation. Increase fan speed.*
	Duct System	See page 3.
High CFM	Fan	Decrease fan speed.
	Duct System	Resize ductwork. Access door, filters, grilles not installed.
Static Pressure Wrong	Duct system has more or less restriction than anticipated	Change obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*
High Horsepower	Fan	Check rotation of wheel. Reduce fan speed.
	Duct System	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan Doesn't Operate	Electrical Supply	Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Overheated Shaft Bearing	Lubrication	Check for excessive or insufficient grease in the bearings.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
Excessive Vibration	Belts	Adjust tightness of belts. Replacement belts should be a matched set.
	System Unbalance	Check alignment of shaft, motor and pulleys. Adjustable pitch pulleys with motors over 15 HP are especially prone to unbalance. Check wheel balance, rebalance if necessary.
	Coupling Misalignment	Check alignment between coupling, motor and fan shafts. Any adjustments should be made per coupling manufacturer's instructions. Shim only under motor.

* Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in motor failure. Do not exceed the maximum cataloged RPM of the fan.

NOTE: Always provide the unit model and serial numbers when requesting parts or service information.

CENTRIFUGAL / INDUSTRIAL PARTS LIST



WARRANTY

Greenheck warrants this equipment to be free from defects in material and workmanship for period of one year from the purchase date. This warranty limits our responsibility to repairing or replacing, to the original purchaser, any part or parts of said equipment found to be defective upon examination by representatives of Greenheck. Additionally, said part or parts will be returned to and received by the factory only after prior authorization, with transportation charges prepaid.

Greenheck shall not be obligated under this warranty, for payment of any delivery, removal or installation charges with regard to repair or replacement of any defective part or parts.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station.



+GF+ PPRO-Seal Suggested Specification Guide

The following guide specifications can be used as guides for preparing project offers or inquiries for George Fischer Sloane, PPRO-Seal, Natural Polypropylene Piping. Two forms are included, a general and a short form specification.

General Specification

Part 1 – General

Quality Assurance

The PPRO-Seal system shall be manufactured to the following ASTM Standards.

- D 4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials.
- D 3311 - Standard Specification for Drain, Waste and Vent (DWV) Plastic Fittings Pattern.
- D 1785 - Standard Specification for (PVC) Plastic Pipe, Schedule 40, 80 and 120 (Dimensional requirements only).
- D 1599 - Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.
- D 2122 - Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings.
- F 1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
- F 1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.

Submittals

Catalog Data: Contractor shall submit ___ copies of manufacturer's literature on the PPRO-Seal system. The literature shall contain complete and current installation instructions.

Part 2 – Products

Manufacturer

The laboratory supply, pure water or pure chemical supply system shall be

PPRO-Seal as manufactured by George Fischer Sloane, Inc.

Materials

- A. Pipe, fittings and valve and connectors shall be manufactured from a polypropylene compound which meets the requirements of ASTM D 4101, Cell Class PP340B53653.
- B. Valve seats shall be made of PFA type Teflon, and O-ring seals shall be made of Teflon-impregnated Viton to insure safe operation under dry conditions.
- C. Pipe shall conform to the dimensional requirements of ASTM D 1785 for Schedule 80, as manufactured by George Fischer Sloane, Inc.
- D. Fittings shall be pressure rated to be compatible with the Schedule 80 pressure pipe and must have dimensional capability to contain electrical fusion coils, as manufactured by George Fischer Sloane, Inc.
- E. Joining Method – The pipe and fittings are joined by the use of electrical fusion coils energized by a low voltage supply.
- F. To insure uniform installation fit, all piping system components shall be the products of one manufacturer.

Non-Flame Retardant – Group 2 Copolymer ASTM Test No.

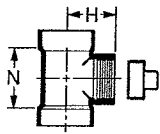
D 792	Specific Gravity @ 23°C	0.91
D 638	Tensile Yield Strength @ 2 in./min., psi	3900
D 256	Izod Impact @ 23°C	8
D 676	Hardness, Rockwell R	87
D 648	Heat Distortion Temp. @ 66 psi	212°F, 100°F
C 177	Thermal Conductivity, BTU/hr. sq. ft./°F/in.	1.15
D 694	Coefficient of Linear Expansion @ 68°F (lin. / in. °F x 10 ⁻⁵)	6.1
D 570	Water Absorption in 24 hrs., %	0.03
D 1694	Environmental Stress Cracking	None
D 4101	Propylene molding & Extrusion Materials	53653

Sample Short Form PPRO-Seal Specification

All PPRO-Seal (Natural Polypropylene) fittings shall be as manufactured by George Fischer Sloane, Inc. so that they are compatible with PPRO-Seal pipe. All PPRO-Seal pipe shall conform to the dimensional requirements of ASTM D-1785 for Schedule 80 pipe as produced by George Fischer Sloane, Inc. The PPRO-Seal system shall be joined by the use of electrical fusion coils energized by a variable low voltage supply.

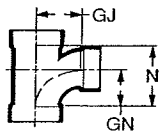
Material: Flame Retardant Polypropylene

Note: 4" and 6" fittings require metal clamps and must be ordered separately.



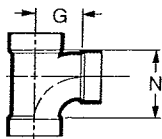
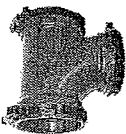
Cleanout Tee w/ Plug (S x S x FT)

Inch Size	Part Number	mp	lbs. each	h	n
1 1/2	526114A	5	.24	1 13/16	2 3/8
2	526115A	15	.34	2 1/8	3
3	526116A	5	.80	2 5/8	3 3/4
4	526117A	10	1.36	3 3/8	5



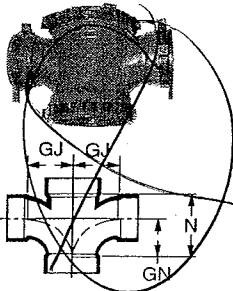
Sanitary Tee - Reducing (S x S x S)

Inch Size	Part Number	mp	lbs. each	gj	gn	n
2 x 2 x 1 1/2	526126	30	.30	2 3/16	1 15/16	3 1/8
3 x 3 x 2	526130	20	.68	2 3/4	2 1/8	3 5/16
3 x 3 x 1 1/2	526131	15	.64	2 9/16	1 3/4	2 11/16
4 x 4 x 2	526134	10	1.49	2 5/16	2 1/16	3 3/16
4 x 4 x 3	526136	5	1.49	3 9/16	3	4 3/4
6 x 6 x 4	526139	2	2.50	4 29/32	3 15/16	6 1/8



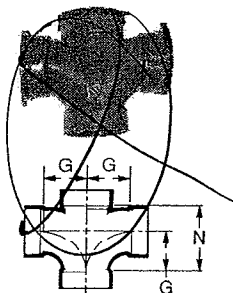
Sanitary Tee (S x S x S)

Inch Size	Part Number	mp	lbs. each	g	n
1 1/2	526151	50	.23	1 3/4	2 3/4
2	526152	10	.34	2 5/16	3 11/16
3	526153	15	1.08	3 1/16	4 7/8
4	526154	12	1.65	3 7/8	6 1/8



Sanitary Tee - Double Reducing (S x S x S x S)

Inch Size	Part Number	mp	lbs. each	gj	gn	n
3 x 3 x 2 x 2	526181	2	.81	2 7/8	2 1/8	3 1/8
2 x 2 x 1 1/2 x 1 1/2	526188	2	.40	2 3/16	1 15/16	3 1/8



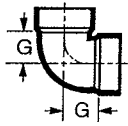
Sanitary Tee - Double (S x S x S x S)

Inch Size	Part Number	mp	lbs. each	g	n
1 1/2	526187	5	.29	1 3/4	2 3/4
2	526186	5	.44	2 5/16	3 11/16
4	526185	4	2.45	4 1/2	6 1/8

Glossary

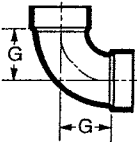
- S = Socket
- FT = Female Thread
- MP = Master Pack
- SPG = Spigot End (same dimension as pipe outside diameter)
- MT = Male Thread

7



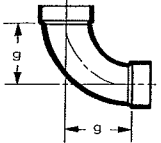
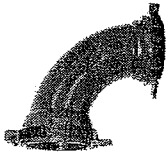
1/4 Bend – Vent (S x S)

Inch Size	Part Number	mp	lbs. each	g
1 1/2	526201	40	.17	1 3/16
2	526202	30	.24	1 1/2
3	526203	5	.29	1 7/8



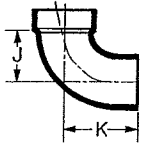
1/4 Bend – Short Sweep (S x S)

Inch Size	Part Number	mp	lbs. each	g
1 1/2	526251	45	.18	1 3/4
2	526252	25	.77	2 5/16
3	526253	30	.72	3 1/16
4	526254	10	1.36	3 7/8
6	526256	5	3.70	5 5/8



1/4 Bend – Long Sweep (S x S)

Inch Size	Part Number	mp	lbs. each	g
1 1/2	526276	30	.24	2 3/4
2	526277	30	.33	3 1/4
3	526278	15	.91	4 1/16
4	526279	4	1.62	4 15/16



1/4 Bend – Short Sweep (Spg x S)

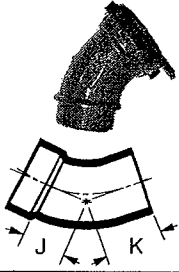
Inch Size	Part Number	mp	lbs. each	j	k
1 1/2	526451	35	.17	1 3/4	2 1/2
2	526452	30	.29	2 5/16	3 3/16
3	526453	5	.72	3 1/16	4
4	526454	5	1.30	3 7/8	4 13/16



1/6 Bend (S x S)

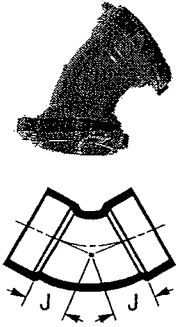
Inch Size	Part Number	mp	lbs. each	j
1 1/2	526601	10	.15	1
2	526602	10	.23	1 5/16
3	526603	5	.50	1 11/16
4	526604	2	.87	2 1/16

1/8 Bend (Spg x S)



Inch Size	Part Number	mp	lbs. each	i	k
1 1/2	526401	45	.15	1 1/8	1 7/8
2	526402	30	.24	1 1/2	2 3/8
3	526403	15	.61	1 3/4	2 11/16
4	526404	10	1.10	2 3/16	3 1/8
6	526406	5	2.40	3 3/8	4 5/8

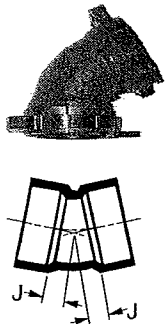
1/8 Bend (S x S)



Inch Size	Part Number	mp	lbs. each	i
1 1/2	526501	40	.16	1 1/8
2	526502	25	.25	1 1/2
3	526503	20	.53	1 3/4
4	526504	10	.97	2 3/16
6	526506	5	2.40	3 3/8

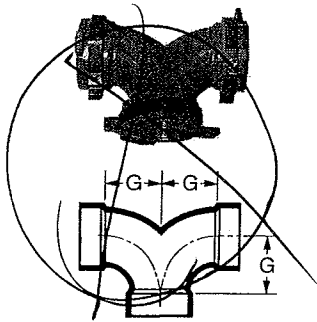
7

1/16 Bend (S x S)



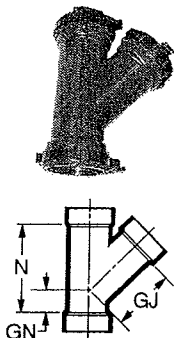
Inch Size	Part Number	mp	lbs. each	j
2	526552	15	.18	11/16
3	526553	2	.40	13/16
4	526554	5	.61	1

3-Way Ell (S x S x S)



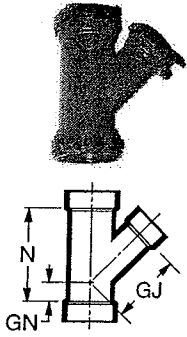
Inch Size	Part Number	mp	lbs. each	g
1 1/2	526261	5	.25	1 3/4
2	526262	10	.44	2 5/16

45° Wye (S x S x S)



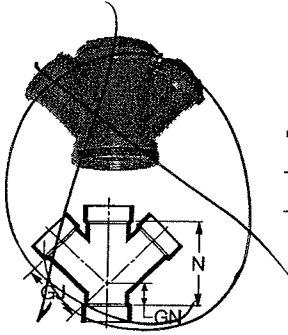
Inch Size	Part Number	mp	lbs. each	gj	gn	n
1 1/2	526301	20	.32	2 7/8	1 1/8	4
2	526302	10	.42	3 5/8	1 3/8	5
3	526303	10	1.23	5	1 5/8	6 5/8
4	526304	5	2.13	6 3/8	1 7/8	8 1/4
6	526306	2	4.77	9 1/8	1 5/8	10 3/4

45° Wye – Reducing (S x S x S)



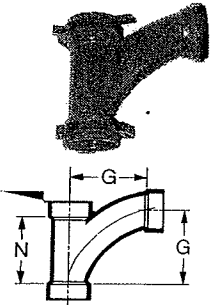
Inch Size	Part Number	mp	lbs. each	gj	gn	n
2 x 2 x 1 1/2	526325	20	.39	3 7/16	1 1/16	4 3/8
3 x 3 x 2	526326	15	.91	4 5/8	7/8	5
4 x 4 x 2	526328	10	1.16	5 9/16	3/8	5 1/16
4 x 4 x 3	526327	10	1.76	6	1 1/16	6 5/8
6 x 6 x 2	526342	2	1.95	6 3/4		4 3/4
6 x 6 x 3	526343	3	2.54	7 3/8		6 3/8
6 x 6 x 4	526344	4	3.28	7 1/4	1/2	7 1/8

45° Wye – Double Reducing (S x S x S x S)



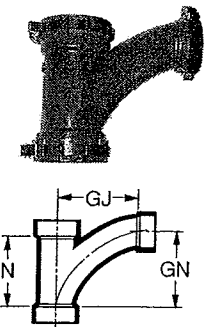
Inch Size	Part Number	mp	lbs. each	gj	gn	n
6 x 6 x 4 x 4	526388	1	3.66	7 3/4	11/16	7 1/8

Long Turn Tee Wye (S x S x S)



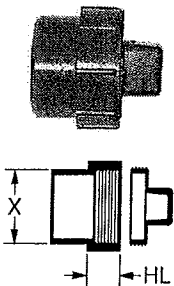
Inch Size	Part Number	mp	lbs. each	g	n
1 1/2	527301	20	.40	3 15/16	3 1/2
2	527302	25	.65	5 1/8	4 7/16
3	527303	10	1.60	7 9/16	6 1/2
4	527304	5	3.05	10	8 1/2

Long Turn Tee Wye – Reducing (S x S x S)



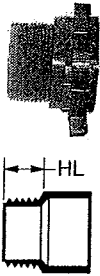
Inch Size	Part Number	mp	lbs. each	gj	gn	n
2 x 2 x 1 1/2	527320	20	.48	4 3/16	3 15/16	3 1/2
3 x 3 x 1 1/2	527326	5	.83	4 3/4	3 15/16	3 1/2
3 x 3 x 2	527327	12	1.05	5 11/16	5 1/8	4 7/16
4 x 4 x 2	527337	5	1.38	6 1/8	5 1/2	4 1/2
4 x 4 x 3	527338	8	2.30	8 1/16	7 9/16	6 1/2

Fitting Cleanout Adapter w/ Plug (Spg x FT)



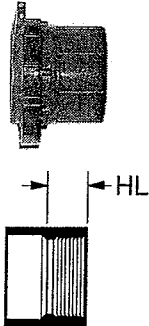
Inch Size	Part Number	mp	lbs. each	hl	x
1 1/2	7701A	40	.12	25/32	1.9
2	7702A	50	.17	25/32	2.375
3	7703A	18	.45	1 3/32	3.5
4	7704A	8	.72	1 1/8	4.5
6	7706A	5	1.69	1 5/16	6.625

Male Adapter (MT x S)



Inch Size	Part Number	mp	lbs. each	hl
1 1/2	526871	50	.08	1 3/16
2	526872	40	.10	1 1/4
3	526873	15	.28	1 27/32
4	526874	10	.40	2

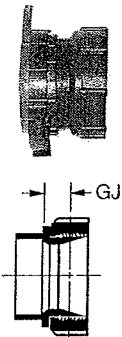
Female Adapter (S x FT)



Inch Size	Part Number	mp	lbs. each	hl
1 1/2	526891	50	.08	1 1/8
2	526892	50	.13	1 5/32
3	526893	18	.35	1 23/32
4	526894	10	.50	1 27/32

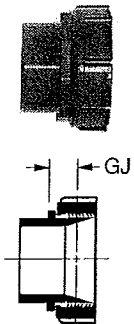
7

Union Nut Adapter – Fuseal Socket (S) x Union Nut*



Inch Size	Part Number	mp	lbs. each	gj
1 1/2	527260A	10	.11	5/8
2	527270A	10	.17	3/4

Union Nut Adapter – IPS Spigot (Spg) x Union Nut*

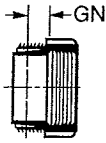


Inch Size	Part Number	mp	lbs. each	gj
1 1/2	7262A	5	.12	5/8

Male Union Adapter – Fuseal Socket (S) x Male Union*

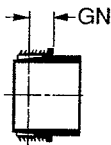


Inch Size	Part Number	mp	lbs. each	gn
1 1/2	527264	5	.06	7/16



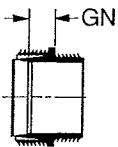
Male Union Adapter – Female IPS Thread (FT) x Male Union*

Inch Size	Part Number		mp	lbs. each	gn
2	7275		5	.10	1/2



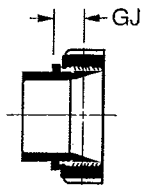
Male Union Adapter – IPS Spigot (Spg) x Male Union*

Inch Size	Part Number		mp	lbs. each	gn
2	7276		5	.11	9/16



Male Union Adapter – Male IPS Thread (MT) x Male Union*

Inch Size	Part Number		mp	lbs. each	gn
2	7277		5	.09	9/16

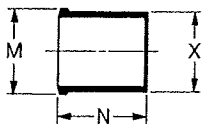


*Combine one Union Nut and one Male Union to make a complete Union Adapter Assembly

Polyethylene (HDPE) Adapter – Polyethylene Socket x Union Nut*

Inch Size	Part Number		mp	lbs. each	gj
1 1/2	7268A		5	.12	5/8
2	7278A		5	.18	3/4

*used with male union adapter



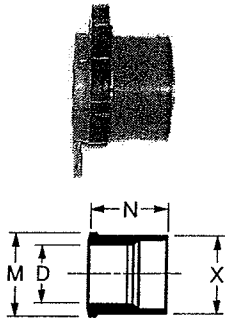
Glass Adapter – Fuseal (Spg) to Beaded Glass Pipe

(used with Beaded Glass Coupling)

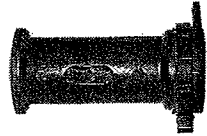
Inch Size	Part Number		mp	lbs. each	m	n	x
1 1/2	7411		5	.08	2.06	2	1.9
2	7412		5	.10	2.58	2	2.375
3	7413		5	.28	3.69	2 1/2	3.5
4	7414		5	.40	4.84	2 1/2	4.5

High Silicon Iron Pipe Adapter – Fuseal Socket (S) to High Silicon Iron Pipe Bead

(used with High Silicon Iron Pipe Coupling)

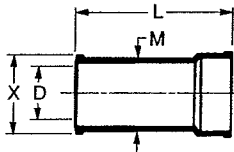


Inch Size	Part Number	mp	lbs. each	d	m	n	x
1 1/2	527431	5	.13	1.5	2.25	1 7/8	2.25
2	527432	5	.17	2	2.81	2	2.75
3	527433	5	.38	3	3.81	2 5/8	3.95
4	527434	2	.50	4	4.81	2 5/8	5.01



Hub Adapter – Fuseal Socket (S) to Caulked Joint

(used with High Silicon Iron Pipe Coupling)

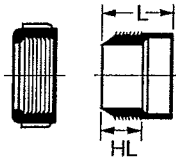


Inch Size	Part Number	mp	lbs. each	d	l	m	x
1 1/2	527441	5	.21	1.5	4 7/8	1 13/16	2.38
2	527442	5	.29	2	5 1/8	2 13/16	2.88
3	527443	5	.62	3	5 9/16	3 7/16	3.88
4	527444	2	.90	4	5 13/16	4 1/2	4.88

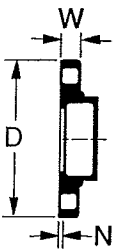
7



Lead Pipe Adapter – Fuseal Socket (S) to Flared Lead (FT)



Inch Size	Part Number	mp	lbs. each	hl	l
1 1/2	7401	10	.13	1 1/8	1 7/8



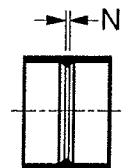
Flange – ANSI 150lb. Pattern (S)

Inch Size	Part Number	mp	lbs. each	no. of holes	dia. of bolts	dia. of circle	d	n	w
2	526922	10	.98	4	5/8	4.75	6	9/64	0.75
3	526923	8	1.85	4	5/8	6	7 1/2	5/32	0.94
4	526924	10	2.92	8	5/8	7.5	9	5/32	1.14
6	526926	3	3.16	8	3/4	9.5	10 15/16	1/4	1.02

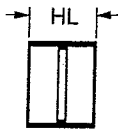
*Van Stone Style



Coupling (S x S)

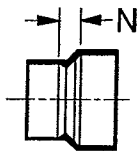


Inch Size	Part Number	mp	lbs. each	n
1 1/2	527001	50	.07	1/16
2	527002	45	.09	1/16
3	527003	60	.18	1/8
4	527004	20	.30	1/8
6	527006	10	.75	3/16



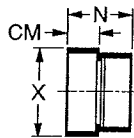
Sleeve Coupling (S x S)

Inch Size	Part Number	mp	lbs. each	hl
1 1/2	527041	5	.07	1 9/16
2	527042	5	.09	1 13/16
3	527043	2	.18	2
4	527044	2	.30	2 1/2
6	527046	2	.75	3



Pipe Increaser (S x S)

Inch Size	Part Number	mp	lbs. each	n
1 1/2 x 2	527022	40	.12	17/32
2 x 3	527024	15	.24	7/8
2 x 4	527025	5	.39	1 3/8
3 x 4	527026	5	.40	15/16

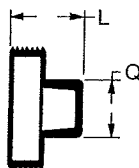


Reducer Bushing (Spg x S) – Extended Style

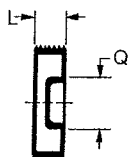
Inch Size	Part Number	mp	lbs. each	cm	n	x
2 x 1 1/2	526752	30	.11	1 1/4	2 1/16	2.38
3 x 1 1/2	526762	15	.18	15/16	1 11/16	3.5
3 x 2	526754	40	.18	15/16	1 13/16	3.5
4 x 2	526758	15	.27	15/16	1 13/16	4.5
4 x 3	526756	20	.28	15/16	1 7/8	4.5
6 x 4	526767	10	.66	1 1/4	2 3/16	6.63

Plug (MT)

Designed for use with cleanout tees and cleanout adapters



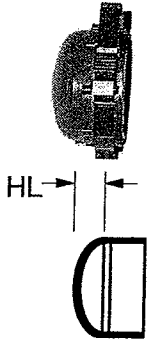
Inch Size	Part Number	mp	lbs. each	l	q
1	7049	1	.03	31/32	3/4
Used as replacement plug for 527201A and 527202A only					
1 1/2	7051	120	.05	1 9/16	1
Also used for 527203A and 527204A					
2	7052	15	.07	1 9/16	1 1/4
3	7053	5	.17	2 1/32	1 5/8
4	7054	5	.29	2 5/32	2
6	7057	10	.57	2 3/8	2.38



Countersunk Plug (MT)

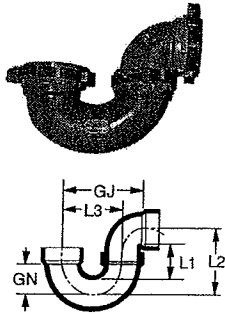
Inch Size	Part Number	mp	lbs. each	l	q
3	7063	10	14	1 1/32	1 5/16
4	7064	5	25	1 5/32	1 5/8

Cap (S)



Inch Size	Part Number	mp	lbs. each	hi
1 1/2	527081	35	.07	17/32
2	527082	50	.09	5/8
3	527083	20	.26	29/32
4	527084	5	.48	1 3/32
6	527087	2	1.32	19/32

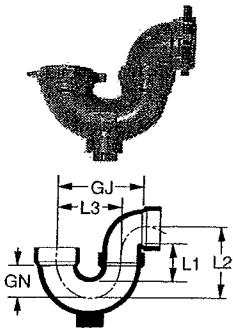
P Trap – Fuseal Connection (SxS)



Inch Size	Part Number	mp	lbs. each	gj	gn	L1	L2	L3
1 1/2	527201	40	.52	4 23/32	1 3/8	2 11/32	3 7/16	3 1/2
2	527202	20	.72	6 7/16	2 1/4	2 17/32	4 7/16	5
3	527203	10	1.72	8 7/8	2 3/4	3 3/16	6 7/16	6 3/4
4	527204	6	3.19	11 3/16	3 7/8	4	8 1/4	8 1/2

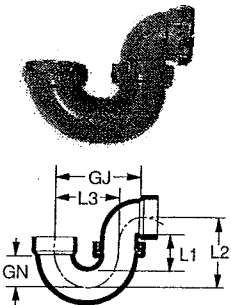
7

P Trap – Fuseal Connection w/ Cleanout (SxS)



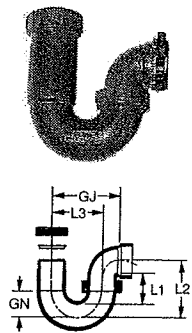
Inch Size	Part Number	mp	lbs. each	gj	gn	L1	L2	L3
1 1/2	527201A	35	.53	4 11/16	1 3/8	2 11/32	3 7/16	3 1/2
2	527202A	15	.78	6 7/16	2 1/4	2 17/32	4 7/16	5
3	527203A	5	1.78	8 9/16	2 15/16	3 1/4	6 7/8	6 3/4
4	527204A	5	3.24	10 3/4	3 3/4	3 7/8	8 1/16	8 1/2

P Trap – Union Connection (SxS)



Inch Size	Part Number	mp	lbs. each	gj	gn	L1	L2	L3
1 1/2	527211E	30	.42	4 15/32	1 7/16	2	3 5/8	3 1/4
2	527212E	20	.76	6 1/2	2 5/16	2 11/16	4 3/4	5 1/16

P Trap – Union Connection (Slip Joint Inlet x S)



Inch Size	Part Number	mp	lbs. each	gj	gn	L1	L2	L3
1 1/2	527225 (S)	8	.97	4 17/32	5 13/16	2	3 5/8	3 5/16
1 1/2	7225F (T)	8	.66	4 17/32	5 13/16	2	3 5/8	3 5/16



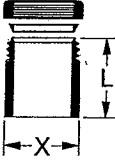
P Trap Outlet Pipe (Spg x MPT)



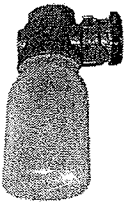
Inch Size	Part Number		mp	lbs. each	l
1 1/2 x 18	7538		5		18



Tailpiece Adapter – (Brass Nut x Spg)



Inch Size	Part Number		mp	lbs. each	l	x
1 1/2	7211X3		25	.17	2 1/8	1.9

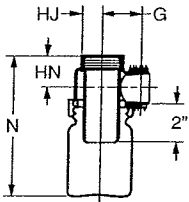


Jar Trap (FT w/ Female Seal x S)

1 qt. Jar: Translucent non-flame retardant polypropylene

Inch Size	Part Number		mp	lbs. each	g	hj	hn	n
1 1/2	527242C		6	.69	2 1/16	1 1/2	1 5/8	10 13/16

Includes 527260A Union Nut Adapters or 7262A for MJ connections

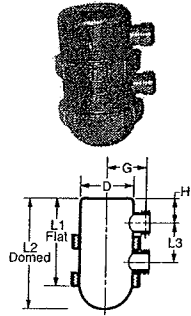


Polypropylene Jar – Translucent Non-Flame Retardant

Inch Size	Part Number		mp	lbs. each
1 Quart	7893		1	28

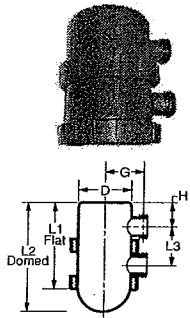
Jar Gasket

Inch Size	Part Number		mp	lbs. each
1 1/2	77241-3		1	



Drum Trap w/ Domed Cap (MT x MT)*

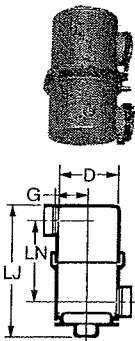
Inch Size	Part Number	mp	lbs. each	d	g	h	L1	L2	L3
1 1/2	7246A	1	.41	1 1/2	4 5/16	2 3/4	10 1/2	13 7/16	4 1/2
2	7247A	1	.51	6 1/16	4 5/16	2 3/4	10 1/2	13 7/16	4 1/2



Drum Trap w/ Flat Cap (MT x MT)*

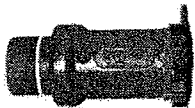
Inch Size	Part Number	mp	lbs. each	d	g	h	L1	L3
1 1/2	7246B	1.00	.350	6 1/16	4 5/16	2 3/4	10 1/2	4 1/2

*Used with Socket x Union-Nut Adapters: 527260A, 527270A or IPS Spigot End x Union-Nut Adapter: 7262A



Drum Trap (S x S)

Inch Size	Part Number	mp	lbs. each	d	g	lj	ln
1 1/2	527248	3		4	2 1/4	9 11/32	5 1/8
2	527249	3		4	2 3/8	9 11/32	5 1/8



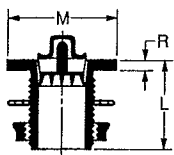
Vertical Expansion Joint w/ EPDM O-Ring

inch size	part number	mp	lbs. each	a	b	c	cj	l	mj	mn
1 1/2	527811A	1	.26	31/32	4 3/32	3/4	3	4 3/32	2.65	2.23
2	527812A	1	.33	1 3/16	4 17/32	7/8	2 3/4	4 1/2	3.13	2.75
3	527813A	1	.69	1 19/32	5 5/16	15/16	4	5 1/4	4.64	4.00
4	527814A	1	1.09	2 3/32	6 11/32	15/16	4 7/16	5 11/16	5.78	5.08

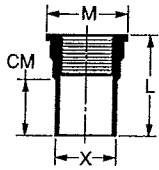
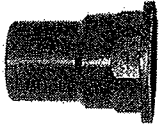


Sink Strainer Assembly

Includes sink strainer, gasket, plug and locknut

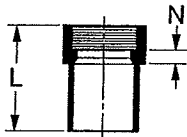


Inch Size	Part Number	mp	lbs. each	l	m	r
1 1/2	7841A	20	.24	2 3/4	3 5/16	1/4



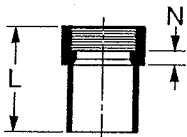
Sink Strainer Adapter

Inch Size	Part Number		mp	lbs. each	cm	l	m	x
1 1/2	7211-7		5	.18	1 15/32	3 3/8	2.88	1.9



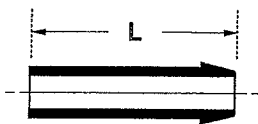
Swivel Sink Strainer Adapter w/ Gasket (Spg x FT)

Inch Size	Part Number		mp	lbs. each	l	n
1 1/2	7216		5	.65	2 15/32	7/16



Swivel Sink Strainer Adapter w/ Gasket (S x FT) (supplied with 12" length of Fuseal PPRF)

Inch Size	Part Number		mp	lbs. each	l	n
1 1/2	527217		5	.70	1 23/32	7/16

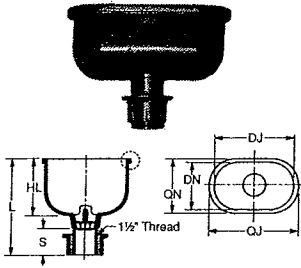


Overflow Pipe

Inch Size	Part Number		mp	lbs. each	l
1 1/2	7842		5	.21	8

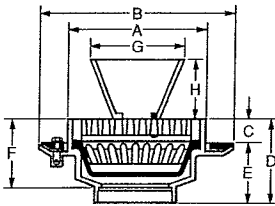
Cup Sink – Includes Sink Strainer, Plug and Retainer Nut

All outlets 1 1/2"



Inch Size	Part Number	mp	lbs. each	dj	dn	hl	l	qj	qn	s
9x3x4 Deep	7851A	5	1.50	8 9/16	3 5/16	4	7	9 3/4	4 1/2	2
6x3x4 Deep	7852A	5	.87	6 5/16	3 5/16	4	7	7 1/2	4 1/2	2

Floor Drain



Inch Size	Part Number	mp	lbs. each	a	b	c	d	e	f
3	527750	1	3.87	8 1/2	12	1 5/8	5 1/4	3 5/8	4 5/16
4	527751	1	3.61	8 1/2	12	1 5/8	5 1/4	3 5/8	4 5/16

7

Anti-Splash Funnel for Floor Drain

Includes screws



Inch Size	Part Number	mp	lbs. each	a	b	c	d	e	f	g	h
All	7750-5A	5	.05							6	4

Fusion Collar with Clamp

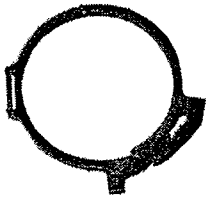
Note: 4" and 6" fittings require metal clamps and must be ordered separately.



Inch Size	Part Number	mp	lbs. each
1 1/2	6282	10	.01
2	6283	10	.01
3	6284	10	.01
4	6285	10	.01
6	6287-1	10	.01

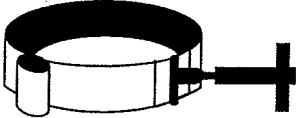
All fittings are shipped assembled with fusion collars on each socket (clamps for 1 1/2" - 4").

Clamp-Ratchet Closure Style

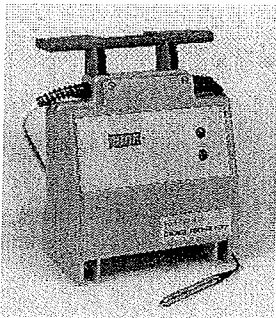


Inch Size	Part Number		mp	lbs. each
1 1/2	FU1282		10	.02
2	FU1283		10	.03
3	FU1284		10	.04

Clamp (Metal)



Inch Size	Part Number		mp	lbs. each
4	FU110		1	
6	FU112		1	



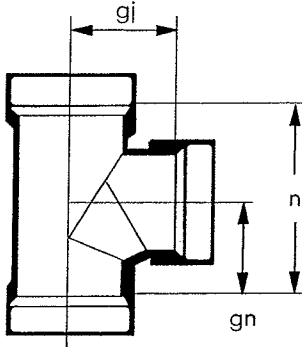
MSA 250 Fusion Unit-Complete Package

	Part Number		mp	lbs. each
	MSA 250SE		1	25 w/cables
	MSA 250EX		1	25 w/cables

+GF+ Fuseal LD

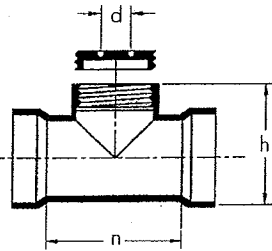
Large Diameter Fusion Joint Fittings
Material: Non-Flame Retardant Polypropylene

Sanitary Tee (S x S x S)



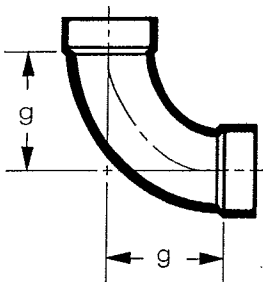
Inch Size	Part Number	mp	lbs. each	gj	gn	n
6 x 6	6141F	1		7 3/4	6	12 1/4
8 x 4	6140F	1		5 13/16	5 15/16	11 7/8
8 x 6	6138F	1	21.24	6 3/8	7 7/16	14 7/8
8 x 8	6158F	1		7 3/8	7 3/8	14 3/4
10 x 4	6121F	1	27.80	11 13/32	9 21/32	15 1/4
10 x 6	6122F	1	29.30	11 13/16	11 13/32	18 3/8
10 x 8	6123F	1	31.00	12 63/64	13 47/64	21 1/2
10 x 10	6155F	1	42.30	15 3/32	15 19/32	24 1/2
12 x 4	6132F	1	36.90	12 7/64	9 39/64	15 1/8
12 x 6	6133F	1	38.40	12 17/32	11 17/32	18 3/8
12 x 8	6135F	1	40.80	13 11/16	13 7/16	21 1/2
12 x 10	6137F	1	53.10	15 51/64	15 19/64	24 1/2
12 x 12	6157F	1	59.00	16 21/32	17 5/32	27

7



Cleanout Tee w/Plug (S x S x ST)

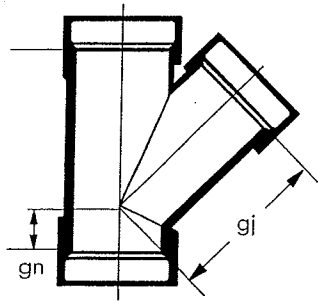
Inch Size	Part Number	mp	lbs. each	d	h	n
6	6118AF	1		4	4	13
8	6119AF	1		4	5	17



1/4 Bend (S x S)

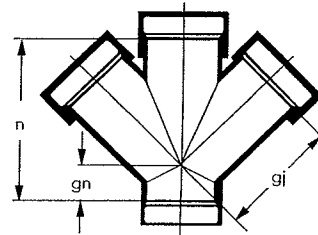
Inch Size	Part Number	mp	lbs. each	g
8	6258F	1		7 3/8
10	6255F	1	28.70	13 5/16
12	6257F	1	38.00	13 13/16

45° Wye (S x S x S)

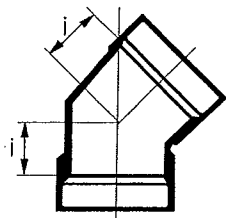


Inch Size	Part Number	mp	lbs. each	gj	gn	n
8 x 3	6347F	1		10 3/8	1/2	10 3/8
8 x 4	6346F	1		10 3/8	1 3/16	11 5/8
8 x 6	6345F	1		11 3/4	2 5/8	14 5/8
8 x 8	6308F	1		13 1/2	4	17 1/2
10 x 3	6321F	1	29.20	11 5/8	1 5/8	14 1/4
10 x 4	6322F	1	29.80	12 5/8	2 1/8	15 1/4
10 x 6	6323F	1	31.30	13 11/16	3 11/16	18 3/8
10 x 8	6324F	1	33.10	15 3/4	5 1/4	21 1/2
10 x 10	6305F	1	46.90	17 3/4	6 3/4	24 1/2
12 x 3	6336F	1	37.50	13 1/8	5/8	14 1/8
12 x 4	6332F	1	38.80	13 5/8	1 1/8	13 3/4
12 x 6	6333F	1	40.70	15 3/16	2 11/16	18 3/16
12 x 8	6334F	1	42.90	17 1/4	4 1/4	21 1/2
12 x 10	6335F	1	57.00	19 1/4	5 3/4	24 1/2
12 x 12	6300F	1	62.20	20 1/4	7 1/4	27 1/2

Double 45° Wye (S x S x S x S)



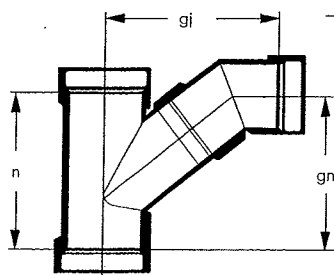
Inch Size	Part Number	mp	lbs. each	gj	gn	n
8 x 6	6386F	1	25.60	11 3/4	2 5/8	14 5/8
10 x 4	6371F	1	30.40	12 5/8	2 1/8	15 1/8
10 x 6	6372F	1	32.60	13 11/16	3 11/16	18 3/8
10 x 8	6373F	1	35.30	15 3/4	5 1/4	21 1/2
10 x 10	6355F	1	61.30	17 3/4	6 3/4	24 1/2
12 x 4	6382F	1	39.60	13 5/8	1 1/8	15 1/4
12 x 6	6383F	1	42.20	15 3/16	2 11/16	18 3/16
12 x 8	6384F	1	46.30	17 1/4	4 1/4	21 1/2
12 x 10	6385F	1	70.30	19 1/4	5 3/4	24 1/2
12 x 12	6350F	1	82.80	20 1/4	7 1/4	27 1/2



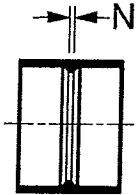
1/8 Bend (S x S)

Inch Size	Part Number	mp	lbs. each	i
8	6508F	1		4 1/4
10	6505F	1	24.50	6 1/4
12	6507F	1	32.40	6 3/4

Combination Wye & 1/8 Bend (S x S x S)

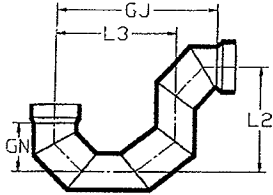


Inch Size	Part Number	mp	lbs. each	gj	gn	n
8 x 6	6715F	1	6.91	14	13 3/4	15
8 x 8	6716F	1		15 3/4	15 5/8	17 1/2
10 x 6	6711F	1	32.50	15 11/32	15 27/64	18 1/2
10 x 8	6712F	1	35.20	17.58	18 21/64	21 1/2
10 x 10	6700F	1	49.00	24 3/4	21 1/4	24 1/2
12 x 6	6718F	1	41.70	16 27/64	15 31/64	16 39/64
12 x 8	6719F	1	45.10	18 41/64	18 25/64	21 1/2
12 x 10	6710	1	58.90	21 13/16	21 5/16	24 1/2
12 x 12	6701F	1	66.80	23 31/32	23 23/32	27 1/2



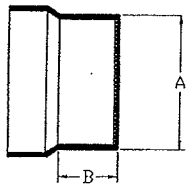
Coupling (S x S)

Inch Size	Part Number	mp	lbs. each	n
8	7008	1	1.22	1/4
10	7010	1	2.85	1/4
12	7020	1	3.37	1/4



P-Trap - Fuseal Connection

Inch Size	Part Number	mp	lbs. each	gj	gn	L2	L3
6	7206 F	1		25 1/2	10	16 1/4	15 3/4
8	7208 F	1		30 1/4	11	18 3/8	18 3/4
10	7210 F	1		34	12	20	20 1/2
12	7212 F	1		32 1/2	13 1/4	21	22 1/4



Cap (S)

Inch Size	Part Number	mp	lbs. each	a	b
8	7088F	1		8 5/8	4

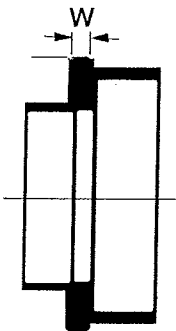
7



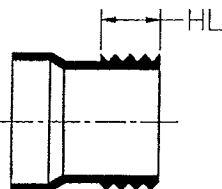
150 lb. Van Stone Flange

inch size	Part Number	mp	lbs. each	d	e	n	w	qty. bolts	dia. bolts	bolt length
8	6928	1	5.66	13 1/2	11 3/4	7/16	1 1/8	8	7/8	3 1/2
10	6930	1	6.95	16	14 1/4	1/2	1 3/16	12	1	3 3/4
12	6932	1	10.04	19	17	9/16	1 1/4	12	1	4

Increaser (Spg x Spg)

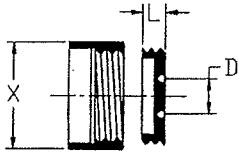


Inch Size	Part Number	mp	lbs. each	w
8 x 6	7033F	1		4 3/4
8 x 4	7034F	1		5
8 x 3	7035F	1		5
10 x 4	7030F	1	13.10	6 1/2
10 x 6	7031F	1	12.90	6 5/8
10 x 8	7032F	1	13.00	6 5/8
12 x 4	7036F	1	16.50	6 5/8
12 x 6	7037F	1	16.40	6 5/8
12 x 8	7038F	1	16.30	6 5/8
12 x 10	7039F	1	25.60	7 3/4



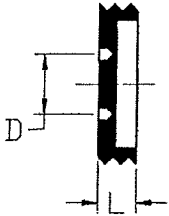
Male Adapter (MPT x S)

Inch Size	Part Number	mp	lbs. each	hl
6	6876F	1		1 1/2
8	6878F	1		1 1/2



Cleanout Adapter w/Plug (Spg x FT)

Inch Size	Part Number		mp	lbs. each	d	l	x
8	7708AF		1	4	3/4		8 5/8

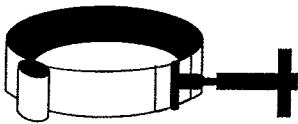


Plug (MT)

Designed for use with cleanout tees and cleanout adapters.
Material: Natural Polypropylene, white

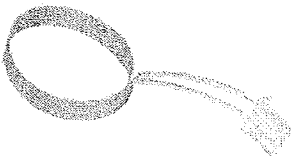
Inch Size	Part Number		mp	lbs. each	d	l
8	7058F		1		4	3/4

Clamp (Metal)



Inch Size	Part Number		mp	lbs. each
4	FU110		1	.45
6	FU112		1	
8	FU118		1	
10	FU119		1	
12	FU120		1	

Coil



Inch Size	Part Number		mp	lbs. each
8	6088		1	.04
10	6090		1	
12	6092		1	

Submittal Transmittal Cover Sheet



UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont

Project #07210

Date: 2/7/08

Transmitted To

Randy Chicoine
New England Air Systems

Transmitted By

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext. 2
Fax: 802-863-8734

Package Transmitted For

No Exceptions Noted

Delivered Via

Mail

Submittal Information

Specification Section	15094
Intended Use	Polypro DI Pipe
Purchase Order #	
Owner's tag or identification number	
Date	2/7/08

Date	Qty	Description
2/6/08	1	Polypro DI Pipe

CC: Company	Contact Name	Copies	Notes
-------------	--------------	--------	-------

University of Vermont	Myron Wheeler	1	
IDC Architects	Elsa Yost	1	
University of Vermont	Michael Stevens	1	

Remarks

Please find 15094 Polypro DI Pipe Submittal- No Exceptions Noted



Client: University of Vermont

Date: February 11, 2008

Project name: Delehanty Cosmogenic Nuclide Lab

Location: Burlington, VT

IDC project number: 364972

To: ReArch Company

From: Elsa Yost/CH2M Hill

Attention: Bert DeLaBruere

Reference Specification Section 15094

With reference to your Submittal No. 001-000

Submittals are dated Feb. 7, 2008, we are taking the following action.

Description	No Exceptions Noted	Make Corrections Noted	Revise and Resubmit	Submit Specified Item
1. Polypro DI Pipe	XXXX			
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Remarks:

See attached sheet(s) for additional comments.

cc: File

By:

Elsa Yost

Submittal Transmittal
Cover Sheet



UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont

Project #07210

Date: 2/7/08

Transmitted To	Transmitted By
Michael Warren IDC Architects	Bert DeLaBruere ReArch Company 30 Community Drive South Burlington, VT 05403 Tel: 802-863-8727, ext. 2 Fax: 802-863-8734

RECEIVED
FEB 07 2008
CH2M HILL PGH

Package Transmitted For	Delivered Via
Review/ Approval	Email

Submittal Information	
Specification Section	15094
Intended Use	Polypro DI Pipe
Purchase Order #	
Owner's tag or identification number	
Date	2/7/08

Date	Qty	Description
2/6/08	1	Polypro DI Pipe

CC: Company	Contact Name	Copies	Notes
University of Vermont	Myron Wheeler	1	
City of Burlington	Post	1	
City of Burlington	Michael Stevens	1	

NO EXCEPTIONS NOTED
 MAKE CORRECTIONS NOTED
 REVISE AND RESUBMIT
 SUBMIT ITEMS AS NOTED

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any Action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the jobsite, fabrication processes and techniques of construction, coordination of the work with that of all other trades and the satisfactory performance of the work.

Remarks: WMAK
02/11/08

ReArch Company

Submittal and Shop Drawings

Received 2/7/08
 Reviewed

B. J.
 Signature, Title

2/7/08
 Date



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 10

DATE: 2/6/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: Network Piping

MANUFACTURER: George Fischer

PRODUCT DESCRIPTION: Polypro DI pipe

MODEL NUMBER: _____

SECTION NUMBER AND TITLE: 15094

PRODUCT DEVIATIONS: _____

REVISION/RESUBMITTAL IDENTIFICATION: _____

CONTRACTOR

REVIEWED BY NEASI	
PM	<u>[Signature]</u>
DATE	<u>2/7/08</u>

WDEXTER\shared\shrjobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 10 Polypro piping.doc

+GF+ PPro-Seal
Natural Polypropylene Piping System

P/L 27: PPro-Seal SCH 80 Pipe

P/L 36: PPro-Seal Electrofusion Fittings
Material: Natural Polypropylene

Note: All fittings must be ordered in standard pack quantities to maintain purity.
Pipe shipped by bag, quantity only to maintain purity.

+GF+ PPRO-Seal Suggested Specification Guide

The following guide specifications can be used as guides for preparing project offers or inquiries for George Fischer Sloane, PPRO-Seal, Natural Polypropylene Piping. Two forms are included, a general and a short form specification.

General Specification

Part 1 - General

Quality Assurance

The PPRO-Seal system shall be manufactured to the following ASTM Standards.

- D 4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials.
- D 3311 - Standard Specification for Drain, Waste and Vent (DWV) Plastic Fittings Pattern.
- D 1785 - Standard Specification for (PVC) Plastic Pipe, Schedule 40, 80 and 120 (Dimensional requirements only).
- D 1599 - Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.
- D 2122 - Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings.
- F 1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
- F 1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.

Submittals

Catalog Data: Contractor shall submit ___ copies of manufacturer's literature on the PPRO-Seal system. The literature shall contain complete and current installation instructions.

Part 2 - Products

Manufacturer

The laboratory supply, pure water or pure chemical supply system shall be

PPRO-Seal as manufactured by George Fischer Sloane, Inc.

Materials

- A. Pipe, fittings and valve end connectors shall be manufactured from a polypropylene compound which meets the requirements of ASTM D 4101, Cell Class PP340B53653.
- B. Valve seats shall be made of PFA type Teflon, and O-ring seals shall be made of Teflon-impregnated Viton to insure safe operation under dry conditions.
- C. Pipe shall conform to the dimensional requirements of ASTM D 1785 for Schedule 80, as manufactured by George Fischer Sloane, Inc.
- D. Fittings shall be pressure rated to be compatible with the Schedule 80 pressure pipe and must have dimensional capability to contain electrical fusion coils, as manufactured by George Fischer Sloane, Inc.
- E. Joining Method - The pipe and fittings are joined by the use of electrical fusion coils energized by a low voltage supply.
- F. To insure uniform installation fit, all piping system components shall be the products of one manufacturer.

Non-Flame Retardant - Group 2 Copolymer ASTM Test No.

D 792	Specific Gravity @ 23°C	0.91
D 638	Tensile Yield Strength @ 2 in./min., psi	3900
D 256	Izod Impact @ 23°C	8
D 676	Hardness, Rockwell R	87
D 648	Heat Distortion Temp. @ 66 psi	212°F, 100°F
C 177	Thermal Conductivity, BTU/hr. sq. ft./°F/in.	1.15
D 694	Coefficient of Linear Expansion @ 68°F (lin. / in. °F x 10 ⁻⁵)	6.1
D 570	Water Absorption in 24 hrs., %	0.03
D 1694	Environmental Stress Cracking	None
D 4101	Propylene molding & Extrusion Materials	53653

Sample Short Form PPRO-Seal Specification

All PPRO-Seal (Natural Polypropylene) fittings shall be as manufactured by George Fischer Sloane, Inc. so that they are compatible with PPRO-Seal pipe. All PPRO-Seal pipe shall conform to the dimensional requirements of ASTM D-1785 for Schedule 80 pipe as produced by George Fischer Sloane, Inc. The PPRO-Seal system shall be joined by the use of electrical fusion coils energized by a variable low voltage supply.

Installation Instructions for +GF+ PPro-Seal

Joint Preparation

1. **Cut pipe end square** with axis of pipe. Use a fine tooth hand saw and mitre box, a power cutoff saw or a plastic tubing cutter.
 2. **Remove all burrs from pipe end.** Chamfer the pipe end to ease insertion of the pipe and prevent the coil from being displaced. (See Figure 1)
 3. **Clean pipe surface and inside of coil with 70% IPA.** (For proper use and safety regulations, see supplier's Material Safety Data Sheets.)
Do not handle the freshly cleaned surfaces before assembling.
3. Connect the PPro-Seal female plug adapter to the MSA 250SE/MSA 250EX (refer to the George Fischer Fusion Unit Operation Guide and/or contact your local George Fischer Representative).

Re-Fusing Leaking Joints

Leaking joints may be caused by:

- Scanning of incorrect barcode.
- Improper pipe size selection.
- Fusing in extremely cold weather (below 0°F).
- Displacing the coil in the joint by improper assembly.
- Bad connection between fitting and MSA plugs.
- Not properly cleaning fitting or pipe to remove any type of contamination, grease, dirt, etc.

1. Drain the system of water in the area of the leaking joint. Be sure the area is completely drained.

2. Tighten a band clamp until it has complete contact all the way around the joint.

CAUTION: Do not tighten the band clamp past hand tight. There should not be any compression on the joint at this time.

Setting up Joints

1. Prior to pipe insertion, it is necessary to visually inspect all sockets to ensure that the coil has not buckled during warehousing and shipping. This inspection will ensure that the pipe can be fully inserted into the socket, minimizing coil damage.
2. Insert the pipe end into the socket of the fitting, while holding plug adapter wires to one side. Push pipe until end passes small shoulder and touches large shoulder at bottom of socket. (See Figure 2)

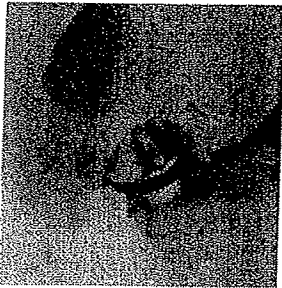


Figure 1

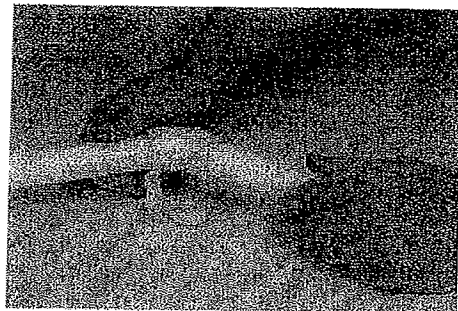
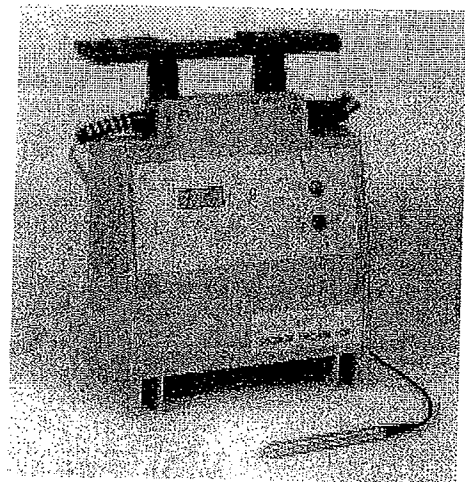


Figure 2



Fusion machine MSA 250SE

The technical data given in this publication implies no warranty of whatever kind and is subject to change without notice. Please consult our Terms and Conditions of Sale.

GEORGE FISCHER +GF+

3. Repeat the JOINT FUSION process.
4. At the end of the fusion cycle, tighten the band clamp one full turn.
5. Allow the joint to cool to the touch before removing the band clamp.
6. After re-fusing, if the leak is not sealed, cut out the fitting and fuse a new fitting into the system.
5. **DO NOT** install the coil more than two hours prior to installation of the pipe. If you allow the coil to sit in the socket longer than two hours, the area in which the coil was bent will begin to come away from the wall of the socket. If the coil comes away from the socket wall, the coil will be damaged when the pipe is inserted.
6. Once the pipe has been inserted into the socket, you may leave it as long as necessary prior to fusion.

Field Coil Insertion

1. Use a small screwdriver or knife to remove the damaged coil from the socket.
2. Bend the replacement coil as little as possible and insert it into the PPro-Seal socket.
3. Use your fingers to smooth the coil out until the coil seats flat against the socket.
4. Clean pipe surface and inside of coil with 70% IPA.
DO NOT handle the freshly cleaned surfaces before assembling.

GEORGE FISCHER +GF+

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B/L George Fischer Pty. Ltd., 4 Jacks Road, AUS-South Oakleigh, Victoria 3167 Tel. 03/9563 88 99, Fax 03/9563 89 66, e-mail: sales@georgefischer.com.au
 Georg Fischer N.V./S.A., Digue du Canal 109-111 - Vaardijk 109-111, B-1070 Bruxelles/Brussel, Tél. 02/556 40 20, Fax 02/524 34 26, e-mail: 106267.254@compuserve.com
- BRA** George Fischer Ltda Av. das Nações Unidas, 21689 CEP 04795-100 - S. Paulo - SP Tel.: 155111 5687 1311 Fax: 155111 5687 6009, e-mail: vendas@br.piping.georgefischer.com
- China** Georg Fischer Piping Systems Ltd, Shanghai, No. 218 Kang Qiao Dong Rd., PRC-Shanghai 201319, P.R. China, Tel. 021/5813 33 33, Fax 021/5813 33 66, e-mail: gfsro@public.shanghai.cn.gb.com
- CH** Georg Fischer Rohrleitungssysteme (Schweiz) AG, Amsler-Laffan-Strasse 1, Postfach, CH-8201 Schaffhausen, Tel. 052/631 30 26, Fax 052/631 28 97, e-mail: info@rohrleitungssysteme.georgfischer.ch, Internet: http://www.piping.georgfischer.com
- D** Georg Fischer GmbH, Daimlerstrasse 6, Postfach 1154, D-73093 Albershausen, Tel. 07161/30 20, Fax 07161/30 22 59, e-mail: info@georgfischer.de, Internet: http://www.georgfischer.de
- DK** Georg Fischer A/S, Klintehøj Vænge 17, DK-3460 Birkerød, Tel. 045/81 19 75, Fax 045/81 16 22
- E** Georg Fischer S.A., Alcalá, 85, 2º, E-28009 Madrid, Tel. 091/781 98 90, Fax 91/576 85 86, e-mail: 101534.3724@compuserve.com
- F** George Fischer S.A., 105-113, rue Charles Michels, B.P.174, F-93208 Saint-Denis Cedex 1, Tél. 01/49 22 13 41, Fax 01/49 22 13 00, e-mail: info@georgefischer.fr
- GB** George Fischer Sales Ltd., Paradise Way, GB-Coventry, CV2 2ST, Tel. 024/76 53 55 35, Fax 024/76 53 04 50, e-mail: info@georgefischer.co.uk, Internet: http://www.georgefischer.co.uk
- I** Georg Fischer S.p.A., Via Sondrio 1, I-20063 Cernusco sul Naviglio (MI), Tel. 02/92 18 61, Fax 02/92 14 07 85, e-mail: office@piping.georgfischer.it
- IND** Georg Fischer Trenton Ltd., 201, Delta, Hiranandani Gardens, Powai, IND-Mumbai 400 076, Tel. 022/570 66 52/54, Fax 022/570 66 53, e-mail: epc@bom3.vsnl.net.in
- J** Kubota George Fischer Ltd., 2-47, Shikitsuhashi, 1-chome, Naniwa-ku, J-Osaka 556-8601, Tel. 06/6648 25 62, Fax 06/6648 25 65, e-mail: kgf-yoshi@kubota.co.jp
- N** Georg Fischer A.S., Rudsletta 97, N-1351 Rud, Tel. 067/17 17 40, Fax 067/13 92 92
- PL** Georg Fischer Sp. z o.o., ul. Radiowa 1A, PL-01-485 Warszawa, Tel. 022/638 91 39, Fax 022/638 00 94
- NL** Georg Fischer N.V., Lange Veenteweg 19, Postbus 35, NL-8160 AA Epe, Tel. 0578/67 82 22, Fax 0578/62 17 68, e-mail: info@georgfischer.nl, Internet: http://www.georgfischer.nl
- S/SF** Georg Fischer AB, Box 113, S-12523 Alvsjö-Stockholm, Tel. 08/727 47 00, Fax 08/749 23 70, e-mail: info@georgfischer.se, Internet: http://www.georgfischer.se
- SGP** George Fischer Pte. Ltd., 15 Kaki Bukit Road 2, K8 Warehouse Complex, SGP-417 845 Singapore, Tel. 747 06 11, fax 747 05 77, e-mail: info@georgfischer.com.sg
- USA*** George Fischer Inc., 2882 Dow Ave., Tustin, CA 92780-7285, Tel. 714/731 88 00, Toll Free 800/854 40 90, Fax 714/731 6201, e-mail: info@us.piping.georgefischer.com, Internet: www.us.piping.georgefischer.com
 *includes North, Central, and South America

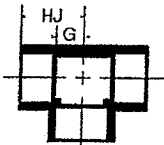
+GF+ PPro-Seal Natural Polypropylene Piping System

P/L 27: Pipe

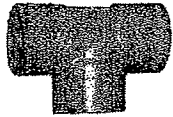
P/L 36: Electro Fusion Fittings
Material: Natural Polypropylene

PPro-Seal Pipe – 10 ft. lengths

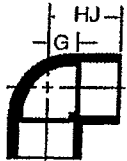
Inch Size	Part Number	bag qty.	lbs. each	avg. o.d.	min. wall
1/2	N8008-005AA	250 ft.	1.4	0.840	0.147
3/4	N8008-007AA	150 ft.	1.8	1.050	0.154
1	N8008-010AA	100 ft.	2.7	1.315	0.179
1 1/2	N8008-015AA	40 ft.	4.5	1.9	0.20
2	N8008-020AA	30 ft.	6.2	2.375	0.218



Tee



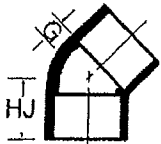
Inch Size	Part Number	sp/mp	lbs. each	hj	g
1/2	801-005F	5/25	0.05	1 7/32	1/2
3/4	801-007F	5/100	0.07	1 3/8	19/32
1	801-010F	5/35	0.13	1 11/16	23/32
1 1/2	801-015F	5/30	0.23	2 1/32	1
2	801-020F	5/10	0.35	2 5/16	1 1/4



90° Ell



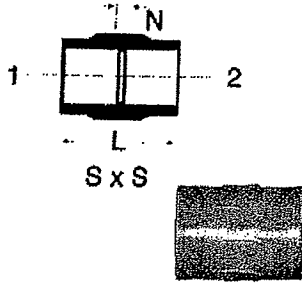
Inch Size	Part Number	sp/mp	lbs. each	hj	g
1/2	806-005F	10/100	0.04	1 7/32	1/2
3/4	806-007F	10/100	0.05	1 3/8	19/32
1	806-010F	10/60	0.09	1 11/16	23/32
1 1/2	806-015F	10/40	0.18	2 1/32	1
2	806-020F	10/30	0.27	2 5/16	1 1/4



45° Ell

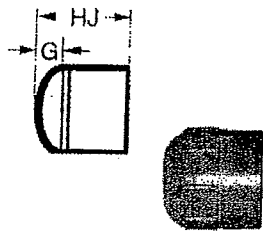


Inch Size	Part Number	sp/mp	lbs. each	hj	g
1/2	817-005F	10/30	0.03	1 1/32	5/16
3/4	817-007F	10/80	0.05	1 1/8	11/32
1	817-010F	10/40	0.08	1 3/8	13/32
1 1/2	817-015F	10/40	0.15	1 9/16	17/32
2	817-020F	10/30	0.21	1 23/32	21/32



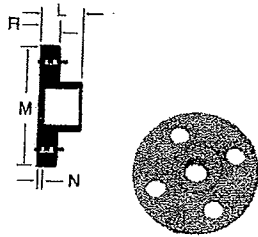
Coupling

Inch Size	Part Number	sp/mp	lbs. each	l	n
1/2	829-005F	10/100	0.03	1 9/16	1/8
3/4	829-007F	10/100	0.04	1 11/16	1/8
1	829-010F	10/60	0.06	2 1/16	1/8
1 1/2	829-015F	10/40	0.11	2 7/32	5/32
2	829-020F	10/40	0.15	2 9/32	5/32



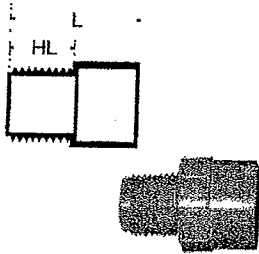
Cap

Inch Size	Part Number	sp/mp	lbs. each	hj	g
1/2	847-005F	10/30	0.02	1 5/32	7/16
3/4	847-007F	10/40	0.03	1 1/4	7/16
1	847-010F	10/40	0.05	1 1/2	17/32
1 1/2	847-015F	10/40	0.10	1 23/32	11/16
2	847-020F	10/40	0.17	1 27/32	25/32



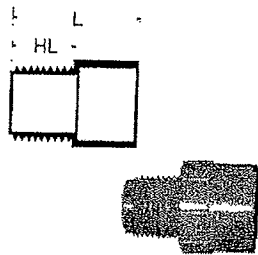
Flange with Backing Ring

inch size	Part Number	sp/mp	lbs. each	# holes	bolts d.	bolt circ d.	m	r	l	n
1/2	851-005F	5/30	0.13	4	1/2	2.38	3.50	0.41	15/16	1/8
3/4	851-007F	5/30	0.18	4	1/2	2.75	3.88	0.47	1	1/8
1	851-010F	5/30	0.25	4	1/2	3.13	4.25	0.53	1 3/16	1/8
1 1/2	851-015F	5/20	0.40	4	1/2	3.88	5.00	0.66	1 1/4	1/8
2	851-020F	5/20	0.62	4	5/8	4.75	6.00	0.71	1 3/8	3/16



Male Adapter (MT x S)*

Inch Size	Part Number	sp/mp	lbs. each	hl	l
1/2	836-005F	3/30	0.03	9/16	1 11/16
3/4	836-007F	3/30	0.04	5/8	13/16
1	836-010F	3/30	0.06	3/4	2 7/32
1 1/2	836-015F	3/15	0.11	3/4	2 11/32
2	836-020F	3/15	0.15	7/8	2 7/16



Male Reducing Adapter (MT x S)*

Inch Size	Part Number	sp/mp	lbs. each	hl	l
1/2 x 1/4	836-036F	10/100	0.05	1/2	2

*Threaded fittings are not recommended for pressure applications.



Reducer Bushing (Spg x S)

Inch Size	Part Number	sp/mp	lbs. each	l
3/4 x 1/2	837-101F	10/50	0.03	1 21/32
1 x 1/2	837-130F	10/50	0.04	1 3/4
1 x 3/4	837-131F	10/20	0.04	1 7/8
1 1/2 x 1	837-211F	10/50	0.07	2
2 x 1	837-249F	10/40	0.09	2
2 x 1 1/2	837-251F	10/40	0.11	1 13/16

Note: Field coil insertion protocol must be followed.

Coils

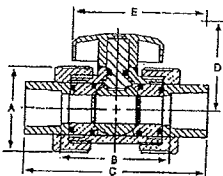


Inch Size	Part Number	sp/mp	lbs. each
1/2	6076	1	0.0003
3/4	6077	1	0.0004
1	6078	1	0.0005
1 1/2	6086	1	0.0006
2	6089	1	0.0007

+GF+ PPRO-Seal

P/L 10: Valves

Material: Natural Polypropylene (2" Valve Body PVDF)



True Union Ball Valves

Inch Size	Part Number	sp/mp	lbs. each	a	b	c	d	e
1/2	1088-005F	10	0.27	2	2 3/8	4 1/8	2	3 1/8
3/4	1088-007F	10	0.50	2 1/2	2 19/32	4 5/8	2 1/2	3 3/4
1	1088-010F	10	1.67	3 5/16	3 5/16	5 1/2	3	3 3/4
1 1/2	1088-015F	5	1.58	4 1/4	4 1/8	6 3/4	4	4 1/2
2	1088-020F	5	5.59	4 1/16	3 15/16	8 31/32	5 1/4	4 9/32



New England Air Systems

Complete Mechanical Systems & Service

June 26, 2008

Mr. Bert Delabruere
ReArch Company
30 Community Drive, Suite #8
South Burlington, Vermont 05403

Re: Statement of Warranty

Project Name: *UVM – Cosmogenic Nuclide Laboratory @ Delehanty Hall*
Project No.: O200212
Location: Trinity Campus, Burlington, Vermont 05401

Dear Mr. Delabruere:

We are proud of our craftsmanship and have confidence in the material and equipment we install. Accordingly, we are responsible to provide a warranty to our customers.

All labor, materials, equipment, and workmanship furnished by New England Air Systems, Inc. carry a **One (1) Year Warranty** from date of beneficial use or start-up whichever occurs first. If you encounter a problem during this warranty period, please contact our Service Department at 802.864.5959. Please see page 3 for a listing of all systems and equipment covered. Reference to the job name and number listed above will greatly assist us in responding to your needs.

Please note that our warranty obligations do not include maintenance of your overall mechanical system. If New England Air Systems, Inc. is not providing a separate maintenance contract on this project you are required to maintain your systems as outlined in your Operation and Maintenance Manuals. Maintenance and warranty are separate issues and must be addressed separately. Equipment failures during the warranty period that are a result of improper or lack of maintenance will void the manufacturer's warranty and subsequently our warranty.

For example, the following are not considered warranty items (non-exhaustive list):

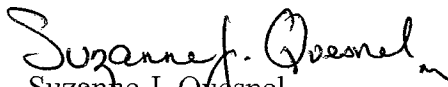
- Dirty Filters, loose or broken belts
- Clogged condensate drain lines or plumbing traps
- Improper water treatment
- Steam trap maintenance
- Lack of oiling, grease, or similar
- Blown fuses or tripped circuit breakers (*caused by power failures, electrical disturbances, or improper settings*) or switches turned off
- System Controls incorrectly adjusted or abused
- Change of building occupancy or space usage

Service calls determined to be outside of our warranty obligations or that are caused by improper or neglected maintenance will be billed to the party placing the call at our current service rates in effect at the time of the call.

The warranty period for the labor, material, equipment and workmanship furnished and installed by New England Air Systems, Inc. is as noted on Page 3 of this document.

We look forward to a long lasting relationship with your firm and the opportunity to keep your equipment operating at peak efficiency. If you have any questions, or if we may be of service in any way, please contact us.

Very truly yours,
New England Air Systems, Inc.


Suzanne J. Quesnel
Operations Coordinator

Copy: Project File
Service Department
O & M Manual



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 01

DATE: 1/11/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: _____

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: Fab-Tech Inc

MANUFACTURER: Same

PRODUCT DESCRIPTION: Fluoropolymer Coated Exhaust Duct

MODEL NUMBER: PSP

SECTION NUMBER AND TITLE: _____

PRODUCT DEVIATIONS: _____

REVISION/RESUBMITTAL IDENTIFICATION: _____

CONTRACTOR

REVIEWED BY NEASI

PM R

DATE 1-11-08

X:\shrjobs\UVM Delehanty Hall\Submittals\SUBMITTAL 01 Coated ex duct.doc

PSP[®]

PermaShield Pipe

Fluoropolymer Coated
Stainless Steel
Corrosive Fume
Exhaust Systems

PRODUCT CATALOG

Catalog 10/07.1



FAB-TECH
INCORPORATED

Catalog 10/07.1

<p>STANDARDS</p>	<p>PermaShield Pipe (PSP®) Ductwork Fabrication Standards _____ 3</p> <p>Straight Duct Gauge _____ 4</p> <p>Ring Mechanical Specifications _____ 5</p> <p>Ring Mechanical Specifications _____ 6</p> <p>PSP-EZ™ Clamp Mechanical Specifications _____ 7</p>
<p>DUCT & FITTINGS</p> <p>4" - 120" DIAMETER PRODUCT GUIDE - 8</p>	<p>Straight Duct _____ 9</p> <p>Straight Duct with Fab-Tech Flange (Use with 2" & 3" PSP-EZ™ Fittings) _____ 10</p> <p>Straight Duct with Straight Tap _____ 11</p> <p>Straight Duct with Conical Tap _____ 12</p> <p>Straight Duct with Shoe Tap _____ 13</p> <p>Straight Duct with Lateral Tap _____ 14</p> <p>Straight Duct with Multiple Taps _____ 15</p> <p>Gored Elbow _____ 16</p> <p>Reducer _____ 17</p> <p>Offset _____ 18</p>
<p>CONTROL DEVICES</p> <p>4" - 120" DIAMETER PRODUCT GUIDE - 21</p>	<p>4" - 12" Wafer Single Blade Isolation Damper _____ 20</p> <p>4" - 14" Industrial Single Blade Balancing Damper _____ 21</p> <p>4" - 14" Industrial Single Blade Isolation Damper _____ 22</p> <p>Micro Adjustable Damper Option _____ 23</p> <p>16" - 34" Heavy Duty Industrial Single Blade Damper _____ 24</p> <p>36" - 48" Heavy Duty Industrial Sealed Bearing Single Blade Damper _____ 25</p> <p>50" & Up Reinforced Heavy Duty Industrial Single Blade Damper _____ 26</p> <p>18" - 72" Vortex Damper _____ 27</p> <p>4" - 36" Single Blade Horizontal Run Isolation Blastgate _____ 28</p> <p>38" & Larger Multi Blade Horizontal Run Isolation Blastgate _____ 29</p> <p>4" - 36" Single Blade Vertical Run Isolation Blastgate _____ 30</p> <p>38" & Larger Multi Blade Vertical Run Isolation Blastgate _____ 31</p>
<p>ACCESSORIES</p> <p>4" - 120" DIAMETER PRODUCT GUIDE - 32</p>	<p>End Cap _____ 33</p> <p>Field Installed Nipple _____ 34</p> <p>Field Installed Nipple / Test Port _____ 35</p> <p>Field Installed Saddle Tap _____ 36</p> <p>Cast Ring _____ 37</p> <p>Angle Ring _____ 38</p> <p>PSP-EZ™ Clamp Kit _____ 39</p>
<p>EZ FITTINGS</p> <p>2" & 3" DIAMETER PRODUCT GUIDE - 40</p>	<p>EZ Straight Duct, Tee and Reducing Tee _____ 41</p> <p>EZ Double Tee, Lateral, 90° Elbow _____ 42</p> <p>EZ 45° Elbow, 30° Elbow, Eccentric Reducer _____ 43</p> <p>EZ Concentric Reducer, Angle Ring to EZ Reducer, End Cap _____ 44</p> <p>Micro-Adjustable EZ Damper _____ 45</p> <p>Field Installed Straight Duct EZ Flange _____ 46</p>
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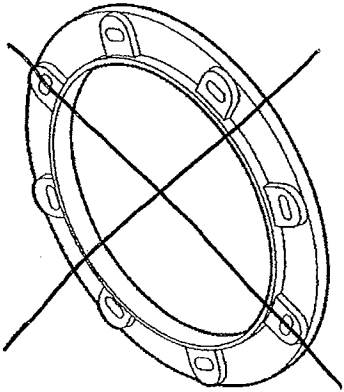
STANDARDS

Straight Duct Gauge

DUCT DIA "D"	MIN GAUGE FOR 4' DUCT							STD DUCT LENGTH	DUCT DIA "D"	MIN GAUGE FOR 8' DUCT							STD DUCT LENGTH	DUCT DIA "D"
	-6" WG	-8" WG	-10" WG	-12" WG	-14" WG	-16" WG	-18" WG			-6" WG	-8" WG	-10" WG	-12" WG	-14" WG	-16" WG	-18" WG		
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120	14							120	14							120		

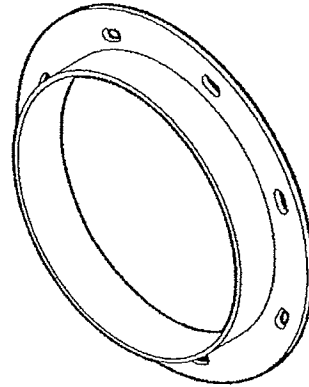
© COPYRIGHT 2007 FAB-TECH, INC. REV: 7/1/07 CAT008CD

Ring Mechanical Specifications



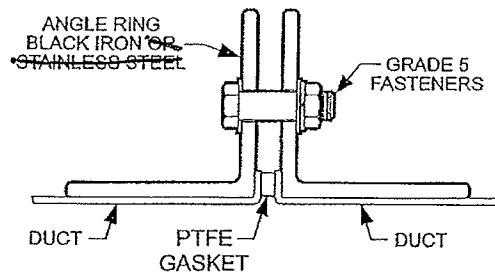
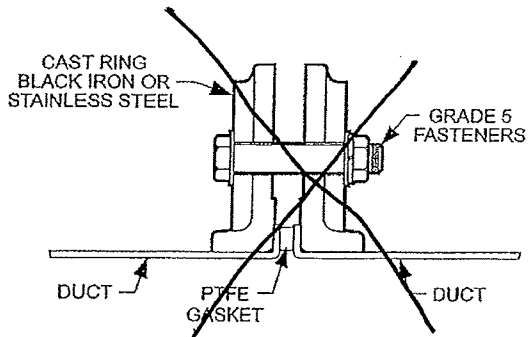
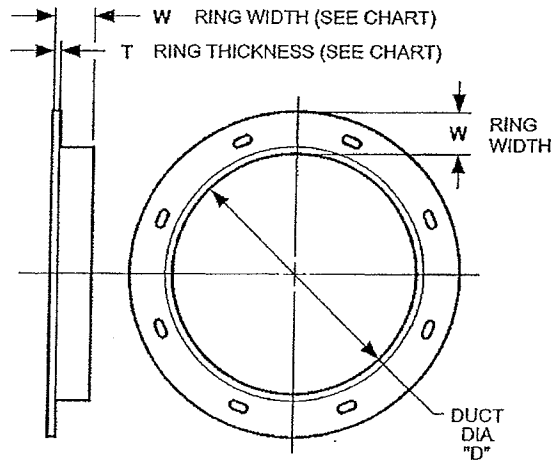
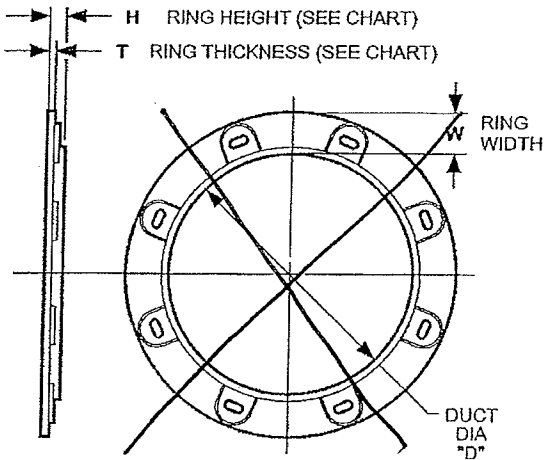
Cast Ring

STANDARD FOR DUCT 4" TO 12"

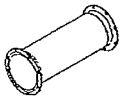

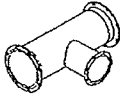
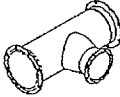
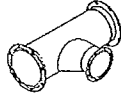
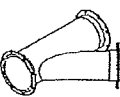

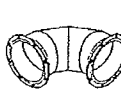
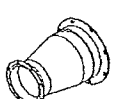
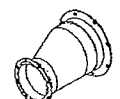
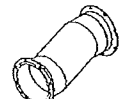
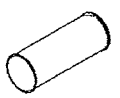
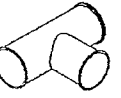



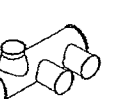

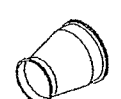




Angle Ring

STANDARD FOR DUCT 14" TO 120"



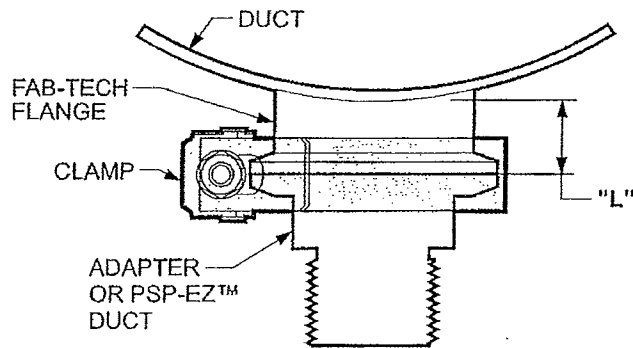
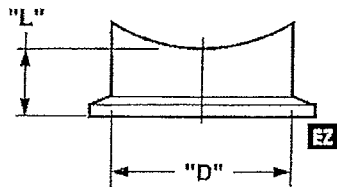
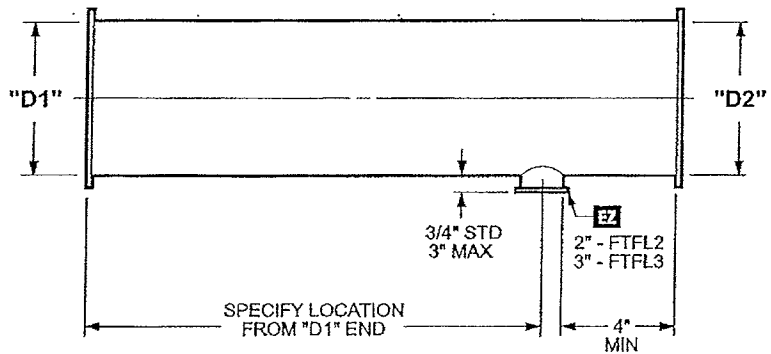
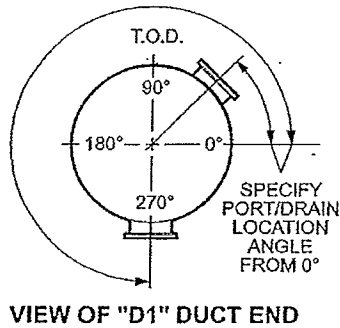
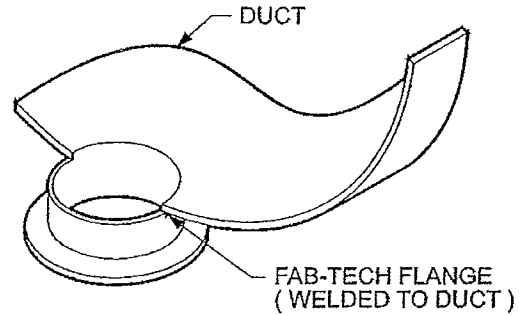
Product Guide

<p>4" to 120" DUCT</p>	<p>STRAIGHT DUCT  SIZE: 4"-120" • PAGE: 8</p>	<p>STRAIGHT DUCT WITH FAB-TECH FLANGE  SIZE: 2", 3", 4" • PAGE: 9</p>
<p>STRAIGHT DUCT WITH STRAIGHT TAP  SIZE: 6"-120" • PAGE: 10</p>	<p>STRAIGHT DUCT WITH CONICAL TAP  SIZE: 6"-120" • PAGE: 11</p>	<p>STRAIGHT DUCT WITH SHOE TAP  SIZE: 6"-120" • PAGE: 12</p>
<p>STRAIGHT DUCT WITH LATERAL TAP  SIZE: 6"-120" • PAGE: 13</p>	<p>STRAIGHT DUCT WITH MULTIPLE TAPS  SIZE: 4"-120" • PAGE: 14</p>	<p>GORED ELBOW 30°, 45°, 60°, 90°  SIZE: 4"-120" • PAGE: 15</p>
<p>CONCENTRIC REDUCER  SIZE: 6"-120" • PAGE: 16</p>	<p>ECCENTRIC REDUCER  SIZE: 6"-120" • PAGE: 16</p>	<p>OFFSET  SIZE: 4"-120" • PAGE: 17</p>
<p>4" to 14" PSP-EZ™ CLAMP</p>	<p>STRAIGHT DUCT  SIZE: 4" TO 14" • PAGE: 8</p>	<p>STRAIGHT DUCT WITH STRAIGHT TAP  SIZE: 4" TO 14" • PAGE: 10</p>
<p>STRAIGHT DUCT WITH CONICAL TAP  SIZE: 6" TO 14" • PAGE: 11</p>	<p>STRAIGHT DUCT WITH SHOE TAP  SIZE: 6" TO 14" • PAGE: 12</p>	<p>STRAIGHT DUCT WITH LATERAL TAP  SIZE: 4" TO 14" • PAGE: 13</p>
<p>STRAIGHT DUCT WITH MULTIPLE TAPS  SIZE: 4" TO 14" • PAGE: 14</p>	<p>GORED ELBOWS 30°, 45°, 60°, 90°  SIZE: 4" TO 14" • PAGE: 15</p>	<p>CONCENTRIC REDUCER  SIZE: 4" TO 14" • PAGE: 16</p>
<p>ECCENTRIC REDUCER  SIZE: 4" TO 14" • PAGE: 17</p>	<p>OFFSET  SIZE: 4" TO 14" • PAGE: 18</p>	

Straight Duct with Fab-Tech Flange

OUR RECOMMENDATION IS TO ADD TAPS TO STANDARD 4' AND 8' STRAIGHT DUCT WHEN POSSIBLE - TAP DIMENSIONS SHOWN ARE MINS

SEE FAB-TECH FLANGE SYSTEM SECTION FOR ADAPTERS AND THE EZ FITTINGS SECTION FOR DUCT TO USE WITH THE FAB-TECH FLANGE. FAB-TECH FLANGE / TEST PORT MAY BE INSTALLED ON FITTINGS OTHER THAN STRAIGHT DUCT (USE CUSTOM ORDER SHEET).



PART NO.	DESCRIPTION	"D"	"L"
FTFL2	2" FT FLANGE	2"	.75"
FTFL3	3" FT FLANGE	3"	.75"

Straight Duct with Lateral Tap

OPTIONS

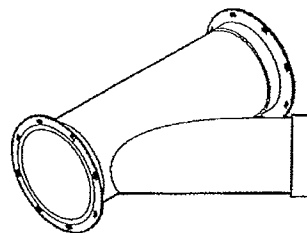
- Custom lengths available.
- Raw end available.
- Multiple and offset taps available (see the multiple tap page).
- Duct greater than 84" diameter requires Fab-Tech Engineering review and approval.

WITH EZ CLAMPS
(AVAILABLE 4" - 14")

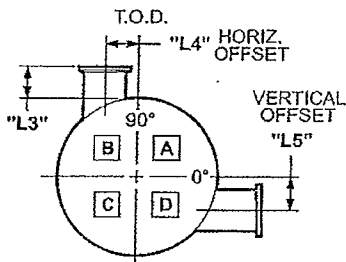
WITH CAST RINGS
(AVAILABLE 4" - 12")

WITH ANGLE RINGS
(AVAILABLE 14" - 120")

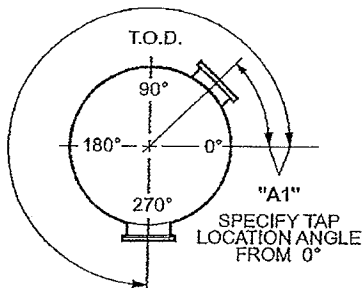
OR A COMBINATION OF JOINING SYSTEMS



OUR RECOMMENDATION IS TO ADD TAPS TO STANDARD 4' AND 8' STRAIGHT DUCT WHEN POSSIBLE - TAP DIMENSIONS SHOWN ARE MINS
LONGER THAN STANDARD LENGTHS AND/OR HIGHER SYSTEM PRESSURES MAY REQUIRE ADDITIONAL STIFFENERS PER SMACNA, CONTACT FAB-TECH FOR SPECIFIC GUIDELINES.



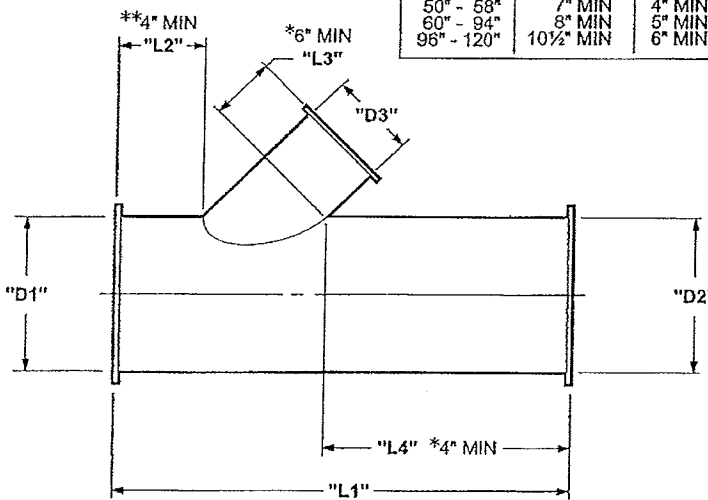
"D1" TAP OFFSET VIEW



VIEW OF "D1" DUCT END

****L2 MIN DISTANCE**
"D1" = 4" - 94": 4" MIN
"D1" = 96" - 120": 5" MIN

"D1"	"L3"	"L4"
4" - 48"	6" MIN	4" MIN
50" - 58"	7" MIN	4" MIN
60" - 94"	8" MIN	5" MIN
96" - 120"	10½" MIN	6" MIN



45° LATERAL TAP

"L1" MIN = ("D3" X 1.414) + 4" + "L4"
(SEE MIN LENGTH CHART ABOVE FOR "L4")
"L1" MAX = 96-1/4"
"D3" MAX = 60"

LATERAL TAP GREATER THAN 60° ["D3"]
REQUIRES 2 PIECE DESIGN
AND ENGINEERING REVIEW

STANDARD LENGTHS ("L")

JOINT SYSTEM	DIAMETER	"L"
EZ CLAMP	4" TO 14"	47.25"
CAST RING	4" TO 12"	47.25"
ANGLE RING	14" TO 48"	47.25"
	50" TO 120"	48.25"
ANGLE RING	16" TO 48"	95.25"
	50" TO 120"	96.25"

Gored Elbow

OPTIONS

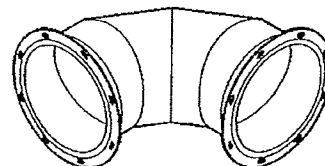
- Standard gores and radii are shown, custom number of gores, custom radii, and throat extensions are available.
- Duct greater than 84" diameter requires Fab-Tech Engineering review and approval.

WITH EZ CLAMPS
(AVAILABLE 4" - 14")

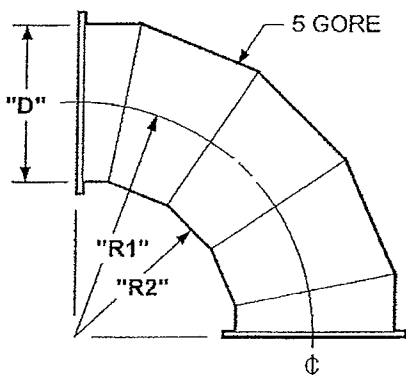
WITH CAST RINGS
(AVAILABLE 4" - 12")

WITH ANGLE RINGS
(AVAILABLE 14" - 120")

OR A COMBINATION OF JOINING SYSTEMS



90° ELBOW



DUE TO MANUFACTURING LIMITATIONS, THE FOLLOWING ELBOWS ARE NOT AVAILABLE:

- 90° ELBOW GREATER THAN 56" DIA.
- 60° ELBOW GREATER THAN 82" DIA.
- 45° ELBOW GREATER THAN 106" DIA.

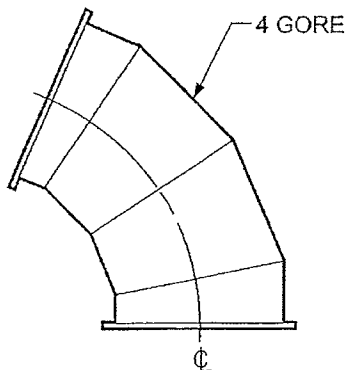
LARGE ELBOWS ABOVE THESE LIMITS WILL BE MANUFACTURED AS SMALLER FITTINGS.
EXAMPLE: AN 86" DIA. 90° ELBOW WILL BE SUPPLIED AS TWO 45° ELBOWS

STANDARD RADIUS AT THE DUCT CENTERLINE

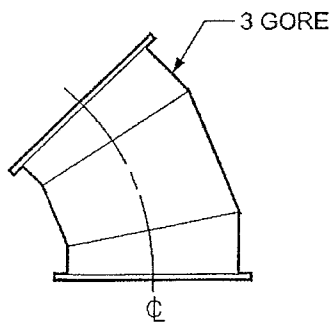
"R1" = 1.5 X "D"

STANDARD THROAT RADIUS

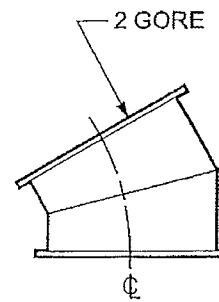
"R2" = "D"



60° ELBOW



45° ELBOW



30° ELBOW

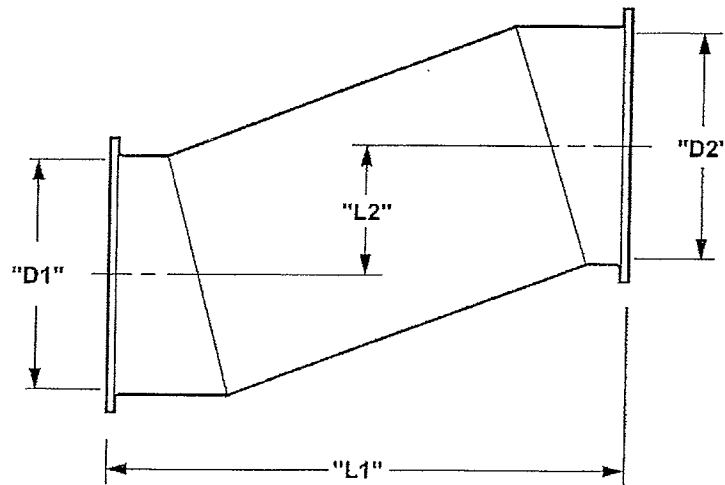
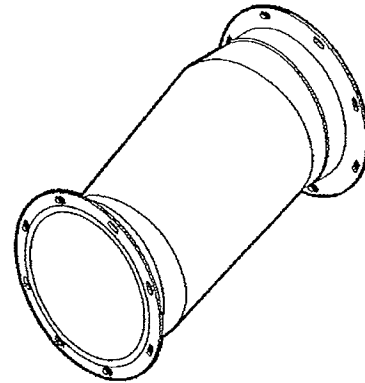
Offset

WITH EZ CLAMPS
(AVAILABLE 4" - 14")

WITH CAST RINGS
(AVAILABLE 4" - 12")

WITH ANGLE RINGS
(AVAILABLE 14" - 120")

OR A COMBINATION
OF JOINING SYSTEMS



4"-14" Industrial Single Blade Isolation Damper

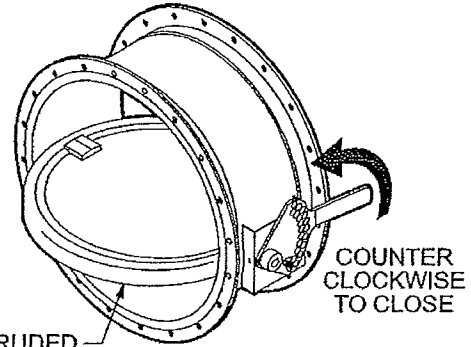
SPECIFICATIONS

- Floating cast rings - steel or black iron 4"-12".
- Floating rings - stainless steel or black iron 14".
- PSP-EZ™ joining system 4"-14".
- Manual actuation.
- PTFE blade 4" only.
- Viton extruded rubber edge seal, 6"-14".
- Molded 25% glass filled PTFE blade holders.
- Liquid tight axle seals.
- Lockout feature - 5° intervals.

OPTIONS

- Micro-adjust actuator.
- Custom length.
- Custom hole pattern.
- Electric / pneumatic actuator.

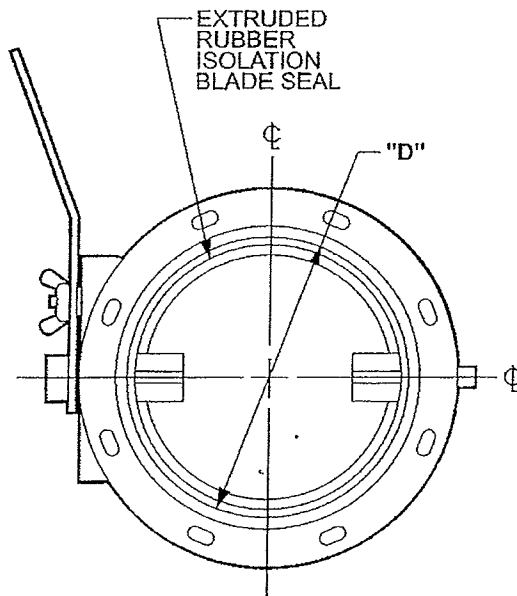
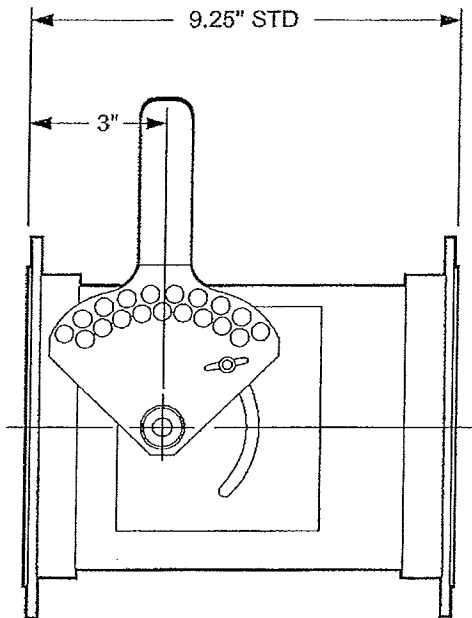
DIAMETER	BLADE	BODY
4" TO 14"	10GA	20GA



WITH EZ CLAMPS
(AVAILABLE 4" - 14")

WITH CAST RINGS
(AVAILABLE 4" - 12")

WITH ANGLE RINGS
(AVAILABLE 14")



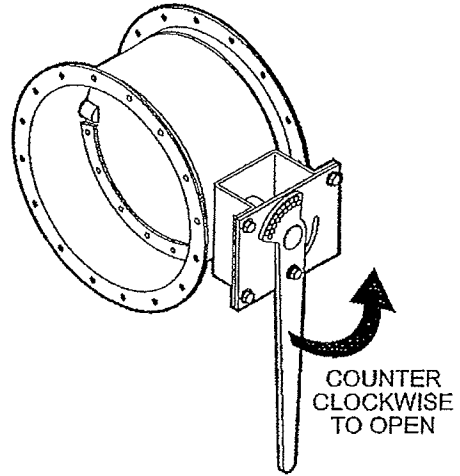
16"-34" Heavy Duty Industrial Single Blade Damper

SPECIFICATIONS

- Welded stainless steel rings
- Mounting holes straddle vertical centerline.
- Liquid tight shaft seals - thermoplastic sleeve bearings.
- 1.38" stainless steel axles - .25" stainless steel blades.
- Stainless steel quadrant plate.
- Multi-position handle, 5° lockout feature.
- Welded blade stops with Viton seal (3/16" x 1-1/2").

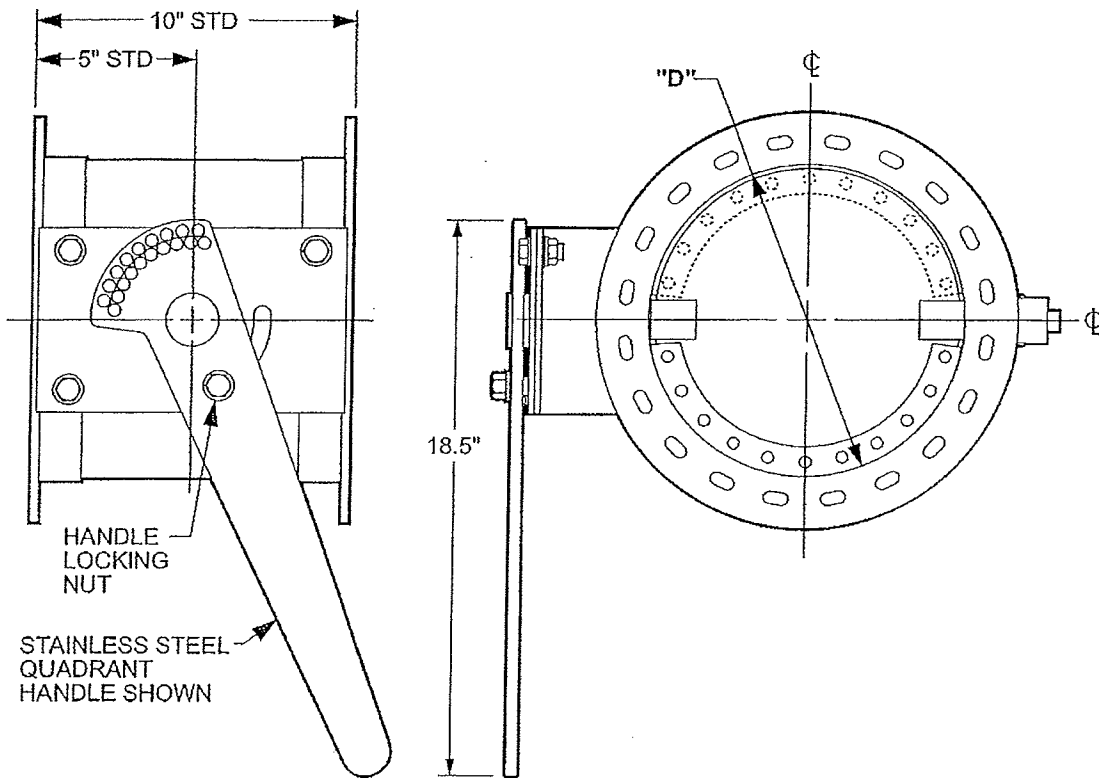
OPTIONS

- Pneumatic actuator.
- Electric actuator.
- Manual gear drive actuator.
- Custom actuator mounting kits.
- Custom hole pattern.



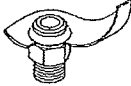


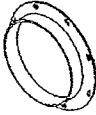







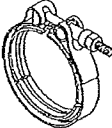
WITH ANGLE RINGS
(AVAILABLE 16" - 34")

DIAMETER	BLADE	BODY
16" TO 34"	.25"	10GA

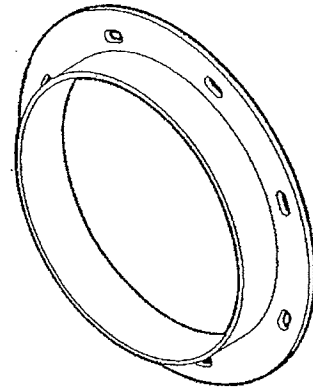


Product Guide

<p>ACCESSORIES</p>	<p>END CAP  SIZE: 4"-120" • PAGE: 33</p>	<p>FIELD INSTALLED NIPPLE  SIZE: 1", 1-1/2", 2" • PAGE: 34</p>
<p>FIELD INSTALLED TEST PORT  SIZE: 3/8", 3/4" • PAGE: 35</p>	<p>FIELD INSTALLED SADDLE TAP  SIZE: 4"-24" TEE • PAGE: 36</p>	<p>CAST RING STAINLESS STEEL OR BLACK IRON  SIZE: 4"-12" • PAGE: 37</p>
<p>ANGLE RING STAINLESS STEEL OR BLACK IRON  SIZE: 4"-120" • PAGE: 38</p>		

<p>ACCESSORIES PSP-EZ™</p>	<p>END CAP  SIZE: 4" TO 14" • PAGE: 33</p>	<p>FIELD INSTALLED SADDLE TAP  SIZE: 4" TO 14" TEE • PAGE: 36</p>
<p>CLAMP  SIZE: 2" & 3" • PAGE: 39</p>	<p>DIE CUT GASKET  SIZE: 2" & 3" • PAGE: 39</p>	<p>CLAMP KIT  SIZE: 2" & 3" • PAGE: 39</p>
<p>CLAMP KIT  SIZE: 4" TO 18" • PAGE: 39</p>		

Angle Ring
BI



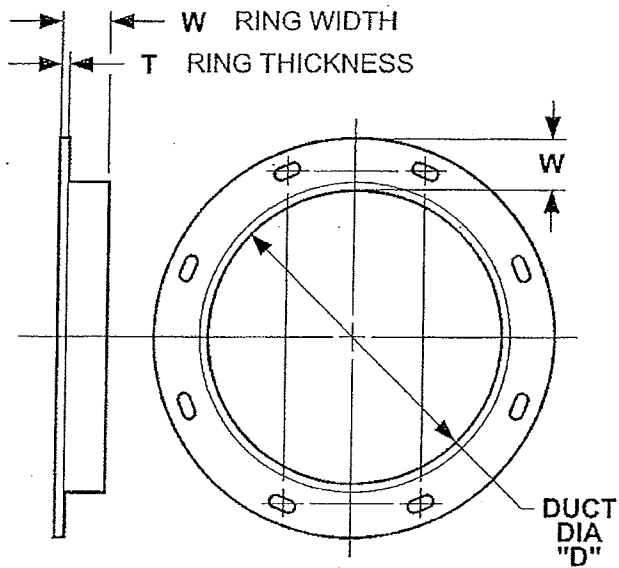
DUCT DIA "D"	ANGLE RING SPECIFICATIONS					DUCT DIA "D"	
	WIDTH (W)	THICKNESS (T)	# HOLES	BOLT HOLE SIZE	BOLT SIZE		BOLT CIRCLE DIA.
14	1-1/2	3/16	12	7/16 x 11/16 SLOT	3/8	15.81	14
16			16			17.63	16
18			18			19.63	18
20			20			21.63	20
22			22			23.68	22
24			24			25.88	24
26			26			27.88	26
28			28			29.88	28
30			30			31.88	30
32			32			33.88	32
34	2	3/16	32	7/16 x 11/16 SLOT	3/8	35.88	34
36			36			37.88	36
38			38			40.38	38
40			40			42.38	40
42			42			44.38	42
44			44			46.38	44
46			46			48.38	46
48			48			50.38	48
50			50			52.88	50
52			52			54.88	52
54	2-1/2	3/16	52	7/16 x 11/16 SLOT	3/8	56.88	54
56			56			58.88	56
58			58			60.88	58
60			60			63.38	60
62			62			65.38	62
64			64			67.38	64
66			66			69.38	66
68			68			71.38	68
70			70			73.38	70
72			72			75.38	72
74	3	1/4	74	1/2 x 3/4 SLOT	7/16	77.38	74
76			76			79.38	76
78			78			81.38	78
80			80			83.38	80
82			82			85.38	82
84			84			87.38	84
86			86			89.38	86
88			88			91.38	88
90			90			93.38	90
92			92			95.38	92
94	4	1/4	94	1/2 x 3/4 SLOT	7/16	97.38	94
96			96			100.38	96
98			98			102.38	98
100			100			104.38	100
102			102			106.38	102
104			104			108.38	104
106			106			110.38	106
108			108			112.38	108
110			110			114.38	110
112			112			116.38	112
114	4	1/4	112	1/2 x 3/4 SLOT	7/16	118.38	114
116			116			120.38	116
118			118			122.38	118
120			120			124.38	120

NOTES:

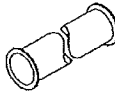
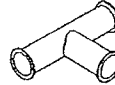
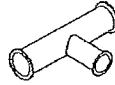
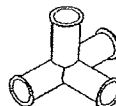



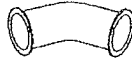
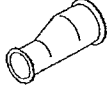





- Standard mounting hole locations for welded (fixed) angle rings straddle the vertical centerline unless otherwise specified.
- Refer to chart for standard angle rings.

OPTIONS:

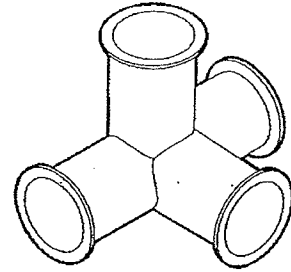
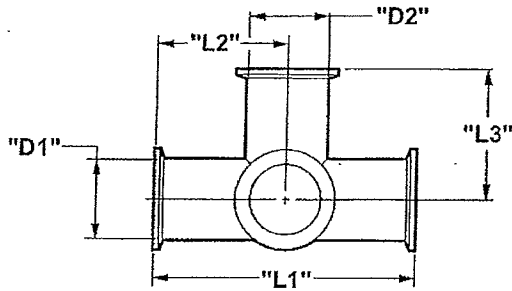
- Custom hole pattern and orientation available.



Product Guide

<p>2" & 3" PSP-EZ™ CLAMP</p>	<p>STRAIGHT DUCT 4' LENGTH OR CUSTOM</p>  <p>SIZE: 2" & 3" • PAGE: 41</p>	<p>STRAIGHT TEE</p>  <p>SIZE: 2" & 3" • PAGE: 41</p>
<p>REDUCING TEE</p>  <p>SIZE: 3" TO 2" • PAGE: 41</p>	<p>DOUBLE TEE</p>  <p>SIZE: 2" & 3" • PAGE: 42</p>	<p>LATERAL - 45°</p>  <p>SIZE: 2" & 3" • PAGE: 42</p>
<p>ELBOW 90°</p>  <p>SIZE: 2" & 3" • PAGE: 42</p>	<p>ELBOW 45°</p>  <p>SIZE: 2" & 3" • PAGE: 43</p>	<p>ELBOW 30°</p>  <p>SIZE: 2" & 3" • PAGE: 43</p>
<p>ECCENTRIC ADAPTER</p>  <p>SIZE: 3" TO 2" 4" TO 2", 4" TO 3" • PAGE: 43</p>	<p>CONCENTRIC ADAPTER</p>  <p>SIZE: 3" TO 2" 4" TO 2", 4" TO 3" • PAGE: 44</p>	<p>VAN STONE TO EZ FLANGE ADAPTER</p>  <p>SIZE: 3" TO 2" 4" TO 2", 4" TO 3" • PAGE: 44</p>
<p>END CAP</p>  <p>SIZE: 2" & 3" • PAGE: 44</p>	<p>MICRO ADJUSTABLE DAMPER</p>  <p>SIZE: 2" & 3" • PAGE: 45</p>	<p>FIELD INSTALL STRAIGHT DUCT FLANGE</p>  <p>SIZE: 2" & 3" • PAGE: 46</p>

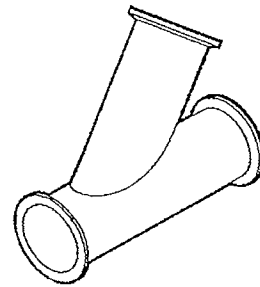
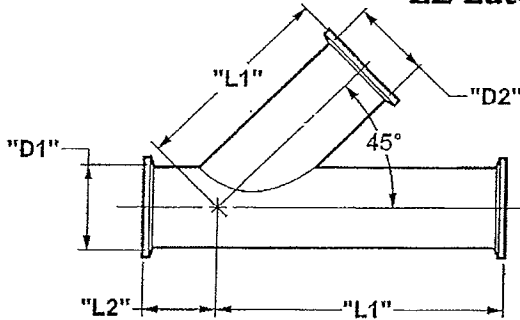
EZ Double Tee



PART NO.*	DESCRIPTION	"D1"	"D2"	"L1"	"L2"	"L3"
2T2T2	2" LINE W/ DOUBLE 2" TEE	2"	2"	6.24"	3.12"	3.12"

*PART NO. INCLUDES: (2) "D1" CLAMPS, (1) "D2" CLAMP & (3) GASKETS

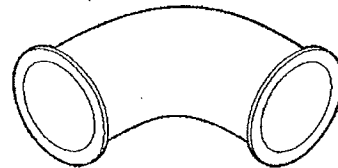
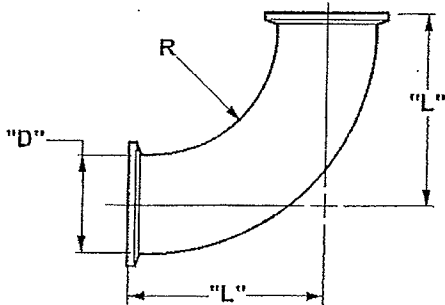
EZ Lateral



PART NO.*	DESCRIPTION	"D1"	"D2"	"L1"	"L2"
02Y02	2" LINE WITH 2" LATERAL	2"	2"	7.50"	2.00"
03Y03	3" LINE WITH 3" LATERAL	3"	3"	9.31"	2.03"

*PART NO. INCLUDES: (2) "D1" CLAMPS, (1) "D2" CLAMP & (3) GASKETS

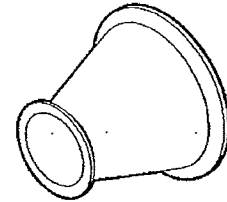
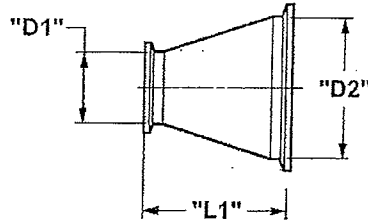
90° EZ Elbow



PART NO.*	DESCRIPTION	"D"	"L"	R
PZE02	2" 90° ELBOW	2"	3.12"	2"
PZE03	3" 90° ELBOW	3"	4.62"	3"

*PART NO. INCLUDES: (1) CLAMP & (1) GASKET

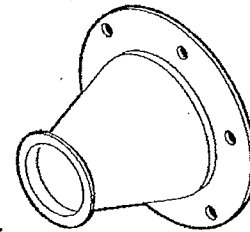
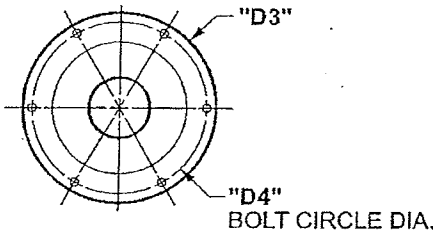
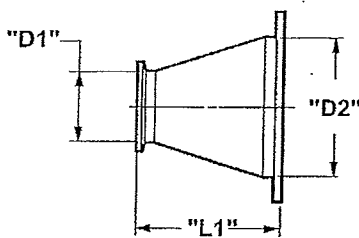
Concentric EZ Reducer



PART NO.*	DESCRIPTION	"D1"	"D2"	"L1"
PCA32F	2" TO 3" CONCENTRIC	2"	3"	4.31"
PCA42F	2" TO 4" CONCENTRIC	2"	4"	3.94"
PCA43F	3" TO 4" CONCENTRIC	3"	4"	4.31"

*PART NO. INCLUDES: (1) "D1" CLAMPS, (1) "D2" CLAMP & (2) GASKETS

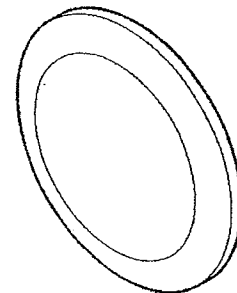
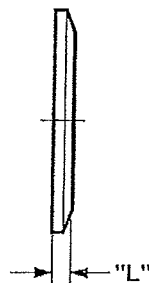
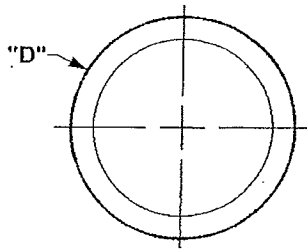
Angle Ring to EZ Reducer



PART NO.*	DESCRIPTION	"D1"	"D2"	"L1"	"D3" O.D.	"D4" DIA.
PCA32R	2" TO 3" ANGLE RING	2"	3"	4.25"	5.06"	4.31"
PCA42R	2" TO 4" ANGLE RING	2"	4"	3.88"	6.06"	5.31"
PCA43R	3" TO 4" ANGLE RING	3"	4"	4.25"	6.06"	5.31"

*PART NO. INCLUDES: (1) "D1" CLAMPS, "D2" HARDWARE FOR ANGLE RING, & (2) GASKETS

EZ End Cap



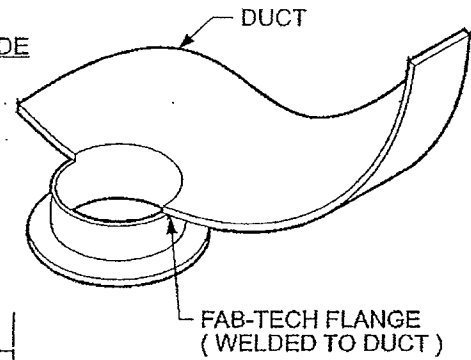
PART NO.*	DESCRIPTION	"D"	"L"
PZC02	2" END CAP	2"	0.21"
PZC03	3" END CAP	3"	0.21"

*PART NO. INCLUDES: (1) CLAMP & (1) GASKET

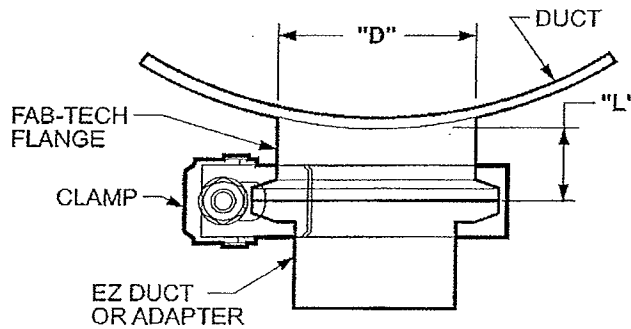
Fab-Tech Flange

NOTES

- Refer to Fab-Tech's INSTALLATION AND ASSEMBLY GUIDE for assembly instructions.
- Fluoropolymer coating on inside surface and flange faces.
- Fab-Tech Flange / Test Port may be installed on fittings other than straight duct.
- Refer to the EZ fittings section for duct or the Fab-Tech Flange system section for adapters to attach to the Fab-Tech Flange.



PART NO.	DESCRIPTION	"D"	"L"
FTFL2	2" FT FLANGE	2"	.75"
FTFL3	3" FT FLANGE	3"	.75"



ADAPTERS AVAILABLE FOR THE FT FLANGE:

Dwyer Pitot Adapter

NPT Male Nipple

Sprinkler Adapter

KF Flange Adapter

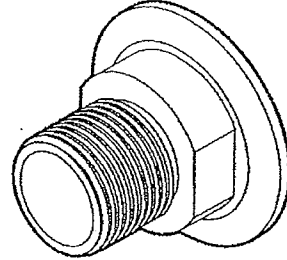
NPT Female Coupler

SWAGELOK® Adapter

NPT Male Nipple Adapter

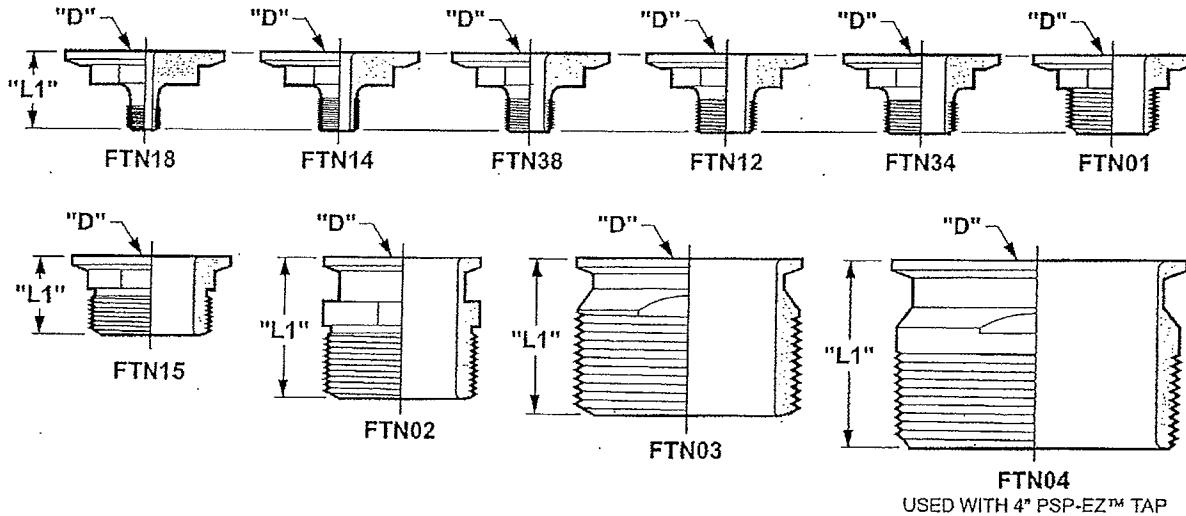
NOTES

- Refer to Fab-Tech's INSTALLATION AND ASSEMBLY GUIDE for assembly instructions.
- Fluoropolymer coating on inside surface and flange face.
- NPT nipples are not covered under warranty other than for defects in manufacture. NPT threads are not coated and since the threads could possibly come in direct contact with corrosive fumes and fluids, Fab-Tech offers only a limited warranty for these parts. Depending on the specific application, NPT adapters should fall into the classification of consumable parts.



PART NO.*	DESCRIPTION	"D"	PIPE THREAD	"L1"
FTN18	2" TO 1/8" NPT	2"	1/8" NPT	1.25"
FTN14	2" TO 1/4" NPT	2"	1/4" NPT	1.25"
FTN38	2" TO 3/8" NPT	2"	3/8" NPT	1.25"
FTN12	2" TO 1/2" NPT	2"	1/2" NPT	1.25"
FTN34	2" TO 3/4" NPT	2"	3/4" NPT	1.25"
FTN01	2" TO 1" NPT	2"	1" NPT	1.25"
FTN15	2" TO 1.5" NPT	2"	1.5" NPT	1.25"
FTN02	2" TO 2" NPT	2"	2" NPT	2.25"
FTN03	3" TO 3" NPT	3"	3" NPT	2.50"
FTN04**	4" TO 4" NPT	4"	4" NPT	3.00"

*PART NO. INCLUDES: (1) CLAMP & (1) GASKET
 **USED WITH 4" PSP-EZ™ TAP

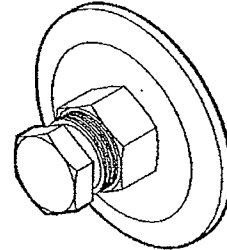


FTN04
 USED WITH 4" PSP-EZ™ TAP

Swagelok® Adapter

NOTES

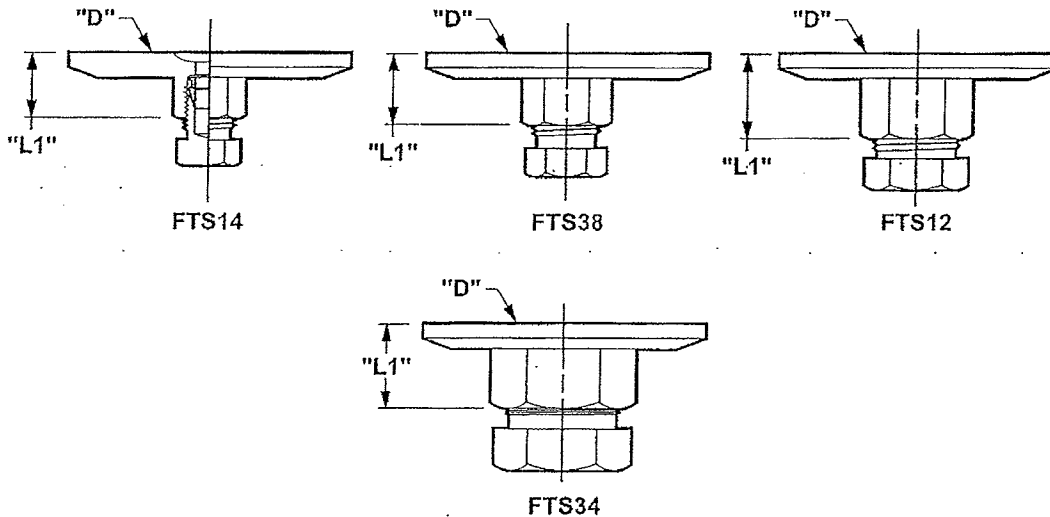
- Refer to Fab-Tech's INSTALLATION AND ASSEMBLY GUIDE for assembly instructions.
- Fluoropolymer coating on flange face.
- SWAGELOK® Adapters are not covered under warranty other than for defects in manufacture. SWAGELOK® threads are not coated and since the threads could possibly come in direct contact with corrosive fumes and fluids, Fab-Tech offers only a limited warranty for these parts. Depending on the specific application, SWAGELOK® adapters should fall into the classification of consumable parts.

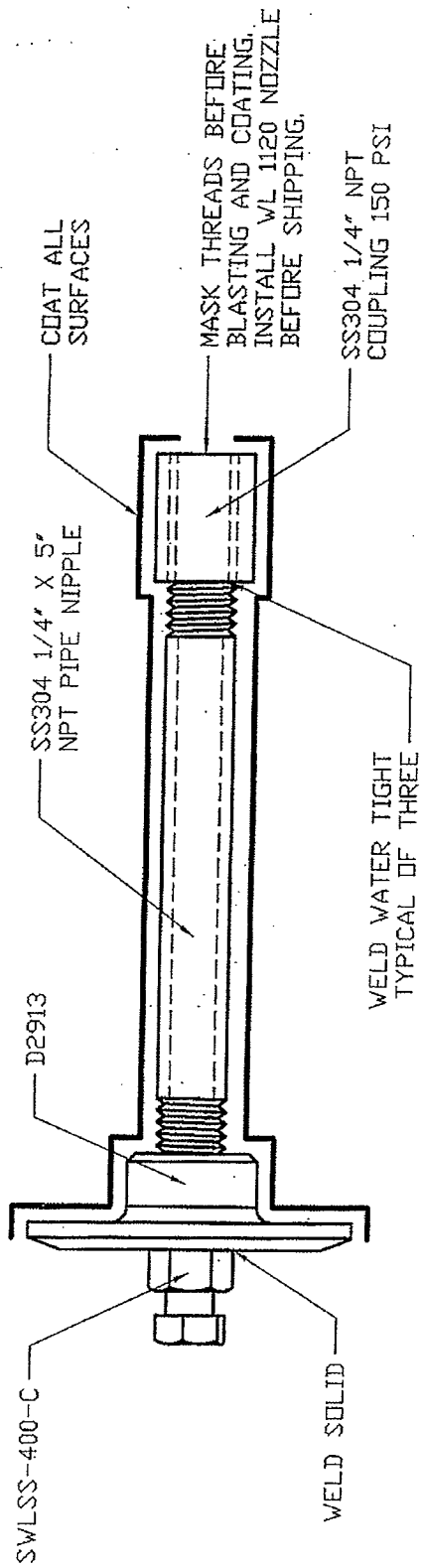


PART NO.*	DESCRIPTION	"D"	THREAD	"L1"
FTS18**	2" TO 1/8" SWAGELOK®	2"		
FTS14	2" TO 1/4" SWAGELOK®	2"	7/16-20	.59"
FTS38	2" TO 3/8" SWAGELOK®	2"	9/16-18	.65"
FTS12	2" TO 1/2" SWAGELOK®	2"	3/4-16	.77"
FTS34	2" TO 3/4" SWAGELOK®	2"	1-1/16-12	.77"

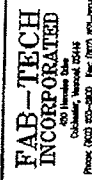
*PART NO. INCLUDES: (1) CLAMP, (1) GASKET, (1) SWAGELOK® FRONT FERRULE & (1) SWAGELOK® BACK FERRULE

**FTS18 IS AVAILABLE AS A CUSTOM ADAPTER, NOT A STOCK ITEM

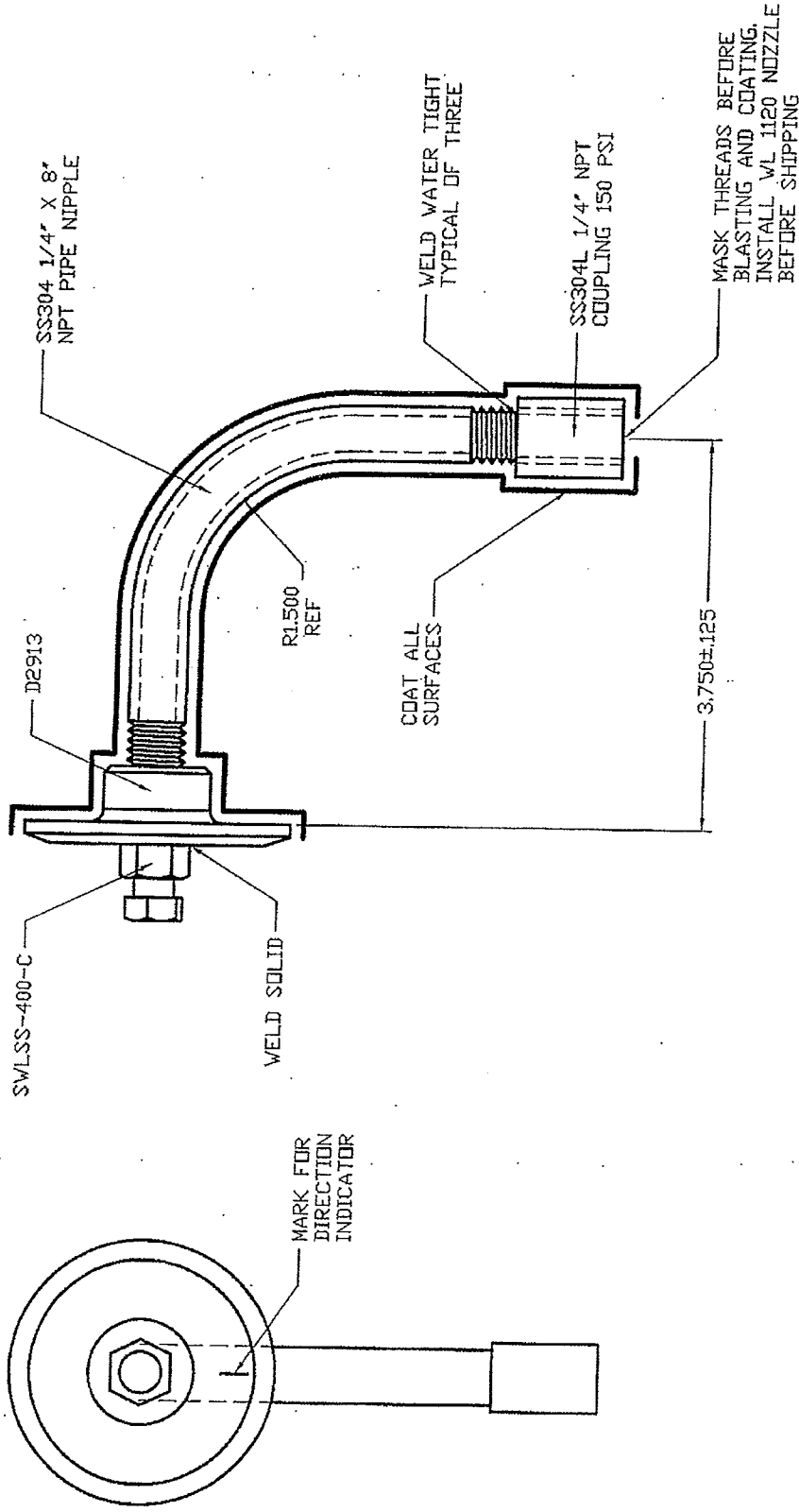




UNLESS OTHERWISE SPECIFIED		SIGNATURE	DATE
ALL DIMENSIONS ARE IN INCHES		DRAWN Ereggo	08sep04
SHEET METAL TOLERANCE		ENGR:	
X ±.002	ANGULAR TOL ± 2°	THIS DRAWING CONTAINS CONFIDENTIAL AND PROPRIETARY INFORMATION OF FAB-TECH INC. NEITHER THIS NOR THE INFORMATION CONTAINED HEREIN SHALL BE DISCLOSED TO OTHERS WITHOUT THE WRITTEN CONSENT OF FAB-TECH INC.	
.XX ±.001	FRACTIONAL #1/16	DO NOT SCALE	
.XXX ±.020	FINISH XXXXX	SCALE: A	
MATERIAL 304 SS	THIRD ANGLE PROJECTION	TITLE: Corner Spray System	
304 SS	⊕	SIZE DRAWING NO. D2917	
Debur Per S.O.P.		SHEET 1 OF 1	
REL. TO PRID.	31809/9/04 GDP		
ENG DOCUMENT	3/16/2007		



FAB-TECH INCORPORATED
 100 Lincoln Ave.
 1000 West 10th St.
 Phone: (803) 800-8800 Fax: (803) 800-8000



WELD WATER TIGHT
TYPICAL OF THREE

SS304L 1/4" NPT
COUPLING 150 PSI

3.750±.125

MARK THREADS BEFORE
BLASTING AND COATING.
INSTALL WL 1120 NOZZLE
BEFORE SHIPPING

UNLESS OTHERWISE SPECIFIED		SIGNATURE	DATE
ALL DIMENSIONS ARE IN INCHES		DRAWN: Greggo	09sep04
SHEET METAL TOLERANCE		ENGR:	
X ±.062	ANGULAR TOL ± 2°	THIS DOCUMENT CONTAINS CONFIDENTIAL AND PROPRIETARY INFORMATION FOR FAB-TECH INC. NEITHER THIS NOR THE CONTENTS HEREIN SHALL BE DISCLOSED TO OTHERS WITHOUT THE WRITTEN EXPRESS AUTHORIZATION OF FAB-TECH INC.	
XX ±.031	FRACTIONAL #1/16	DO NOT SCALE	
XXX ±.020	FINISH: XXXXX	SCALE: A	
MATERIAL: SS 304	THIRD ANGLE PROJECTION	TITLE: 6" In-Line Spray System	
317919/9/04 GDP		DRAWING NO. D2916	
3/16/2007 1:22 PM		SIZE: A	
BY: [Signature]		SCALE: SHEET 1 OF 1	



New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 06

DATE: 01/30/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: BETE Fog Nozzle

MANUFACTURER: BETE

PRODUCT DESCRIPTION: Exhaust Duct Nozzle Data

MODEL NUMBER: TF8 & PSP

SECTION NUMBER AND TITLE: _____

PRODUCT DEVIATIONS: _____

REVISION/RESUBMITTAL IDENTIFICATION: #1

NOTE - Nozzle Lay-out will be with Duct Construction Submittal

CONTRACTOR

REVIEWED BY NEASI	
PM	_____
DATE	_____

X:\shrjobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 01 Coated ex duct REV-1.doc

Randy Chicoine

From: Michael Peters [mpet@bete.com]
Sent: Monday, January 28, 2008 3:21 PM
To: Randy Chicoine
Subject: "Pig Tail" nozzle from BETE



TF8@20psi 1.pdf
(16 KB)

Dear Randy,

Attached are the projected trajectories for the 90 degree (1/4"TF8FCN) and 120 degree (1/4"TF8FC) nozzles at 20 psi. If you need any further information on the nozzles please let me know.

Regards,
Mike Peters
Applications Engineer
BETE Fog Nozzle, Inc.
Performance Through Engineering
413-772-2166 x 192
www.bete.com
<<TF8@20psi 1.pdf>>



TF

55 Reg

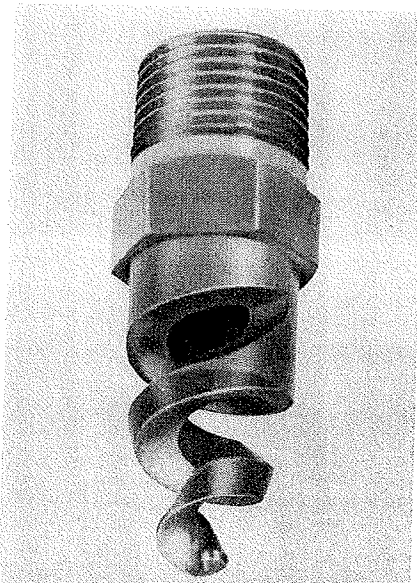
Wide Range of Flows and Angles

DESIGN FEATURES

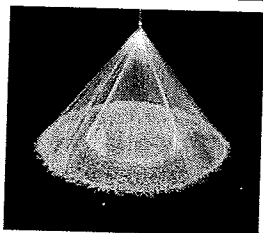
- The original spiral nozzle invented by BETE and continuously improved!
- High energy efficiency
- One-piece/no internal parts
- Clog-resistant performance
- High discharge velocity
- Male connection standard; female connection available by special order
- TF24-150 has FM approval

SPRAY CHARACTERISTICS

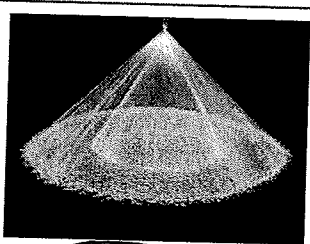
- Wide range of flow rates and spray angles
 - Fine atomization
- Spray patterns:** Full and Hollow Cone
Spray angles: 50° to 180°
Flow rates: 0.5 to 3320 gpm
 (Higher flow rates available)



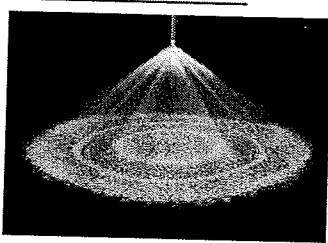
60°, 90°, 120° Metal



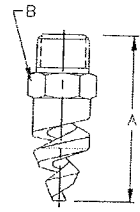
Full Cone 60° (NN)



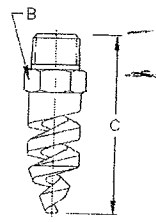
Full Cone 90° (FCN)



Full Cone 150°/170°



90°, 120°



150°, 170°

Dimensions are approximate. Check with BETE for critical dimension applications.

TF Full Cone Flow Rates and Dimensions

Full Cone, 60° (NN), 90° (FCN or FFCN), 120° (FC or FFC), 150° and 170° Spray Angles, 1/8" to 4" Pipe Sizes

Male Pipe Size	Nozzle Number	Available Spray Angles					K Factor	GALLONS PER MINUTE @ PSI										Approx. (in.)		Dim. (in.) for Metal Only*			Wt. (oz.)						
		60°	90°	120°	150°	170°		5 PSI	10 PSI	20 PSI	30 PSI	40 PSI	50 PSI	60 PSI	80 PSI	100 PSI	200 PSI	400 PSI	Free Orif. Dia.	Pass. Dia.	A**	B	C	60°	90°	120°			
1/8	TF6	60°	90°	120°	150°	170°	0.221	0.495	0.70	0.99	1.21	1.40	1.57	1.71	1.98	2.21	3.13	4.43	0.09	0.09	1.69	0.56	1.69	1.00	0.20				
	TF8	60°	90°	120°	150°	170°	0.411	0.919	1.30	1.84	2.25	2.60	2.91	3.18	3.68	4.11	5.81	8.22	0.13	0.13	1.69	0.56	2.19						
1/4	TF6	60°	90°	120°	150°	170°	0.221	0.495	0.70	0.99	1.21	1.40	1.57	1.71	1.98	2.21	3.13	4.43	0.09	0.09	1.88	0.56	1.88	1.25	0.20				
	TF8	60°	90°	120°	150°	170°	0.411	0.919	1.30	1.84	2.25	2.60	2.91	3.18	3.68	4.11	5.81	8.22	0.13	0.13	1.88	0.56	2.38						
	TF10	60°	90°	120°	150°	170°	0.632	1.41	2.00	2.83	3.46	4.00	4.47	4.90	5.66	6.32	8.94	12.6	0.16	0.13	1.88	0.56	2.38						
3/8	TF6	60°	90°	120°			0.221	0.495	0.70	0.99	1.21	1.40	1.57	1.71	1.98	2.21	3.13	4.43	0.09	0.09									
	TF8	60°	90°	120°			0.411	0.919	1.30	1.84	2.25	2.60	2.91	3.18	3.68	4.11	5.81	8.22	0.15	0.13									
	TF10	60°	90°	120°			0.632	1.41	2.00	2.83	3.46	4.00	4.47	4.90	5.66	6.32	8.94	12.6	0.16	0.13									
	TF12	60°	90°	120°	150°	170°	0.949	2.12	3.00	4.24	5.20	6.00	6.71	7.35	8.49	9.49	13.4	19.0	0.19	0.13	1.88	0.69	2.38	1.63	0.25				
	TF16	60°	90°	120°	150°	170°	1.68	3.75	5.30	7.50	9.18	10.6	11.9	13.0	15.0	16.8	23.7	33.5	0.22	0.13									
1/2	TF20	60°	90°	120°	150°	170°	2.61	5.83	8.25	11.7	14.3	16.5	18.4	20.2	23.3	25.1	36.9	52.2	0.25	0.13									
	TF24	60°	90°	120°	150°	170°	3.81	8.52	12.1	17.0	20.9	24.1	26.9	34.1	38.1	53.9	76.2	0.31	0.13										
3/4	TF28	60°	90°	120°	150°	170°	5.22	11.7	16.5	23.3	28.6	33.0	36.9	40.4	46.7	52.2	73.8	104	0.38	0.19	2.50	0.88	3.06	3.00	0.50				
	TF32	60°	90°	120°	150°	170°	6.64	14.8	21.0	29.7	36.4	42.0	47.0	51.4	59.4	66.4	93.9	133	0.44	0.19	2.75	1.13	3.50	5.50	0.88				
1	TF40	60°	90°	120°	150°	170°	10.6	23.7	33.5	47.4	58.0	67.0	74.9	82.1	94.8	106	150	212	0.63	0.25	3.63	1.38	4.38	8.50	2.50				
	TF48	60°	90°	120°	150°	170°	15.0	33.6	47.5	67.2	82.3	95.0	106	116	134	150	212	300	0.75	0.25									
1 1/2	TF56	60°	90°	120°	150°	170°	20.4	45.6	64.5	91.2	112	129	144	158	182	204	288	408	0.88	0.31									
	TF64	60°	90°	120°	150°	170°	26.7	59.7	84.5	120	146	169	189	207	239	267	378	534	1.00	0.31	4.38	2.00	5.38	22.0	4.25				
	TF72	60°	90°	120°	150°	170°	30.4	67.9	96.0	136	166	192	215	235	272	304	429	607	1.13	0.31									
2	TF88	60°	90°	120°	150°	170°	44.3	99.0	140	198	242	280	313	343	396	443	626	885	1.38	0.44	5.63	2.50	5.88	46.0	8.00				
	TF96	60°	90°	120°	150°	170°	55.9	125	177	250	306	354	395	433	500	559	791	1120	1.50	0.44	6.88	2.50	7.00	54.0	9.00				
3	TF112	60°	90°	120°	150°	170°	81.0	181	256	362	443	512	572	627	724	810	1150	1620	1.75	0.56	8.63	3.50	9.25	114	20.0				
	TF128	60°	90°	120°	150°	170°	107	239	339	480	588	679	759	831	960	1070	1510	2150	2.00	0.56									
4	TF160	60°	90°	120°			166	371	525	742	909	1050	1170	1290	1480	1660	2350	3320	2.50	0.63	10.1	4.50		169	27.0				

Flow Rate (GPM) = K √PSI *Dimensions are for bar stock, cast sizes may vary. **60° nozzles slightly longer, consult BETE. † Three turn nozzles

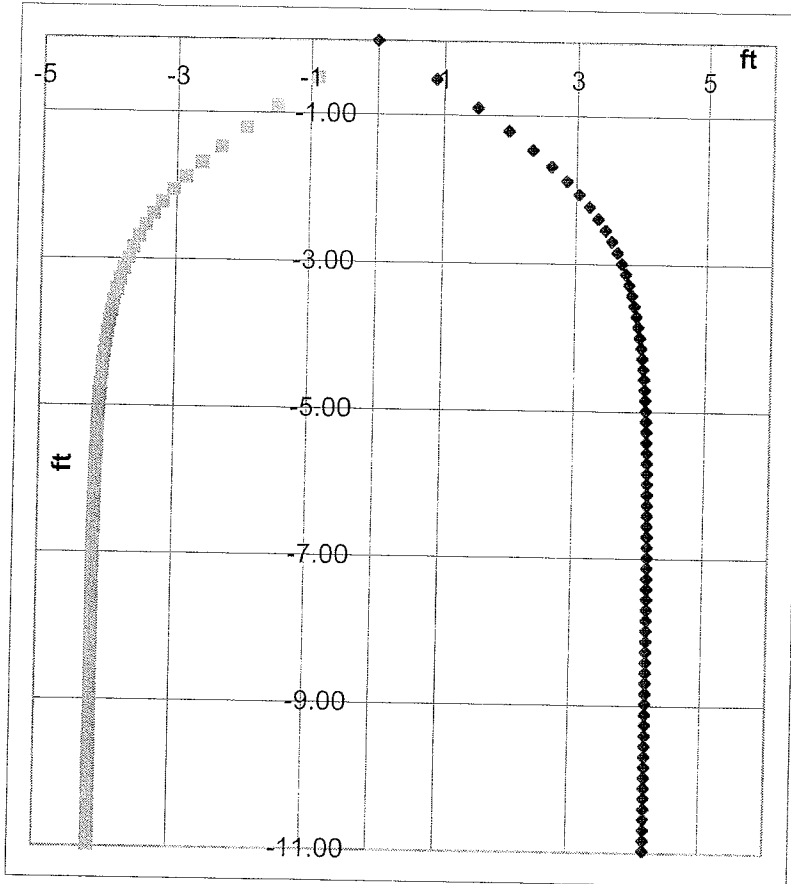
Standard Materials: Brass, 316 Stainless Steel (PVC), polypropylene and PTFE (Poly. not available for TF6 thru TF10).

Spray angle performance varies with pressure. Contact BETE for specific data on critical applications.



TO ORDER: specify pipe size, connection type, nozzle number, spray angle, and material.

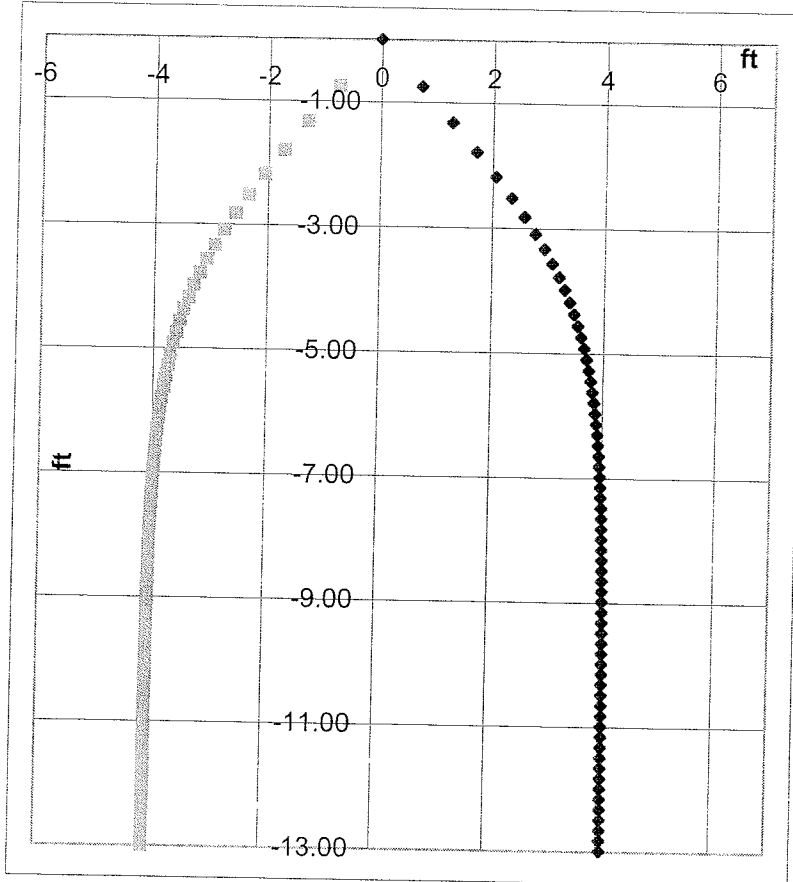
NE Air
Application 080157
1/4 TF8FC at 20 psi 120°



nozzle orientation 270°

NE Air
Application 080157
1/4 TF8FCN at 20 psi

90°

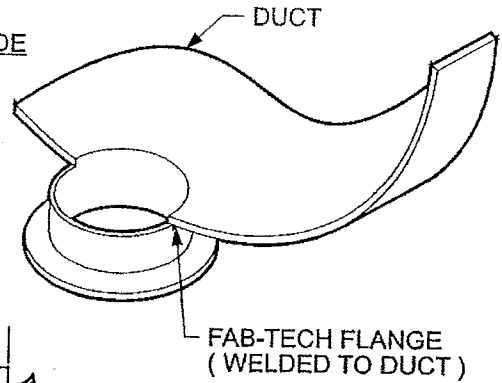


nozzle orientation 270°

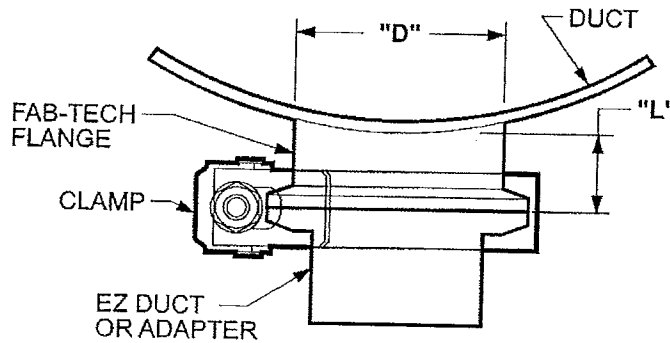
Fab-Tech Flange

NOTES

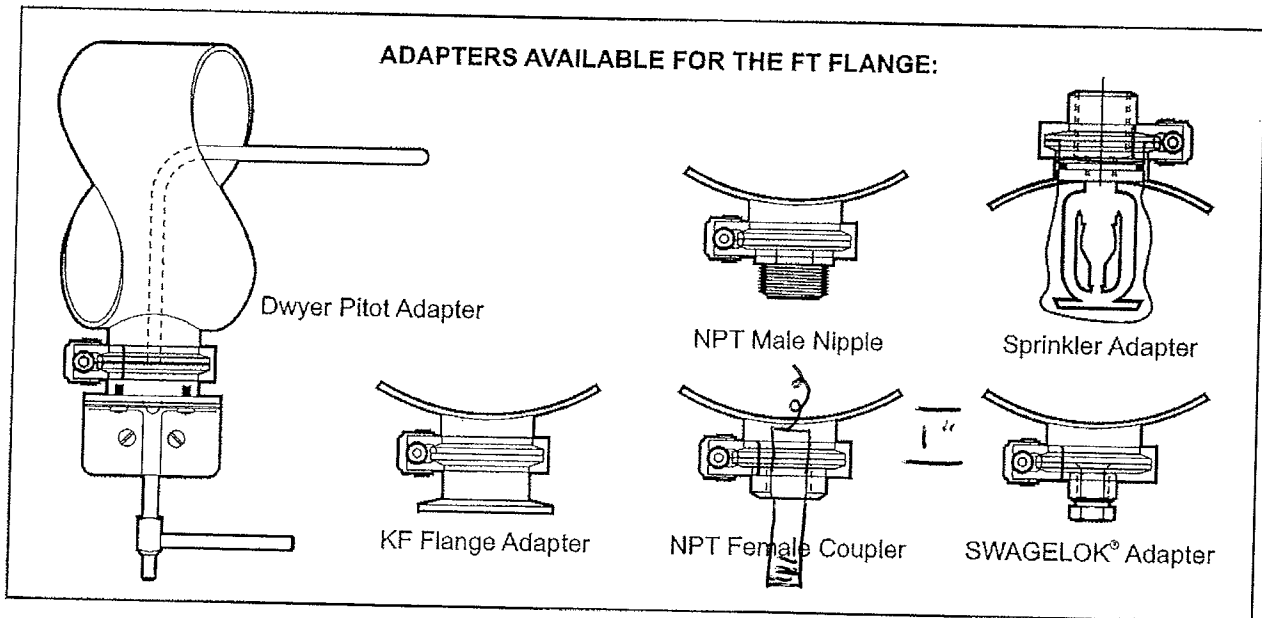
- Refer to Fab-Tech's INSTALLATION AND ASSEMBLY GUIDE for assembly instructions.
- Fluoropolymer coating on inside surface and flange faces.
- Fab-Tech Flange / Test Port may be installed on fittings other than straight duct.
- Refer to the EZ fittings section for duct or the Fab-Tech Flange system section for adapters to attach to the Fab-Tech Flange.



PART NO.	DESCRIPTION	"D"	"L"
FTFL2	2" FT FLANGE	2"	3 1"
FTFL3	3" FT FLANGE	3"	.75"



ADAPTERS AVAILABLE FOR THE FT FLANGE:





New England Air Systems

Complete Mechanical Systems & Service

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 04 revised

DATE: 02/29/2008

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: Filter Sales and Service

MANUFACTURER: Camfil Farr

PRODUCT DESCRIPTION: ULPA Diffusers


MODEL NUMBER: _____

SECTION NUMBER AND TITLE: 15861

PRODUCT DEVIATIONS: _____

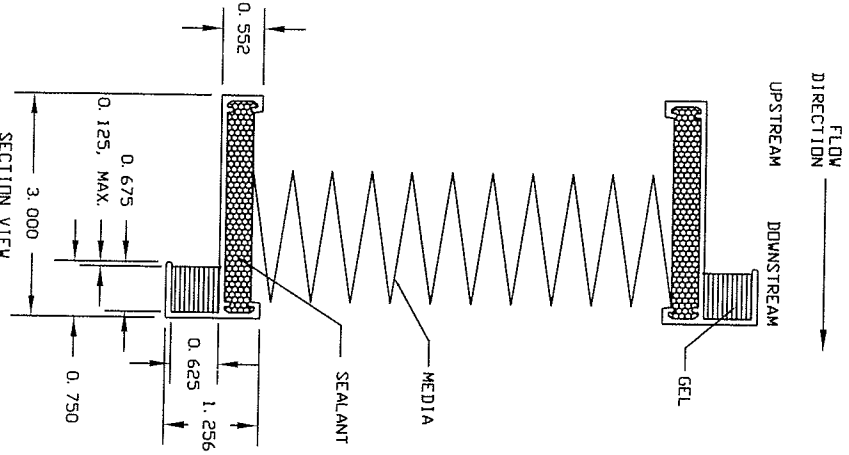
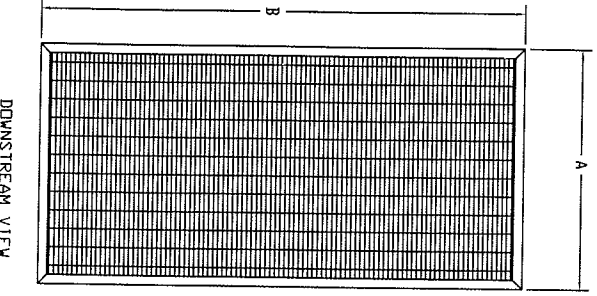
REVISION/RESUBMITTAL IDENTIFICATION: _____

CONTRACTOR

REVIEWED BY NEASI	
PM	
DATE	<u>2/29/08</u>

\\DEXTER\shared\shrjobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 04 hepa diffusers.doc

DESCRIPTION	SIZE (A x B) (in inches)	CFM	PART NUMBER
S2-21.62-43.87-1-41-FU-00-00-0	21-5/8 x 43-7/8	549	SUBMITTAL



- NOTES:**
1. FILTER MEDIA: E-PTFE (BORDON FREE)
 2. SEPARATOR MAT'L: THERMOPLASTIC RESIN SPACED @ 25mm INTERVALS
 3. FRAME MAT'L: 6063-T5 ANODIZED ALUMINUM
 4. SEALANT MAT'L: FIRE RETARDANT/PHOSPHORUS FREE TPO PART POLYURETHANE
 5. GEL MAT'L: SELF-HEALING NON-FLOWING SILICONE

TESTING NOTES:

1. EACH FILTER SHALL BE LEAK TESTED IN ACCORDANCE WITH TEST-RP-CC-034.

FILTER SPECIFICATIONS:

EXTRUSION TYPE: FIL-TLJ3

PLEAT DEPTH (mm): 45

EFFICIENCY: 99.99995% MIN. vs. MPPS @ 100 FPM USABLE FACE VELOCITY

RESISTANCE: 0.48" W.G. INITIAL AVG. @ 100 FPM USABLE FACE VELOCITY

UL RATING:

1. FILTERS MEET UL-900 CLASS 1

FRAME TOLERANCES:

LENGTHS: +0.000 / -0.063"

DIAGONALS: WITHIN 1/4" TOTAL ALLOWANCE FOR DIAGONALS > 30in.
WITHIN 1/8" TOTAL ALLOWANCE FOR DIAGONALS < 30in.

CUSTOMER APPROVAL BLOCK

YOUR APPROVAL OF THIS PRINT AUTHORIZES CAMFIL FARR TO PROCEED WITH MATERIAL PROCUREMENT, TOOLING AND PRODUCE FABRICATION. ANY CHANGES MADE AFTER APPROVAL MAY INCUR FURTHER EXPENSES TO THE CUSTOMER.

- APPROVED APPROVED TO REVISIT W/ MARKS SEND REVISED DWG.

SIGNATURE/DATE _____

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One North Corporate Drive
Riverdale, NJ 07457
973-616-7300, FAX: 973-616-7771

APPROVED BY: JC DATE: 2/25/08 DRAWN BY: PV DATE: 2/25/08

SEE TABLE

PART DESCRIPTION: CUSTOM MEGALAM PANEL
45mm PTFE

SCALE: N/A PAGE: 1/1 DWG. NO.: 5025

DESCRIPTION	SIZE (A x B) (in inches)	CFM	PART NUMBER
S2-21.62-43.87-1-41-FU-00-00-0	21-5/8 x 43-7/8	549	SUBMITTAL

NOTES:

1. FILTER MEDIA: E-PTFE (BORON FREE)
2. SEPARATOR MAT'L: THERMOPLASTIC RESIN SPACED @ 25mm INTERVALS
3. FRAME MAT'L: 6063-T5 ANODIZED ALUMINUM
4. SEALANT MAT'L: FIRE RETARDANT/PHOSPHORUS FREE TWD PART POLYURETHANE
5. GEL MAT'L: SELF-HEALING NON-FLOWING SILICONE

TESTING NOTES:

1. EACH FILTER SHALL BE LEAK TESTED IN ACCORDANCE WITH TEST-RP-CC-034.

FILTER SPECIFICATIONS:

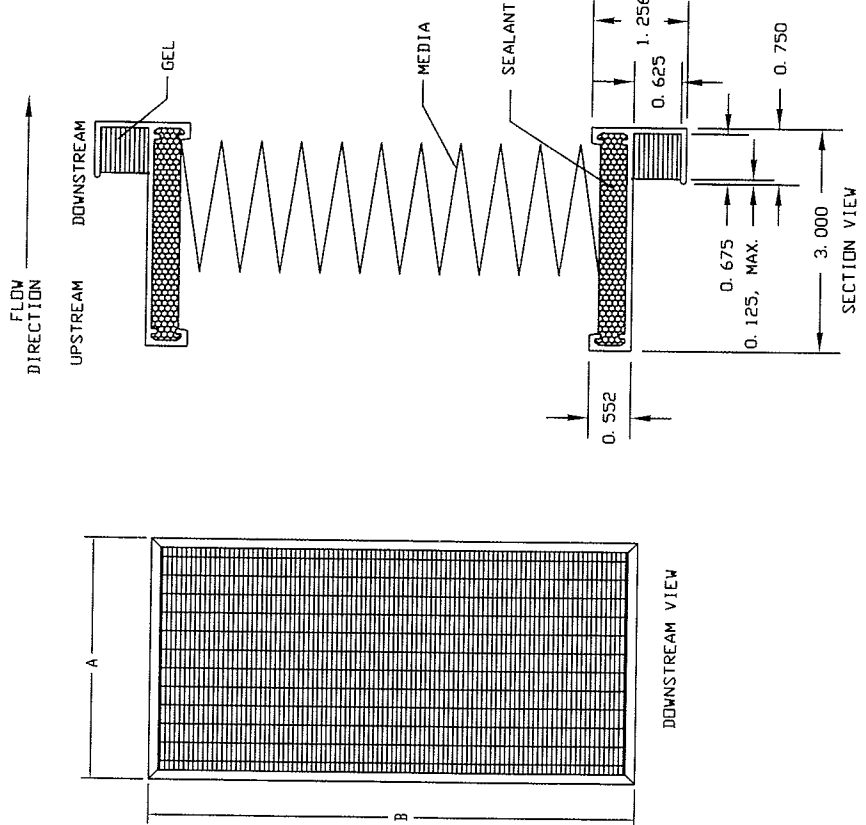
EXTRUSION TYPE: FIL-TLJ3
 PLEAT DEPTH (mm): 45
 EFFICIENCY: 99.99995% MIN. vs. MPPS @ 100 FPM USABLE FACE VELOCITY
 RESISTANCE: 0.48" W.G. INITIAL AVG. @ 100 FPM USABLE FACE VELOCITY

UL RATING:

1. FILTERS MEET UL-900 CLASS 1

FRAME TOLERANCES:

LENGTHS: +0.000 / -0.063"
 DIAGONALS: WITHIN 1/4" TOTAL ALLOWANCE FOR DIAGONALS > 30in.
 WITHIN 1/8" TOTAL ALLOWANCE FOR DIAGONALS < 30in.



One North Corporate Drive
 Riverdale, NJ 07457
 973-616-7300, FAX: 973-616-7771

APPROVED BY: JC DATE: 2/25/08
 DRAWN BY: PV DATE: 2/25/08

PART NUMBER: SEE TABLE

PART DESCRIPTION: CUSTOM MEGALAM PANEL
 45mm PTFE

SCALE: N/A PAGE: 1/1 DWG. NO.: 502571

CUSTOMER APPROVAL BLOCK

YOUR APPROVAL OF THIS PRINT AUTHORIZES CAMFIL FARR TO PROCEED WITH MATERIAL PROCUREMENT, TOOLING AND PRODUCT FABRICATION. ANY CHANGES MADE AFTER APPROVAL MAY INCUR FURTHER EXPENSES TO THE CUSTOMER.

APPROVED APPROVED TO REVISE W/ MARKS SEND REVISED DWG.

SIGNATURE/DATE: _____

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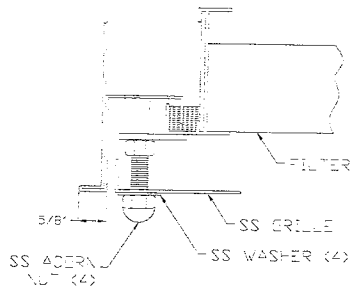
Ultrastar Pharma Replaceable Terminal Modules (P-RTM)

The standard Ultrastar Pharma- Replaceable Terminal Module (P-RTM) housing is manufactured from 0.063" thick aluminum with welded seams and equipped with 5/8" integral turned-out flanges for compatibility with either 1 1/2" tee bar grids or gypsum/plastered ceilings. Optional flanges of 304 stainless steel are available.

Our module is an excellent choice where Class 1 or better HEPA filtered air supplies are required. Housing and filters are shipped in separate cartons to ensure the HEPA filters are not installed until site conditions are inspected and approved.

INSTALLATION OF HOUSING

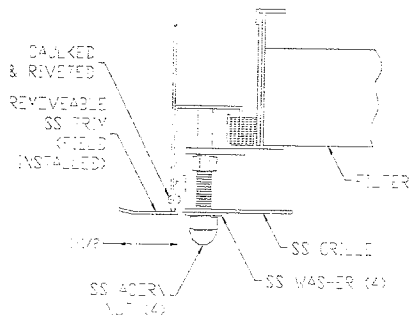
- Remove housing from shipping carton and inspect for any damage.
- When site conditions are not clean or filter installation will be delayed for more than two weeks, remove faceguards and store in a secure and clean area.
- Install and support housing as instructed in A, B or C below. Flexible duct connections should be made using stainless steel, worm-gear type drawbands for maximum reliability. Housing installation must be accomplished in a professional manner with flanges sealed to prevent dust infiltration from the interstitial space.



1-1/2" & 2" T-BAR GRID UNITS

A) Installation in 1 1/2" ceiling grid

Standard housing – Suspend housing independently with optional hanging tabs and/or grid hangers to support module. Seal housing flanges airtight against tee bar.



HARD DRYLINE UNITS - A & SS HOUSING
(REMOVABLE SS TRIV FRAME)

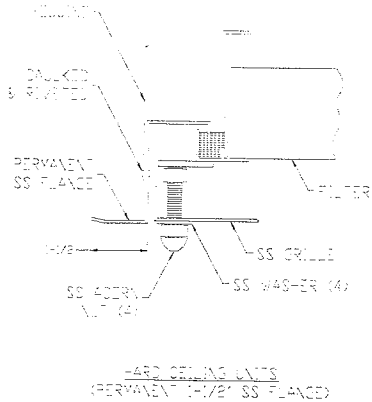
B) Installation in plaster or gypsum ceilings

Standard housing or optional module with stainless steel perimeter trim – Suspend housing from four corners and level to align top flat of flange with finish ceiling elevation. *Note:* Flange is not designed to support ceiling. Grout flange flush with ceiling.

FILTRATION GROUP

912 E. Washington Street - Joliet, IL 60433 – Phone: 800-FGI-TEAM (344-8326) – Fax: 815-726-8912
E-mail: aerostar@filtrationgroup.com -- www.filtrationgroup.com

Ultrastar Pharma Replaceable Terminal Modules (P-RTM)



C) Optional Module with removable stainless steel angle trim frame

Remove angle trim assembly and suspend module from four corners. Level housing and align lip of housing with finish ceiling and grout module in place. Insert angle trim assembly and rivet to housing.

WARNING – When performing the following procedures, do not open the damper beyond 2½ turns of the damper adjustment screw. Exceeding 2½ turns can result in damage to the unit. Dampers are shipped in a fully closed position. **DO NOT OPEN WITH THE SUPPLY AIR ON.**

FILTER INSTALLATION

Before installing HEPA filter cartridges, the system must be balanced, cleaned, blown down, and operational with pre-filters in place. This will minimize the amount of particulate swept into the filter pack at startup.

1. Remove face guard from module, check damper operation and leave damper open.
 - **OPERATING THE DAMPER**
 - Turn supply air off
 - Open damper completely, 2 ½ turns maximum
 - Turn supply air on
 - Adjust damper as required
2. Inspect the knife-edge filter seal inside housing for damage
3. Wipe housing and components clean using a lint-free cloth and solvent, such as diluted isopropyl alcohol.
4. Rotate the four retaining latches parallel to housing wall to allow filter insertion
5. Just before installation carefully remove the filter from shipping carton and bag.
6. Inspect the filter face each filter unit for shipping damage before inserting. Handle delicate filter media carefully to avoid accidental damage. **DO NOT** install a damaged filter.

NOTE: Setting filters properly requires two people. **DO NOT** install filters with supply air on. Install filter and then turn on supply air.
7. Position the filter with fluid-filled pocket turned upward.
8. Align and insert the cartridge upward into the module. The housing's knife-edge should penetrate the gel pocket around the lower outside edge of the filter. When installing the filter, the knife edge should penetrate the gel track in or near the center of the track on all four sides. Failure to center the filter in the hood could result in leakage caused by the knife-edge (module) sliding down the edge of the gel track (filter) creating a leak path.
9. Holding the filter in position, rotate the four latches 90° (perpendicular) to the housing edges to support the filter cartridge. Tighten latch nuts if necessary finger tight, do not over tighten.
10. Upon completion of test and balance work, the perforated faceguard may be installed using four acorn nuts. Be sure the face-guard is clean and dust free before installing.

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 E-mail: aerostar@filtrationgroup.com -- www.filtrationgroup.com

Ultrastar Pharma Replaceable Terminal Modules (P-RTM)

OPERATION - Once in position the P-RTM may be balanced and tested.

1. Adjust the main air supply and duct branches to meet overall design air-flow before attempting to balance any of the filter modules. The butterfly damper in the housing should be open. Follow the steps in FILTER INSTALLATION for Step 1.

NOTE: This is a trim device and not intended to induce a large pressure drop.

2. To determine output of the module, measure the total air volume in CFM using a soft-balancing hood equipped with a velometer. Reading and averaging numerous points at the filter face is not recommended.
3. Adjust the module damper or system branch duct damper as required to provide the desired air volume.
4. Replace the well-nut plug in the damper adjustment port.
5. Reinstall faceguard onto module.

TESTING

The module may be leak tested in place. An optional aerosol injection device is accessible from the room side to individually test each unit. Aerosol is introduced above the filter by removing the ½" square head plug from the room side and connecting the aerosol generator to this port. An additional aerosol sample port is used to validate the upstream challenge concentration.

An alternative method for aerosol injection is to introduce the challenge in the upstream ductwork at least ten diameters away or preferably into the fan intake. The sample port may be used to check the contamination level of the supply air from the room side at any time.

MAINTENANCE

An annual check of air-flow is recommended. When the filter throughput eventually declines to an unacceptable level due to particulate accumulation, the filter cartridge should be replaced.



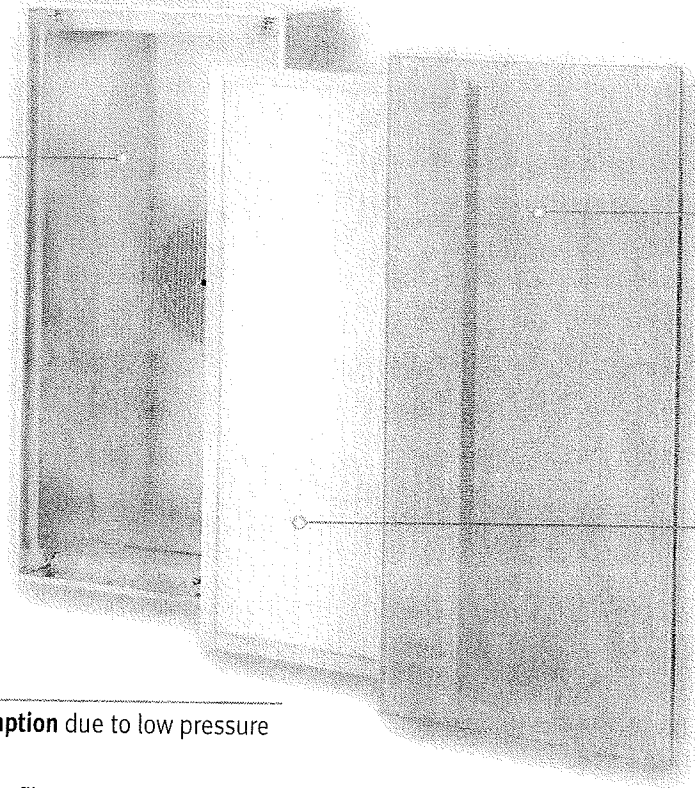
FILTRATION GROUP

912 E. Washington Street - Joliet, IL 60433 – Phone: 800-FGI-TEAM (344-8326) – Fax: 815-726-8912
E-mail: aerostar@filtrationgroup.com -- www.filtrationgroup.com

ULTRASTAR PHARMA-REPLACEABLE TERMINAL MODULES

 **Filtrair HPP**
High Performance Products

Leak-free rugged construction with gel fluid sealant and housing options of stainless steel or aluminum



Stainless steel screen (20 gauge with 40% open area) fits flush with housing

2" or 4" mini-pleated media pack with a 99.9995% efficiency at 0.12mm particle size

- ▶ **Reduced Energy Consumption** due to low pressure drop design
- ▶ **Easy Filter Change** due to filter retaining system
- ▶ **Stainless Steel Screen** (20 gauge with 40% open area) fits flush with housing
- ▶ **Easy to Remove and Clean**
- ▶ **Fluid Gel Sealant** ensures a leak free, uniform seal

DESCRIPTION

The Pharma-Replaceable Terminal Module (P-RTM) is designed for applications that require frequent filter testing and routine cleaning procedures as found in hospitals (surgical suites) the pharmaceutical and biotechnology cleanrooms. The P-RTM is easy to install, change filter and provides an optimum service life. A gel seal between the filter and hood eliminates any by-pass leakage. The P-RTM uses 2.0" (51mm) or 4.0" (100mm) mini-pleated media pack with efficiency of 99.99% at 0.3 mm or 99.9995% at 0.12 mm particle size. The low profile module is manufactured out of either aluminum or stainless steel. The P-RTM is designed to fit into T-bar ceiling and plaster ceilings. Standard features are collar, diffuser/damper, stainless

steel grill and static pressure port. Each unit is subjected to a factory 5-inch positive pressure W.G. leak test. Due to varying end user requirements, custom engineered units are available.

BENEFITS

- An adjustable butterfly damper (range of 30-110 FPM) creates a balanced and uniform airflow resulting in longer service life.
- Lower cost of ownership—only the filter is changed, not the entire unit.
- Rugged leak free construction available in aluminum or stainless steel. Each unit is subject to a factory 5-inch positive pressure W.G. leak test.
- Access to aerosol injection system, test port and damper control for easy service of filter.

APPLICATIONS

The P-RTM is designed to optimize performance in filtration applications for pharmaceutical, biotechnological, medical microelectronics, semiconductors, food processing industries, as well as surgical center operating rooms and isolation areas.

ULTRASTAR PHARMA-REPLACEABLE TERMINAL MODULES



MODULE SIZE*

ORDER CODE	DESCRIPTION
P-RTM1	23 5/8 X 23 5/8 (5/8 TRIM FLANGE)
P-RTM2	23 5/8 X 47 5/8 (5/8 TRIM FLANGE)
P-RTM3	25 3/8 X 25 3/8 (1 1/2 TRIM FLANGE)
P-RTM4	25 3/8 X 49 3/8 (1 1/2 TRIM FLANGE)

Please see price list for order information.

* All dimensions are in inches. Modules are manufactured in 0.063 aluminum (also available in stainless steel), have a perforated 304 SS removable screen with 4 cap-nuts. Filter is not included.

FILTERS

ORDER CODE	DESCRIPTION
*41658	21.62 x 19.88 x 3.5 - 2" MEDIA PACK
*41163	21.62 x 43.88 x 3.5 - 2" MEDIA PACK
*41656	21.62 x 19.88 x 5.25 - 4" MEDIA PACK
*41657	21.62 x 43.88 x 5.25 - 4" MEDIA PACK
**41666	1.62 x 19.88 x 3.5 - 2" MEDIA PACK
**41667	21.62 x 43.88 x 3.5 - 2" MEDIA PACK
**41664	21.62 x 19.88 x 5.25 - 4" MEDIA PACK
**41665	21.62 x 43.88 x 5.25 - 4" MEDIA PACK

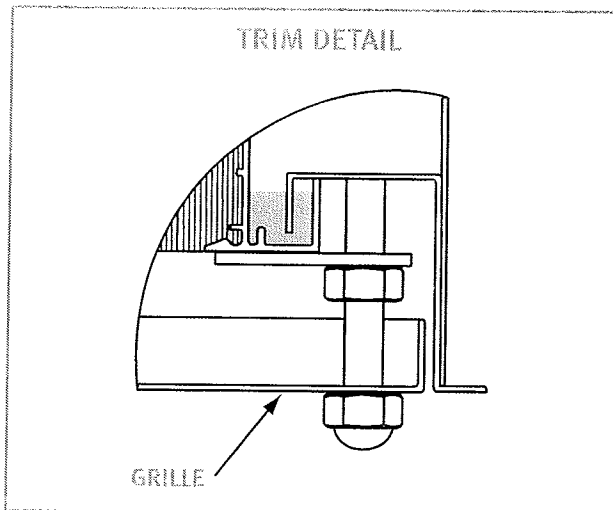
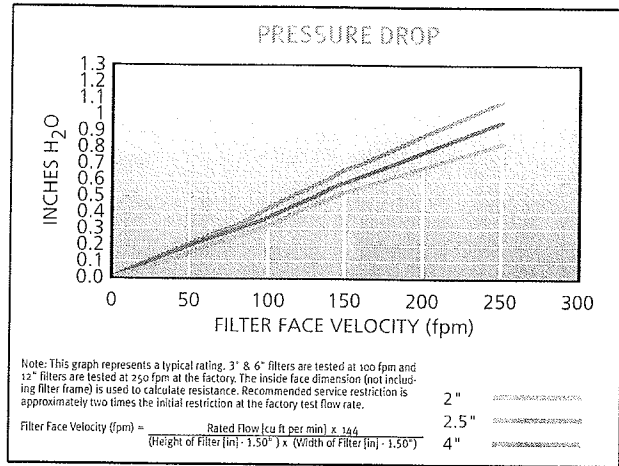
* All filters are efficiency 99.99% at 0.3 mm with downstream gel. Downstream screen and divider not included.

**All filters are efficiency 99.9995% at 0.12 mm with downstream gel. Downstream screen and divider not included.

AVAILABLE OPTIONS

- ◊ Removable Stainless Steel Trim
- ◊ Insulation
- ◊ Aerosol Dispersion Nozzle
- ◊ Aerosol Dispersion Quick Disconnect
- ◊ Seismic Tabs
- ◊ Heavy Duty Butterfly Damper
- ◊ Guillotine Damper
- ◊ Extended Stainless Steel Grill

Please contact us for additional options.
Specifications & drawings available upon request.



REPRESENTED BY

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FILTRATION GROUP

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Phone: 815-726-4600 • Fax: 800-518-1162 • www.filtrationgroup.com



Vermont Gas Systems, Inc.
PO Box 467
Burlington, VT 05402-0467

Date: 3-5-08

Attn: Manager of Field Services

Re: Pressure Test Record

Dear Sir:

I, Aaron Rabtoy, representing New England Air Systems Inc
(name in full) (company)

hereby certify that the gas piping installed by my company at the following address has passed a suitable pressure test as outline in the National Gas Code, NFPA 54, Section 4.1.

Job Location: UVM Delehanty Hall, Burlington Vt. High level lab 15" pipe to 1 turret

Test Date: 3-3-08

Test Medium: Air Nitrogen Carbon Dioxide

Test Pressure: 5 psi
(1-1/2 times maximum working pressure, minimum 3 lbs.)

Test Duration: 2 hours
(1-1/2 hour for each 500 cu. ft. of pipe volume, 10 minutes for volumes less than 10 cu. ft. or single family dwellings.)

Signed:

Title: _____

Witness:

Natural Gas Certification number: GB-1904



Vermont Gas Systems, Inc.
PO Box 467
Burlington, VT 05402-0467

Date: 3-5-08

Attn: Manager of Field Services

Re: Pressure Test Record

Dear Sir:

I, Aaron Rabtoy, representing New England Air Systems Inc.
(name in full) (company)

hereby certify that the gas piping installed by my company at the following address has passed a suitable pressure test as outline in the National Gas Code, NFPA 54, Section 4.1.

Job Location: UVM Delehanty Hall Burlington Vt. (35' pipe to 2 turrets) ^{Production Lab}

Test Date: 3-3-08

Test Medium: Air Nitrogen Carbon Dioxide

Test Pressure: 5psi
(1-1/2 times maximum working pressure, minimum 3 lbs.)

Test Duration: _____
(1-1/2 hour for each 500 cu. ft. of pipe volume, 10 minutes for volumes less than 10 cu. ft. or single family dwellings.)

Signed: [Signature]

Title: _____

Witness: [Signature]

Natural Gas Certification number: GB-1904

New England Air Systems

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: UVM Delehanty Hall

Job Number: 0-200212

Location: Burlington Vt

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-5-08

SYSTEM Emergency Shower / Eyewash Tempered Hot Water

LENGTH 80'

PRESSURE House System pressure (water) PSI

DURATION 24 hrs. and turned on HRS.


PASSED FAILED

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS 

CONTRACTOR'S WITNESS 

CITY WITNESS _____

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PIPING TEST REPORT

Job Name: UVM Delehanty Hall

Job Number: 0-200212

Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-5-08

SYSTEM Domestic Cold Water to Backflow Preventer in Doghouse
for scrubber piping

LENGTH 50'

PRESSURE Street pressure PSI _____

DURATION 24 hours + turned on HRS. _____

PASSED FAILED _____

Is Glycol required for freeze protection? N/A


Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS



CONTRACTOR'S WITNESS



CITY WITNESS

New England Air Systems

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PIPING TEST REPORT

Job Name: UVM Delehanty Hall

Job Number: 0-200212

Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-7-08

SYSTEM ACID WASTE & VENT PIPING TO S-1 SINK & FH-1 F

LENGTH 60'

PRESSURE 5 psi PSI

DURATION 24 hrs. HRS.

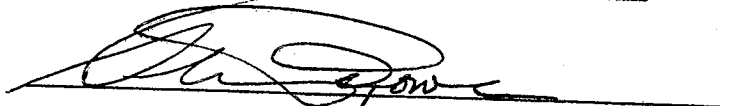
PASSED FAILED

Is Glycol required for freeze protection? N/A

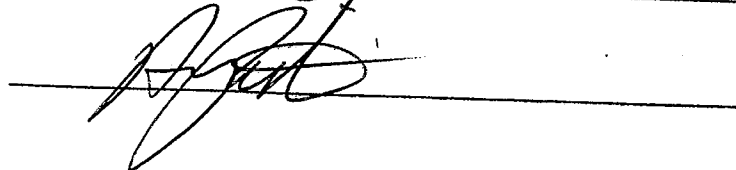
Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS



CONTRACTOR'S WITNESS



CITY WITNESS

New England Air Systems

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PIPING TEST REPORT

Job Name: UVM Delehanty Hall

Job Number: 0-200212

Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-17-08

SYSTEM ACID Waste system 3" from Doghouse to main in 2nd Floor ceiling

LENGTH 20'

PRESSURE 5 psi PSI

DURATION 24 hrs. HRS.


PASSED FAILED

Is Glycol required for freeze protection? N/A

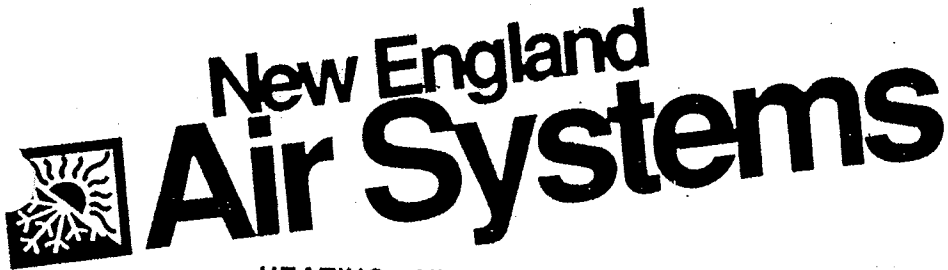
Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS 

CONTRACTOR'S WITNESS 

CITY WITNESS _____



HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: UVM Delehanly Hall

Job Number: 0-200212

Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-5-08

SYSTEM Acid Waste Drainage to FH-2 - FH-5, ^{below lab} venting Above ceiling.

LENGTH 170'

PRESSURE 5 psi PSI

DURATION 24 Hours HRS.

PASSED FAILED

Is Glycol required for freeze protection? N/A

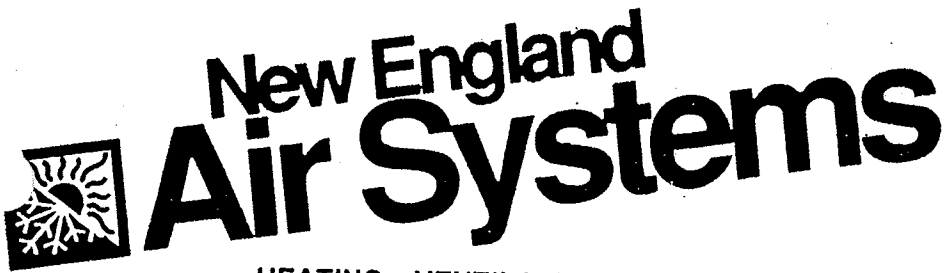
Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS [Signature]

CONTRACTOR'S WITNESS [Signature]

CITY WITNESS _____



HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: UVM Delehanty Hall
Job Number: 0-200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-17-08

SYSTEM Cold water to FH-1, FH-2, FH-3, FH-4, FH-5 (All Fume Hoods)

LENGTH 150'

PRESSURE Street Pressure and turned on PSI

DURATION 24 hrs. HRS.

PASSED FAILED

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS [Signature]

CONTRACTOR'S WITNESS [Signature]

CITY WITNESS _____

New England Air Systems

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PIPING TEST REPORT

Job Name: UVM Delehanty Hall

Job Number: 0-200212

Location: Burlington VT

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 3-18-08

SYSTEM Deionized Water Supply & Return to All Fume Hoods & Lab Sinks.

LENGTH 160'

PRESSURE System pressure about PSI _____

DURATION 24 hrs. HRS. _____


PASSED FAILED _____

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS 

CONTRACTOR'S WITNESS 

CITY WITNESS _____

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PIPING TEST REPORT

Job Name: UVM Delehanty Hall
Job Number: 0-200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 4-2-08

SYSTEM Sanitary Drainage & Venting to new Floor Drain, LV-1 and SK-1 and washdown drainage piping to doghouse

LENGTH 100'

PRESSURE 5 psi PSI _____

DURATION 1 hour HRS. _____

PASSED FAILED _____

Is Glycol required for freeze protection? N/A

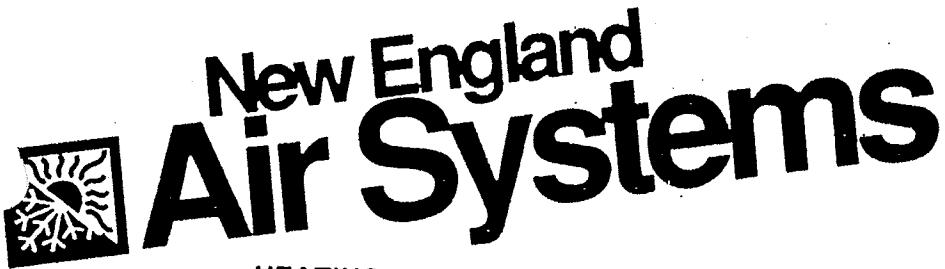
Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS _____


CONTRACTOR'S WITNESS _____


CITY WITNESS _____



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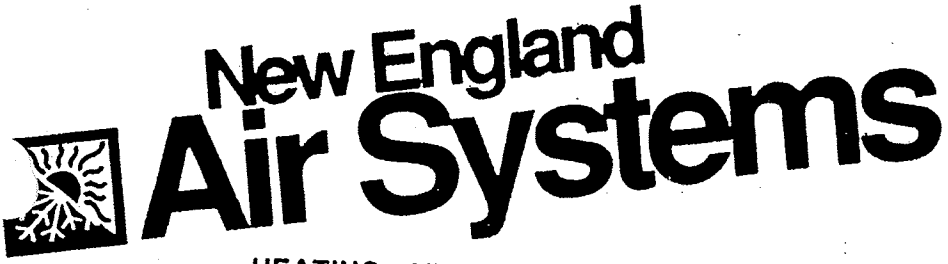
PIPING TEST REPORT

Job Name: Uvm Delehanty Hall
Job Number: 0-200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-20-08
SYSTEM Chilled Water Piping to AHU.
LENGTH ~~120~~ 140'
PRESSURE 100 PSI _____
DURATION 24 hrs. HRS. _____
PASSED ✓ FAILED _____
Is Glycol required for freeze protection? yes
Is Glycol called for Per Specifications? NO
Date Injected 5-20-08 Tested for -5°F F°

OWNER'S WITNESS _____
CONTRACTOR'S WITNESS _____
CITY WITNESS _____



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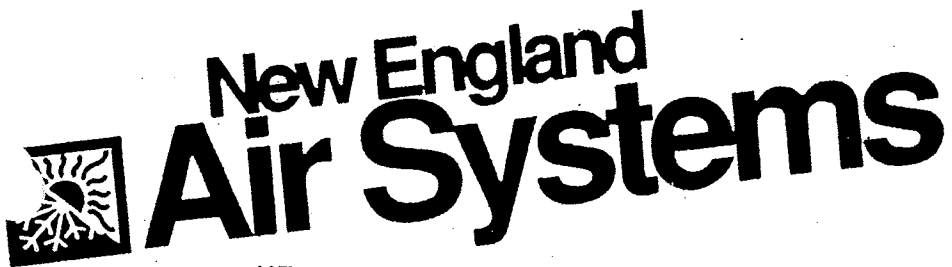
PIPING TEST REPORT

Job Name: UVM Delehanty Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-20-08
SYSTEM Heating System to Altu
LENGTH 120'
PRESSURE 100 PSI PSI _____
DURATION 24 Hrs. HRS. _____
PASSED ✓ FAILED _____
Is Glycol required for freeze protection? Yes
Is Glycol called for Per Specifications? NO
Date Injected 5-28-08 Tested for +23° F F°

OWNER'S WITNESS [Signature]
CONTRACTOR'S WITNESS [Signature]
CITY WITNESS _____



HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: Uvm. Delehanly Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-19-08

SYSTEM Heating System to doghouse for Reheat Coils.

LENGTH ~~100~~

PRESSURE 100 PSI PSI _____

DURATION 24 HRS HRS. _____

PASSED FAILED _____

Is Glycol required for freeze protection? Yes

Is Glycol called for Per Specifications? NO

Date Injected 5-28-08 Tested for + 23° F F°

OWNER'S WITNESS 

CONTRACTOR'S WITNESS _____

CITY WITNESS _____

New England Air Systems

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: UVM Delehanty Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-13-08

SYSTEM Non Potable Water to Exhaust Washdown System on Roof-

LENGTH 300'

PRESSURE ~~800~~ 100 PSI PSI

DURATION 24 HRS HRS.

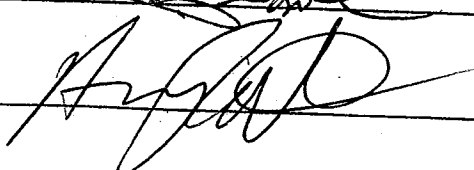
PASSED ✓ FAILED

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS 

CONTRACTOR'S WITNESS 

CITY WITNESS _____

New England Air Systems

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: UVM Delehanthy Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-19-08

SYSTEM Drainage System for Washdown ~~System~~ on Roof.

LENGTH 160'

PRESSURE 5 PSI PSI _____

DURATION 24 HRS. HRS. _____

PASSED FAILED _____

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS

[Signature]

CONTRACTOR'S WITNESS

[Signature]

CITY WITNESS

New England Air Systems

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PIPING TEST REPORT

Job Name: Uvm Delehanty Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-24-08

SYSTEM NON Potable water to Scrubber from doghouse on Roof.

LENGTH 25'

PRESSURE System Pressure 70psi PSI

DURATION Turned System on. HRS. _____

PASSED FAILED

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS

CONTRACTOR'S WITNESS

CITY WITNESS

New England Air Systems

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PIPING TEST REPORT

Job Name: Uvm Delehanty Hall.
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-14-08

SYSTEM: ACID Drainage From Scrubber to doghouse

LENGTH: 25'

PRESSURE: 5 PSI PSI _____

DURATION: 24 hrs. HRS. _____

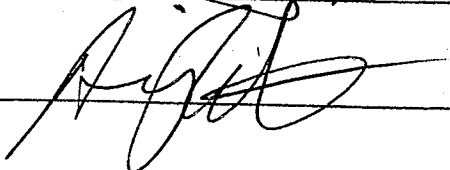
PASSED FAILED _____

Is Glycol required for freeze protection? N/A

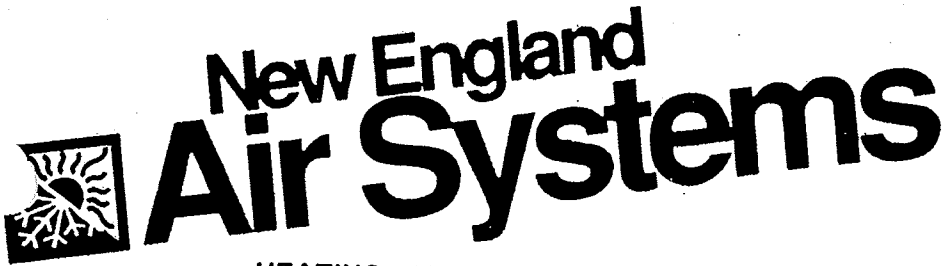
Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS 

CONTRACTOR'S WITNESS 

CITY WITNESS _____



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PIPING TEST REPORT

Job Name: Uvm Deleheny Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-30-08
SYSTEM Condensate piping From Altu 4
LENGTH 40'
PRESSURE 5 psi PSI _____
DURATION 24 hrs. HRS. _____
PASSED FAILED _____

Is Glycol required for freeze protection?

Is Glycol called for Per Specifications?

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS [Signature]

CONTRACTOR'S WITNESS [Signature]

CITY WITNESS _____

New England Air Systems

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PIPING TEST REPORT

Job Name: UVM Delehanty Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-20-08

SYSTEM Steam Piping From Humidifier to AHU-4

LENGTH 70'

PRESSURE 100 PSI

DURATION 24 HRS.

PASSED FAILED

Is Glycol required for freeze protection? N/A

Is Glycol called for Per Specifications? N/A

Date Injected _____ Tested for _____ F°

OWNER'S WITNESS

[Signature]

CONTRACTOR'S WITNESS

[Signature]

CITY WITNESS

New England Air Systems

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION • PLUMBING • DESIGN

PIPING TEST REPORT

Job Name: Uvm Delehanty Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-8-08
SYSTEM Natural Gas Piping to Humidifier
LENGTH 20'
PRESSURE 10 psi PSI
DURATION 24 hrs. HRS.
PASSED FAILED
Is Glycol required for freeze protection? N/A
Is Glycol called for Per Specifications? N/A
Date Injected _____ Tested for _____ F°

OWNER'S WITNESS

CONTRACTOR'S WITNESS

CITY WITNESS

New England Air Systems

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PIPING TEST REPORT

Job Name: Uvm Delehanty Hall
Job Number: 0200212
Location: Burlington Vt.

WE HAVE WITNESSED THE FOLLOWING DESCRIBED TEST ON THIS

DATE: 5-29-08
SYSTEM RO water to Humidifier
LENGTH 45'
PRESSURE System Pressure 60psi PSI
DURATION turned on HRS. _____
PASSED FAILED _____
Is Glycol required for freeze protection? N/A
Is Glycol called for Per Specifications? N/A
Date Injected _____ Tested for _____ F°

OWNER'S WITNESS

CONTRACTOR'S WITNESS

CITY WITNESS



New England Air Systems, Inc.

Equipment Start Up Report

Customer University of Vermont-Delehanty Hall Model (O) --- S/N ---
 Address Trinity Campus, Burlington, Vermont Model (I) GTS-04-400 S/N 1161619-01-01
 Make of Equipment DriSteem Technician Allen Tremblay Date 06-10-2008
 Unit Location /ID# Mechanical Room/HUM #1 Job # O200212
 Project Manager: Randy Chicoine

- Filters () N/A Belts () N/A
1. Are anchoring and supports secure? X
 2. Are all field and unit wiring connections tight? X
 3. Check and Record; Stand-by Voltage 119
 -Unit voltage rating 120 Phase 1
 -Check all step up/down transformer line volt taps X
 -Check and record operating voltage 118
 -Record fuse size and type..... FRNR-3
 -Minimum and maximum fuse rating on unit 3 Amps
 4. Is unit properly grounded, insulated, fused? X
 5. Seal all penetration holes X
 6. Calibrate thermostat, adjust heat anticipator, level DDC
 Record anticipator setting tstat make Honeywell Model DDC
 7. Is condensate drain trapping etc., properly installed? X
 8. Are return and supply air diffusers free? Check T.D. rise/drop X
 9. Adjust belt tension-pulley alignment, etc.. Check fan rotation N/A
 10. Are all shipping blocks, (fan, motor, compressor, etc.) removed? X
 11. Confirm with Project Manager that all external piping was pressure tested. X
 12. Check/Record gas supply off and operating ---
 -Gas manifold LOW --- HIGH ---
 -Oil pressure N/A
 13. Perform combustion adjustments/efficiency test. Record efficiency results. 82.7
 CO₂ 8.35 Stack Temp 412 O₂ 6.0 Room Temp 74°
 14. Flue gas CO_{af} content 0 ppm. Vent system per mfg and code X
 15. Run and test air conditioning system. Complete information below:
 -Ambient Temp F N/A Return Air Temp F N/A
 -High Side PSIG --- Low Side PSIG ---
 -Superheat Temp F --- Subcooling Temp F ---
 -Compressor Amps 1) N/A 2) --- 3) ---
 -Condenser Fan Amps 1) N/A 2) --- 3) ---
 -Supply Fan Amps N/A Return Fan amps N/A
 -Oil Level --- Sight Glass N/A
 -Economizer Operates --- Set Minimum Outside Air Damper N/A
 16. Have all safety devices (low PSI, high PSI, oil safety, etc.) been tested? X
 17. Leave unit in full operation mode- confirm with customer on set points. X
 18. Place NEASI sticker and blue service tag on unit. X

Additional Work Recommended/Other Comments:

Combustion air to equipment correct X. Put dimensions and calculations on back of form.

Refrigerant type = R- --- Total Charge = --- lbs --- oz.

Owner/General Contractor:

Signature:



New England Air Systems, Inc.

Equipment Start Up Report

Customer University of Vermont-Delehanty Hall Model (O) (fan size) 22 FAN-WALL S/N A091AH-01
 Address Trinity Campus, Burlington, Vermont Model (I) --- S/N ---
 Make of Equipment CleanPak Technician Allen Tremblay Date 06-10-2008
 Unit Location /ID# Roof/AHU #1 Job # O200212
 Project Manager: Randy Chicoine

- Filters (6) 24x24x4 () _____ Belts () N/A () _____
1. Are anchoring and supports secure? X
 2. Are all field and unit wiring connections tight? X
 3. Check and Record; Stand-by Voltage 208
 -Unit voltage rating 208 230 Phase 3
 -Check all step up/down transformer line volt taps X
 -Check and record operating voltage . 1) 201 @ motor 2) 201 @ motor
 -Record fuse size and type..... 80 amp breaker
 -Minimum and maximum fuse rating on unit @ VFD ---
 4. Is unit properly grounded, insulated, fused? X
 5. Seal all penetration holes X
 6. Calibrate thermostat, adjust heat anticipator, level N/A
 Record anticipator setting tstat make Honeywell Model DDC
 7. Is condensate drain trapping etc., properly installed? X
 8. Are return and supply air diffusers free? Check T.D. rise/drop TBD
 9. Adjust belt tension-pulley alignment, etc.. Check fan rotation X
 10. Are all shipping blocks, (fan, motor, compressor, etc.) removed? X
 11. Confirm with Project Manager that all external piping was pressure tested. X
 12. Check/Record gas supply off and operating --- ---
 -Gas manifold LOW --- HIGH ---
 -Oil pressure ---
 13. Perform combustion adjustments/efficiency test. Record efficiency results. ---
 CO₂ --- Stack Temp --- O₂ --- Room Temp ---
 14. Flue gas CO_{af} content --- ppm. Vent system per mfg and code ---
 15. Run and test air conditioning system. Complete information below:
 -Ambient Temp F N/A Return Air Temp F ... N/A
 -High Side PSIG N/A Low Side PSIG ---
 -Superheat Temp F N/A Subcooling Temp F ---
 -Compressor Amps 1) N/A 2) --- 3) ---
 -Condenser Fan Amps 1) N/A 2) --- 3) ---
 -Supply Fan Amps 1) 16.5 2) 16.6 Return Fan amps N/A
 -Oil Level N/A Sight Glass N/A
 -Economizer Operates N/A Set Minimum Outside Air Damper 100%
 16. Have all safety devices (low PSI, high PSI, oil safety, etc.) been tested? X
 17. Leave unit in full operation mode- confirm with customer on set points. X
 18. Place NEASI sticker and blue service tag on unit. X

Additional Work Recommended/Other Comments:
 Combustion air to equipment correct ---. Put dimensions and calculations on back of form.

Refrigerant type = R- --- Total Charge = --- lbs --- oz.

Owner/General Contractor: _____ Signature: _____



New England Air Systems Inc.

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION

START-UP REPORT

Job Location:	<u>UVM – Delehanty Hall</u>	Project # :	<u>O200212</u>
Equip. Location:	<u>Roof</u>	Start-up Date:	<u>06-10-2008</u>
Equipment I.D.#:	<u>EF #4</u>	Technician:	<u>Allen Tremblay</u>

Make:	<u>Hartzell</u>	Type:	<u>Exhaust Fan</u>
Model:	<u>A41-9-222FA100FGFEN3</u>	Serial #:	<u>0821763-01</u>
Motor HP:	<u>10</u>	Amps:	<u>23.2/11.6</u>
R.P.M.	<u>1755</u>	Voltage:	<u>230/460</u>
Belts:	<u>(2) BX66</u>	Phases:	<u>3</u>

Additional Checks: Run amps = 18/19/19
Confirmed rotation

Work Recommended: _____

Tech. Signature: _____



New England Air Systems Inc.

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION

START-UP REPORT

Job Location: UVM – Delehanty Hall **Project # :** O200212
Equip. Location: Roof **Start-up Date:** 06-10-2008
Equipment I.D.#: EF #5 **Technician:** Allen Tremblay

Make: Hartzell **Type:** Exhaust Fan
Model: A41-9-222FA100FGFEN3 **Serial #:** 0821763-02
Motor HP: 10 **Amps:** 23.2/11.6
R.P.M. 1755 **Voltage:** 230/460
Belts: (2) BX66 **Phases:** 3

Additional Checks: Run amps = 18/17/18
Confirmed rotation

Work Recommended: _____

Tech. Signature: _____



New England Air Systems Inc.

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION

START-UP REPORT

Job Location: UVM – Delehanty Hall **Project # :** O200212
Equip. Location: Roof **Start-up Date:** 06-11-2008
Equipment I.D.#: EF-6 **Technician:** Allen Tremblay

Make: Plastifer **Type:** Exhaust Fan
Model: CNW-250 **Serial #:** ---
Motor HP: 3 **Amps:** 15
R.P.M. 1765 **Voltage:** 208
Belts: (2) BP30 **Phases:** 3

Additional Checks: (3) TR15R fuses. Tightened belts and align.

Run amps = 4.9/4.5/4.7. Confirmed rotation.

Work Recommended: Heaters to be replaced by electrical contractor

Tech. Signature: _____



New England Air Systems Inc.

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION

EXISTING EQUIPMENT

START-UP REPORT

Job Location:	<u>UVM – Delehanty Hall</u>	Project # :	<u>O200212</u>
Equip. Location:	<u>Roof</u>	Start-up Date:	<u>06-11-2008</u>
Equipment I.D.#:	<u>EF-6</u>	Technician:	<u>Allen Tremblay</u>

Make:	<u>Plastifer</u>	Type:	<u>Exhaust Fan</u>
Model:	<u>CNW-250</u>	Serial #:	<u>---</u>
Motor HP:	<u>3</u>	Amps:	<u>15</u>
R.P.M.	<u>1765</u>	Voltage:	<u>208</u>
Belts:	<u>(2) BP30</u>	Phases:	<u>3</u>

Additional Checks: (3) TR15R fuses. Tightened belts and align.
Run amps = 4.9/4.5/4.7. Confirmed rotation.

Work Recommended: Heaters to be replaced by electrical contractor

Tech. Signature: _____



New England Air Systems Inc.

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION

START-UP REPORT

Job Location:	<u>UVM – Delehanty Hall</u>	Project # :	<u>O200212</u>
Equip. Location:	<u>Mechanical Room</u>	Start-up Date:	<u>06-11-2008</u>
Equipment I.D.#:	<u>P-1</u>	Technician:	<u>Allen Tremblay</u>

Make:	<u>Bell & Gossett</u>	Type:	<u>Heating Circulating Pump</u>
Model:	<u>Series 60</u>	Serial #:	<u>ID #i72727</u>
Motor HP:	<u>½</u>	Amps:	<u>2.1-2.2/1.1</u>
R.P.M.	<u>1725</u>	Voltage:	<u>208-230/460</u>
Belts:	<u>N/A</u>	Phases:	<u>3</u>

Additional Checks: Run amps = 1.7/1.5/1.7

Work Recommended: Heaters to be replaced by electrical contractor

Tech. Signature: _____

VFD's 1 & 2

Group 9: Start-up Data	Group 12: Constant Speeds	Group 15: Analogue Outputs	Group 24: Torque C
0301 FB CMD WORD 1	1201 CONST SPEED SEL	1501 AO1 CONTENT	2401 TORQ RAMP UP
0302 FB CMD WORD 2	1202 CONST SPEED 1	1502 AO1 CONTENT MIN	2402 TORQ RAMP DOWN
0303 FB STS WORD 1	1203 CONST SPEED 2	1503 AO1 CONTENT MAX	Group 22: Accel/Decel
0304 FB STS WORD 2	1204 CONST SPEED 3	1504 MINIMUM AO1	2201 ACC/DEC 1/2 SEL
0305 FAULT WORD 1	1205 CONST SPEED 4	1505 MAXIMUM AO1	2202 ACCELER TIME 1
0306 FAULT WORD 2	1206 CONST SPEED 5	1506 FILTER AO1	2203 DECELER TIME 1
0307 FAULT WORD 3	1207 CONST SPEED 6	1507 AO2 CONTENT	2204 RAMP SHAPE 1
Group 03: Actual Signals	1208 CONST SPEED 7	1508 AO2 CONTENT MIN	2205 ACCELER TIME 2
0401 LAST FAULT	Group 13: Analogue Inputs	1509 AO2 CONTENT MAX	2206 DECELER TIME 2
0402 FAULT TIME 1	1301 MINIMUM AI1	1510 MINIMUM AO2	2207 RAMP SHAPE 2
0403 FAULT TIME 2	1302 MAXIMUM AI1	1511 MAXIMUM AO2	2208 EM DEC TIME
0404 SPEED AT FLT.	1303 FILTER AI1	1512 FILTER AO2	2209 RAMP INPUT 0
0405 FREQ AT FLT	1304 MINIMUM AI2	Group 20: Limits	Group 25: Critical Speeds
0406 VOLTAGE AT FLT.	1305 MAXIMUM AI2	2001 MINIMUM SPEED	2501 CRIT SPEED SEL
0407 CURRENT AT FLT.	1306 FILTER AI2	2002 MAXIMUM SPEED	2502 CRIT SPEED 1 LO
0408 TORQUE AT FLT.	Group 14: Relay Outputs	2003 MAX CURRENT	2503 CRIT SPEED 1 HI
0409 STATUS AT FLT.	1401 RELAY OUTPUT 1	2006 UNDERVOLT CTRL	2504 CRIT SPEED 2 LO
0410 DI1-3 AT FLT	1402 RELAY OUTPUT 2	2007 MINIMUM FREQ	2505 CRIT SPEED 2 HI
0411 DI4-6 AT FLT	1403 RELAY OUTPUT 3	2008 MAXIMUM FREQ	2506 CRIT SPEED 3 LO
0412 PREVIOUS FAULT 1	1404 RO 1 ON DELAY	2013 MIN TORQUE SEL	2507 CRIT SPEED 3 HI
0413 PREVIOUS FAULT 2	1405 RO 1 OFF DELAY	2014 MAX TORQUE SEL	Group 26: Motor Control
Group 10: Start/Stop/Dir	1407 RO 2 OFF DELAY	2015 MIN TORQUE 1	2601 FLUX OPT
1001 EXT1 COMMANDS	1408 RO 3 ON DELAY	2016 MIN TORQUE 2	2602 FLUX BRAKING
1002 EXT2 COMMANDS	1409 RO 3 OFF DELAY	2017 MAX TORQUE 1	2603 IR COMP VOLT
1003 DIRECTION	1410 RELAY OUTPUT 4	2018 MAX TORQUE 2	2604 IR COMP FREQ
Group 11: Reference Select	1411 RELAY OUTPUT 5	Group 21: Start/Stop	2605 U/F RATIO
1101 KEYPAD REF SEL	1412 RELAY OUTPUT 6	2101 START FUNCTION	2606 SWITCHING FREQ
1102 EXT1/EXT2 SEL	1413 RO 4 ON DELAY	2102 STOP FUNCTION	2607 SW FREQ CTRL
1103 REF1 SELECT	1414 RO 4 OFF DELAY	2103 DC MAGN TIME	2608 SLIP COMP RATIO
1104 REF1 MIN	1415 RO 5 ON DELAY	2104 DC CURR CTL	Group 17: Override
1105 REF1 MAX	1416 RO 5 OFF DELAY	2106 DC CURR REF	1701 OVERRIDE SEL
1106 REF2 SELECT	1417 RO 6 ON DELAY	2107 DC BRAKE TIME	1702 OVERRIDE FREQ
1107 REF2 MIN	1418 RO 6 OFF DELAY	2108 START INHIBIT	1703 OVERRIDE SPEED
1108 REF2 MAX	Group 16: System Controls	2109 EM STOP SEL	1704 OVERR PASS CODE
	1601 RUN ENABLE	2110 TORQ BOOST CURR	1705 OVERRIDE ENABLE
	1602 PARAMETER LOCK	Group 23: Speed Control	3106 AR UNDERVOLTAGE
	1603 PASS CODE	2301 PROP GAIN	9802 COMM PROT SEL
	1604 FAULT RESET SEL	2302 INTEGRATION TIME	
	1605 USER PAR SET CHG	2303 DERIVATION TIME	
	1606 LOCAL LOCK	2304 ACC COMPENSATION	
	1607 PARAM SAVE	2305 AUTOTUNE RUN	
	1608 START ENABLE 1		

Group 34: Fault Functions	Group 34: Panel Display / Process	Group 52: RS-232 / Panel	Group 01: Operating
3001 AI-MIN FUNCTION	3401 SIGNAL 1 PARAM	5201 STATION ID	0102 SPEED
3002 PANEL COMM ERR	3402 SIGNAL 1 MIN	5202 BAUD RATE	0103 OUTPUT FREQ
3003 EXTERNAL FAULT 1	3403 SIGNAL 1 MAX	5203 PARITY	0104 CURRENT
3004 EXTERNAL FAULT 2	3404 OUTPUT 1 DSP FORM	5204 OK MESSAGES	0105 TORQUE
3005 MOT THERM PROT	3405 OUTPUT 1 UNIT	5205 PARITY ERRORS	0106 POWER
3006 MOT THERM TIME	3406 OUTPUT 1 MIN	5206 FRAME ERRORS	0107 DC BUS VOLTAGE
3007 MOT LOAD CURVE	3407 OUTPUT 1 MAX	5207 BUFFER OVERRUNS	0109 OUTPUT VOLTAGE
3008 ZERO SPEED LOAD	3408 SIGNAL 2 PARAM	5208 CRC ERRORS	0110 DRIVE TEMP
3009 BREAK POINT FREQ	3409 SIGNAL 2 MIN	Group 53: EFB Protocol	0111 EXTERNAL REF
3010 STALL FUNCTION	3410 SIGNAL 2 MAX	5301 EFB PROTOCOL ID	0112 EXTERNAL REF
3011 STALL FREQUENCY	3411 OUTPUT 2 DSP FORM	5302 EFB STATION ID	0113 CTRL LOCATION
3012 STALL TIME	3412 OUTPUT 2 UNIT	5303 EFB BAUD RATE	0114 RUN TIME (R)
3013 UNDERLOAD FUNC	3413 OUTPUT 2 MIN	5304 EFB PARITY	0115 KWH COUNTER
3014 UNDERLOAD TIME	3414 OUTPUT 2 MAX	5305 EFB CTRL PROFILE	0116 APPL BLK OUTPUT
3015 UNDERLOAD CURVE	3415 SIGNAL 3 PARAM	5306 EFB OK MESSAGES	0118 DI 1-3 STATUS
3017 EARTH FAULT	3416 SIGNAL 3 MIN	5307 EFB CRC ERRORS	0119 DI 4-6 STATUS
3018 COMM FAULT FUNC	3417 SIGNAL 3 MAX	5308 EFB UART ERRORS	0120 AI1
3019 COMM FAULT TIME	3418 OUTPUT 3 DSP FORM	5309 EFB STATUS	0121 AI2
3021 AI1 FAULT LIMIT	3419 OUTPUT 3 UNIT	5310 EFB PAR 10	0122 RO 1-3 STATUS
3022 AI2 FAULT LIMIT	3420 OUTPUT 3 MIN	5311 EFB PAR 11	0123 RO 4-6 STATUS
		5312 EFB PAR 12	0124 AO1
Group 31: Automatic Reset	3421 OUTPUT 3 MAX	5313 EFB PAR 13	0125 AO2
3101 NR OF TRIALS	5	5314 EFB PAR 14	0126 PID 1 OUTPUT
3102 TRIAL TIME	Group 35: Motor Temp Meas	5315 EFB PAR 15	0127 PID 2 OUTPUT
3103 DELAY TIME	3501 SENSOR TYPE	5316 EFB PAR 16	0128 PID 1 SETPNT
3104 AR OVERCURRENT	3502 INPUT SELECTION	5317 EFB PAR 17	0129 PID 2 SETPNT
3105 AR OVERVOLTAGE	3503 ALARM LIMIT	Group 29: Maint Trig	0130 PID 1 FBK
3106 AR UNDERVOLTAGE	3504 FAULT LIMIT	2901 COOLING FAN TRIG	0131 PID 2 FBK
3107 AR AI-wind	ENABLE	2902 COOLING FAN ACT	0132 PID 1 DEVIATION
3108 AR EXTERNAL FLT	ENABLE	2903 REVOLUTION TRIG	0133 PID 2 DEVIATION
Group 32: Supervision		2904 REVOLUTION ACT	0134 COMM RO WORD
3201 SUPERV 1 PARAM	ENABLE	2905 RUN TIME TRIG	0135 COMM VALUE 1
3202 SUPERV 1 LIM LO	4	2906 RUN TIME ACT	0136 COMM VALUE 2
3203 SUPERV 1 LIM HI	ENABLE	2907 USER MWH TRIG	0137 PROCESS VAR 1
3204 SUPERV 2 PARAM	ENABLE	2908 USER MWHACT	0138 PROCESS VAR 2
3205 SUPERV 2 LIM LO	ENABLE	Group 33: Information	0139 PROCESS VAR 3
3206 SUPERV 2 LIM HI	ENABLE	3301 FW VERSION	0140 RUN TIME
3207 SUPERV 3 PARAM	ENABLE	3302 LP VERSION	0141 MWH COUNTER
3208 SUPERV 3 LIM LO		3303 TEST DATE	0142 REVOLUTION CNTR
3209 SUPERV 3 LIM HI		3304 DRIVE RATING	0143 DRIVE ON TIME (HI)
			0144 DRIVE ON TIME (LO)
			0145 MOTOR TEMP

Group 40: Process PID Set		Group 41: Process PID Set		Group 42: External/Trimming PID		Group 81: PFC C	
4001 GAIN	4101 GAIN	4201 GAIN	8103 REFERENCE STEP				
4002 INTEGRATION TIME	4102 INTEGRATION TIME	4202 INTEGRATION TIME	8104 REFERENCE STEP				
4003 DERIVATION TIME	4103 DERIVATION TIME	4203 DERIVATION TIME	8105 REFERENCE STEP				
4004 PID DERIV FILTER	4104 PID DERIV FILTER	4204 PID DERIV FILTER	8109 START FREQ 1				
4005 ERROR VALUE INV	4105 ERROR VALUE INV	4205 ERROR VALUE INV	8110 START FREQ 2				
4006 UNIT	4106 UNIT	4206 UNIT	8111 START FREQ 3				
4007 DSP FORMAT	4107 DSP FORMAT	4207 DSP FORMAT	8112 LOW FREQ 1				
4008 0% VALUE	4108 0% VALUE	4208 0% VALUE	8113 LOW FREQ 2				
4009 100% VALUE	4109 100% VALUE	4209 100% VALUE	8114 LOW FREQ 3				
4010 SET POINT SEL	4110 SET POINT SEL	4210 SET POINT SEL	8115 AUX MOT START D				
4011 INTERNAL SETPNT	4111 INTERNAL SETPNT	4211 INTERNAL SETPNT	8116 AUX MOT STOP D				
4012 SETPOINT MIN	4112 SETPOINT MIN	4212 SETPOINT MIN	8117 NR OF AUX MOT				
4013 SETPOINT MAX	4113 SETPOINT MAX	4213 SETPOINT MAX	8118 AUTOCHNG INTERV				
4014 FBK SEL	4114 FBK SEL	4214 FBK SEL	8119 AUTOCHNG LEVEL				
4015 FBK MULTIPLIER	4115 FBK MULTIPLIER	4215 FBK MULTIPLIER	8120 INTERLOCKS				
4016 ACT1 INPUT	4116 ACT1 INPUT	4216 ACT1 INPUT	8121 REG BYPASS CTRL				
4017 ACT2 INPUT	4117 ACT2 INPUT	4217 ACT2 INPUT	8122 PFC START DELAY				
4018 ACT1 MINIMUM	4118 ACT1 MINIMUM	4218 ACT1 MINIMUM	8123 PFC ENABLE				
4019 ACT1 MAXIMUM	4119 ACT1 MAXIMUM	4219 ACT1 MAXIMUM	8124 ACC IN AUX STOP				
4020 ACT2 MINIMUM	4120 ACT2 MINIMUM	4220 ACT2 MINIMUM	8125 DEC IN AUX START				
4021 ACT2 MAXIMUM	4121 ACT2 MAXIMUM	4221 ACT2 MAXIMUM	Group 36: Timer Func.				
4022 SLEEP SELECTION	4122 SLEEP SELECTION	4228 ACTIVATE	3601 TIMERS ENABLE				
4023 PID SLEEP LEVEL	4123 PID SLEEP LEVEL	4229 OFFSET	3602 START TIME 1				
4024 PID SLEEP DELAY	4124 PID SLEEP DELAY	4230 TRIM MODE	3603 STOP TIME 1				
4025 WAKE-UP DEV	4125 WAKE-UP DEV	4231 TRIM SCALE	3604 START DAY 1				
4026 WAKE-UP DELAY	4126 WAKE-UP DELAY	4232 CORRECTION SRC	3605 STOP DAY 1				
4027 PID 1 PARAM SET			3606 START TIME 2				
Model #			3607 STOP TIME 2				
ACH550-UH-048A-2			3608 START DAY 2				
Serial #			3609 STOP DAY 2				
2074700732			3610 START TIME 3				
Customer:			3611 STOP TIME 3				
UVM			3612 START DAY 3				
DELEHANTY HALL			3613 STOP DAY 3				
Date:6/10/08			3614 START TIME 4				
			3615 STOP TIME 4				
			3616 START DAY 4				
			3617 STOP DAY 4				
			3622 BOOST SEL				
			3623 BOOST TIME				
			3626 TIMER 1 SRC				
			3627 TIMER 2 SRC				
			3628 TIMER 3 SRC				



New England Air Systems, Inc.

Equipment Start Up Report

EXISTING EQUIPMENT

Customer University of Vermont – Delehanty Hall Model (O) --- S/N ---
 Address Burlington, Vermont Model (I) PM 0715 IN09KIA CX S/N C95F05770
 Make of Equipment Teledyne Laars Technician Djorn Crown Date 03-11-2008
 Unit Location /ID# Penthouse – Boiler #1 Job # O200212
 Project Manager: Randy Chicoine

- Filters () --- Belts () ---
1. Are anchoring and supports secure? X
 2. Are all field and unit wiring connections tight? X
 3. Check and Record; Stand-by Voltage 121
 -Unit voltage rating 115 Phase 1
 -Check all step up/down transformer line volt taps X
 -Check and record operating voltage 120
 -Record fuse size and type..... 20 amp circuit brkr
 -Minimum and maximum fuse rating on unit No Min nor Max Listed > 12 amps
 4. Is unit properly grounded, insulated, fused? X
 5. Seal all penetration holes X
 6. Calibrate thermostat, adjust heat anticipator, level ---
 Record anticipator setting --- tstat make --- Model ---
 7. Is condensate drain trapping etc., properly installed? ---
 8. Are return and supply air diffusers free? Check T.D. rise/drop ---
 9. Adjust belt tension-pulley alignment, etc.. Check fan rotation ---
 10. Are all shipping blocks, (fan, motor, compressor, etc.) removed? X
 11. Confirm with Project Manager that all external piping was pressure tested. X
 12. Check/Record gas supply off and operating 14.4" Off 11.2" On
 -Gas manifold LOW --- HIGH ---
 -Oil pressure ---
 13. Perform combustion adjustments/efficiency test. Record efficiency results. X
 CO₂ 4.29% Stack Temp 305.7°F O₂ 13.3% Room Temp 63°
 14. Flue gas CO_{af} content 33 ppm. Vent system per mfg and code X
 15. Run and test air conditioning system. Complete information below:
 -Ambient Temp F --- Return Air Temp F ---
 -High Side PSIG --- Low Side PSIG ---
 -Superheat Temp F --- Subcooling Temp F ---
 -Compressor Amps 1) --- 2) --- 3) ---
 -Condenser Fan Amps 1) --- 2) --- 3) ---
 -Supply Fan Amps --- Return Fan amps ---
 -Oil Level --- Sight Glass ---
 -Economizer Operates --- Set Minimum Outside Air Damper ---
 16. Have all safety devices (low PSI, high PSI, oil safety, etc.) been tested? X
 17. Leave unit in full operation mode- confirm with customer on set points. X
 18. Place NEASI sticker and blue service tag on unit. X

Additional Work Recommended/Other Comments:

Combustion air to equipment correct X. Put dimensions and calculations on back of form.
 Damper interlock OK – Combustion Air Damper size 30" x 44"

Refrigerant type = R- --- Total Charge = --- lbs --- oz.

per/General Contractor:

Signature:



New England Air Systems, Inc.

Equipment Start Up Report

EXISTING EQUIPMENT

Customer University of Vermont – Delehanty Hall Model (O) --- S/N ---
 Address Burlington, Vermont Model (I) PM 0715 IN09KIA CX S/N C95F05769
 Make of Equipment Teledyne Laars Technician Djorn Crown Date 03-11-2008
 Unit Location /ID# Penthouse – Boiler #2 Job # O200212
 Project Manager: Randy Chicoine

- Filters () --- Belts () ---
1. Are anchoring and supports secure? X
 2. Are all field and unit wiring connections tight? X
 3. Check and Record; Stand-by Voltage 121
 -Unit voltage rating 115 Phase 1
 -Check all step up/down transformer line volt taps X
 -Check and record operating voltage 120
 -Record fuse size and type..... 20 amp circuit brkr
 -Minimum and maximum fuse rating on unit No Min nor Max Listed > 12 amps
 4. Is unit properly grounded, insulated, fused? X
 5. Seal all penetration holes X
 6. Calibrate thermostat, adjust heat anticipator, level ---
 Record anticipator setting --- tstat make --- Model ---
 7. Is condensate drain trapping etc., properly installed? ---
 8. Are return and supply air diffusers free? Check T.D. rise/drop ---
 9. Adjust belt tension-pulley alignment, etc.. Check fan rotation ---
 10. Are all shipping blocks, (fan, motor, compressor, etc.) removed? X
 11. Confirm with Project Manager that all external piping was pressure tested. X
 12. Check/Record gas supply off and operating 14.4" Off 11.2" On
 -Gas manifold LOW 1.7 HIGH 3.3
 -Oil pressure ---
 13. Perform combustion adjustments/efficiency test. Record efficiency results. X
 CO₂ 3.9% Stack Temp 279.1 O₂ 14.0% Room Temp 63°
 14. Flue gas CO_af content 15 ppm. Vent system per mfg and code X
 15. Run and test air conditioning system. Complete information below:
 -Ambient Temp F --- Return Air Temp F ---
 -High Side PSIG --- Low Side PSIG ---
 -Superheat Temp F --- Subcooling Temp F ---
 -Compressor Amps 1) --- 2) --- 3) ---
 -Condenser Fan Amps 1) --- 2) --- 3) ---
 -Supply Fan Amps --- Return Fan amps ---
 -Oil Level --- Sight Glass ---
 -Economizer Operates --- Set Minimum Outside Air Damper ---
 16. Have all safety devices (low PSI, high PSI, oil safety, etc.) been tested? X
 17. Leave unit in full operation mode- confirm with customer on set points. X
 18. Place NEASI sticker and blue service tag on unit. X

Additional Work Recommended/Other Comments:

Combustion air to equipment correct X. Put dimensions and calculations on back of form.
 Damper interlock OK – Damper size 30" x 44"

Refrigerant type = R- --- Total Charge = --- lbs --- oz.

Operator/General Contractor:

Signature:



New England Air Systems Inc.

HEATING • VENTILATING • AIR CONDITIONING • REFRIGERATION

START-UP REPORT

Job Location: UVM – Delehanty Hall **Project # :** O200212
Equip. Location: _____ **Start-up Date:** 06-10-2008
Equipment I.D.#: EF-6 **Technician:** Allen Tremblay

Make: Greenheck **Type:** Exhaust Fan
Model: 8BISW-41-X-10-1 **Serial #:** 11221500-0802
Motor HP: _____ **Amps:** Rated – 2.2-2.0/1.0
R.P.M. _____ **Voltage:** Rated – 208/230/460
Belts: (1) 4L300R **Phases:** _____

Additional Checks: Run voltage – 200/201/202
Run amps – 1.4/1.3/1.4
Heaters = B-3.30

Work Recommended: _____

Tech. Signature: _____

**Submittal Transmittal
Cover Sheet**



**UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont**

Project #07210

Date: 2/20/08

Transmitted To

Randy Chicoine
New England Air Systems

Transmitted By

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext. 2
Fax: 802-863-8734

Package Transmitted For

Make Corrections Noted

Delivered Via

Hand Deliver

**Submittal Information
Specification Section**

15900

Intended Use

DDC Commercial Controls

Purchase Order #

Owner's tag or identification number

Date

2/8/08

Date	Qty	Description
2/8/08	1	DDC Controls Drawings (Topology, AHU-4, Reheat Zones, Exhaust Fans, Washdown & Interlocks, Monitoring Panels, Digital Interface Pts., Analog Interface Pts., Valve Schedule)
2/8/08	1	DDC Controls Equipment Cut Sheets (As outlined in Table of Contents)

CC: Company

Contact Name

Copies Notes

Remarks

Randy,

Please find 15900 DDC Submittal – Make Corrections Noted.



CH2MHILL

RECEIVED

FEB 20 2008

Submittal Reply Form

Client: University of Vermont

Date: February 19, 2008

Project name: Delehanty Cosmogenic Nuclide Lab

Location: Burlington, VT

IDC project number: 364972

To: ReArch Company

From: Elsa Yost/CH2M Hill

Attention: Bert DeLaBruere

Reference Specification Section 15900

With reference to your Submittal No. 001-000

Submittals are dated February 11, 2008, we are taking the following action.

Description	No Exceptions Noted	Make Corrections Noted	Revise and Resubmit	Submit Specified Item
1. DDC Commercial Controls		XXXX		
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Remarks:

See attached sheet(s) for additional comments.

cc: File

By:

Elsa Yost

**Submittal Transmittal
Cover Sheet**



**UVM – Delehanty Cosmogenic Nuclide
Laboratory
Burlington, Vermont**

Project #07210

Date: 2/11/08

Transmitted To

Michael Warren
IDC Architects
200 Corporate Center Drive,
Suite 200
Moon Township, PA 15108

Transmitted By

Bert DeLaBruere
ReArch Company
30 Community Drive
South Burlington, VT 05403
Tel: 802-863-8727, ext. 2
Fax: 802-863-8734

RECEIVED
FEB 12 2008
CH2S HILL PGH

Package Transmitted For

Review/ Approval

Delivered Via

Fed Ex Overnight

**Submittal Information
Specification Section**

15900

Intended Use

DDC Commercial Controls

Purchase Order #

Owner's tag or identification number

Date

2/8/08

Date	Qty	Description
2/8/08	1	DDC Controls Drawings (Topology, AHU-4, Reheat Zones, Exhaust Fans, Washdown & Interlocks, Monitoring Panels, Digital Interface Pts., Analog Interface Pts., Valve Schedule)
2/8/08	1	DDC Controls Equipment Cut Sheets (As outlined in Table of Contents)

CC: Company

University of Vermont
Facilities Design & Construction
Marsh Hall Suite 10
31 Spear Street
Burlington, VT 05405-0344

Contact Name

Myron Wheeler

Copies Notes

1

IDC Architects
University of Vermont
Facilities Design & Construction
Marsh Hall Suite 10
31 Spear Street
Burlington, VT 05405-0344

Elsa Yost
Michael Stevens

1

Transmittal Only

ReArch Company

Remarks

Submittal and Shop Drawings

X] Received 2/11/08

✓ Reviewed

Bert Proz
Signature Title

2/11/08
Date



New England Air Systems

Complete Mechanical Systems & Service

RECEIVED
FEB 12 2008
CH2M HILL PCH

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL FORM

SUBMITTAL # 13

DATE: 2/8/08

PREVIOUS SUBMISSION DATE: N/A

PROJECT NUMBER: O-200212

PROJECT NAME: UVM Delehanty Hall

CONTRACTOR: ReArch Company

SUPPLIER: Control Tech

MANUFACTURER: Honeywell

PRODUCT DESCRIPTION: DDC Controls

MODEL NUMBER: _____

SECTION NUMBER AND TITLE: 15900
M-5

PRODUCT DEVIATIONS: _____

REVISION/RESUBMITTAL IDENTIFICATION: _____

<input type="checkbox"/> NO EXCEPTIONS NOTED <input checked="" type="checkbox"/> MAKE CORRECTIONS NOTED <input type="checkbox"/> REVISE AND RESUBMIT <input type="checkbox"/> SUBMIT ITEMS AS NOTED	<p>Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any Action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the jobsite, fabrication processes and techniques of construction, coordination of the work with that of all other trades and the satisfactory performance of the work.</p> <p>By: <u>Jeffrey Welter</u> Dated: <u>2/14/08</u></p> <p> CH2MHILL</p>
--	--

CONTRACTOR _____

REVIEWED BY NEASI	
PM	<u>[Signature]</u>
DATE	<u>2/8/08</u>

:\DEXTER shared\shijobs\UVM Delehanty Hall O200212\Submittals\SUBMITTAL 13 Controls.doc

Sequence of Operation Section

- Sheet 1 of 9 Verify that in no way can the Delahanty Hall LonWorks network can affect the Cosmogenic Nuclide lab control system.
- Sheet 2 of 9 Paragraph #1
Interlock AHU-1 and EF-4/5/6/7 operation with the duct smoke detector.
When a fan failure is detected, command the fan off and close the associated isolation damper as the backup fan is initiated.
During auto-rotation, if a fan is commanded off and damper-closed status is incorrect, command the fan back on and reopen the damper. Display an alarm to the operator workstation and abort the auto-rotation sequence.
During system shutdown, if a fan is commanded off and damper-closed status is incorrect, continue the fan-off command.
- Paragraph #2
Revise the first sentence to read: "A discharge temperature setpoint will be...."
- Paragraph #3
Revise the sequence to control humidifier to duct humidity in lieu of space humidity. Delete the sentence describing averaging of space humidity status inputs.
- Sheet 3 of 9 Open RHC 26, 27 and 28 control valves when AHU-1 is off.
- Sheet 4 of 9 Update the washdown sequence to be consistent with RFI 23 response.
- Sheet 6 of 9 Coordinate all horn activation with owner. Do not necessarily provide audible enunciation at each alarm input.
- Sheet 8 of 9 Alarm list is less than that shown on sheet M-5. Coordinate with owner for all requested alarm enunciations per the Alarm Matrix on sheet M-5.
- Sheet 9 of 9 Revise AHU-4 heating coil to 3-way.
Revise AHU-4 heating valve size to 1 1/4", Pd = 3.3 psi
Revise AHU-4 cooling coil valve size to 1 1/2", Pd = 4.3 psi

Hardware submittal section

- 1 Verify that sufficient software and memory capacity is provided to adequately trend all points as described in the Alarm Matrix on sheet M-5.
- 2 Verify that auto archiving capability is provided.
- 3 Provide user-adjustable temperature sensors in the laboratories.
- 4 Provide EF isolation damper actuators rated for -10F ambient conditions.

UVM COSMOGENIC NUCLIDE LAB BURLINGTON, VERMONT

Architect: IDC Architects
Engineer: IDC Architects
Contractor: New England Air Systems

Drawing Index:

TOPOLOGY	Page 1	EXHAUST FANS	Page 4	DIGITAL INTERFACE POINTS	Page 7
AHU-4	Page 2	WASHDOWN & INTERLOCKS	Page 5	ANALOG INTERFACE POINTS	Page 8
REHEAT ZONES	Page 3	MONITORING PANELS	Page 6	VALVE SCHEDULE	Page 9

SUBMITTAL NOTES:
Point addresses shown are generic. Addresses and terminals will be clarified after programming. As-Built documentation will reflect the actual addresses. Point types will not change.



SUBMITTAL DRAWINGS

Job #: V07169

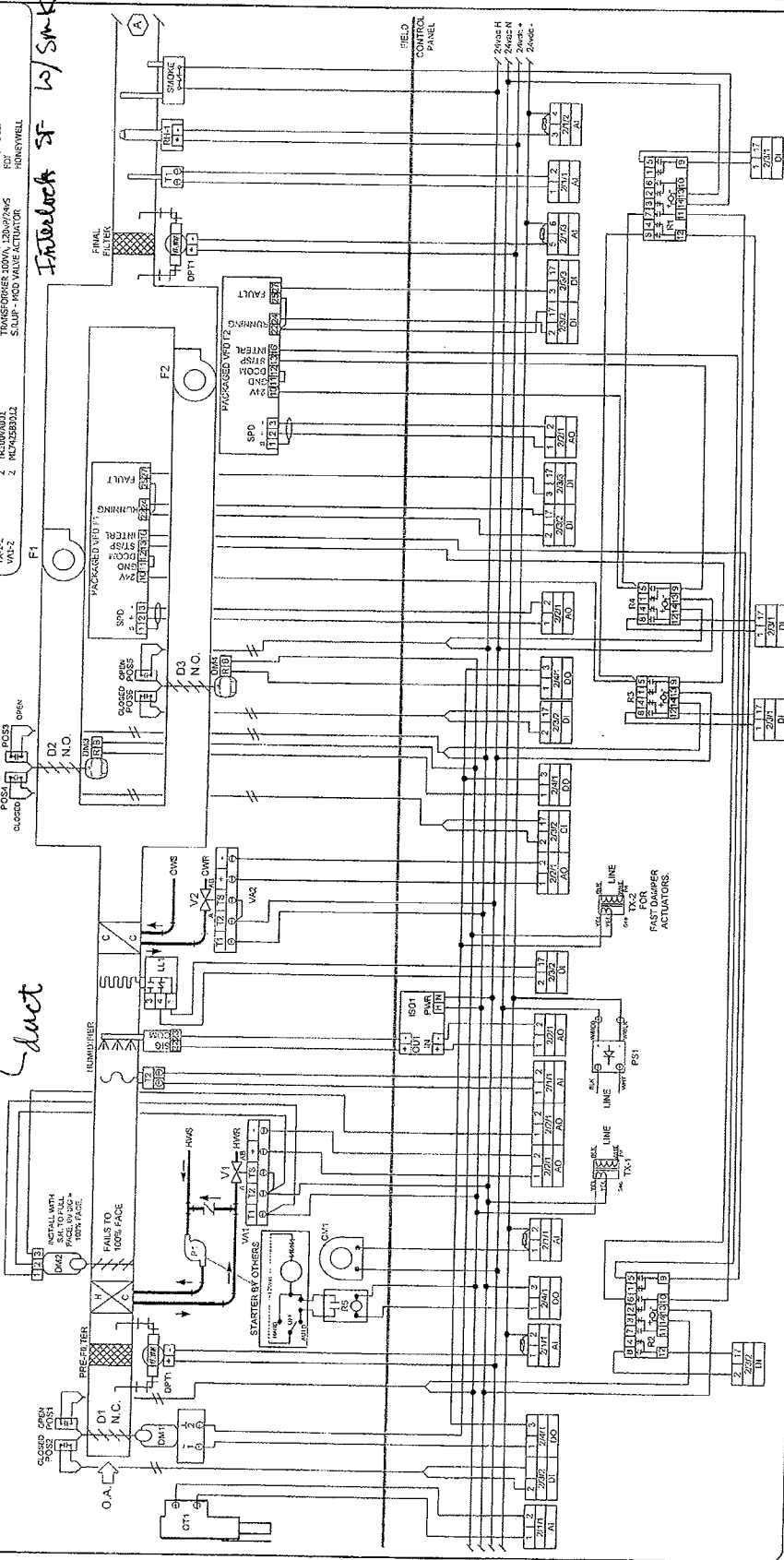
Temperature
 AHU with FF-6? Shutdown of
 pump
 check

If fan is commanded via
 rotation transition, fan should be
 re-commanded on. If fan is
 commanded off due to manual shut off,
 continue fan-off command

MODE OF OPERATION:

The system will normally operate at all times. When the system is commanded off (due to alarm conditions as per 6x-5 matrix, Low Temperature Limit, low supply static pressure alarm, sniffer system), the exhaust fans (EF-4/5, EF-6, EF-7) will be commanded off (1.5 second delay between systems) to avoid negative pressure in lab areas. The duct smoke detector will be hard wired to shut down AHU-4. Upon start, AHU-4 fan is commanded off (1.5 second delay between systems) to avoid pressure in lab areas. Upon start command of either fan, the exhaust fans will be commanded to start. The exhaust fans will remain off until the AHU-4 supply duct static pressure returns to normal. Upon start command of either fan, the exhaust fans will be commanded to start. The exhaust fans will remain off until the AHU-4 supply duct static pressure returns to normal. Upon start command of either fan, the exhaust fans will be commanded to start. The exhaust fans will remain off until the AHU-4 supply duct static pressure returns to normal.

Device	Qty	Part Number	Manufacturer
DM1	1	888099-29	GENERAL ELECTRIC
DM2	1	888099-29	GENERAL ELECTRIC
DM3	1	888099-29	GENERAL ELECTRIC
DM4	1	888099-29	GENERAL ELECTRIC
DM5	1	888099-29	GENERAL ELECTRIC
DM6	1	888099-29	GENERAL ELECTRIC
DM7	1	888099-29	GENERAL ELECTRIC
DM8	1	888099-29	GENERAL ELECTRIC
DM9	1	888099-29	GENERAL ELECTRIC
DM10	1	888099-29	GENERAL ELECTRIC
DM11	1	888099-29	GENERAL ELECTRIC
DM12	1	888099-29	GENERAL ELECTRIC
DM13	1	888099-29	GENERAL ELECTRIC
DM14	1	888099-29	GENERAL ELECTRIC
DM15	1	888099-29	GENERAL ELECTRIC
DM16	1	888099-29	GENERAL ELECTRIC
DM17	1	888099-29	GENERAL ELECTRIC
DM18	1	888099-29	GENERAL ELECTRIC
DM19	1	888099-29	GENERAL ELECTRIC
DM20	1	888099-29	GENERAL ELECTRIC
DM21	1	888099-29	GENERAL ELECTRIC
DM22	1	888099-29	GENERAL ELECTRIC
DM23	1	888099-29	GENERAL ELECTRIC
DM24	1	888099-29	GENERAL ELECTRIC
DM25	1	888099-29	GENERAL ELECTRIC
DM26	1	888099-29	GENERAL ELECTRIC
DM27	1	888099-29	GENERAL ELECTRIC
DM28	1	888099-29	GENERAL ELECTRIC
DM29	1	888099-29	GENERAL ELECTRIC
DM30	1	888099-29	GENERAL ELECTRIC
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DM45	1	888099-29	GENERAL ELECTRIC
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DM98	1	888099-29	GENERAL ELECTRIC
DM99	1	888099-29	GENERAL ELECTRIC
DM100	1	888099-29	GENERAL ELECTRIC



CONTROL TECHNOLOGIES

121 PARK AVENUE, SUITE 10
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Checked by: _____ Date: _____
 Software by: _____
 Designed by: TRS Date: 2/8/08
 Contractor: IDC Architects
 Engineer: IDC Architects
 Architect: UVA COSMOGENIC
 BUCLIDE LAB
 BURLINGTON, VERMONT

AHU-4

SHEET NO. 2 OF 9
 FILE NAME
 JOB NUMBER V07169

ONTROL TECHNOLOGIES
 121 PARK AVENUE, SUITE 10
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#	Change	DATE

Architect: IDC Architects
 Engineer: IDC Architects
 Contractor: New England Air Systems
 Designed by: TRS
 Date: 2/8/08
 Checked by: []
 Software by: []

JOB NUMBER: UVM COSMOGENIC
 FILE NAME: NUCLIDE LAB
 BURLINGTON, VERMONT
 SHEET NO. 3 OF 9
 REHEAT ZONES

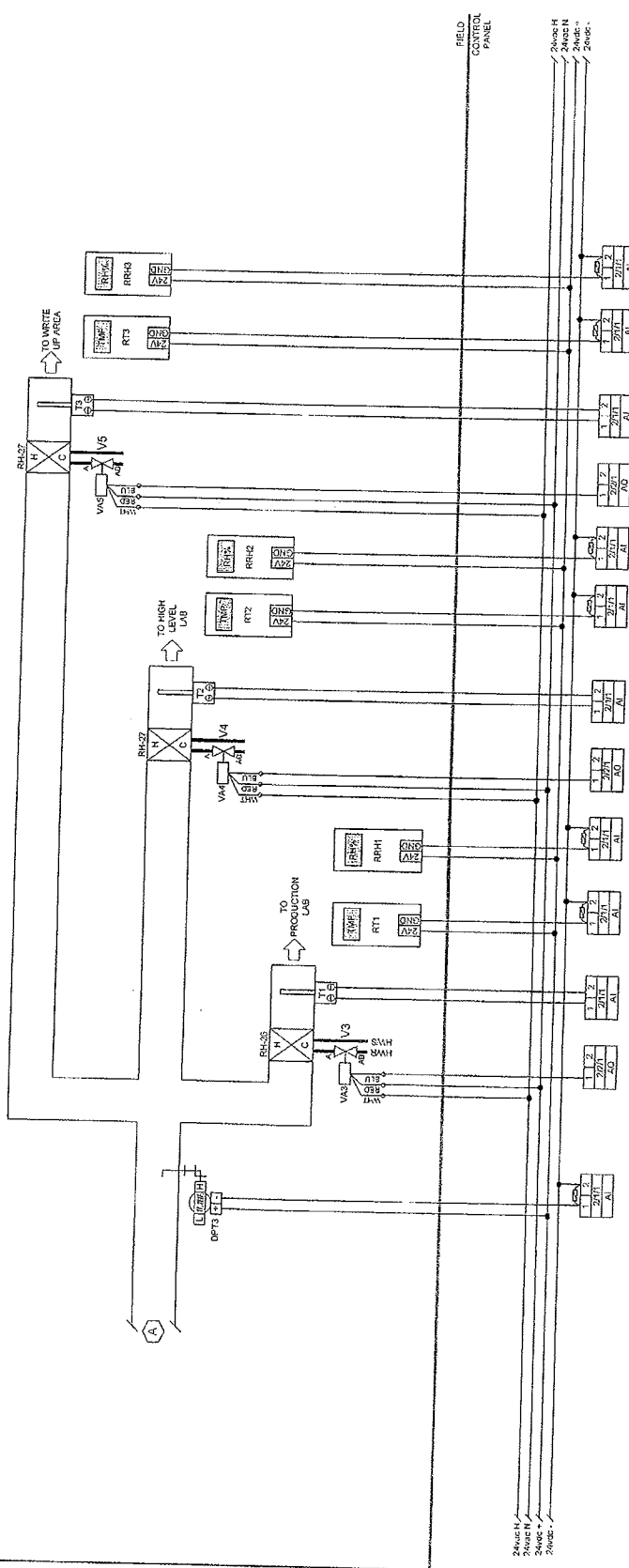
BILL OF MATERIALS

Qty	Part Number	Description	Manufacturer
1	ZF5-30-05-05-RS-ST-0	0.5" (1.27cm) Transmitter	BAPI
3	8W100-0-0	Space Humidity Transmitter, 4-	BAPI
1	8W100-0-0	Space Temp Transmitter w/box	BAPI
2	CV41230-0005-0D-2-CE	Direct Temp Sensor	HONEYWELL
2	MVA180000	Valve Actuator	HONEYWELL
1	MVA1003005	Valve Actuator, 0.50"	HONEYWELL

REHEAT ZONES

Zone	Part Number	Description
Zone 1	RT1	Reheat Transmitter
Zone 2	RT2	Reheat Transmitter
Zone 3	RT3	Reheat Transmitter
Zone 4	RT4	Reheat Transmitter
Zone 5	RT5	Reheat Transmitter
Zone 6	RT6	Reheat Transmitter
Zone 7	RT7	Reheat Transmitter
Zone 8	RT8	Reheat Transmitter
Zone 9	RT9	Reheat Transmitter
Zone 10	RT10	Reheat Transmitter
Zone 11	RT11	Reheat Transmitter
Zone 12	RT12	Reheat Transmitter
Zone 13	RT13	Reheat Transmitter
Zone 14	RT14	Reheat Transmitter
Zone 15	RT15	Reheat Transmitter
Zone 16	RT16	Reheat Transmitter
Zone 17	RT17	Reheat Transmitter
Zone 18	RT18	Reheat Transmitter
Zone 19	RT19	Reheat Transmitter
Zone 20	RT20	Reheat Transmitter
Zone 21	RT21	Reheat Transmitter
Zone 22	RT22	Reheat Transmitter
Zone 23	RT23	Reheat Transmitter
Zone 24	RT24	Reheat Transmitter
Zone 25	RT25	Reheat Transmitter
Zone 26	RT26	Reheat Transmitter
Zone 27	RT27	Reheat Transmitter
Zone 28	RT28	Reheat Transmitter
Zone 29	RT29	Reheat Transmitter
Zone 30	RT30	Reheat Transmitter

MODE OF OPERATION:
 The reheat valves will modulate to maintain the space temperature setpoint. The setpoint will be adjustable at the front end of open valves when ATTA-1 is off.



Zone	Part Number	Description
Zone 1	RT1	Reheat Transmitter
Zone 2	RT2	Reheat Transmitter
Zone 3	RT3	Reheat Transmitter
Zone 4	RT4	Reheat Transmitter
Zone 5	RT5	Reheat Transmitter
Zone 6	RT6	Reheat Transmitter
Zone 7	RT7	Reheat Transmitter
Zone 8	RT8	Reheat Transmitter
Zone 9	RT9	Reheat Transmitter
Zone 10	RT10	Reheat Transmitter
Zone 11	RT11	Reheat Transmitter
Zone 12	RT12	Reheat Transmitter
Zone 13	RT13	Reheat Transmitter
Zone 14	RT14	Reheat Transmitter
Zone 15	RT15	Reheat Transmitter
Zone 16	RT16	Reheat Transmitter
Zone 17	RT17	Reheat Transmitter
Zone 18	RT18	Reheat Transmitter
Zone 19	RT19	Reheat Transmitter
Zone 20	RT20	Reheat Transmitter
Zone 21	RT21	Reheat Transmitter
Zone 22	RT22	Reheat Transmitter
Zone 23	RT23	Reheat Transmitter
Zone 24	RT24	Reheat Transmitter
Zone 25	RT25	Reheat Transmitter
Zone 26	RT26	Reheat Transmitter
Zone 27	RT27	Reheat Transmitter
Zone 28	RT28	Reheat Transmitter
Zone 29	RT29	Reheat Transmitter
Zone 30	RT30	Reheat Transmitter

MODE OF OPERATION:

WASH-DOWN: When the wash-down pushbutton is activated the system will operate as follows: The Wash-down valves will open in sequence (only 1 valve will open at a time) for an adjustable period of time, then close. The sequence will continue until all 5 valves have cycled open. When wash-down is not active and a valve closed end switch status is not detected after a 30 second delay, a valve closure failure alarm will be issued to the front end.

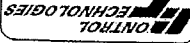
HOOD ALARM CONTACTS: The DDC system will monitor the hood packaged alarm for alarm reporting to front end.

HOOD OUTLET INTERLOCKS: When a system airflow failure (Hood exhaust fans or AHU system) is detected the breaker/shunt trip circuits will be activated to de-energize the hood electrical outlets.

BILLOMATERIALS

Device	Part Number	Description	Manufacturer
WASHDOWN	1 WASHDOWN	Emergency Pushbutton, Black	DDC
RI-5	5 RI-5	TRANSFORMER 100VA, 120V/240V	FUNCTIONAL DEVICES
TX-4-5	5 TX-4-5	1-1/2" Stainless Ball Valve	VALVE WORK
WV-5	5 WV-5	1-1/2" Stainless Ball Valve	VALVE WORK

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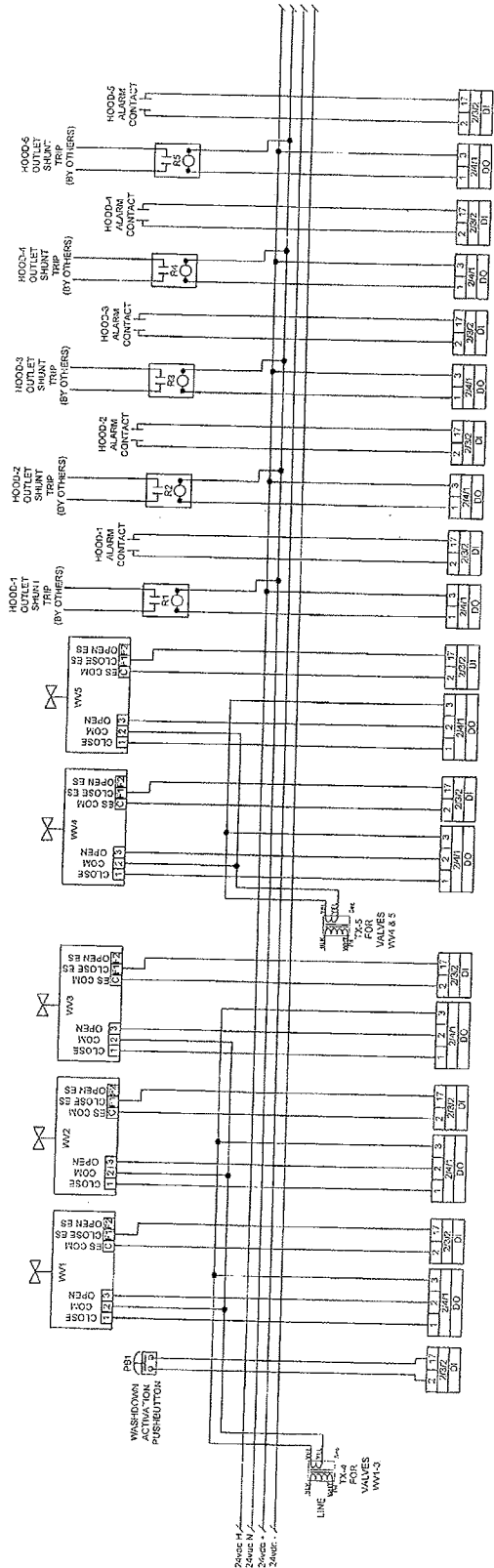


#	Change	Revisions

Architect: IDC Architects
Engineer: IDC Architects
Contractor: New England Air Systems
Designed by: FRA
Software by: FRA
Checked by: FRA
Date: 2/8/08

UVA COSMOGENIC
NUCLIDE LAB
BURLINGTON, VERMONT
WASHDOWN &
INTERLOCKS

JOB NUMBER
V07169
FILE NAME
Exp07169.rvt
SHEET NO.
5 OF 9



Update for RI 23

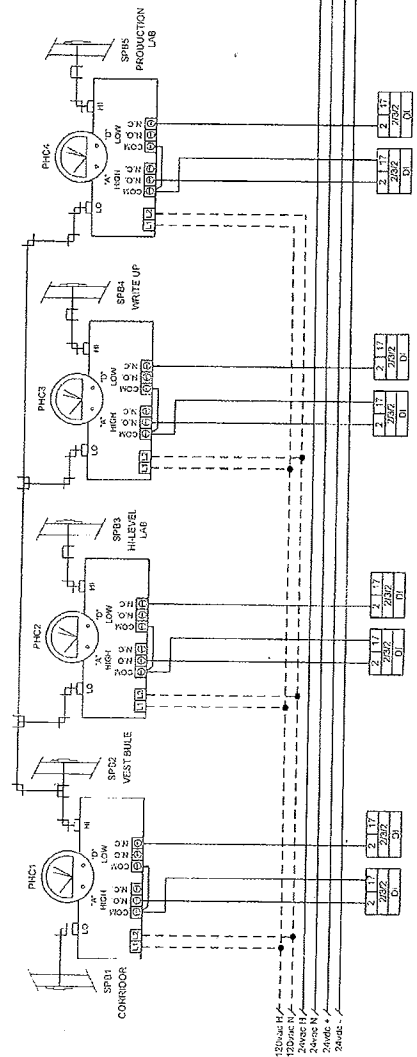
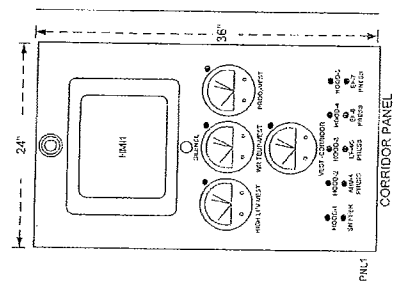
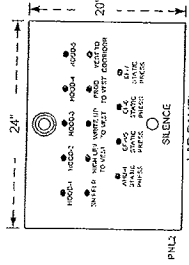
MODE OF OPERATION:

There will be an indicating panel provided in the corridor and in the lab area.

The space differential pressures will be monitored with Photohelic switches mounted in the corridor panel face. A touch screen PC will be mounted in the panel face. The PC will have a "SymmetrE" client to allow review and access of systems and alarms.

Red LED indicator lights will be provided in both panels for notification of monitored points. When a monitored point is in an alarm condition, the associated light will be activated and the horn will be activated. When the silence button is pushed on either panel the horn will be deactivated but the indicating light will remain on as long as the associated point is in alarm condition. The horn will be activated again with any sequential alarm condition.

Coordinate horn activation with alarm per Eval.



PANELS	Device	Qty	Part Number	Description	Manufacturer
PNL1	PHC1	1	PHC1	Pressure Switch	PHOTHELIC
PNL1	PHC2	1	PHC2	Pressure Switch	PHOTHELIC
PNL1	PHC3	1	PHC3	Pressure Switch	PHOTHELIC
PNL1	FLS1	1	FLS1	Flow Switch	PHOTHELIC
PNL1	FLS2	1	FLS2	Flow Switch	PHOTHELIC
PNL1	FLS3	1	FLS3	Flow Switch	PHOTHELIC
PNL1	FLS4	1	FLS4	Flow Switch	PHOTHELIC
PNL1	FLS5	1	FLS5	Flow Switch	PHOTHELIC
PNL1	FLS6	1	FLS6	Flow Switch	PHOTHELIC
PNL1	FLS7	1	FLS7	Flow Switch	PHOTHELIC
PNL1	FLS8	1	FLS8	Flow Switch	PHOTHELIC
PNL1	FLS9	1	FLS9	Flow Switch	PHOTHELIC
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PNL1	FLS98	1	FLS98	Flow Switch	PHOTHELIC
PNL1	FLS99	1	FLS99	Flow Switch	PHOTHELIC
PNL1	FLS100	1	FLS100	Flow Switch	PHOTHELIC

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#	Change	Date

Architect: IDC Architects
Contractor: New England Air Systems
Designed by: TRA
Software by: Date:
Checked by: Date:
Date: 2/8/08

UVM COSMOGENIC
NUCLIDE LAB
BURLINGTON, VERMONT

JOB NUMBER: V07189
FILE NAME: Monitor_07_08_05
SHEET NO. 6 OF 9

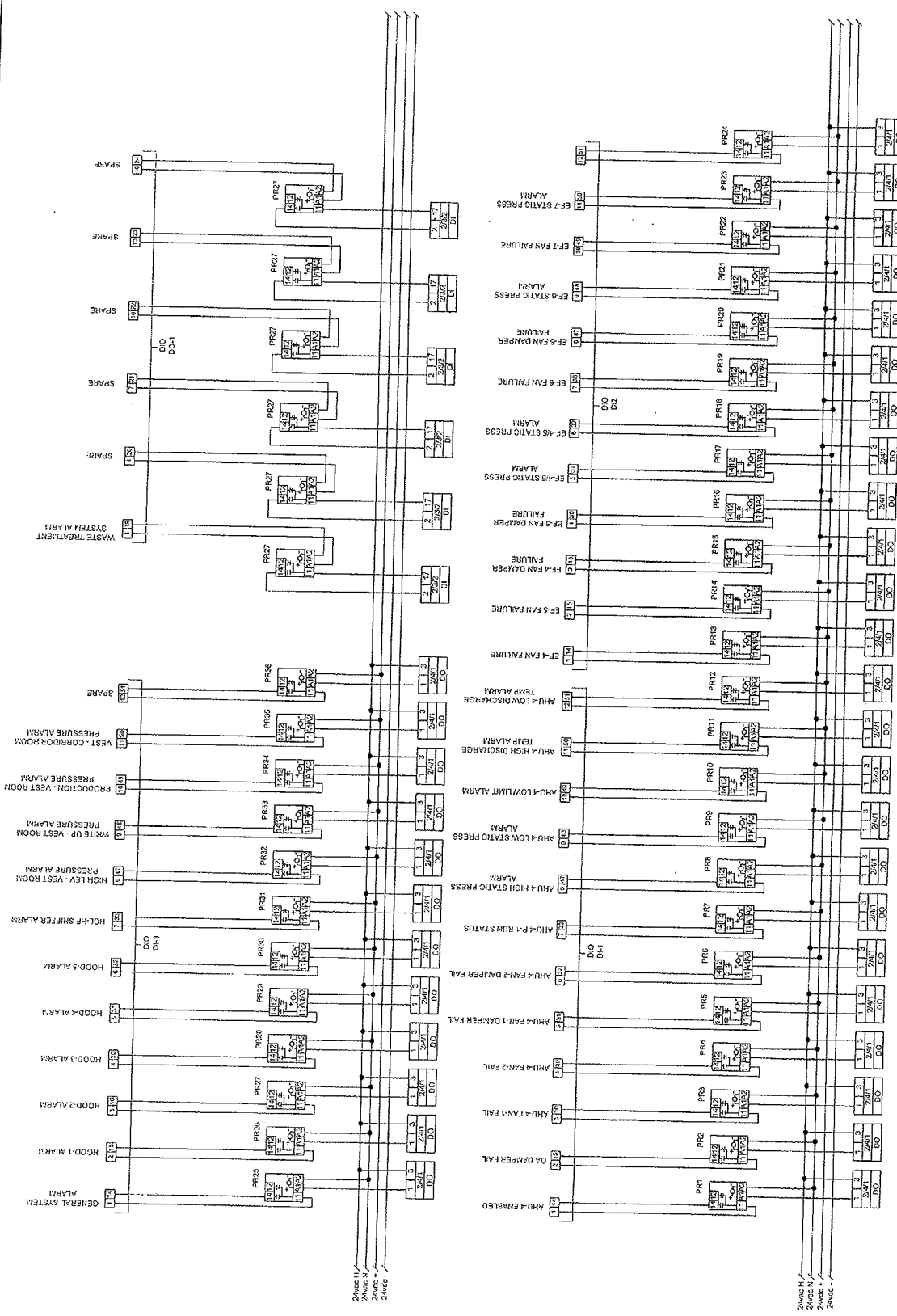
ONTROL TECHNOLOGIES
 121 PARK AVENUE, SUITE 10
 WILSTON, VT 05495
 PHONE: (802) 754-2200
 FAX: (802) 754-2299

#	CHANGES	DATE

Architect: IDC Architects
 Engineer: IDC Architects
 Contractor: New England Air Systems
 Designed by: TRA
 Date: 2/8/08
 Checked by: [blank]
 Software by: [blank]

UVM COSMOGENIC
 NUCLIDE LAB
 BURLINGTON, VERMONT
 DIGITAL INTERFACE
 POINTS

JOB NUMBER: V01769
 FILE NAME: Nuclide_Lab_Points_V01769
 SHEET NO: 7 OF 9



Zone 1
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CONTROL TECHNOLOGIES
 121 PARK AVENUE, SUITE 10
 WILMISTON, VT 05495
 PHONE: (802) 784-2200
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#	Change	Date

Architect: IDC Architects
 Engineer: IDC Architects
 Contractor: New England Air Systems
 Designer by: TRA
 Date: 2/8/08
 Checked by: _____
 Date: _____

UVM COSMOGENIC
 NUCLIDE LAB
 BURLINGTON, VERMONT
 ANALOG INTERFACE
 POINTS

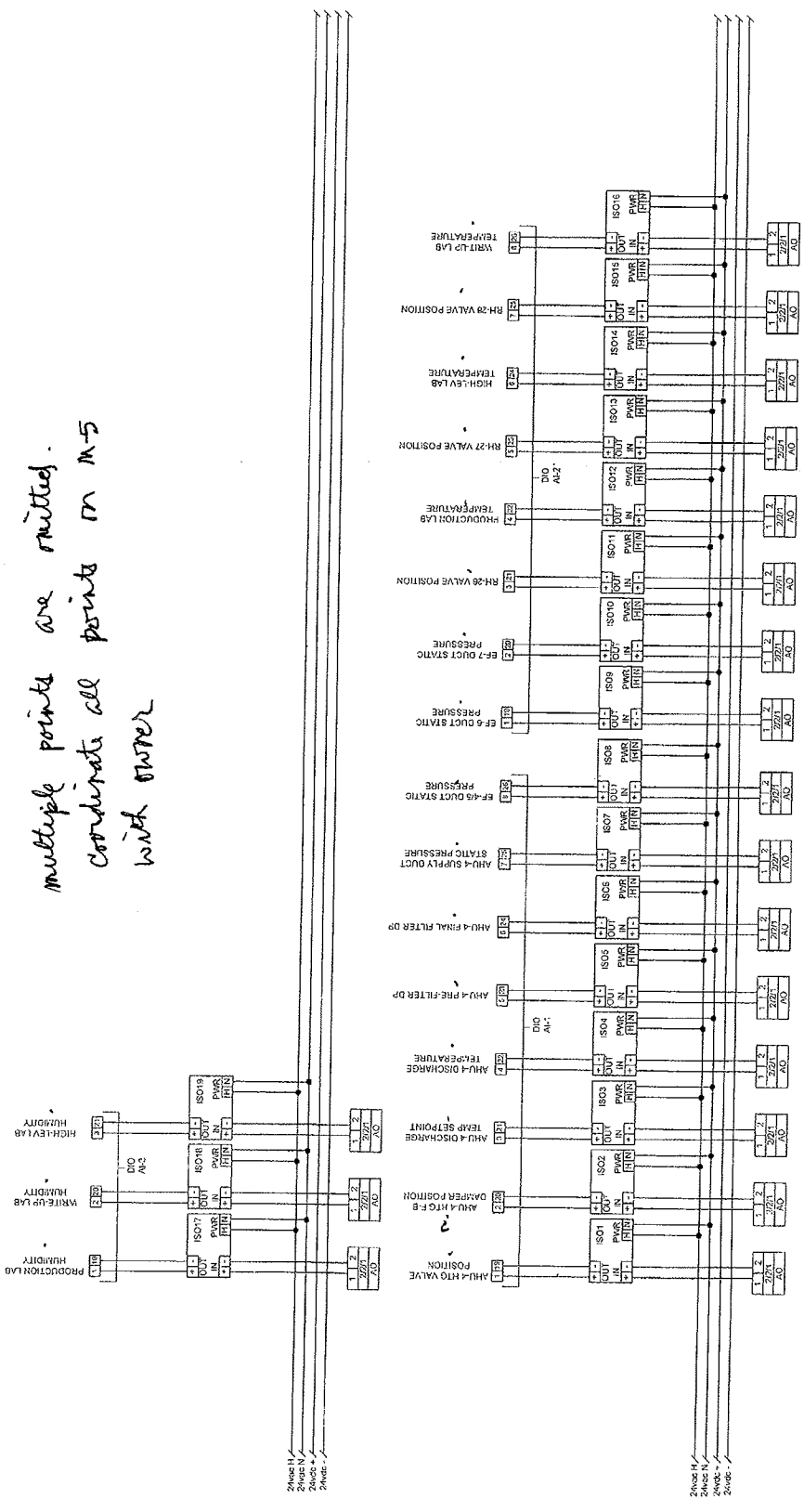
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 8 OF 9 SHEET NO.

BILL OF MATERIALS

DESCRIPTION	QTY	PART NUMBER	MANUFACTURER
DC to DC Converter	19	DT13-24-00-00-0-000	TELT
"ULC DIN RUBY"	2	286628	PHOENIX CONTACT

*multiple points are omitted.
 coordinate all points on M-5
 with owner*

MODE OF OPERATION:
 The data points shown will be transmitted between the Lab DDC system and the Campus DDC system through the hardwired interlocks as shown.



2Wire M
 2Wire N
 2Wire

2Wire M
 2Wire N
 2Wire

CONTROL TECHNOLOGIES
121 PARK AVENUE, SUITE 10
WILLISTON, VT 05495
PHONE: (802) 764-2200
FAX: (802) 764-2299

#	Change	Date

Architect: IDC Architects
Engineer: IDC Architects
Contractor: New England Air Systems
Designed by: TRA
Date: 2/8/08
Checked by:
Date:
Software by:
Date:
SHEET NO. 9 OF 9

JOB NUMBER
407169
FILE NAME
BURLINGTON, VERMONT
UVM COSMOGENIC
VALVE SCHEDULE

VALVE SCHEDULE

TAG	QTY	Serves	VALVE TYPE	VALVE #	ACTUATOR #	MANUF.	ACTION	Valve Size	FLOW #HP	Valve Cv	Pd	CONN TYPE	Fail Position	Close-Off (test)
V1	1	AHU-4 HEATING COIL VALVE	Globe	V5011N1081	ML7425B3012	Honeywell	3 2-Way, Modulating	1-1/2"	34.0	29.3	1.35	FNPT	OPEN	57
V2	1	AHU-4 COOLING COIL VALVE	Globe	V5011N1089	ML7425B3013	Honeywell	2-Way, Modulating	1"	61.0	46.8	1.70	FNPT	OPEN	37
V3	1	RH-26 HEATING COIL VALVE	Globe	V5662A3029	MF410FT006	Honeywell	2-Way, Modulating	1"	12.4	11.0	1.27	FNPT	NSR	232
V4	1	RH-27 HEATING COIL VALVE	Globe	V5662A3062	MF410FT000	Honeywell	2-Way, Modulating	3/4"	3.3	2.9	1.20	FNPT	NSR	232
V5	1	RH-28 HEATING COIL VALVE	Globe	V5662A3047	MF410FT000	Honeywell	2-Way, Modulating	1/2"	1.3	1.2	1.17	FNPT	NSR	232

1
1 1/2" 1/2"

FOR THE WASH-DOWN VALVES SEE WASH-DOWN CONTROL DRAWING.

February 8, 2008

**UVM COSMOGENIC NUCLIDE LAB
BURLINGTON, VERMONT
JOB NO. V07169**

SUBMITTAL

ARCHITECTS: IDC ARCHITECTS

ENGINEER: IDC ARCHITECTS

CONTRACTOR: NEW ENGLAND AIR SYSTEMS

Verify sufficient software &
memory for branding as specified
& described in the documents.

**UVM COSMOGENIC NUCLIDE LAB
SUBMITTAL
Equipment Cut Sheets**

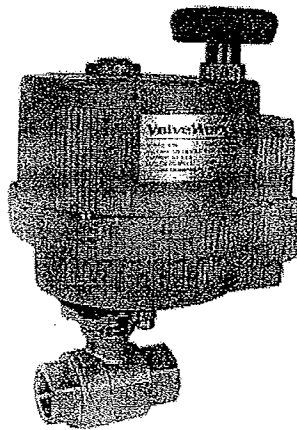
TABLE OF CONTENTS

JOB NUMBER: V07169

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
540610	1-1/4" Stainless Ball Valve
2966278	"PLC" DIN Relay
A3300-00N	-0.05-.20inw Photohelic Switch
ABW12B	Momentary Pushbutton, Black
AL6MP4P-R	Red Indicating Light, 24v
BA/H200-R-D	Space Humidity Transmitter, 4-
BA/T1K(55TO85)BD-Z-CG	TEMP TRANSMITTER
C7041C2003	18" Duct Temp Sensor
C7041F1008	OUTDOOR TEMP SENSOR
DCP-250-H	HUB MOUNT DC POWER SUPPLY
DT13-24-C(0-10v-0-10v)	DC to DC Isolator
FS-33	Low Limit, Auto Reset
JJ-TCLB-38-1	3/8" P-Clamp (10 pack)
KEL-BAM	END STOPS
KEL-BJS6	JUMPER BAR
KEL-EV6	JUMPER BAR HARDWARE KIT
KEL-M4/6	TERMINAL BLOCKS
M7410F1000	Valve Actuator, 0-10v
M7410F3006	Valve Actuator, 0-10v
ML7425B3012	S.R.UP - MOD VALVE ACTUATOR
MS7520A2007	S.R. Modulating Damper Actuator
MS8120F1200	S.R. Fast Acting Damper Actuator
MS8309F1001	Fast Acting Damper Actuator S.
P00370	Damper Position Switch
PC215A	PANEL MOUNT PC
Precision-490	Dual-Core Tower PC w/Printer
RH2B-ULAC24V	DPDT Relay
RH4B-ULAC24V	4PDT Relay
RIB-U1C	Relay
RIBXK420-20	Current Sensor, 0-20amp, 4-20m
RIBXK420-50	Current Sensor, 0-50amp, 4-20m
SC628A	Alarm Horn
SCE-20EL2408LP	20"H x 24"W x 8" D Enclosure
SCE-24P20	Sub-Panel
SCE-36EL2410LP	36"H x 24"W x 10"D Enclosure
SCE-36P24	Sub-Panel
SCE-60EL3610LP	60" H x 36" W x 10"D Enclosure
SH2B-05	Din Rail Socket
SH4B-05	Din Rail 4-Pole Socket
SYMMETRE R310	SYMMETRE SCADA SOFTWARE

TR100VA001
V5011N
V5862A
XC5010C
XF522A
XF523A
XF524A
XF526
XFL521B
XFL523B
XFL524B
XH561
XH561
XH562H
XP502
XSL511
XSL513
XSL514
ZPS-20-04-BB-ST-D
ZPS-20-05-BB-ST-D
ZPS-ACC01
ZPS-ACC07

TRANSFORMER 100VA, 120vP/24vS
GLOBE VALVE
VALVE
XL500 CPU
8-ANALOG OUTPUT MODULE
12-DIGITAL INPUT MODULE
6-DIGITAL OUTPUT MODULE
8-Analog Input Module
LON 8-ANALOG INPUT MODULE
LON 12-DIGITAL INPUT MODULE
LON 6-DIGITAL OUTPUT MODULE
XL-500 Housing
XL-500 Housing
XL-500 Housing Blank Cover
XL500 POWER SUPPLY
LON CONNECT MODULE
LON TERMINAL BLOCK 521/522/523
LON TERMINAL BLOCK FOR XSL524
0-2.5inw D-P Transmitter w/Dis
0-5.0inw D-P Transmitter
Wall Static Probe
Static Press Pickup w/snubber



ValveWorx

Electric Actuated Stainless Ball Valve 1-1/4", 24V

Stock #: 540610
 Brand: ValveWorx
 Series: 5406
 Mfr Part #: 540610

Usually Ships: Same Day

Qty:

Specifications

Electric actuated stainless steel ball valve for on-off control of air, oil, water and other media (typically not suitable for steam or applications above 250° F). The 2-piece ball valve is a full port design for unrestricted flow and direct mounts to the actuator. The ball seats are RTFE (reinforced Teflon). Adjustable blowout proof triple stem seal design incorporates a lower tapered seal ring plus secondary (back-up) seals include an O-ring and Vee packing rings energized by bellville washers. This design adjusts packing compression to compensate for wear, pressure or temperature fluctuations. High duty cycle electric actuator uses a reversing motor to open and close the ball valve. Limit switches at both the open and closed position automatically stop the valve in the correct position (even with the power left on). Electronic torque limiter protects the motor from overload conditions. Standard features include a visual valve position indicator, manual override knob, and two extra auxiliary limit switches for position indication. Included heater activated once the temperature inside the housing drops below 77°F to help reduce any condensation build-up. Ball valve package can be mounted in any orientation.

Valve Maximum Pressure - Temperature							
PSI	1000	1000	1000	1000	1000	850	650
°F	0	50	100	150	200	250	300

- Voltage: 24VDC or 24VAC (1.0 Amps)
- Pipe Size: 1-1/4" NPT female
- Port Size: Full Port, Orifice 1.26 inches, Cv 105
- Pressure (Max): 1000 PSI WOG
- Valve Temperature: 300° F maximum
- Actuator Temperature: -4 to 131° F
- Valve Body: Stainless Steel CF8M, 316SS, investment cast
- Ball/Stem: 316 stainless steel
- Stem Seals: RTFE (Teflon), Viton O-ring
- Ball Seats: PTFE (Teflon)
- Cycle Time: 8 seconds per 90° rotation
- Duty Cycle: 75% duty cycle
- Enclosure: Techno-polymer/die-cast aluminum
- Enclosure Protection: IP65-67 water and dust tight
- Electrical Connection: (2) PG11 cable
- Auxiliary Limit Switches: (2) Switches with dry contacts
- Heater: Activated when temperature drops below 77° F inside housing
- Dimensions: 10.56"H x 6.18"W. 4.02" valve end to end
- Weight: 8.4 pounds
- PDF Wiring Diagram: [Electrical Wiring Diagram Series 5306-266-530-975](#)

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 - [Learn about Ball Valves](#)
 - [Learn about Pressure Gauges](#)
 - [Learn about Pressure Transducers](#)
 - [Learn about Air Regulators](#)

- Web Catalogs**
- [ValveStore.com](#)
 - [GaugeStore.com](#)
 - [RegulatorStore.com](#)

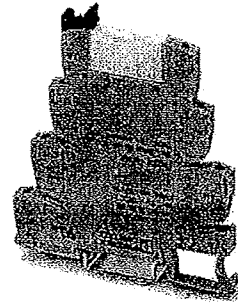
- Company Info**
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PLC-RSC- 24UC/21AU

Order No.: 2966278



The illustration shows the version PLC-RSC-24DC/21

<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2966278>

PLC relay, consisting of base terminal block PLC-BSC.../21 with screw connection and pluggable miniature relay with multi-layer contact, for assembly on mounting rail NS 35/7.5, 1 PDT, input voltage 24 V AC/DC

Commercial data	
EAN	4017918131029
Pack	10 Pcs.
Customs tariff	85364190
Weight/Piece	0.03599 KG
Catalog page information.	Page 67 (IF-2007)

Product notes

WEEE/RoHS-compliant since:
05/15/2006

<http://www.download.phoenixcontact.com>
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Technical data

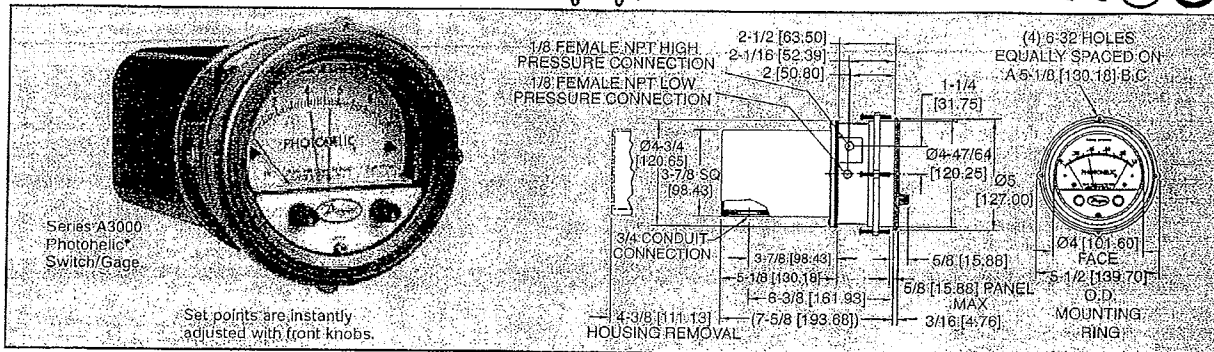
Coil side	
Nominal input voltage U_N	24 V AC/DC
Nominal input current at U_N	11 mA (at $U_N = 24$ V AC) 8.5 mA (at $U_N = 24$ V DC)
Typical response time	6 ms
Typical release time	15 ms
Operating voltage display	Yellow LED

Name of protection	Bridge rectifier
Protective circuit/component	Bridge rectifier
Contact side	
Contact type	Single contact, 1-PDT
Contact material	Ag alloy, hard gold-plated
Maximum switching voltage	30 V AC 36 V DC
Minimum switching voltage	100 mV
Maximum inrush current	50 mA
Min. switching current	1 mA
Limiting continuous current	50 mA
Power rating (ohmic load) max.	1.2 W (for 24 V DC)
Note	the following values are applicable if a gold layer is destroyed
Maximum switching voltage	250 V AC/DC
Minimum switching voltage	12 V AC/DC
Limiting continuous current	6 A
Min. switching current	10 mA
Power rating (ohmic load) max.	140 W (for 24 V DC) 20 W (for 48 V DC) 18 W (for 60 V DC) 23 W (for 110 V DC) 40 W (for 220 V DC) 1500 VA (for 250 V AC)
General data	
Length	80 mm
Height	94 mm
Width	6.2 mm
Test voltage relay winding/relay contact	4 kV AC (50 Hz, 1 min)
Ambient temperature (operation)	-25 °C ... 60 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Operating mode	100% operating factor
Service life mechanical	2×10^7 cycles
Inflammability class in acc. with UL 94 (housing)	V0
Standard designation	Standards/regulations

Series
A3000

Photohelic® Pressure Switch/Gages

3-in-One Indicating Gage, Lo-Limit and Hi-Limit Control

Series A3000
Photohelic®
Switch/GageSet points are instantly
adjusted with front knobs.

Photohelic® Switch/Gages function as versatile, highly repeatable pressure switches combined with a precise pressure gage employing the time-proven Magnehelic® gage design. The Photohelic® gage measures and controls positive, negative or differential pressures of air and compatible gases. Standard models are rated to 25 psig (1.7 bar) with options to 35 (2.4) or 80 (5.5 bar) psig. Single pressure 36000S models measure to 6000 psig (413 bar) with a 9000 psig (620 bar) rating.

Two phototransistor actuated, DPDT relays are included for low/high limit control. Easy to adjust setpoint indicators are controlled by knobs located on the gage face. Individual setpoint deadband is one pointer width — less than 1% of full scale. Setpoints can be interlocked to provide variable deadband — ideal for control of fans, dampers, etc. Gage reading is continuous and unaffected by switch operation, even during loss of electrical power. Choose from full scale pressure ranges from a low 0-25" (0-6 mm) w.c. up to 30 psi (21 bar); single positive pressure to 6000 psig (413 bar).

PHOTOHELIC SENSING — HOW IT WORKS

In typical applications, these Dwyer switch/gages control between high and low pressure set points. When pressure changes, reaching either set point pressure, the infrared light to the limiting phototransistor is cut off by the helix-driven light shutter. The resulting phototransistor signal is electronically amplified to actuate its DPDT slave relay and switching occurs. Dead band between make and break is 1% of full scale or less — just enough to assure positive, chatter-free operation.

RELAY-TRANSFORMER FEATURES

A plastic housing protects all electronic components. Solid-state and integrated circuit electronics are on glass-epoxy printed circuit boards and self-extinguishing terminal boards (for the Series A3000 only).

APPLICATIONS — PHOTOHELIC® SWITCH/GAGES

In both series of pressure switch/gages, you get the convenience of a visual indication plus high-low limit switching. For both OEM and in-plant applications, the Photohelic® switch/gage is used to control pressures in air conditioning systems, clean rooms, fluidic and pneumatic control systems, materials handling equipment, alarm or control fume exhaust systems, control pressure in air structures, and monitor respiratory and blood pressures.

STANDARD MODEL

Two phototransistor-actuated circuits and two DPDT relays permit both high and low alarms or limit controls. Relays are de-energized when gage pointer is to the left of respective set points; relays are energized as pointer passes to the right of set points. Loss of electrical power or loss of pressure provide "fail safe" protection.

SPECIFICATIONS

GAGE SPECIFICATIONS

Service: Air and non-combustible, compatible gases.

Wetted Materials: Consult factory.

Accuracy: ±2% of full scale at 70°F (21.1°C). ±3% on -0 and ±4% on -00 models.

Pressure Limits: -20" Hg. to 25 psig (-0.677 to 1.72 bar). MP option; 35 psig (2.41 bar), HP option; 80 psig (5.52 bar). A36003S - 36010S; 150 psig (10.34 bar). A36020S and higher; 1.2 x full scale pressure.

Temperature Limits: 20 to 120°F (-6.67 to 48.9°C) Low temperature option available.

Process Connections: 1/8" female NPT.

Size: 4" (101.6 mm) dial face, 5" (127 mm) O.D. x 8-1/4" (209.55 mm).

Weight: 4 lb (1.81 kg).

SWITCH SPECIFICATIONS

Switch Type: Each setpoint has 2 Form C relays (DPDT).

Repeatability: ±1% of full scale.

Electrical Rating: 10A @ 28 VDC, 10A @ 120, 240 VAC.

Electrical Connections: Screw terminals. Use 167°F (75°C) copper conductors only.

Power Requirements: 120 VAC, 50/60 Hz; 240 VAC & 24 VAC Power optional.

Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.

Set Point Adjustment: Adjustable knobs on face.

Agency Approvals: UL, CSA, CE.

OPTIONS

Single contact, right set point, for actuation on increasing or decreasing pressure.

OEM Model, less relay and transformer components and housing but including infrared diodes and phototransistor(s), light shutter and set pointer(s). For single or double contact.

Remote-Mounted Relay, relay pack may be mounted remotely from gage. Standard

length is 5 ft. For other lengths, specify cable length required.

Tamper-proof knobs, low temperature option, special scales, voltages and other features and modifications are available.

Special Housings available include Weatherproof (NEMA 4) and Explosion-proof (NEMA 7 CD, 9 EFG; NEC Class I, Div. 1 & 2, Groups C, D, Class II, Div. 1 & 2, Groups E, F, G, Class III. Contact Customer Service for detailed dimension drawings.

HIGH AND LOW LATCHING CIRCUITS

Dwyer Photohelic® switch/gages can be wired for high-latching, low-latching or combination high-low latching circuits. That is, the equipment will hold in these respective positions once activated and until manually reset. This can be particularly useful for alarm and signal applications where control is accomplished by another Photohelic® switch/gage or other means. Complete wiring and operational instructions are included. Where manual reset is required a dry circuit push button such as Dwyer Part A-601 should be used.

Standards/regulations	IEC 60664
	IEC 60664 A
	DIN VDE 0110
	DIN EN 50178/DIN VDE 0160 (in relevant parts)
	DIN EN 50178/VDE 0160
	IEC 60255/DIN VDE 0435 (in relevant parts)
Pollution degree	3
Surge voltage category	III
Mounting position	Any
Assembly instructions	In rows with zero spacing

Connection data

Type of connection	Screw connection
Conductor cross section solid min.	0.14 mm ²
Conductor cross section solid max.	2.5 mm ²
Conductor cross section stranded min.	0.14 mm ²
Conductor cross section stranded max.	2.5 mm ²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	14
Stripping length	8 mm
Screw thread	M 3

Certificates/Approvals

Approval logo



requested approbations

Certification	CUL, CUL Listed, GL, GOST, UL, UL Listed, VDE-PZI
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Accessories

Item	Designation	Description
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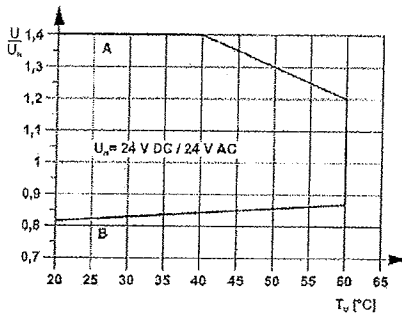
Assembly		
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
0801377	NS 35/ 7,5 V2A UNPERF 2000MM	DIN rail, material: High-grade steel V2A, unperforated, height 5.5 mm, width 15 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
2966841	PLC-ATP BK	Separating plate, 2 mm thick, required at the start and end of a PLC terminal strip. Furthermore, it is used for: visual separation of groups, safe isolation of different voltages of neighboring PLC relays in acc. with DIN VDE 0106-101, isolation

Bridges		
2966812	FBST 6-PLC BU	Plug-in bridge, 2-pos., 6 mm long, insulated, for potential distribution with PLC, color of the insulation material: blue
2966825	FBST 6-PLC GY	Plug-in bridge, 2-pos., 6 mm long, insulated, for potential distribution with PLC, color of the insulation material: gray
2966236	FBST 6-PLC RD	Plug-in bridge, 2-pos., 6 mm long, insulated, for potential distribution with PLC, color of the insulation material: red
2967688	FBST 8-PLC GY	Plug-in bridge, 2-pos., 8 mm long, insulated, for potential distribution with PLC, with separating plate, color of the insulation material: gray
2967691	FBST 14-PLC BK	Plug-in bridge, 2-pos., 14 mm long, insulated, to increase efficiency with PLC...IC and PLC..HC, color of the insulation material: black
2966692	FBST 500-PLC BU	Continuous plug-in bridge, 500 mm long, insulated, can be cut to length, for potential distribution with PLC..., color of the insulating material: blue
2966838	FBST 500-PLC GY	Continuous plug-in bridge, 500 mm long, insulated, can be cut to length, for potential distribution with PLC..., color of the insulating material: gray
2966786	FBST 500-PLC RD	Continuous plug-in bridge, 500 mm long, insulated, can be cut to length, for potential distribution with PLC..., color of the insulating material: red

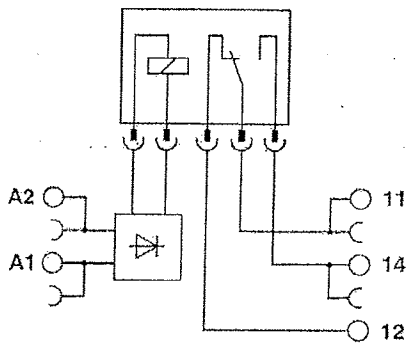
Marking		
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
5060935	ZB 6/WH-100:UNBEDRUCKT	Zack strip, unprinted: For individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, for a terminal width of 6.2 mm, color: White
1051003	ZB 6:UNBEDRUCKT	Zack strip, unprinted, strips with 10 labels for individual labeling with M-PEN or CMS system, for terminal block width: 6.2 mm, color: white

Drawings

Diagram



Circuit diagram



PLC-RSC- 24UC/21AU Order No.: 2966278
<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2966278>

Address

PHOENIX CONTACT Inc., USA
586 Fulling Mill Road
Middletown, PA 17057, USA
Phone (800) 888-7388
Fax (717) 944-1625
<http://www.phoenixcon.com>



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PANEL & INSTALLATION MATERIALS

PUSH-BUTTON SWITCHES

ABW, AOW SERIES

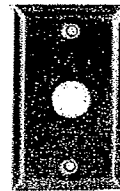


DESCRIPTION

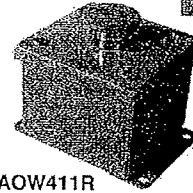
ABW and AOW Series Push-button Switches are for manual control of fans, pumps, compressors, or control circuits.

FEATURES

- Flush, extended, or mushroom style available
- Snap-fit blocks with N.O. and N.C. contacts
- Self-cleaning silver contacts
- Rugged, oil-tight construction



SSG1-67



AOW411R
mounted in
E-1PBG



Extended



Mushroom



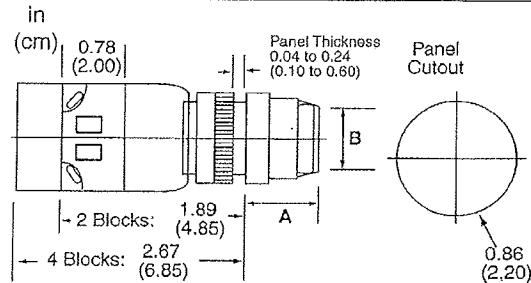
Flush



SPECIFICATIONS

Contact rating	10A, 600 VAC/VDC 5 mA, 3 VAC/VDC min
Contact resistance	50 mΩ max (initial value)
Insulation rating	600 V
Contact material	Silver
Mechanical life	500,000 min operations
Electrical life	500,000 min operations
Terminals	#6-40 (M3.5) screws
Mounting	0.86" (2.20 cm) hole
Panel thickness	Panel thickness adjustment ring, 0.04" to 0.24" (0.10 to 0.61 cm)
Protection rating	NEMA 1, 2, 3, 3R, 4, 4X, 12, 13
Agency approvals	UL listed, File #E70646; CSA certified, File #LR48366
Warranty	1 year

DIMENSIONS



PUSHBUTTONS	A	B
Flush	0.507 (1.30)	Ø 0.936 (2.40)
Extended	0.741 (1.90)	Ø 0.936 (2.40)

PANEL & INSTALLATION MATERIALS

ORDERING INFORMATION

MODEL	DESCRIPTION
ABW	Momentary action push-button switch
AOW	Maintained action push-button switch
	1 Flush (includes colored buttons of red, green, and black)
	2 Extended (specify color below, red standard)
	4 Mushroom (specify color below, red standard)
	# Normally open contacts (max 2)
	# Normally closed contacts (max 2)
	Button color for extended and mushroom models
	(B) = Black, G = Green, R = Red

Example: ABW101 Momentary flush push button with one normally closed contact

RELATED PRODUCTS

HW-C10	Normally open contact	E-2PBG*	Two-hole NEMA 12/13 push-button enclosure
HW-C01	Normally closed contact	E-3PBG*	Three-hole NEMA 12/13 push-button enclosure
TW-DB	Dummy block (needed when only 1 HW-C10 or HW-C01 is used)	E-4PBG*	Four-hole NEMA 12/13 push-button enclosure
NWAR-27	Emergency stop label 2.75" (6.99 cm) round	SSG1-67	Wall plate box mount 7/8" hole
E-1PBG	One-hole NEMA 12/13 push-button enclosure		

* Holes are 22.5 mm in a vertical arrangement.



PANEL & INSTALLATION MATERIALS

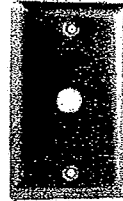
PILOT LIGHTS AND MINIATURE SWITCHES A SERIES

DESCRIPTION

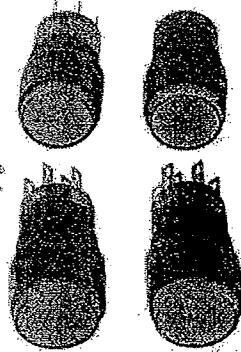
A Series Pilot Lights and Illuminated Push Buttons are low-cost, lighted operator devices.

FEATURES

- Attractive housing with bright LED indication
- Smaller 5/8" (1.59 cm) cutout required
- Long-lasting LED lamps, 24 VAC/VDC $\pm 5\%$
- One-amp contacts, 24/120V
- Oil-tight (IP65 when mounted in enclosure)
- SPDT switches
- Momentary or maintained switches
- Illuminated push buttons ideal for push-to-test applications
- One-year warranty



SSG1-5/8



AL6M-M14P-S



AB6M-M1P



AS6M-2Y2P



AS6M-3Y2P



DESCRIPTION

A Series Selector Switches and non-illuminated push buttons are low-cost operator devices.

FEATURES

- Smaller 5/8" (1.59 cm) cutout required
- Oil-tight (IP65 when mounted in enclosure)
- One-amp contacts, 24/120V
- SPDT switches
- Momentary and maintained push buttons
- Maintained two- and three-position selector switch
- One-year warranty

PANEL & INSTALLATION MATERIALS

ORDERING INFORMATION

NON-ILLUMINATED PUSH BUTTONS * (Black button if no color specified)

MODEL	DESCRIPTION
AB6M	Round non-illuminated push button
M	Momentary operation
A	Maintained operation
1P	SPDT contacts
2P	DPDT contacts
BUTTON COLOR: G (green), R (red), S (blue), W (white), Y (yellow) *	

[AB6M]-[M][1P]-[R] Example: AB6M-M1P-B Round non-illuminated push button, momentary, SPDT contacts, red button

ILLUMINATED PUSH BUTTONS

MODEL	DESCRIPTION
AL6M	Round illuminated push button, 24 VAC/VDC
M	Momentary operation
A	Maintained operation
14P	SPDT contacts
24P	DPDT contacts
BUTTON COLOR: A (amber), G (green), R (red), S (blue), W (white), Y (yellow)	

[AL6M]-[M][14P]-[A] Example: AL6M-M14P-A Round illuminated push button, momentary, SPDT contacts, amber lens

PILOT LIGHTS

MODEL	DESCRIPTION
AL6M-P4P	Round pilot light, 24 VAC/VDC
LENS COLOR: A (amber), G (green), R (red), S (blue), W (white), Y (yellow)	

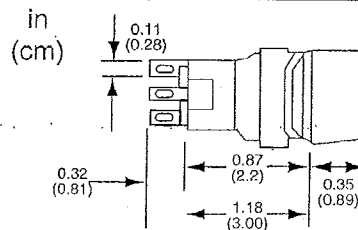
[AL6M-P4P]-[A] Example: AL6M-P4P-A Round pilot light, amber lens

SELECTOR SWITCHES

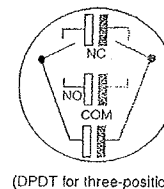
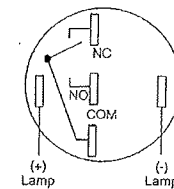
MODEL	DESCRIPTION
AS6M	Round selector switch
2Y2P	Two-position, maintained operation
3Y2P	Three-position, maintained operation
2KT2PA	Two-position keylock, removable any position

[AS6M]-[2Y2P] Example: AL6M-2Y2P Two-position round selector switch, maintained operation

DIMENSIONS



WIRING



Illuminated Push Buttons and Pilot Lights Non-Illuminated Push Buttons and Selector Switches

RELATED PRODUCT

SSG1-5/8 Wall plate box mount 5/8" hole

B4

Delta or BAPI-Stat 2™ Style Room Units

Humidity & Combination Temp/Humidity Sensors

Rev. 01/30/06

*Verify user adjustable*

Features & Options

- Delta or BAPI-Stat 2 Style Enclosure
- Humidity Only or Temp./Humidity Combo
- LCD Readout (optional)
- 2% and 3% RH Accuracies
- Communications Jack (optional)
- User Adjustable Toggle Rate Between Temperature and Humidity
- Wide Selection of Temperature Sensing Elements
- Full-range Temperature Compensation of RH Signal
- Two Year Warranty



Delta Style Enclosure with LCD Display

The Delta Style or BAPI-Stat 2 Style room units are available as Humidity Only sensors or as Combination temperature and humidity sensors. The Delta Style enclosure features an optional LCD display with a user adjustable toggle rate between humidity and temperature and can display in either °C or °F. Both enclosure styles are available with the entire line of BAPI temperature sensors. In addition, these units save time and money by allowing for field replacement of humidity elements without recalibration. If a temperature transmitter and humidity transmitter are desired, then see the "X-Combo" Unit on page B8 of this section.



BAPI-Stat 2 Enclosure (Humidity with display is not available at present.)



Delta Style Enclosure

For detailed specs on the individual Sensors & Transmitters, turn to the "Sensors" section.

*Some items may not be CE compliant, call BAPI for additional information.

Specifications

Power: 15 to 35 VDC (0 -5 VDC or 4 - 20 mA outputs)
 15 to 40 VDC (0 - 10 VDC Output)
 12 to 24 VAC (0 -5 VDC or 4 - 20 mA outputs)
 15 to 28 VAC (0 - 10 VDC Output)

Power Consumption:
 22 mA max. DC (0 -5 VDC or 4 - 20 mA Outputs)
 6 mA max DC (0 - 10 VDC Output)
 0.53 VA max. AC (0 -5 VDC or 4 - 20 mA Outputs)
 0.14 VA max. AC (0 -10 VDC Output)

Sensing Elements:
 Temperature - Thermistor, RTD or Semiconductor
 Humidity - Impedance Type, ±2% or ±3% RH

Wiring: 2 to 3 pair of 16 to 22 AWG*

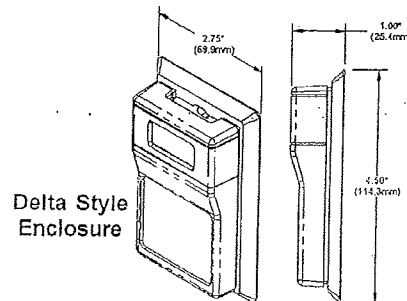
Mounting: Standard 2"x4" J-box or drywall mount - screws provided

Environmental Operation Range:
 Temperature: 32 to 122 °F (0 to 50 °C)
 Humidity: 0 to 95%, non-condensing

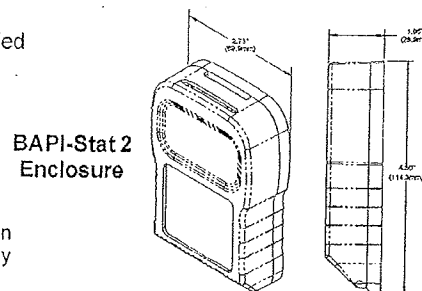
Material: ABS Plastic

Material Rating: UL 94, V-0

* BAPI recommends that you do not run wiring for the room units in the same conduit as line voltage wiring or with wiring used to supply highly inductive loads such as motors, generators, and coils.



Delta Style Enclosure



BAPI-Stat 2 Enclosure



Delta or BAPI-Stat 2™ Style Room Units

Humidity & Combination Temp/Humidity Sensors

B5

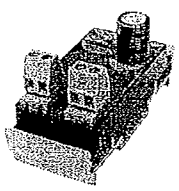
Rev. 01/30/06

Ordering Information		Delta or BAPI-Stat 2 Style Room Unit, Humidity only or Temp./Humidity Combo			
BAI					
Sensor Type Use the designator number (shown to the left in bold) to indicate the sensor					
##	THERMISTORS		RTDs		
	1.8K	1.8K Ω @ 25 °C	100	100 Ω Platinum @ 0 °C, .385 Ω/°C temp. coeff.	
	3K	3K Ω @ 25 °C	100(3W)	3 Wire 100 Ω Platinum @ 0 °C, .385 Ω/°C temp. coeff.	
	3.3K	3.3K Ω @ 25 °C	1K (375)	1K Ω Platinum @ 0 °C, 3.75 Ω/°C temp. coeff.	
	10K-2	10K Ω @ 25 °C	1K	1K Ω Platinum @ 0 °C, 3.85 Ω/°C temp. coeff.	
	10K-3	10K Ω @ 25 °C	2K	2K Ω Silicon @ 20 °C, 8 Ω/°C temp. coeff.	
	10K-3(11K)	5,238 Ω @ 25 °C			
	20K	20K Ω @ 25 °C			
	50K	50K Ω @ 25 °C	334	SEMICONDUCTORS	
	100K	100K Ω @ 25 °C	592	LM334 Semiconductor AD592 Semiconductor, 273 μA @ 0 °C	
TEMPERATURE TRANSMITTERS					
T10K - Note See T10K Specific ordering grid on page B21 of this section					
Humidity Transmitter					
-H200		±2% Humidity Transmitter with Interchangeable Output of 0 to 5 V or 4 to 20 mA*			
-H210		±2% Humidity Transmitter with 0 to 10 V Output			
-H300		±3% Humidity Transmitter with Interchangeable Output of 0 to 5 V or 4 to 20 mA*			
-H310		±3% Humidity Transmitter with 0 to 10 V Output			
Enclosure Style					
(-R)		Delta Style Room Enclosure			
-B		BAPI-Stat 2 Style Enclosure (not available with display at present)			
LCD Display Omit if ordering a unit without display					
(D)		LCD Display			
Optional Comm. Jack Mounted in unit's base					
-C35L		3.5 mm Phono Style Jack with Leads Attached			
-C35LT		3.5 mm Phono Style Jack w/ Leads & Term. Block			
-C11L		RJ11 (4 pin) Style Jack with Leads			
-C11LT		RJ11 (4 pin) Style Jack w/ Leads and Term. Block			
EXAMPLE					
BAI	10K-2	H200	-R	D	-C35L
Example Part Number: BAI10K-2-H200-RD-35L					
Your Part Number:					

*DC input voltage is required for current output.
See the "X-Combo" Unit on page B8 for more Temperature Transmitter & Humidity Transmitter combination options.
Call BAPI if you have questions about the above ordering grid or the configuration of the product you are ordering.

VC75 - AC to DC Voltage Converter

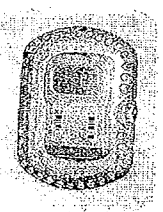
BAPI recommends using DC voltage on room sensors for a more stable reading. With its compact size and rugged design, BAPI's VC75 is the perfect AC to DC converter. Besides the 75 mA model (VC75), BAPI also offers 100 mA and 350 mA models, all of which are snaptrack mountable. For more info, see the Accessories section.



VC75 mounted in optional snaptrack

The BAPI-Guard™

- Prevents Tampering, Physical Damage and Unauthorized Adjustment
- Exceptional Airflow for Proper Thermostat Operation
- Two Sizes to Fit Most Thermostats



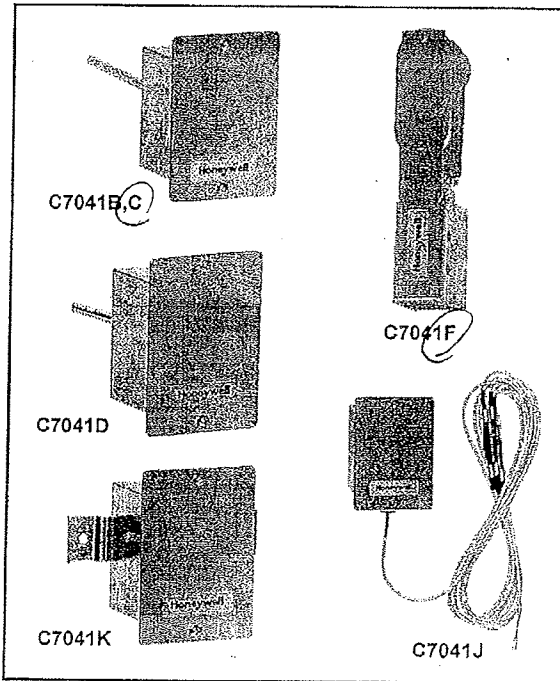
BAPI-Guard Mounted Over a Thermostat
(See Accessories for more info.)

Honeywell



C7041B,C,D,F,J,K Electronic Temperature Sensors

PRODUCT DATA



FEATURES

- C7041B,C,J sense duct air temperature.
- C7041D,K sense water temperature.
- C7041F senses outdoor air temperature.
- C7041K with strap-on mounting senses water temperature.
- C7041J senses average duct air temperature.
- Solid state components not affected by dust or dirt.
- C7041F is weatherproof for outdoor use and connects directly to 1/2 in. externally-threaded conduit.

SPECIFICATIONS

Models: Use C7041 Temperature Sensors with Excel 10, 15, 80, 100, and 500 controllers. See Table 1 for specifications.

Dimensions: See Fig. 2 through 5.

Element Operating Range: -40° to 250°F (-40° to 121°C).

Element Maximum Ambient Temperature: 302°F (150°C).

Sensor Resistance (ohms) at 77°F (25°C): 20,000.

Sensor Response: NTC non-linear.

Accessories:

32005960-001 Well Assembly: Used with C7041D.

APPLICATION

The C7041 Electronic Temperature Sensors are designed to be used with electronic controllers in domestic or commercial heating and cooling systems.

Contents

Application	1
Features	1
Specifications	1
Ordering Information	2
Installation	4
Operation and Checkout	6



C7041B,C,D,F,J,K ELECTRONIC TEMPERATURE SENSORS

Table 1. Electronic Primary Sensor Application Guide.

Model	Control Application	Element Insertion Length in in. (mm)	Weight in oz (kg)	Dimensions (Fig.)
C7041B	Duct discharge air	6 (152)	9 (0.26)	2
C7041C	Duct discharge air	18 (457)		
C7041D	Hot or chilled water (order immersion well separately)	4 (102)	14 (0.40)	1
C7041F	Outdoor air	—	9 (0.26)	3
C7041J	Duct discharge air (averaging sensor with 4 elements)	150 (3810)	12 (0.34)	4
C7041K	Hot water (strap-on mounting)	a	13 (0.37)	5

^a Strap-on model not equipped with well; temperature sensed at surface of pipe.

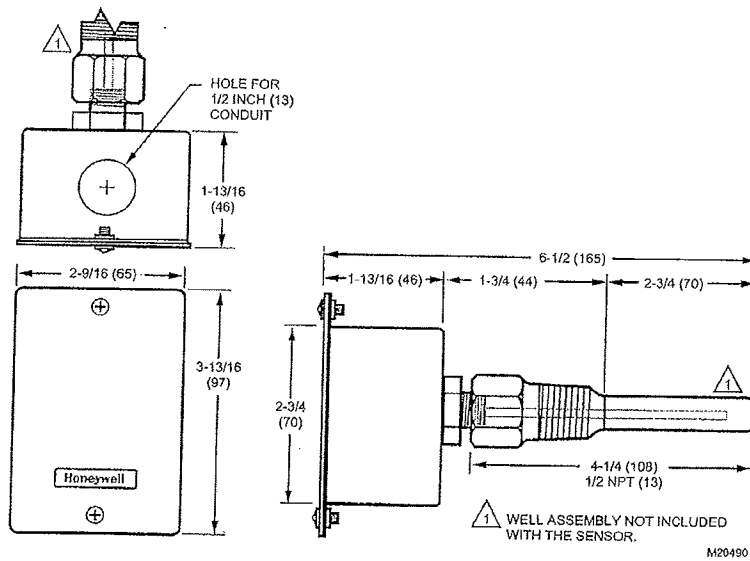


Fig. 1. C7041D dimensions in in. (mm).

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Home and Building Control Sales Office (check white pages of your phone directory).
2. Home and Building Control Customer Relations
Honeywell, 1885 Douglas Drive North
Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

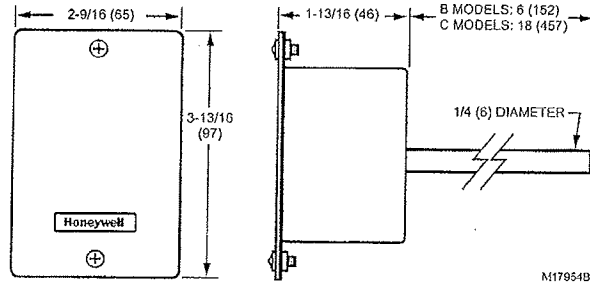


Fig. 2. C7041B,C dimensions in in. (mm).

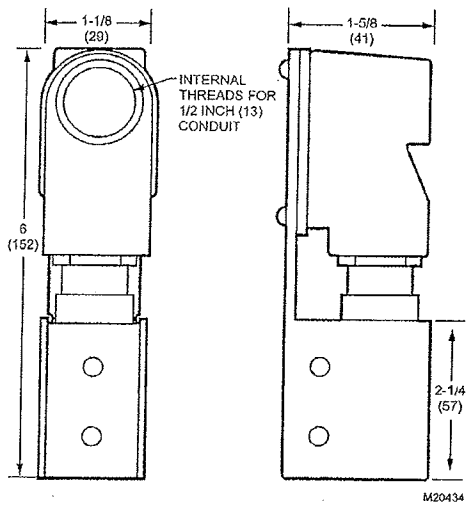


Fig. 3. C7041F dimensions in in. (mm).

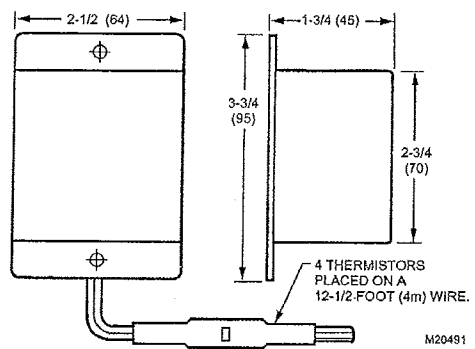


Fig. 4. C7041J dimensions in in. (mm).

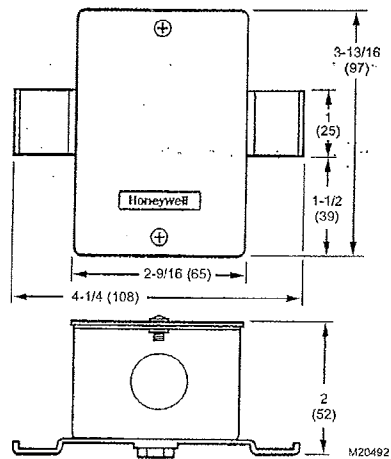


Fig. 5. C7041K dimensions in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.



CAUTION

Electrical Shock or Equipment Damage Hazard. Can shock individuals or short equipment circuitry. Disconnect power supply before installation.

Mounting

The method of mounting depends on the particular application of the C7041 Temperature Sensor. The following procedures include outdoor, duct, immersion well and strap-on applications. Also refer to the instructions for the electronic control.

Outdoor Mounting

The C7041F senses outdoor air temperature. Mount this control where it can sense average outdoor air temperature. Normally, the north side of a building provides a suitable location.

NOTE: The C7041F is weatherproof for outdoor use and connects directly to 1/2 in. externally-threaded conduit.

1. Remove and set aside the two screws from the case.
2. Set aside the sunshield and gasket.
3. Thread the sensor onto standard 1/2 in. conduit.

NOTE: Mount sensor so that the element points down.

4. Make wiring connections to the screw terminal block.
5. Reattach the gasket and sunshield to the case.

Duct Mounting

The C7041B,C,J can be mounted in a duct to sense air temperature.

IMPORTANT

Select a spot for the C7041 where it will be exposed to average duct air temperature. Avoid locations where stratification can cause sensing errors.

C7041B,C MOUNTING

1. Cut a hole in the duct just large enough to accept the sensing element.
2. Use the sensor case to mark the locations of the pilot holes for the mounting screws.
3. Drill the pilot holes and fasten the sensor to the duct with the screws provided.

C7041J MOUNTING

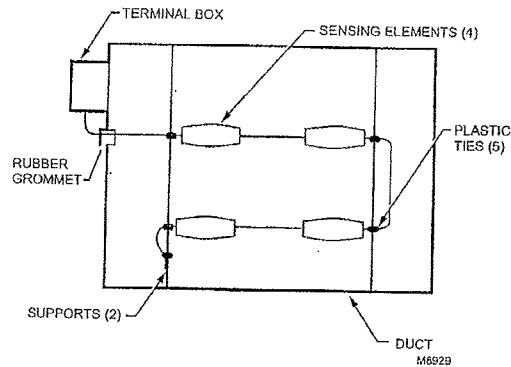


Fig. 6. Duct cross section showing method of installing C7041J Averaging Electronic Sensor.

1. Install two supports inside the duct to hold the averaging element.
2. Cut a 7/8 in. (22 mm) hole in the side of the duct to insert the averaging element.
3. Fasten the terminal box to the outside of the duct and thread the element through the hole and into the duct.
4. Use plastic wire ties to fasten the element to supports. Seal the hole around the element with a rubber grommet.
5. Secure the end of the element to the duct on the support to prevent continuous flexing or abrasion.

IMPORTANT

To assure that the C7041J senses the average duct temperature, position the temperature sensitivity elements approximately as shown in Fig. 6. Do not allow the sensing elements to touch or be close to the sides of the duct.

NOTE: When the C7041J is used as a deck sensor in a multizone system, be sure to space the elements equally in the duct midstream as shown in Fig. 7.

Install one C7041J Sensor just upstream from the cold deck zone dampers and the other C7041J Sensor upstream from the hot deck zone dampers. Position the thermistors to sense the average deck temperature.

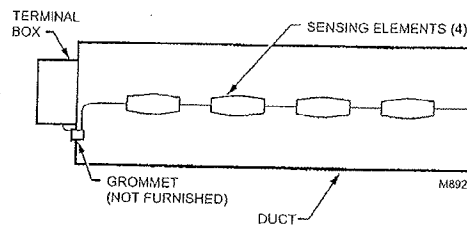


Fig. 7. Duct cross section showing method of installing C7041J Sensor in a multizone system.

Immersion Well Mounting

The C7041D Sensor is not supplied with an immersion well. For the C7041D Sensors, wells (part no.: 32005960-001) can be ordered as an accessory.

When used on a boiler, follow the manufacturer instructions for location. If a tapped hole is not provided for the immersion well, provide one as follows:

1. Drain boiler and drill a 23/32 in. (18 mm) hole at the selected location.
2. Cut threads in the hole with a 1/2 in. (13 mm) by 14 NPT tap.

In other installations, mount the immersion well in an elbow with a heel outlet as shown in Fig. 8.

1. Drain the system, if you have not already done it, and open the tapped hole.
2. Put pipe joint compound on the threads of the immersion well and screw it into the tapped hole or elbow, tightening it securely.
3. Refill the system and check for leaks.



CAUTION

Equipment Damage Hazard
Attach the well adapter to the well independent of the sensor.

If the sensor is forced into the well with the adapter tightened to the sensor probe, the adapter will not thread smoothly. This can damage the well and/or adapter threads.

Mount the C7041D to the well:

1. Loosen the set screw.
2. Remove the threaded well adapter from the sensor.
3. Thread the well adapter into the well and hand tighten.
4. Slide the sensor into the well.
5. Orient the sensor:
 - a. Push and turn the sensor onto the well adapter.
 - b. The sensor seats into one of four pre-cut adapter detents.
6. Tighten the set screw.

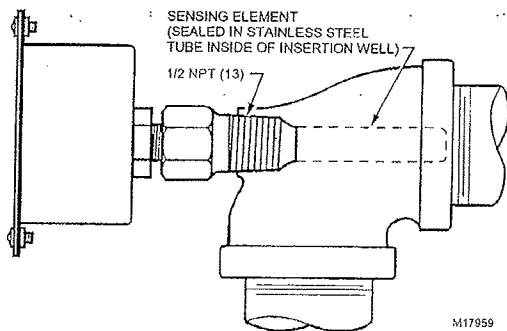


Fig. 8. Method of mounting C7041D Sensor.

Strap-On Mounting

Strap-on mounting is well-suited for retrofit applications where installation costs can be reduced by not draining the system. The C7041K Sensor mounts on metal pipes from one inch to four inches in diameter using the straps supplied. Clean the surface of the pipe where the sensor makes contact before mounting (remove insulation from the pipe at the point of installation if necessary). Thermal compound is recommended with the strap-on C7041K Sensor. The time constant with the compound is 30 seconds; without the compound, the time constant is two minutes. Locate the sensor on the discharge pipe within 3 feet (0.9m) of the boiler. See Fig. 9.

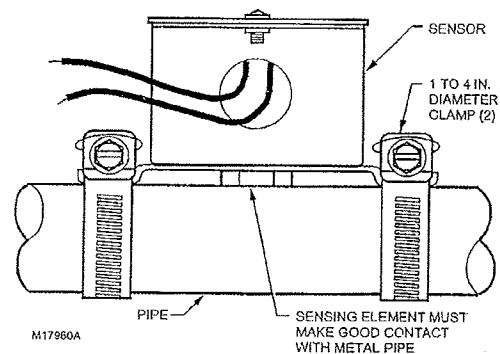


Fig. 9. Strap-on mounting of C7041K Sensor.

Wiring



CAUTION

Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.



CAUTION

Erratic System Operation Hazard.
Failure to follow proper wiring practices can introduce disruptive electrical interference (noise). Keep wiring at least one foot away from large inductive loads such as motors line starters, lighting ballasts, and large power distribution panels.

Shielded cable is required in installations where these guidelines cannot be met.

Ground shield only to grounded controller case.

IMPORTANT

1. All wiring must agree with applicable codes, ordinances and regulations.
2. Do not mount sensor in incorrect environment.
3. Wire according to the applicable controller instructions.

OPERATION AND CHECKOUT

Operation

The C7041 Temperature Sensors are designed for use with XL500, XL100, XL50, XL15, XL10, and Honeywell LCBS Controllers or any controller requiring 20K ohm NTC non-linear input. As the temperature at the C7041 Sensor increases, the resistance of the sensor decreases, causing the controller to operate and offset the temperature change.

Checkout

Refer to the applicable controller instructions when checking out the complete heating and cooling systems.

To check out the sensors, move the thermostat or remote setpoint potentiometer below the temperature of the cooling or heating medium. Watch the motor, valve or damper for the correct movement.

POWER SUPPLIES

ENCLOSED DC POWER SUPPLY MODEL DCP-250

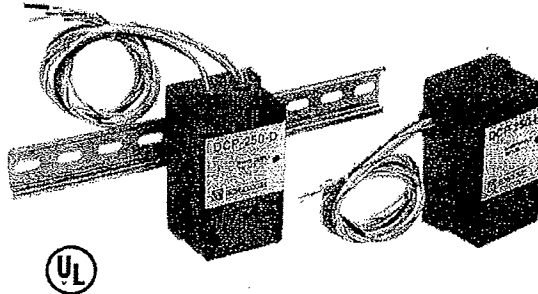
DESCRIPTION

The **Model DCP-250** is a unique DC power supply that provides regulated 24 VDC power from 120 VAC input. It is well-suited for powering transmitters, transducers, actuators and other equipment in building automation and temperature control systems. The **DCP-250** can be ordered for hub mounting, surface mounting in a panel or DIN rail mounting.

FEATURES

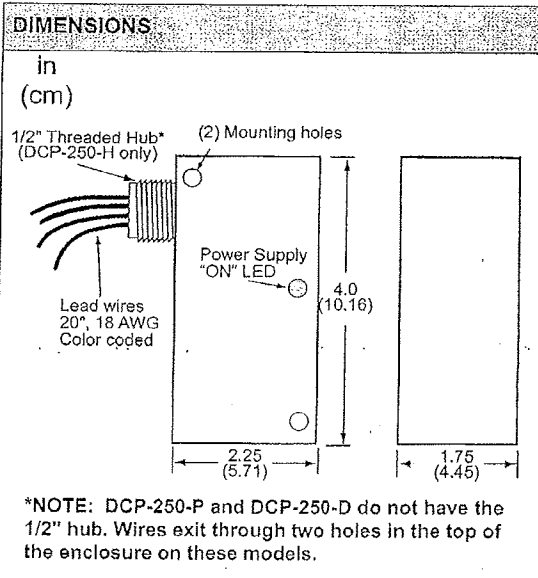
- Flexible mounting - hub, panel/surface, DIN rail
- Compact size
- Fully enclosed
- Color coded wiring
- LED indication

Technologies
A Kele Company



SPECIFICATIONS	
Input voltage	110-125 VAC, 50/60 Hz, 5 VA
Output voltage	23.5-24.5 VDC (regulated)
Max load	250 mA
Mounting	1/2" hub, panel/surface, DIN rail
Lead wires	20" (50.8 cm), 18 AWG
Temperature	-22° to 104°F (-30° to 40°C)
Weight	1 lb (0.5 kg)
Approvals	UL listed, file #E185225

WIRING		
BLACK	L	} 120 VAC
WHITE	N	
WHITE/RED	+	} 24 VDC
WHITE/BLACK	-	



ORDERING INFORMATION

DCP-250-H	DC Power Supply, hub mount
DCP-250-P	DC Power Supply, panel/surface mount
DCP-250-D	DC Power Supply, DIN rail mount

Related Products

DIN-3F, BAM-1000

DIN mounting rail

OUTPUT TRANSDUCERS

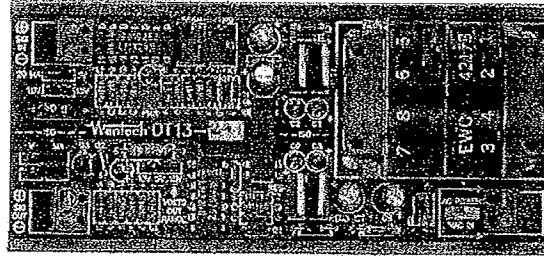
ISOLATED DC-TO-DC TRANSMITTER MODEL DT13



DESCRIPTION

The Model DT13 is a signal isolator that accepts a current or voltage input and provides a linearly transferred current or voltage output. The input and output are electrically isolated, making the Model DT13 useful for ground loop elimination, common-mode signal rejection, and noise pickup reduction. The Model DT13 is designed to function effectively in electrically noisy environments. The Model DT13 is compatible and can interface with recorders, data loggers, personal computers, programmable controllers, HVAC controllers, building automation controllers, variable speed drives, and other process monitoring and control systems. The Model DT13 is furnished with snap-track for easy mounting.

Kele

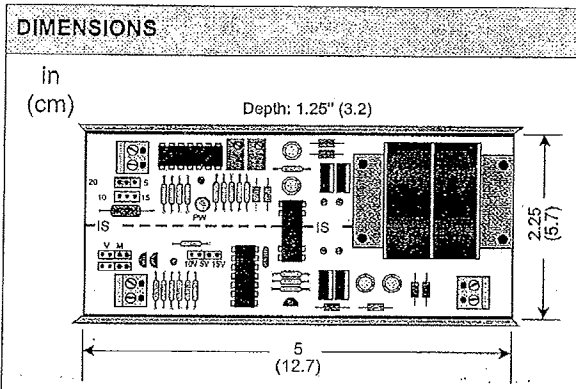


FEATURES

- Eliminates ground loop wiring problems
- Multiple input/output ranges are jumper selectable
- 24 and 120 VAC powered models
- Snap-track mounting for easy installation
- Low cost

OPERATION

The Model DT13 input conditioning circuitry scales and filters the DC input and drives a precision isolator, which carries the signal across the isolation barrier. The output side of the isolator drives a circuit that reconverts the signal into a replica of the input, which is again scaled (if necessary) to meet the user's requirement.



SPECIFICATIONS			
Input/Output	0-20 mA, 4-20 mA, 0-5V, 1-5V, 0-10V, 2-10V, 0-15V, or 3-15 VDC jumper selectable	Isolation	1000V (DC or AC peak) max
Input impedance		Linearity	Better than 0.1% of span
Voltage	5 VDC: 49.9 k Ω ; 10 VDC: 99.8 k Ω ; 15 VDC: 74.8 k Ω	Response time	70 ms typical
Current	20 mA: 250 Ω max	Ambient operating temp	14° to 140°F (-10° to 60°C)
Output capability		Humidity	5% to 95% noncondensing
Voltage	15 VDC, 6 mA max current loading	Power	
Current	20 mA DC, 1000 Ω max load	DT13-24	24 VAC \pm 10% 50/60 Hz, 12 VA
Output zero/span	Up to 20% offset to the 0-20 mA, 0-5V, 0-10V, and 0-15V ranges	DT13-120	120 VAC \pm 10% 50/60 Hz, 6 VA
		Dimensions	5" W x 2.25" H x 1.25"D (12.7 x 5.7 x 3.2 cm)
		Weight	0.65 lb (0.3 kg)

OUTPUT TRANSDUCERS

ISOLATED DC-TO-DC TRANSMITTER MODEL DT13



SETUP AND CALIBRATION

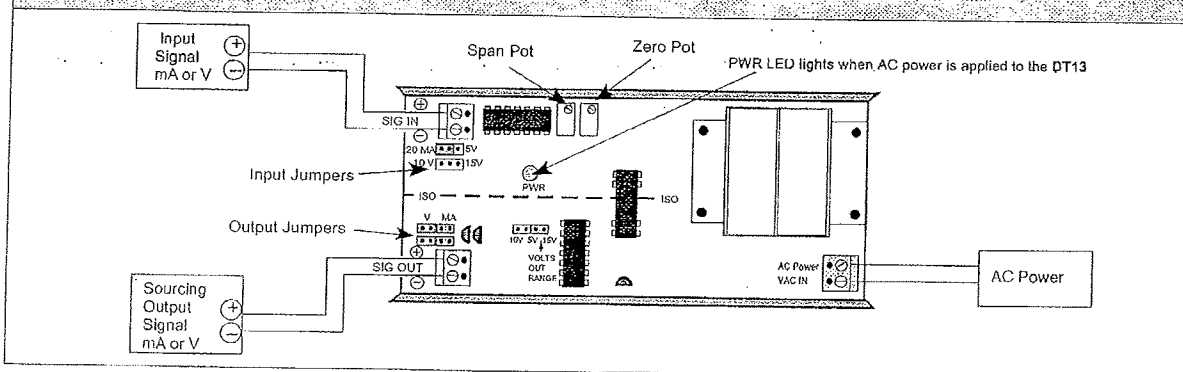
Figure 1 below shows the input and output configurations available with the DT13. Determine the signal requirements for the application, and set the input and output jumpers according to the table. The input jumpers are located on the DT13 near the SIG IN terminals. The output jumpers are located near the SIG OUT terminals. If CAL appears in the table for desired signals, the DT13 will also require field calibration of the zero and span pots.

To field calibrate the DT13, apply the appropriate supply voltage to the AC power terminals. The red PWR LED will be on continuously. Apply the minimum input signal to the SIG IN terminals. Adjust the zero pot until desired minimum output is reached. Now apply the maximum input signal, and adjust the span pot until the desired maximum output is reached. Repeat this process as necessary until accurate results are achieved.

FIGURE 1. INPUT AND OUTPUT CONFIGURATIONS

INPUT SIGNAL	JUMPERS	OUTPUT SIGNAL							
		0-20 mA	4-20 mA	0-5V	1-5V	0-10V	2-10V	0-15V	3-15V
0-20 mA	INPUT	20 MA	20 MA	20 MA	20 MA	20 MA	20 MA	20 MA	20 MA
	OUTPUT	MA, MA	MA, MA, CAL	V, V, 5V	V, V, 5V, CAL	V, V, 10V	V, V, 10V, CAL	V, V, 15V	V, V, 15V, CAL
4-20 mA	INPUT	20 MA	20 MA	20 MA	20 MA	20 MA	20 MA	20 MA	20 MA
	OUTPUT	MA, MA, CAL	MA, MA	V, V, 5V, CAL	V, V, 5V	V, V, 10V, CAL	V, V, 10V	V, V, 15V, CAL	V, V, 15V
0-5V	INPUT	5V	5V	5V	5V	5V	5V	5V	5V
	OUTPUT	MA, MA	MA, MA, CAL	V, V, 5V	V, V, 5V, CAL	V, V, 10V	V, V, 10V, CAL	V, V, 15V	V, V, 15V, CAL
1-5V	INPUT	5V	5V	5V	5V	5V	5V	5V	5V
	OUTPUT	MA, MA, CAL	MA, MA	V, V, 5V, CAL	V, V, 5V	V, V, 10V, CAL	V, V, 10V	V, V, 15V, CAL	V, V, 15V
0-10V	INPUT	10V	10V	10V	10V	10V	10V	10V	10V
	OUTPUT	MA, MA	MA, MA, CAL	V, V, 5V	V, V, 5V, CAL	V, V, 10V	V, V, 10V, CAL	V, V, 15V	V, V, 15V, CAL
2-10V	INPUT	10V	10V	10V	10V	10V	10V	10V	10V
	OUTPUT	MA, MA, CAL	MA, MA	V, V, 5V, CAL	V, V, 5V	V, V, 10V, CAL	V, V, 10V	V, V, 15V, CAL	V, V, 15V
0-15V	INPUT	15V	15V	15V	15V	15V	15V	15V	15V
	OUTPUT	MA, MA	MA, MA, CAL	V, V, 5V	V, V, 5V, CAL	V, V, 10V	V, V, 10V, CAL	V, V, 15V	V, V, 15V, CAL
3-15V	INPUT	15V	15V	15V	15V	15V	15V	15V	15V
	OUTPUT	MA, MA, CAL	MA, MA	V, V, 5V, CAL	V, V, 5V	V, V, 10V, CAL	V, V, 10V	V, V, 15V, CAL	V, V, 15V

WIRING



ORDERING INFORMATION

MODEL	DESCRIPTION
DT13-24	Isolated DC-to-DC Transmitter 24 VAC
DT13-120	Isolated DC-to-DC Transmitter, 120 VAC
-C	Option: Factory set to specific input/output (specify when ordering)

DYNACON INC

www.dynacononline.com

Provide low limit temperature control and/or indication in operating dampers, valves, and compressor or fan motors in HVAC systems.

- Manual and automatic reset models available.
- SPDT or DPDT (two SPDT) switching action.
- Responsive to lowest temperature sensed along any 1-foot section of 20-foot capillary element.
- Setpoint visible through front cover and adjustable from top of controller case.
- Test lever for manual operation during checkout.
- Manual reset models cannot be reset until sensed temperature is at least 5°F (3°C) above setpoint.
- Automatic reset models automatically reset when sensed temperature rises 5°F (3°C) above setpoint.

APPROVALS: U.L. listed; ULC listed; CE compliant.

SWITCH ACTION:

FS-30, FS-33: SPDT.

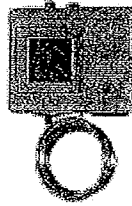
FS-50, FS-53: DPDT (two SPDT).

SWITCH RATING: See electrical ratings below.

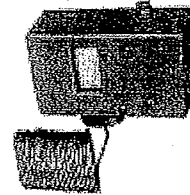
MOUNTING: Surface with capillary installed in horizontal serpentine pattern. Case must not be exposed to lower temperatures than those sensed by the capillary.

FS-30, FS-33, FS-50, FS-53

LOW LIMIT CONTROLS
Manual and Auto Reset
SPDT and DPDT



FS-30, FS-33



FS-50, FS-53

SENSING ELEMENT: Vapor-filled copper capillary, tin-plated. 5/64" x 20-feet (2mm x 6096 mm).

OPERATING AMBIENT: -60°F to 160°F (-51°C to 71°C); 300 °F (149 °C) maximum on sensing element.

DIMENSIONS:

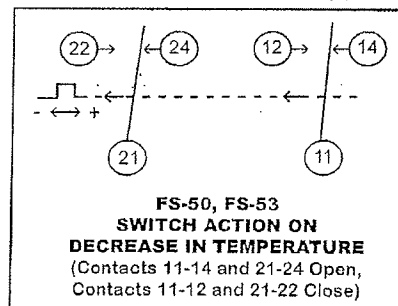
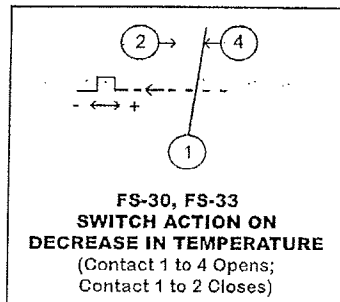
FS-30, FS-33: 2.94"H x 3.35"W x 1.57"D (75mm x 85mm x 40mm).

FS-50, FS-53: 3.63"H x 5.5"W x 2.63"D (92mm x 140mm x 67mm).

ACCESSORIES: FX-4520 capillary mounting clip.

ELECTRICAL RATINGS

	FS-30, FS-33 (SPDT)		FS-50, FS-53 (DPDT)	
	120 vac	240 vac	120 vac	240 vac
INDUCTIVE				
F.L.A.	24	24	14	12
L.R.A.	144	144	84	72
Horsepower	2	3	3/4	2
PILOT DUTY	720 va max @ 120 to 600 vac 144 va max @ 24 vac		720 va max @ 120 to 600 vac 144 va max @ 24 vac	



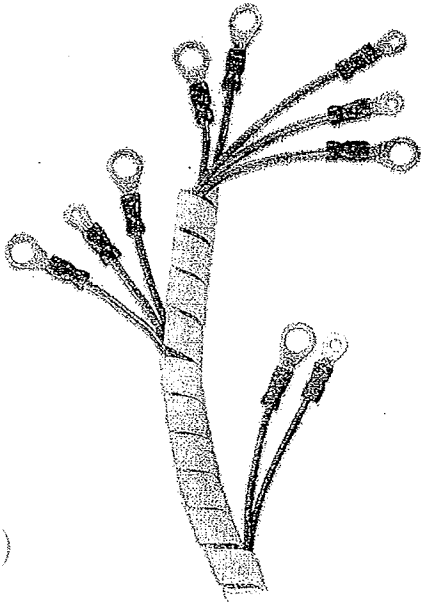
Model	Reset Action	Switch Action	Setpoint Range	Differential	Comments
FS-30	manual	SPDT	35° to 68°F (2° to 20°C)	4.5°F (2.5°C), fixed	FX-4520 capillary mounting clips must be ordered separately
FS-33	automatic				
FS-50	manual	DPDT	34° to 70°F (1° to 21°C)	4.6°F (2.6°C), fixed	five FX-4520 capillary mounting clips supplied with each control
FS-53	automatic				

Cable Management

Spiral Cut Loom and Cable Clamps

Next

Spiral Cut Loom

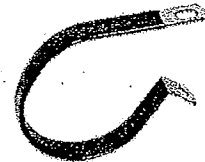
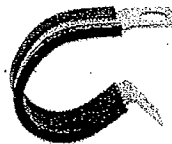


Spiral Cut Loom is designed to form a flexible cover to harness, protect and insulate wires, cable and tubing. Spiral cut loom offers the diversity of bundling various diameters in a dense spiral or economical interval wrapping. Available in polyethylene natural, black UV resistant, and fire resistant.

*Minimum quantity of 100' rolls

Natural		Black	
Part Number	Diameter in Inches	Part Number	Diameter in Inches
TSP-16	1/8	TSPB-16	1/8
TSP-14	1/4	TSPB-14	1/4
TSP-3/8	3/8	TSPB-3/8	3/8
TSP-1/2	1/2	TSPB-1/2	1/2
TSP-5/8	5/8	TSPB-5/8	5/8
TSP-3/4	3/4	TSPB-3/4	3/4
TSP-1	1	TSPB-1	1

Natural Nylon, Black Nylon, Cushion* and Metal Cable Clamps



*Natural Nylon Clamps	
Part Number	Diameter
TCL-16	1/8
TCL-36	3/16
TCL-14	1/4
TCL-56	5/16
TCL-38	3/8
TCL-12	1/2
TCL-34	3/4
TCL-78	7/8
TCL-1	1

Black Nylon Clamps	
Part Number	Diameter
TCLB-16	1/8
TCLB-36	3/16
TCLB-14	1/4
TCLB-56	5/16
TCLB-38	3/8
TCLB-12	1/2
TCLB-34	3/4
TCLB-78	7/8
TCLB-1	1

Cushion Clamps*	
Part Number	Diameter
CCR-14	1/4
CCR-38	3/8
CCR-12	1/2
CCR-34	3/4
CCR-58	5/8
CCR-78	7/8
CCR-1	1
CCR-1-14	1 1/4
CCR-1-12	1 1/2
CCR-1-34	1 3/4
CCR-2	2

Metal Clamps	
Part Number	Diameter
MCC-17	1/4
MCC-38	3/8
MCC-12	1/2
MCC-58	5/8
MCC-34	3/4
MCC-1	1
MCC-1-14	1 1/4
MCC-1-12	1 1/2
MCC-1-34	1 3/4
MCC-2	2
MCC-2-12	2 1/2
MCC-3	3

*Sold in quantities of 100

*Added carbon black provides very good UV resistance. *Sold in quantities of 100

*Stocked Cushion Clamps are manufactured with an EPDM (Ethylene-Propylene-Diene Monomer) black cushion material and is temperature rated -50° to 350°F.

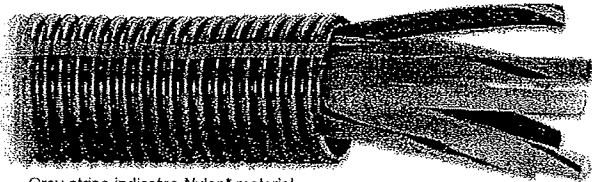
Metal and Cushion Clamps sold individually.

Cable Management

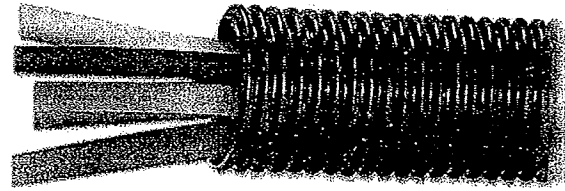
Convolutd Loom and Accessories

Next

Nylon and Polyethylene Convolutd Loom



Gray stripe indicates Nylon* material



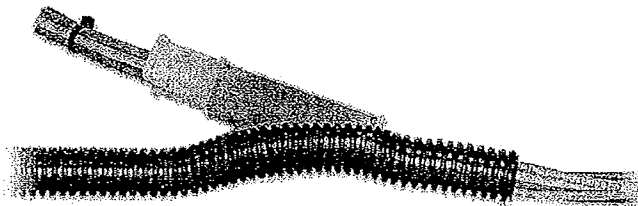
Polyethylene

Convolutd loom holds groups of wire in position and gives excellent abrasion and crushing protection. The loom is slit to allow easy insertion of wires, yet remains closed when the loom is bent and twisted. Available in Nylon (temperature rated -40°F to +300°F) or Polyethylene (temperature rated -40°F to +200°F).

Nylon Loom				Common Specifications				Polyethylene Loom			
Spooled Part Number	Spool Footage	Boxed Part Number	Box Footage	Size in Inches	I.D. in Inches	O.D. in Inches	Wall Thickness in Inches	Spooled Part Number	Spool Footage	Boxed Part Number	Box Footage
LOOM12-250	250	LOOM12-BOX	2000	1/4	.236 - .264	.375 - .400	.0017 - .0192	LOOM12PE-250	250	LOOM12PE-BOX	2000
LOOM38-250	250	LOOM38-BOX	1900	3/8	.337 - .632	.491 - .516	.0059 - .0217	LOOM38PE-250	250	LOOM38PE-BOX	1900
LOOM12-250	250	LOOM12-BOX	1100	7/8	.484 - .509	.670 - .695	.0074 - .0628	LOOM12PE-250	250	LOOM12PE-BOX	1100
LOOM58-100	100	LOOM58-BOX	800	5/8	.605 - .630	.790 - .836	.0083 - .0240	LOOM58PE-100	100	LOOM58PE-BOX	800
LOOM34-100	100	LOOM34-BOX	650	3/4	.730 - .755	.960 - .985	.0094 - .0252	LOOM34PE-100	100	LOOM34PE-BOX	650
LOOM1-50	50	LOOM1-BOX	300	1	1.00 - 1.039	1.278 - 1.306	.0118 - .0276	LOOM1PE-50	50	LOOM1PE-BOX	300
N/A	N/A	LOOM114-BOX	250	1 1/4	1.25 - 1.276	1.625 - 1.684	.0118 - .0276	N/A	N/A	LOOM114PE-BOX	250
N/A	N/A	LOOM112-BOX	150	1 1/2	1.50 - 1.528	1.858 - 1.925	.0118 - .0276	N/A	N/A	LOOM112PE-BOX	150
N/A	N/A	LOOM2-BOX	100	2	1.980 - 2.035	2.491 - 2.409	.0118 - .0276	N/A	N/A	LOOM2PE-BOX	100

*Minimum order of 10 feet

Loom Tool



This split loom installation tool makes wire and cable management easy. Gather the wires into the bottom of the tool and insert the tool and wires into the split loom tubing. Slide the tool with the wires through the tubing.

Part Number	Fits Loom Diameter
SLT-025	1/2" - 1/4"
SLT-16	1/2" - 5/8"
SLT-20	3/4" - 7/8"
SLT-08	1/4" - 3/8"

INSTALLATION MATERIALS

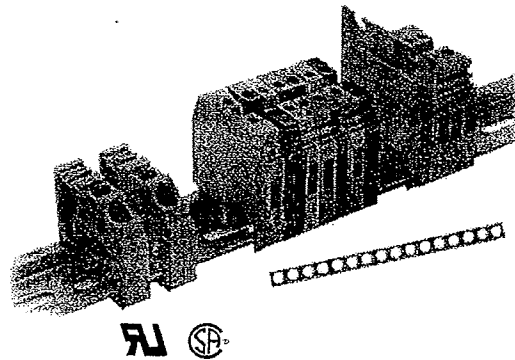
DIN RAIL TERMINAL BLOCKS MODEL M4/6

DESCRIPTION

The M4/6 DIN Rail Terminal Blocks offer a modular design for flexibility in layout and reduced installation time. Unique marker holders provide optional top or side mount marking capability. These blocks can be used with the M10/16SFL fuse holder.

FEATURES

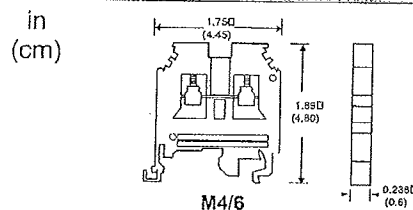
- Wire secured by ribbed compression clamp
- Universal DIN rail mounting
- Reduced installation time
- Block can be removed without displacing adjacent blocks
- Various marking options



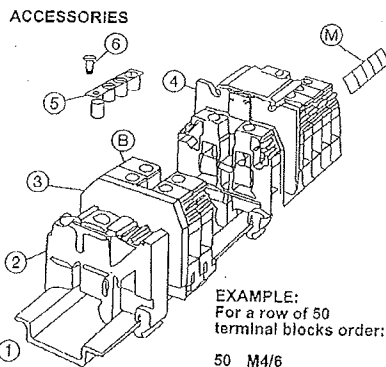
SPECIFICATIONS

Rated voltage	600 VAC/DC
Rated current	30 amps UL, 25 amps CSA
Rated wire size	22-10 AWG
Spacing	0.238" (0.60cm)
Circuits per ft	50
Approvals	UL recognized file #E60645, E72667 CSA Certified

DIMENSIONS



ORDERING INFORMATION

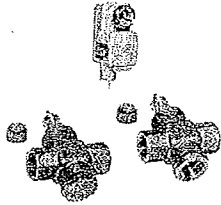


EXAMPLE:
For a row of 50 terminal blocks order:

50 M4/6
1 FEM6
2 BAM
1 DIN-3F

MODEL	DESCRIPTION
(B) M4/6	DIN Rail Terminal Block - Gray
M4/6-BK	DIN Rail Terminal Block - Black
M4/6-BL	DIN Rail Terminal Block - Blue
M4/6-GR	DIN Rail Terminal Block - Green
M4/6-RD	DIN Rail Terminal Block - Red
M4/6-OR	DIN Rail Terminal Block - Orange
M4/6-YW	DIN Rail Terminal Block - Yellow
M4/6.P	DIN Rail Grounding Block - Green & Yellow
① DIN-3F	35 mm steel DIN Mounting Rail length: 39.4 in (1 meter)
② BAM	End Stop (2 required)
③ FEM6	End Section (1 required)
④ SCF6	Circuit Separator
⑤ BJS6	Jumper Bar - 20 poles/bar
⑥ EV6	Jumper Bar Hardware (screw & post, pkg. 20)
(M) MARKERS (Side mount, individually scored)	
RC610B	Blank Strips
RC610/1-10	10 strips of 1-10
RC610/1-50	2 strips of 1-50
RC610/1-100	1 strip of 1-100
RC610/101-200	1 strip of 101-200
RC610/201-300	1 strip of 201-300
RC610/301-400	1 strip of 301-400
RC610/401-500	1 strip of 401-500
RTM7	Top Mount - Blank length: 19.7 in (50 cm)

Honeywell



M6410A, M7410F Actuators V5862A, V5863A Valves

HIGH-FORCE NON-SPRING RETURN ACTUATORS AND 1, 1-1/4, 1-1/2 INCH NPT CARTRIDGE GLOBE VALVES

M6410A and M7410F Series 3000 Non-Spring Return Valve Actuators provide floating or modulating control of V5862A and V5863A Series 3000 Cartridge Globe Valves.

The actuators are used in electronic temperature control systems, which use hot and/or cold water (with glycol up to 50 percent) as the controlled medium in variable air volume (VAV) terminal units, fan-coil units, small reheaters and recoolers.

SPECIFICATIONS

! CAUTION

Equipment Damage Hazard.

Installing a high-force (67.5 lb [300 N]) actuator on 1/2 or 3/4 in. valve can damage the valve beyond repair.

Use only Series 1000 (40.5 lb [180 N]) actuators with the smaller (1/2 in. and 3/4 in.) valves.

! CAUTION

Electrical Shock or Equipment Damage Hazard.

Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

IMPORTANT

- A low-force (40.5 lb [180 N]) actuator installed on a valve larger than 3/4 in. cannot operate the valve.
- Install high-force actuators (67.5 lb) only on large valves (1 in., 1-1/4 in., 1-1/2 in.).

Models:

- M6410A: Non-Spring Return Valve Actuator. Provides floating control of the V5862A and V5863A Valves.
- M7410F: Non-Spring Return Valve Actuator. Provides modulating control of V5862A and V5863A Valves.
- V5862A: Two-way NPT Valves.
- V5863A: Three-way NPT Mixing Valves.

Control Modes:

- M6410A: Floating.
- M7410F: Modulating.

Ambient Ratings:

- Operating Temperature Range: 32° to 122°F (0° to 50°C)
- Storage Temperature Range: -40° to 158°F (-40° to 70°C)
- Humidity Range: 5 to 95% RH (noncondensing)

Weight:

- M6410A: 5 oz (0.15 kg).
- M7410F: 5.6 oz (0.16 kg).

SPECIFICATION DATA

FEATURES

- Small size allows installation in limited space.
- Long stroke allows wider range of control.

Actuators

- Low power consumption.
- Synchronous motor.
- No mounting tools required.
- Low-maintenance plastic housing.
- Conduit connector standard.
- No separate linkage required.
- M6410A provides 3-position floating control without proportional feedback.
- M7410F receives 0 to 10 Vdc or 2 to 10 Vdc input signal, selectable at the site.
- M7410F includes direct/reverse acting switch.
- Especially suitable for Excel® Controller or Individual Room Controller (IRC) System.
- Internal valve position indicator.
- Magnetic coupling for torque limitation independent of voltage supply, and self-adjustment of close-off port.
- Ready-to-wire connecting cable.

Valves

- V5862A is a two-way female NPT valve.
- V5863A is a three-way female NPT mixing valve.
- Pressure-balanced plug.
- Soft valve seat provides low leakage rate.
- Valve inserts are changeable with the insert replacement tool.
- Threaded plastic cover allows manual operation.
- Brass body and stainless steel stem.

Mounting:

- Actuator screws onto valve body.

Connections:

- M6410A, M7410F: 4.9 ft (1.5m) cable.

Electrical Ratings:

- Input Power:
 - 24 Vac, +10/-30 percent, 50/60 Hz.
- Power Consumption:
 - M6410A: 0.7 VA.
 - M7410F: 1.4 VA.
- Input Signal (M7410F): Modulating 0 to 10V, 2 to 10V (adjustable), 0.1 mA.
- Input Impedance (M7410F): 100K ohms.



Stroke:

- 1/4 in. (6.5 mm).

Running Time:

- At 50 Hz: 150 seconds.
- At 60 Hz: 125 seconds.

Stem Force:

- 67.5 lb (300 N).

Suitable Medium:

- Water with maximum 50% glycol.

Controlled Water Temperature:

- 36° to 230°F (2° to 110°C).

Rangeability:

- Two-way Valve: 50:1.
- Three-way Valve: 50:1 for controlled port (A to AB).

Flow Characteristic:

- Linear.

Valve Cv Rating:

- See Table 1.

NOTE: To determine the capacity index (Cv) needed for your application, use the following formula: Cv = gallons per minute divided by the square root of the pressure drop across the valve when the valve is fully open.

Body Material:

- Brass.

Stem and Plug Assembly:

- Stem: Stainless steel.
- Plug: Brass.

Actuator Required:

- M6410A: Non-Spring Return Valve Actuator (3-position floating).
- M7410F: 0 to 10 Vdc or 2 to 10 Vdc Electronic Actuator.
- Valve inserts are provided as spare parts. See Table 2.

Leakage Rate:

- ≤0.05% of Cv.

Valve Close-off Ratings:

- See Table 1.

Approvals (Actuators):

- Underwriters Laboratories Inc. listed for plenum use (UL94-5V).

Table 1. Valve Close-off Ratings.

Pipe Size in in. (mm)	Cv ^a	Close-off Rating (psi)	
		Two-way	Three-way
1 (25)	5.5	232	232
	7.8		
	11		
1-1/4 (32)	18	174	174
1-1/2 (38)	25	145	145

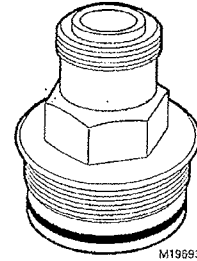
^a The Cv for the bypass port (B) on all three-way valves is reduced by one Cv level. Example: A Port Cv = 11; B Port Cv = 7.8. This feature eliminates the need for a balancing valve with the load matched to the proper Cv.

Accessories and Replacement Parts:

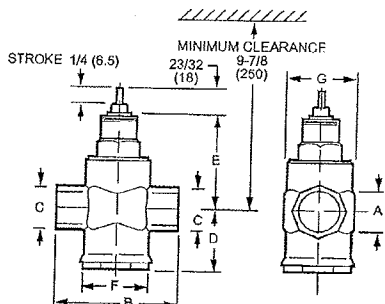
- WV3000R Insert Replacement Tool, for replacing cartridge insert.

Table 2. Valve Insert Replacement Parts.

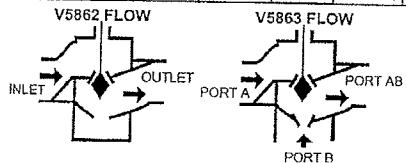
Diameter (in.)	For Valve	Cv	Part Number
Two-Way			
1	V5862A3003	5.5	0903827
	V5862A3011	7.8	
	V5862A3029	11	
1-1/4	V5862A3037	18	0903828
1-1/2	V5862A3045	25	0903829
Three-Way			
1	V5863A3002	5.5	0903827
	V5863A3010	7.8	
	V5863A3028	11	
1-1/4	V5863A3036	18	0903828
1-1/2	V5863A3044	25	0903829



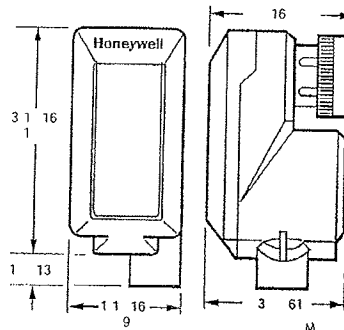
Dimensions in in. (mm):



VALVE SIZE A (NPT)	B	C	D	E	F	G
1 (25)	4-1/8 (105)	1-5/8 (41)	2-1/16 (53)	3-5/8 (92)	2 (50)	2-5/16 (58)
1-1/4 (32)	4-15/16 (125)	2 (50)	2-7/16 (62)	3-5/8 (92)	2-3/16 (55)	2-5/16 (58)
1-1/2 (38)	5-1/8 (130)	2-3/16 (55)	2-9/16 (65)	3-7/8 (98)	2-3/8 (60)	2-11/16 (69)



M19619A



Non-Spring Return Actuators
(M6410A, M7410F)

TYPICAL SPECIFICATION

Cartridge Globe Valves

Cartridge globe valve supplier must be Honeywell. Valves shall be available in two- and three-way mixing models with brass bodies and stainless steel stem. Valves must have nominal rangeability of 50:1 or better. Valves must have a leakage rating less than 0.05% of the Cv.

Valves 1 in. or larger must be pressure balanced. Valves shall be usable with hot water, chilled water, or glycol solutions up to 50 percent. Valves must have available insert replacement tools to facilitate changing the cartridge.

Cartridge Globe Valve Actuators

Cartridge globe valve actuator supplier must be Honeywell. Electric actuators shall provide either floating or modulating control of two- and three-way cartridge globe valves. Actuator will operate at 24 Vac (+10/-30%) and 50/60 Hz. Actuator must screw onto compatible valve body without the aid of mounting tools. Actuators shall have an ambient temperature rating of 32 to 122 degrees Fahrenheit.

Honeywell

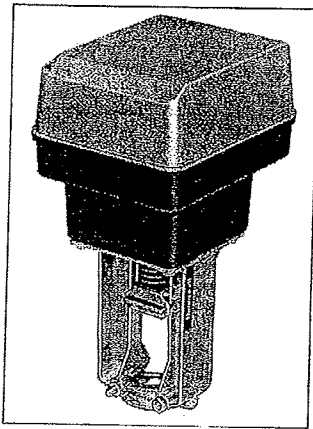




Honeywell

ML6425, ML7425 Spring Return Electric Linear Valve Actuators

PRODUCT DATA



FEATURES

ML6425 and ML7425

- Accurate valve positioning.
- Quick and easy installation.
- No separate linkage required.
- On power failure:
ML6425A and ML7425A drive valve stem down.
ML6425B and ML7425B draw valve stem up.
- Conduit connector is standard.
- No adjustments required.
- True spring return on power failure.
- Low power consumption.
- High close-off ratings.
- Force-limiting end switches.
- Direct/reverse action.
- Synchronous motor.
- Corrosion resistant design.
- Maintenance free.

ML7425

- Position Feedback signal.
- Fail-safe position selection for control signal loss.

APPLICATION

The ML6425 Spring Return Electric Linear Valve Actuators are floating control actuators used with controllers that provide a switched or floating single-pole double-throw (spdt) output. These actuators operate standard Honeywell valves in heating, ventilating, and air conditioning (HVAC) applications.

The ML7425 Spring Return Electric Linear Valve Actuators are modulating control actuators used with controllers that provide an analog output of 0 to 10 Vdc or 2 to 10 Vdc. These actuators operate standard Honeywell valves in heating, ventilating, and air conditioning (HVAC) applications. An internal selector plug can be used to reverse the direction of action.

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63-2516-04

SPECIFICATIONS

Models:

Model	Spring Return Action	Description
ML6425A	Drive valve stem down on power failure	Electric Linear Valve Actuator
ML7425A		
ML6425B	Draw valve stem up on power failure	
ML7425B		

Dimensions: Refer to Fig. 1.

Weight: 5.1 lb (2.3 kg).

Electrical Ratings:

Power Input: 24 Vac \pm 15%, 60 Hz.

Power Consumption:

ML6425: 11 VA maximum at 24 Vac.

ML7425: 12 VA maximum at 24 Vac.

Signal Source Output Resistance: 1 kOhm maximum.

Signal Load: 1 mA maximum.

Signal Inputs (Supply Voltage Between Terminals):

ML6425:

B and 24 Vac: Drive valve stem down.

W and 24 Vac: Draw valve stem up.

ML7425: 0 to 10 Vdc or 2 to 10 Vdc.

Stem Force: 135 lbf (600 N).

Actuator Stroke: 3/4 in. (19 mm).

Actuator Run Time at 60 Hz: 90 seconds.

Spring Return Time: 12 seconds.

Temperature Ranges:

Ambient: 14° to 122° F (-10° to +50° C).

Storage: -40° to +158° F (-40° to +70° C).

Maximum Valve Medium: 300° F (149° C).

Humidity: 5 to 95 percent relative humidity, noncondensing.

Close-off Pressure Ratings: Refer to Table 1.

Protection Standard: IP54.

Approvals:

Underwriter's Laboratories, Inc. UL94-5V Flame Retardant.
Meets CE requirements.

Cable entry: Conduit connector and one knockout on case.

Actuator Material:

Cover: ABS-FR plastic.

Base: PBTP-FR plastic.

Yoke: Diecast aluminum.

Accessories:

43191679-111 Single Auxiliary 10K ohm Potentiometer.

43191679-112 Single Auxiliary 220 ohm Potentiometer.

43191680-105 Dual Auxiliary Switch (for 24 Vac use *only*).

43196000-001 High Temperature Kit (1/2 to 3 in. valves).

Increases temperature range high-end to 428° F (220° C).

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
1885 Douglas Drive North
Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Toronto, Ontario M1V 4Z9.

International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

ML6425, ML7425 SPRING RETURN ELECTRIC LINEAR VALVE ACTUATORS

Table 1. Close-off Ratings for ML6425, ML7425 Electric Linear Valve Actuators and Honeywell Valves (psi).

Type	Valve	1/2 in.	3/4 in.	1 in.	1-1/4 in.	1-1/2 in.	2 in.	2-1/2 in.	3 in.
Flange	V5011A	—	—	—	—	—	—	28	16
	V3350/ 3351/ 3450/ 3451	—	—	—	—	—	—	21	14
	V5013B, C; V3360/ 3361/ 3460/ 3461	—	—	—	—	—	—	21 ^a	14 ^a
NPT	V5011F, G	150 ^b	150 ^b	150 ^b	134 ^b	77	49	28	16
	V5011H, J	150	150	150	145	—	—	—	—
	V5011N1xxx, V5011N3xxx, V5013N	230	230	163	104	67	37	—	—
	V5011N2xxx	100	100	100	100	67	37	—	—
	V5013F	150	150	150	126	77	49	—	—

^aRepresents maximum pressure difference between the outlet and either of the two inlets.

^bDo not exceed 100 psi with V5011G valves used in steam applications.

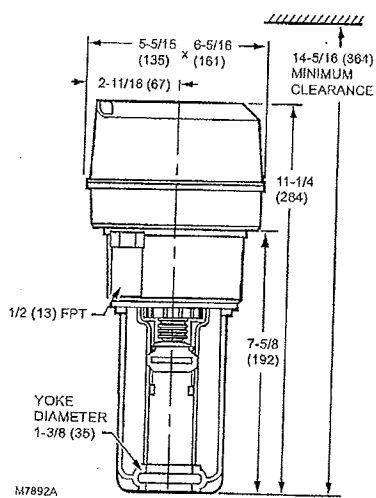


Fig. 1. Approximate Dimensions of ML6425, ML7425 Electric Linear Valve Actuator in in. (mm).

INSTALLATION

When Installing this Product...

1. Read instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check ratings and description given in the specifications to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.
Disconnect power supply before installation.

Location

Install the actuator in a location that allows enough clearance for mounting accessories and for servicing.

CAUTION

Equipment Damage Hazard.
Can damage actuator due to condensation or a valve gland leak.
Install the actuator in a position above horizontal.

Mounting

1. Place the actuator on the valve with the U-bolt around the valve collar (Refer to Fig. 2).
2. Place the U-bolt against the valve collar and secure the actuator to the valve by turning each U-bolt nut clockwise. To assure even pressure on the collar, first tighten the nuts finger-tight and then alternate turning each U-bolt nut until both are snug.
3. Push aside the stem button retaining clip and hold (Refer to Fig. 3).
4. Lift valve stem until the head of the valve stem button is inside the large slot of the stem button retaining clip on the actuator.
5. Release the stem button retaining clip to secure the stem button. Check to make certain the stem button is secured by the retaining clip.
6. Remove the cover from the actuator using a Phillips or crosspoint screwdriver (Refer to Fig. 4).

CAUTION

Personal Injury Hazard.
Manual spring handle under tension can turn quickly when lifted, pinching fingers between handle and plastic casing.
Use a screwdriver to lift and release manual spring handle (Refer to Fig. 5).

7. Remove the manual spring handle retaining clip, and lift and release the handle (Refer to Fig. 5). The easiest way to perform this operation safely is to:
 - a. Remove the retaining clip.
 - b. Wedge a small, flat-bladed screwdriver under the manual spring handle and pry up the handle (Refer to Fig. 5).

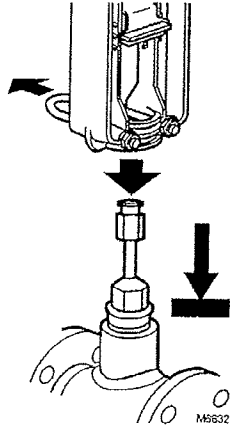


Fig. 2. Attaching Actuator to Valve Collar.

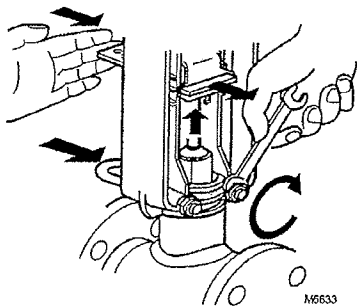


Fig. 3. Securing Actuator to Valve.

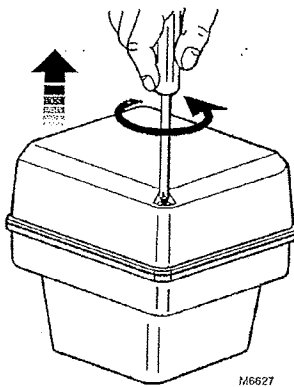


Fig. 4. Removing Actuator Cover.

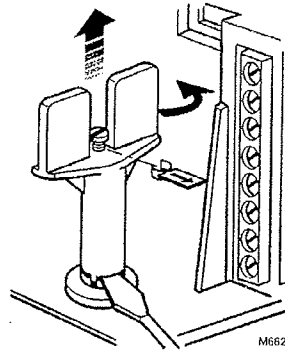


Fig. 5. Removing Spring Retaining Clip and Releasing Manual Spring Handle.

WIRING

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.
Disconnect power supply before installation.

All wiring must comply with local electrical codes, ordinances and regulations. Voltage and frequency of the transformer used with the actuator must correspond with the power supply and actuator characteristics. Refer to Figures 6 through 13 for connection information and typical wiring hookups.

1. Feed power and control wires through the conduit connector located on the bottom of the actuator case (See Fig. 6).

⚠ CAUTION

Equipment Damage Hazard.
Conduit connection or removal can break an unsupported connector.
When removing or attaching conduit, use a wrench to support the motor connector.

2. Using the wiring diagram in Fig. 7, connect power and control wires. Make sure that all wiring is correct.
3. When wiring is complete, replace the cover on the actuator (Refer to Fig. 14).
4. Apply power and control signals to the actuator.

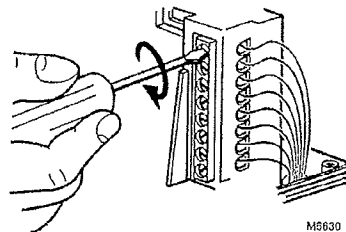


Fig. 6. Connecting Power and Control Wiring.

ML6425, ML7425 SPRING RETURN ELECTRIC LINEAR VALVE ACTUATORS

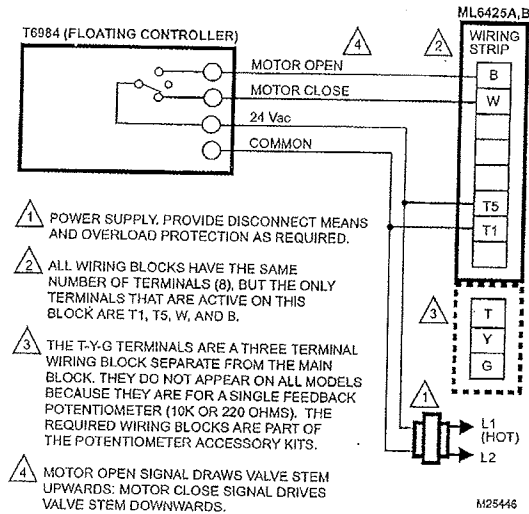


Fig. 7. ML6425 Wiring.

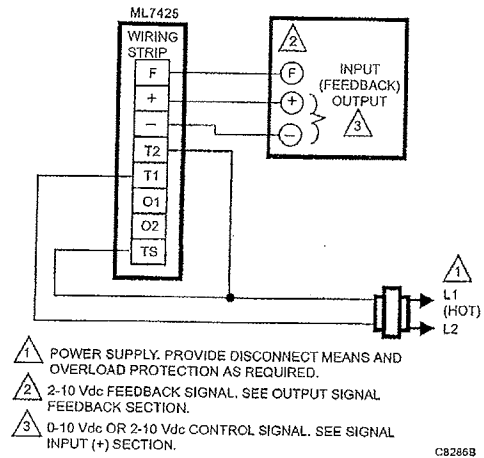


Fig. 9. ML7425 Wiring using Controller Feedback Output and a Common Transformer.

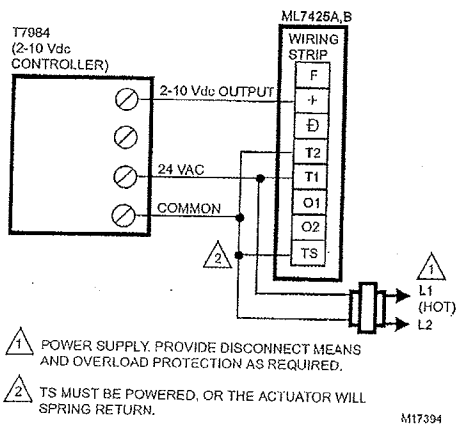


Fig. 8. ML7425 Wiring.

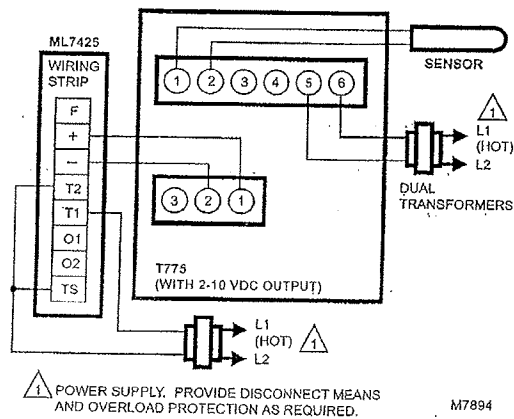


Fig. 10. ML7425 Wiring using 2 to 10 Vdc Control Signal and Separate Transformers.

ML6425, ML7425 SPRING RETURN ELECTRIC LINEAR VALVE ACTUATORS

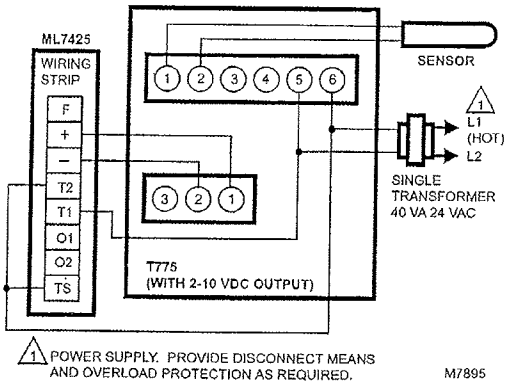


Fig. 11. ML7425 Wiring using 2 to 10 Vdc Control Signal and a Common Transformer.

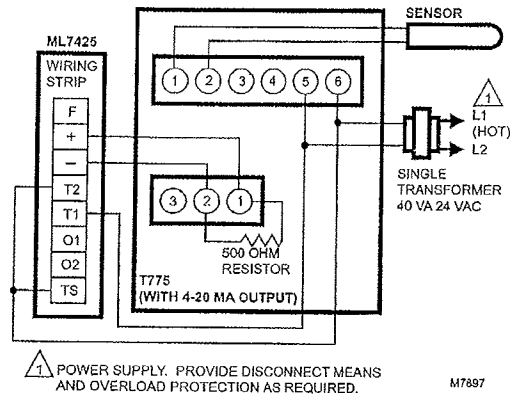


Fig. 13. ML7425 Wiring using 4 to 20 mA Control Signal and a Common Transformer.

NOTE: 500 ohm resistor not shipped with product.

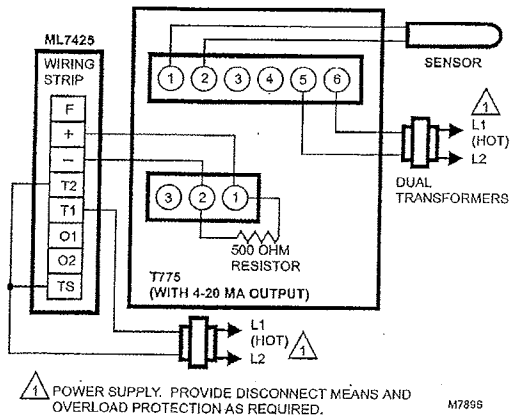


Fig. 12. ML7425 Wiring using 4 to 20 mA Control Signal and Separate Transformers.

NOTE: 500 ohm resistor not shipped with product.

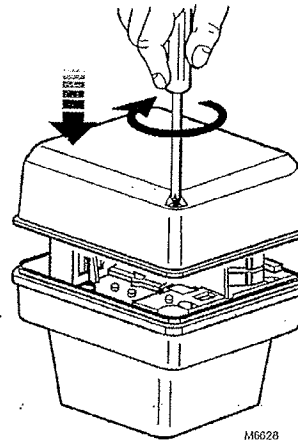


Fig. 14. Replacing Actuator Cover.

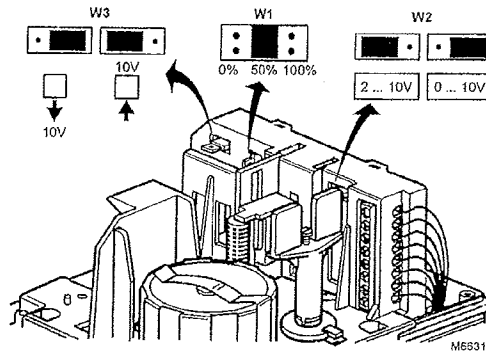


Fig. 15. Location of W1, W2, and W3 Selector Plugs.

Auxiliary Potentiometers

The 43191679 Auxiliary Potentiometers can be used as feedback potentiometers and to provide remote indication of the valve position. Refer to the Installation Instructions packed with the potentiometers.

Auxiliary Switches

! CAUTION

Equipment Damage Hazard.
Improper voltage will damage the auxiliary switch beyond repair.
Use the 43191680 Dual Auxiliary Switch only with 24 Vac applications.

The 43191680 Dual Auxiliary Switch can be used on both the ML6425 and ML7425 Electric Linear Valve Actuators. Switching points are adjustable over the full length of actuator stroke; for example, the switch can be used to switch pumps or provide remote indication of any stroke position. Refer to the Installation Instructions packed with the auxiliary switch.

OPERATION

In the actuator, the drive of a synchronous motor is converted into the linear motion of the actuator stem by using a spur gear transmission. A button retainer clip connects the actuator stem to the valve stem.

An integrated spring package limits the stem force to a factory adjusted value in either direction. Installed microswitches turn off the actuator when the specified stem force is reached.

The ML6425, ML7425 Spring Return Valve Actuators provide a safety valve position in the event of power failure. On power failure, the ML6425A and ML7425A extend the actuator stem; the ML6425B and ML7425B retract the actuator stem.

The actuators are shipped from the factory with a spring handle retaining clip installed, so the actuator can be connected to the valve without applying power. Remove this clip after the actuator is installed. (Refer to the Installation section.)

ML7425

Signal Input (+)

The analog input signal (+) range is set at the factory to 0 to 10 Vdc. Changing the position of the W2 selector plug sets the range to 2 through 10 Vdc. Selector plugs W1, W2, and W3 are positioned on the back side of the printed circuit board. Refer to Fig. 15 for location of the selector plugs.

Signal Input Failure

Using selector plug W1, the actuator can be set to run to one of three positions in event of a signal failure:

- 0% Actuator position corresponds with 0 or 2 Vdc signal.
- 50% Actuator stem in mid-position.
- 100% Actuator position according to 10 Vdc signal.

NOTE: W1 is factory set at the mid-position.

Output Signal Feedback (F)

An analog output signal (2 to 10 Vdc) that represents the actual actuator stem position is available at terminal F. It can be used for remote indication of the stem position. When the valve stem is fully downward, the output signal is 10 Vdc.

When the valve stem is up, the output signal is 0 or 2 Vdc. The output of the signal does not change when the action of the actuator is reversed using W3. See Direction of Action.

Actuator Override

To override the control signal (for freeze protection or similar applications), connect the 24 Vac common (T2) to either terminal O1 or O2. Connecting to terminal O1 fully extends the actuator stem. Connecting to O2 fully retracts the actuator stem.

The control signal (+) is ignored when the override signal is applied to Terminal O1 or O2. This override can be achieved with a switch or a relay (See Fig. 16).

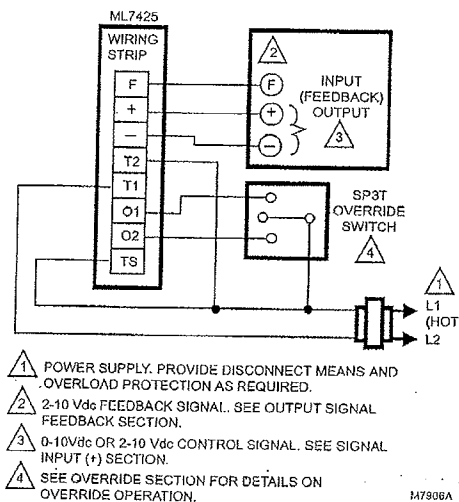


Fig. 16. Connections for Overriding Control Signal to Drive ML7425 to a Specific Position.

Direction of Action

The direction of actuator action can be changed by repositioning selector plug W3, which is factory set so that the actuator drives the valve stem down on increasing signal and draws it up on decreasing signal. When the valve stem is up, the output signal from the feedback (F) function is 0 or 2 Vdc. The output of the signal does not change when W3 is used to reverse the action of the actuator (Refer to Fig. 15).

CHECKOUT

The actuator can be checked out either directly or by using a controller.

Direct Checkout

1. Mount the actuator for the required application; see Installation section.
2. Check the valve position and make sure that 24 Vac is correctly applied to the actuator.
3. Apply the power to the appropriate leadwires to move the valve.
4. If the actuator does not move, make sure the actuator is properly installed/wired.
5. If the actuator installation and wiring are both correct and the actuator does not run, replace the actuator.

Controller Checkout

1. Adjust the setpoint of the controller to call for opening the valve. Observe the actuator.
2. If the valve is closed, it should begin to open.
3. If the valve remains closed, move the setpoint further toward the open setting.
4. If the valve does not move, check for 24 Vac in the actuator power input.
5. If 24 Vac is present and the actuator does not operate, check the voltage across the controller leadwires to determine if the device is miswired.
6. If the wiring is correct, 24 Vac is present on the power input terminals, and the actuator does not run, replace the actuator.

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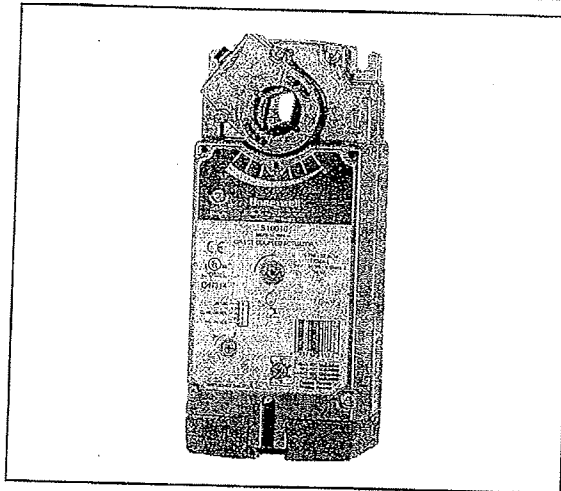
Honeywell

Honeywell

S05, S10, S20 Series Spring Return Direct Coupled Actuators

MS4105, MS4110, MS4120, MS71XX, MS7505, MS7510, MS7520,
MS8105, MS8110, MS8120

PRODUCT DATA



FEATURES

- Brushless DC submotor with electronic stall protection for floating/modulating models.
- Brush DC submotor with electronic stall protection for 2-position models.
- Self-centering shaft adapter (shaft coupling) for wide range of shaft sizes.
- Models available with three torque ratings: 44 lb-in. (5 N•m), 88 lb-in. (10 N•m), and 175 lb-in. (20 N•m).
- Models available for use with two-position, single pole single throw (spst), line- (Series 40) or low- (Series 80) voltage controls.
- Models available for use with floating or switched single-pole, double-throw (spdt) (Series 60) controls.
- Models available for use with proportional current or voltage (Series 70) controls.
- Models available with combined floating/modulating control in a single device.
- Models available with adjustable zero and span.
- Models available with line-voltage internal end switches.
- Access cover to facilitate connectivity.
- Metal housing with built-in mechanical end limits.
- Spring return direction field-selectable.
- Shaft position indicator and scale.
- Manual winding capability with locking function.
- UL (cUL) listed and CE compliant.
- All Models are plenum-rated per UL873.

APPLICATION

MS41XX, MS71XX, MS75XX, MS81XX Spring Return Direct Coupled Actuators (DCA) are used within heating, ventilating, and air-conditioning (HVAC) systems. They can drive a variety of quarter-turn, final control elements requiring spring return fail-safe operation.

Applications include:

- Volume control dampers, mounted directly to the drive shaft or remotely (with the use of accessory hardware).
- Quarter-turn rotary valves, such as ball or butterfly valves mounted directly to the drive shaft.
- Linear stroke globe or cage valves mounted with linkages to provide linear actuation.

Contents

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63-2607-06

SPECIFICATIONS

Models: See Tables 2 and 3.

NOTE: This document also covers the MS7110K and MS7106K.

Dimensions: See Fig. 1.

Device Weight: 7 lb (3.2 kg).

Temperature Ratings:

Ambient: -40°F to 140°F (-40°C to 60°C).

Shipping and Storage: -40°F to 158°F (-40°C to 70°C).

Humidity Ratings: 5% to 95% RH noncondensing.

Electrical Connections:

Field wiring 14 to 22 AWG (2.0 to 0.344 mm sq) to screw terminals, located under the removable access cover.

Electrical Ratings: See Table 1.

End Switches (Two SPDT):

Settings (fixed): 7° nominal stroke, 85° nominal stroke.

Ratings (maximum load):

Low-Voltage Models: 250 Vac, 5A resistive, 3A inductive.

Line-Voltage Models: 250 Vac, 5A resistive.

Mounting: Self-centering shaft adapter (shaft coupling).

Round Damper Shafts: 0.375 to 1.06 in. (10 to 27 mm).

Square Damper Shafts: 1/2 to 3/4 in. (13 to 19 mm).

Actuator can be mounted with shaft in any position.

NOTE: For 175 lb-in. (20 N•m) models: 3/4 in. or greater shaft diameter recommended.

Minimum Damper Shaft Length: 1 in. (25 mm); 3 in. (76 mm) recommended.

Timing (At Rated Torque and Voltage):

Drive Open (typical):

Floating, Modulating Models: 90 seconds.

Floating, Modulating Models: 60 seconds.

Two-Position Models: 45 seconds ±5 seconds.

Spring Close: 20 seconds typical.

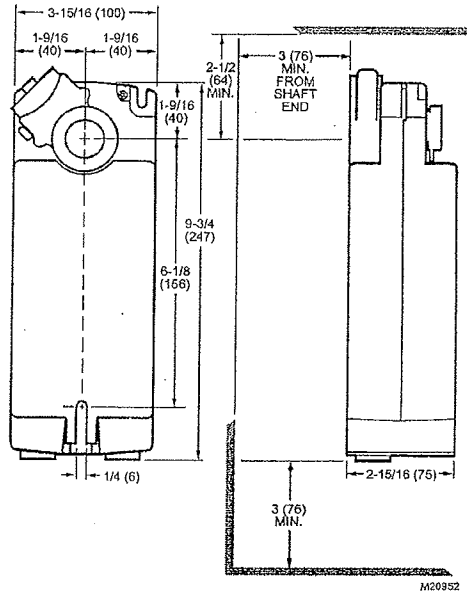


Fig. 1. Dimensional drawing of actuator in in. (mm).

Table 1. Electrical Ratings*.

Model(s)	Power Input		Power Consumption (VA)					
	Voltage	Frequency	44 lb-in. (5 N•m)		88 lb-in. (10 N•m)		175 lb-in. (20 N•m)	
			Driving	Holding	Driving	Holding	Driving	Holding
Floating, Modulating	24 Vac ±20% (Class 2), 24 Vdc	50/60 Hz.	13	5	14	5	16	5
Two-Position, Low-voltage	24 Vac ±20% (Class 2), 24 Vdc	50/60 Hz.	25	8	30	8	40	8
Two-Position, Line-voltage	100-250 Vac	50/60 Hz.	45	13	45	13	60	13

* Floating/Modulating 60 sec models
 88 lb-in. (10 N•m) 18 VA Driving
 175 lb-in. (20 N•m) 22 VA Driving
 24 VAC ± 20%

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

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2. Honeywell Customer Care
 1885 Douglas Drive North
 Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Toronto, Ontario M1V 4Z9.

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S05, S10, S20 SERIES SPRING RETURN DIRECT COUPLED ACTUATORS

Table 2. O.S. Number Selection (see Table 3 also).

M	Electrical Motor
S	Fail Safe Function (Spring Return)
41	120 Vac Two-Position Control; Reversible Mount
71	24 Vac Modulating Control; Reversible Mount
75	24 Vac Modulating and Floating Control; Reversible Mount
81	24 Vac Two-Position Control; Reversible Mount
05	44 lb-in. (5 N•m)
10	88 lb-in. (10 N•m)
20	175 lb-in. (20 N•m)
A ^a	Standard U.S. Model
B ^b	Standard European Model
E ^b	Selectable control signal; Adjustable zero and span; Includes service and auto-adapt modes
H ^a	
1	No Feedback
2	Voltage Feedback Signal
0	No End Switches
2	Two End Switches
XX	System Controlled Numbers

M S 75 20 A 2 0 XX

^a Model manufactured for sale in the United States.
^b Model manufactured for sale in Europe.

- 60 second models
 MS7510A2016
 MS7510A2214
 MS7520A2015
 MS7520A2213

Table 3. Actuator Catalog Numbering (see Table 2 also).

S	Spring Return Fail Safe Mode
N	Non-Spring Return Fail Safe Mode
05	44 lb-in. (5 N•m); Spring Return Only
10	88 lb-in. (10 N•m); Spring Return Only
20	175 lb-in. (20 N•m)
34	300 lb-in. (34 N•m); Non-Spring Return Only
24	24 Vac Floating (Series 60) Control
24-2POS	24 Vac Two-Position Control
120-2POS	120 Vac Two-Position Control
230-2POS	230 Vac Two-Position Control
010	24 Vac Modulating and Floating Control
	Fixed Zero/Span, No End Switches
	-SW2 Internal End Switches
	-SER ^a Enhanced Modulating; Adjustable Zero/Span

S 10 24-2POS -SW2

^a Enhanced models include two internal end switches.

Stroke: 95° ±3°, mechanically limited.

Approvals: See Table 4.

Design Life (at Rated Voltage):**

Two-position models: 50,000 full stroke cycles;
 50,000 full stroke spring returns.
 Floating and Modulating models: 60,000 full stroke cycles;
 1,500,000 repositions; 60,000 full stroke spring returns.

Controller Type:

S05, S10, S20: See Table 3.
 S05, S10, S20: Modulating (Series 70) or Floating (Series 60);
 controlled by selector switch.
 MS71XX: Modulating Voltage Input.
 Input Impedance: 95K ohms minimum.
 Feedback Signal: 0 or 2-10 Vdc;
 Driving current is 3 mA minimum.

Torque Ratings:

Typical Holding, Driving, Spring Return:
 S05: 44 lb-in. (5 N•m).
 S10: 88 lb-in. (10 N•m).
 S20: 175 lb-in. (20 N•m).
 Stall Maximum (fully open at 75°F):
 S05: 100 lb-in. (11.3 N•m).
 S10: 200 lb-in. (22.6 N•m).
 S20: 350 lb-in. (39.6 N•m).

Noise Rating at 1m (Maximum):

Holding: 20 dBA (no audible noise).
 Two-position models:
 Driving: 50 dBA.
 Spring Return: 65 dBA.
 Floating and Modulating models:
 Driving: 40 dBA.
 Spring Return: 50 dBA.

Table 4. Approvals.

	S05, S10, S20 Series	MS7110, MS7106
UL/cUL	X	X
UL873 Plenum Rating, File No. E4436; Guide No. XAPX.	X	X
CE	X	
C-TICK	X	

Environmental Protection Ratings:

NEMA2 (US Models) or IP54 (European Models) when mounted on a horizontal shaft with access cover below the shaft.

Accessories:

- 27518 Balljoint (5/16 in.).
 - 103598 Balljoint (1/4 in.).
 - 205860 Electronic Minimum Position Potentiometer.
 - 27520A-E, G, H-L, Q Pushrod (5/16 in. diameter).
 - 32000085-001 Water-tight Cable Gland/Strain-relief Fitting (10 pack).
 - 32003036-001 Weather Enclosure.
 - 32004254-002 Self-Centering Shaft Adapter (supplied with actuator).
 - 50001194-001 Foot Mount Kit.
 - 50005859-001 NEMA4/4X Enclosure.
 - 50006427-001 Anti-Rotation Bracket (supplied with actuator).
 - SW2-US Auxiliary Switch Package.
- See also Form 62-2620.

** Floating/Modulating 60 sec models
 20,000 full stroke cycles
 100,000 repositions

Sizing

Required Torque

In lieu of data from a Specification Engineer or Manufacturer, required torque for a given damper load can be determined using the following method: $T_R = T_D \times A_D$

Where:

- T_R = Required torque for the damper load.
- T_D = Damper torque rating from the manufacturer, expressed in either (lb-in.)/(sq ft) or (N·m)/(sq m), the damper load.
- A_D = Damper area expressed in either sq ft or sq m.

Actuators Required

In lieu of data from a Specification Engineer or Manufacturer, the number of required actuators for a given damper load can be determined using the following method:

$$N = \frac{T_R}{T_A \times SF}$$

Where:

- N = Number of actuators.
- T_R = Required torque for the damper load. (See above.)
- T_A = Actuator torque rating.
- SF = Safety factor.

NOTE: The safety factor accounts for variables such as misalignments, aging of the damper, etc. 0.8 is a typical safety factor.

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.



CAUTION

Electrical Shock or Equipment Damage Hazard. Low voltage can shock individuals or short equipment circuitry. Disconnect power supply before installation.

IMPORTANT

All wiring must agree with applicable codes, ordinances and regulations.

Location

These actuators are designed to mount directly to a damper external drive shaft. The shaft coupling fastens to the drive shaft. The actuator housing includes slots which, along with an anti-rotation bracket, secure the actuator to the damper frame or duct work (see Fig. 8).

NOTES:

- When mounted correctly, these slots allow the actuator to float without rotating relative to the damper shaft.
- Using other brackets or linkages, the actuator can be foot-mounted or tandem-mounted.



CAUTION

Motor Damage Hazard. Deteriorating vapors and acid fumes can damage metal parts. Install motor in areas free of acid fumes and other deteriorating vapors.



CAUTION



Equipment Damage Hazard. Tightly securing actuator to damper housing can damage actuator. Mount actuator to allow it to float along its vertical axis.

Preparation

Before mounting the actuator onto the damper shaft, determine the:

- Damper/valve opening direction for correct spring return rotation. The actuator can be mounted to provide clockwise or counterclockwise spring return.
- Damper shaft size (see the Specifications section).

Determine Appropriate Mounting Orientation

The actuators are designed to open a damper by driving the damper shaft in either a clockwise  or counterclockwise  direction (see Fig. 2).

NOTES:

- Actuators are shipped in the fully closed (spring return) position.
- An arrow molded into the hub points to tick marks on the label to indicate the hub rotary position.

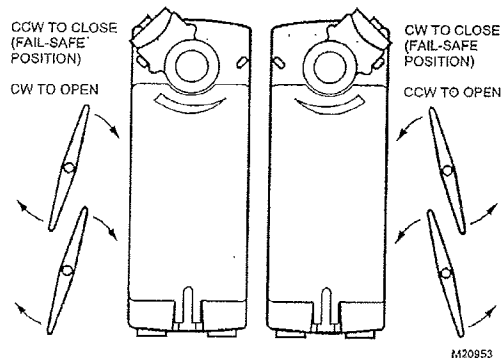


Fig. 2. Spring Return DCA mounting orientation.

Measure Damper/Valve Shaft Length

If the shaft is less than three inches in length, the shaft coupling must be located between the damper/valve and actuator housing. If the shaft length is more than three inches, the shaft coupling may be located on either side of the actuator housing.

S05, S10, S20 SERIES SPRING RETURN DIRECT COUPLED ACTUATORS

If the coupling must be moved from one side of the actuator to the reverse, follow these instructions (see Fig. 3):

1. Remove the retainer clip from the shaft coupling and set it aside for later use.
2. Remove shaft coupling from one side of the actuator.
3. Replace the shaft coupling on the opposite side of the actuator aligning it based on the stroke labelling.
4. Replace the retainer clip on the shaft coupling using the groove of the coupling.

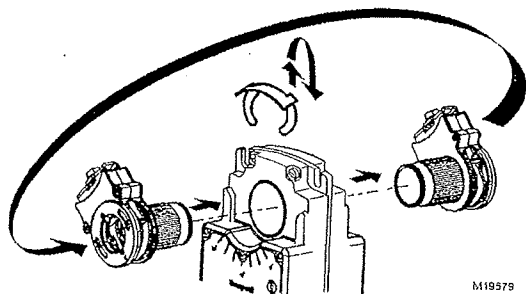


Fig. 3. Mounting shaft coupling to actuator opposite side.

Select Actuator Control Signal

These actuators are available in two control types:

- Standard: includes mode selection dial to select the desired input signal.

- Enhanced: includes different mode selection dial to select the desired input signal. Also includes dials for adjusting the input signal zero and span.

NOTE: Selections are made using a dial that appears on both the front and back of the actuator (see Fig. 4). For available options, see Table 5.

To select the control signal simply turn the mode selection dial to the desired control signal (as indicated on the device label).

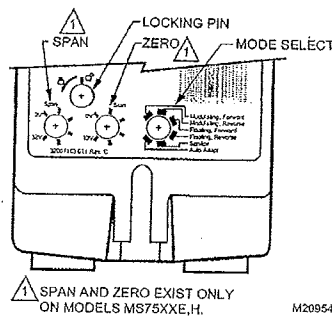


Fig. 4. Dials for control signal and zero/span.

Table 5. Actuator Control Signal Selections.

Mode Options	Standard	Enhanced	Details
Floating: forward	X ^a	X ^a	Series 60 control. Power to terminal 4 drives toward spring return position.
Floating: reverse	X ^b	X ^b	Series 60 control. Power to terminal 3 drives toward spring return position.
Modulating: 0-10 Vdc	X ^c		Series 70 control. 0 Vdc signal drives toward spring return position.
Modulating: 10-0 Vdc	X ^c		Series 70 control. 10 Vdc signal drives toward spring return position.
Modulating: 2-10 Vdc	X ^c		Series 70 control. 2 Vdc signal drives toward spring return position.
Modulating: 10-2 Vdc	X ^c		Series 70 control. 10 Vdc signal drives toward spring return position.
Modulating: forward		X	Voltage input with adjustable zero and span. Minimum signal drives toward spring return position.
Modulating: reverse		X	Voltage input with adjustable zero and span. Maximum signal drives toward spring return position.
Service		X	Actuator hub stops in place and ignores control signal changes.
Auto-adapt		X	For setup only. Rescales to allow full input signal over mechanically limited stroke.

^a Feedback: MS75XXA,H and U.S. S... models are 2-10 Vdc, MS75XXB,E and European S... models are 0-10 Vdc.

^b Feedback: MS75XXA,H and U.S. S... models are 10-2 Vdc, MS75XXB,E and European S... models are 10-0 Vdc.

^c When operating in Modulating mode, the feedback signal matches the control signal.

Non-Standard Stroke

Mechanical Stroke Limit Reduction

For applications requiring a span less than 95 degrees, a simple adjustment can be made. When the rotational mounting of the shaft coupling is changed, the actuator drives less than the full 95 degree stroke.

The stroke is adjustable in 5 degree increments. Once adjusted, the actuator drives until the shaft coupling reaches the mechanical stop (part of the housing). The stop causes the

motor to discontinue driving and the shaft coupling drives no farther. When the actuator returns, it stops at the fail-safe position.

To set the fail-safe position, proceed as follows:

1. Remove the retainer clip from the shaft coupling and set it aside for later use.
2. Remove shaft coupling from the actuator.
3. Rotate the coupling to the desired fail-safe position, aligning it based on the stroke labelling. See Fig. 5.

S05, S10, S20 SERIES SPRING RETURN DIRECT COUPLED ACTUATORS

NOTE: The shaft coupling location determines the travel span.

EXAMPLE: Setting shaft coupling to an approximate fail-safe position of 35 degrees (as indicated on the housing) limits stroke to 60 degrees. (See Fig. 5)

4. Install the shaft coupling at this position.
5. Replace the retainer clip on the shaft coupling using the groove of the coupling.
6. If necessary, replace the holder and position indicator on the shaft coupling.

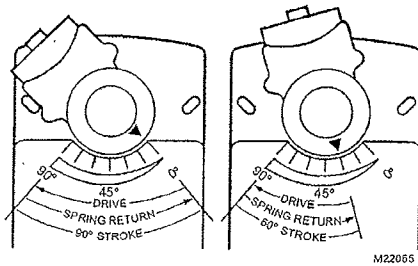


Fig. 5. Stroke reduction.

**Adjustable Zero and Span
(Enhanced Modulating Models only)**

These actuators have the capability of adjustable zero and span. Fig. 4 shows the dials. These dials are present only on the Enhanced Modulating models. A basic description of these dials follows:

- Zero: Sets input voltage to define the 0% angle of rotation. It is factory set to 0 Vdc, and can be adjusted up to 10 Vdc.
- Span: Adjusts motor response to travel full stroke through the selected input span. It is factory set to 10 Vdc, and is adjustable from 2 to 32 Vdc.

SET ADJUSTABLE ZERO AND SPAN

1. Apply 24 Vac to the actuator.
2. Turn the zero dial (see Fig. 4) past the desired start point.
3. Using either a controller or signal generator, apply an input signal equal to the start point signal.
4. Slowly adjust zero toward the minimum setting until the actuator hub begins to move.
5. Turn the span dial (see Fig. 4) to the minimum setting (2 Vdc).
6. Using either a controller or signal generator, apply an input signal equal to the desired end point signal.
7. Allow the actuator to open fully.
8. Slowly adjust span toward the maximum setting until the actuator hub moves slightly from fully open.
9. Carefully adjust span knob toward minimum until the actuator hub returns to fully open.

Auto-Adapt

When using these actuators for standard stroke applications, this function can be ignored. When it is desirable to use a mechanically limited stroke (see Mechanical Stroke Limit Adjustment section), it is possible to use the Auto-Adapt feature to rescale the input signal over the new limited stroke.

1. Rotate actuator control signal dial to Auto-Adapt.

NOTE: The actuator will drive open, then closed to establish the new open and closed positions.

2. Return the actuator control signal dial to the desired input signal position.

Manual Positioning

The actuator can be operated with no power present. Use this feature during installation or to move and lock the damper or valve shaft position when there is no power.

To operate the manual positioning:

1. If the power is on, turn it off.
2. Insert supplied hex wrench (key) as shown in Fig. 6.
3. Rotate key in the direction indicated on the cover.
4. Once the desired position is reached, hold the key to prevent the spring return from moving the actuator.
5. With the key held in place, use a screwdriver to turn the gear train lock pin in the indicated direction until the detent is reached.

NOTE: At the detent, the pin resists further rotation.

6. Remove the key without rotating it further.

To release the manual positioning with no power present:

1. Insert supplied key.
2. Turn key 1/4 turn in the direction indicated on the cover.
3. Remove key without engaging the gear train lock pin.
4. The spring will return actuator to the fail-safe position.

NOTE: Once power is restored, the actuator will return to normal automated control.

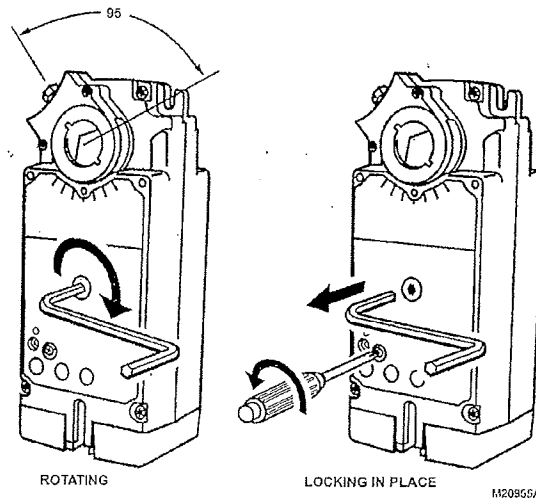


Fig. 6. Manual positioning.

Mounting

⚠ CAUTION

Device Malfunction Hazard.
Improper shaft coupling tightening causes device malfunction.
Tighten shaft coupling with proper torque to prevent damper shaft slippage.

⚠ CAUTION

Actuator Damage Hazard.
Using actuator as shaft bearing causes device damage.
Use actuator only to supply rotational torque. Avoid any side loads to actuator output coupling bearings.

⚠ CAUTION

Equipment Damage Hazard.
Can damage the motor beyond repair.
Never turn the motor shaft by hand or with a wrench.
Forcibly turning the motor shaft can damage the gear train.

To mount the actuator to an external drive shaft of a damper, proceed as follows:

1. Place actuator over damper shaft; and hold mounting bracket in place. See Fig. 8.
2. Mark screw holes on damper housing.
3. Remove actuator and mounting bracket.
4. Drill or center-punch holes for mounting screws (or use no. 10 self-tapping sheet metal screws).
5. Turn damper blades to desired normal (closed) position.
6. Place actuator and mounting bracket back into position and secure bracket to damper box with sheet metal screws.
7. Using 10 mm wrench, tighten shaft coupling securely onto damper shaft using minimum 120 lb-in. (13.6 N·m), maximum 180 lb-in. (20.3 N·m) torque.

NOTE: See Fig. 7 for proper mounting to a square damper shaft.

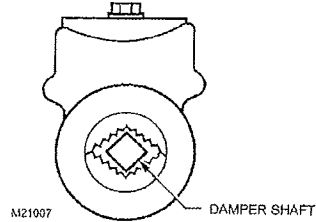
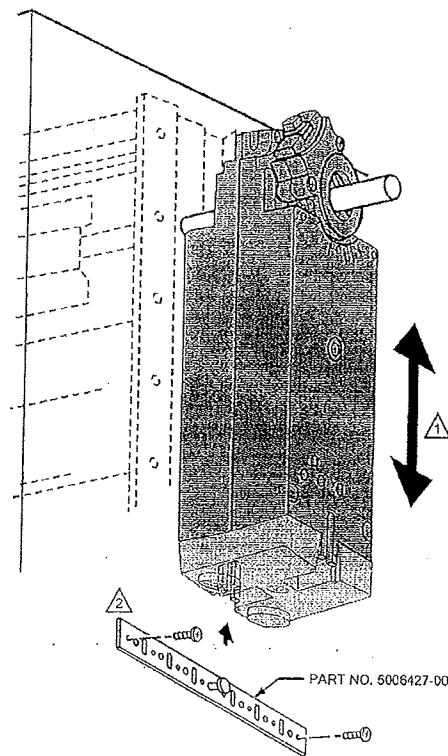


Fig. 7. Proper mounting to square damper shaft.



- 1 ENSURE THAT MOUNTING ASSEMBLY PREVENTS ACTUATOR ROTATION AND ALLOWS ACTUATOR TO FLOAT ALONG INDICATED AXIS. WHEN TOO TIGHT, THE RESULTING BINDING CAN DAMAGE THE ACTUATOR OR REDUCE TORQUE OUTPUT.
- 2 THE BRACKET CAN BE BENT TO ALLOW MOUNTING THE ACTUATOR PARALLEL TO THE MOUNTING SURFACE.

M20956

Fig. 8. Mounting actuator to damper housing.

WIRING

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard.
Disconnect all power supplies before installation.
Motors with auxiliary switches can have more than one disconnect.

IMPORTANT

All wiring must comply with local electrical codes, ordinances and regulations.

Access Cover Removal (Fig. 9)

⚠ CAUTION

Equipment Damage Hazard.
Improper cover removal can damage electric connections.
Pull the cover along the axis of the actuator.
The cover contains contact sockets that must connect to actuator contact pins.
Bending these pins can permanently damage the device.

NOTE: This cover can be removed before or after actuator mounting.

In order to wire the device, the access cover must be removed as follows:

1. Remove the screw from the center of the cover, set the screw aside.
2. Pull the cover along the long axis of the actuator.
3. If the actuator is not yet mounted, set it aside.
4. Remove conduit dust covers as necessary.
5. Thread wire through conduit holes.
6. Connect wires as appropriate to the terminal block(s). (See Fig. 10 and 11.)

NOTE: With US Models, use 1/2 in. NPS strain relief gland or 1/2 in. conduit adapters. Recommend using flex conduit.
With European Models, use M16 strain relief gland.

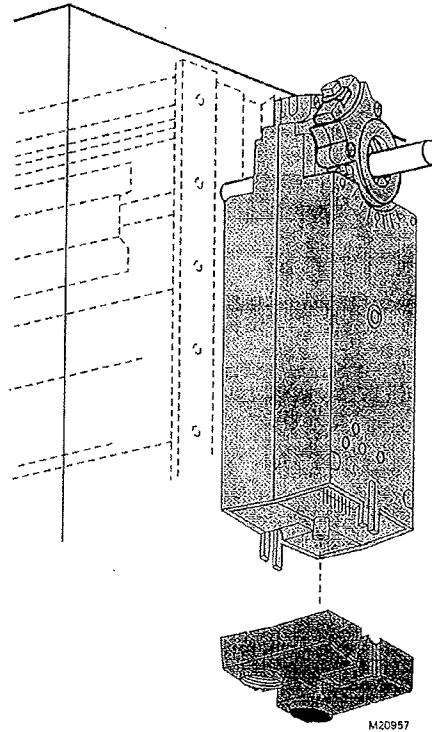


Fig. 9. Removing access cover.

Typical Wiring

See Fig. 10 through 26 for typical wiring details.

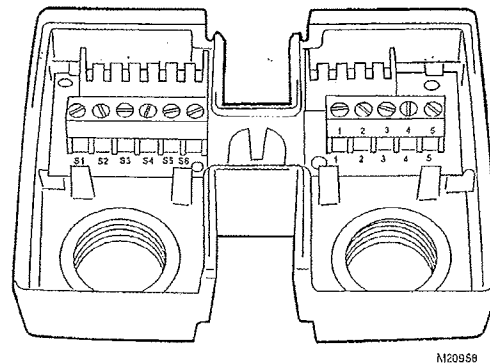


Fig. 10. Terminal block details.

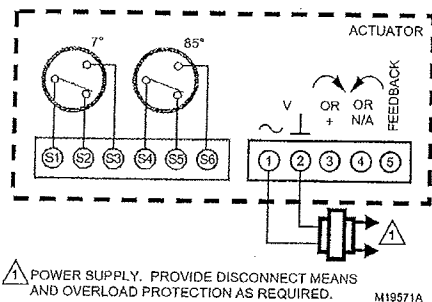


Fig. 11. Terminal block details.

Table 6. Wiring details.

Terminal	Floating	Modulating	Two-Position		Color ^a
			24 Vac	120 Vac 240 Vac	
1	~	power	power	power	Red
2	⊥	common	common	neutral	Black
3	↻	cw	—	—	White
4	↻	ccw	—	—	—
5	←	feedback	—	—	Brown

^a Only applies to models with wires.

Sxx24-2POS Models

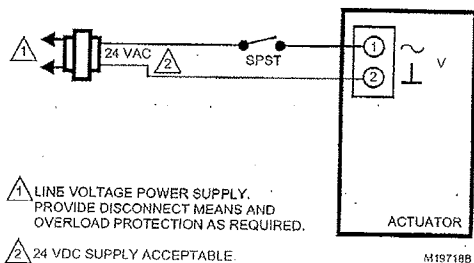


Fig. 12. Wiring for low-voltage two-position control.

Sxx120-2POS, Sxx230-2POS Models

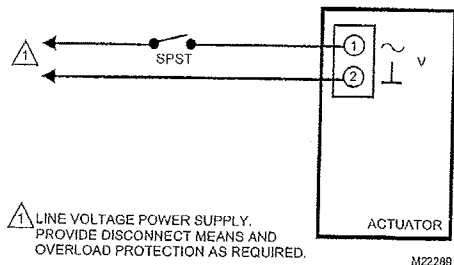


Fig. 13. Wiring for line-voltage two-position control.

Sxx010 Models

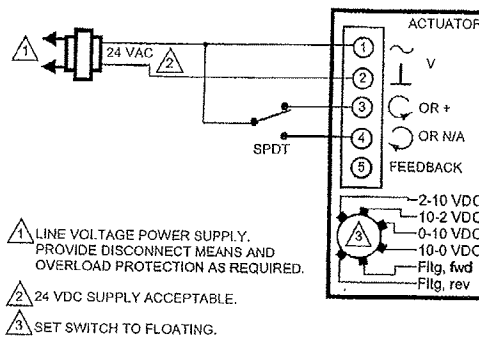


Fig. 14. Wiring for SPDT on/off control.

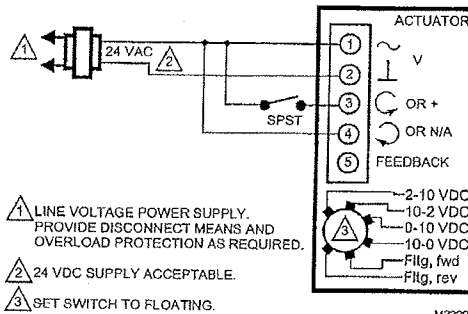


Fig. 15. Wiring for SPST on/off control.

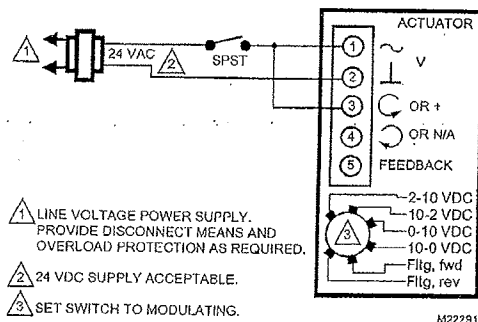


Fig. 16. Wiring for two-wire SPST on/off control.

S05, S10, S20 SERIES SPRING RETURN DIRECT COUPLED ACTUATORS

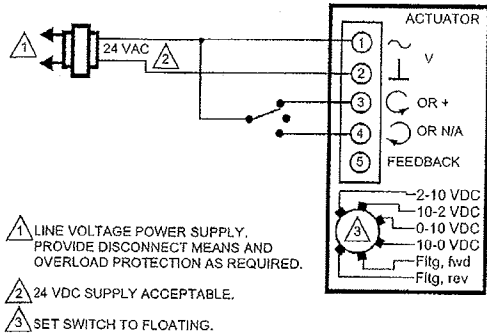


Fig. 17. Wiring for floating control.

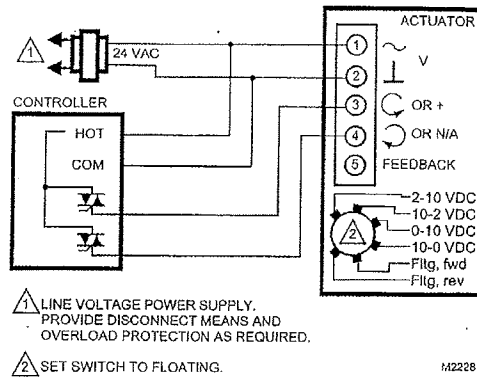


Fig. 20. Wiring for high side (triac source) floating control.

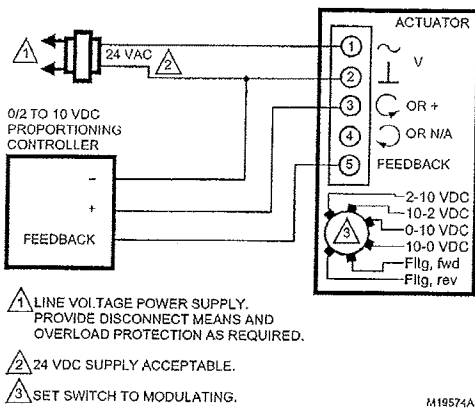


Fig. 18. Wiring for 0/2-10 Vdc proportioning controllers.

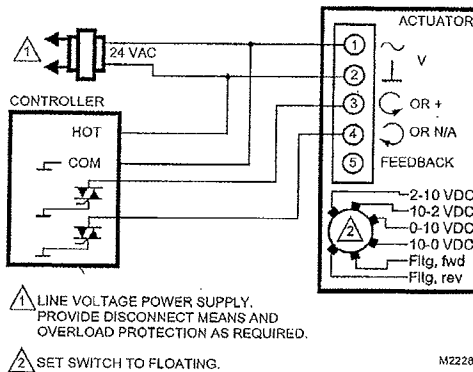


Fig. 21. Wiring for low side (triac sink) floating control.

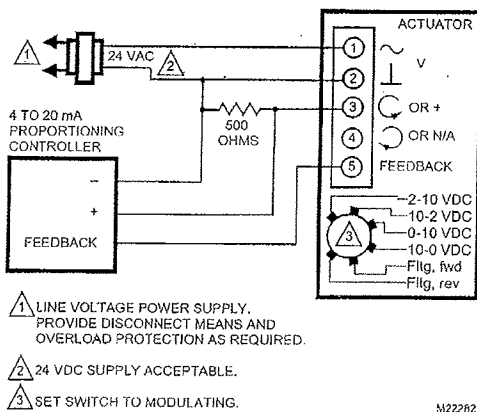


Fig. 19. Wiring for 4-20 mA proportioning controllers.

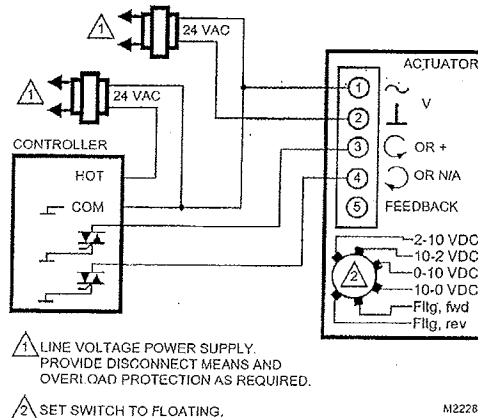


Fig. 22. Wiring for low side (triac sink) floating control using separate transformers.

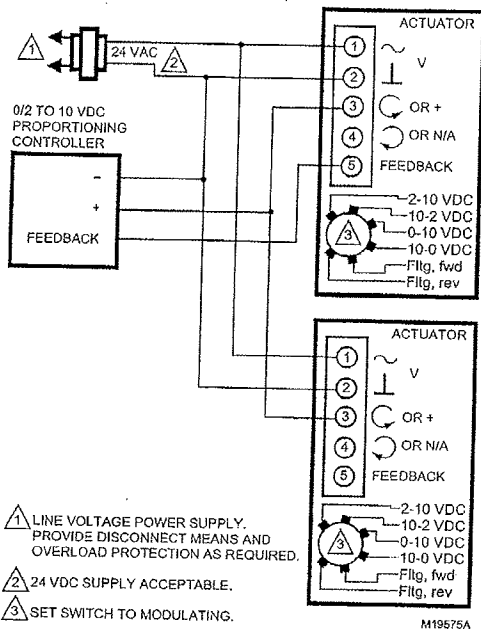


Fig. 23. Wiring for 0/2-10 Vdc proportioning controller operating multiple actuators.

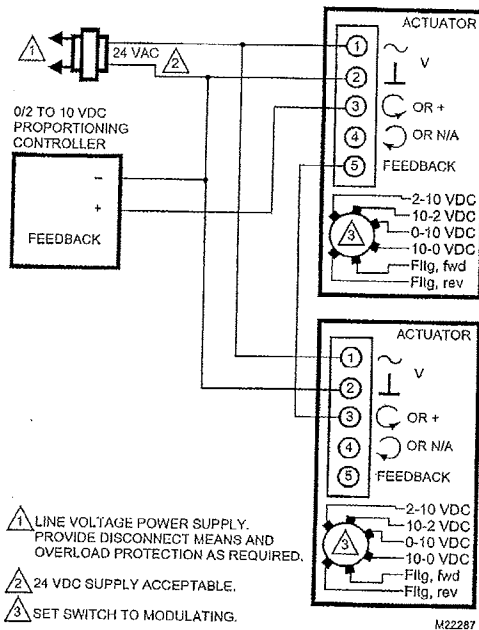


Fig. 25. Wiring for 0/2-10 Vdc proportioning controller operating multiple actuators as master/drone.

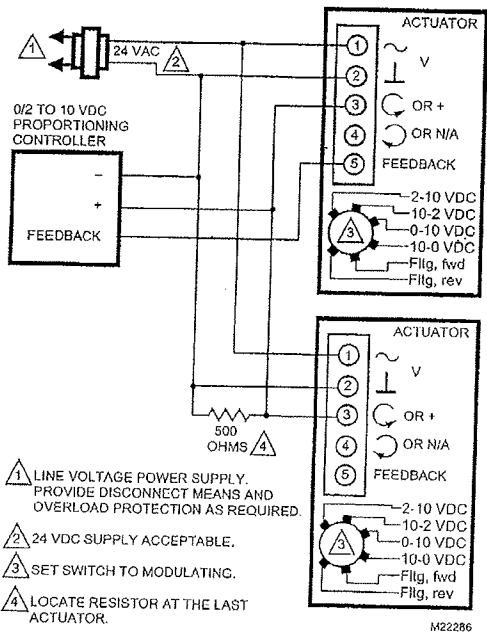


Fig. 24. Wiring for 4-20 mA proportioning controller operating multiple actuators.

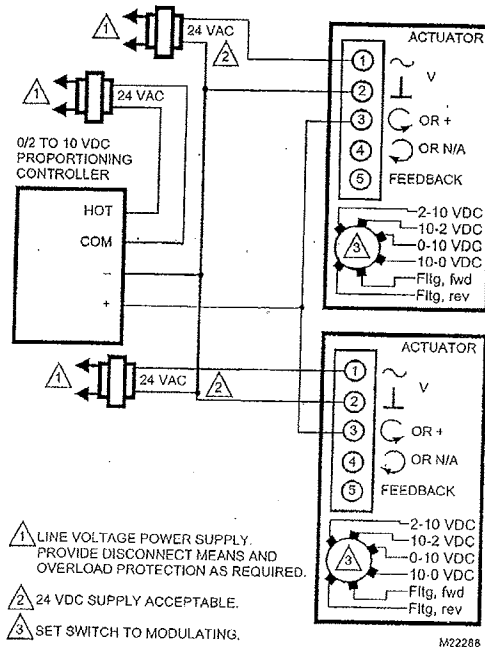


Fig. 26. Wiring for 0/2-10 Vdc proportioning controller operating multiple actuators with separate transformers.

OPERATION

The actuator is designed to be used in ventilating and air conditioning installations to operate valves, dampers, ventilation flaps and louvers requiring torque up to the rating. (For ratings, see the Specifications section.) If the power fails, the actuator will spring return to the start position.

The actuator is operated by a proportional controller. When using a proportional controller, the actuator drives toward its fully open position when the input signal increases; the actuator drives toward the fully closed position when the input signal decreases. The actuator stops when the input signal reaches the desired proportional control point.

IMPORTANT

The actuator is designed to respond to DDC Controller instantaneous contact closures. Take care not to short cycle the actuator. Unstable damper control can cause premature actuator failure.

Actuator Override

To override the control signal (for freeze protection or similar applications):

1. Override to full open:
 - a. Disconnect the input signal (from terminal 3).
 - b. Apply 24 Vac to terminal 3.
 - c. See Fig. 27.
2. Override to full closed:
 - a. Disconnect the input signal (from terminal 3).
 - b. See Fig. 28.

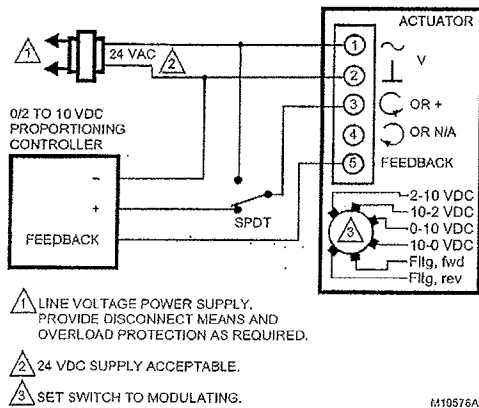


Fig. 27. Override to full open.

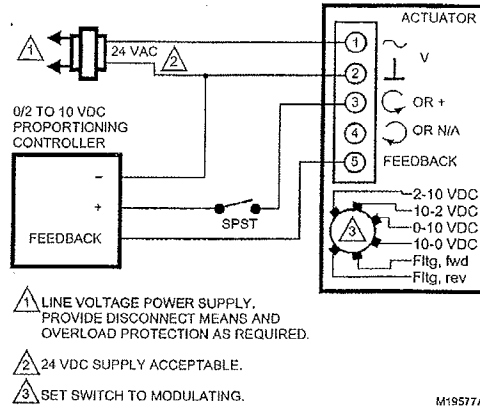


Fig. 28. Override to full close.

End Switches

Some models include end switches (see Table 2). For wiring details, see Fig. 11.

SPDT Switches (Fig. 29)

For SPDT end switch wiring, see Fig. 11.

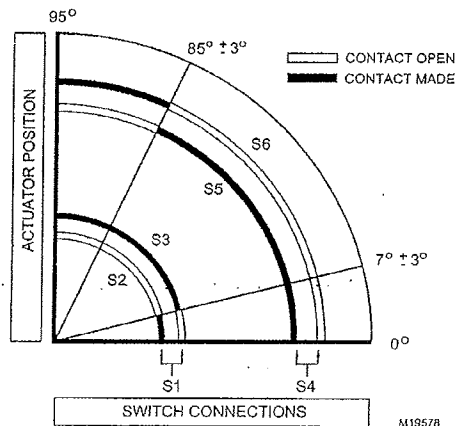






Fig. 29. SPDT End Switch Operation.

CHECKOUT

Modulating/Floating Operation

1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper).
2. Connect power to terminals 1 and 2. (See Fig. 11 and Table 6.)
3. Set "Mode Select" dial to desired control signal. (See Fig. 4 and Table 5.)
4. Apply control signal for actuator 100% position. (See Fig. 11 and Table 6.)
 - a. (0)2-10 Vdc: apply 10 Vdc signal to terminal 3.
 - b. 10-(0)2 Vdc: apply (0)2 Vdc signal to terminal 3.
 - c. (0)4-20 mA: apply 20 mA signal to terminal 3.
 - d. 20-(0)4mA: apply (0)4 mA signal to terminal 3.
 - e. Floating: apply 24 Vac to appropriate CW (3) or CCW (4) terminal.
5. Actuator drives to 100% position.
6. Apply control signal for actuator 0% position. (See Fig. 11 and Table 6.)
 - a. (0)2-10 Vdc: apply (0)2 Vdc signal to terminal 3.
 - b. 10-(0)2 Vdc: apply 10 Vdc signal to terminal 3.
 - c. (0)4-20 mA: apply (0)4 mA signal to terminal 3.
 - d. 20-(0)4mA: apply 20 mA signal to terminal 3.
 - e. Floating: apply 24 Vac to appropriate CW (3) or CCW (4) terminal.
7. Actuator drives to 0% position.

Spring Return Operation

1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper).
2. Connect power to terminals 1 and 2. (See Fig. 11 and Table 6.)

NOTE: For two-position models skip to step 5.





3. Set "Mode Select" dial to desired control signal. (See Fig. 4 and Table 5.)
4. Apply control signal for actuator 50% position. (See Fig. 11 and Table 6.)
 - a. Vdc Input Signal: apply 5-6 Vdc signal to terminal 3.
 - b. mA Input Signal: apply 10-12 mA signal to terminal 3.

- c. Floating: apply 24 Vac to appropriate CW (3) or CCW (4) terminal.
5. Allow the actuator to drive to 50% position.
 6. Disconnect wire from terminal 1.
 7. Actuator spring returns to 0% position.
 8. Re-connect wire to terminal 1, actuator drives towards 100% position.



Feedback Operation

1. Connect a multi-meter, set for Vdc, to terminals 2 and 5.
2. Apply the same signal as in step 4 of Modulating Operation.
3. The multi-meter reading increases to match the input signal as actuator drives towards 100% position.
4. Apply the same signal as in step 6 of Modulating Operation.
5. The multi-meter reading decreases to match the input signal as actuator drives towards 0% position.

Direct Checkout

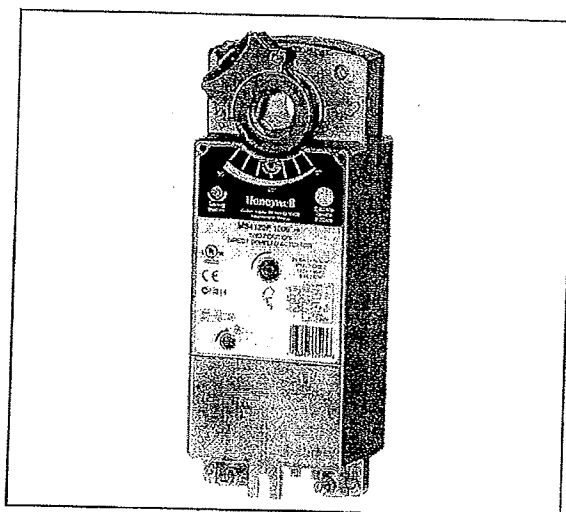
1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper).
2. Check damper position and make sure that 24 Vac is present at the appropriate connections. (See Fig. 10.)
3. Apply control signal to the appropriate connections to move the damper to the opposite position. The actuator should drive the damper.
4. If actuator does not run, verify that the actuator is properly installed for either clockwise  or counterclockwise  rotation.
5. If actuator is correctly installed and still does not run, replace the actuator.

Two-Position Checkout

1. Mount actuator for required application (either clockwise  or counterclockwise  rotation to open the damper).
2. Check damper position and make sure that power is present at terminals 1 and 2.
3. Actuator drives to 100% position.
4. Disconnect power from terminals 1 and 2.
5. Actuator spring-returns to 0% position.
6. If actuator is correctly installed and does not run, replace the actuator.

MS4120F, MS4620F, MS8120F, S2024-F, S20230-F Fast-Acting, Two-Position Actuators

PRODUCT DATA



FEATURES

- 175 lb-in. (20 N•m) minimum driving torque at 350°F (176°C).
- Reversible mounting facilitates use in either clockwise (cw) or counterclockwise (ccw) spring rotation.
- Integral spring return ensures level of return torque.
- Stainless steel internal spring.
- Fifteen-second spring return timing.
- No special cycling required during long-term holding. (See "Operation" on page 7.)
- No audible noise during holding.
- Patent pending design eliminates need for limit switches to reduce power consumption.
- Models available for 24, 120, and 230 Vac applications.
- Ninety-five degree angle of rotation.
- Actuator holds rated torque at reduced power level.
- Die-cast aluminum housing.
- Housing design allows flush mounting to damper.
- High-temperature indicator included.
- Self-centering shaft adapter (SCSA), patent pending.

APPLICATION

The MS4120F, MS4620F, MS8120F, S2024-F, and S20230-F Fast-Acting, Two-Position Actuators are spring return direct coupled actuators (DCA) for on/off damper control. The actuator accepts an on/off signal from a single-pole, single-throw (spst) controller. Reversible mounting allows actuator to be used for either clockwise (cw) or counterclockwise (ccw) spring rotation.

The MS4120F, MS4620F, and MS8120F DCA are designed to operate reliably in smoke control systems requiring Underwriter's Laboratories Inc. UL555S ratings up to 350°F.

MS4120F, MS4620F, MS8120F

- High temperature Teflon® lead wires.
- Designed to operate reliably in smoke control systems requiring Underwriter's Laboratories Inc. UL555S ratings up to 350°F.
- Models available with integral high temperature (350°F) SPST position-indicating switches (7°, 85° stroke).

S2024-F, S20230-F

- Double-insulation rating.
- Halogen-free, silicone-free leadwires.
- Models available with integral high temperature (350°F) SPDT position-indicating switches (7°, 85° stroke).

APPLICABLE LITERATURE

— Specification Data Sheet	63-2592
— Motor/Actuator Selection Guide for Damper Applications	63-8419
— Engineering Manual of Automatic Control (also called The Gray Manual)	77-1100
— Direct Coupled Actuator Quick Selection Guide	63-8553
— Damper Torque Calculator	63-8437

Contents

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SPECIFICATIONS

Models: See Tables 1, 2, and 3.

Table 1. MS4120F, MS4620F, MS8120F DCA Models.

Model	Voltage in Vac	Internal Auxiliary Switches
MS4120F1006	120	None
MS4120F1204	120	2 SPST ^a
MS4620F1005	230	None
MS4620F1203	230	2 SPST ^a
MS8120F1002	24	None
MS8120F1200	24	2 SPST ^a
S2024-F	24	None
S20230-F	230	
S2024-F-SW2	24	2 SPDT
S20230-F-SW2	230	

^a Internal SPST switches are designed to pass UL555S requirements (at 350°F).

Auxiliary Switches (SPST):

Ratings (maximum load): 250 Vac, 5A resistive, 3A inductive.
Settings (fixed): 7° nominal stroke, 85° nominal stroke.

Dimensions: See Fig. 1.

Device Weight: 7 lb (3.2 kg).

Temperature Ratings:

Ambient: -40°F to 130°F (-40°C to 55°C).
Shipping and Storage: -40°F to 140°F (-40°C to 60°C).

IMPORTANT

The actuator is designed to meet UL555S standards at 350°F (176°C). The actuator must be tested with the damper to achieve this rating.

Humidity Ratings: 5% to 95% RH noncondensing.

Stroke: 95° ± 3°, mechanically limited.

Minimum Damper Shaft Length:

1 in. (25 mm); 3-1/4 (83 mm) recommended.

Mounting: Self-centering shaft adapter.

Round Damper Shafts: 0.5 to 1.06 in.

Square Damper Shafts: 1/2 to 3/4 in.

Actuator can be mounted with shaft in any position.

IMPORTANT

- Honeywell does not recommend using linkages with these actuators because side-loading of the output hub reduces actuator life.
- 3/4 in. or greater shaft diameter recommended.

Electrical Ratings:

Power Input:

MS4120F: 120 Vac ±10%, 60 Hz.

MS4620F, S20230-F: 230 Vac ±10%, 50/60 Hz.

MS8120F, S2024-F: 24 Vac +20%, -10%, 50/60 Hz (Class 2).

Power Consumption:

MS4120F: Driving: 0.35A, 35W. Holding: 0.15A, 10W.

MS4620F, S20230-F:

Driving: 0.20A, 35W. Holding: 0.14A, 10W.

MS8120F, S2024-F: Driving: 45 VA. Holding: 10 VA.

Electrical Connections:

Lead Wires:

MS4120, MS4620, MS8120: 1m Teflon wire.

S2024-F, S20230-F: 1m halogen-free, silicone-free wire.

Two integral 3/8 in. flexible conduit connections.

Timing (At Rated Torque and Voltage):

Drive Open: 15 seconds typical.

Spring Close: 15 seconds typical.

Controller Type:

MS4120F: Line voltage (120 Vac), 2-position, spst (Series 40).

MS4620F, S20230-F: Line voltage (230 Vac), 2-position, spst (Series 40).

MS8120F, S2024-F: Low voltage (24 Vac), 2-position, spst (Series 80).

Torque Rating (at rated voltage):

Typical Holding (minimum at 350°F): 175 lb-in. (20 N·m).

Spring Return (minimum at 350°F): 175 lb-in. (20 N·m).

Stall Maximum (fully open at 75°F): 425 lb-in. (48.0 N·m).

350°F Minimum Driving: 175 lb-in. (20 N·m).

Design Life (at Rated Voltage): 30,000 full stroke cycles.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Home and Building Control Sales Office (check white pages of your phone directory).

2. Home and Building Control Customer Relations

Honeywell, 1885 Douglas Drive North

Minneapolis, Minnesota 55422-4386

Control Products

Honeywell AG, Böblinger Straße 17

D.71107 Schönaich, Germany

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.

International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Noise Rating at 1m (Maximum):
 Driving or Spring Return: 70 dBA.
 Holding: 20 dBA (no audible noise).

Environmental Protection Ratings:
 NEMA2 and IP54 when mounted on a horizontal shaft.

Table 2. Actuator Selection (MS Series).

M	Electrical Motor
S	Fail Safe Function (Spring Return)
41	120 Vac 2-position Control; Reversible Mount Spring Return
46	230 Vac 2-position Control; Reversible Mount Spring Return
81	24 Vac 2-position Control; Reversible Mount Spring Return
20	175 lb-in. (20 N·m)
F	Fire and Smoke (US)
1	No Feedback
0	No Auxiliary Switches
2	Two Auxiliary Switches
XX	System Controlled Numbers

M S 41 20 F 1 2 XX

Table 3. Actuator Selection (S20 Series).

S	Fail Safe Function (Spring Return)
20	20 N·m (175 lb-in.)
24	24 Vac 2-position Control; Reversible Mount Spring Return
230	230 Vac 2-position Control; Reversible Mount Spring Return
F	Fire and Smoke Actuator
	No Auxiliary Switches
-SW2	Two Auxiliary Switches

S 20 24 F -SW2

Approvals: See Table 4.

Accessories (not supplied with actuator):
 205649 Mounting Bracket (not supplied with actuator).

Table 4. Approvals.

	MS4120F	MS4620F, MS8120F	S20230-F, S2024-F
UL/cUL	X	X	
UL873 Plenum Rating, File No. E4436; Guide No. XAPX. ^a	X	X	
CE		X	X
C-TICK		X	X

^a Plenum applications require that conductors be enclosed in conduit (see Wiring section for conduit details).

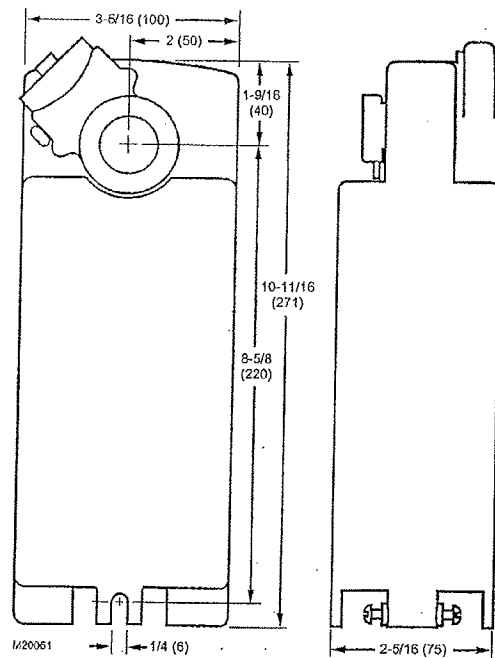


Fig. 1. Dimensional drawing of actuator in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

WARNING

Electrical Power Hazard.
Line voltage can cause death or serious injury and short equipment circuitry.
Disconnect power supply before installation.



CAUTION

Electrical Shock or Equipment Damage Hazard.
Low voltage can shock individuals or short equipment circuitry.
Disconnect power supply before installation.

IMPORTANT

All wiring must agree with applicable codes, ordinances and regulations.

Location

The actuators are designed to open a damper by driving the damper shaft in either a clockwise  or counterclockwise  direction. The actuator housing has two slots on the bottom, either of which, with a 205649 Mounting Bracket, secures it flush to a damper box (see Fig. 2).

NOTE: When mounted correctly, these slots allow the actuator to *float* without rotating relative to the damper shaft.

CAUTION

Equipment Damage Hazard.
Tightly securing actuator to damper housing can damage actuator.
Mount actuator to allow it to float along its vertical axis.

Preparation

Before mounting the actuator onto the damper shaft, determine the:

- Damper/valve opening direction for correct spring return rotation. The actuator can be mounted to provide clockwise or counterclockwise spring return.
- Damper shaft size (see Specifications section).

Determine Appropriate Mounting Orientation

See Fig. 2 for mounting orientation.

NOTES:

- Actuators are shipped in the fully closed position.
- An arrow molded into the hub points to tick marks on the label to indicate the hub rotary position.
- See Fig. 3 for proper mounting to a square damper shaft.

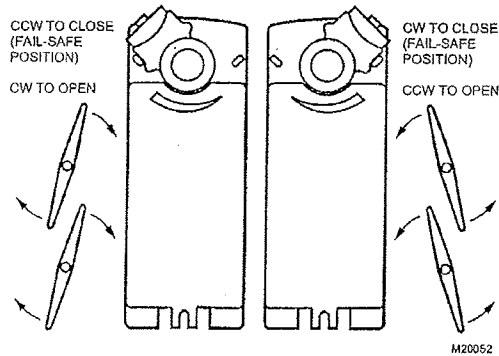


Fig. 2. Spring Return DCA mounting orientation.

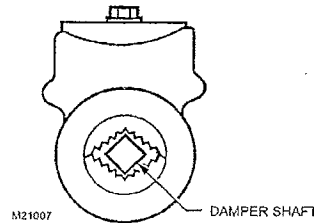


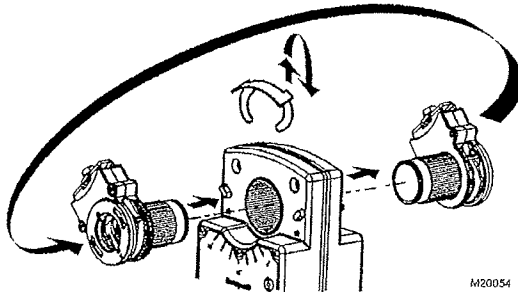
Fig. 3. Proper mounting to square damper shaft.

Measure Damper/Valve Shaft Length

If the shaft is less than three inches in length, the shaft coupling must be located between the damper/valve and actuator housing. If the shaft length is more than three inches, the shaft coupling may be located on either side of the actuator housing.

If the coupling must be moved from one side of the actuator to the reverse, follow these instructions (see Fig. 4):

1. Remove the retainer clip from the shaft coupling and set it aside for later use.
2. Remove shaft coupling from one side of the actuator.
3. Replace the shaft coupling on the opposite side of the actuator aligning it based on the stroke labelling.
4. Replace the retainer clip on the shaft coupling using the groove of the coupling.



M20054

Fig. 4. Mounting shaft coupling to actuator opposite side.

Mounting

⚠ CAUTION

Device Malfunction Hazard.
Improper shaft coupling tightening causes device malfunction.
Tighten shaft coupling with proper torque to prevent damper shaft slippage.

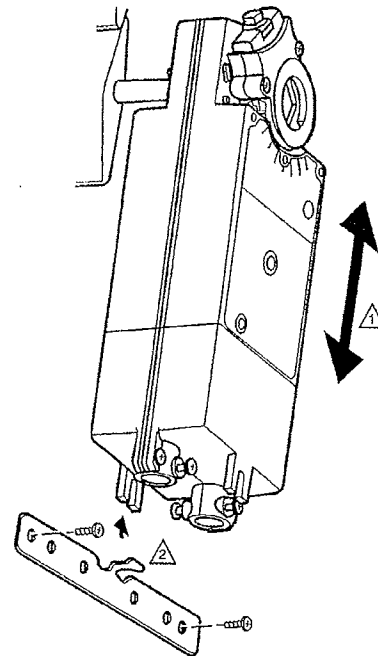
⚠ CAUTION

Actuator Damage Hazard.
Using actuator as shaft bearing causes device damage.
Use actuator only to supply rotational torque. Avoid any side loads to actuator output coupling bearings.

To mount actuator, proceed as follows:

1. Place actuator over damper shaft; and hold mounting bracket in place. See Fig. 5.
2. Mark screw holes on damper housing.
3. Remove actuator and mounting bracket.
4. Drill or center-punch holes for mounting screws (or use no. 10 self-tapping sheet metal screws).
5. Turn damper blades to desired normal (closed) position.

6. Place actuator and mounting bracket back into position and secure bracket to damper box with sheet metal screws.
7. Using 10 mm wrench, tighten shaft coupling securely onto damper shaft using minimum 120 lb-in., maximum 180 lb-in. torque.



⚠ ENSURE THAT MOUNTING ASSEMBLY PREVENTS ACTUATOR ROTATION AND ALLOWS ACTUATOR TO FLOAT ALONG INDICATED AXIS. WHEN TOO TIGHT, THE RESULTING BINDING CAN DAMAGE THE ACTUATOR OR REDUCE TORQUE OUTPUT.

⚠ ACCESSORY MOUNTING BRACKET IS NOT SUPPLIED WITH THE ACTUATOR. M20055

Fig. 5. Mounting actuator to damper housing.

WIRING

See Fig. 6 through 10 for typical wiring diagrams.

WARNING

Electrical Power Hazard.
Line voltage can cause death or serious injury and short equipment circuitry.
Disconnect power supply before installation.

CAUTION

Electrical Shock or Equipment Damage Hazard.
Disconnect all power supplies before installation.
Motors with auxiliary switches can have more than one disconnect.

IMPORTANT

1. All wiring must comply with local electrical codes, ordinances and regulations.
2. Voltage and frequency of transformer used with MS8120F and S2024-F must correspond with the characteristics of power supply and actuator.

NOTE: The conduit fittings are designed for use with 3/8 in. reduced-wall steel or aluminum flexible conduit.

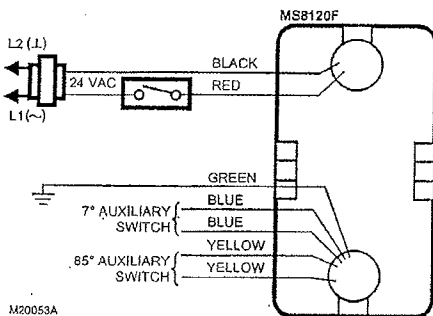


Fig. 6. Typical 24 Vac wiring (MS Series).

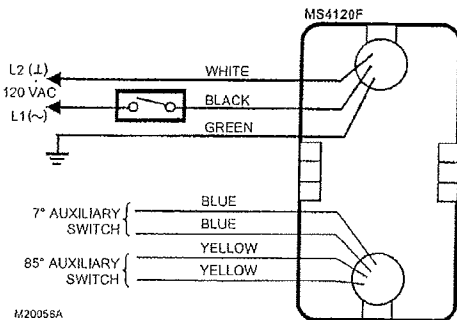


Fig. 7. Typical 120 Vac wiring (MS Series).

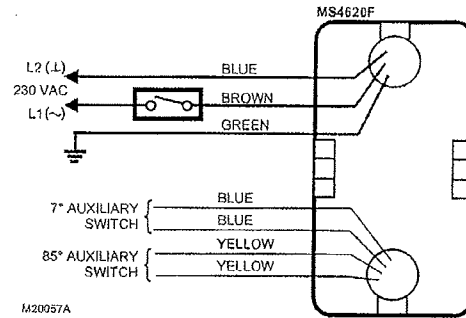


Fig. 8. Typical 230 Vac wiring (MS Series).

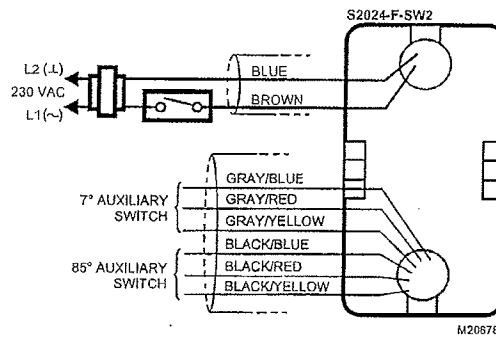


Fig. 9. Typical 24 Vac wiring (S20 Series).

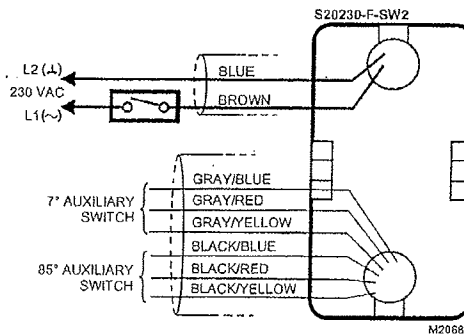


Fig. 10. Typical 230 Vac wiring (S20 Series).

OPERATION

The actuators are designed for use in Smoke Control Systems. If power fails, the actuator spring returns to the 0° position. The actuator mounts flush with the damper box. The actuator drives from 0° to 95° and spring returns back to 0°.

IMPORTANT

A break in power of less than one second can cause the actuator to spring-return 5 degrees or less and remain in place until a break in power of longer duration.

The actuators are operated by an spst two-position controller. When using an spst two-position controller, the actuator drives to the damper fully open position when controller contact makes and spring returns to the damper fully closed position when controller contact breaks. The actuator drops to holding power level on detection of stall, independent of hub position.

Cycling

The actuator and the internal spring are designed so that no special cycling during long-term holding is required. Honeywell recommends following all local, state, and national codes for periodic testing of the entire smoke control system. Refer to National Fire Protection Association (NFPA) National Fire Codes®: NFPA90A, NFPA92A, and NFPA92B for your application.

Temperature Indicator

The temperature indicator, located on the cover of the actuator, provides evidence that the ambient temperature has exceeded 200°F (93°C). This is an indication that something in the building has caused temperatures to rise well above the long-term actuator operation temperature. While the actuator is capable of operating at 350°F (176°C) for extended periods of time, this indicator provides a visual signal that the actuator has been exposed to high temperatures for an undetermined period of time. The indicator provides a visual indication to fire authorities regarding the extent of damage after an event in the building.

IMPORTANT

If the indicator turns black, replace the actuator.

NOTE: The actuator is designed to operate for 30 minutes during a one-time excursion to 350°F (176°C).

Auxiliary Switches

Some models include auxiliary switches (see Table 1).

SPST Switches (Table 5)

See Fig. 6 through 8 for SPST auxiliary switch wiring.

Table 5. SPST Auxiliary Switch Operation.

Switch	Wire Color	Makes	Breaks
		(degrees from fully closed position)	
7°	blue	less than 7	greater than 7
85°	yellow	greater than 85	less than 85

NOTE: Both sets of contacts are open when the actuator is between 7° and 85°.

SPDT Switches (Fig. 11)

See Fig. 9 through 11 for SPDT auxiliary switch wiring.

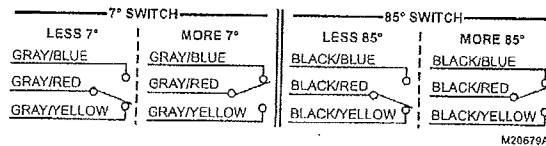


Fig. 11. SPDT auxiliary switch operation.

CHECKOUT

MS4120F (120 Vac model)

1. Verify that the indicator has not turned black (see Temperature Indicator section).
2. Check damper position.
3. Connect 120 Vac to the black and white leadwires to drive the damper to the open position. The actuator should drive the damper.
4. If the actuator does not run, remove power for at least two seconds.
5. If the actuator spring returns, allow it to close entirely, then return to step 3.
6. If the actuator does not spring return, verify that the actuator is properly installed. See Installation section.
7. If the actuator is correctly installed but neither runs nor spring returns, replace the actuator.

MS4620F, S20230-F (230 Vac models)

1. Verify that the indicator has not turned black (see Temperature Indicator section).
2. Check damper position.
3. Connect 230 Vac to the blue and brown leadwires to drive the damper to the open position. The actuator should drive the damper.

4. If the actuator does not run, remove power for at least two seconds.
5. If the actuator spring returns, allow it to close entirely, then return to step 3.
6. If the actuator does not spring return, verify that the actuator is properly installed. See Installation section.
7. If the actuator is correctly installed but neither runs nor spring returns, replace the actuator.

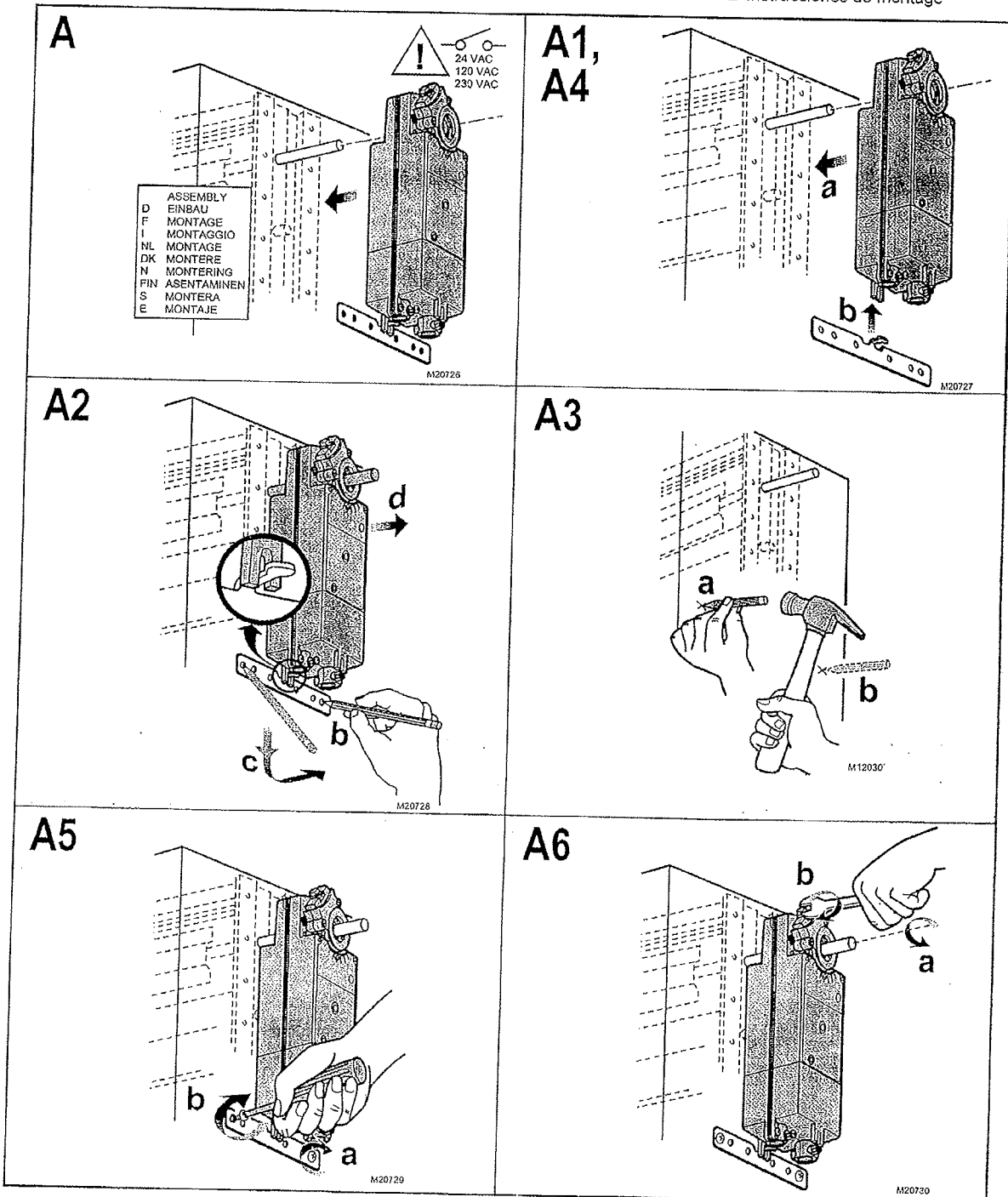
MS8120F, S2024-F (24 Vac models)

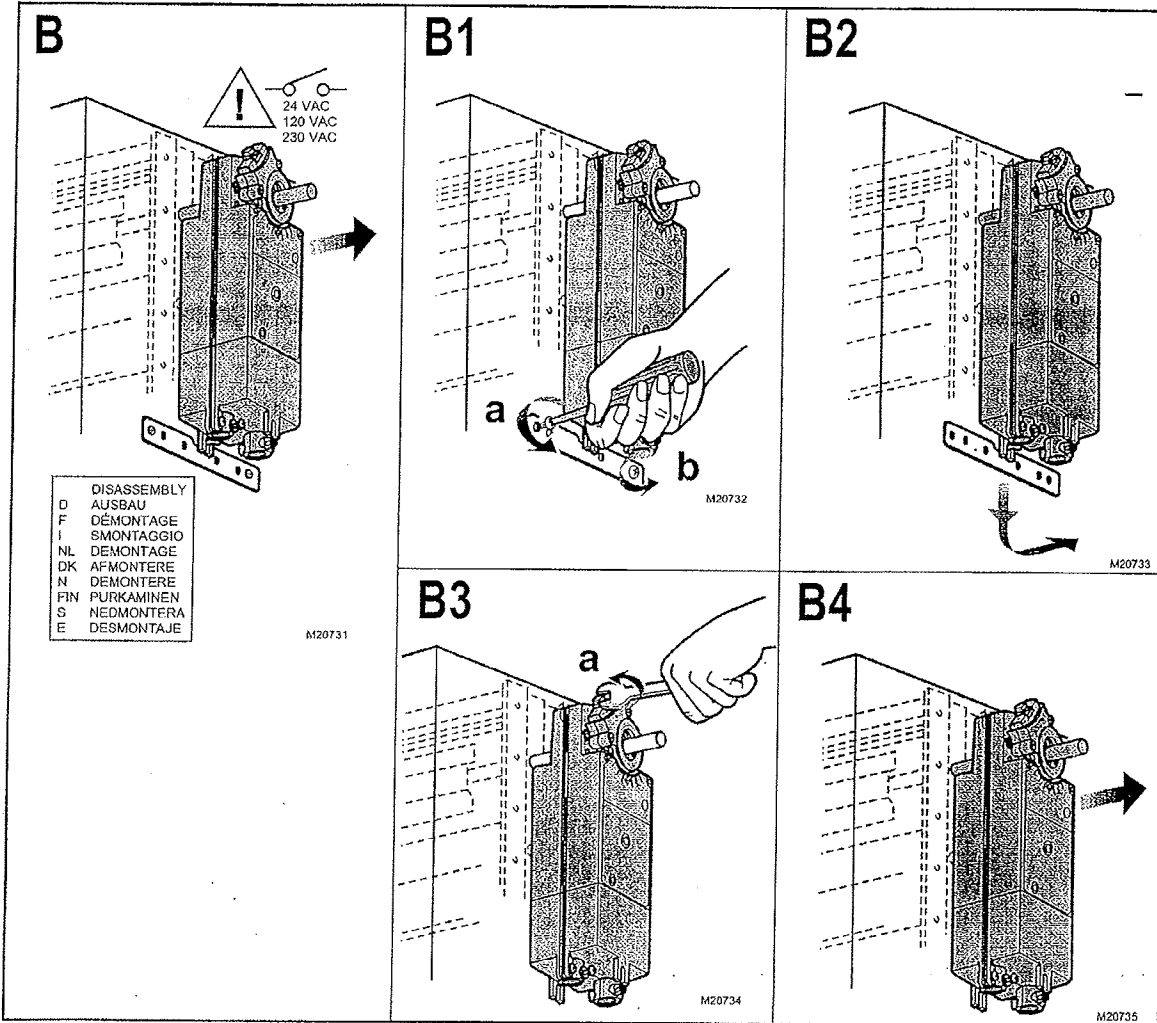
1. Verify that the indicator has not turned black (see Temperature Indicator section).
2. Check damper position.
3. Connect 24 Vac to the red and black leadwires to drive the damper to the open position. The actuator should drive the damper.
4. If the actuator does not run, remove power for at least two seconds.
5. If the actuator spring returns, allow it to close entirely, then return to step 3.
6. If the actuator does not spring return, verify that the actuator is properly installed. See Installation section.
7. If the actuator is correctly installed but neither runs nor spring returns, replace the actuator.

D Montageanweisung
 F Instructions d'Installation
 I Istruzioni per l'Installazione

NL Installatievoorschrift
 DK Installasjonsinstruks
 N Installationsinstruktionen

SF Asennusohje
 S Installations Instruktionen
 E Instrucciones de montaje





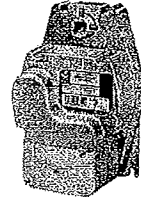
Verify -10 F & outdoor duty.

Honeywell

MS4209F, MS4309F, MS4709F, MS4809F, MS8209F, MS8309F

Fast-Acting, Two-Position Actuators

FOR FIRE/SMOKE CONTROL APPLICATIONS



The MS4209F, MS4309F, MS4709F, MS4809F, MS8209F, MS8309F Fast-Acting, Two-Position Actuators are spring return direct coupled actuators (DCA) with an integral junction box for on/off damper control. The actuator accepts an on/off signal from a single-pole, single-throw (spst) controller. Models are available with clockwise (cw) or counterclockwise (ccw) spring return and are designed to operate reliably in smoke control systems requiring Underwriter's Laboratories Inc. UL555S ratings up to 350°F.

SPECIFICATION DATA

FEATURES

- 80 lb-in. (9 N•m) minimum driving torque at 350°F (176°C).
- Integral spring return ensures level of return torque.
- Stainless steel internal spring.
- Fifteen-second spring return timing.
- No special cycling required during long-term holding.
- No audible noise during holding.
- Patent pending design eliminates need for limit switches to reduce power consumption.
- Models available for 24, 120, and 230 Vac.
- Ninety-five degree angle of rotation.
- Actuator holds rated torque at reduced power level.
- Die-cast aluminum housing.
- Housing design allows flush mounting to damper.
- Integral junction box with three conduit openings eliminates need for separate wiring box.

SPECIFICATIONS

Models:

Model	Spring Return Direction	Voltage in Vac	Torque in lb-in. (N•m)
MS4209F	cw	120	80 (9)
MS4309F	ccw		
MS4709F	cw	230	
MS4809F	ccw		
MS8209F	cw	24	
MS8309F	ccw		

Electrical Ratings:

- Power Input:
 - MS4209, MS4309: 120 Vac +10%, -15%, 60 Hz.
 - MS4709, MS4809: 230 Vac ±10%, 50/60 Hz.
 - MS8209, MS8309: 24 Vac +20%, -10%, 50/60 Hz.
- Power Consumption (at Rated Voltage):
 - MS4209, MS4309: Holding: 0.13A, 7W. Running (at 80 lb-in.): 0.25A, 23W.
 - MS4709, MS4809: Holding: 0.09A, 7W. Running (at 80 lb-in.): 0.13A, 23W.
 - MS8209, MS8309: Holding: 7 VA. Running (at 80 lb-in.): 23 VA.

Electrical Connections:

- MS4209, MS4309, MS8209, MS8309: Two color coded 16 in. leads.
- MS4709, MS4809: 1m appliance cable.
- Ground screw.
- Three 7/8 in. conduit connection holes (fittings not included).

Controller Type:

- MS4209, MS4309: Line voltage (120 Vac), two-position, spst (Series 40).
- MS4709, MS4809: Line voltage (230 Vac), two-position, spst (Series 40).
- MS8209, MS8309: Low voltage (24 Vac), two-position, spst (Series 80).

Device Weight:

- 5 lb (2.3 kg).

Temperature Ratings:

- Ambient: 0°F to 130°F (-18°C to 55°C).
- Shipping and Storage: -40°F to 140°F (-40°C to 60°C).

Humidity Rating:

- 5% to 95% RH noncondensing.

IMPORTANT

- The actuator is designed to meet UL555S standards at 350°F (176°C). The actuator must be tested with the damper to achieve this rating.
- Honeywell does not recommend using linkages with these actuators because side-loading of the output hub reduces actuator life.

Stroke:

- 95° ± 3°, mechanically limited.

Torque Rating (at Rated Voltage):

- Typical Holding (0°F to 350°F): 80 lb-in. (9 N•m).
- Typical Driving (0°F to 350°F): 80 lb-in. (9 N•m).
- Spring Return: 80 lb-in. (9 N•m).
- Stall Maximum: 240 lb-in. (27 N•m).

Noise Ratings (Maximum):

- Driving Open: 80 dBA at 1m.
- Holding: 20 dBA at 1m (no audible noise).

Timing (at Rated Torque and Voltage):

- Drive Open:
 - Ambient Conditions: 25 sec maximum, 14 sec typical.
 - At 350°F: 75 sec maximum.
- Spring Close: 20 sec maximum.

Design Life (at Rated Voltage):

- 60,000 full stroke cycles.

Minimum Damper Shaft Length:

- 1-1/2 in. (38 mm).



63-1292-6

MS4209F, MS4309F, MS4709F, MS4809F, MS8209F, MS8309F FAST-ACTING, TWO-POSITION ACTUATORS

Cycling Requirements:

- Prolonged holding-period (1 year) testing of these actuators has been performed with no spring return failures. The actuator and the internal spring are designed to require no special cycling during long-term holding.
- Honeywell recommends following all local, state and national codes for periodic testing of the entire smoke control system. Refer to National Fire Protection Association (NFPA) National Fire Codes[®]: NFPA90A, NFPA92A and NFPA92B for your application.
- NFPA recommends periodic examination of each fire/smoke damper (semi-annually or annually) to ensure proper performance.

Mounting:

- 3/8 to 1/2 in. square or round damper shafts.
- The actuator can be mounted with shaft in any position.
- Secure hub to shaft with:
 - MS4709, MS4809: Four 3 mm set screws. Use 3 mm Allen wrench to tighten set screws.
 - MS4209, MS4309, MS8209, MS8309: 1/4-28 UNF set screws. Use 1/8 Allen wrench to tighten set screws.

Environmental Protection Ratings:

	MS4209, MS4309	MS4709, MS4809, MS8209, MS8309
NEMA1	X	X
IP54		X

Approvals:

	MS4209, MS4309	MS4709, MS4809, MS8209, MS8309
UL/cUL	X	X
UL873 Plenum Rating, File No. E4436; Guide No. XAPX	X	X
CE		X
C-TICK		X

Accessories (not supplied with actuator):

- 201391 Shaft Adapter for 3/8 in. shafts.
- 205649 Mounting Bracket.
- 32003532-002 Dual Auxiliary Switch Package for UL555(S) applications.

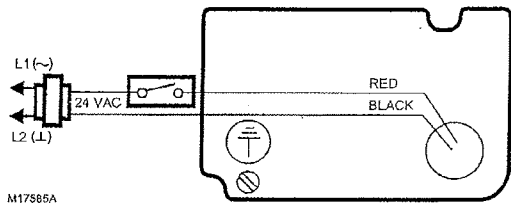


Fig. 1. Typical 24 Vac wiring.

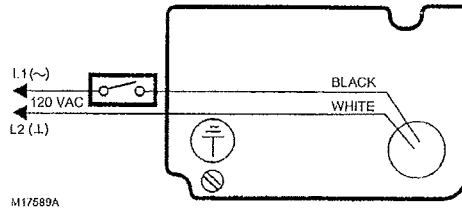


Fig. 2. Typical 120 Vac wiring.

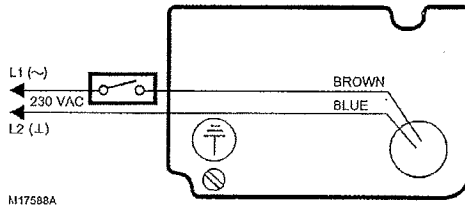
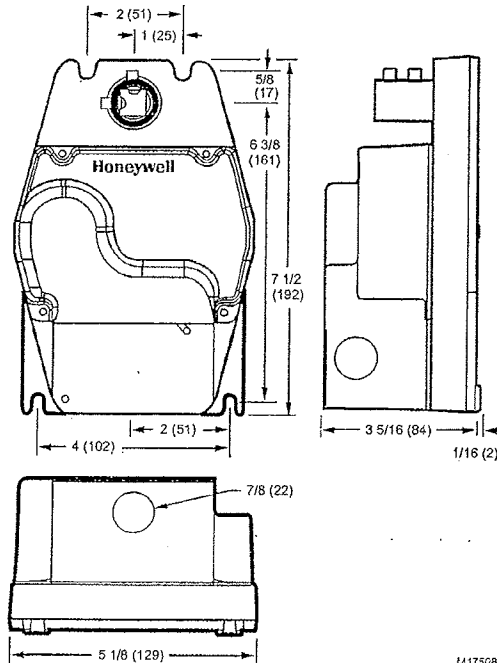


Fig. 3. Typical 230 Vac wiring.

Dimensions:



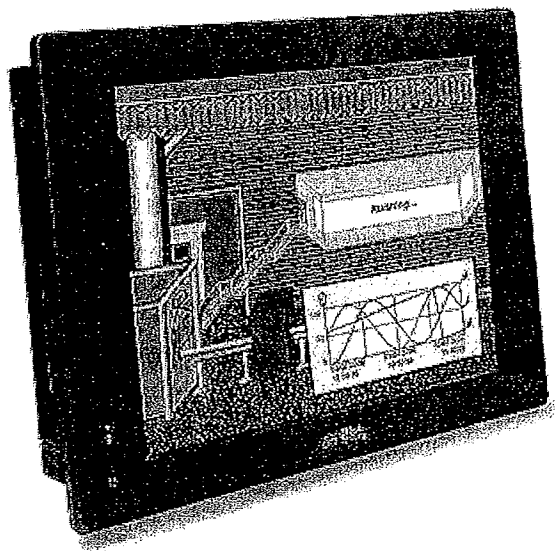
National Fire Codes[®] is a registered trademark of the National Fire Protection Association (NFPA).

Automation and Control Solutions

Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422
customer.honeywell.com

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Toronto, Ontario M1V 4Z9

Honeywell



Hardware Specifications

Model Part Number - PC215A

Display

Type - XGA Color TFT LCD
Size (Diagonal)- 15 inches [381 mm]
Size (W x H) - 12.1 x 9.1 inches [306 x 231 mm]
Resolution - 1024 x 768 pixels
Brightness - 350 cd/m²
Brightness Control- potentiometer on rear panel
Contrast- 400:1
Max. Colors - 16M (6-bit FRC)
Pixel Pitch (H x V) - 0.297 x 0.297 mm
Viewing Angle (T/B/R/L)- 40°/60°/60°/60°
Backlight - CCFL with 50,000 hour minimum life span

Touchscreen

Type - 7-wire analog resistive
Light Transmission - 82%
Life - 10 million keypresses

Hardware

Microprocessor - Intel® Celeron® 2.0GHz, expandable to Intel® Pentium 4® 2.8GHz
Memory Support - 256MB DDR, expandable to 1GB
Hard Drive - 40 GB standard, expandable to 80GB
Storage - IDE Compact Flash module optional

Drive Bays - for optional CD/DVD drive and 3.5" Floppy drive
USB - 2 x USB 2.0
VGA port - up to 1600 x 1200 pixels max.
Keyboard/mouse - 2 mini DIN ports
Audio - Line in/Line out/Mic in
Warranty - 1 year

Software

Operating System - Microsoft® Windows® XP Professional Edition

Physical Dimensions

Height - 11.8 inches [300 mm]
Width - 15.7 inches [400 mm]
Total Depth - 3.9 inches [100 mm]

Panel Cutout and Dimensional Drawings

Mechanical

Material - aluminum front bezel + electro galvanized steel chassis
Mounting - panel
VESA mounting support - 75mm/100mm VESA bracket optional
Wiring - AC input jack for power and D-style communication connectors
Weight - 20.9 pounds [9.5 kg]

Environment

Ratings - IP65, NEMA 4
Operating Temperature - 32 to 104° F [0 to 40° C]
Storage Temperature - -4 to 140° F [-20 to 60° C]
Relative Humidity - 20% to 90% (non-condensing)

Certifications

CE -Complies with EN50081-2 (1993) & EN50082-2 (1995)
FCC - 47 CFR, Part 15, Class A

Power Requirements

Input Voltage - 100 to 120 VAC @60Hz; or 200 to 240 VAC @50Hz
Power Requirements - 200W AC
Backup Battery - 3.0 V CR2032 for clock

Communication

Ethernet Port - 10/100/1000Mbps BaseT
Serial Ports - 4 COM ports, DE9S

COM1: RS232 (Pin 9 support for +5V or +12V)
COM2: RS232/422/485 (Pin 9 support for +5V only)
COM3: RS232
COM4: RS232
Parallel Printer - DB25S supports SPP/EPP/ECP

Upgrade Options

Microprocessor Upgrade -

- Intel Celeron 2.4 Ghz
- Intel Celeron 2.6 Ghz
- Intel Celeron 2.8 Ghz
- **Intel Pentium 4 2.4 Ghz**
- Intel Pentium 4 2.8 Ghz

Memory Upgrade -

- 512 MB DDR
- 1 GB DDR

Hard Drive Upgrade -

- 3.5" 80 GB

CD/DVD Add-On -

- Slim CD-ROM drive
- Slim CD-RW drive
- Slim DVD-R drive
- **Slim DVD-RW drive**

Floppy Drive Add-On -

- Slim 1.44" Floppy Disk Drive

Compact Flash Drive Add-On -

- IDE CompactFlash Card Module

Other upgrade options and accessories may be available. Contact Maple Systems at 425.745.3229 for pricing and more information.

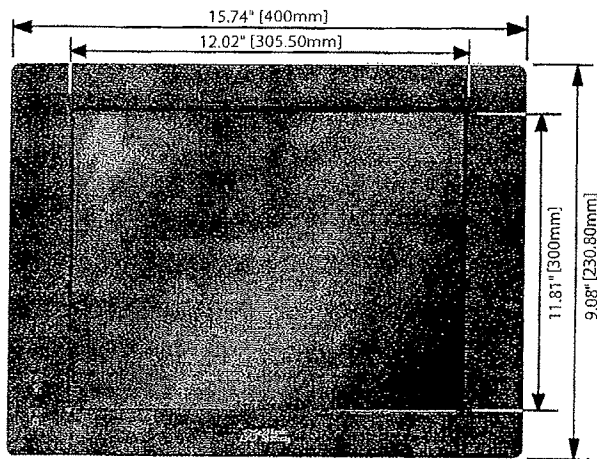
Maple Systems, Inc.

http://www.maplesystems.com
Last revised August 29, 2006

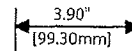
Dimensional Outline, PC215A



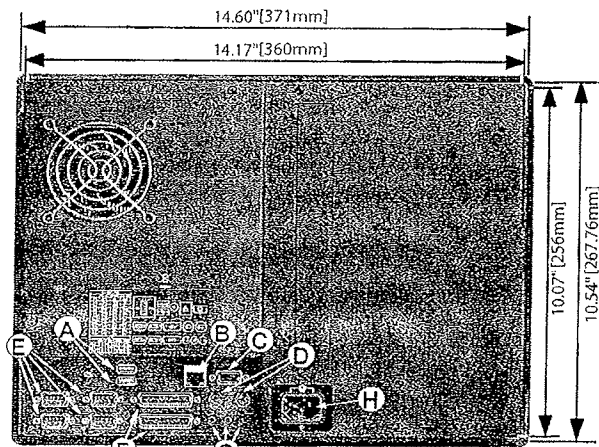
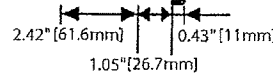
Top View



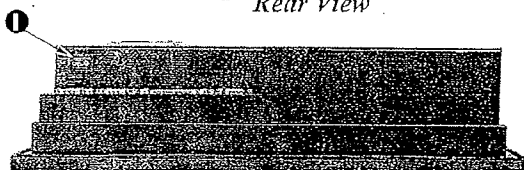
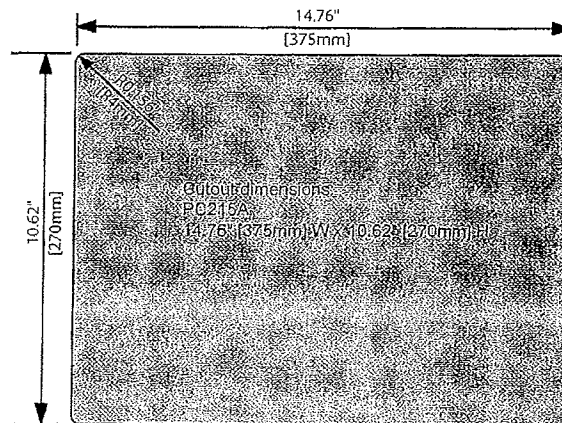
Front View



Side View



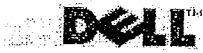
Rear View



Bottom View

- | | | |
|------------------------|--|--|
| A 2 x USB 2.0 | D Mouse and Keyboard | F Parallel Port (SPP/EPP/ECP) and Digital I/O port (8D1/8D0) |
| B LAN 10/100/1000 Mbps | E 4 x COMs (pin 9 support +5V or +12V), COM2 for RS232/422/485 | G Audio Line-in, MIC and Line-out |
| C VGA 1600 x 1200 max. | | H AC Jack (200W) |
| | | I ON/OFF Switch |

Dimensions are in inches [mm]



Print this page | Close

Dell recommends Windows Vista® Business.

Print Summary



Dell Precision 490

Estimate Payments | Apply


Discount Details

Preliminary Ship Date: 2/15/2008²

My Selections All Options

- Dell Precision 490

Date	2/8/2008 1:51:57 PM Central Standard Time		
Catalog Number	4 Retail 04		
Catalog Number / Description	Product Code	SKU	Id
Processor:			
Dual Core Intel® Xeon® Processor 5140 (2.33GHz, 4M234 4MB L2,1333)		[222-3800]	1
Operating System:			
Genuine Windows® XP Professional, SP2 with Media	XPP2E	[310-8617][420-4860]	11
Graphic Cards:			
128MB PCIe x16 nVidia Quadro NVS 285, Dual DVI or Dual VGA Capable	NV285DV	[320-4761]	6
Memory:			
2GB, DDR2 SDRAM FBD Memory, 667MHz, ECC (4 DIMMS)	2G4E6	[311-6401]	3
CD-ROM, DVD, and Read-Write Devices:			
16X DVD+/-RW w/ Cyberlink PowerDVD™ and Roxio Creator™ Dell Ed	DVRW16	[313-4287]	16
Hard Drive Configuration:			
C1 All SATA drives, Non-RAID, 1 or 2 drive total configuration	SATA12	[341-3425]	9
Boot Hard Drive:			
250GB SATA 3.0Gb/s, 7200 RPM NCQ Hard Drive with 8MB DataBurst Cache™	250ST	[341-3409]	8
Monitors:			
Dell 20 inch UltraSharp™ 2007FP Widescreen, adjustable stand, VGA/DVI	2007FPW	[320-4686]	5
Labels:			
Genuine Windows® XP Sticker	VC	[466-2909]	750
Sound Card and 1394:			
No 1394aCard or Sound Blaster Audigy™ 2(D) Card selected	NS1394	[313-4164]	17

Keyboard: USB Entry Quietkey, No Hot Keys	U	[310-7949]	4
Mouse: Dell USB 2-Button Mechanical Mouse with Scroll	ELD	[310-7959]	12
Floppy Drive and Media Card Reader Options: 3.5 inch 1.44MB Floppy Drive	FD	[341-3690]	10
Speakers: No Speaker option	NSPKR	[313-2663]	18
Modem: Dell™ Data/Fax PCI Modem	MDM	[313-4151]	14
Productivity Software: Microsoft® Office 2007 Basic and Adobe Acrobat 8.1 STD	WS27BC	[410-1099][420-6711]	22
Security Software: Norton Internet Security™ 2007 15 Month Subscription	NIS15EV	[410-0860]	25
Resource CD: No Resource CD	NORCD	[313-3673]	21
SERVICES & SUPPORT PLANS: 3 Year Basic Limited Warranty and 3 Year NBD On-Site Service	U3YOS	[986-9592][987-4080][989-9517] [989-9518]	29
On-Site System Setup: No Onsite System Setup	NOINSTL	[900-9987]	32
Purchase Intent: Purchase is not intended for resale.	NOT4SEL	[462-4506]	138
<ul style="list-style-type: none"> • Dell 1125 Multifunction Laser Printer 			
Date	2/8/2008 1:51:57 PM Central Standard Time		
Catalog Number	4 Retail 04		
Catalog Number / Description	Product Code	SKU	Id
Dell Multi-Function Laser Printer 1125: Dell Multi-Function Laser Printer 1125	1125PR	[223-0918]	1
Hardware Support Services: 1 yr Ltd. Warranty- Advance Exchange	AE1YR	[982-7800][986-4807][986-8317]	29
 Print			

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¹ Monthly payment based on 48-month Fair Market Value ("FMV") QuickLease and does not include taxes, fees, shipping and handling charges. Your monthly payment may vary, depending on your creditworthiness. QuickLease arranged by Dell Financial Services L.P. ("DFS"), an independent entity, to qualified Small Business customers. Minimum transaction size of \$500 required. At the end of the FMV QuickLease, you can: purchase the equipment for the then FMV, renew the lease or return the equipment to DFS. Please contact your DFS representative for further details. All terms subject to credit approval and availability, and are subject to change without notice.

² The Preliminary Ship Date represents the estimated time it takes to process your order and custom build your computer based on approved credit card purchase. The Preliminary Ship Date is not intended to provide you with an actual estimated ship date. Your estimated ship date may vary based upon the payment method you choose and other factors. You will receive your Estimated Ship Date in your e-mail confirmation. Customers using E-Check as their method of payment should add 3 days to their Preliminary Ship Date.

RELAYS & CONTACTORS

IDEC GENERAL PURPOSE RELAYS RH / RR SERIES

DESCRIPTION

IDEC General Purpose Relays are available in the RH Series Midget Relays and the RR Series Power Relays. The RH Series Midget Relays are compact in size to reduce space requirements and have a full 10 amp switching capacity. RH Series Relays are available in SPDT, DPDT, 3PDT, and 4PDT contact configurations driven by AC or DC coils and have blade mount terminals.

The RR Series Power General Purpose Relays have a 10 amp contact rating and are characterized by their high reliability and long life. They are suited for use in industrial grade equipment, control equipment, communications and motor loads up to 1/4 horsepower. IDEC RR Series Relays are available in SPDT, DPDT and 3PDT configurations driven by AC or DC coils and have pin or blade type terminals.



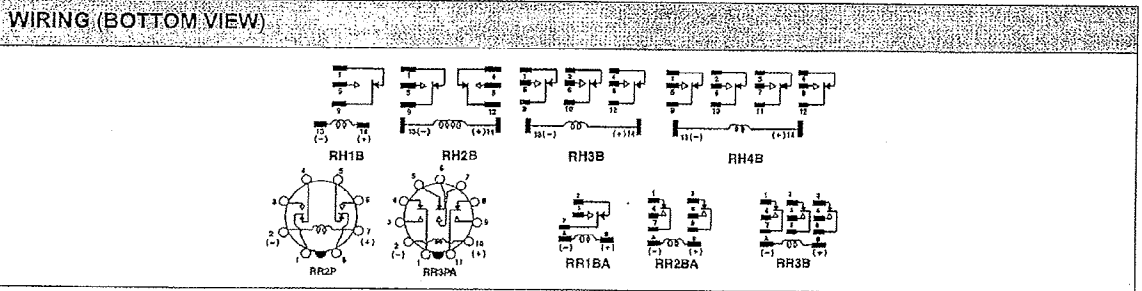
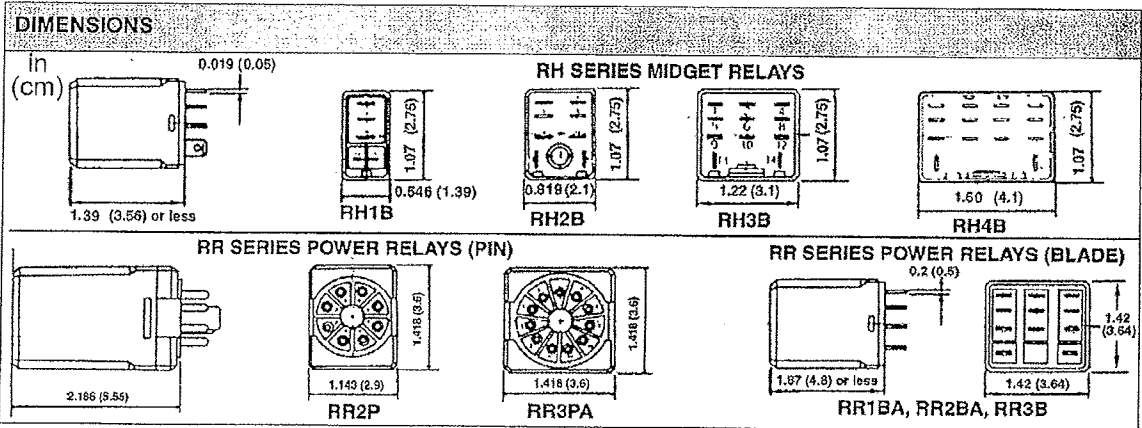
FEATURES

- General purpose power and midget styles
- 10 amp contact rating
- Indicator light and/or check button available
- Surface or DIN rail mount
- UL recognized and CSA certified

SPECIFICATIONS													
COIL RATINGS - RH SERIES					CONTACT RATINGS - RH SERIES (UL RATINGS)								
Rated Voltage (V)	Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±15% at 20°C				
	60 Hz				50 Hz								
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT			
AC	12	75	100	140	165	86	118	165	196	176.8	39.3	25.3	21.2
	24	37	50	70	83	42	59.7	81	98	300	153	103	84.5
	120	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	7680	4170	2770	2220
	240	3.2	5.5	7.1	8.3	3.7	6.5	8.2	9.8	31200	15210	12100	9120
DC		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
	12	64		75		120		125		168	160	100	96
	24	32		36.9		60		62		750	650	400	385
COIL RATINGS - RR SERIES					CONTACT RATINGS - RR SERIES (UL RATINGS)								
Rated Voltage (V)	Rated Current (mA) ±15% at 20°C			Coil Resistance (Ω) ±10% at 20°C		Voltage (V)	RESISTIVE (A)	INDUCTIVE (A)	MOTOR LOAD				
	60 Hz		50 Hz										
AC	12	210		245		240 AC	10	7	1/3 hp				
	24	105		121		120 AC	10	7.5	1/4 hp				
	120	20.5		24		30 DC	10	7	-				
	240	10.5		12.1									
DC	12	120			100								
	24	60			400								
Maximum continuous applied voltage					110% of rated voltage AC/DC @ 20°C								
Minimum operating voltage					80% of rated voltage AC/DC @ 20°C								
Drop-out voltage					30% or more of the rated voltage AC								
					10% or more of the rated voltage DC								
Contact material					RH Silver cadmium oxide								
					RR Silver								
Contact resistance					RH 50 mΩ maximum (initial)								
					RR 30 mΩ maximum (initial)								
Operate time					25 msec max								
Release time					25 msec max								
Minimum load					RH 24 VDC/30 mA, 5 VDC/100 mA								
					RR 24 VDC/10 mA, 5 VDC/20 mA								
Operating Temp.					-22° to 158°F (-30° to 70°C)								
Approvals					UL recognized, file #E87770, E59804								
					E64245								
					CSA certified, file #LR35144								
					CE certified								

RELAYS & CONTACTORS

IDEC GENERAL PURPOSE RELAYS RH / RR SERIES



ORDERING INFORMATION

RH1B	Midget Relay, Single Pole Double Throw SPDT, Blade (Use SH1B-05 Socket)
RH2B	Midget Relay, Double Pole Double Throw DPDT, Blade (Use SH2B-05 Socket)
RH3B	Midget Relay, Three Pole Double Throw 3PDT, Blade (Use SH3B-05 Socket)
RH4B	Midget Relay, Four Pole Double Throw 4PDT, Blade (Use SH4B-05 Socket)
RR2P	Power Relay, Double Pole Double Throw, DPDT, 8-Pin (Use SR2P-05 or SR2P-06 Socket)
RR3PA	Power Relay, Three Pole Double Throw, 3PDT, 11-Pin (Use SR3P-06 Socket)
RR1BA	Power Relay, Single Pole Double Throw SPDT, Blade (Use SR3B-05 Socket)
RR2BA	Power Relay, Double Pole Double Throw DPDT, Blade (Use SR3B-05 Socket)
RR3B	Power Relay, Three Pole Double Throw 3PDT, Blade (Use SR3B-05 Socket)
U	Standard Relay, UL Recognized
UT	Top Bracket Mounting (RH Series only)
(UL)	Indicator Light (RH1B-L not UL Recognized)
UC	Check Button (Not RH1B)
ULC	Indicator Light and Check Button (Not RH1B)
AC	AC coil
DC	DC coil
12V	12 Volts
24V	24 Volts
120V	120 Volts
240V	240 Volts

Example: RH3B-ULAC24V - Three pole double throw midget blade relay with indicator light and 24 VAC coil.

Related Products

SH / SR Series Relay Sockets BAM-1000 or DIN-3F Mounting DIN Rail




310 South Union Street
 P.O. Box 368
 Russiaville, Indiana
 46979-0368

Office (765) 883-5538
 Orders (800) 888-5538
 Fax (765) 883-7505
 Email sales@functionaldevices.com

<http://www.functionaldevices.com>



RIBUTC Enclosed Relay 10 Amp SPDT with 10-30 Vac/dc/120 Vac Coil



Functional Devices, Inc. A600A 2003

CONTACT RATINGS

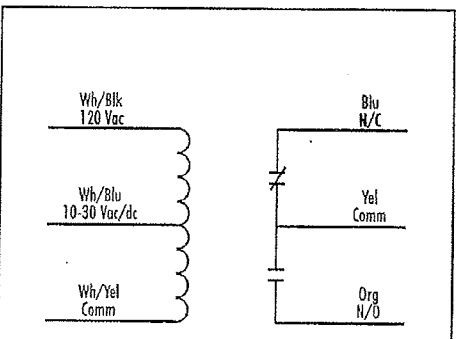
10 Amp resistive	120-277 Vac
10 Amp resistive	28 Vdc
480 VA Pilot Duty	240-277 Vac
480 VA Ballast	277 Vac
600 Watt Tungsten	120 Vac N.O.
240 Watt Tungsten	120 Vac N.C.
1/3 HP for N.O.	120-240 Vac
1/6 HP for N.C.	120-240 Vac
1/4 HP for N.O.	277 Vac
1/8 HP for N.C.	277 Vac

COIL CURRENT

30 mA @ 10 Vac	12 mA @ 10 Vdc
32 mA @ 12 Vac	14 mA @ 12 Vdc
42 mA @ 24 Vac	16 mA @ 24 Vdc
50 mA @ 30 Vac	18 mA @ 30 Vdc
25 mA @ 120 Vac	

COIL VOLTAGE INPUT

10-30 Vac/dc, 120 Vac; 50-60 Hz
 DROP OUT = 2.1 Vac / 2.8 Vdc
 PULL IN = 9 Vac / 10 Vdc



GENERAL SPECIFICATIONS

Relays & Contact Type: One (1) SPDT Continuous Duty Coil
 Expected Relay Life: 10 million cycles minimum mechanical
 Operating Temperature: -30 to 140° F
 Operate Time: 20mS
 Relay Status: LED On = Activated
 Dimensions: 1.7" x 2.8" x 1.5" with 1/2" HPT nipple
 Wires: 16", 600V Rated
 Approvals: UL Listed, UL916, UL864, C-UL Canada
 California State Fire Marshal
 Housing Rating: Plenum, NEMA 1
 Gold Flash: Yes
 Override Switch: No

NOTES:



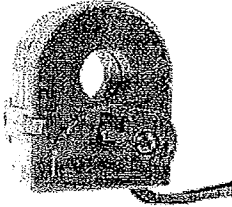
Functional Devices, Inc.
 310 South Union Street
 Russlerville, IN 46979
 www.FunctionalDevices.com

Office 765.883.5538
 Sales 800.888.5538
 Fax 765.883.7505
 Email sales@functionaldevices.com

RIBXK420 SERIES

CURRENT TRANSDUCER

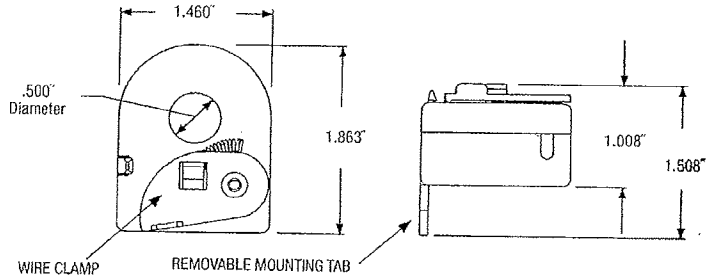
Enclosed 20, 50, and 100 Amp Current Transducers with Loop Powered 4-20 mA Output (Pre-Wired)



SPECIFICATIONS

Operating Temperature: -30 to 140° F
 Wires: Red & Black, 16", 18 AWG, 600V Rated
 Sensor Type: Internal, with 4-20 mA Transmitter Output
 Sensor Range: 0-20 Amps, 0-50 Amps, or 0-100 Amps
 (See Selection Guide Below)
 Accuracy: 96.4% FS
 Linearity: 99% FS (25%-100% Span)
 Max Output Current: 30 mA
 Max Sense Voltage: 600 Vac
 Approvals: UL Listed, UL916, UL864, C-UL, CE
 Housing Rating: Plenum, NEMA 1

Mounting/Installation: Removable mounting tab provided. The wire clamp locks against the load wire, securing the unit in place.



MAXIMUM OUTPUT LOAD RESISTANCE SUPPLY VOLTAGE

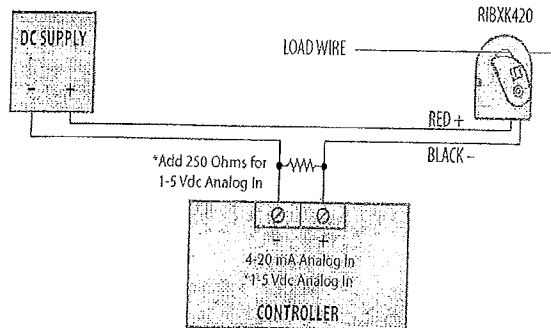
MAXIMUM OUTPUT LOAD RESISTANCE	SUPPLY VOLTAGE	
	MINIMUM	MAXIMUM
800 ohms	24 Vdc	35 Vdc
500 ohms	18 Vdc	35 Vdc
350 ohms	15 Vdc	35 Vdc
250 ohms	13 Vdc	30 Vdc
200 ohms	12 Vdc	30 Vdc
100 ohms	10 Vdc	28 Vdc
50 ohms	9 Vdc	28 Vdc

RIBXK420 SERIES SELECTION GUIDE

MODEL #	SENSOR RANGE	OUTPUT
RIBXK420-20	0-20 Amps	Loop Powered 4-20 mA Transmitter (Pre-Wired)
RIBXK420-50	0-50 Amps	Loop Powered 4-20 mA Transmitter (Pre-Wired)
RIBXK420-100	0-100 Amps	Loop Powered 4-20 mA Transmitter (Pre-Wired)

NOTES

LOOP-POWERED RIBXK420 SERIES



ENCLOSED MINI CURRENT SENSORS

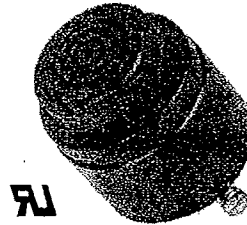
RIBXK420-20
 RIBXK420-50
 RIBXK420-100

INSTALLATION MATERIALS

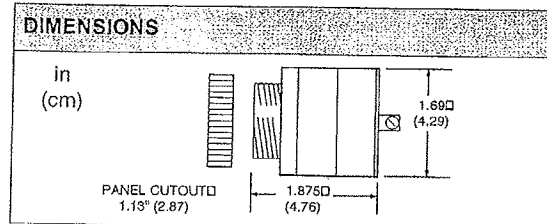
ALARM HORN / CIRCUIT BREAKER MODEL SC SERIES ALARM HORNS / NRAS SERIES

DESCRIPTION

The **SC628 Alarm Horn** provides an audible tone when an electric signal is applied. It can be used in applications when an audible alarm is needed to indicate that immediate attention is required.



SPECIFICATIONS	
Operating voltage	SC628: 6 to 28 VDC SC628A: 6 to 28 VAC/DC SC110: 30 to 120 VAC/DC
Tone	Continuous
Mounting	Panel, cutout 1.13" (2.87 cm)
Loudness	Medium, 68 to 80 dB
Operating current	SC628: 3 to 18 mA SC628A: 6 to 23 mA SC100: 6 to 21 mA
Approvals	UL recognized file #S1290



ORDERING INFORMATION



SC628
SC628A
SC110

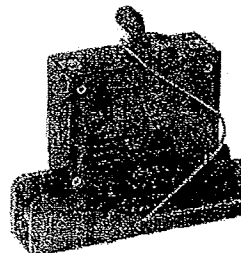
Alarm Horn 24 VDC
Alarm Horn 24 VAC/DC
Alarm Horn 120 VAC

DESCRIPTION

The **NRAS Series Circuit Breaker** provides excellent protection against overloads and short-circuits for electrical circuits and small-sized electrical equipment.

FEATURES

- Excellent overload and short circuit protection
- Small size and high efficiency
- Life expectancy of over 10,000 operations
- Convenient surface or DIN rail mounting



SPECIFICATIONS			
Rated voltage	250 VAC 50/60 Hz, 65 VDC	Life expectancy	10,000 cycles, minimum
Rated current	1, 3, or 5 Amps	Dimensions	3.57"H x 0.76"W x 3.02"D
Rated interruption capacity	1000 A @ 250 VAC, 65 VDC	including socket	(9.06 cm x 1.9 cm x 7.67 cm)
Protection method	Electromagnetic tripping	Approvals	UL recognized file# E68029, E74843 CSA certified file# LR47985
Time delay	125% Rated current 10-120 sec 150% rated current 6-45 sec		

ORDERING INFORMATION

NRAS1100-1A-AA
NRAS1100-3A-AA
NRAS1100-5A-AA
NUS1
NR21

Circuit Breaker, 1 AMP
Circuit Breaker, 3 AMP
Circuit Breaker, 5 AMP
Surface mount Circuit Breaker Socket
Din rail mount Circuit Breaker Socket

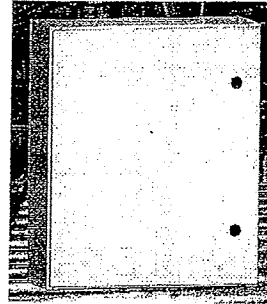


Saginaw Control & Engineering
 95 Midland Road
 Saginaw, MI 48638
 Phone: (989)799-6871
 Fax: (989)799-4524
<http://www.saginawcontrol.com>

Part Details - SCE-20EL2408LP

Part Number: SCE-20EL2408LP
Description: EL Enclosure
Height: 20.00 inches
Width: 24.00 inches
Depth: 8.00 inches
Page Number: 157

Panel: SCE-24P20 -
Product Code: E3
Est. Shipweight: 35.00 lbs.
NEMA Rating: 12 & 4



[Detailed Drawing \(PDF\)](#)
[Downloadable Drawing](#)
[3D STP Drawing \(NEW\)](#)

Construction -

- 0.075 In. carbon steel.
- Seams continuously welded and ground smooth.
- Flange trough collar around all sides of door opening.
- Oil-resistant gasket.
- Collar studs provided for mounting optional panels.
- Concealed hinge.
- Removable and interchangeable doors.
- Black quarter turn latches on three sides of the doors.
- Latches are opened or closed with a screwdriver.
- Mounting holes in back of enclosure.
- Mounting hardware, sealing washer and hole plug included.
- Removable print pocket.
- Ground studs on door and body.

Similar Partnumbers -

- [SCE-12EL1206LP](#)
- [SCE-12EL2406LP](#)
- [SCE-16EL1206LP](#)
- [SCE-16EL1208LP](#)
- [SCE-16EL1408LP](#)
- [SCE-16EL1606LP](#)
- [SCE-16EL1608LP](#)
- [SCE-16EL2006LP](#)
- [SCE-16EL2008LP](#)
- [SCE-20EL1206LP](#)

Having trouble downloading drawings? [Click Here](#) for help.

Application -

Designed to house electrical and electronic controls, instruments and components. Provides protection from dust, oil and water. For outdoor application a drip shield is recommended.

Finish -

ANSI-61 gray urethane polyester powder coating inside and out over phosphatized surfaces. Stainless steel enclosures are Type 304 stainless with #4 brushed finish. Optional panels are powder coated white epoxy polyester.

Options -

- Optional Tamper-resistant inserts are available.
- Optional mounting feet available.
- Door hardware available.

Industry Standards -

NEMA Type 4, 12, & 13
 UL Listed Type 4 & 12
 CSA Type 4 & 12
 IEC 60529 IP 66

Notes -

Interchangeable latches and handles found on pages 147-148.
 Optional Enviroline 3-point latching system reviewed on page 161.

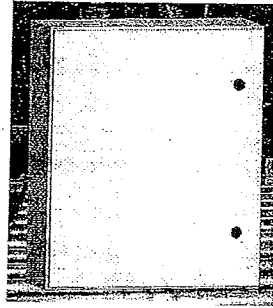


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 Fax: (989)799-4524
<http://www.saginawcontrol.com>

Part Details - SCE-36EL2410LP

Part Number: SCE-36EL2410LP
Description: EL Enclosure
Height: 36.00 inches
Width: 24.00 inches
Depth: 10.00 inches
Page Number: 157

Panel: SCE-36P24 -
Product Code: E3
Est. Shipweight: 74.00 lbs.
NEMA Rating: 12 & 4



[Detailed Drawing \(PDF\)](#)
[Downloadable Drawing](#)
[3D STP Drawing \(NEW!\)](#)

Construction -

- 0.075 In. carbon steel.
- Seams continuously welded and ground smooth.
- Flange trough collar around all sides of door opening.
- Oil-resistant gasket.
- Collar studs provided for mounting optional panels.
- Concealed hinge.
- Removable and interchangeable doors.
- Black quarter turn latches on three sides of the doors.
- Latches are opened or closed with a screwdriver.
- Mounting holes in back of enclosure.
- Mounting hardware, sealing washer and hole plug included.
- Removable print pocket.
- Ground studs on door and body.

Similar Partnumbers -

- [SCE-24EL1206LP](#)
- [SCE-24EL1606LP](#)
- [SCE-24EL1608LP](#)
- [SCE-24EL2006LP](#)
- [SCE-24EL2008LP](#)
- [SCE-24EL2010LP](#)
- [SCE-24EL2012LP](#)
- [SCE-24EL2016LP](#)
- [SCE-24EL2406LP](#)
- [SCE-24EL2408LP](#)

Having trouble downloading drawings? [Click Here](#) for help.

Application -

Designed to house electrical and electronic controls, instruments and components. Provides protection from dust, oil and water. For outdoor application a drip shield is recommended.

Finish -

ANSI-61 gray urethane polyester powder coating inside and out over phosphatized surfaces. Stainless steel enclosures are Type 304 stainless with #4 brushed finish. Optional panels are powder coated white epoxy polyester.

Options -

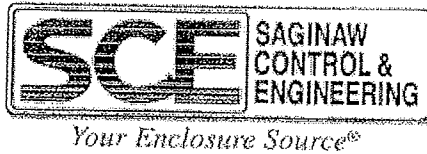
- Optional Tamper-resistant inserts are available.
- Optional mounting feet available.
- Door hardware available.

Industry Standards -

NEMA Type 4, 12, & 13
 UL Listed Type 4 & 12
 CSA Type 4 & 12
 IEC 60529 IP 66

Notes -

Interchangeable latches and handles found on pages 147-148.
 Optional Enviroline 3-point latching system reviewed on page 161.

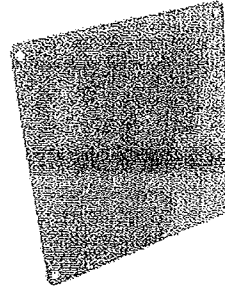


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<http://www.saginawcontrol.com>

Part Details - SCE-36P24

Part Number: SCE-36P24
Description: Subpanel, Bent
Height: 33.00 inches
Width: 21.00 inches
Depth: 0.88 inches
Page Number: 225

Product Code: P3
Est. Shipweight: 22.00 lbs.
NEMA Rating: N/A
Edge Flanges: Four
Configuration: C



[Detailed Drawing \(PDF\)](#)
[Downloadable Drawing](#)
[3D STP Drawing \(NEW!\)](#)

Similar Partnumbers -

- [SCE-24P16](#)
- [SCE-24P20](#)
- [SCE-24P24](#)
- [SCE-30P16](#)
- [SCE-30P20](#)
- [SCE-30P24](#)
- [SCE-30P30](#)
- [SCE-36P16](#)
- [SCE-36P30](#)
- [SCE-36P36](#)
- [SCE-40P24](#)
- [SCE-42P24](#)
- [SCE-42P30](#)
- [SCE-42P36](#)
- [SCE-48P24](#)
- [SCE-48P30](#)
- [SCE-48P36](#)

Having trouble downloading drawings? [Click Here](#) for help.

Finish -

Powder coated white epoxy polyester.

Options -

Sub-plates can be special ordered in Stainless Steel or Galvanized material.
Please consult a factory representative for assistance.

Installation Information -

- [Sub-Plate Layout & Grounding](#)

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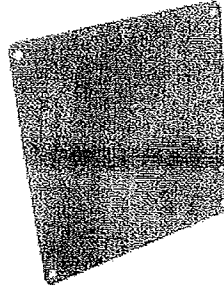


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Fax: (989)799-4524
<http://www.saginawcontrol.com>

Part Details - SCE-24P20

Part Number: SCE-24P20
Description: Subpanel, Bent
Height: 21.00 inches
Width: 17.00 inches
Depth: 0.88 inches
Page Number: 225

Product Code: P3
Est. Shipweight: 11.00 lbs.
NEMA Rating: N/A
Edge Flanges: Four
Configuration: C



[Detailed Drawing \(PDF\)](#)
[Downloadable Drawing](#)
[3D STP Drawing \(NEW!\)](#)

Similar Partnumbers -

- [SCE-12DLP12](#)
- [SCE-12P10](#)
- [SCE-12P12](#)
- [SCE-12P24](#)
- [SCE-14P12](#)
- [SCE-14P8](#)
- [SCE-16DLP14](#)
- [SCE-16P10](#)
- [SCE-16P12](#)
- [SCE-16P14](#)
- [SCE-16P16](#)
- [SCE-20P12](#)
- [SCE-20P16](#)
- [SCE-20P20](#)
- [SCE-24P16](#)
- [SCE-24P24](#)
- [SCE-30P16](#)
- [SCE-30P20](#)
- [SCE-30P24](#)
- [SCE-30P30](#)
- [SCE-36P16](#)
- [SCE-36P24](#)
- [SCE-36P30](#)

Having trouble downloading drawings? [Click Here](#) for help.

Finish -

Powder coated white epoxy polyester.

Options -

Sub-plates can be special ordered in Stainless Steel or Galvanized material.
Please consult a factory representative for assistance.

Installation Information -


- [Sub-Plate Layout & Grounding](#)

RELAYS & CONTACTORS

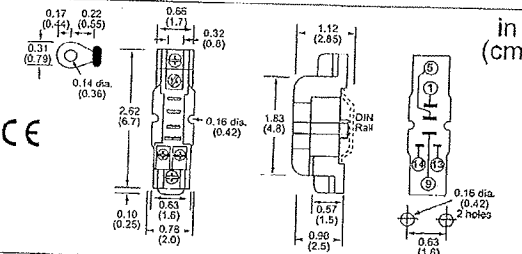
IDEC RELAY SOCKETS SH / SR SERIES

SPECIFICATIONS (SH & SR-SERIES)			
Mounting	DIN rail or surface mount	Material grade	UL94V-0
Rated voltage	300V, SH1B: 250 V	Terminals	M3.5 screws w/ captive wire clamp M3 screws on SH1B coil
Rated current	10A, SR3B: 15 A (UL rating)	Wire Size	Up to 2 - #12 AWG
Insulation resistance	100 MΩ minimum	Approvals	UL recognized, file #E62437 CSA certified, file #LR35144 CE certified
Dielectric strength	2000 VAC, 1 minute		

SH1B-05
Use with Relay: RH1B




Socket Type: Blade
Hold-Down Spring: SY2S-02F1
Hold-Down Clip: SFA-101, SFA-202



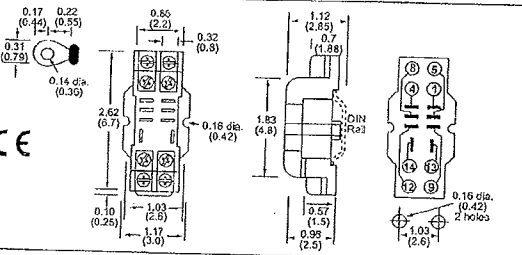
in (cm)

UL SF CE

SH2B-05
Use with Relay: RH2B




Socket Type: Blade
Hold-Down Spring: SY4S-02F1
Hold-Down Clip: SFA-101, SFA-202

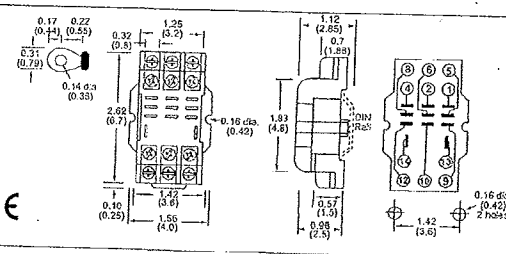


UL SF CE

SH3B-05
Use with Relay: RH3B, RH2LB (Latching relay)




Socket Type: Blade
Hold-Down Spring: SH3B-05F1
Hold-Down Clip: SFA-101, SFA-202

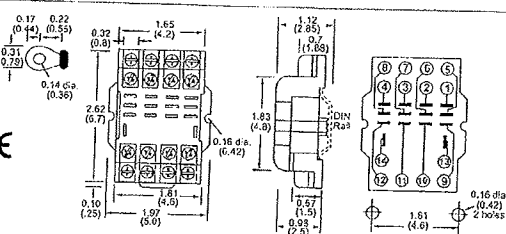


UL SF CE

SH4B-05
Use with Relay: RH4B



Socket Type: Blade
Hold-Down Spring: SH4B-02F1
Hold-Down Clip: SFA-101, SFA-202



UL SF CE

RELAYS & CONTACTORS

IDEC RELAY SOCKETS SH / SR SERIES

SR2P-05
Use with Relay: RR2P, RTE-P1 (Timer)

Socket Type: 8-pin octal
Hold-Down Spring: SR2B-02F1
Hold-Down Clip: SFA-203

in (cm)

SR2P-06
Use with Relay: RR2P, RTE-P1 (Timer)

Socket Type: 8-pin octal
Hold-Down Spring: SR2B-02F1
Hold-Down Clip: SFA-202

SR3P-06
Use with Relay: RR3PA, RR2KP, RTE-P2 (Timer)

Socket Type: 11-pin
Hold-Down Spring: SR3B-02F1, SR3P-06F3**
Hold-Down Clip: SFA-202
**For RR2KP relay

SR3B-05
Use with Relay: RR1BA, RR2BA, RR3B RTE-B (Timer)

Socket Type: 11-blade
Hold-Down Spring: SR3B-02F1
Hold-Down Clip: SFA-202

ORDERING INFORMATION

SH1B-05	Relay Socket, Single Pole, Blade Type, DIN/Surface Mount
SH2B-05	Relay Socket, Double Pole, Blade Type, DIN/Surface Mount
SH3B-05	Relay Socket, Three Pole, Blade Type, DIN/Surface Mount
SH4B-05	Relay Socket, Four Pole, Blade Type, DIN/Surface Mount
SR2P-05	Relay Socket, Double Pole, Pin Type, DIN/Surface Mount
SR2P-06	Relay Socket, Double Pole, Pin Type, DIN/Surface Mount
SR3P-06	Relay Socket, Three Pole, Pin Type, DIN/Surface Mount
SR3B-05	Relay Socket, Three Pole, Blade Type, DIN/Surface Mount

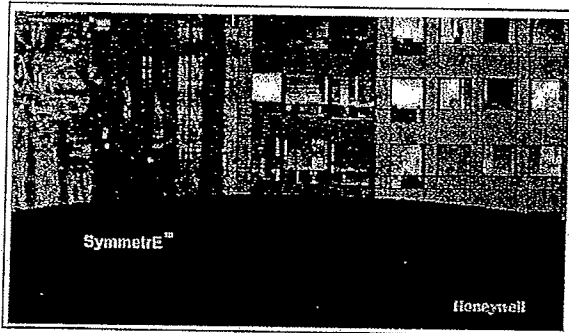
For touchsafe sockets, add "C" to the end of the SH Series socket model numbers.
Order hold down springs and clips separately by model number.

Related Products

RH/RR Series	Idec Relays	BAM-1000	Aluminum DIN rail
RTE Series	Idec Timers	DIN-3F	Steel DIN rail

SymmetrE® R310

SPECIFICATION DATA



KEY FEATURES

- Total solution for Heating, Ventilation & Air conditioning Building Management Systems.
- Integration with a diverse range of devices, Internet and Intranet sources allowing intelligent management of key facility information.
- Uses Industry standard hardware and Windows® 2000 Professional and Windows XP® Professional Operating Systems
- Supports the leading open standards: BACnet®, LONMARK®, ODBC, OPC®, AdvanceDDE and Modbus®.
- Easy-to-use web-style interface reduces operator training costs and puts the user in control of every situation.
- Designed and developed to International Standard ISO® 9001:2000 for quality assurance.

GENERAL

SymmetrE® is a highly configurable facility management system providing an efficient and reliable way of ensuring the comfort of people and the effective operation of buildings and facilities. A Building Management System that provides a complete solution to access information and the control needs of one or more buildings.

SymmetrE integrates using Open System Standards and Internet and Intranet applications. This allows you to choose the best field solutions for your building and to integrate information into SymmetrE seamlessly for further processing, reporting and distribution. SymmetrE provides operators, supervisors, and managers with a sophisticated web-style operator interface to enable personnel to easily monitor and control buildings at one or more sites.

SYSTEM ARCHITECTURE

Client/Server

SymmetrE is based on industry standard LAN/WAN and serial communications, using current and emerging Open System Standards.

SymmetrE's client/server architecture provides a scalable system that accommodates configurations ranging from a small single node system to an extended system with a server and multiple stations connected across LAN or WAN.

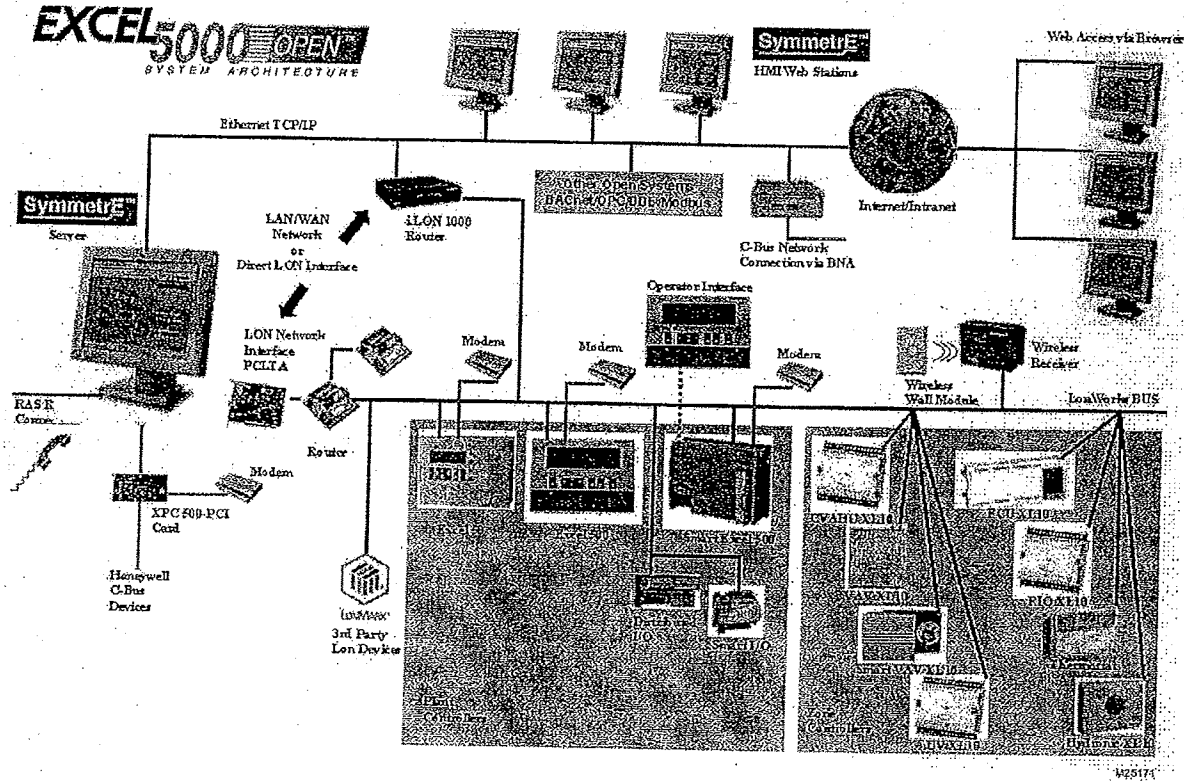
The SymmetrE Server runs on the multi-user, multi-tasking, industry standard, Windows 2000 Professional and Windows XP Professional platforms. The SymmetrE Server runs application software that communicates to field controllers and updates a real time database. The SymmetrE Server can also act as the file server for displays and historical data collection and archiving.

The SymmetrE HMIWeb Stations provide a high resolution, color graphical Human Machine Interface to the SymmetrE Server. Up to 5 simultaneous operator station connections are available on a single SymmetrE Server, providing access for an unlimited number of users on a first come, first served basis. An operator may use the SymmetrE Station or an Internet connected Web Browser to perform a range of facility management tasks such as:

- View and respond to alarms.
- Schedule equipment operation.
- Configure hardware and software points in the SymmetrE Database for each controller connected.
- View, manipulate, and analyze data acquired from various controllers.
- View custom displays from the Server.

The comprehensive networking capability of SymmetrE, based on the industry standard TCP/IP protocol, allows communication to other Intranet/Internet systems and PC networks.





HONEYWELL EXCEL 5000® INTEGRATION

Honeywell Products Supported

SymmetrE supports a full range of Honeywell Excel 5000, C-Bus devices including:

- XL 500, XL 600, XL 100, XL 80, XL 50, XL 20
- O-Link, Zone Manager
- XL10 (VAV II, ROI, CVAHU, UV, FCU, CHC, HYD)

Excel 5000 Controller Features

SymmetrE supports full communication to Excel 5000 controllers through either Scan Task or Direct (Point Server) interface including:

- Point Monitoring & Control
- Controller and Global Scheduling
- Database upload & download
- Excel 5000 Controller Firmware Download
- Communication Health Monitoring
- Dial-up Communications

C-Bus Interface Options

SymmetrE supports a variety of C-Bus interfaces providing flexibility and custom architecture design. Communication speeds vary from 9600 to 76.8K baud by interface option and hardware selected.

Direct connection to the SymmetrE Server or LAN connected PC (NXN) via:

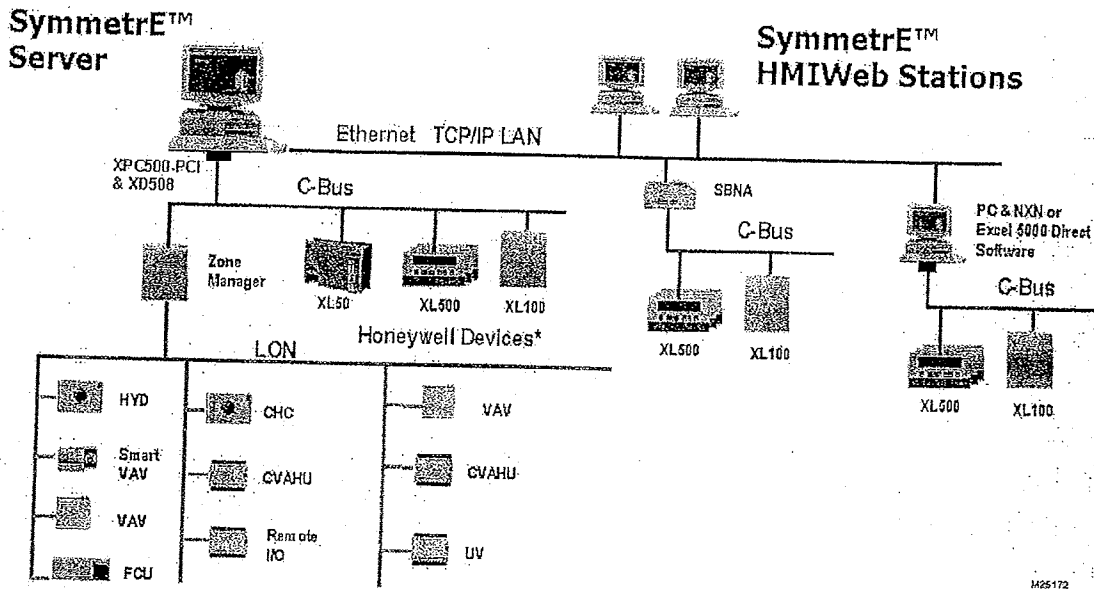
- XPC500-PCI card to C-Bus & XD508 module
- Serial (COM Port) to C-Bus via external RS-232 to RS-485 converter
- Serial to C-Bus via internal RS-485 converter

TCP/IP Ethernet LAN/WAN connected via:

- SymmetrE Building Network Adapter (CBNA) (no modem support)

Dial-up to remote Controllers or C-Bus via XPC500-PCI card (with Scan Task) to:

- XM100 C-Bus Modem
- XDM506 Controller Module
- XL50 Controller



SYSTEM INTEGRATION

SymmetrE provides an open system architecture which combines a variety of controllers, standard hardware devices, and communications interfaces into one, integrated, central system that maximizes the performance of your building or facility.

SymmetrE can integrate with the following subsystems:

- HVAC monitoring and control
- Energy usage monitoring
- Industrial process controllers
- Maintenance management
- Web, Internet and Intranet pages and systems
- Mobile Phone, paging and SNMP notification systems

SymmetrE supports local or remote equipment connection via RS-422, RS-232, RS-485, or via IEEE 802.3 (Ethernet). SymmetrE gathers information from a wide range of field devices and presents data in a unified, consistent format.

OPEN SYSTEMS

In addition to being based on a range of open technologies, SymmetrE supports a wide variety of open standards for integrating other systems and subsystems. The Open System Standards supported are listed in the following sections.

HTML

SymmetrE's extensive graphics builder creates displays in native HTML format, ensuring SymmetrE has the most open graphics capability in the market. These displays can be viewed in SymmetrE Stations and over the Internet through Microsoft's Internet Explorer® web browser.

LONWORKS®

LONWORKS is a network of interoperable devices from multiple vendors conforming to the LONMARK standard. SymmetrE supports both Honeywell and third party LONWORKS devices that conform to this LONMARK standard including the Honeywell XL10 series, and XL50 & XL500-LON controllers.

The interface supports both read and write of Network Variables and Configuration Properties. The SymmetrE LONWORKS Interface is based on Echelon's LNS® Database to provide compatibility with third party LON® tools.

Connections between SymmetrE and LON Networks can be direct (using a PCLTA-10) or via the network (using an Ethernet to LON network router such as the Echelon i.LON® 600).

BACnet

SymmetrE supports ASHRAE® standard for BACnet Protocol implementing both BACnet Client and BACnet Server functionality. SymmetrE supports BACnet over Ethernet and IP communications with automatic device discovery capability. Support is provided for Read and Write Property, Change of Value, Who Is, I Am, Who Has, I Have, Time Synchronization and Alarm services specified by BACnet. A detailed BACnet PICS is available on request. Scheduling, trending, and serving-up BACnet point information is accomplished within the SymmetrE Server.

OPC®

SymmetrE supports Object Linking and Embedding (OLE) for Process Control (OPC) 2.0. This interface allows SymmetrE to read from and write to an OPC Data Server as an OPC Client. This capability provides access to a wide range of third party OPC Data Servers allowing cost effective integration of third party devices. A SymmetrE Server can also be an OPC Server. OPC Client and Server capabilities can be used as a means for exchanging data between two OPC compliant systems to provide integration at a system level.

AdvanceDDE

SymmetrE supports the open AdvanceDDE standard for data exchange. The SymmetrE AdvanceDDE Client provides a high performance connection to third party AdvanceDDE servers. This Client capability provides access to a wide range of third party written and tested AdvanceDDE Data Servers.

Modbus

Modbus is a good general purpose interface and de facto standard communications protocol that can be used to integrate SymmetrE to different controller types. The SymmetrE interface is a ModBus "Master" and uses the ModBus RTU, ASCII or TCP (Ethernet) protocol. ModBus Function Codes 01 through 06 and 16 are supported by this interface.

ODBC

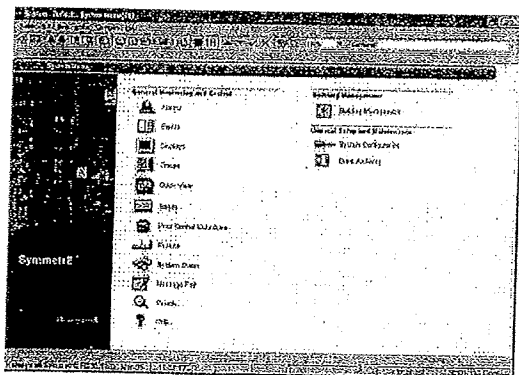
Open Database Connectivity (ODBC) is an industry standard for database access. SymmetrE provides read-only ODBC access to its real time database. This may be used to extract information from SymmetrE using ODBC compliant reporting tools.

OPERATOR INTERFACE

In critical situations, it is important to provide data to a user in a clear and concise format. The SymmetrE Station operator interface displays high resolution, color graphics that can be tailored to the requirements of each individual facility. Alternatively, Microsoft Internet Explorer can be used as an operator interface to SymmetrE. Extensive use of Web style menus, toolbars, and icons allow intuitive navigation and fast access to important information. The operator interface is designed to accommodate novice and experienced operators alike.

The operator interface allows a user to perform the following tasks:

- Display and control field equipment
- Acknowledge alarms on a priority basis
- Display point status
- Display point history information
- Define and alter time schedules
- Initiate printing of reports
- View, archive and retrieve event logs
- Monitor data communications channels
- Configure system parameters
- Build points
- Create color graphic displays
- Display information from Internet and Intranet sites
- Display ActiveX[®] documents



You can create custom displays using HMIWeb Display Builder to tailor the system to your building layout. The graphics consist of a combination of static background and dynamic data that indicates the status and alarm condition of all devices represented on the screen. You can also link graphic elements to execute tasks and to call displays or reports.

Web Enabled

Displays are fully Web-enabled. Not only can they be created in the native HTML format, they can be viewed in either Station or in a Web browser, such as Windows Internet Explorer. Full control of your facility is possible through a browser. SymmetrE's embracement of open technologies ensures that operators have the best information at their fingertips.

SymmetrE can integrate Intranet or Internet pages into your custom displays, enabling SymmetrE data to be matched with external information such as weather, utility prices or key company policies and procedures. Alternatively, data from SymmetrE can be integrated into your company Intranet, providing building occupants with live data regarding their comfort or other facility information. All such access can be strictly controlled.

Operator Security

SymmetrE offers sophisticated methods for controlling access to sensitive data.

Operator Sign On

Each operator has a unique identification and password that defines their security profile. An operator's password consists of an alphanumeric string between 5 and 6 characters. New passwords can not be the same as any previous passwords used in the past three months. All SymmetrE passwords are encrypted when stored and transferred. If you continually attempt to sign on to a SymmetrE Station without the correct operator password, you will be locked out of the system for a specified length of time and an alarm will be generated.

It is also possible to use the Windows' operator ID and password to authenticate an operator in SymmetrE. This ensures that operators only need to remember one set of credentials. Operators need only to sign on to the system once.

You can restrict operators to only certain operator stations and certain times. Operators can also be defined as either single or multi-users, which are able to sign on at more than one station at the same time. Individual areas may be assigned to an operator with actions that may be accomplished by the operator defined as: Acknowledge only, View only, Full or No Access.

Security and Control Levels

In SymmetrE, you can restrict and control what activity operators can perform by giving them different security levels. The system supports six different levels of operator security.

In addition to this, SymmetrE incorporates control levels to limit manual control of devices. Only operators with appropriate control levels can issue manual keyboard commands to these points. For example, you may restrict an operator from changing the set point value, but not from acknowledging an alarm.

REAL-TIME DATABASE

SymmetrE provides overall system management by collecting information from its field devices and using this intelligently to improve system monitoring and control. For example:

- A point exceeding a given temperature automatically triggers a particular report.

SymmetrE communicates to controllers that have distributed intelligence. The local controller determines normal HVAC control strategies without input from the server. If the communications link between a controller and the server fails, normal system functions continue to operate and the controller buffers transactions. When the communications link is re-established, this information is reported back to the server. Changes in the server database may be downloaded to the relevant subsystem controllers.

Schedules

SymmetrE provides extensive scheduling functions both from the SymmetrE server itself and from controller-specific schedules. Occupancy scheduling can be defined by selecting the appropriate dates and times from a simple calendar display. A single SymmetrE schedule can define system behavior on any weekday, weekend or holiday. In addition, a special occasion schedule can be applied to override the normal occupancy schedules to handle special events.

SymmetrE provides server based, Point Control and Global scheduling functions to control points on a periodic and one-off basis. Different schedule types include:

- Once (executes one time and is then deleted)
- Daily (executes every day)
- Workday (executes Monday through Friday)
- Weekend (executes Saturday and Sunday)
- Holiday (executes on up to 30 user defined holidays)
- Individual Days (executes on selected days)

Global schedule locations may be defined that include any controller and points identified by the system. This includes points from LonWorks, BACnet, Modbus, or any other Open Subsystem communicating with the SymmetrE Server.

Global schedule time periods may be configured graphically through simple Point & Click - Drag & Drop operator actions.

In addition to this, SymmetrE supports the native Honeywell Excel 5000 controller time schedules. These schedules can be configured as individual controller based schedules or as global schedules running across multiple controllers.

Event Initiated Programs

SymmetrE allows you to trigger additional controls or system functions from input points. When the input point changes state, this may cause a range of actions such as:

- Enabling output controls based on a logical combination of inputs
- Alarming a master point based on the alarm states of subordinate points
- Averaging a set of temperatures into the value of one point

Database Partitioning

SymmetrE can easily support the requirements of a multi-tenant or campus system. You can divide your facility into "areas" and then all data is partitioned into these areas. Each area includes a logical set of points, reports, and displays. Each operator can view, monitor, and control only those points within their designated areas. In this way, you can easily prevent operators from viewing information from another part of the system or being overwhelmed by alarms from another part of the system that is not relevant to them.

Phone Control

Phone control is an additional option, which can be used to provide an external way to control points in the SymmetrE database in a secure manner. For example, in a multi-tenant facility, it may be important to allow each tenant and the occupants, the ability to issue simple commands on SymmetrE to control their environment. By using the Phone Control option, building occupants can dial a number and then be stepped through a series of voice prompts. This allows them, using the keypad on their telephone, to issue simple controls to SymmetrE such as turning lighting and air-conditioning points on. Building occupants are required to enter a PIN code before they can successfully issue commands.

Phone Control is a separate option for SymmetrE and may be installed on the SymmetrE Server PC or on any network connected computer. Customer specific voice prompts can be recorded so that the system can be tailored to the unique requirements of each site, making it easy for occupants to understand and use the system.

ALARM MANAGEMENT

The comprehensive alarm management facilities of SymmetrE ensure that you are immediately notified of any building anomalies. Operators can easily respond to alarms and quickly find relevant information by using the dedicated function keys.

Acknowledge—Use the mouse to select the alarm point on the display and press the Acknowledge key to acknowledge the alarm. Your action will automatically be recorded in the system event file and optionally on an alarm printer.

Alarm Summary—Press the Alarm Summary key at any time to view a display showing all currently active alarms. The alarm messages are color-coded to show priorities. From the summary display, you can acknowledge alarms and access an associated display defined for each point. You can sort alarms or filter only for certain characteristics. You can even add comments to alarms or print an appropriate alarm list.

Associated Display—Select the Associated Display and be immediately taken to a graphic showing where in your facility the alarm is originating.

SymmetrE announces alarms as follows:

- **Audible Tone**—The audible tone is based on a *.wav file for each priority on each operator station.
- **Alarm Line**—A dedicated alarm line appears on all displays and shows the most recent, highest priority, unacknowledged alarm in the system.
- **Alarm Indicator**—An alarm indicator appears on all displays and flashes red when there are any unacknowledged alarms.
- **Alarm Summary Display**—An alarm summary page shows all alarms in the system and color-codes them to indicate priority and severity.
- **Alarm Printer Output**—You can print out alarm messages on the alarm printer for a hard copy record.

Alarms announce at operator stations even if no user is currently signed on. Even if an operator station is minimized, the audible tone sounds and the operator station icon flashes to indicate that there is an alarm. Alarms can drive an external communicator such as a light or siren.

Alarms can be associated with different point states for digital points or special conditions such as high or low values or rates of change for analog points. Each alarm is assigned a different priority: journal, low, high or urgent. Each alarm priority supports up to 15 sub-priorities. This allows for sophisticated alarm prioritization.

It is possible to automatically elevate an alarm to the next highest priority level or generate an additional alarm if an operator does not acknowledge an alarm within a certain time, ensuring alarms are always handled promptly.

With the Advanced Alarm Management feature, you can provide further information to assist operators. When an operator acknowledges an alarm, they proceed to an alarm instruction page which details appropriate alarm handling procedures. After following these procedures, the operator can enter a response that indicates the actions taken to correct the situation, or can choose from a pre-configured list of responses. This ensures operators have the information they need to be fully responsible and accountable for handling alarms. Operator responses are logged to an event file for subsequent analysis.

Alarm Pager

Alarm Pager is an additional option on SymmetrE which allows alarms to be routed to pagers and mobile phones, email and Simple Network Management Protocol managers. This is ideal when operators are off-site or when the station is unattended but operators still need to be notified of critical alarms immediately. It is possible to nominate a range of points and certain priority alarms which will cause an external pager to be notified. For example, you may wish to send urgent priority alarms on your chiller to the building supervisor but high and urgent priority alarms from critical temperatures or processes to department managers or end users. The Alarm Pager option gives you the flexibility to control when and to whom such information is sent. You can configure which alarms to send to the pager on a per point or per area basis, enable pager escalation to ensure proper notification, and define a page delay time period to allow operators to respond while manning the station.

The Alarm Pager option uses the industry standard Paging Entry Terminal (PET) protocol, Telocator Alphanumeric Protocol (TAP) or the UCP protocol to communicate with Pager Service Providers for telephone paging. E-Mail messaging utilizes Windows Simple Mail Transport Protocol (SMTP), an IIS service. The Simple Network Management Protocol (SNMP) messages may be trapped by third party SNMP utilities.

EVENT MANAGEMENT

System events may be viewed from the Event Summary display, or on the Recent Events tab for any SymmetrE system database point.

Events include alarms, point changes of state, changes in system status and all operator actions. As system events occur, SymmetrE creates a journal of the events in an event file. Journalized event entries include a description, condition, message, time of occurrence, and responsible operator.

The system event file stores event data in an online buffer. It is possible to store as many events as you want - subject only to disk space on your server. When the online buffer becomes full, SymmetrE transfers the event data to an archived buffer and may be easily configured to automatically save to external media on a periodic basis. The online buffer can continue to store events without interruption. An operator can retrieve current or archived system event data for use online or in reports.

HISTORY AND TRENDING

SymmetrE provides continuous history about how points in the system have been behaving over time. SymmetrE can sample and store analog and status point values as historical data. SymmetrE supports a range of different history collection rates. Both snapshots and averages are collected allowing you to view what was happening on your system at any instant in time or over a longer period.

This historical data can be viewed in several ways, for example as graphical trends (such as line or bar charts) and as lists of numeric values. Historical data can also be used in reports, application programs and archived to off-line media for long term storage.

Trend displays can display historical data for up to eight points and can also plot two sets of data against each other (X-Y plots). The number of historical samples and ranges of each trend display can be configured. Operators can zoom in on trends for closer inspection and scroll forward or backward in time. Operators can even copy and paste trend data directly into Microsoft Excel®.

REPORTING

SymmetrE provides comprehensive reporting facilities including a range of standard reports, the ability to create custom reports, the ability to export and import information and the ability to use other standard reporting systems. Some examples of reporting are as follows:

- All points in alarm over a configurable time period
- All activities by a certain operator
- All activities for a certain group of points
- After hours alarm reports
- How often a point has changed state

SymmetrE also provides Open Database Connectivity (ODBC) access to its database from any ODBC-compliant tool. This enables you to create your own reports with a tool such as Microsoft Access® or Crystal Reports®.

All standard reports can be generated on demand from the reporting subsystem or from a custom display. Reports may be initiated directly from viewing alarms and events. Reports may also be generated periodically, such as once per day, or may be initiated by an event.

MAINTENANCE MANAGER

Integrated Maintenance Management

SymmetrE provides an Integrated Maintenance Manager (IMM) facility that retrieves data from field devices to determine when equipment requires maintenance.

IMM automatically initiates a work order request for a piece of equipment when certain maintenance conditions are met. Types of configurable maintenance events include duty cycles, run hours, and high data values.

IMM can be accessed through an operator station or through a Web browser. IMM includes a range of standard reports; alternatively, custom reports can be designed which include information such as past and present works orders, equipment lists and equipment history reports.

SymmetrE ensures that ongoing maintenance of your facility is easy by using IMM to automate as much of the maintenance as possible.

EXTENDING THE SYSTEM

SymmetrE provides a range of tools to allow you to extend the use of your SymmetrE system.

Server Scripting

Server scripting is the easiest way of extending the functionality of your system with minimal effort. It allows you to write simple scripts that perform additional functions when, for example, alarms occur, reports are generated and points return to normal. Scripts are created in an integrated script editor using Microsoft VBScript, a popular scripting language.

Network API

To extract simple point information from SymmetrE for use in another application, it is possible to use the Network API to read and write point data. This API is easy to use even for the novice programmer.

Microsoft Excel Data Exchange

Microsoft Excel Data Exchange is used to link SymmetrE and Microsoft Excel. A wizard in Microsoft Excel enables you to connect to your SymmetrE Server and to any points. You can then use both historical and real-time values of these points in Excel spreadsheets and have them updated automatically.

Web Toolkit

If you want to link your SymmetrE system to your corporate Intranet or the Internet, the Web Toolkit provides all the information you need. Web pages may be created to provide control and monitoring of system point data by an unlimited number of end-users through password protected web pages. Web pages may incorporate live and historical data from the SymmetrE database.

Such Web pages can even give users control of SymmetrE points. For example, they could provide tenants with information about temperatures in various parts of their building and allow them to change the temperature setpoints.

SYSTEM CONFIGURATION TOOLS

Quick Builder

SymmetrE is configured using an extremely flexible and powerful engineering tool called Quick Builder. Quick Builder allows both "novice" and "power users" to configure points, controllers, stations, and the printers.

Novice users will benefit from the intuitive interface and context-sensitive help and can start their projects by modifying a sample database. Power users can take advantage of the many powerful features, such as filtering and multiple point editing. Quick Builder ensures systems are implemented quickly and easily.

HMIWeb Display Builder

HMIWeb Display Builder is an object-based, fully integrated custom display builder for development of site-specific graphical floor plans in HTML, card layouts, faceplates and alarm handling procedures.

It is easy to create displays with simple point and click operations. For example, to create a button that calls another display, you simply click on the button icon, draw the required size button, double-click on it, and enter the target page.

Static objects include text, rectangles, arcs, and circles. Dynamic objects include text, buttons, indicators, charts, check boxes, combo boxes, and scrollbars. It is easy to link dynamic objects to the database by double-clicking and choosing the point ID from a list box, allowing the display to show the doors, temperature sensors and cameras in the facility.

HMIWeb Display Builder allows incorporation of live video elements at any size, using the live video tool. This enables you to complement your custom displays with live video data where an operator can actually see what is happening at the time.

SymmetrE provides a library of common symbols and indicators used in building management systems, enabling you to achieve a consistent look and feel. SymmetrE also allows you to embed ActiveX controls and ActiveX documents in displays.

Advanced users may add their own scripts to displays to animate them. HMIWeb Display Builder provides a VBScript editor and an object model for all display elements. Some examples of what can be done include:

- Animating fans and other equipment to show real actions
- Changing colors in response to system temperatures
- Validating data entry from operators
- Alerting operators to special conditions with messages

HMIWeb Display Builder saves displays in HTML format which, if required, can be edited by some other HTML editors.

Diagnostic Capture Tool

The Integral Diagnostic Capture Tool enables the collection of relevant diagnostic information including traces, logs, system data and software installed. This data is consolidated into a single package that can be sent to support organizations for later analysis.

Point Browser

The Point Browser is available anywhere an operator needs to enter the point ID. The point browser "pops-up" with a list of point names with type-ahead capability or can be filtered by area and may be applied to the data entry field selected. This greatly reduces configuration time for engineers and operators.

PRODUCT DATA SUMMARY

SYSTEM ARCHITECTURE

Client/server architecture
 Microsoft Windows 2000 Professional SP4
 Microsoft Windows XP Professional SP2
 Native 32-bit application
 Real time database
 Points: Analog, digital, totalizer, and container

ARCHITECTURE

Single server

NETWORKING

Uses industry-standard TCP/IP networking over Ethernet
 Station licensing based on the number of simultaneous connections
 Controllers may be connected to Ethernet
 Remote connections via WAN or PSTN

OPEN SYSTEMS SUPPORT

HTML Graphics
 LONWORKS - LONMARK standard & LNS 3.2
 BACnet - ASHRAE standard
 OPC - OLE for Process Control 2.0 Data Access
 AdvanceDDE - Rockwell Software Standard
 Modbus - Modbus RTU
 ODBC database access

SYMMETRE® R310

OPERATOR INTERFACE

Microsoft Windows 2000 Professional SP4
Microsoft Windows XP Professional SP2
Internet Explorer 6.0
Over 100 pre-configured standard displays
User configurable object based custom displays
Designed for display resolution of 1024 x 768 or higher
Embeds bitmaps, tga, jpg, png, wmf, and enhanced Windows
Metafiles into displays
Embed SafeBrowse® for secure Internet/Intranet integration
ActiveX animation using VBScripts
ActiveX document integration
Launch Windows applications directly from displays
Easy point search with wildcard support
Cut, copy, and paste facilities for easy editing of text
User input devices include keyboard, mouse, trackball
(optional), touchscreen (optional)

OPERATOR SECURITY

Six levels of access to system functions:

- Level 1 — Building Engineer
- Level 2 — Building Supervisor
- Operator — Building Manager

Up to 255 control levels for operator initiated actions
Automatic idle time logout
Prompt for periodic change of passwords
Events logged by operator ID
Individual operator profiles including areas assignment
Effective data partitioning of facility into different areas
Operator sign-on can be restricted to certain stations and certain times
Automatic change of area assignment by time
Use Windows operator accounts for authentication in SymmetrE

REAL TIME DATABASE

Connects to HVAC and related controls
Database partitioning into 1,000 areas
Phone Control option for remote control of points
Event initiated programs include:
— Arithmetic calculations
— Logic calculations
— Composite hierarchical point alarming
— Report, task or display request activated by status change
— Area or group alarm inhibit

ALARM MANAGEMENT

Color-coded alarm summary page with filtering by alarm priorities and area
Four levels of alarm priority with fifteen sub-priorities
Alarm segregation through database partitioning
Alarm parameters can be adjusted online
Dedicated alarm zone displays most recent highest priority alarm on Display Builder (.dsp) pages
All alarm and return to normal conditions logged in event summary
Individual or page acknowledgment of alarms
Alarm actions by operators logged into event summary
Additional messages can be attached to an alarm
Alarm acknowledge (writes through to controller)
Individual alarm prioritization of different input states for the same point
Alarms and events can trigger reports
Alarm annunciation can use custom sound files (*.wav)
Automatic alarm priority elevation if alarm un-actioned

Analog scan task point alarm types include:

- PV High
- PV Low
- PV High High
- PV Low Low
- Deviation High
- Deviation Low
- Rate of Change
- Transmitter High
- Transmitter Low

ALARM PAGER

Transmit events to pager using the PET/PG1*, TAP* or UCP® * protocols, via e-mail using SMTP, and via SNMP viewed through a standard trap utility.

* Check with local phone provider if any of these services are offered

EVENTS

System events created for all:

- operator changes
- alarm acknowledgment
- point state changes
- manual controls
- alarms
- and for many other system activities

Event file limited only by disk space available
Simple archiving of events to offline storage media
Simple retrieval of offline events for reporting

HISTORIAN

Virtually unlimited historical record of both live and derived data can be stored.

Intervals include:

- 1, 2 or 5 second snapshots
- 1, 8, 24 hour snapshots
- 6 minute average
- 1, 8, 24 hour averages

Collection is configured per point.

SymmetrE can collect history concurrently on points up to the following limits:

- Standard History—Maximum of 10,000 point parameters
- Extended History—Maximum of 5,000 point parameters
- Fast History—Maximum of 1,000 point parameters

Composite and Point Server parameters may be selected for history collection.

Archive to online or offline storage

TRENDS

Multiple formats include:

- Single (bar graph)
- Dual (bar graph)
- Triple (bar graph)
- Multiplot (line graph)
- X Y Plot (point plot)
- Numeric (tabular)
- On-line change of trend type
- Up to eight parameters on one trend
- Configurable sample densities / periods
- Individual pen enable/disable
- On-line pan and zoom
- Rubber band zoom
- Hairline cursor readout
- Copy and paste trend data to Microsoft Excel
- Embed trends in custom displays

REPORTS:

Periodic, On-Demand, or Event driven reports
 ODBC access for custom reports
 Crystal Reports recommended custom reporting tool
 Standard reports include:

Report	Description
After Hours	Lists all points changing state matching a certain search criteria occurring over a specified range of time.
Alarm Duration	Calculates how long certain points have been in alarm.
Alarm Event	Summary of all events of a specified type for selected points occurring over a specified range of time. This report can also summarize all changes made by a specific operator.
All Points	Lists all points which match a specified search criteria.
Generic Crystal	This report can execute any custom designed report using the Crystal Reports tool.
History Archive	This report automatically archives history collections to a specified location.
Point Attribute	Lists all points specified by the following attributes: Out of service, Alarm suppressed, Abnormal input levels, In Manual mode, Nominated state.
Point State Changes	Calculates the total number of changes of state (including none) for specified points over a given time period.
Time Period	Lists all information about Time Periods matching a specified search criteria.

MAINTENANCE MANAGEMENT

Interfaces to:
 Honeywell Integrated Maintenance Manager (IMM)

APPLICATION DEVELOPMENT

Microsoft Excel Data Exchange: Wizard for getting live and historical point data from Symmetre to Microsoft Excel
 Web Toolkit: Allows live and historical point data to be incorporated onto web pages.

QUICK BUILDER

Graphical engineering tool
 Pre-configured typical system databases
 Easy creation of point, hardware, stations and printers
 Multi-point edit
 User defined fields
 Import/export facility

HMIWEB DISPLAY BUILDER

Object based display building package with dynamic display objects such as:

- Shapes
- Pushbuttons
- Alpha-numeric
- Checkboxes
- Comboboxes
- Charts

Many standard drawing features including:

- Tool Palette
- Color palette
- Alignment
- Resizing objects
- Horizontal and vertical spacing
- Library of commonly used symbols
- Remote engineering support
- SafeBrowsesupport
- VBScripting support
- Snap to grid
- Zooming
- Group/Ungroup

DOCUMENTATION:

- Overview Guide
- Configuration and Administration Guide
- Operator's Guide
- Display Building Guide
- Installation Guide
- Building Management
- Application Development Guide
- Hardware and Point Build Reference

BUILDING MANAGEMENT CONTROLLER SUPPORT

Honeywell Excel 5000 family of controllers
 Honeywell Excel 10 family of controllers
 BACnet compatible controllers (Ethernet/IP)
 Third party LONMARK and LONWORKS Controllers

INDUSTRIAL CONTROLLER SUPPORT

Modbus (Modicon)
 OLE for Process Control (OPC)
 AdvanceDDE

PRODUCT SPECIFICATIONS

Server:

Dell® PC with Intel processor (qualified & recommended)
 Processor: 3.0 GHz Pentium™ 4 processor
 (Recommended Dual 3.0 GHz Xeon® processor or higher)
 Memory: Minimum of 2 GB RAM
 Keyboard: with 12 function keys
 Monitor: Super VGA monitor capable of non interlaced operation at 1024 x 768 pixel resolution (70 Hz or better vertical refresh rate)
 Graphics Card: Super VGA non interlaced graphics card capable of 1024 x 768 pixel resolution and 65K colors/True color (4 MB video memory)
 CD ROM Drive: SCSI
 Tape Backup Unit: SCSI DAT
 Network Interface Card: Adapter for Ethernet networking compatible with TCP/IP network protocols
 Pointing Device: Mouse
 Hard Disk: 80 GB drive (NTFS)
 Diskette Drive: 1.44 MB disk drive
 Display Resolution: 1024 x 768 and 65K colors
 Operating system: Microsoft Windows 2000 Professional SP4 or Windows XP Professional SP2
 Network Protocols: TCP/IP
 Internet Browser: IE 6.0 SP1

Operator Station (Client) Platform:

Dell PC with Intel processor (qualified & recommended)
 Processor: 2.0 GHz Pentium™ 4 processor or higher
 Memory: 1 GB minimum
 Graphics Card: Super VGA non interlaced graphics card capable of 1024 x 768 pixel resolution and 65 K colors/True Color (4 MB video memory)
 Hard Disk: 20 GB drive (NTFS)
 Monitor: Super VGA monitor capable of non-interlaced operation at 1024 x 768 pixel resolution (70 Hz or better vertical refresh rate)
 Keyboard: 12 function keys
 Pointing Device: Mouse
 Network Interface Card: Adapter for Ethernet networking compatible with TCP/IP network protocols
 Display Resolution: 1024 x 768 and 65K colors
 Operating systems: Microsoft Window 2000 Professional SP4 or Windows XP Professional SP2
 Network Protocol: TCP/IP
 Internet Browser Software: IE 6.0 SP1

SYMMETRE® R310

Network:

LAN uses standard cable types: Thin Ethernet, Thick Ethernet, Fiber, and Twisted Pair

Database Sizing:

SymmetrE is available in the following size configurations:

Size	Points
1	250
2	251-500
3	501-1,000
4	1,001-2,000
5	2,001-3,500
6	3,501-5,000
7	5,001-7,500
8	7,501-10,000
9	10,001-15,000
10	15,001-20,000

For additional database size contact Honeywell.

Other Database parameters include the following:

Item	Maximum Number
Operator Stations	Licensed individually up to 5
Printers	50
Channels	97
Reports	250
Schedules	1,000
Events	100,000 per 60 MB of disk space available
Areas	1,000
Users	1,000

SymmetrE Base Software Package includes:

250 Point Database, Excel 5000 Direct Interface, LONWORKS Interface, Network Server, Quick Builder, HMIWeb and Standard Display Builder, Microsoft Excel Data Exchange (MEDE), Web Toolkit, 1 HMIWeb Station and 4 Browser Client Licenses

Optional SymmetrE Software Packages include:

- LNS Database
- BACnet Client Interface
- BACnet Server Interface
- AdvancedDDE, OPC Client & Server, and Modbus
- Excel 5000 Dial-up
- Web Point Control
- Alarm Pager
- Integrated Maintenance Manager (IMM)
- Option to upgrade Browser Clients to Full Station Clients

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APPENDIX

SymmetrE Submittal Sheet

SymmetrE Server: (minimum)
 Processor: Minimum 3.0 GHz Pentium® 4 processor or higher
 (Recommended Dual 3.0 GHz Xeon® processor or higher)
 Memory: Minimum of 2 GB RAM
 Keyboard: with 12 function keys
 Monitor: Super VGA monitor capable of non interlaced operation
 at 1024 x 768 pixel resolution (70 Hz or better vertical refresh
 rate)
 Graphics Card: Super VGA non interlaced graphics card
 capable of 1024 x 768 pixel resolution and 65K colors/True
 color (4 MB video memory)
 CD ROM Drive: SCSI
 Tape Backup Unit: SCSI DAT
 Network Interface Card: Adapter for Ethernet networking
 compatible with TCP/IP network protocols
 Pointing Device: Mouse
 Hard Disk: 80 GB drive (NTFS) (minimum)
 Diskette Drive: 1.44 MB disk drive
 Display Resolution: 1024 x 768 and 65K colors
 Operating system: Microsoft Windows 2000 Professional SP4 or
 Microsoft Windows XP Professional SP2
 Network Protocols: TCP/IP
 Internet Browser Software: IE 6.0 SP1

SymmetrE Server:
 Configuration Provided: DELL PRECISION-
490 w/ monitor, PRINTER

Operator HMIWeb Station (Client) Platform: (minimum)
 Processor: 2.0 GHz Pentium™ 4 processor or higher
 Memory: 1 GB minimum
 Graphics Card: Super VGA non interlaced graphics card
 capable of 1024 x 768 pixel resolution and 65 K colors/True
 Color (4 MB video memory)
 Hard Disk: 20 GB drive (NTFS)
 Monitor: Super VGA monitor capable of non interlaced operation
 at 1024 x 768 pixel resolution (70 Hz or better vertical refresh
 rate)
 Keyboard: 12 function keys
 Pointing Device: Mouse
 Network Interface Card: Adapter for Ethernet networking
 compatible with TCP/IP network protocols
 Display Resolution: 1024 x 768 and 65K colors
 Operating system: Microsoft Windows 2000 Professional SP4 or
 Microsoft Windows XP Professional SP2
 Network Protocol: TCP/IP
 Internet Browser Software: IE 6.0 SP1

SymmetrE Operator HMIWeb Station (Client) Platform:
 Configuration Provided: _____

Network LAN uses standard cable types:

- Thin Ethernet
- Thick Ethernet
- Fiber
- Twisted Pair

Database Size Licensed:

Size	Points	Size	Points
<input checked="" type="checkbox"/> 1	250	<input type="checkbox"/> 6	3,501-5,000
<input checked="" type="checkbox"/> 2	251-500	<input type="checkbox"/> 7	5,001-7,500
<input checked="" type="checkbox"/> 3	501-1,000	<input type="checkbox"/> 8	7,501-10,000
<input type="checkbox"/> 4	1,001-2,000	<input type="checkbox"/> 9	10,001-15,000
<input type="checkbox"/> 5	2,001-3,500	<input type="checkbox"/> 10	15,001-20,000

Software parameter defined:

Item	Number Programmed:
Operator Client Stations	1 HMIWeb Station & 4 Browser Clients
Excel 5000 Interface	<input checked="" type="checkbox"/> Direct (Point Server) <input type="checkbox"/> Scan Task
Printers	(max. 50)
Channels	(max. 97)
Reports	(max. 250)
Schedules	(max. 1000)
Areas	(max. 1000)
Users	(max. 1000)

Optional Software Packages Licensed:

- LNS Server
- BACnet Client Interface
- BACnet Server Interface
- AdvancedDDE, OPC Client & Server, and Modbus
- Excel 5000 Dial-up
- Web Point Control
- Alarm Pager, E-Mail & SNMP
- Integrated Maintenance Manager (IMM)

Upgrade Browser Clients to HMIWeb Stations:

2nd	3rd	4th	5th
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SYMMETRE® R310

Automation and Control Solutions

Honeywell International Inc.
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Golden Valley, MN 55422
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Scarborough, Ontario M1V 4Z9

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Printed in U.S.A. on recycled
paper containing at least 10%
post-consumer paper fibers.

Honeywell



310 South Union Street
 P.O. Box 368
 Russiaville, Indiana
 46979-0368

Office (765) 883-5538
 Orders (800) 888-5538
 Fax (765) 883-7505
 Email sales@functionaldevices.com

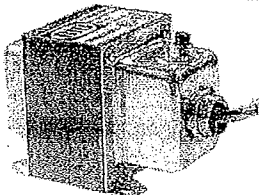
<http://www.functionaldevices.com>



TR100VA001

Transformer, 100VA, 120 to 24 Vac, Circuit Breaker, Foot and Single Threaded Hub Mount

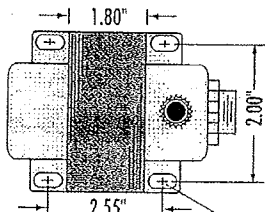
 LISTED
 Class II



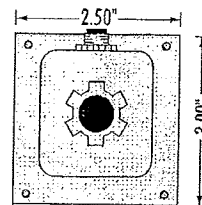
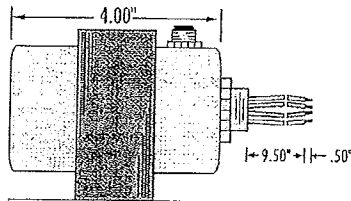
Functional Devices, Inc. A600A 2003

GENERAL SPECIFICATIONS

VA Rating: 100
 Frequency: 50/60 Hz
 Mounting: Foot & Single Threaded Hub
 Over Current Protection: Circuit Breaker
 Dimensions: 3.00" x 2.50" x 4.00"
 (w/ .5" HPT Hub)
 Wire Length: 9.5" Typical w/ .5" Strip
 Operating Temperature: -30 to 140° F
 MTBF: 100,000 Hours @ 77° F
 Construction: Split-Bobbin
 Weight: 4.06 lbs.
 Approvals: Class II UL1585 Listed, US / Canada



Mounting Hole = .350" x .175"



PRIMARY WIRES

White 120 Vac
 Black Common

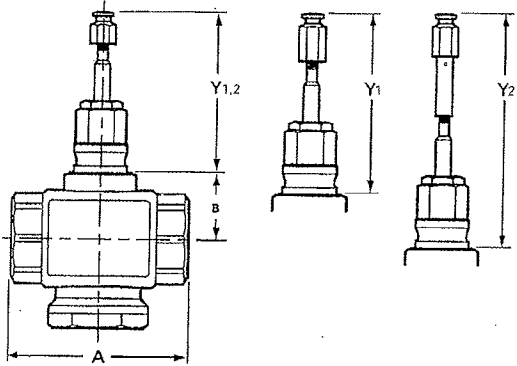
SECONDARY WIRES

Yellow 24 Vac
 Yellow 24 Vac

NOTES:

V5011N TWO-WAY THREADED GLOBE VALVE

Dimensions:



VALVE SIZE (IN)	A in. (mm)	B in. (mm)
1/2	3-1/4 (83)	1-9/16 (40)
3/4		
1	4-1/16 (103)	
1-1/4	4-3/16 (106)	
1-1/2	4-3/4 (120)	1-13/16 (47)
2	5-1/4 (134)	

VALVE	Y1 in. (mm)	Y2 ^a in. (mm)
V5011N1XXX OR	3-1/2 (89)	5-1/4 (133)
V5011N2XXX	STEM FULLY DOWN	
V5011N3XXX	4-3/16 (107)	5-15/16 (151)
	STEM FULLY UP	

^aY2 WITH STEM EXTENSION FOR MP853C,E (8 IN. ONLY)

M17378A

TYPICAL SPECIFICATIONS

Automatic control valves shall have threaded type fittings, 1/2 in. through 2 in. sizes, and shall be ANSI-rated to withstand the pressures and temperatures encountered.

Valves shall have metal-to-metal seats, stainless-steel stems, and replaceable spring-loaded reinforced carbon filled teflon packing.

Valves shall have a leakage rate of 0.05% C_v or less. Valves shall have a 50:1 rangeability or better.

All two way water valves shall be provided with equal-percentage contoured throttling plugs. All steam valves shall be provided with linear contoured throttling plugs.

ACCESSORIES

Stem Button:

- 090116

Repack Kits:

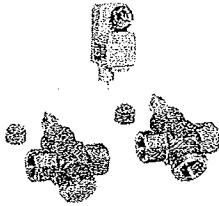
- 0901786 for 1/4 in. stems (1/2 in. through 1-1/4 in. valves).
- 0901787 for 3/8 in. stems (1-1/2 in. through 2" valves).

Rebuild Kits:

- Refer to V5011N Two-Way Threaded Globe Valve Product Data, form 63-2548.

Honeywell





M6410A, M7410F Actuators V5862A, V5863A Valves

HIGH-FORCE NON-SPRING RETURN ACTUATORS AND 1, 1-1/4, 1-1/2 INCH NPT CARTRIDGE GLOBE VALVES

M6410A and M7410F Series 3000 Non-Spring Return Valve Actuators provide floating or modulating control of V5862A and V5863A Series 3000 Cartridge Globe Valves.

The actuators are used in electronic temperature control systems, which use hot and/or cold water (with glycol up to 50 percent) as the controlled medium in variable air volume (VAV) terminal units, fan-coil units, small reheaters and recoolers.

SPECIFICATIONS

! CAUTION

Equipment Damage Hazard.

Installing a high-force (67.5 lb [300 N]) actuator on 1/2 or 3/4 in. valve can damage the valve beyond repair.

Use only Series 1000 (40.5 lb [180 N]) actuators with the smaller (1/2 in. and 3/4 in.) valves.

! CAUTION

Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

IMPORTANT

- A low-force (40.5 lb [180 N]) actuator installed on a valve larger than 3/4 in. cannot operate the valve.
- Install high-force actuators (67.5 lb) only on large valves (1 in., 1-1/4 in., 1-1/2 in.).

Models:

- M6410A: Non-Spring Return Valve Actuator. Provides floating control of the V5862A and V5863A Valves.
- M7410F: Non-Spring Return Valve Actuator. Provides modulating control of V5862A and V5863A Valves.
- V5862A: Two-way NPT Valves.
- V5863A: Three-way NPT Mixing Valves.

Control Modes:

- M6410A: Floating.
- M7410F: Modulating.

Ambient Ratings:

- Operating Temperature Range: 32° to 122°F (0° to 50°C).
- Storage Temperature Range: -40° to 158°F (-40° to 70°C).
- Humidity Range: 5 to 95% RH (noncondensing).

Weight:

- M6410A: 5 oz (0.15 kg).
- M7410F: 5.6 oz (0.16 kg).

SPECIFICATION DATA

FEATURES

- Small size allows installation in limited space.
- Long stroke allows wider range of control.

Actuators

- Low power consumption.
- Synchronous motor.
- No mounting tools required.
- Low-maintenance plastic housing.
- Conduit connector standard.
- No separate linkage required.
- M6410A provides 3-position floating control without proportional feedback.
- M7410F receives 0 to 10 Vdc or 2 to 10 Vdc input signal, selectable at the site.
- M7410F includes direct/reverse acting switch.
- Especially suitable for Excel[®] Controller or Individual Room Controller (IRC) System.
- Internal valve position indicator.
- Magnetic coupling for torque limitation independent of voltage supply, and self-adjustment of close-off port.
- Ready-to-wire connecting cable.

Valves

- V5862A is a two-way female NPT valve.
- V5863A is a three-way female NPT mixing valve.
- Pressure-balanced plug.
- Soft valve seat provides low leakage rate.
- Valve inserts are changeable with the insert replacement tool.
- Threaded plastic cover allows manual operation.
- Brass body and stainless steel stem.

Mounting:

- Actuator screws onto valve body.

Connections:

- M6410A, M7410F: 4.9 ft (1.5m) cable.

Electrical Ratings:

- Input Power:
 - 24 Vac, +10/-30 percent, 50/60 Hz.
- Power Consumption:
 - M6410A: 0.7 VA.
 - M7410F: 1.4 VA.
- Input Signal (M7410F): Modulating 0 to 10V, 2 to 10V (adjustable), 0.1 mA.
- Input Impedance (M7410F): 100K ohms.



M6410A, M7410F ACTUATORS V5862A, V5863A VALVES

Stroke:

- 1/4 in. (6.5 mm).

Running Time:

- At 50 Hz: 150 seconds.
- At 60 Hz: 125 seconds.

Stem Force:

- 67.5 lb (300 N).

Suitable Medium:

- Water with maximum 50% glycol.

Controlled Water Temperature:

- 36° to 230°F (2° to 110°C).

Rangeability:

- Two-way Valve: 50:1.
- Three-way Valve: 50:1 for controlled port (A to AB).

Flow Characteristic:

- Linear.

Valve Cv Rating:

- See Table 1.

NOTE: To determine the capacity index (Cv) needed for your application, use the following formula: Cv = gallons per minute divided by the square root of the pressure drop across the valve when the valve is fully open.

Body Material:

- Brass.

Stem and Plug Assembly:

- Stem: Stainless steel.
- Plug: Brass.

Actuator Required:

- M6410A: Non-Spring Return Valve Actuator (3-position floating).
- M7410F: 0 to 10 Vdc or 2 to 10 Vdc Electronic Actuator.
- Valve Inserts are provided as spare parts. See Table 2.

Leakage Rate:

- ≤0.05% of Cv.

Valve Close-off Ratings:

- See Table 1.

Approvals (Actuators):

- Underwriters Laboratories Inc. listed for plenum use (UL94-5V).

Table 1. Valve Close-off Ratings.

Pipe Size in in. (mm)	Cv ^a	Close-off Rating (psi)	
		Two-way	Three-way
1 (25)	5.5	232	232
	7.8		
	11		
1-1/4 (32)	18	174	174
1-1/2 (38)	25	145	145

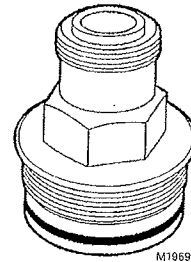
^a The Cv for the bypass port (B) on all three-way valves is reduced by one Cv level. Example: A Port Cv = 11; B Port Cv = 7.8. This feature eliminates the need for a balancing valve with the load matched to the proper Cv.

Accessories and Replacement Parts:

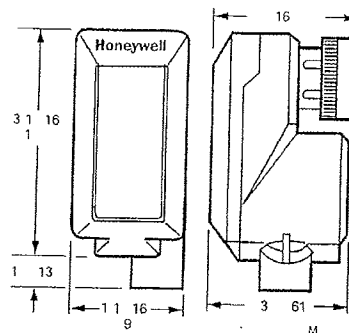
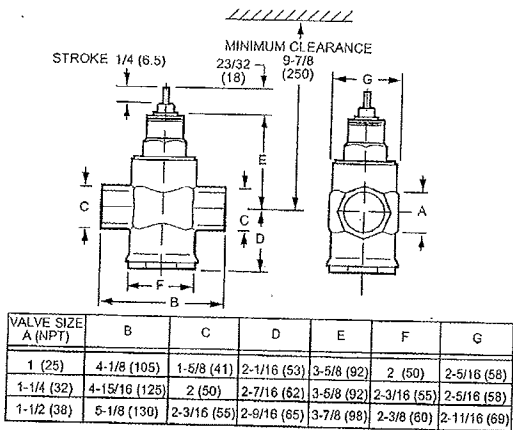
- WV3000R Insert Replacement Tool, for replacing cartridge insert.

Table 2. Valve Insert Replacement Parts.

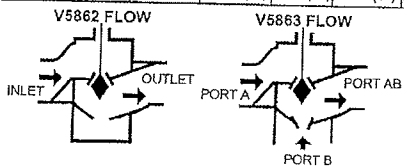
Diameter (in.)	For Valve	Cv	Part Number
Two-Way			
1	V5862A3003	5.5	0903827
	V5862A3011	7.8	
	V5862A3029	11	
1-1/4	V5862A3037	18	0903828
1-1/2	V5862A3045	25	0903829
Three-Way			
1	V5863A3002	5.5	0903827
	V5863A3010	7.8	
	V5863A3028	11	
1-1/4	V5863A3036	18	0903828
1-1/2	V5863A3044	25	0903829



Dimensions in in. (mm):



Non-Spring Return Actuators
(M6410A, M7410F)



M19619A

TYPICAL SPECIFICATION

Cartridge Globe Valves

Cartridge globe valve supplier must be Honeywell. Valves shall be available in two- and three-way mixing models with brass bodies and stainless steel stem. Valves must have nominal rangeability of 50:1 or better. Valves must have a leakage rating less than 0.05% of the Cv.

Valves 1 in. or larger must be pressure balanced. Valves shall be usable with hot water, chilled water, or glycol solutions up to 50 percent. Valves must have available insert replacement tools to facilitate changing the cartridge.

Cartridge Globe Valve Actuators

Cartridge globe valve actuator supplier must be Honeywell. Electric actuators shall provide either floating or modulating control of two- and three-way cartridge globe valves. Actuator will operate at 24 Vac (+10/-30%) and 50/60 Hz. Actuator must screw onto compatible valve body without the aid of mounting tools. Actuators shall have an ambient temperature rating of 32 to 122 degrees Fahrenheit.

Honeywell



Pressure Transmitter with Display

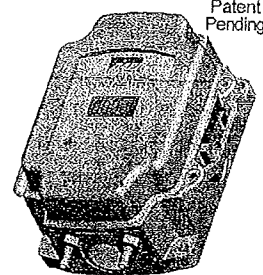
Zone Pressure Sensors (ZPS)

Rev. 01/30/06



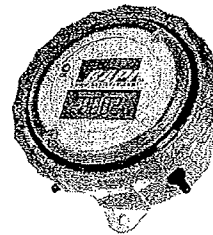
Features & Options

- 5 Direct and 5 Bi-Directional Standard Ranges
- Inches of Water Column (W.C.) or Pascal Operation
- 4 to 20 mA, 0 to 5 VDC, or 0 to 10 VDC Output
- Pressure Range and Outputs are Field Selectable
- Microprocessor Controlled Auto-Zero
- Two Rugged, IP66 Rated Enclosures
- Accepts 1/8" or 5/32" I.D. Tubing
- Mounting Tabs for Easy Installation
- Three Year Warranty



Patent Pending

BAPI-Box (BB) Enclosure



EU Enclosure

BAPI's Zone Pressure Transmitter is an accurate, rugged and economical solution for measuring and reporting duct/building static pressure, room-to-room differential pressure or air velocities/volumes. The heart of the unit is a micro-machined silicon piezoresistive pressure sensor specifically developed for low pressure. The sensor receives a five-point error correction over the compensated temperature range for excellent accuracy, repeatability and stability – even at low pressures.

The LCD model offers an additional level of troubleshooting and monitoring capability over the standard model by displaying the actual differential pressure over the entire operational range (-5 to +5 inches W.C. or -1,000 to 1,000 Pascals) regardless of which individual pressure range is selected for output to the system controller. If the pressure range of 0 to 1" W.C. is selected on the pressure transmitter for instance, then an actual pressure of 2" W.C. "maxes out" the transmitter output. The facility manager does not know the true differential pressure, only that it is above the 0 to 1" W.C. range. With the LCD Display model, the facility manager knows the true pressure which helps to isolate and correct the source of a pressure problem.

The unit is available in two rugged, IP66-rated enclosures with short circuit proof outputs and reverse polarity protected inputs to perform under real world conditions. The unit installs quickly by connecting standard 1/8" or 5/32" I.D. tubing to the two pressure ports. The various Output Ranges and Pressure Ranges are all field selectable with DIP switches, and the auto-zeroing process is microprocessor-controlled for simplicity (flip a switch, wait five seconds, flip it back and walk away).

Specifications

Power:

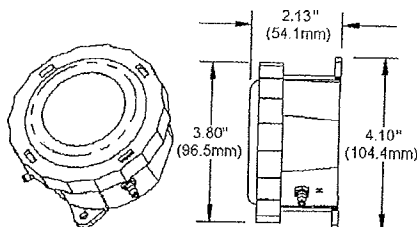
- 7 to 45 VDC (4-20 mA output)
- 7 to 45 VDC or 7 to 32 VAC (0-5 VDC output)
- 13 to 45 VDC or 13 to 32 VAC (0-10 VDC output)

Power Consumption:

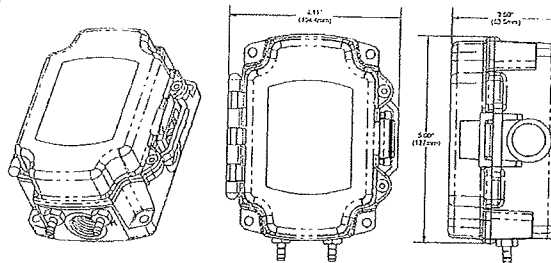
- 4.9 mA max DC at 0-5 VDC or 0-10 VDC Output
- 0.12 VA max AC at 0-5 VDC or 0-10 VDC Output
- 20 mA max, DC only at 4-20 mA Output

Load Resistance:

- 0-5 VDC or 0-10 VDC Output - 1 k Ω minimum
- 4-20 mA Output - 850 Ω max @ 24 VDC



EU Enclosure



BAPI-Box Enclosure



Pressure Transmitter with Display

C5

Zone Pressure Sensors (ZPS)

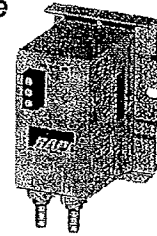
Rev. 01/30/06

Specifications

- Accuracy:**
 ±1% on 0 to 0.1 range and ±0.1 range,
 ±0.5% on other ranges
- Stability:** ±2 % F.S. (full scale) per year
- Temperature Error:**
 Zero - ±0.025% F.S. per °C,
 Span - max ±0.03% F.S. per °C
- Overpressure:** Proof - 5 PSI, Burst - 10 PSI
- Material:** ABS Plastic (EU), Polycarbonate (BB)
- Encl. Rating:** IP66 for EU and BAPI-Box
- Environmental Operation Range:**
 Temp.: -13 to 176 °F (-25 to 80 °C)
 32 to 140 °F (0 to 60 °C) compensated range
 Humidity: 0 to 95% RH, non-condensing
- Wiring:** *2 (loop powered) or 3 (AC powered) wires

Snaptrack Mountable

BAPI offers a Snaptrack Mountable Zone Pressure Sensor which fits industry standard 2.75" snaptrack.



For more information, see pages C2-3 of this section.

* BAPI recommends that you do not run wiring for the pressure transmitter in the same conduit as line voltage wiring or with wiring used to supply highly inductive loads such as motors, generators, and coils.
 Note: Mount unit with the pressure fittings on the bottom to prevent condensation from entering the sensor.

Ordering Information		Zone Pressure Sensor with Display	
Output Range ‡			
(-20)	4 to 20 mA	(8.5 to 45 VDC Supply ONLY)	
-05	0 to 5 V	(8.5 to 45 VDC Supply or 8.5 to 32 VAC Supply)	
-10	0 to 10 V	(13 to 45 VDC Supply or 13 to 32 VAC Supply)	
Pressure Range ‡			
(-SR)range	Standard Pressure Ranges - replace (range) with option # shown below		
	<u>Option</u>	<u>Range (inches W.C.)</u>	<u>Option</u> <u>Range (Pascals)</u>
	01	0 to 0.10	11 0 to 25
	02	0 to 0.25	12 0 to 50
	03	0 to 1.00	13 0 to 300
	04	0 to 2.50	14 0 to 500
	05	0 to 5.00	15 0 to 1,000
	06	-0.10 to 0.10	16 -25 to 25
	07	-0.25 to 0.25	17 -50 to 50
	08	-1.00 to 1.00	18 -300 to 300
	09	-2.50 to 2.50	19 -500 to 500
	10	-5.00 to 5.00	20 -1,000 to 1,000
	<u>Custom Range (W.C.)</u>		<u>Custom Range (Pascals)</u>
	CI	[x.xx to y.yy]*	CP [xxxx to yyyy]**
Enclosure Style (EU is standard)			
-EU	Weather Tight Enclosure - IP66 rated ABS polymer enclosure		
(-BB)	BAPI-Box Enclosure - IP66 rated, UV-resistant polycarbonate		
Optional Static Pressure Probe			
-NT	No Tube or Probe Included		
(-ST)	Static Pressure Measurement Probe		
LCD Display			
(-D)	LCD Display		
Mounting Options for the EU & BB Enclosures			
-FMK	Field Mounting Kit		
-FM	1/2" conduit adaptor only from the Field Mounting Kit		
-PM	Panel Mount (wires are run out the back rather than the side)		
EXAMPLE			
ZPS	-20	-SR01	-EU -NT -D -FMK
Example Part Number: ZPS-20-SR01-EU-NT-D-FMK			
Your Part Number:			

*For custom W.C. ranges, x.xx and y.yy can be any pressure from -5.00 to +5.00 inches W.C. However, x.xx must be less than y.yy and y.yy - x.xx must be at least .1 inches. (Example Part #: ZPS-20-SR01[0.00 to 3.00]-EU-NT-D)

**For custom Pascal ranges, xxxx and yyyy can be any pressure from -1250 to +1250 Pascals. However, xxxx must be less than yyyy and yyyy - xxxx must be at least 25 Pascals. (Example Part #: ZPS-20-SRCP[0 to 100]-EU-NT-D)

‡ Custom output ranges and higher accuracy units are available. Contact BAPI for details.

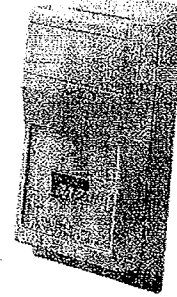


Wall & Ceiling Pressure Pickup Ports & Temp./Pressure Pickup Combos

Features & Options

- Economical & Easy to Install
- Delta Enclosure or Stainless Steel Plate for Wall Mount
- Ceiling Mount with or without J-Box
- Connects to Zone Pressure Sensor
- 100 Micron Filter
- Accommodates 1/8" I.D. to 5/32" I.D. Tubing

The Wall Pressure Pickup Port comes standard on a brushed stainless steel plate or in a Delta Style enclosure, both sized to fit a common 2" x 4" electrical box. A foam gasket seals the plate or enclosure to the wall to insure the integrity of the measured space. The Wall Plate and Delta Style Enclosure can be used for pressure alone or as a combination temperature sensor and pressure pickup port. BAPI also offers a Ceiling Mount Cover designed to fit a standard 3/4" thick suspended ceiling tile. If additional protection is required in the ceiling, the Ceiling Mount Cover fits on a common 2" x 4" electrical box. The brass fitting on the back of all Pickup Ports accommodates standard 1/8" to 5/32" I.D. tubing.



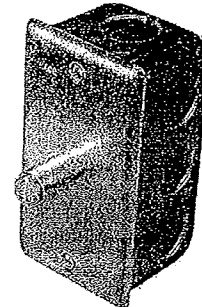
Delta Style
Enclosure



Wall Plate



Ceiling Mount
Cover



Ceiling Mount
Cover & J-Box

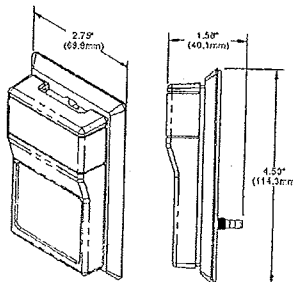
Specifications

Environmental Operation Range:

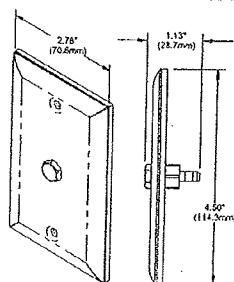
Temp. - 32 to 122 °F (0 to 50 °C)
Humidity - 0% to 95% RH, non-condensing

Material:

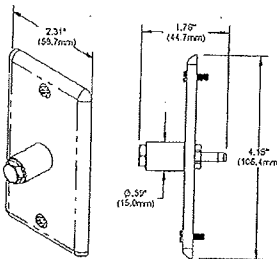
Delta Style Enclosure:
ABS Plastic, UL 94, V-0
Wall Plate: Stainless Steel



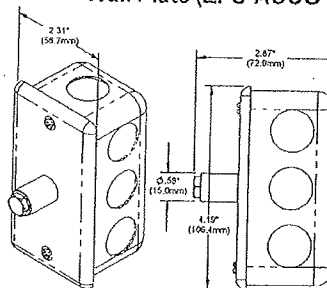
Delta Enclosure (ZPS-ACC03)



Wall Plate (ZPS-ACC01)



Ceiling Mount Cover
(ZPS-ACC05)



Ceiling Mount Cover & J-Box
(ZPS-ACC06)



Zone Pressure Accessories

C7

Zone Pressure Sensors (ZPS)

Rev. 01/30/06

Pressure Pickup Ports and Probe Assemblies

Ordering Information		Pressure Pickup Ports
ZPS		
Pressure Pickup Type		
-ACC	Option	Description
	01	2" X 4" Stainless Steel Wall Plate with Static Pickup
	02	Unassigned
	03	Room Mount Delta Style Enclosure with Static Pickup
	04	Unassigned
	05	Ceiling Mount 2" X 4" Cover with Static Pickup
	06	Ceiling Mount 2" X 4" Cover and Box with Static Pickup
	07	Static Pressure Probe Assembly, 6" long
	08	Static Tube Only (6") with Circular Foam (no hose or surge damper)
	09	Rubber Hoses with Surge Damper
	10	Outside Air Pickup Port with EU Enclosure
	11	Pitot Pressure Probe Assembly, 3.5" long (includes Static Probe Assy and Total Probe Assy)
	12	Pitot Pressure Probe Assembly, 6" long (includes Static Probe Assy and Total Probe Assy)
EXAMPLE		
ZPS	-ACC	03
Example Part Number: ZPS-ACC03		
Your Part Number:		

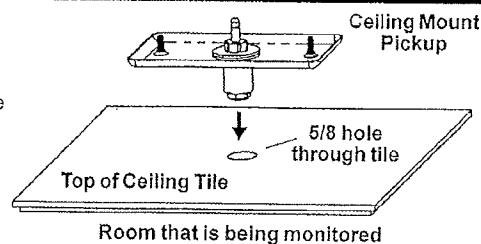
Combination Static Pressure Pickup Port & Temperature Sensor

Ordering Information		Combination Pressure Pickup Port & Temp Sensors
ZPS		
Pressure Pickup Type		
-ACC	Option	Description
	01	2" X 4" Stainless Steel Wall Plate with Static Pickup
	02	Unassigned
	03	Room Mount Delta Style Enclosure with Static Pickup
	04	Unassigned
Temperature Sensor Type		
	-0	100 Platinum RTD, 100 Ω @ 0 °C, 0.385 Ω /°C temp. coeff.
	-1375	1K Platinum RTD, 1,000 Ω @ 0 °C, 3.75 Ω /°C temp. coeff.
	-1	1K Platinum RTD, 1,000 Ω @ 0 °C, 3.85 Ω /°C temp. coeff.
	-2	2K Silicon RTD, 2,000 Ω @ 20 °C, 8 Ω /°C temp. coeff.
	-18	1.8K Thermistor, 1,800 Ω @ 25 °C
	-22	2.2K Thermistor, 2,200 Ω @ 25 °C
	-3	3K Thermistor, 3,000 Ω @ 25 °C
	-33	3.3K Thermistor, 3,300 Ω @ 25 °C
	-102	10K-2 Thermistor, 10,000 Ω @ 25 °C
	-103	10K-3 Thermistor, 10,000 Ω @ 25 °C
	-10311	10K-3(11K) Therm., 5,238 Ω @ 25 °C, 11k Ω shunt resistor
	-20	20K Thermistor, 20,000 Ω @ 25 °C
	-47	47K Thermistor, 47,000 Ω @ 25 °C
	-50	50K Thermistor, 50,000 Ω @ 25 °C
	-100	100K Thermistor, 100,000 Ω @ 25 °C
	-334	LM334 Semiconductor
	-592	AD592 Semiconductor, 273 μ A @ 0 °C
	-592-10K	AD592 Semiconductor with a 10 k Ω shunt resistor, 2.73 V @ 0 °C
EXAMPLE		
ZPS	-ACC	03 -102
Example Part Number: ZPS-ACC03-102		
Your Part Number:		

Call BAPI if you have questions about the above ordering grid or the configuration of the product you are ordering.

Ceiling Mount Pickup Installation

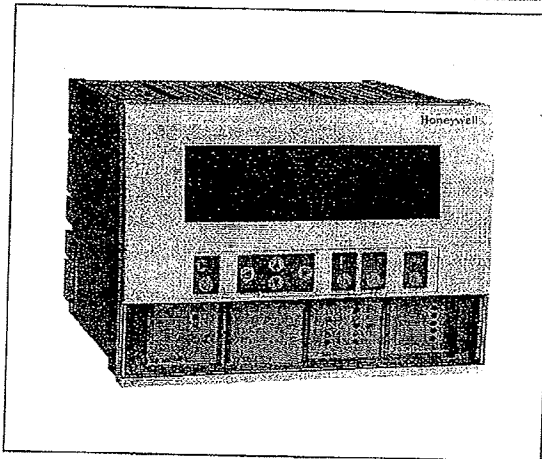
The Ceiling Mount pickup is designed to fit through a standard 3/4-inch thick ceiling tile. Cut a 5/8-inch hole in the tile and place the static pressure sensor on top of the tile with the filter extending through the hole. The filter should stick out slightly below the tile's room surface. Attach tubing to the barbed fitting on the back of the pickup port and run the tubing to the pressure sensor. An optional Junction Box is available for the cover to protect the barbed fitting.



Excel 500/600 CONTROL SYSTEM

EXCEL 500 OPEN
SYSTEM

SPECIFICATION DATA



FEATURES

- Various state-of-the-art communication options: Open LONWORKS® bus (Excel 500, only) or C-bus (Excel 500/600) communication; modem or ISDN terminal adapter at up to 38.4 Kbaud (Excel 500, only); dial-up through TCP/IP networks
- Maximum of 5 housings per Excel 500/600 control system with up to 16 I/O modules
- 128 physical data points and 256 pseudo points per Excel 500/600 controller (C-bus communication)
- Use with both internal, plug-in I/O modules, and Distributed I/O modules via LONWORKS bus (Excel 500, only)
- Unique features in open LONWORKS networks: NV-Booster® reduces the number of required NVs and thus also the number of required controllers; NV bindings can be restored after controller reset (and thus need not be redone after exchanging controllers); 512 NVs supported for LONWORKS integration; autobinding with Honeywell Distributed I/O modules, Smart I/O modules and 3rd party LonWorks® devices makes NV binding unnecessary, thus saving considerable engineering time
- Easy-to-use controls and six-line LCD display
- Front door or control panel mounting with DIN-rail
- Wireless communication via GSM (Excel 500, only)
- Applications programmable with Honeywell's CARE programming tool and downloadable into Flash EPROM (Excel 500, only)
- Enhanced controller functions including: alarm, trend and global broadcast hysteresis, network-wide time synchronization, firmware downloading via modem and C-Bus

GENERAL

The Excel 500/600 is a freely programmable control and monitoring system specifically designed for building management. Using the latest Direct Digital Control (DDC) technology, the modular design of the Excel 500/600 is particularly well suited for use in medium-sized buildings such as schools, hotels, offices, shopping centers, and hospitals.

In addition to control applications for heating, ventilation, and air conditioning (HVAC), the Excel 500/600 also performs a wide range of energy management functions, including optimum start/stop, night purge, and maximum load demand. Up to four Building Supervisors can be connected via the system bus.

The Excel 500 controller has a LONWORKS® bus interface, allowing interoperability with a wide range of Honeywell and third-party controllers and devices. Up to 512 LONWORKS network variables can be mapped to data points.

A modem or ISDN terminal adapter can be connected for communication via the public telephone network. Connection to a Siemens M20 Terminal allows wireless communication via the 900 MHz GSM network. Excel 600 requires an XDM506 for stand-alone modem communication.

The modular design enables the system to be expanded to meet growing needs. The data point user addresses and plain language descriptors are stored in the controller and are therefore available for viewing locally at an external interface without the need of a central PC.

Table 1. Modules for the Excel 500/600 System

Modules	Description
XC5010C	Computer module Excel 500 (required for Distributed I/O); UL916 and UL864-approved
XC5210C	Large RAM version of Excel 500
XC6010	Computer module Excel 600
XP502	Power supply module
XD505A/508	C-bus communication submodules (XL600, only)
XDM506	Modem communication submodule (XL600, only)
XF521A/526	Analog input modules
XF522A/527	Analog output modules
XF523A	Digital input modules
XF524A/529	Digital output modules
XF525A	Three-position output module

DESCRIPTION

The Excel 500/600 System is part of the EXCEL 5000 family of controllers. The Excel 500/600 System is freely programmable and can be used as a stand-alone controller or as part of a network of up to 30 controllers connected via a C-bus (9.6 Kbaud up to 76.8 Kbaud). The Excel 500/600 System provides energy management and control functions via internal plug-in I/O modules in the unit housing as well as via a 2-wire LonWORKS bus interface (Excel 500, only) to Honeywell Distributed I/O modules or Smart I/O modules.

The Excel 500/600 housing has four slots for plug-in modules (see Table 1). The primary unit consists of a CPU module (Excel 500 uses XC5010C, Excel 600 uses XC6010 for special high-performance requirements), a power supply module (XP502), and two additional I/O modules. Up to four more Excel 500/600 housings (without CPU and Power Supply module) can be connected in series providing slots for additional modules. An Excel 500/600 System can consist of up to 16 I/O modules (total number of plug-in and Dis-

tributed I/O modules (Excel 500, only)) with up to 128 inputs and outputs. A maximum of ten modules of the same type are allowed per system. In addition, the Excel 500 can communicate with any LonWORKS product. Up to 512 LonWORKS NVs can be mapped to data point.

There are two sources for Excel 500/600 program applications:

1. The controller is shipped with a wide range of standard functions permanently stored in EPROM. By selecting applications from these applications, the user program is assembled. No further programming is necessary.
2. Using Honeywell's Windows-based CARE programming tool, standard HVAC technology applications can be freely programmed, as needed.
3. The user program is then automatically generated based on the graphically designed schematic diagram, instrumentation, and control strategies.

SPECIFICATIONS

Electrical

Operating voltage
24 Vac, $\pm 20\%$

Power consumption
max. 40 VA (max. 30 W)

Memory buffer

XC5010C: gold capacitor buffer for 72 hours
XC6010: Lithium battery 3 V, (e.g. Varta CR $\frac{1}{2}$ AA-3V)
RAM buffer for approx. 1 month.

Application security on power failure

Complete backup of total system for 15 min., UPS.
Optional XAPU 24-2F.

Overvoltage protection

All inputs and outputs are protected against 24 Vac and 40 Vdc overvoltage as well as short-circuiting.

Environmental

Ambient temperature

Operation: 32 to 122°F (0 to 50°C)
Storage: -4 to 158°F (-20 to 70°C)

Ambient humidity (operation and storage)

5 to 93% r.h. noncondensing

Mechanical

Housing dimensions (H x W x D)

5-5/8 x 7-1/2 x 7-3/8 in.
(144 x 192 x 188 mm)

Housing material

Plastic, flame-retardant

Mounting methods

Panel (with DIN-rail) or front door

Calculated lifetime of weakest components

MTBF ≥ 60 years (for typical Excel 500 applications)

Protection class

IP 30

Communication

C-Bus

The C-bus transmits data between the EXCEL 5000® System controllers, devices, and building supervisors at 9.6 Kbaud up to 76.8 Kbaud. The maximum C-bus network length is 1,200 m (3,900 ft) or 15,700 ft. (4,800 m) using the XD507 or XD509 repeaters.

There is a maximum number of 30 controllers or devices per C-bus. See Excel 100/500/600 Installation Instructions (EN1R-1047GE51) for wiring details.

LonWORKS Bus (Excel 500, only)

The Excel 500 uses an FTT-10A Free Topology Transceiver, transmitting data at 78 Kbaud using LonTalk® protocol.

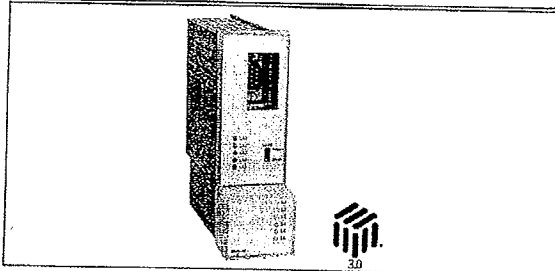
Cable length from 1,050 to 7,200 ft. (320 to 2,200 m). See Excel 100/500/600 Installation Instructions (EN1R-1047GE51) for wiring details.

Modem (Excel 500, only)

A modem or ISDN terminal adapter can be connected to the serial port for dial-up access at a transmission rate of up to 38.4 Kbaud. A Siemens M20 Terminal can be connected to allow wireless communication via GSM.

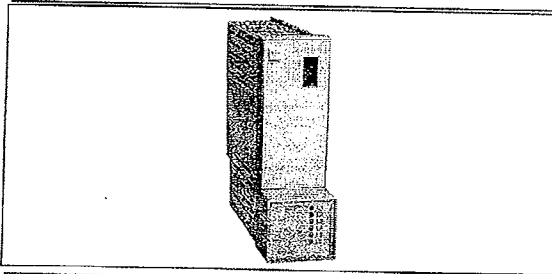
INTERNAL MODULES

Computer Module XC5010C / XC5210C



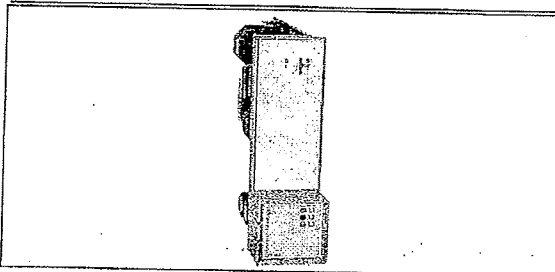
- Toshiba TMP93CS41F 16-bit microprocessor
- 1.28 MB total memory; 2x512 KB Flash EPROM for operating system and applications; 2x128 KB RAM
XC5210C, only: 1x128 KB plus 1x512 KB RAM
- Six operating status LEDs
- RS 232 port for MMI, modem or ISDN terminal adapter.
- RS 485 port for C-bus
- Coding pin (pin 8)
- Gold capacitor for data buffer
- Reset button
- Watchdog function
- Neuron[®] chip 3120
- LONWORKS service button and LED
- Firmware download

Computer Module XC6010



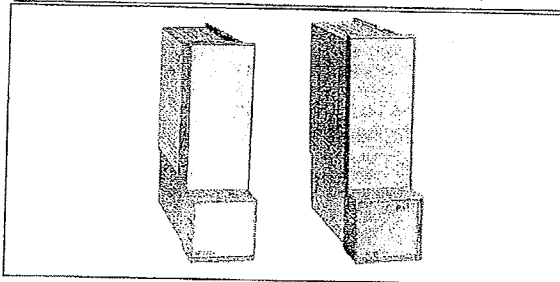
- Intel[®] i960 32-bit microprocessor
- 1.536 MB total memory
2x512 KB EPROM
4x128 KB RAM
1x256 KB Flash EPROM
- Six operating status LEDs
- RS 232 port for attachment of operator interface
- RS port for C-bus
- Coding pin (pin 8)
- Buffer battery providing 30-day data
- Reset button
- Watchdog function

Power Supply Module XP502



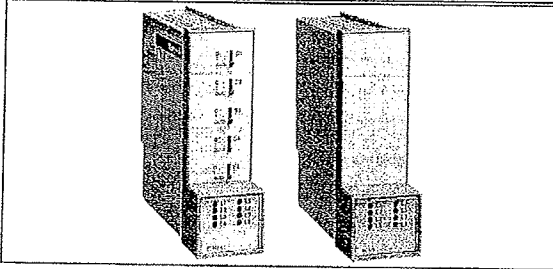
- Provides low voltage to modules via internal bus
- Can be connected to UPS device XAPU 24-2F
- Three operating status LEDs
- Coding pin (pin 6)
- Watchdog function

Analog Input Module XF521A/526



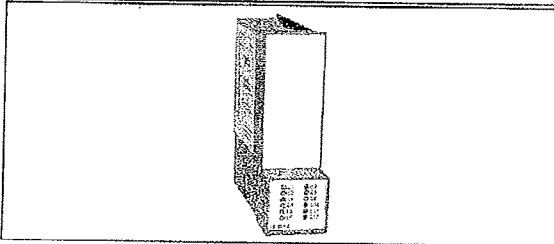
- Eight analog inputs (AI1 - AI8)
0 to 10 Vdc
0 to 20 mA (via external 500-ohm resistor)
4 to 20 mA (via external 500-ohm resistor)
NTC 20k ohm and PT 1000 (-50°C to +150°C)
XF526, only:
PT 1000 (0°C to +400°C), PT 3000, PT 100, Balco 500
- Protected inputs up to 40 Vdc / 24 Vac
- 12-bit resolution
- 1 sec (XC5010C) or 250 ms (XC6010) CPU polling time
- Coding pin (pin 7)

Analog Output Module XF522A/527



- Eight outputs (AO1 - AO8), short-circuit proof
- Signal levels 0 to 10 Vdc
U_{max} = 11 Vdc,
I_{max} = +1 mA, -1 mA
- Protected outputs up to 40 Vdc / 24 Vac
- 8-bit resolution
- Zero point < 200 mV
- Accuracy $\leq \pm 150$ mV deviation from output voltage
- One red LED per channel
light intensity proportional to output voltage
- Control updating every 1 sec (XC5010C) or 250 ms (XC6010) with CPU
- XF522A, only: manual override controls for five outputs

Digital Input Module XF523A

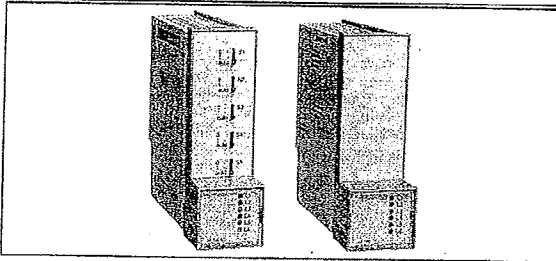


- Twelve inputs (DI1 - DI12), R_i = 15k ohm

inputs	1 - 2	3 - 12
max. freq.	15 Hz	0.4 Hz
min. pulse duration	20 msec	1.25 sec
min. pulse pause	33 msec	1.25 sec
max bounce time	5 msec	50 msec

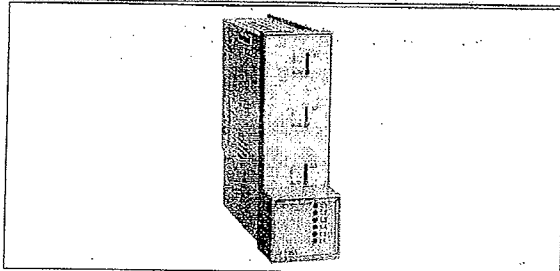
- Switching conditions: OFF: U_i \leq 2.5 V, ON: U_i \geq 5 V
- Protected switching up to 40 Vdc / 24 Vac
- Coding pin (pin 9)
- One status LED per channel, invertible (NO/NC)
- 18 Vdc auxiliary voltage supply (unregulated)
- 1 sec (XC5010C) or 250 ms (XC6010) CPU polling time

Digital Output Module XF524A/529



- Five isolated change-over contacts and 1 NO contact
- Max. voltage U_{max} = 240 Vac per output
- Max. current I_{max} = 4 A per output
- 12-A total current per module
- Coding pin (pin 10)
- LED per channel
OFF: LED off
ON: LED illuminated (yellow)
- Cycle time 1 sec (XC5010C) or 250 ms (XC6010) with CPU
- XF524A, only: manual override switches for 5 outputs

Three Position Output Module XF525A



- Three three-position relays
- Max. load
1.2 A at 24 Vac
0.2 A at 240 Vac
- Coding pin (pin 12)
- Two LEDs per channel with manual override switches

L1 (green):	servo motor closes
L2 (red):	servo motor opens
L3 (green):	servo motor closes
L4 (red):	servo motor opens
L5 (green):	servo motor closes
L6 (red):	servo motor opens

- Cycle time 1 sec (XC5010C) or 250 ms (XC6010) with CPU

Module Locations

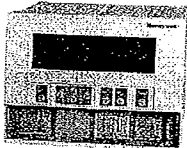
Each Excel 500/600 housing has four module slots numbered 1 through 4 from left to right. Table 2 indicates the possible slot positions for each module.

Table 2. Slot positions for the various Excel 500/600 modules

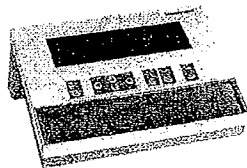
Module	Slot position
Computer module XC5010C/XC5210C/XC6010	first Excel 500 housing, slot 4
Power Supply module XP502	first Excel 500 housing, slot 1
Analog Input module XF521A/526	any slot
Analog Output module XF522A/527	any slot
Digital input module XF523A	any slot
Digital Output module XF524A/529	not in first Excel 500 housing
3-Position Output module XF525A	not in first Excel 500 housing

NOTE: Also see the Distributed I/O Product Data sheet, EN0B-0090GE51.

OPERATOR INTERFACE XI581AH/XI582AH



XI581

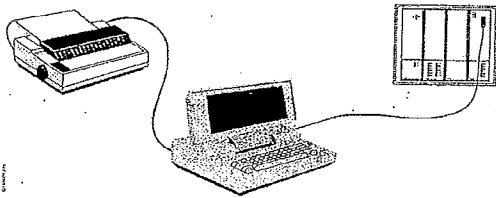


XI582

The XI581AH or XI582AH operator interface is the command and information center of the Excel 500/600 system. With them, data can be entered and displayed. Information such as current temperature values, control status, etc. can also be displayed. The menu-driven, six-line, backlit LCD graphic display with 34 characters per line, together with eight clearly marked keys, makes the device easy to use.

The operator interface is connected to the serial port at the front of the computer module. The XI582AH unit can be mounted on the front cover or up to 48 ft. (15 m) away from the controller. This can be extended to 328 ft. (100 m) using line drivers. A blank cover is also available.

OPERATOR AND SERVICE SOFTWARE EXCEL ONLINE (FORMERLY XI584)



Excel 500/600 with Excel Online (formerly XI584) and printer

The PC-based Excel Online (formerly XI584) is the local intelligent operating and service software. It performs all the operating functions of the XI581AH/XI582AH as well as having the advantages of a PC. Not only can the Excel Online (formerly XI584) make major modifications such as changing setpoint values and time program switching points, it also offers all service and commissioning functions.

The Excel Online (formerly XI584) can be operated at five different access levels, three of which are password protected. A printer can be connected to the parallel interface of the Excel Online (formerly XI584) to log alarms and error messages. As with the XI582AH, the PC with the Excel Online (formerly XI584) operator and service software can be placed up to 15 meters from the computer module. Line drivers allow distances of up to 328 ft. (100 m).

PROGRAMMING

The Excel 500 system includes a comprehensive software package specially designed to meet the requirements of application engineers. The easy-to-use, menu-driven software features the following functions:

- data point description
- time program
- alarm handling
- application program (DDC program)
- password protection

Data Point Description

Data points are the basis of the Excel 500 system. They contain system-specific information such as values, status, limit values, and default settings. The user has easy access to data points and the information they contain. The user can recall and modify information in the data points.

Time Program

The time program can be used to enter the setpoint or status at any time for any data point. The following time programs are available:

- daily program
- weekly program
- annual program
- TODAY function
- special day list

Daily programs are used to create a weekly program. The annual program is created automatically by multiplying the weekly program and then incorporating daily programs. The TODAY function allows direct changes to the switching program. It allows you to allocate a setpoint or status to the selected data point for a defined period of time.

Alarm Handling

The alarm handling facility offers system security. Alarm signals can, for example, alert the operator to scheduled maintenance work. All alarms that occur are stored in data files and reported immediately. If your system configuration allows, you can also list alarms on a printer or transmit alarms to higher level devices.

There are two types of alarms, critical and non-critical. Critical alarms (e.g. system alarms caused by a fault in the controller) have priority over non-critical alarms. To distinguish between alarm types, you can generate your own alarm messages or use pre-programmed system messages. The following events all generate alarm messages:

- exceeding limit values
- overdue maintenance work
- totalizer readings
- digital data point changes of state

Application Program (DDC program)

You can use Honeywell's CARE (Computer Aided Regulation Engineering) programming tool to create application programs for your system. A particular advantage offered by CARE is the ability to create a fully functional control program without having to be familiar with the programming language.

Password Protection

The control system is also protected by passwords. This ensures that only authorized persons have access to system data. There are four operator levels, each protected by its own password.

Operator level 1: Read only. The operator can display information about setpoints, switching points, and operating hours.

Operator level 2: Read and make limited changes. The operator can display system information and modify certain pre-set values.

Operator level 3: Read and make changes. System information can be displayed and modified.

Operator level 4: Programming can be carried out.

Trending

The Excel 500 system provides controller-based trending. This feature allows historical values to be stored in the controller. Both time-based or value-hysteresis-based trending are possible.

ACCESSORIES

Table 3 lists the accessories available for the Excel 500/600.

Table 3. Accessories for the Excel 500/600

Order code	Description
XD509	C-bus repeater
XM100A	Modem device
XS563	socket for wall mounting
XS564	socket for panel mounting
XH561	housing (empty, without socket)
XH562H	blank cover
XI581AH	operator interface, controller cover
XI582AH	operator interface, desktop/wall mounted
XW568	80mm cable, horiz. housing connection, only
XW569	330mm cable, vert. housing connection, only
XW564	cable to XI582
XW565	cable to XI582 (5 m)
XW567	cable to XI584 (2.5 m)
XW582	cable to XI582AH (XC5010C, front)
XW583	cable to XI582AH (XC5010C, rear)
XW584	adapter cable
XW585	cable to XI584 (5 m, XC5010C)

DISTRIBUTED I/O MODULES

See the Distributed I/O Product Data sheet, EN0B-0090GE51.

Honeywell

Control Products
Honeywell Inc.
Honeywell Plaza
P.O. Box 524
Minneapolis, MN 55408-0524
USA
<http://www.honeywell.com>

Control Products
Honeywell Limited-Honeywell Limitee
155 Gordon Baker Road
North York, Ontario
M2H 3N7
Canada
<http://www.honeywell.ca>

Control Products
Honeywell AG
Böblinger Straße 17
D-71101 Schönaich
Germany
<http://europe.hbc.honeywell.com>

manufacturing
locating certified to

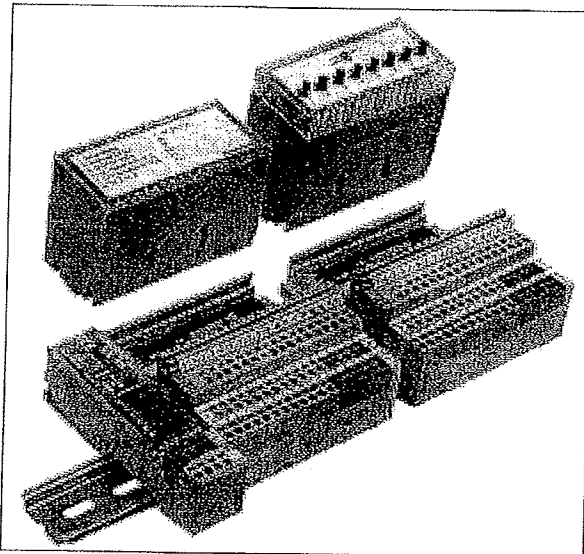
DIN EN ISO
9001/14001

Distributed I/O

XFL 521, 522, 523 AND 524 MODULES



SPECIFICATION DATA



FEATURES

- 2-wire LON® bus between controller and I/O.
- No additional field terminals required.
- Can be used in conjunction with standard I/O modules.
- Addressing with hex switch (autoconfiguring LON Bus).
- No wiring required between neighboring modules due to sliding bus connector.
- Fast connection due to clamp terminals.
- Module exchange during operation.
- LON bus slide connector per module.
- Optional manual override with feedback.
- Alarm in case of defective module.
- Mechanical coding prevents mismatching of modules.
- Power LED (L1, green) and LON service LED (L2, red) on all electronic modules.

GENERAL

The XFL521, 522, 523 and 524 modules are digital and analog I/O modules that can be installed at strategic locations within a building. As part of the EXCEL 5000 system, these modules convert sensor readings and provide output signals used for operating actuators. Each I/O module plugs into a base terminal block allowing communication with a CPU through the built-in Echelon® LON bus. The terminal block provides spring terminals for easy connection of field cables from the various sensors and actuators.

The modular system allows I/O modules to be removed from the system without disturbing other modules. The module with terminal block mounts easily onto a DIN rail.

DESCRIPTION

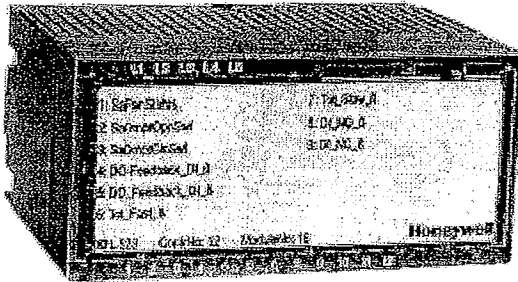
The XFL521, 522, 523 and 524 are distributed I/O modules used with XC5010C or newer CPUs in the EXCEL 5000 family product line.

Table 1. Distributed I/O Modules.

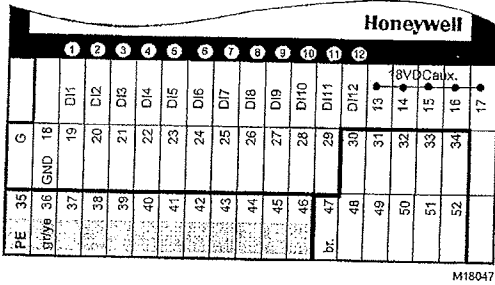
Module	Description
XFL521	Analog Input module
XFL522	Analog Output module
XFL523	Digital Input module
XFL524	Digital Output module
XSL513	Terminal block for XFL521/522/523
XSL514	Terminal block for XFL524
XFR522	Analog Output manual override module
XFR524	Digital Output manual override module
XSL511	LON connector module
XSL512	Manual terminal disconnect module



Digital Input Module XFL523



- 12 inputs (DI1 - DI12).
- Ri = 10K ohm.
- Maximum 20 Hz input frequency.
- Switching conditions:
OFF: $U_i \leq 2.5V$;
ON: $U_i \geq 5V$.
- Protected switching up to 40 Vdc/24 Vac.
- LED per channel, color selectable in two groups; (SW1: DI 1-6; SW2 DI: 7-12) color combinations: See Table 2.
- 18 Vdc auxiliary voltage supply (unregulated).
- 1 sec polling time with CPU.
- Dimensions (WxLxH): 47x97x70 mm.



The digital input module has 12 input channels for connecting sensors or any device that provides a digital output. The input values are read by the CPU and then used for monitoring or as parameters for controlling other devices

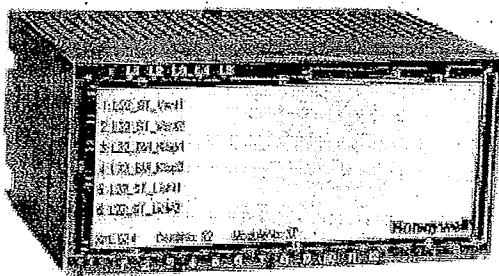
The XFL523 plugs into the XSL513 Terminal Block. It can be inserted and removed without disturbing other units on the bus. Terminals A11 through A12 are the digital inputs. Terminals 13 through 17 are wired together and provide an auxiliary voltage of 18 Vdc. The module address is set with a HEX rotary switch.

*The logic in Table 2 depends on your CARE application.

Table 2. Switching Indication.

Logic*	Signal level	Switch = ON	Switch = OFF
Normally closed	$\leq 2.5V$	yellow	red
	$\geq 5.0V$	OFF	green
Normally open	$\leq 2.5V$	OFF	green
	$\geq 5.0V$	yellow	red

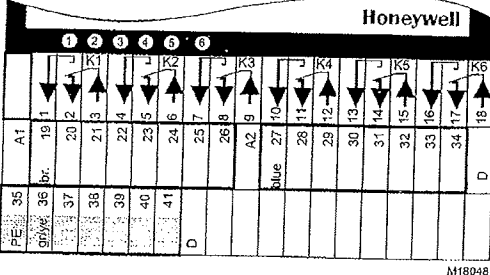
Digital Output Module XFL524



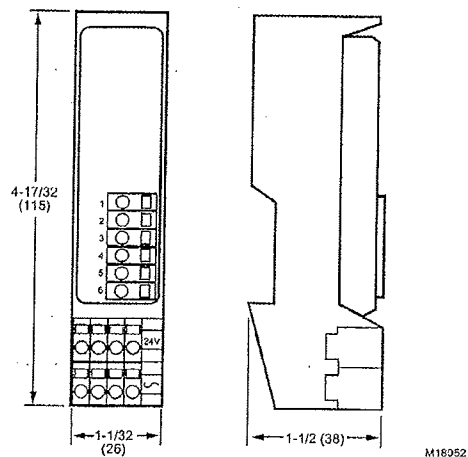
- 6 isolated change-over contacts.
- Maximum voltage $U_{max} = 230 Vac$ per output.
- Max. current $I_{max} = 2A$ per output.
- LED per channel:
OFF: LED off.
ON: LED illuminated (yellow).
- Cycle time 1 sec with CPU.
- Dimensions (WxLxH): 47x97x70 mm.

The digital output module has 6 isolated change-over contacts which can be connected to actuators or other switchable devices.

The XFL524 plugs into the XSL514 Terminal Block and can be inserted and removed without disturbing other units on the bus. Terminals 1 through 18 are switched according to the adjacent figure. Six LED are located on top of the module. The module address is set with a HEX rotary switch.



DISTRIBUTED I/O XFL 521, 522, 523 AND 524 MODULES



Dimensions of XSL511 LON Connector Module in in. (mm).

Honeywell

Home and Building Control
Honeywell Inc.
Honeywell Plaza
P.O. Box 524
Minneapolis, MN 55408-0524

Home and Building Control
Honeywell Limited-Honeywell Limitee
155 Gordon Baker Road
North York Ontario
M2H 3N7

Home and Building Control Products
Honeywell AG
Böblinger Straße 17
D-71101 Schönaich
Phone (49-7031) 637-01
Fax (49-7031) 637-493



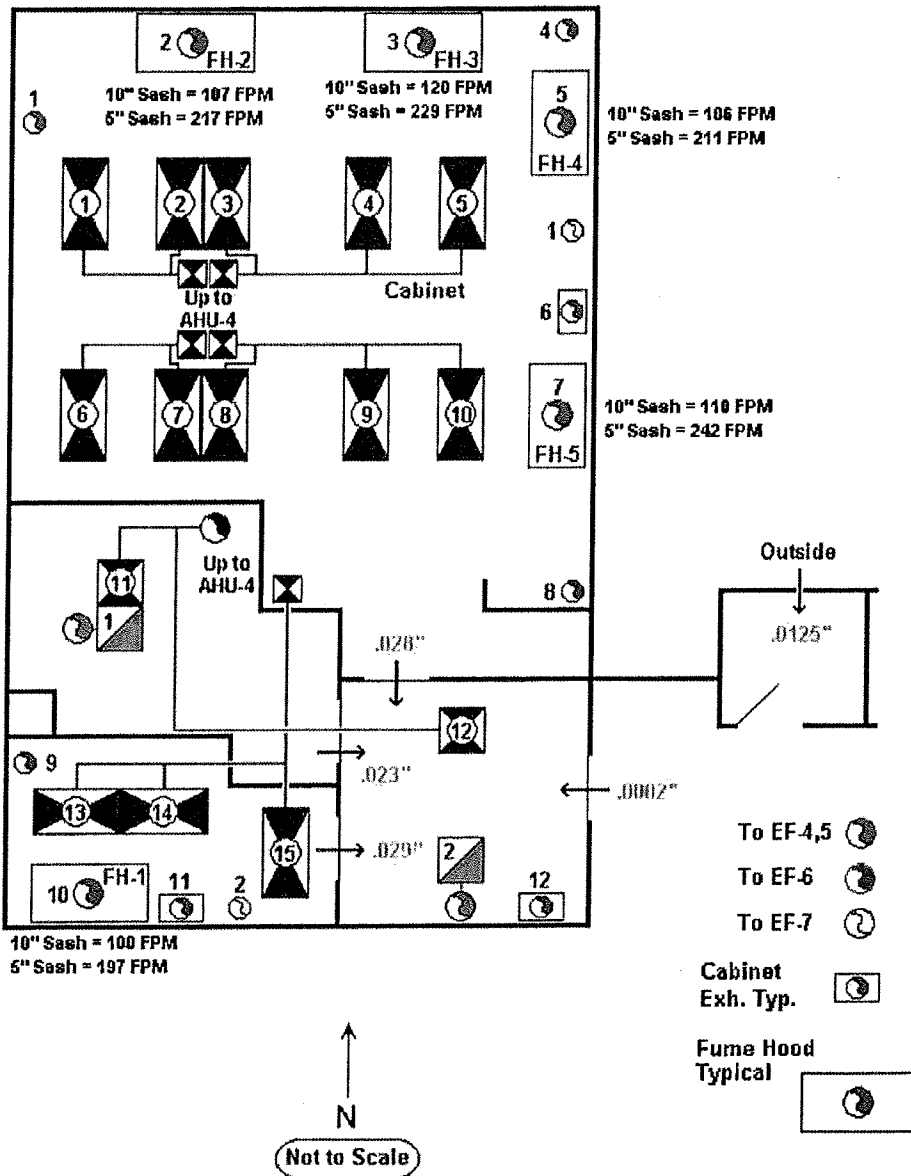
**Cosmogenic Nuclide
Laboratory
Delehanty Hall
University Of Vermont
Burlington, Vermont
NEAS # RC646-S
Precision Balancing # 1987
June, 2008**

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & TC	
Project: 1987AHU4	Location: Burlington, Vermont	Date: 6-27-08	

Air Apparatus Test Report

System/Unit: AHU-4

UNIT DATA

Make	Clean PAK	Class/Discharge	/
Model No.	Size 22 Fanwall	Tag No.	AHU-1
Serial No.	A09 AH-01	Location	Rooftop

MOTOR DATA

Make	Toshiba (Two Motors)	Model / Part No.	B0154FLF2USH02	RPM	1775
Frame	254T	Volts / Phase /Hz	230-460, 3, 60	S.F.	1.15
H.P.	15	Full Load Amps	37 - 18.5	Flac	N/A
Measured Volts	66.5% (Freq)	Measured Amps	16.0 (Freq)	BHP	N/A

DRIVE DATA

Fan Data		Motor Data	
Sheave Size / Make	Direct Drive	Sheave Size / Make	Direct Drive
Bushing / Bore Size	Direct Drive	Bushing / Bore Size	Direct Drive
No. Belts / Make / Size	Direct Drive	Sheave C to C	Direct Drive
Fan Design RPM	2222 (74 Hz)	Fan Actual RPM	1752
		Motor Actual RPM	1752

AIR DATA

	Design	Actual		Design	Actual
Total CFM	7,500 Rated	7,077	Total S.P.	6.0"	N/A
O.A. CFM	/	7,077	Disch. S. P.	/	.80" Control
Ret. Air CFM	/	/	Suc. S. P.	/	N/A
Pre-Heat S.P. Drop	N/A	Cooling Coil S.P. Drop	N/A	Re-Heat S.P. Drop	N/A
Pre-Filter S.P. Drop	N/A	Hi Eff. Filter S.P. Drop	N/A		
Vortex Damp. Pos.	57.8 Hz	O.A. Damper Pos.	100% OP	Ret. Air Damp Pos.	/

NOTES

- 1.) Unable to drill unit for pressure readings.
- 2.) Control point readout equals .80".
- 3.) System balance with 'B' fan running.

PRECISION BALANCING LLC

SAVE ENERGY • BE COMFORTABLE • GET BALANCED!

Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & TC	
Project: 1987ef4	Location: Burlington, Vermont	Date: 6-13-08	

Air Apparatus Test Report

System/Unit: EF-4

UNIT DATA

Make	HartZell Fan	Class/Discharge	/
Model No.	A41-9-222FA100FGFEN3	Tag No.	PO # RC622
Serial No.	Order # 0821763-01	Location	Rooftop

MOTOR DATA

Make	Westinghouse	Model / Part No.	S # GSP407607	RPM	1755
Frame	215T	Volts / Phase /Hz	230-460, 3, 60	S.F.	1.15
H.P.	10	Full Load Amps	23.2 - 11.6	Flac	25.7
Measured Volts	206.6, 207.3, 207.9	Measured Amps	18.0, 17.6, 18.0	BHP	7.70

DRIVE DATA

Fan Data		Motor Data	
Sheave Size / Make	5 3/8" OD	Sheave Size / Make	2BK57H / Power Drive
Bushing / Bore Size	B 1 11/16	Bushing / Bore Size	H X 1 3/8"
No. Belts / Make / Size	2 / Browning / BX66	Sheave C to C	26"
Fan Design RPM	1808	Fan Actual RPM	1821
		Motor Actual RPM	1767

AIR DATA

	Design	Actual		Design	Actual
Total CFM	5,665	5,947	Total S.P.	5.0"	N/A
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	N/A
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	4.65" Control
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

- 1.) Unable to drill coated exhaust duct for pressures.
- 2.) Control point readout equals 4.65".
- 3.) Fan is rated for 6,500 CFM at 5.0".

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-3	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM & TC	
Project: 1987ef5	Location: Burlington, Vermont	Date: 6-17-08	

Air Apparatus Test Report

System/Unit: EF-5

UNIT DATA

Make	Hartzell Fan	Class/Discharge	/
Model No.	A41-9-222FA100FGFEN3	Tag No.	PO # RC622
Serial No.	Order # 0821763-02	Location	Rooftop

MOTOR DATA

Make	Westinghouse	Model / Part No.	S # GSP407607	RPM	1755
Frame	215T	Volts / Phase /Hz	230-460, 3, 60	S.F.	1.15
H.P.	10	Full Load Amps	23.2 - 11.6	Flac	25.7
Measured Volts	206.5, 207.1, 208	Measured Amps	16.8, 16.9, 17.4	BHP	7.34

DRIVE DATA

Fan Data		Motor Data	
Sheave Size / Make	5 3/8" OD	Sheave Size / Make	2BK57H / Power Drive
Bushing / Bore Size	B 1 11/16	Bushing / Bore Size	H X 1 3/8"
No. Belts / Make / Size	2 / Browning / BX66	Sheave C to C	26"
Fan Design RPM	1808	Fan Actual RPM	1827
		Motor Actual RPM	1770

AIR DATA

	Design	Actual		Design	Actual
Total CFM	5,665	5,590	Total S.P.	5.0"	N/A
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	N/A
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	4.30" Control
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

- 1.) Unable to drill coated exhaust duct for pressures.
- 2.) Control point readout equals 4.30".
- 3.) Fan is rated for 6,500 CFM at 5.0".

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: TC & PM	
Project: 1987ef6	Location: Burlington, Vermont	Date: 6-13-08	

Air Apparatus Test Report

System/Unit: EF-6

UNIT DATA

Make	Greenheck	Class/Discharge	/
Model No.	8-BISW-41-X-10-1	Tag No.	EF
Serial No.	11221500 0802	Location	Rooftop

MOTOR DATA

Make	WEG	Model / Part No.	1UTOICGNXX1/204E	RPM	1750
Frame	B56	Volts / Phase /Hz	208-230-460, 3, 60	S.F.	1.25
H.P.	1/2	Full Load Amps	2.21 - 2.0 - 1.0	Flac	2.22
Measured Volts	207, 207.1, 207.3	Measured Amps	2.2, 1.9, 1.6	BHP	.43

DRIVE DATA

Fan Data			Motor Data		
Sheave Size / Make	AK34 x QT		Sheave Size / Make	AK44	
Bushing / Bore Size	QT x 1"		Bushing / Bore Size	QT x 5/8"	
No. Belts / Make / Size	1 / Carlisle / 4L300R		Sheave C to C	8 3/4"	
Fan Design RPM	1808	Fan Actual RPM	1369	Motor Actual RPM	1771

AIR DATA

	Design	Actual		Design	Actual
Total CFM	410	548	Total S.P.	1.5"	.641"
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	.001" pos
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	.64" neg
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

1.) Exhaust set to room pressure.

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: DC & TC	
Project: 1987ef7	Location: Burlington, Vermont	Date: 6-12-08	

Air Apparatus Test Report

System/Unit: EF-7

UNIT DATA

Make	M.K. Plastics	Class/Discharge	/
Model No.	CNW250	Tag No.	EF-6
Serial No.	/	Location	Rooftop

MOTOR DATA

Make	WEG	Model / Part No.	Part # HT003404P	RPM	1765
Frame	182T	Volts / Phase / Hz	208-230-460, 3, 60	S.F.	1.25
H.P.	3	Full Load Amps	7.8 - 3.9	Flac	7.83
Measured Volts	206.9, 207.1, 207.3	Measured Amps	4.6, 4.9, 4.8	BHP	1.88

DRIVE DATA

Fan Data			Motor Data		
Sheave Size / Make	2B40SH		Sheave Size / Make	2VP45 x 1 1/8	
Bushing / Bore Size	SH 15/16		Bushing / Bore Size	1 1/8"	
No. Belts / Make / Size	2 / Carlisle / BP30		Sheave C to C	10 1/2"	
Fan Design RPM	Not Given	Fan Actual RPM	1600	Motor Actual RPM	1777

AIR DATA

	Design	Actual		Design	Actual
Total CFM	1,105 (Rated)	Note 3	Total S.P.	5.5"	N/A
O.A. CFM	/	Exh. Fan	Disch. S. P.	/	.01" pos
Ret. Air CFM	/	Exh. Fan	Suc. S. P.	/	1.45" Control
Pre-Heat S.P. Drop	/	Cooling Coil S.P. Drop	/	Re-Heat S.P. Drop	/
Pre-Filter S.P. Drop	/	Hi Eff. Filter S.P. Drop	/		
Vortex Damp. Pos.	/	O.A. Damper Pos.	/	Ret. Air Damp Pos.	/

NOTES

- 1.) Adjustable sheave on motor set two turns from maximum.
- 2.) Control setpoint readout equals 1.45".
- 3.) Unable to drill fan for total airflow and pressure.
- 4.) Fan has an inlet bleed on the roof (set near full open).

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Precision Balancing No. 1987		Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM & TC	
Project: 1987 Pump	Location: Burlington, Vermont	Date: 6-13-08	

Pump Test Report

System/Unit: Pump-1 (AHU-4 Hot Water Coil)

PUMP DATA

Pump Number	Pump 1
Service / Location	H.W. Coil AHU-4 / Penthouse
Pump Manuf.	Bell & Gossett
Model Number	60
Impeller Size	1x5.25
RPM	Not Given
Design GPM	Not Given
Design Head (FT)	Not Given

MOTOR DATA

Motor Manuf.	Bell & Gossett
Motor Part# /Frm	48T175BP / 48Y
Horsepower	1/2
RPM	1725
Volts / Ph	208-230-460 / 3
F.L. Amps / S.F.	2.1-2.2-1.1 / 1.25
NEMA Eff. / P.F.	/

TEST DATA

Pump Off Pres.	N/A	
Valve Shut Diff	N/A	
Actual Impell. Dia	N/A	
Valve Open Diff.	35.6-33=2.6 psig (6.01 ft/hd))	
Valve Open GPM	47	
Final Suction Pr.	33.2 psig	
Final Disch. Pr.	36.4 psig	
Final Differential	3.2 psig (7.39 ft/hd)	
Final GPM	35	
Voltage	T1-T2	204
	T2-T3	206.5
	T3-T1	206.7
Amps	T1	2.0
	T2	1.9
	T3	1.8

NOTES

1.) Pump trips on overloads.

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Precision Balancing No. 1987	Contractor No. NEAS # RC646-S	
Contract No.	Job Name: Delehanty Hall, UVM	Technician: PM DC
Project: 1987CS	Location: Burlington, Vermont	Date: 6-13-08

Circuit Setter Flow Test Report

System/Unit: Chilled Water & Hot Water Coils

Area Served or Device #	Model	Size	C.S. Set Point	C.S. Pressure Drop (FT.)	Design GPM	Actual GPM	Notes
AHU-4							
C.W. Coil	T/A	3"	5.0	1.0	61	41	1
H.W. Coil	T/A	2 1/2"	4.0	1.75	34	35	
Re-Heats							
RH-26	T/A	1 1/4"	1.25	46.1	12.4	13.1	
RH-27	T/A	1"	.7	36	3.3	3.4	
RH-28	T/A	3/4"	.5	32.4	1.3	2.3	2
End of Line							
By-Pass	T/A	1/2"	.6	80	1.0	1.0	
Unit Heater	T/A	3/4"	.5		3.0		3
U.H. By-Pass	T/A	3/4"	.5	63	3.0	3.2	

NOTES

- 1.) Circuit setter on its highest graphable setting (1.0 ft).
- 2.) Circuit setter on its lowest graphable setting (0.5).
- 3.) Broken control valve.

AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

Customer ID: 011144 S/N: M951030
 Customer: PRECISION BALANCING LLC City: ESSEX JUNCTION State: VT
 As-Received Model #: ADM-870 Converted to Model #: _____ Order #: R072913
 PO #: _____ Customer Eqpt ID#: _____ Calibration Due Date: _____

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Quality Assurance and calibration procedures meet the requirements for ANSI/NCCL Z540-1-1994; MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. All Uncertainties are expressed in expanded terms (twice the calculated uncertainty). This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments, Inc. Results relate only to the item calibrated. For limitations on use, see Shortridge Instruments, Inc. Instruction Manual for the use of AirData Multimeters. Procedure used: Procedure for Differential Pressure, Absolute Pressure and Temperature Recalibration of AirData Multimeters SIP-CP02 Revision: 26 Dated: 03/31/06

Calibration Technician(s): A. Gaurab J. Laubner Calibration Date: 09/19/2007
 Calibration Approved by: E. Bayless Title: Cal Date: 09/20/2007

AS-Received By <u>ag</u>	Fipe1 Test By <u>ZL</u>	Test By _____
Date <u>09/17/07</u> Rh <u>54</u> %	Date <u>09/19/07</u> Rh <u>41</u> %	Date _____ Rh _____ %
Ambient Temperature <u>74</u> °F	Ambient Temperature <u>75</u> °F	Ambient Temperature <u>NA</u> °F
Barometric Pressure <u>28.36</u> in Hg	Barometric Pressure <u>28.41</u> in Hg	Barometric Pressure _____ in Hg
Within spec <u>YES</u> NO NA	Within spec <u>YES</u> NO	Within spec YES NO

ABSOLUTE PRESSURE TEST (in Hg)

TEST METER TOLERANCE = ± 2.0 % ± .1 in Hg		AS-RECEIVED TEST WITHIN SPEC <u>YES</u> NO N/A	
Pressure Standard: Heise #02-R	S/N: 41741/42451	Calibration Date: 02/28/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #04-R	S/N: 41743/42453	Calibration Date: 10/25/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #06-R	S/N: 41742/42452	Calibration Date: 02/08/07	Calibration Due Date: 02/2008
Pressure Standard: Heise #08-R	S/N: 42186/43328	Calibration Date: 11/15/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #10-R	S/N: 42203/43352	Calibration Date: 01/15/07	Calibration Due Date: 01/2008
Pressure Standard: Heise #12-R	S/N: 43166/44731	Calibration Date: 03/26/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #14-R	S/N: 43412/45043	Calibration Date: 06/08/07	Calibration Due Date: 06/2008

Heise Model PPM-2 Mfgd by Dresser Industries Rated Accuracy: 0.05% fs (0.0305 in Hg) Range: 0-61 in Hg Resolution: 0.01 Uncertainty: < 0.0358

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
14.0	14.35	14.3	-0.35	13.95	13.9	-0.36			
28.4	28.36	28.3	-0.21	28.41	28.2	-0.74		NA	
40.0	40.38	40.2	-0.45	42.53	42.2	-0.78			

DIFFERENTIAL PRESSURE TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± 0.001 in wc		AS-RECEIVED TEST WITHIN SPEC <u>YES</u> NO N/A	
Pressure Standard: Heise #01-L	S/N: 41739/42449	Calibration Date: 03/06/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #01-R	S/N: 41739/42446	Calibration Date: 03/06/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #02-L	S/N: 41741/42454	Calibration Date: 03/06/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #03-L	S/N: 41738/42448	Calibration Date: 11/03/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #03-R	S/N: 41738/42445	Calibration Date: 11/02/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #04-L	S/N: 41743/42456	Calibration Date: 11/02/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #05-L	S/N: 41740/42450	Calibration Date: 02/15/07	Calibration Due Date: 02/2008
Pressure Standard: Heise #05-R	S/N: 41740/42447	Calibration Date: 02/15/07	Calibration Due Date: 02/2008
Pressure Standard: Heise #06-L	S/N: 41742/42455	Calibration Date: 02/13/07	Calibration Due Date: 02/2008
Pressure Standard: Heise #07-L	S/N: 42185/42186	Calibration Date: 11/29/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #07-R	S/N: 42185/43326	Calibration Date: 11/29/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #08-L	S/N: 42186/43329	Calibration Date: 11/22/06	Calibration Due Date: 11/2007
Pressure Standard: Heise #09-L	S/N: 42202/43351	Calibration Date: 01/13/07	Calibration Due Date: 01/2008
Pressure Standard: Heise #09-R	S/N: 42202/43350	Calibration Date: 01/13/07	Calibration Due Date: 01/2008
Pressure Standard: Heise #10-L	S/N: 42203/43353	Calibration Date: 01/23/07	Calibration Due Date: 01/2008
Pressure Standard: Heise #11-L	S/N: 43165/44551	Calibration Date: 03/27/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #11-R	S/N: 43165/44730	Calibration Date: 03/27/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #12-L	S/N: 43166/44732	Calibration Date: 03/27/07	Calibration Due Date: 03/2008
Pressure Standard: Heise #13-L	S/N: 43415/45041	Calibration Date: 06/12/07	Calibration Due Date: 06/2008
Pressure Standard: Heise #13-R	S/N: 43415/45039	Calibration Date: 06/11/07	Calibration Due Date: 06/2008
Pressure Standard: Heise #14-L	S/N: 43412/45045	Calibration Date: 06/12/07	Calibration Due Date: 06/2008

Differential Pressure Standards: Heise Model PPM1 Manufactured by Dresser Industries
 01-L, 03-L, 05-L, 07-L, 09-L, 11-L, 13-L Rated Accuracy: > 0.07% fs (0.000175 in wc) Range: 0.0-0.25 in wc Res.: 0.00001 Uncertainty: < 0.00035
 01-R, 03-R, 05-R, 07-R, 09-R, 11-R, 13-R Rated Accuracy: > 0.06% fs (0.003 in wc) Range: 0.0-5.0 in wc Res.: 0.0001 Uncertainty: < 0.00348
 02-L, 04-L, 06-L, 08-L, 10-L, 12-L, 14-L Rated Accuracy: > 0.06% fs (0.03 in wc) Range: 0.0-50.0 in wc Res.: 0.001 Uncertainty: < 0.0346

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
0.0500	0.0505	0.0504	-0.20	0.0521	0.0520	-0.19			
0.1250	0.1264	0.1262	-0.16	0.1282	0.1284	0.14			
0.2250	0.2214	0.2211	-0.14	0.2239	0.2232	-0.31			
0.2700	0.2723	0.2734	0.40	0.2733	0.2739	0.22			
2.000	2.007	2.009	0.10	2.013	2.012	-0.05			
3.600	3.644	3.644	0	3.677	3.673	-0.11			
4.400	4.433	4.466	0.74	4.475	4.479	0.09			
27.00	27.06	27.20	0.52	27.10	27.11	0.04			
50.00	50.56	50.57	0.02	49.60	49.42	-0.36			
Overage	NA	✓	NA	NA	✓	NA	NA	NA	NA

HDM-250 HYDRODATA MULTIMETER CERTIFICATE OF CALIBRATION

 CO ID: 011144

 S/N: W07120

 Customer: Precision Balancing LLC

 City: Essex Junction

 State: VT

 Model #: HDM250

PO #: _____

Calibration Due Date: _____

 Order #: 071458

 Tr: R. Cichanowicz

 Date 07/16/2007

 Rh 52 %

 Ambient Temperature 76 °F

 Barometric Pressure 28.28 in Hg

HDM Pressure Standard Heise #1-L: S/N: 41744/42459

Calibration Date: 08/30/06

Calibration Due Date: 08/2007

HDM Pressure Standard Heise #3-L: S/N: 41745/42460

Calibration Date: 02/13/07

Calibration Due Date: 02/2008

 Model PPM-1 Manufactured by Dresser Industries Rated Accuracy: 0.06% fs Range: 0.0 to 15.0 in wc Res: 0.001 in wc Uncertainty: < 0.00651 in wc
 Used at Set Points: 3.0; 14.0

HDM Pressure Standard Heise #1-R: S/N: 41744/42457

Calibration Date: 08/30/06

Calibration Due Date: 08/2007

HDM Pressure Standard Heise #3-R: S/N: 41745/42458

Calibration Date: 02/13/07

Calibration Due Date: 02/2008

 Model PPM-1 Manufactured by Dresser Industries Rated Accuracy: 0.06% fs Range: 0.0 to 150.0 in wc Res: 0.01 in wc Uncertainty: < 0.07540 in wc
 Used at Set Points: 25.0; 31.0; 140.0

HDM Pressure Standard Heise #2-L: S/N: 41747/42464

Calibration Date: 08/24/06

Calibration Due Date: 08/2007

HDM Pressure Standard Heise #4-L: S/N: 41746/42463

Calibration Date: 02/08/07

Calibration Due Date: 02/2008

 Model PPM-2 Manufactured by Dresser Industries Rated Accuracy: 0.05% fs Range: 0.0 to 50.0 psi Res: 0.1 in wc Uncertainty: < 0.479 in wc
 Used at Set Points: 225.0; 275.0; 1025

HDM Pressure Standard Heise #2-R: S/N: 41747/42462

Calibration Date: 08/24/06

Calibration Due Date: 08/2007

HDM Pressure Standard Heise #4-R: S/N: 41746/42461

Calibration Date: 02/08/07

Calibration Due Date: 02/2008

 Model PPM-2 Manufactured by Dresser Industries Rated Accuracy: 0.05% fs Range: 0.0 to 300 psi Res: 1 in wc Uncertainty: < 2.77 in wc
 Used at Set Points: 1620; 2000; 4500; 6930

DIFFERENTIAL PRESSURE TEST (in wc) TEST METER TOLERANCE = ± 2.0 % ± .28 in wc

Approx Set Pt	Standard	Test Meter	% Diff
3.0	3.10	3.1	0
14.0	14.38	14.4	.14
25.0	25.26	25.4	.55
31.0	31.38	31.4	.06
140.0	140.80	140.9	.07
5.0	225.4	225.9	.22
15.0	275.4	276.4	.36
1025	1007.3	1007	-.03
1620	1644	1639	-.30
2000	2001	2000	-.05
4500	4512	4509	-.07
6930	6925	6910	-.22

GAGE PRESSURE (P₂) TEST (in wc) TEST METER TOLERANCE = ± 2.0 % ± .28 in wc

Approx Set Pt	Standard	Test Meter	% Diff
3.0	3.10	3.1	0
14.0	14.38	14.5	.83
25.0	25.26	25.5	.95
31.0	31.50	31.5	0
140.0	139.69	139.8	.08
225.0	230.9	231.2	.13
275.0	277.0	277.2	.07
1025	1006.9	1006	-.09
1620	1630	1625	-.31
2000	2012	2013	.05
4500	4510	4509	-.02
6930	6914	6894	-.29

Shortridge Instruments, Inc.

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(480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com • info@shortridge.com

FLUKE® Everett Service Center75th St. SW
Everett, Washington 98203
USA**Calibration Certificate**

NQA ISO 9000: 2000 Certified

Description:	MULTIMETER	Certificate Number:	885905-66480245:1199875789
Manufacturer:	FLUKE	Date of Calibration:	09 January 2008
Model:	21 II	Date of Certificate:	09 January 2008
Serial Number:	66480245	Date Due:	09 January 2009
Customer Name:	PRECISION BALANCING LLC	Procedure Name:	FLUKE 21-2: (1 YEAR) CAL VER/ALT 5520A
City, State:	ESSEX JUNCTION, VT	Procedure Revision:	1.0
Customer Item ID:	66480245	Temperature:	23.00 °Celsius
PO Number:	MITCHELL CCS	Relative Humidity:	40 %
RMA Number:	3872716	Data Type:	FOUND-LEFT
		Test Result:	PASS

In the attached measurement results, deviation may be expressed with units, *Measured Value (MV) - Nominal Value (NV)* or as a proportion of the nominal value ($(MV-NV)/NV$), expressed without units with a scalar multiplier such as % (0.01), or as a ratio of the units (mW/W, mA/A, mV/V, etc.) Descriptions such as mW/W, mV/V, and others, where used to annotate results or measurement uncertainties, are the preferred replacements for what was historically labeled as "ppm" or parts-per-million and describe the results in that column, unless otherwise noted by units symbols.

The Data type that could be found in this certificate must be interpreted as:

- As Found - Calibration data collected before the unit is adjusted and/or repaired.
- As Left - Calibration data collected after the unit is adjusted and/or repaired.
- As Found/ As Left - Calibration data collected without any adjustment and/or repair performed.

Unless otherwise stated the TUR (Test Uncertainty Ratio) of this calibration is 4:1 or greater.

This calibration conforms to ANSI/NCSL Z540.1-1994(R2002)

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification are indicated by "I".

This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval of Fluke Corporation. The user is obliged to have the object recalibrated at appropriate intervals. Calibration certificates without signature are not valid.

Comments:

Long Le

Metrology Technician

David Deaver

Technical Manager

**TESTING AND BALANCING REPORT
LABORATORY HOOD TESTING
UVM DELEHANTY HALL RENOVATIONS
BURLINGTON, VERMONT**



Test And Balance Report

HVAC Testing - Analysis -Commercial - Industrial

JOB NAME: UVM DELEHANTY HALL RENOVATIONS

CONTRACTOR: NEW ENGLAND AIR SYSTEMS

ARCHITECT: SMITH, ALVAREZ & SIENKIEWYCZ

ENGINEER: L.N. CONSULTING, INC.

JOB NUMBER:

CERTIFICATION:

The X Air distribution system Water distribution system has been completely balanced in accordance with the plans and specifications to within the tolerance and limitations of the installed equipment. The testing and balancing has been performed in accordance with standards published by the Associated Air Balance Council. The results of the tests are herein recorded.

By: DARBY SYNSTAD, CHRIS RIVERS

Date: 1/23/2008

Approved:



Air Balance Procedure

The air balance for this project was accomplished by the following basic procedures:

1. Check all dampers on systems and secure in open position; fresh, return and exhaust dampers in operating positions.
2. Check air filters for cleanliness
2. Check fan for proper rotation.
4. Check fan speed.
5. Check fan motor power reading
6. Check system static pressure
7. Establish total air on system by velocity traverse method.
8. Test and adjust individual outlets for design CFM and adjust for air flow patterns.

Water Balance Procedure

The water balance for this project was accomplished by the following basic procedures:

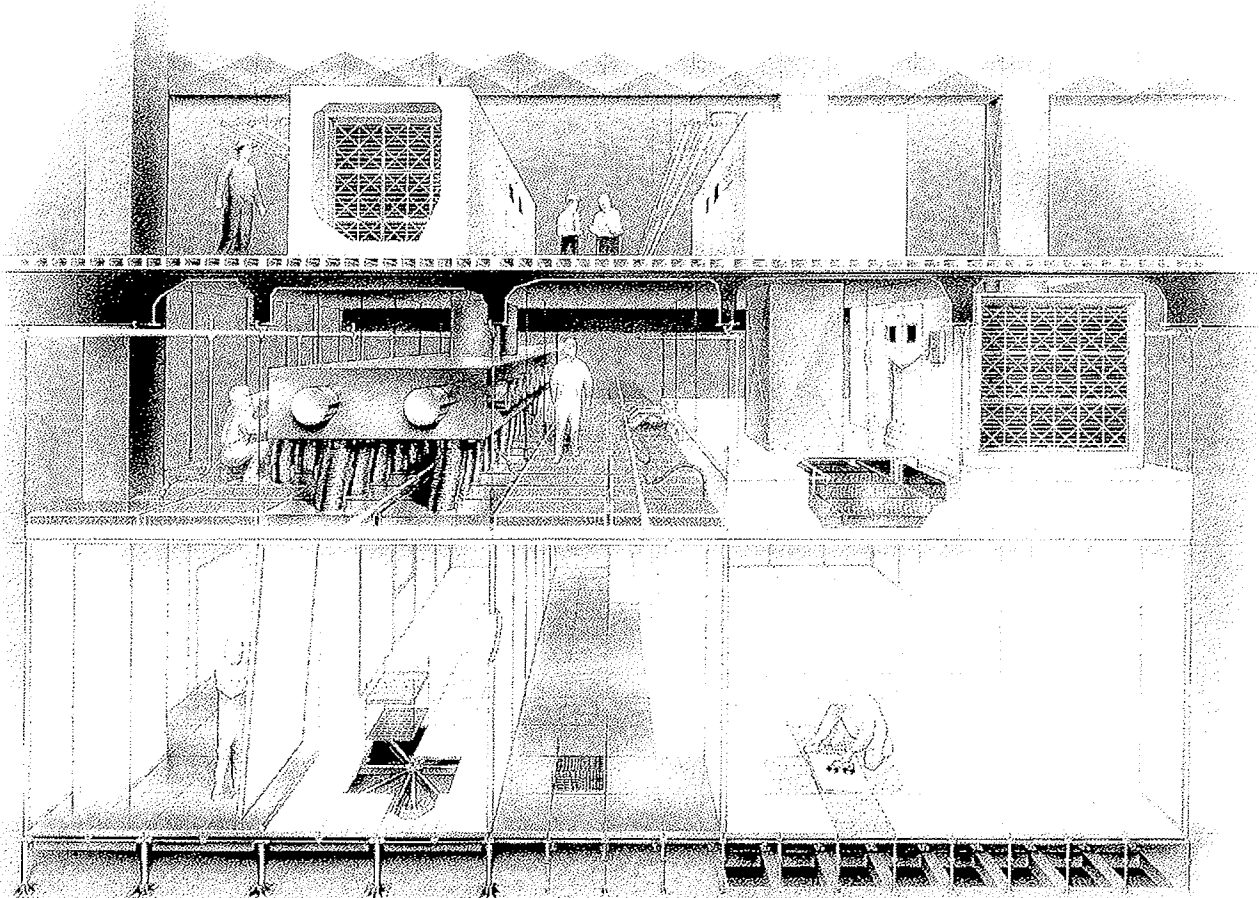
1. Fix supply water temperature during test period.
2. Fix volume of each heating element to full flow during test period.
3. Check no load and running amperes to determine approximate brake horsepower.
4. Check pump heads at full flow and no flow and compare same against manufacturer's pump curve.
5. Determine required temperature drop for each element for actual air and water conditions as against design conditions.
6. Adjust valves on pumps to obtain approximate design flow.
7. Adjust balancing fittings of each element to the proper design G.P.M.
8. After all elements are adjusted, check each circulating pump for final operating conditions.

Instruments Used for Balancing Were:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Self Timing Tachometer / Strobe | <input type="checkbox"/> Instantaneous Reading Air Element Pyrometer |
| <input checked="" type="checkbox"/> Clamp-on-Volt Ammeter | <input type="checkbox"/> Air Pattern Smoke Bomb |
| <input type="checkbox"/> Velometer | <input type="checkbox"/> Electronic Water Meter |
| <input type="checkbox"/> Sling Psychrometer | <input type="checkbox"/> Calibrated Pressure Gauges |
| <input checked="" type="checkbox"/> Vel-Grid | <input checked="" type="checkbox"/> Electronic Air Flow Hood |
| <input type="checkbox"/> Electronic Temperature Probe | <input checked="" type="checkbox"/> Electronic Air Data Meter |



OPERATION & MAINTENANCE
U of VERMONT – DELENHANTY HALL
CPI Job #08-303011 MAR. 31st, 2008



Tom Johnson

11241 S.E. Highway 212 Clackamas, OR 97015 503.557.4500 503.557.4501 FAX



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Thank you.

CLEANPAK International
11241 S.E. Highway 212
Clackamas, OR 97015
(503) 557-4500



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INTRODUCTION

OPERATIONS AND MAINTENANCE INSTRUCTIONS

U of VERMONT – DELEHANTY HALL

CPI Job #08-303011 March 31, 2008

The CPI CLEAN-PAK® air handling unit is designed for ease of operation and minimum maintenance. Each unit is equipped with ABB Adjustable Frequency Drive for in-flight flow regulation, they are intended for year-round, continuous-duty operation.

Although there are no preventive maintenance requirements as are typical of other systems, the unit is designed and manufactured for ease of access, should any component need maintenance.

The following is operational and descriptive information for the components that comprise the CLEAN-PAK® air handling unit.



B



FAN UNIT DATA SHEETS, NOTES, and DRAWINGS

SUBMITTAL RELEASE SUMMARY

3/31/2008

	FILE NUMBER			
	303311			
	JOB NUMBER	DASH	QTY	TAG
	A091AH		1	Shipping and Billing
	A091AH	1	1	AHU-1
	A091AH	2	1	Ship Loose Dash



Unit Submittal Data Sheet

Project Name	U of V - Delehanty Hall COSMO LAB MAH
Job Number	A091AH
Sales Engineer	Andrew Hall
Prepared by	Tom Strobel
File Number	303011

Date	1/18/2008
Revised	
Revision	
Tag Number	
Quantity	

1 Shipping and Billing Data

1.1 Project		1.2 Order Info.	
a. Name	U of V - Delehanty Hall COSMO LAB	a. Salesman	Andrew Hall
b. Job No.	A091AH	b. Agency Order No.	RC624
c. File No.	303011	c. Date Entered	1/8/2008
1.3 Invoice:		1.4 Ship To:	
New England Air Systems		UVM - Delehanty Hall	
43 Krupp Drive		Trinity Campus	
P.O. Box 525		180 Colchester Ave.	
Williston, VT 05495		Burlington, VT 05401	
1.5 Contractors		1.6 Ship Notes:	
a. Engineer	CH2M Hill	Call Randy Chicoine 72 hours prior to delivery at (802) 264-1239.	
b. General	New England Air Systems		
c. Install			
1.7 Preliminary Schedule		1.8 Transit Ownership and Payment:	
a. Date Wanted	3/08/2008	a. FOB:	Factory
		b. Payment:	10% down / 90% upon shipment
		c. Ship via:	Best Way
1.9 Notes			
a. Submittal due on 1-18-2008			



Unit Submittal Data Sheet

Project Name	U of V - Delehanty Hall COSMO LAB MAH
Job Number	A091AH-01
Sales Engineer	Andrew Hall
Prepared by	Tom Strobel
File Number	303011

Date	1/17/2008
Revised	3/31/2008
Revision	3
Tag Number	AHU-1
Quantity	1

1 Air Handler Summary

1.1 Dimensions / Weights / Jobsite Elevation			
a. Height	62.42"	d. Dry Weight	7,350 Lbs
b. Width	80"	e. Wet Weight	
c. Length	293"	f. Elevation (feet)	0
1.2 Miscellaneous		1.3 Jobsite Services	
a. Unit Testing	STD Fan Vibration	a. Factory Supervision	None
b. Witness Test	No	b. Factory Startup	None
c. Seismic Calcs	None	c. VFD Startup	No
1.4 Preparation for Shipment			
a. Cleaning	Protocol-2: Isopropyl Alcohol wipe with Non-Shed Cloth (Powdercoated parts only)		
b. Packaging	Ship on open bed truck, stretch wrap and reinforced polyethelyene final wrap, tarp.		
c. Jobsite Conditions	No limited jobsite conditions known.		
d. Qty of Shipping Sections	1		
e. Ship Loose	Std: Caulking and Touch-up Paint.		
1.5 Notes / Features			
a. An insulated (green) equipment grounding conductor to be provided in all conduits.			

2 Unit Construction: Cabinet

2.1 Construction		2.2 Cabinet Material	
a. Type	Outdoor/Slab mounted	a. Exterior	16ga./Galv/pc
b. Assembly	Drive Screw	b. Liner #1	Solid/22ga./Galv/pc
c. Panel Depth	2.0 Inch	c. Liner #2	
d. Panel Type	Standard	d. Liner #3	
e. Liner Type	Interior drive screw & fully caulk	e. Blankoffs	16ga./Galv/pc
f. Caulk	Sikaflex-1A		
2.3 Insulation - Walls & Ceiling		2.4 Unit Finish	
a. Type	AP/Armaflex insulation	a. Exterior	Powder Coat - Wet White
b. Depth	2 inch	b. Interior	Powder Coat - Wet White
2.5 Access Doors		2.6 Misc.	
a. Inner Panel	18ga./Galv/Powdercoated	a. Sensor Ports	None
b. Outer Panel	18ga./Galv/Powdercoated	b. Motor Rails	None
c. Construction	Thermal Brake	c. Mech. Latch	Fan and Fan Inlet doors
d. Window	Fan Section Thermal Pane - wire glass	d. Elec. Listing	ETL in accordance with NEC
e. Hardware	SS hinge w/ Allegis handles	e. Elec. Conduit	EMT
2.7 Notes / Features			
<p>a. Unit will be OUTDOOR construction with sloped roof (sloped away from access doors) special AP/Armaflex insulation, covered with 22 ga galv solid steel liners powder coated wet white.</p> <p>b. Access doors will be provided with stainless steel piano hinges, Allegis handles, thermal break, powder coated wet white, inside and out. Fan access door to have a thermal pane wire glass 9x9 view window. VFD access door to be provided with ventilation louver. VFD compartment door is louver/vented hollow door.</p> <p>c. CPI to provide un-insulated reversed panel on header side of coil for coil removal.</p> <p>d. Space for steam type humidifier shall be provided. Humidifier is provided and mounted, at the jobsite, by others.</p>			

2 Unit Construction: Cabinet

2.1 Construction		2.2 Cabinet Material	
a. Type	Outdoor/Slab mounted	a. Exterior	16ga./Galv/pc
b. Assembly	Drive Screw	b. Liner #1	Solid/22ga./Galv/pc
c. Panel Depth	2.0 Inch	c. Liner #2	
d. Panel Type	Standard	d. Liner #3	
e. Liner Type	Interior drive screw & fully caulk	e. Blankoffs	16ga./Galv/pc
f. Caulk	Sikaflex-1A		
2.3 Insulation - Walls & Ceiling		2.4 Unit Finish	
a. Type	AP/Armaflex insulation	a. Exterior	Powder Coat - Wet White
b. Depth	2 inch	b. Interior	Powder Coat - Wet White
2.5 Access Doors		2.6 Misc.	
a. Inner Panel	18ga./Galv/Powdercoated	a. Sensor Ports	None
b. Outer Panel	18ga./Galv/Powdercoated	b. Motor Rails	None
c. Construction	Thermal Brake	c. Mech. Latch	Fan and Fan Inlet doors
d. Window	Fan Section Thermal Pane - wire glass	d. Elec. Listing	ETL in accordance with NEC
e. Hardware	SS hinge w/ Allegis handles	e. Elec. Conduit	EMT

2.7 Notes / Features

- Unit will be OUTDOOR construction with sloped roof (sloped away from access doors) special AP/Armaflex insulation, covered with 22 ga galv solid steel liners powder coated wet white.
- Access doors will be provided with stainless steel piano hinges, Allegis handles, thermal break, powder coated wet white, inside and out. Fan access door to have a thermal pane wire glass 9x9 view window. VFD access door to be provided with ventilation louver. VFD compartment door is louver/vented hollow door.
- CPI to provide un-insulated reversed panel on header side of coil for coil removal.
- Space for steam type humidifier shall be provided. Humidifier is provided and mounted, at the jobsite, by others.

3 Unit Construction: Base

3.1 Base Structure		3.2 Base Skin	
a. Type	Structural Tube	a. Material	16ga./Galv/pc
b. Material	Steel	b. Skin Finish	Powder Coat - Wet White
c. Height	6 inch	c. Seams	Caulked
d. Base Finish	Powder Coat - Wet White	d. Floor Drains	None
3.3 Base Insulation		3.4 Base Accessories	
a. Type	AP/Armaflex	a. Lifting Lugs	Welded
b. Depth	2"	b. Drain Handing	Same side as coil connections
c. Liner Material	Solid/22ga./BG/no paint		

3.5 Notes / Features

- Unit base will be constructed with 6" tube steel with welded lifting lugs at 1/4 points.
- Unit base skin will be 16 ga galv powder coated wet white.
- 304 stainless steel double sloped drain pans will be provided under Humidifier and Cooling coil, w/1.25" drains access side.
- Under base shall have 2" AP/Armaflex insulation with 22 ga G90 solid steel liners.

4 FANWALL TECHNOLOGY™ – Supply Fan Patent No 7,137,775 B2 issued and others pending

4.1 Configuration / Quantity		4.2 Performance	
a. Orientation	Horizontal Std Arrgt 4 Direct Drive	a. Total CFM	7,500
b. Row Qty	2 see drawing	b. CFM per Fan	7,500
c. Column Qty	1 see drawing	c. ESP	
d. Active Fans	1 see drawing	d. TSP	6" wg
e. Redundant Fans	2	e. Total BHP	11.49
f. Ship Loose Fans	0	f. BHP per Fan	11.49
4.3 Fan Wheel		4.4 Construction	
a. Diameter	22	a. Inlet Cone Material	Steel Flat Cone
b. % Width	105%	b. Inlet Cone Location	Upstream Removable
c. RPM	2,222	c. Coplanar Silencer	2 inch Melamine
d. Class	2	d. Air Straightener	Yes
e. Rotation	CW	e. Discharge Screen	None
f. Material	Aluminum	f. Backdraft Damper	Mounted on all fans
		g. Finish	Powder Coat - Wet White

4.5 Notes / Features

- Fans balanced to a maximum allowable level of 0.022 inches/second peak.
- Fan wall assembly components to be powder coated.
- FWT fan have no spring isolation.
- FWT fans will include the coplanar option and backdraft dampers on the inlets of both fans.
- 100% fan redundancy.

5 Fan Motor

5.1 Motor Overview		5.2 Misc.	
a. Qty	2	a. Bearings	Sealed
b. Manufacturer	Toshiba	b. Shaft Grounding	Aegis Shaft Grounding Ring
c. Horsepower	15	c. Efficiency	92.4
d. RPM	1750	d. F.L. Amps	40
e. Frame	254T	e. Service Factor	1.15
f. Voltage/Ph./Hz.	208/3/60	f. Model	EQP3 - B0154FLF2USH04
g. Enclosure	TEFC	g. Shaft Diameter	1.625"

5.3 Notes / Features

- A flexible electrical connection will be provided to the fan motor J-box, the balance of motor power run to ABB control panel/VFD will be standard EMT conduit.
- Factory to mount motor shaft grounding device.

6 Variable Frequency Drive (VFD)

6.1 VFD Overview		6.2 Misc.	
a. Qty	2	a. Amp/HP rating	46.2
b. Manufacturer	ABB	b. Operating Freq.	76
c. Model	ACH550-PC-046A-2	c. Furnished by	Factory (wired by Factory)
d. Voltage/Ph./Hz.	208/3/60	d. Install	As shown

6.3 Notes / Features

- ABB VFDs will be mounted in ventilated compartment and wired to Fan Wall.

7 Backdraft Damper

7.1 Damper Specifications

a. Application	Fan Wall Cell	e. Material	Aluminum Frame and Blades
b. Manufacturer	Ruskin	f. Size	28"W (A) x 28"H (B)
c. Model	CD-50	g. Options	FF
d. Mounting	Vertical	h. Qty	2

7.2 Notes / Features

- a. CPI to provide and mount backdraft damper to the inlet of the fans. Actuator by others.

8 Lighting and Receptacles

8.1 Lighting

a. Power Source	120V light J-box
b. Qty	1
c. Switch Type	SPST
d. Fixture Type	23 Watt compact fluorescent marine
e. Options	Weatherproof

8.2 Receptacles

a. Power Source	None
b. Qty	
c. Type	
d. Options	

8.3 Notes / Features

- a. 120v/1ph/60hz facility power provided by others.
b. CPI to provide, mount and wire a compact fluorescent light in each accessible section, and wire to SPST switch at fan door.

9 Coil - Cooling

9.1 Coil Overview (See coil run for Performance)

a. Qty	1
b. Hand (AIB)	Right Hand
c. Coil Pull	Header Side
d. Rack	SS Slide Rack, uncoated
e. Coil Manuf.	Heatcraft
f. Model	5WL0906C

9.2 Material of Construction

a. Casing	304ss
b. Fins	Aluminum .0075"
c. Connection	Steel MPT
d. Header	Copper
e. Tubes	Copper .020"

9.3 Coil Size

a. Size (Fin)	48"H x 62"L		
b. FPI	9		
c. Rows	6		
d. Conn. Dia.	2.00"	e. Length	8"

9.4 Drain Pan

a. Material	304 stainless
b. Style	Double sloped
c. Finish	Uncoated
d. Drain Size	1.25"

9.5 Notes / Features

- a. Cooling coil to be provided with .0075" aluminum fins, .020" copper tubes and 16 ga 304 stainless steel casing.

10 Pre Filters

10.1 Specifications

a. Number of Sets	2 (1 is spare)
b. Manufacturer	AAF
c. Model	Perfect Pleat HC
d. Efficiency	30%
e. UL Class	2

10.2 Clarifications

a. Face Velocity	313 ft/min
b. Frame Style	Face Load Type 9 powdercoated
c. Filter Clips	C-78-4 qty (24)
d. Rack loaded from	Upstream Side
e. Filters To Ship	Installed in Rack

10.3 Notes / Features

- a. Part # 179-401-863 (6) 24"W x 24"H x 4" Deep pre-filters face load into powder coated type 9 frames.

11 Pre Filter Pressure Gage

11.1 Specifications

a. Manufacturer	Dwyer Instruments	c. Options	Weatherproof w/ UV cover.
b. Model / Range	Magnehelic 2001 / 0-1 Inch	d. Qty	1

11.2 Notes / Features

- a. Pressure gage on outdoor unit to have weather cover and UV cover.
- b. Pressure gage to measure pressure drop across pre filter.

12 Damper

12.1 Damper Specifications

a. Application	OSA
b. Manufacturer	Ruskin
c. Model	CD50 (alum. frame and blades)
d. Size	Nominal 60"W (A) x 36"H (B)
e. Blade Config	Opposed
f. Options	No Flange
g. Qty	1
h. Velocity	500 ft/min

12.2 Actuator

a. Manufacturer	None
b. Model	
c. Direction	
d. Location	
e. Power	
f. Control	
g. Qty	
h. Furnished by	Others
i. Mounted by	Others
j. Wiring	By Others

12.3 Notes / Features

- a. OSA damper located on inlet of unit, attached to louver, actuator by others.

13 Damper

13.1 Damper Specifications

a. Application	VFD ventilation
b. Manufacturer	Ruskin
c. Model	CD50 (alum. frame and blades)
d. Size	Nominal 6"W (A) x 12"H (B)
e. Blade Config	Opposed
f. Options	No Flange
g. Qty	1
h. Velocity	

13.2 Actuator

a. Manufacturer	
b. Model	Galv Manual Locking Quadrant
c. Direction	
d. Location	
e. Power	
f. Control	
g. Qty	
h. Furnished by	
i. Mounted by	
j. Wiring	

13.3 Notes / Features

- a. Mount on upstream wall of VFD compartment.

14 Louver

14.1 Specifications

a. Application	OSA	e. Options	
b. Manufacturer	Ruskin	f. Qty	1
c. Model	ELF6375DX	g. Velocity	500 ft/min
d. Size	60"W (A) x 36"H (B)		

14.2 Notes / Features

- a. 304 SS drain pan required with 3/4" connection (OSA louver only).

15 Buyout Schedule: WING Coil

Supplier/Manuf.:			
15.1 Identifier	Qty	Size	Description
a. Wing	1	45.88"x68.5"	D-60TR Hot water, single section (3 Row)
b.			
c.			
d.			
15.2 Notes / Features			
a. CPI to provide, mount and plumb coil connections to cabinet exterior, actuator by others.			

16 Final Filters

16.1 Specifications		16.2 Clarifications	
a. Number of Sets	1	a. Face Velocity	469 ft/min
b. Manufacturer	AAF	b. Frame Style	Face Load Type 9 powdercoated
c. Model	Varicel RF SH	c. Filter Clips	C-83 qty (16)
d. Efficiency	90%	d. Rack loaded from	Upstream Side
e. UL Class	2	e. Filters To Ship	Loose in unit
16.3 Notes / Features			
a. Part # 3011079-001 (4) 24"W x 24"H x 11.5"Deep finla filters face load into type 9 powder coated frames.			

17 Final Filter Pressure Gage

17.1 Specifications			
a. Manufacturer	Dwyer Instruments	c. Options	Weatherproof w/UV cover.
b. Model / Range	Magnehelic 2002 / 0-2 Inch	d. Qty	1
17.2 Notes / Features			
a. Pressure gage on outdoor unit to have weather cover and UV cover.			
b. Pressure gage to measure pressure drop across final filter.			

18 Buyout Schedule: Access Doors

Supplier/Manuf.:			
18.1 Identifier	Qty	Size	Description
a. Inlet, Humid, PL	3	20Wx48Hx2D	LHH, Out open, Thermal Break, R13 insulation, and Alegis handles
b. VFD Enclosure	1	27Wx48Hx2D	LHH, Out open, Louver/Vented hollow door, and Alegis handles
c. Fan Section	1	28Wx48Hx2D	RHH, In open, Thermal Break, R13 insulation, and Alegis handles
d.			
18.2 Notes / Features			
a. Doors are all 2" Thermal Break, except the VFD compartment door which is louver / vented hollow door.			



Unit Submittal Data Sheet

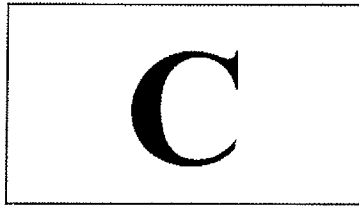
Project Name	U of V - Delehanty Hall COSMO LAB MAH
Job Number	A091AH-02
Sales Engineer	Andrew Hall
Prepared by	Tom Strobel
File Number	303011

Date	1/17/2008
Revised	1/30/2008
Revision	
Tag Number	AHU-1
Quantity	1

1 Ship Loose

1.1 Dash to capture Time and Material.

- a. Ship loose units parts, fasteners, caulk and touch-up paint.





FAN WALL TECHNOLOGY DESCRIPTION and CURVE



Project Name	University of Vermont
Quote Number	303011
Job Number	

Unit Tag	MAH
Date	10/24/07

Fan Function	
Function	Supply Fan
Dual Fan Wall	No
Orientation	Standard

Options	
Coplanar Silencer	YES
Inlet Airflow Straightener	YES
Fan Safety Guard	NO
Back Draft Dampers	YES

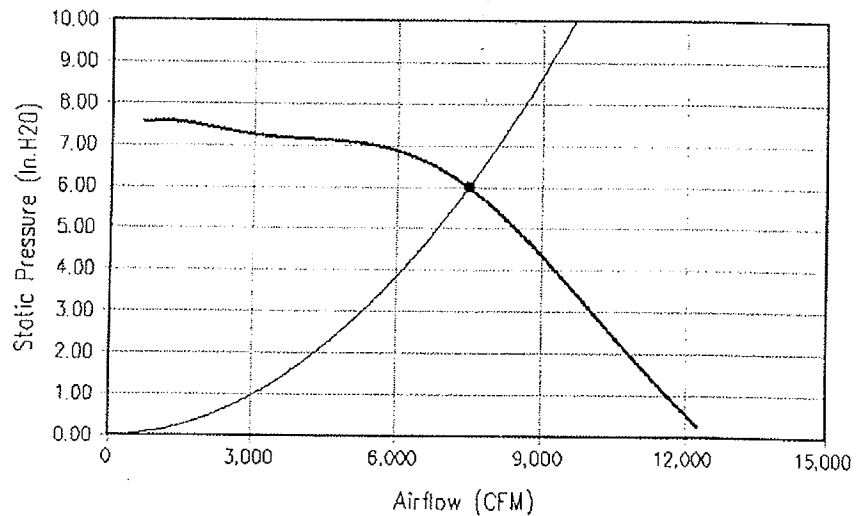
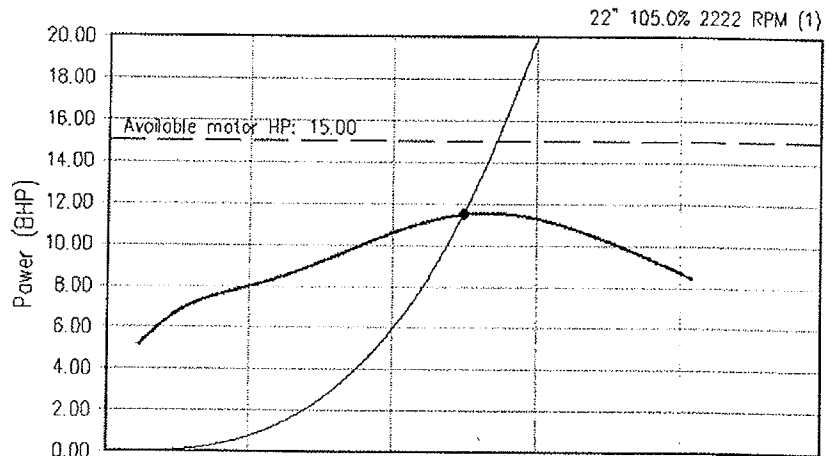
Performance	
Total CFM	7,500
CFM per Fan	7,500
TSP	6.00
Peak SP	7.55
% of Peak SP	79%
Total BHP	11.49
BHP per Fan	11.49

Fan Wheel	
Diameter	22
Width	105.0%
RPM	2222
Class	Class 2

Quantity / Configuration	
Active Fans	1
Redundant Fans	1
Array	1 Row x 2 Cols
Cell Size	55.000 H x 38.375 W
Fan Wall Depth	45.000

Motor	
HP Each	15
Total Motor HP	15.0
RPM	1750
Frame	254T
Enclosure	TEFC
Voltage / Phase	460V / 3 Phase
Operating Hz	76

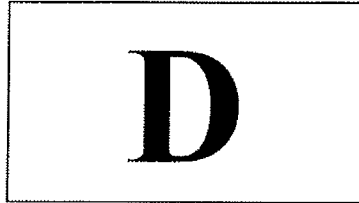
Air Density	
Altitude	0 Feet
Temperature	70° F
Air Density	0.0750 Lb/ft³



Notes

Bare Fan Sound Power with Coplanar Silencer and Inlet Airflow Straightener (dB re: 10E-12 watts)										
Hz	63	125	250	500	1k	2k	4k	8k	LwA	Lw
Inlet	90	85	83	85	81	79	78	71	87	93
Outlet	79	74	84	78	77	76	72	65	83	87

FANWALL TECHNOLOGY® Patent Number 7,137,775 B2 issued and others pending





COOLING COIL DESCRIPTION and DATA

Customer:	Date:	2/1/2008
Contact:	From:	MEP
Telephone:	Company:	
Fax:	Return Tel:	
Job:	Return Fax:	
Quote: 0		

GIVEN DATA

Construction

Item:	CC
Coils Per Bank:	1
Allow Opp. End:	No
Tube OD IN:	5/8
Coil Duty:	Cool-Standard
Fins Per Inch:	Optimize
Rows:	6
Fin Surface:	Optimize ABC
Fin Height (IN):	48.00
Finned Length (IN):	62.00
Tubing Mat. (IN):	0.020 Copper
Fin Mat. (IN):	0.0075 Aluminum
Conn Qty/Size (IN):	1 / Optimize
Circuiting:	Optimize
Face Area (SQ FT):	20.67

Air Side

Air Flow (Sft^3/min)	7,500
Altitude FT:	.00
Ent. Air DB/WB °F:	88.00 / 71.00
Lvg. Air DB/WB °F:	55.00 / 54.00
Total / Sensible MBH:	.00 / .00
Max Air PD "H2O:	.00

Fluid Side

Fluid Type:	Water
Ent. Fluid :	45.00
Lvg. Fluid :	.00
Fluid Flow gal/min:	61.00
Max FPD FT H2O:	15.00
TurboSpirals:	No

OUTPUT DATA			OPTIONS	
Model Number:		5WH0906C	Casing Material:	304L S/S
Air Velocity:	(Sft/min)	362.9	Casing Type:	Flanged
Total Capacity:	MBH	420.0	Hand:	Right
Sens. Capacity:	MBH	279.3	Connection Material:	Carbon Steel
Lvg. Air DB:	°F	53.95	Connection Type:	MPT
Lvg. Air WB:	°F	53.55	Vent/Drain:	.50 MPT Ext./Length of
Standard APD	"H2O	.58	Label Kit:	No
Lvg. Fluid:	°F	58.73	Corrosion Resistant Coating:	No
Fluid Flow:	gal/min	61.00	Mounting Holes:	No
Fluid PD:	FT H2O	12.74	Drain Headers:	No
Fluid Vel.:	ft/s	4.07	Boxed Headers:	No
Conn Size:	IN	(1) 2.00		
Weight (Dry):	lbm	365.7		
Weight (w/Fluid):	lbm	526.8		
Notes:		AL		

Notes:

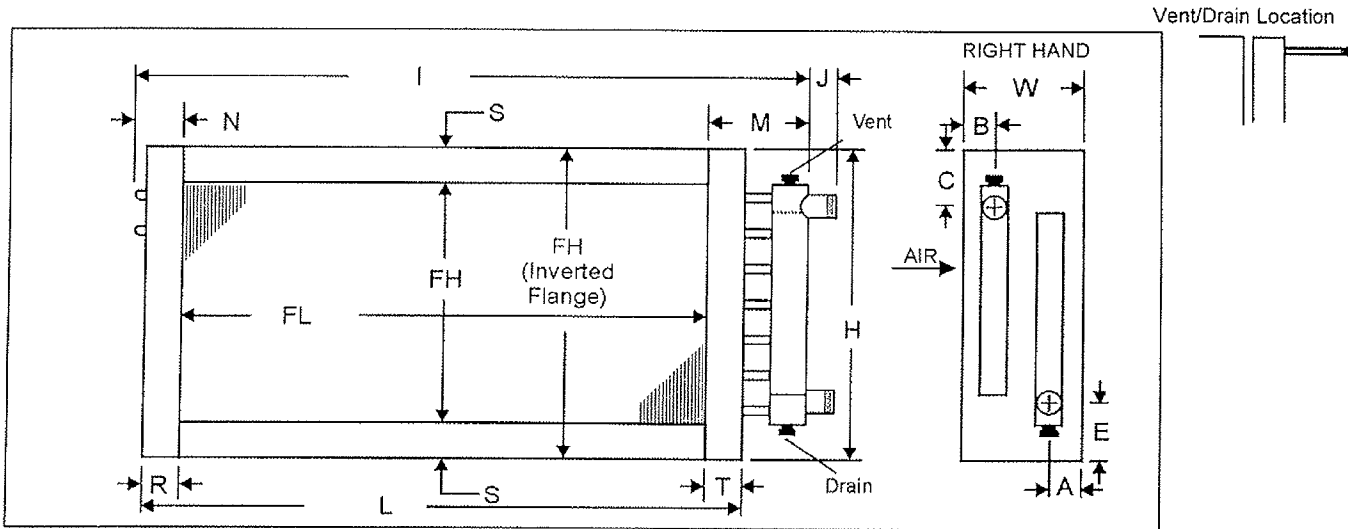
A) ARI Certified And Rated In Accordance With ARI 410. L) Coil rating valid for Heatcraft coils only.

Customer:
 Contact:
 Telephone:
 Fax:
 Job:
 Quote: 0

Date: 2/1/2008
 From: MEP
 Company:
 Return Tel:
 Return Fax:

ITEM	QTY	TYPE	MODEL NUMBER				FH (IN)	FL (IN)	HAND
			FPI	ROWS	FIN				
CC	1	5WH	09	06	C	48.00	62.00	Right	

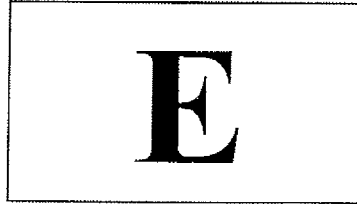
MATERIALS OF CONSTRUCTION		OPTIONS			
Finns	.0075 Aluminum	Casing Type	Flanged	Label Kit	No
Tubes	.020 Copper	Vent/Drain	.50 MPT Ext./Length of Conn.	Corrosion Resistant	No
Casing	304L S/S			Mounting Holes	No
Connection	2.000 MPT Carbon Steel			Turbospirals	No
				Drain Headers	No



DIMENSIONAL DATA (IN)														
CONNECTION										FLANGES				
SIZE	A	B	C	E	H	I	J	L	M	N	R	S	T	W
2.00	1.753	1.75	6.00	6.00	49.50	69.50	6.00	65.00	5.00	2.50	1.50	.75	1.50	10.00

GENERAL NOTES

1. All dimensions are in inches.
2. One intermediate tube support fabricated from heavy gauge stock of the same material as the fins will be provided.
3. The supply line should be connected to the lower connection on the leaving air side for counterflow operation.
4. Coils will vent and drain through factory-installed vent and drain fittings when mounted level for horizontal flow.
5. Connection location other than standard could affect vent and drain locations. Consult factory.
6. Dimension S is less than one inch. Vents and drains will be located on the face or side of the header.





WING FACE/BYPASS COIL DESCRIPTION and DATA

LJ WING

Specification Sheet

Prepared By:

Mark McIvers
Olympic Engineered Sales
P.O. Box 549
Bellevue, WA 98009-0549
Phone: 425-454-0701
Fax: 425-454-0229

Prepared For:

Mark Pedersen
Cleanpak International
11241 SE Hwy 212
Clackamas, Oregon 97015
Phone: 503-557-4577
Fax: 503-557-4501

Date: 1/8/2008

Coil Tag:

Project: Huntair (Cleanpak)

1.0 General

- 1.1 Furnish IFB coil with performance as shown in the schedule. The unit inlet and discharge flanges shall be pre-punched and designed for easy adaptation to external duct work or optional accessories. The unit shall include all components and accessories as set forth herein.
- 1.2 Coil shall have horizontal tubes.
- 1.3 All coils will be built with orientation and control locations as indicated on drawings.
- 1.4 The coil shall be manufactured by the L.J. Wing Company.

2.0 Certification

- 2.1 Each coil shall be certified by ARI for compliance with ARI Standard 410 and bear the seal indicating manufacturer's compliance. Each coil shall carry ETL label for compliance with UL Standard 1995 and bear the seal indicating manufacturer's compliance. All electrical components shall be UL/CSA approved devices.

3.0 Heating Coil Construction and Material

- 3.1 Coil shall consist of a built-in series of finned heating elements.
- 3.2 By-passes with mechanically interlocked dampers shall be designed into the casing of each unit.
- 3.3 Coil shall be capable of maintaining a constant discharge air temperature within +/-5° F regardless of variations in entering air temperature.
- 3.4 Finned heating elements shall be fabricated of seamless 5/8 inch O.D. hairpin type copper tubes with 0.035 inch wall thickness.
- 3.5 Each element shall be individually secured to the supply and return headers by a brazed joint. Each element shall be individually removable for ease in maintenance and repair.
- 3.6 Fins shall be rectangular embossed aluminum with a thickness of 0.010 inch.
- 3.7 Headers shall be constructed of Schedule 40 steel pipe with a minimum wall thickness of 0.216". Each tube shall be free to expand and contract individually. Channel-shaped tube retainers shall maintain distances between tubes and shall be free floating to allow for tube expansion.

4.0 Dampers and Casing Construction

- 4.1 Dampers shall be arranged so as to completely enclose and isolate the heating elements of the coil when no temperature rise is required.
- 4.2 Intake dampers shall be constructed of 16 gauge galvanized steel die-formed to an aerodynamic shape designed for minimum airflow resistance. Outlet dampers shall be constructed of 18 gauge galvanized steel.
- 4.3 Damper position shall be controlled by indirect coupled actuator. Individual face and by-pass damper blades shall be interconnected through precision punched 1/4" thick steel bar with brass pins. Misadjustment of individual dampers will not be possible.

4.4 Casing shall be constructed of 14 gauge galvanized steel.

4.5 Damper and casing surfaces shall be finished with air-dried, alkyd enamel paint.

5.0 Operation

5.1 Volume of air passing through the coil shall not vary more than +/-5% regardless of the position of the internal dampers.

5.2 The temperature at any point in a parallel plane to the face of the coil three feet downstream from the leaving air side will not vary more than +/-5° F from the average discharge air stream temperature.

6.0 Options and Accessories

6.1 Stainless Steel Construction (Option #40350)

Manufacturer shall provide stainless steel casing, damper blades, flat bar linkage and connecting rods for corrosive applications.



IFB Coil Performance

Prepared By:

Mark McIvers
 Olympic Engineered Sales
 P.O. Box 549
 Bellevue, WA 98009-0549
 Phone: 425-454-0701
 Fax: 425-454-0229

Prepared For:

Mark Pederspn
 Cleanpak, International

Date: 1/30/2008
Coil Tag:
Project: University of Vermont

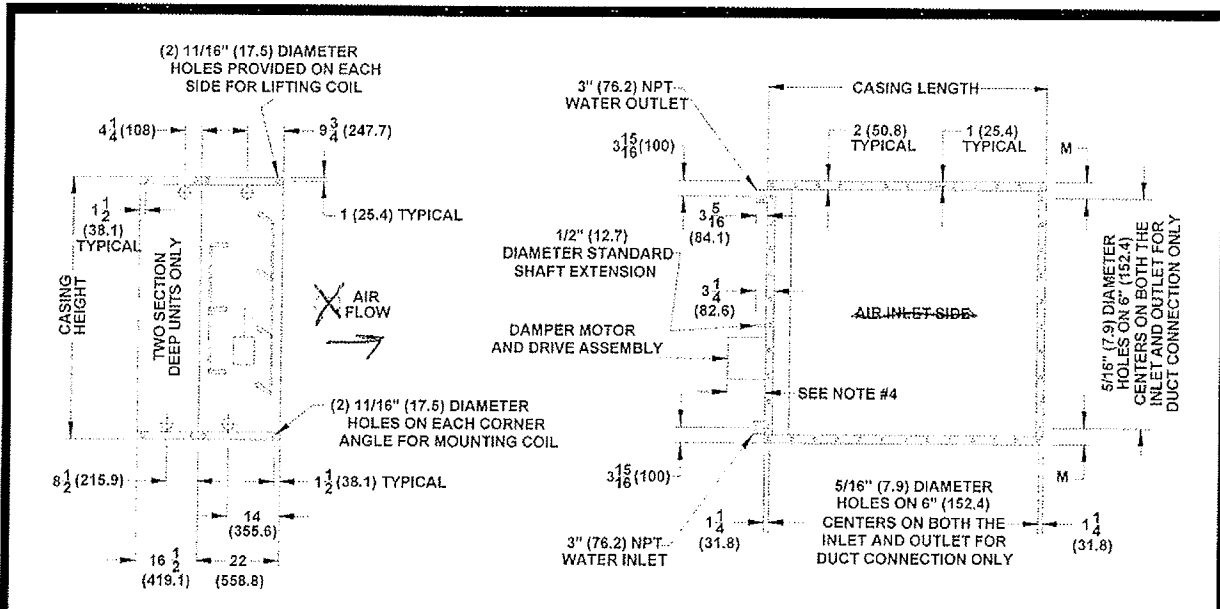
Heating Coil:	Performance shown is certified under ARI Standard 410.
Model No.	D-60-TR Hot Water, Single Section (3 Row)
Fin Material	Aluminum
Fins per Inch	11 fpi
Tube Material	Copper
Airflow Direction	Horizontal
Airflow Rate	7,500 SCFM
Altitude	0 FT
Outlet Velocity	433 fpm
Air Pressure Drop	0.35" WC
Entering Air Temp.	-10.0° F
Leaving Air Temp.	63.0° F
Fluid and Flow Rate	Water, Glycol concentration = 0.0%, 34 GPM
Water Pressure Drop	4.17' WC
Entering Water Temp.	180.0° F
Leaving Water Temp.	144.7° F
Sensible Heat	590,738 Btu/h

Damper Controls:

Controls by Others

Options:

Stainless Steel Construction
 Coil Configured for Direct Coupled Actuator



- NOTES:
- (1) DAMPER MOTOR AND COIL CONNECTIONS MUST BE ON SAME SIDE. (3) DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS.
 - (2) LEFT-HAND COIL CONNECTIONS STANDARD AS SHOWN. (4) SUGGESTED DIMENSION FOR INDIRECT COUPLED ACTUATOR IS 10" (254).
~~(RIGHT HAND IS OPTIONAL)~~ SUGGESTED DIMENSION FOR DIRECT COUPLED ACTUATOR IS 5 1/2" (139.7).

**IFB SIDE HEADER COIL
FOR
HOT WATER HEATING**

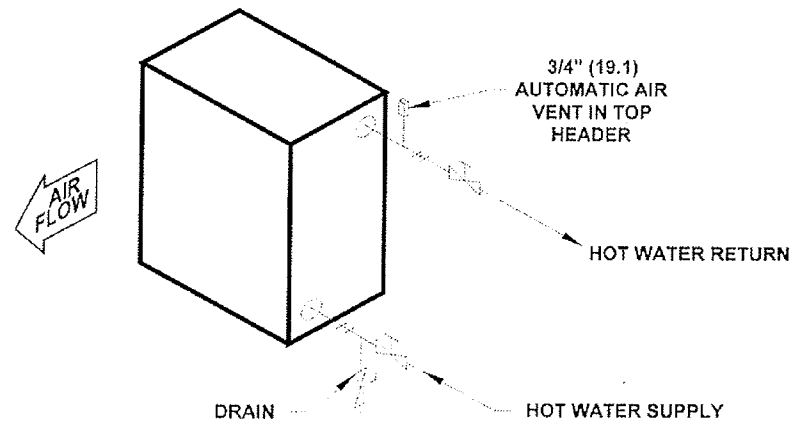


01/10/07

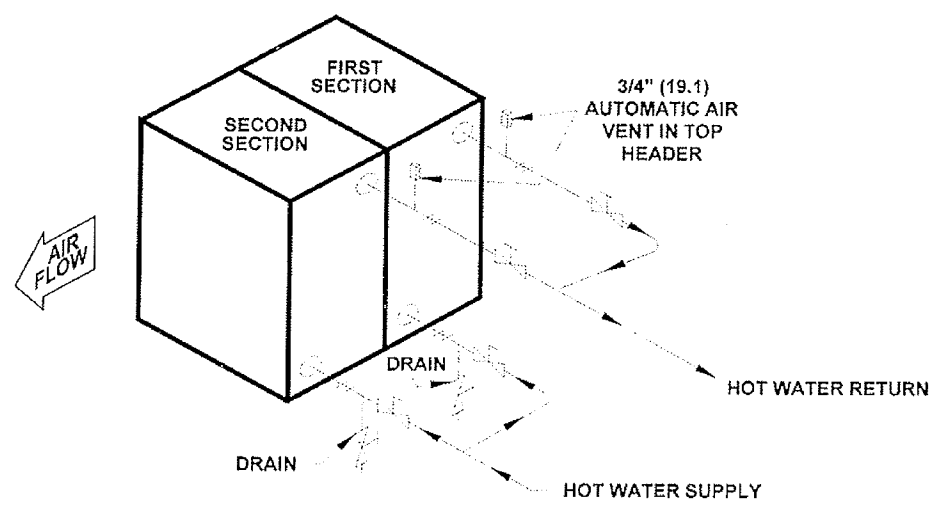
W01

Model:	D-60-TR Hot Water, Single Section (3 Row)
Casing Height:	45.875 inches
Casing Length:	68.5 inches
M Dimension:	4.938 inches
Unit Weight:	643 pounds
Shipping Weight:	804 pounds
Coil Tag:	
Project:	Huntair (Cleanpak)

SINGLE SECTION - 2 AND 3 ROW COILS



DOUBLE SECTION - 4 ROW COIL



NOTE : DIMENSIONS ARE IN INCHES.
DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS.

**HOT WATER PIPING DIAGRAM
FOR IFB SIDE HEADER
COIL - SIZE 18 THRU 60 .**



01/30/2007

W17

Model: D-60-TR Hot Water, Single Section (3 Row)
Coil Tag:
Project: Huntair (Cleanpak)



F



ELECTRICAL: MOTOR, VFD, and CONTROL PANEL

TOSHIBA INTERNATIONAL Industrial Division / Houston Motor Plant SQUIRREL CAGE INDUCTION MOTOR PERFORMANCE SPECIFICATIONS	INDEX	MPCF-1033
	SHEET NO.	1 of 1
	ISSUED	11/08/96
	SUPERSEDES	10/06/95
	REVISION	1
	WRITTEN BY	R. EVANS
APPROVED BY	Jay Bugbee	

CUSTOMER: _____ Customer Tag: _____
 TIC File No.: _____
 Customer PO: _____

MOTOR NAMEPLATE DATA			
HP.: 15	VOLTS: 230/460	3Ø/ 60 Hz	Sync. RPM: 1800
FRAME: 254T	ENCL: TEFC	Full Load Amp: 37/18.5	Full Load RPM: 1775
FORM: FBK1	S.F.: 1.15	NEMA DESIGN: B	Ins. CLASS: F
TYPE: IKKH	AMB.: 40 °C	CODE: G	DUTY: CONT.
MODEL No.: B0154FLF2USH02		KW.: 11	
NOM. EFF.: 92.4	MIN. EFF.: 91.7	P.F.: 83.5	FLAmp for 208V: 40

MOTOR PERFORMANCE DATA		
<u>AMPERAGE</u>	<u>TORQUES</u>	<u>** BEARINGS</u>
LOCKED ROTOR: 110	FULL LOAD (lb-ft): 44.4	DRIVE END: 6309UU
	LOCKED ROTOR (%): 229	OPP. DRIVE END: 6208UU
	BREAK DOWN (%): 254	
	<u>EFFICIENCY</u>	<u>POWER FACTOR</u>
	FULL LOAD: 92.4 %	FULL LOAD: 83.6 %
	¼ LOAD: 92.6 %	¼ LOAD: 79.7 %
	½ LOAD: 91.8 %	½ LOAD: 71.0 %

ALL CHARACTERISTICS ARE AVERAGE EXPECTED VALUES BASED UPON RATED VOLTAGE, FREQUENCY AND SINEWAVE POWER INPUT.

* TEMPERATURE RISE WILL BE CONSISTENT WITH INSULATION, AMBIENT AND SERVICE FACTOR AS DEFINED BY NEMA-MG-12.43 OR -20.40.

** BEARINGS ARE THE ONLY RECOMMENDED SPARE PART(S).

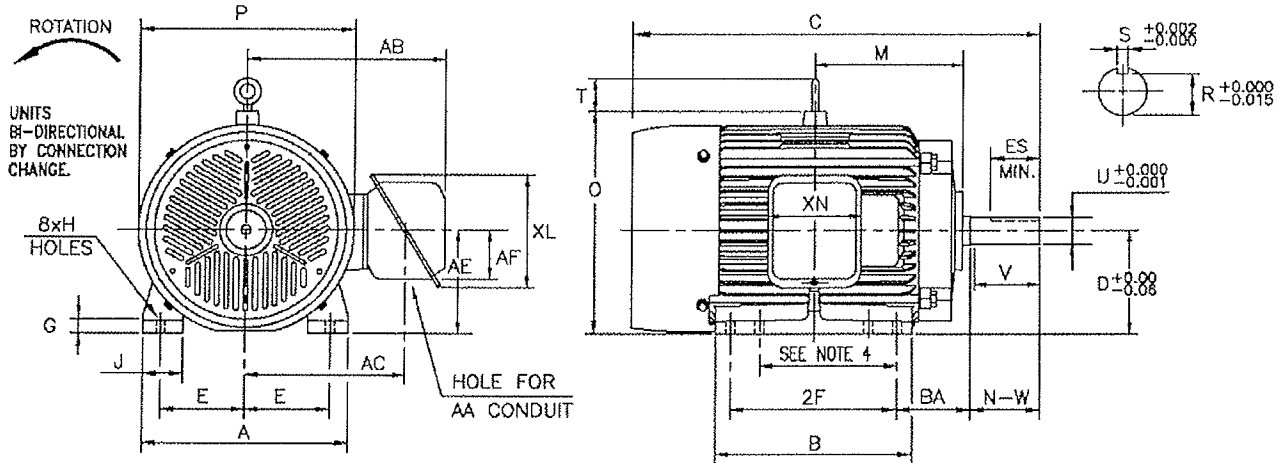
Prepared by:
 Date: 09 Jan 2008

INDEX	MDSL0001-04
REV. LEVEL	4
SHEET	1 OF 1

TOSHIBA/HOUSTON

TOTALLY-ENCLOSED FAN-COOLED
HORIZONTAL FOOT-MOUNTED

Fr. 254T-256T



UNITS: INCHES

FRAME SIZE	MOUNTING				CONDUIT BOX							
	E	2F	H	BA	AA	AB	AC	AE	AF	XL	XN	
254T	5.00	8.25	0.53	4.25	1.25	11.6	9.4	6.3	2.8	6.8	5.6	
256T	5.00	10.00	0.53	4.25	1.25	11.6	9.4	6.3	2.8	6.8	5.6	

FRAME SIZE	MOTOR DIMENSIONS									
	A	B	C	D	G	J	M	O	P	T
254T/256T	12.3	11.7	24.2	6.25	0.75	2.4	8.8	13.4	12.7	1.8

FRAME SIZE	SHAFT EXTENSION			KEY SEAT			BEARINGS		MAXIMUM WEIGHT
	N-W	V	U	R	S	ES	LS	OS	
254T/256T	4.00	3.75	1.625	1.416	0.375	2.91	6309UU	6208UU	310 lbs.

NOTES:

- DIMENSION V REPRESENTS LENGTH OF STRAIGHT PART OF SHAFT.
- CONDUIT BOX MAY BE ROTATED IN 90° INCREMENTS AND MAY BE MOUNTED ON OPPOSITE SIDE ON SPECIAL ORDER.
- KEY DIMENSIONS EQUAL S x S x 2.88 (MOTOR SUPPLIED WITH KEY)
- DIMENSIONS FOR 254T MOUNTING EQUAL (2F) LOCATED IN 254T SIDE VIEW.
- MOTOR WEIGHT SHOWN IS MAXIMUM HORSEPOWER IN FRAME.

ALL DATA SUBJECT TO CHANGE WITHOUT NOTICE.
FOR CONSTRUCTION USE ONLY CERTIFIED DATA.

CERTIFIED DATA

CUSTOMER: _____ PO NO.: _____ TAG NO.: _____

MOTOR MODEL No: B0154FLF2USH02 TOSHIBA FILE NO.: _____

HP: 15 RPM (Sync): 1800 VOLTAGE: 230/460 Hz: 60

FRAME SIZE: 254T LOG NO.: _____ LOG REV. LEVEL: _____

REMARKS: _____

PER: _____ ISSUE DATE: 09 Jan 2008 SUPERSEDES: _____



VARIABLE FREQUENCY DRIVE COMMENTS

Variable Frequency Drives that power direct drive fans need to be programmed for operating conditions by the installing contractor. Basic parameters like motor FLA and maximum RPM (frequency) settings should be addressed before or during startup.

Programming is critical for fans that are selected at operating points below or above the synchronous speed of the motor (above or below the actual RPM of the motor at its design frequency, generally 60 Hz in the U.S.) Fans selected at a maximum operating point below the synchronous speed of the motor cannot be run straight off line power or cannot accommodate a VFD with a bypass option, unless specifically designed to do so (e.g. a motor that is oversized for operating conditions to accommodate the additional power requirements in bypass). Additionally, fans selected above the synchronous speed of the motor will not meet performance when run in an optional bypass mode.

Note: Motors operated below synchronous speed will have less power available for fan use (a 10HP-1780rpm/60Hz motor will only provide approximately 5HP @ 890rpm/30Hz). However, the opposite is not true as a motor operated above synchronous speed, will only provide the nameplate power (a 10HP-1780rpm/60Hz motor will only provide 10HP @ 2077rpm/70Hz).

CLEANPAK International will not be held responsible for damaged caused by improper setup of VFD by installing contractor.

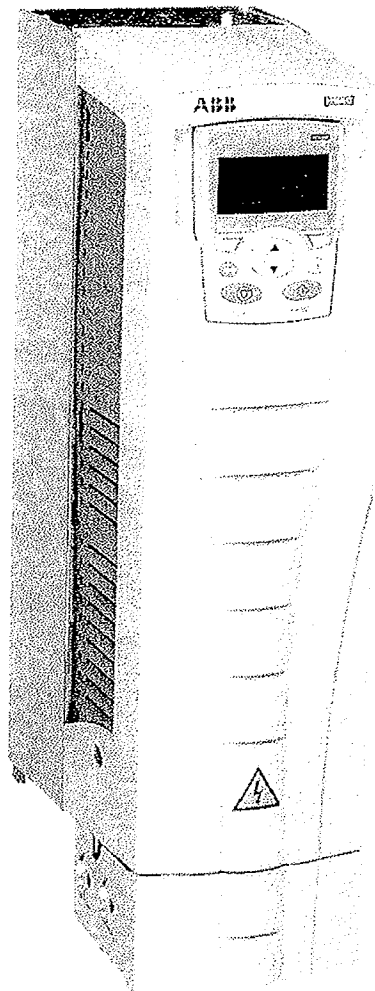
ACH550 Product Overview

Description

The ACH550 series is a microprocessor based Pulse Width Modulated (PWM) adjustable speed AC drive. The ACH550 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for a wide range of HVAC applications.

With drives ranging from 1 to 550 HP, the ACH550 series features a universal full graphic interface that "speaks" to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis. The ACH550 is also programmable in fourteen other languages.

Each ACH550 drive comes equipped with an extensive library of pre-programmed HVAC application macros which, at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for specific HVAC applications to maximize convenience and minimize start-up time. The ACH550 series can handle the most demanding commercial applications in an efficient, dependable, and economic manner.



ACH550 Standard Features

- UL, cUL labeled and CE marked
- EMI/RFI Filter (1st Environment, Restricted Distribution)
- Start-Up Assistants
- Maintenance Assistants
- Diagnostic Assistants
- Real Time Clock
 - Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Full Graphic and Multilingual Display
 - for Operator Control, Parameter Set-Up and Operating
- Data Display:
 - Output Frequency (Hz)
 - Speed (RPM)
 - Motor Current
 - Calculated % Motor Torque
 - Calculated Motor Power (kW)
 - DC Bus Voltage
 - Output Voltage
 - Heatsink Temperature
 - Elapsed Time Meter (reset-able)
 - KWh (reset-able)
 - Input / Output Terminal Monitor
 - PID Actual Value (Feedback) & Error
 - Fault Text
 - Warning Text
 - Three (3) Scalable Process Variable Displays
 - User Definable Engineering Units
- Two (2) Programmable Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Up to six (6) Programmable Relay Outputs (Three (3) Standard)
- Adjustable Filters on Analog Inputs and Outputs
- Mathematical Functions on Analog Reference Signals
- All Control Inputs Isolated from Ground and Power
- Three (3) Resident Serial Communication Protocols
 - Johnson Controls N2
 - Siemens Building Technologies FLN (P1)
 - Modbus RTU
- Input Speed Signals
 - Current 0 (4) to 20 mA
 - Voltage 0 (2) to 10 VDC
 - Increase/Decrease Reference Contacts (Floating Point)
 - Serial Communications
- Start/Stop
 - 2 Wire (Dry Contact Closure)
 - 3 Wire (Momentary Contact)
 - Application of Input Power
 - Application of Reference Signal (PID Sleep/Wake-Up)
- Up)
 - Serial Communications
- Start Functions
 - Ramp
 - Flying Start
 - Premagnetization on Start
 - Automatic Torque Boost
 - Automatic Torque Boost with Flying Start
 - Auto Restart (Reset) – Customer Selectable and Adjustable
- Stop Functions
 - Ramp or Coast to Stop
 - Emergency Stop
 - DC Braking / Hold at Stop
 - Flux Braking
- Accel/Decel
 - Two (2) sets of Independently Ramps
 - Linear or Adjustable 'S' Curve Accel/Decel Ramps

- HVAC Specific Application Macros
- Separate Safeties (2) and Run Permissive Inputs
- Damper Control
- Override Input (Fire Mode)
- Timer Functions
 - Four (4) Daily Start/Stop Time Periods
 - Four (4) Weekly Start/Stop Time Periods
 - Four Timers for Collecting Time Periods and Overrides
- Seven (7) Preset Speeds
- Supervision Functions
- Adjustable Current Limit
- Electronic Reverse
- Automatic Extended Power Loss Ride Through (Selectable)
- Programmable Maximum Frequency to 500 Hz
- PID Control
 - Two (2) Integral Independent Programmable PID Setpoint Controllers (Process and External)
 - External Selection between Two (2) Sets of Process
 - PID Controller Parameters
 - PID Sleep/Wake-Up
- Motor Control Features
 - Scalar (V/Hz) and Vector Modes of Motor Control
 - V/Hz Shapes
 - Linear
 - Squared
 - Energy Optimization
 - IR Compensation
 - Slip Compensation
 - Three (3) Critical Frequency Lockout Bands
- Preprogrammed Protection Circuits
 - Overcurrent
 - Short Circuit
 - Ground Fault
 - Overvoltage
 - Undervoltage
 - Input Phase Loss
 - Output Device (IGBT) Overtemperature
 - Adjustable Current Limit Regulator
 - UL508C approved Electronic Motor Overload (I²T)
- Programmable Fault Functions for Protection Include
 - Loss of Analog input
 - Panel Loss
 - External Fault
 - Motor Thermal Protection
 - Stall
 - Underload
 - Motor Phase Loss
 - Ground Fault
- 5% Input Impedance
 - Equivalent 5% Impedance with Internal Reactor(s)
 - Patented Swinging Choke Design for Superior Harmonic Mitigation (R1 to R4)

OPTIONAL FEATURES

- 3 Relay Extension Module (OREL-01)
- 115/230 V Digital input Interface Card (OHDI-01)
- Embedded Fieldbus Protocols
 - BACnet (MS/TP)
- Fieldbus Adapter Modules
 - LonWorks
 - Profibus
 - Ethernet
- DriveWindow Light Start-up, Operation, Programming and Diagnostic Tool
- Fan Replacement Kit

ACH550 Specifications

Input Connection

Input Voltage (U ₁)	208/220/230/240 VAC 3-phase +/-10%
	208/220/230/240 VAC 1-phase +/-10%
	380/400/415/440/460/480 VAC 3-phase +/-10%
	500/600 VAC 3-phase +/-10%
Frequency:	48 - 63 Hz
Line Limitations:	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cos φ):	0.98 at nominal load
Connection:	U ₁ , V ₁ , W ₁ (U ₁ , V ₁ , 1-phase)
Output (Motor) Connection	
Output Voltage:	0 to U ₁ , 3-phase symmetrical, U ₂ at the field weakening point
Output Frequency:	-500 to 500 Hz
Frequency Resolution:	0.01 Hz
Continuous Output Current:	
Variable Torque:	1.0 * I _{2N} (Nominal rated output current, Variable Torque)
Short Term Overload Capacity:	
Variable Torque:	1.1 * I _{2N} , (1 min/10 min)
Peak Overload Capacity:	
Variable Torque:	1.35 * I _{2N} , (2 sec/1 min)
Base Motor Frequency Range:	10 to 500 Hz
Switching Frequency:	1, 4, 8 or 12 kHz
Acceleration Time:	0.1 to 1800 s
Deceleration Time:	0.1 to 1800 s
Efficiency:	0.98 at nominal power level
Short Circuit Withstand Rating:	100,000 AIC (UL) w/o fuses
Connection:	U ₂ , V ₂ , W ₂
Enclosure	
Style:	UL (NEMA) Type 1, Type 12, or Type 3R
Agency Approval	
Listing and Compliance:	UL, cUL, CE
Ambient Conditions, Operation	
Air Temperature:	-15 ⁰ to 40 ⁰ C (5 ⁰ to 104 ⁰ F), above 40 ⁰ C the maximum output current is de-rated 1% for every additional 1 ⁰ C (up to 50 ⁰ C (122 ⁰ F) maximum limit.
Relative Humidity:	5 to 95%, no condensation allowed, maximum relative humidity is 60% in the presence of corrosive gasses
Contamination Levels:	
IEC:	60721-3-1, 60721-3-2 and 60721-3-3
Chemical Gasses:	3C1 and 3C2
Solid Particles:	3S2
Installation Site Altitude:	0 to 1000 m (3300 ft) above sea level. At sites over 1000 m (3300 ft) above sea level, the maximum power is de-rated 1% for every additional 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or representative for further information
Vibration:	Max 3.0 mm (0.12 in) 2 to 9 Hz, Max 10 m/s ² (33 ft/s ²) 9 to 200 Hz sinusoidal
Ambient Conditions, Storage (in Protective Shipping Package)	
Air Temperature:	-40 ⁰ to 70 ⁰ C (-40 ⁰ to 158 ⁰ F)
Relative Humidity:	Less than 95%, no condensation allowed
Vibration:	In accordance with ISTA 1A and 1B specifications
Shock (IEC 60086-2-29):	Max 100 m/s ² (330 ft/s ²) 11 ms
Ambient Conditions, Transportation (in Protective Shipping Package)	
Air Temperature:	-40 ⁰ to 70 ⁰ C (-40 ⁰ to 158 ⁰ F)
Relative Humidity:	Less than 95%, no condensation allowed
Atmospheric Pressure:	60 to 106 kPa (8.7 to 15.4 PSI)
Vibration:	Max 3.5 mm (0.14 in) 2 to 9 Hz, Max 15 m/s ² (49 ft/s ²) 9 to 200 Hz sinusoidal
Shock (IEC 60086-2-29):	Max 100 m/s ² (330 ft/s ²) 11 ms
Free Fall:	
R1:	76 cm (30 in)
R2:	61 cm (24 in)
R3:	46 cm (18 in)
R4:	31 cm (12 in)
R5 & 6:	25 cm (10 in)

ACH550 Specifications (continued)

Cooling Information

Cooling Method:	Integral fan(s)
Power Loss:	Approximately 3% of rated power

Analog Inputs

Quantity:	Two (2) programmable
Voltage Reference:	0 (2) to 10 V, 250kOhm, single ended
Current Reference:	0 (4) to 20 mA, 100Ohm, single ended
Potentiometer:	10 VDC, 10 mA (1K to 10KOhms)
Input Updating Time:	8 ms
Terminal Block Size:	2.3mm ² / 14AWG

Reference Power Supply

Reference Voltage:	+10 VDC, 1% at 25°C (77°F)
Maximum Load:	10 mA
Applicable Potentiometer:	1 kOhm to 10 kOhm
Terminal Block Size:	2.3mm ² / 14AWG

Analog Outputs

Quantity:	Two (2) programmable current outputs
Signal Level:	0 (4) to 20 mA
Accuracy:	+/- 1% full scale range at 25°C (77°F)
Maximum Load Impedance:	500 Ohms
Output Updating Time:	2 ms
Terminal Block Size:	2.3mm ² / 14AWG

Digital Inputs

Quantity:	Six (6) programmable digital inputs
Isolation:	Isolated as one group
Signal Level:	24 VDC, (10V Logic 0)
Input Current:	15 mA at 24 VDC
Input Updating Time:	4 ms
Terminal Block Size:	2.3mm ² / 14AWG

Internal Power Supply

Primary Use:	Internal supply for digital inputs
Voltage:	+24 VDC, max 250 mA
Maximum Current:	250 mA
Protection:	Short circuit protected

Relay Outputs

Quantity:	Three (3) programmable relay (Form C) outputs
Switching Capacity:	8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
Max Continuous Current:	2A RMS
Contact Material:	Silver Cadmium Oxide (AgCdO)
Isolation Test Voltage:	4 kVAC, 1 minute
Output Updating Time:	12 ms
Terminal Block Size:	2.3mm ² / 14AWG

Protections

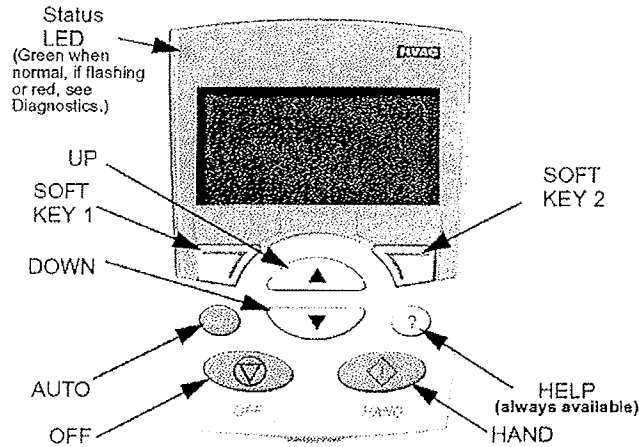
Single Phase:	Protected (input & output)
Overcurrent Trip Limit:	3.5 x I _N instantaneous
Adjustable Current Regulation Limit:	1.1 x I _N (RMS) max.
Overvoltage Trip Limit:	1.30 x U _N
Undervoltage Trip Limit:	0.65 x U _N
Overtemperature (Heatsink):	+115°C (+239°F)
Auxiliary Voltage:	Short Circuit Protected
Ground Fault:	Protected
Short Circuit:	Protected
Microprocessor fault:	Protected
Motor Stall Protection:	Protected
Motor Overtemperature Protection (I _{zt}):	Protected
Input Power Loss of Phase:	Protected
Loss of Reference:	Protected
Short Circuit Current Rating:	100,000 RMS symmetrical Amperes
Input Line Impedance:	5% with standard internal choke(s), Swinging Choke (R1 to R4)

U ₁ = Input Voltage	U _N = Nominal Motor Voltage
U ₂ = Output Voltage	f _N = Nominal Motor Frequency
P _N = Power – Normal Duty (HP)	I _{2N} = Nominal Motor Current – Normal Duty

Specifications are subject to change without notice. Please consult the factory when specifications are critical.

ACH550 Control Panel

The ACH550 Control Panel is a multifunction control panel with full graphic LCD display and multiple language capability. The control panel can be connected to and detached from the ACH550 at any time. The panel can be used to upload and copy parameters to other ACH550 drives.



Run Indication and Shaft Direction

Control Panel Display	Significance
Rotating arrow (clockwise or counterclockwise)	Drive is running and at set point Shaft direction is forward or reverse
Rotating arrow blinking	Drive is operating but not at setpoint
Stationary arrow	Drive is stopped

LED Indicators

The green LED indicates that the power is on and the drive is operating normally. The red LED indicates a fault. A blinking green LED indicates an alarm condition. A blinking red LED indicates a fault that requires power to be cycled off and on to reset the drive.

Fault Indications

The ACH550 Control Panel can display over 20 alarm and fault messages. The last fault and previous faults (1 to 9) are retained in memory. The last fault and previous faults (1 & 2) also record important diagnostic information to assist in troubleshooting. Most faults can be reset by pressing the RESET key (Soft Key 1).

Parameters

Application specific parameters are immediately accessible through a selection of start-up "Assistants". A complete list of parameters is also available grouped by function in approximately 33 menu groups. One of the basic menu functions can be used to display the complete list of changed parameters.

Real Time Clock

The Operator Control Panel includes a real time clock which provides Day, Date and Time information, displayed in a choice of formats. The real time clock has a 10 year battery back up and provides time and date stamping of drive faults and other events. The clock is also used by the ACH550s internal timer functions, providing an integral time clock for start/stop control as well as other control operations.

Control Modes

When the HAND key is pressed, the drive starts and pressing the UP/DOWN keys can modify the reference frequency. The HAND (keypad) control mode is indicated.

When the OFF key is pressed, the drive stops and the OFF control mode is indicated.

When the AUTO key is pressed, the AUTO control mode is indicated. The drive can be started and stopped using whichever remote start/stop command has been configured, a contact closure applied to the start/stop input, a serial communication command or a process feedback signal. In AUTO mode the drive speed is typically controlled by the external speed reference input or by the PID controller.

If the HAND key is pressed while the drive is running in the AUTO control mode, the drive continues to run without changing speed, but ceases to respond to external input or PID speed reference changes. (Bumpless transfer) Pressing the UP/DOWN keys can modify the reference frequency.

If the AUTO key is pressed while the drive is running in the HAND control mode and an external start command is present, the drive continues to run and follows the acceleration or deceleration control ramp to the speed set by the external input or PID speed reference. (Bumpless transfer)

Cable Connections

Terminal	Description	Note
U1, V1, W1	3~ power supply input	Use of 1~ supply requires 50% derate of output current and is applicable for 208 to 240 VAC operation only.
PE / GND	Protective Ground	Follow local rules for cable size.
U2, V2, W2	Power output to motor	
Uc+, Uc-	DC bus	
X1 1 to 18	Control Wiring	Low voltage control – Use shielded cable
X1 19 to 27	Control Wiring	Low voltage or 115VAC
X1 28 to 32	Serial Communications	Use shielded cable

Follow local codes for cable size. To avoid electromagnetic interference, use separate metallic conduits for input power wiring, motor wiring, control and communications wiring. Keep these four classes of wiring separated in situations where the wiring is not enclosed in metallic conduit. Also, keep 115VAC control wiring separated from low voltage control wiring and power wiring.

Use shielded cable for control wiring.

Ampacity is based on the use of 60 °C rated power cable up to 100 Amps (75 °C over 100 Amps).

Refer to the included tables for current ratings, fuse recommendations and maximum wire size capacities and tightening torques for the terminals. The ACH550 is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 480 V maximum. The ACH550 has an electronic motor protection feature that complies with the requirements of the National Electric Code (NEC). When this feature is selected and properly adjusted. Additional overload protection is not required unless more than one motor is connected to the drive or unless additional protection is required by applicable safety regulations.

For CE installation requirements, see ABB publication CE-US-02 "CE Council Directives and Variable Speed Drives." Contact your local ABB representative for specific IEC installation instructions.

ACH550 Control Terminals - Main I/O Terminal X1

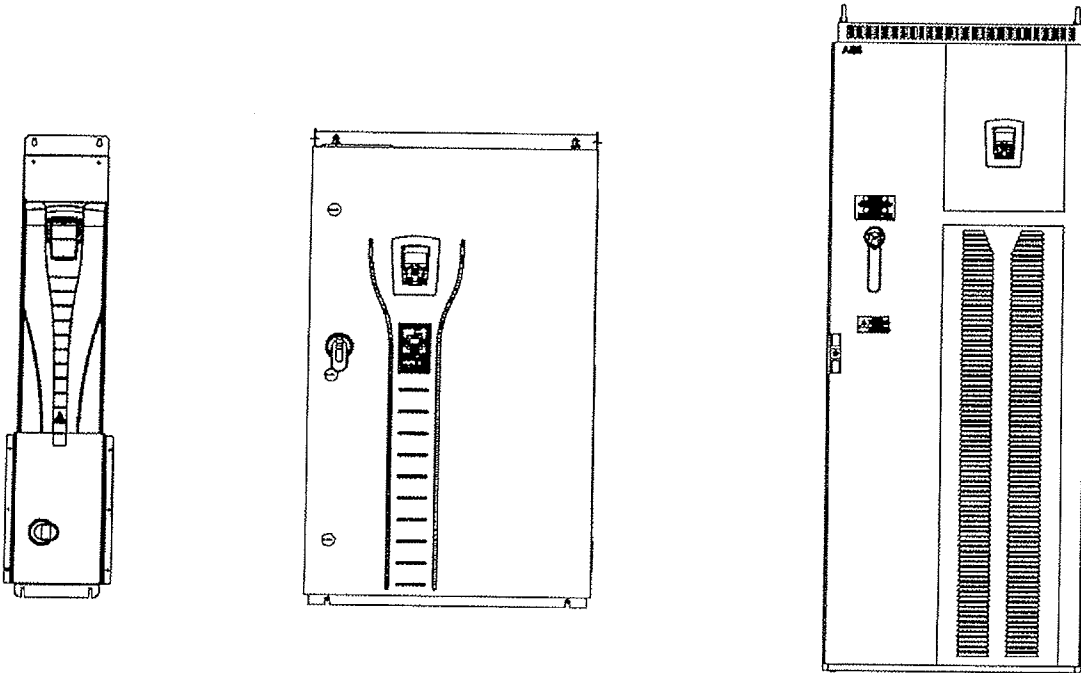
X1	Identification	Description	
1	SCR	Terminal for signal cable screen. (Connected internally to chassis ground.)	
2	AI 1	Analog input channel 1, programmable. Resolution 0.1 % accuracy ± 1 %. Default: 0 (4) - 20 mA ($R_i = 500 \Omega$) (J1:AI1 ON) 0 (2) - 10 V ($R_i = 200 \text{ k}\Omega$) (J1:AI1 OFF) External reference	
3	AGND	Analog input common. (Connected internally to chassis ground through 1 M Ω)	
4	10 V	10 V/10 mA reference voltage output for analog input potentiometer, accuracy ± 2 %.	
5	AI 2	Analog input channel 2, programmable. Resolution 0.1 % accuracy ± 1 %. Default: 0 (4) - 20 mA ($R_i = 500 \Omega$) (J1:AI2 ON) 0 (2) - 10 V ($R_i = 200 \text{ k}\Omega$) (J1:AI2 OFF) PID Feedback	
6	AGND	Analog input common. (Connected internally to chassis ground through 1 M Ω)	
7	AO1	Analog output channel 1, programmable. Default: 0 (4) - 20 mA (load < 500 Ω) Output frequency	
8	AO2	Analog output channel 2, programmable. Default: 0 (4) - 20 mA (load < 500 Ω) Output current	
9	AGND	Analog output common. Connected internally to chassis ground through 1 M Ω)	
10	24 V	Auxiliary voltage output 24 V DC / 250 mA (Reference to AGND). Short circuit protected.	
11	GND	Common for digital input (DI) return signals.	
12	DCOM	Digital input circuit common for all digital inputs (DIs).	
DI Configuration		To activate a digital input, there must be $\geq +10$ V (or ≤ -10 V) between that input and DCOM. The 24 V may be provided by the ACH550 (X1:10) or by an external 12-24 V source of either polarity.	
13	DI 1	AUTO mode Start/Stop: Activation starts the drive	
14	DI 2	Not used	
15	DI 3	Constant speed 1: Activation selects constant speed 1	
16	DI 4	Start enable 1: Deactivation stops the drive.	
17	DI 5	Not used	
18	DI 6	Not used	
19	RO1C	Normally Closed (NC)	Relay output 1, programmable (Default: Ready - 19 connected to 21). 12 - 250 V AC / 30 V DC, 10 mA - 2 A
20	RO1A	Common	
21	RO1B	Normally Open (NO)	
22	RO2C	Normally Closed (NC)	Relay output 2, programmable (Default: Running - 22 connected to 24). 12 - 250 V AC / 30 V DC, 10 mA - 2 A
23	RO2A	Common	
24	RO2B	Normally Open (NO)	
25	RO3C	Normally Closed (NC)	Relay output 3, programmable (Default: Fault(-1) - 25 connected to 27). 12 - 250 V AC / 30 V DC, 10 mA - 2 A
26	RO3A	Common	
27	RO3B	Normally Open (NO)	
28	Screen	Terminal for signal cable screen. (Connected internally to chassis ground.)	
29	B	RS-485 Serial Communications Positive input connection	
30	A	RS-485 Serial Communications Negative input connection	
31	AGND	Analog input common. (Connected internally to chassis ground through 1 M Ω .)	
32	Screen	Terminal for signal cable screen. (Connected internally to chassis ground.)	

Notes: Digital input impedance 1.5 k Use multi-strand wire, size range: 20-16 AWG (0.5-1.5 mm²) For fail-safe reasons, the Fault (-1) Relay signals a "Fault", when the ACH550 is powered down.

Drive Pack Standard Features

ACH550 Drive Pack - Overview

The ACH550 Drive Pack is an ACH550 HVAC Drive in an integrated UL Type 1 or UL Type 12 enclosure with an input disconnect switch and fuses or circuit breaker. The ACH550 Drive Pack provides an input disconnect switch or circuit breaker with door mounted, interlocked operator (padlockable in the OFF position), electronic motor overload protection, a local operator keypad with indicating lights, and provisions for external control connections.



ACH550 Drive Pack Exterior Views

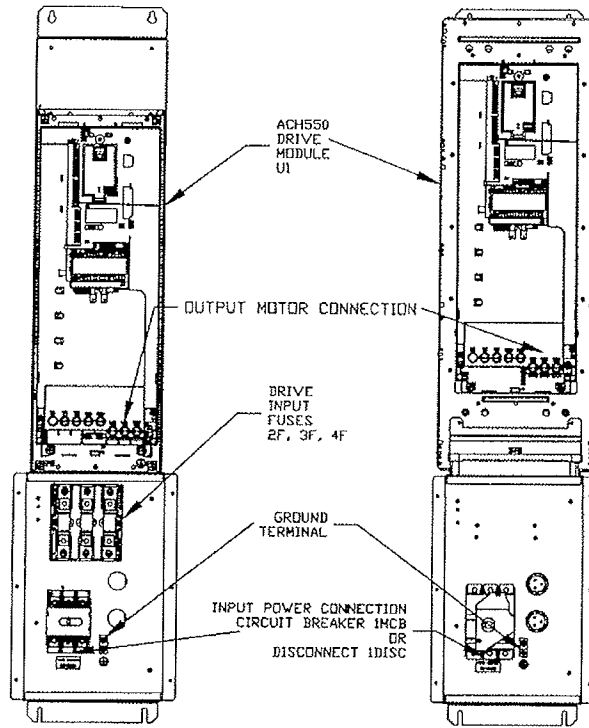
Cable Connections

The following illustrations show the ACH550 Drive Pack cable connection points for the various enclosure styles. The illustrations indicate the location of input and output power connections as well as equipment and motor grounding connection points.

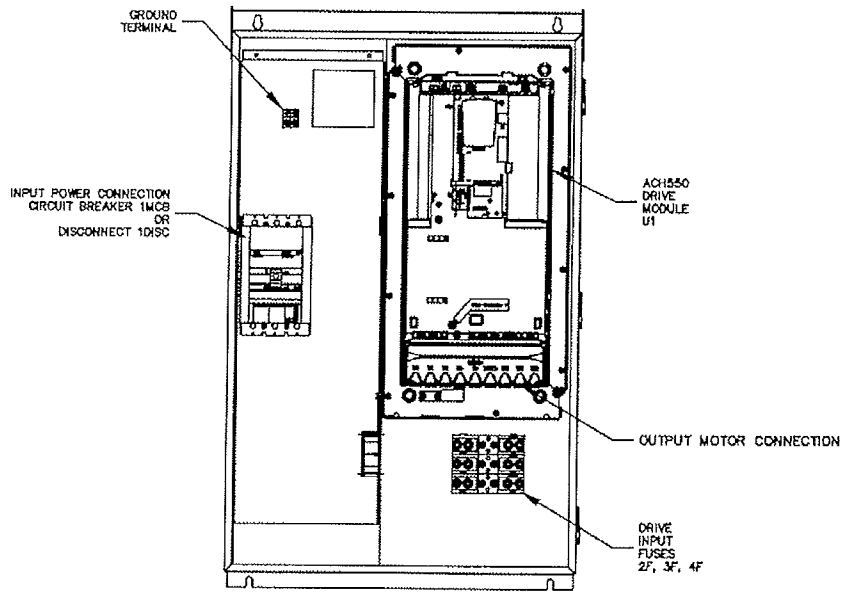
ACH550-PD drives are configured for wiring access from the bottom only on vertical wall mount units and from the top only on standard wall mount and all floor mount units. At least three separate metallic conduits are required, one for input power, one for output power to the motor and one for control signals.

Terminal Sizes

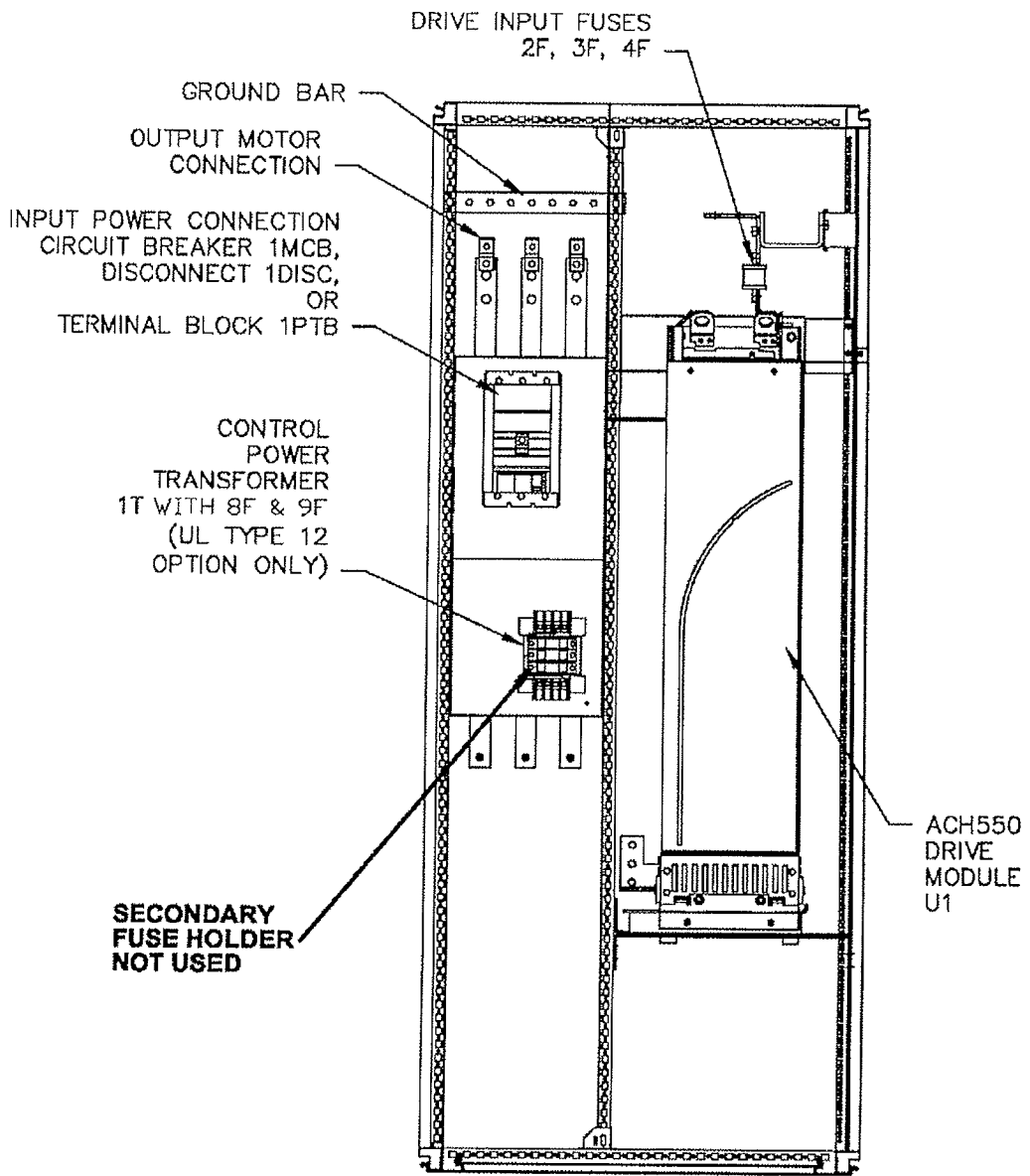
Power and motor cable terminal sizes are shown in the *Submittal Schedule Details* and in the *Wire Size Capacities of Power Terminals* Table. The information provided is for connections to an input circuit breaker or disconnect switch, a motor terminal block, overload relay and ground lugs. The table also lists torque that should be applied when tightening the connections.



Vertical Wall Mount Drive Pack Internal Views



Standard Wall Mount Drive Pack Internal View



Standard Floor Mounted Drive Pack Internal View





LOUVER and DAMPER DATA SHEETS and DRAWINGS

RUSKIN®

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ELF375DX and ELF375DXH DRAINABLE STATIONARY LOUVERS EXTRUDED ALUMINUM

STANDARD CONSTRUCTION

FRAME

4" (102) deep, 6063T5 extruded aluminum. ELF375DX - .081" (2.1) nominal wall thickness. ELF375DXH - .125" (3.2) nominal wall thickness. Downspouts and caulking surfaces provided.

BLADES

6063T5 extruded aluminum. ELF375DX - .081" (2.1) nominal wall thickness. ELF375DXH - .125" (3.2) nominal wall thickness. Drainable blades are positioned at 37 1/2° angle and spaced approximately 5 3/32" (129) center to center.

SCREEN

3/4" x .051" (19 x 1.3) expanded, flattened aluminum bird screen in removable frame. Screen adds approximately 1/2" (13) to louver depth.

FINISH

Mill.

MINIMUM SIZE

12"w x 12"h (305 x 305).

APPROXIMATE SHIPPING WEIGHT

ELF375DX - 4 lbs./ft.² (19.5 kg per m²).
ELF375DXH - 6 lbs./ft.² (29.3 kg per m²).

MAXIMUM FACTORY ASSEMBLY SIZE

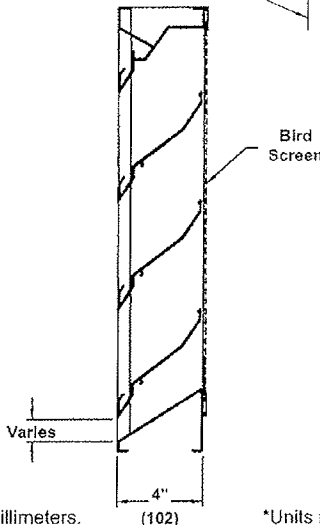
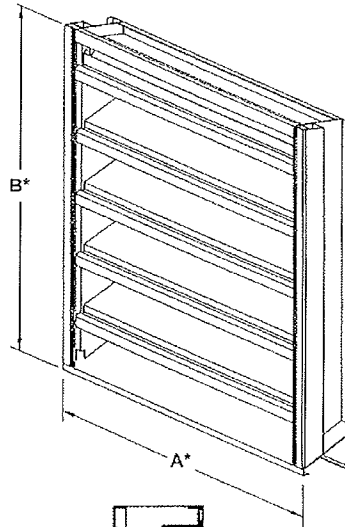
Shall be 75 sq. ft. (7m²) per section, not to exceed 120"w x 90"h (3048 x 2286) or 90"w x 120"h (2286 x 3048).

Louvers larger than the maximum factory assembly size will require field assembly of smaller sections.

SUPPORTS

Louvers may be provided with rear mounted blade supports that increase overall louver depth depending on louver size, assembly configuration or windload.

Consult Ruskin for additional information.



FEATURES

The ELF375DX and ELF375DXH offers:

- 54% Free Area.
- Published performance ratings based on testing in accordance with AMCA Publication 511.
- High performance frame system with drainable head collects and removes water to provide excellent water penetration performance.
- Drain gutter in each blade minimizes water cascade between blades.
- Architecturally styled, hidden mullions allowing continuous line appearance up to 120" (3048).
- Aluminum construction for low maintenance and high resistance to corrosion.
- All welded construction.

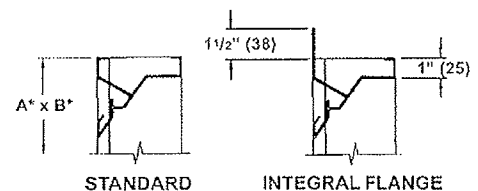
VARIATIONS

Variations to the basic design of these louvers are available at additional cost. They include:

- Extended sill.
- Hinged frame.
- Front or rear security bars.
- Filter racks.
- A variety of bird and insect screens.
- Selection of finishes: prime coat, baked enamel (modified fluoropolymer), epoxy, Acrodize, Kynar, clear and color anodize. (Some variation in anodize color consistency is possible.)

Consult Ruskin for other special requirements.

FRAME CONSTRUCTION



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

Dimensions in inches, parenthesis () indicate millimeters.

TAG	QTY.	SIZE		FRAME	VARIATIONS
		A*-WIDE	B*-HIGH		
MAH-1	1	60	36		
PROJECT ARCH./ENGR. REPRESENTATIVE			LOCATION CONTRACTOR DATE		

SUGGESTED SPECIFICATION

Furnish and install louvers as hereinafter specified where shown on plans or as described in schedules. Louvers shall be stationary drainable type with drain gutters in each blade and downspouts in jambs and mullions. Louvers shall have a minimum of 54% free area based on a 48" wide x 48" high (1219 x 1219) size. Stationary drainable blades shall be contained within a 4" (102) frame. Louver components (heads, jambs, sills, blades, & mullions) shall be factory assembled by the louver manufacturer. Louver sizes too large for shipping shall be built up by the contractor from factory assembled louver sections to provide overall sizes required. Louver design shall limit span between visible mullions to 10 feet (3) and shall incorporate structural supports required to withstand a windload of 20 lbs. per sq. ft. (.96kPa) (equivalent of a 90 mph [145 KPH] wind – specifier may substitute any loading required).

Louvers shall be Ruskin Model ELF375DX or ELF375DXH extruded 6063T5 aluminum alloy construction as follows:

Frame: 4" (102) deep. ELF375DX - .081" (2.1) wall thickness. ELF375DXH - .125" (3.2) wall thickness.

Blades: ELF375DX - .081" (2.1) wall thickness. ELF375DXH - .125" (3.2) wall thickness. Drainable blades are positioned at 37 1/2° angle and spaced approximately 5 3/32" (129) center to center.

Screen: 3/4" x .051 (19 x 1.3) expanded, flattened aluminum in removable frame.

Finish: Select finish specification from Ruskin Finishes Brochure.

Published louver performance data bearing the AMCA Certified Ratings Seal for Air Performance & Water Penetration must be submitted for approval prior to fabrication and must demonstrate pressure drop and water penetration equal to or less than the Ruskin model specified.

PERFORMANCE DATA

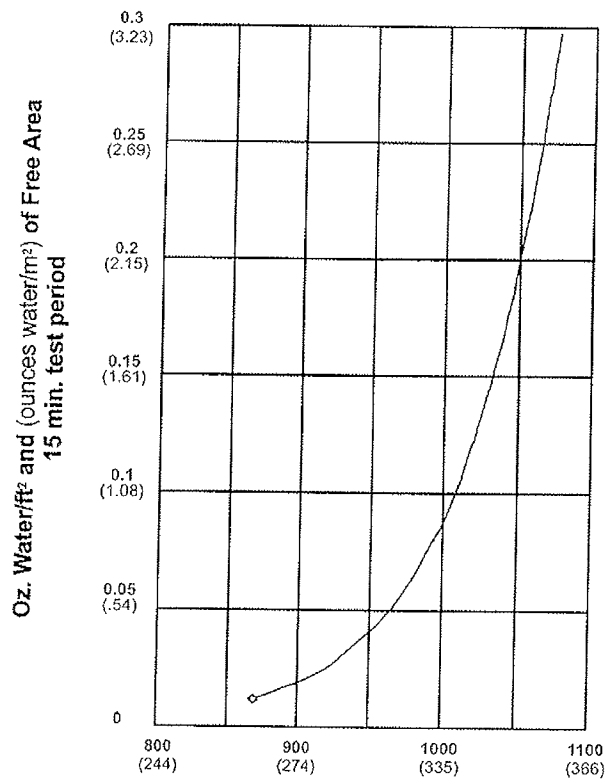
AMCA Standard 500 provides a reasonable basis for testing and rating louvers. Testing to AMCA 500 is performed under a certain set of laboratory conditions. This does not guarantee that other conditions will not occur in the actual environment where louvers must operate.

The louver system should be designed with a reasonable safety factor for louver performance. To ensure protection from water carryover, design with a performance level somewhat below maximum desired pressure drop and .01 oz./sq. ft. of water penetration.

WATER PENETRATION

Test size 48" wide x 48" high (1219 x 1219)

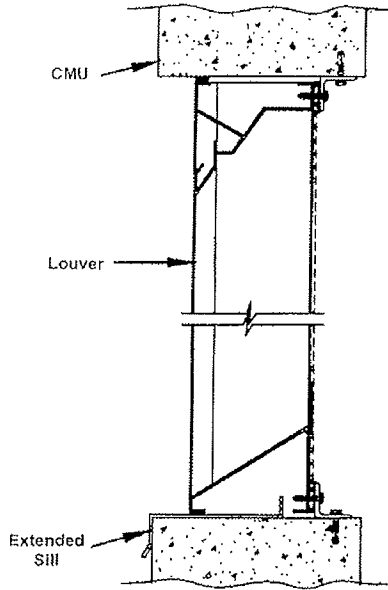
Beginning point of water penetration at .01 oz./sq. ft. is 873 fpm (266 m/min).



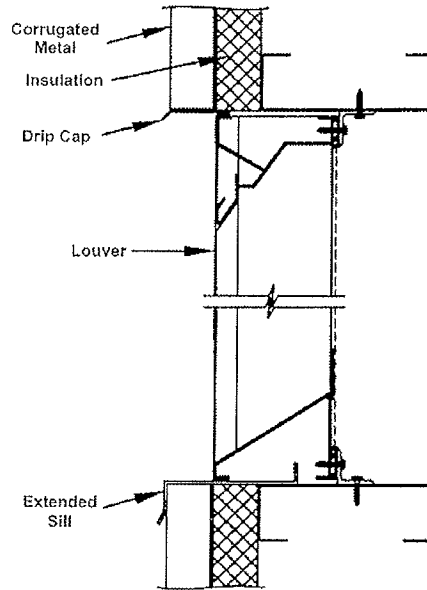
Free Area Velocity in feet and (meters) per minute
Standard air .075 lb/ft³

TYPICAL INSTALLATION DETAILS

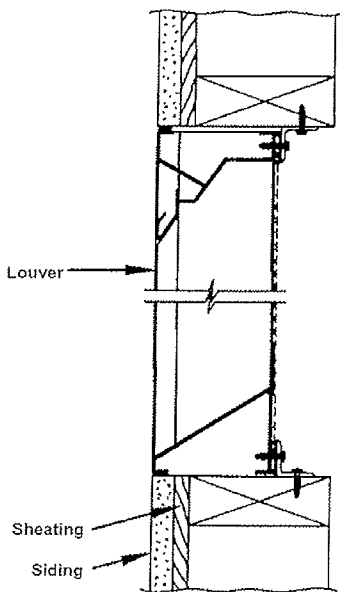
Masonry Wall



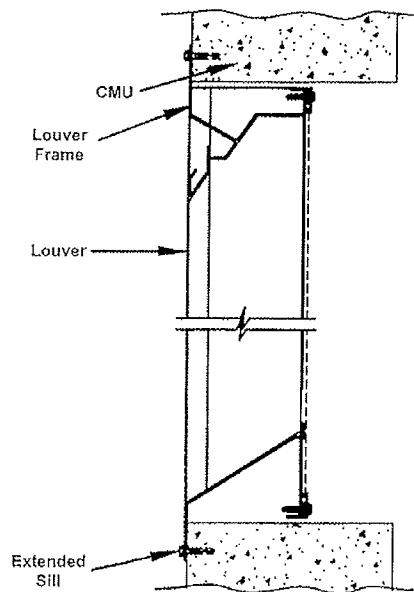
Metal Panel Wall



Wood Installation



Flange Mount



Accessories at additional cost.

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CD50 LOW LEAKAGE CONTROL DAMPER EXTRUDED ALUMINUM

STANDARD CONSTRUCTION

FRAME

5" x 1" x 6063T5 extruded aluminum hat channel with .125" minimum wall thickness (127 x 25 x 3.2). Low profile, 5" x 1/2" (127 x 13) top and bottom frames on dampers 12" (305) high and less. Mounting flanges on both sides of frame.

BLADES

6" (152) wide, 6063T5 heavy gage extruded aluminum, airfoil shape.

LINKAGE

Concealed in frame.

AXLES

1/2" (13) plated steel hex.

BEARINGS

Molded synthetic.

SEALS

Blade Edge – Extruded Ruskiprene (TPR) for -72°F to +275°F (-58°C to +135°C).

Jamb – Flexible metal compressible type.

CONTROL SHAFT

Removable, 1/2" (13) diameter shaft extends 6" (152) beyond frame.

FINISH

Mill.

MINIMUM SIZE

Single blade, parallel action – 6"w x 5"h (152 x 127).

Two blade, opposed action – 6"w x 9"h (152 x 229).

MAXIMUM SIZE

Single section – 60"w x 72"h (1524 x 1829).

Multiple section assembly – Unlimited size.

Dampers larger than the single section maximum are furnished in an assembly of 48" x 72" (1219 x 1829) or less equal sized individual sections. Tee flange option maximum 60" x 72" (1524 x 1829) on multiple sections.

FEATURES

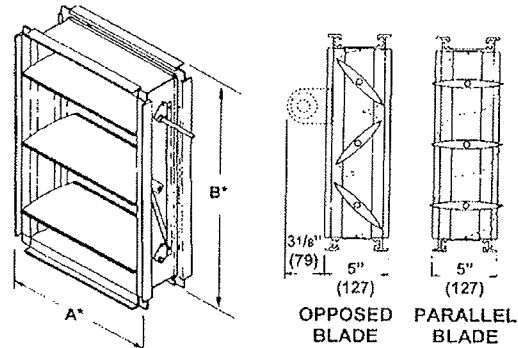
Ruskin's premier damper for medium pressure commercial and industrial HVAC systems offers the lowest leakage available with a standard, commercial built damper. The CD50 was the first AMCA licensed low leakage damper and bears the AMCA Air Leakage Seal.

Linkage is concealed in the frame out of the airstream for low maintenance and reduced air turbulence. Hexagonal axles ensure a positive lock with blades. An easily replaceable, double-edge blade seal features an inflatable pocket that assists in blade seal.

NOTE: Dimensions shown in parenthesis () indicate millimeters.

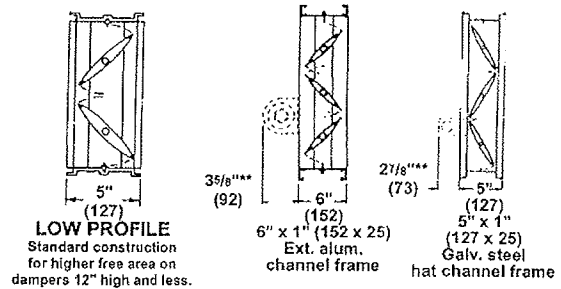
*Units furnished approximately 1/4" (6) smaller than given opening dimensions.

**Jackshaft standard on multiple section dampers.



Ruskin Company certifies that the CD50 shown here-in 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.

FRAME CONSTRUCTION OPTIONS



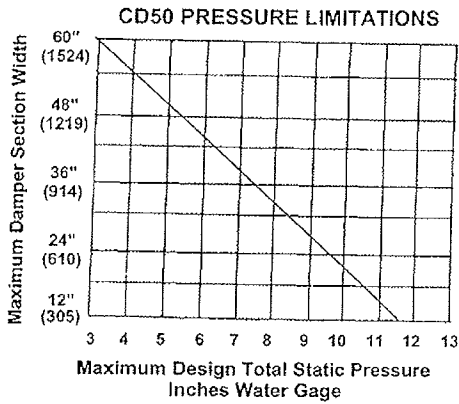
VARIATIONS

Variations to the CD50 basic design are available at additional cost. They include:

- Anodize and special finishes
- Pneumatic or electric actuators
- SP100 Switch Package
- Front or rear or flange frame
- 5" x 1" x 16 gage (127 x 25 x 1.6) galvanized steel hat channel frame
- 6" x 1" x 6063T5 (152 x 25 x 3.2) extruded aluminum hat channel frame
- Face and bypass mixing damper assemblies

QTY.	OPENING DIM.		FRAME STYLE			VARIATIONS
	A*	B*	STD.	Front Flange FF	Rear Flange RF	
JOB CONTRACTOR			LOCATION			

CD50 PERFORMANCE DATA

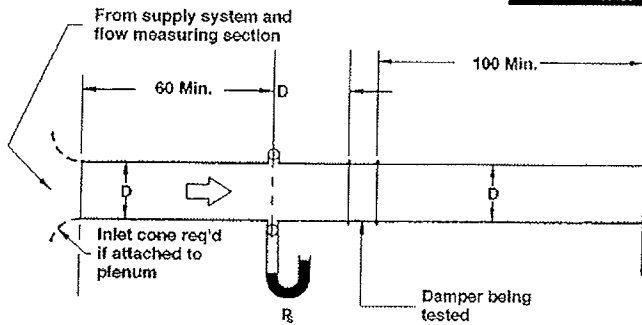


The CD50 may be used in systems with total pressures exceeding 3.5" by reducing damper section width as indicated. Example: Maximum design total pressure of 8.5" w.g. would require CD50 damper with maximum section width of 36" (914).

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 CD50 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.



AMCA STANDARD 500

FIGURE 5.3 DAMPER TEST SETUP WITH INLET AND OUTLET DUCTS

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

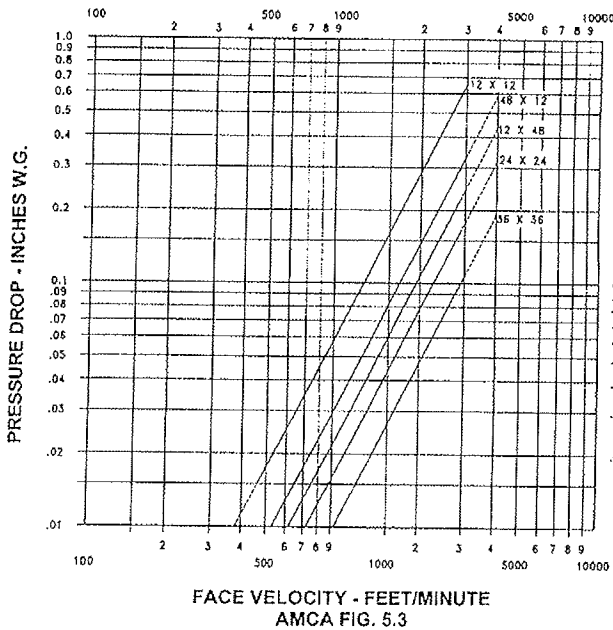
Class I =

4 CFM Sq. Ft. @ 1" w.g.;
8 CFM Sq. Ft. @ 4" w.g.;
11 CFM Sq. Ft. @ 8" w.g.

Class II =

10 CFM Sq. Ft. @ 1" w.g.;
20 CFM Sq. Ft. @ 4" w.g.;
28 CFM Sq. Ft. @ 8" w.g.

VELOCITY VS. PRESSURE DROP

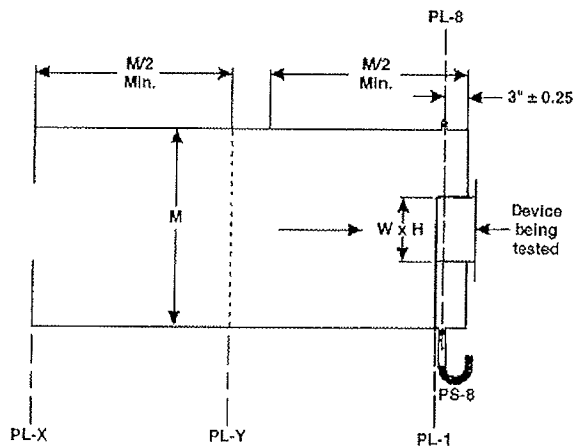


FACE VELOCITY - FEET/MINUTE
AMCA FIG. 5.3

CD50 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/ft³.

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/ft³.



ALTERNATE MOUNT B (LEAKAGE TEST ONLY)
FIGURE 5.5 TEST DEVICE SETUP WITH INLET CHAMBER

CD50 SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans, or in accordance with schedules, Low leakage dampers shall meet the following minimum construction standards: Frames shall be 5" x 1" x .125" (minimum thickness) 6063T5 extruded aluminum hat channel with hat mounting flanges on both sides of the frame. Each corner shall be reinforced with two die formed internal braces and machine staked for maximum rigidity. Blades shall be airfoil type extruded aluminum (maximum 6" depth) with integral structural reinforcing tube running full length of each blade.

Blade edge seals shall be extruded double edge design with inflatable pocket which enables air pressure from either direction to assist in blade to blade seal off. Blades seals shall be mechanically

locked in extruded blade slots, yet shall be easily replaceable in field. Adhesive or clip-on type blade seals are not acceptable. Bearings shall be non-corrosive molded synthetic. Axles shall be hexagonal (round not acceptable) to provide positive locking connection to blades and linkage. Linkage shall be concealed in frame. Submittal must include leakage, maximum air flow and maximum pressure ratings based on AMCA Publication 500. Damper shall be tested and certified in accordance with AMCA 511 for Air Performance and Air Leakage. Damper widths from 12" to 60" wide shall not leak any greater than 8 cfm sq. ft. @ 4" w.g. Dampers shall be in all respects equivalent to Ruskin Model CD50.

CD50 PERFORMANCE DATA

The actual pressure drop through a damper is the result of many factors. The formula and area factor table below may be used to estimate pressure drop for a CD50 of a given size, with straight duct runs upstream and downstream, as in AMCA Figure 5.3.

CD50 FREE AREA

Height Dim. B	Dimension A - Width In Inches													
	8" (203)	12" (305)	16" (406)	20" (508)	24" (610)	28" (711)	32" (813)	36" (914)	40" (1016)	44" (1118)	48" (1219)	52" (1321)	56" (1422)	60" (1524)
8" (203)	0.18	0.32	0.45	0.59	0.72	0.86	0.99	1.13	1.27	1.40	1.54	1.67	1.81	1.94
10" (254)	0.24	0.42	0.59	0.77	0.95	1.12	1.30	1.48	1.66	1.83	2.01	2.19	2.36	2.54
12" (305)	0.31	0.55	0.78	1.01	1.24	1.48	1.71	1.94	2.17	2.41	2.64	2.87	3.10	3.34
14" (356)	0.35	0.61	0.87	1.13	1.39	1.66	1.92	2.18	2.44	2.70	2.96	3.22	3.48	3.74
16" (406)	0.41	0.71	1.01	1.31	1.62	1.92	2.22	2.52	2.83	3.13	3.43	3.73	4.04	4.34
18" (457)	0.48	0.83	1.20	1.56	1.91	2.27	2.63	2.99	3.35	3.70	4.06	4.42	4.78	5.14
20" (508)	0.56	0.97	1.38	1.80	2.21	2.62	3.04	3.45	3.87	4.28	4.69	5.11	5.52	5.93
24" (610)	0.69	1.20	1.71	2.22	2.73	3.24	3.75	4.26	4.77	5.28	5.80	6.31	6.82	7.33
28" (711)	0.82	1.43	2.03	2.64	3.25	3.86	4.47	5.07	5.68	6.29	6.90	7.51	8.11	8.72
32" (813)	0.97	1.69	2.41	3.12	3.84	4.56	5.28	6.00	6.72	7.44	8.16	8.88	9.60	10.32
36" (914)	1.10	1.91	2.73	3.55	4.36	5.18	6.00	6.81	7.63	8.45	9.26	10.00	10.89	11.71
40" (1016)	1.23	2.14	3.06	3.97	4.88	5.80	6.71	7.62	8.54	9.45	10.36	11.28	12.19	13.11
44" (1118)	1.36	2.37	3.38	4.39	5.40	6.41	7.42	8.43	9.45	10.46	11.47	12.48	13.49	14.50
48" (1219)	1.51	2.63	3.75	4.87	6.00	7.12	8.24	9.36	10.48	11.61	12.73	13.85	14.97	16.09
52" (1321)	1.64	2.86	4.08	5.30	6.52	7.73	8.95	10.17	11.39	12.61	13.83	15.05	16.27	17.49
56" (1422)	1.77	3.09	4.40	5.72	7.03	8.35	9.67	10.98	12.30	13.62	14.93	16.25	17.57	18.88
60" (1524)	1.92	3.35	4.77	6.20	7.63	9.06	10.48	11.91	13.34	14.77	16.19	17.62	19.05	20.48
64" (1626)	2.05	3.57	5.10	6.62	8.15	9.67	11.20	12.72	14.25	15.77	17.30	18.82	20.35	21.87
68" (1727)	2.18	3.80	5.42	7.05	8.67	10.29	11.91	13.53	15.16	16.78	18.40	20.02	21.64	23.27
72" (1829)	2.33	4.06	5.80	7.53	9.26	10.99	12.73	14.46	16.19	17.93	19.66	21.39	23.13	24.86

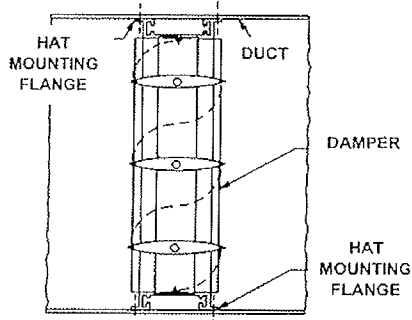
Formula

$$\Delta P = 2.18 \left[\frac{\text{CFM}}{\text{AREA FACTOR}} - \text{Vel.} \right]^2$$

4005

ΔP = Pressure drop in inches w.g.
 Vel. = Duct Velocity in feet per minute
 CFM = Duct area in sq. ft. x velocity in FPM

CD50 TYPICAL INSTALLATION



TYPICAL MODEL CD50 INSTALLATION

Two 1/2" hat mounting flanges are provided around damper perimeter for easy and economical installation. Damper may be quickly installed in ductwork by use of sheet metal screws. Dampers must be installed square and free from racking. Actuator must be installed on the linkage side of the damper. Opposed blade dampers must be operated from a power blade.

For complete assembly and installation instructions details refer to the Ruskin "Standard Multiple Section Control Damper Details" and "Induct Mount Control Dampers Installation Instructions."

BRACING OF MULTIPLE SECTION DAMPER ASSEMBLIES

The CD50 is intended to be self supporting only in its largest single section size. Multiple section damper assemblies may require bracing to support the weight of the assembly and to hold against the system pressure. Ruskin recommends appropriate bracing to support the damper horizontally at least once for every 8' of damper width and bracing of vertical assemblies and higher system pressures may require more bracing.

The CD50 is designed for installation with blades running horizontally. Installation with blades running vertically is not recommended. Contact Ruskin for vertical blade installations.

CD50 SOUND RATINGS

Damper Size	Damper Full Open		Damper 75% Open		Damper 50% Open		Damper 25% Open	
	CFM	NC	CFM	NC	CFM	NC	CFM	NC
12 x 12	2000	17	1500	11	1000	11	500	*
	3000	28	2250	22	1500	19	750	*
	4000	35	3000	29	2000	24	1000	*
18 x 18	2250	17	1688	10	1125	21	563	*
	4500	33	3375	26	2250	32	1125	*
	6750	43	5063	37	3375	40	1688	15
24 x 24	4000	11	3000	10	2000	26	1000	*
	8000	32	6000	30	4000	38	2000	21
	12000	43	9000	42	6000	46	3000	31

NC = Noise criteria in Decibels is based on 10db room effect and 10db of room attenuation.

* = Less than 10 NC

See ASHRAE Handbook (1977 Fundamentals, Chapter 7) for explanation of NC Ratings.

RUSKIN®

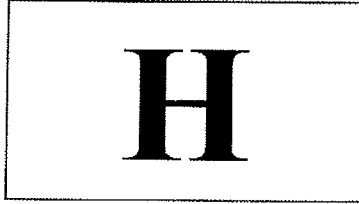
3900 Dr. Greaves Rd.
Kansas City, MO 64030
(816) 761-7476
FAX (816) 765-8955
www.ruskin.com



Damper and Actuation Control Wiring

CLEANPAK International is NOT responsible for the unit damper control. CLEANPAK International recommends that dampers be fully open before fan or (fans) are energized and stay fully open as long as fan is rotating.

CLEANPAK International will not be held responsible for damper and/or unit damage as the result of damper closing while fan is operating.





ACCESSORIES: FILTERS, GAGES, and LIGHTS

AEOLUS FILTER
111-C CREEK RIDGE ROAD
GREENSBORO, NC 27406
(888) 851-1379



SMP 50
24 x 24 x 4

PRE
FILTER

Description: Synthetic Mini-Pleat Panel Filter
Model: SMP 5024244
Ashrae Efficiency: MERV 8 (30-35%)
Nominal Size: 24 x 24 x 4
Rated Air Flow: 2000 cfm

QTY: 3



3011079-001

RigiFil II SH
24 x 24 x 12 1 FILTER
90%-95%

SBULBNBC:BTW



1-888-AAF-2003
P.O. BOX 35690
LOUISVILLE, KY
40232-5690 MADE IN USA

CN: rg0903-5



FINAL FILTER



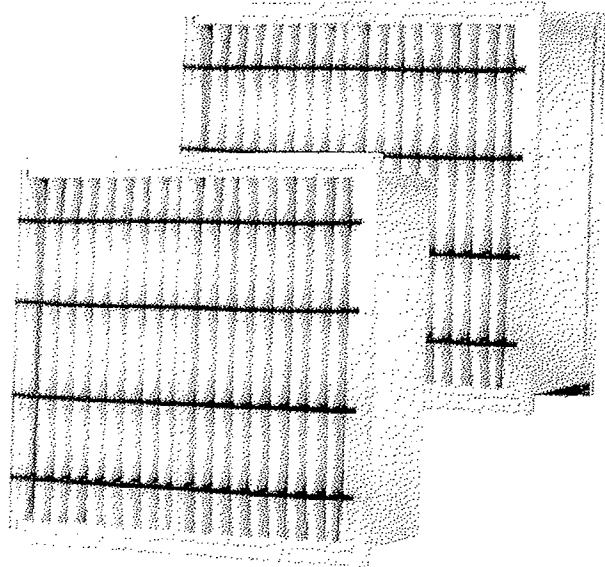
Better Air is Our Business®

AmericanAirFilter®

VariCel® RF

*Extended-Surface Rigid Air Filter
with Synthetic Media*

- Designed for improved performance and durability
- Layered synthetic media with plastic pleat spacers on both sides
- Heavy-duty expanded metal media support grid
- Ideal for VAV systems



Excellent Performance

With superior strength and durability, the VariCel® RF is ideal for Variable Air Volume (VAV) systems. It provides a high level of filtration efficiency in those applications where cleaner air is required. With metal cell sides and a layered synthetic media pack, the VariCel RF offers superior dust holding, moisture resistance, and overall performance. Color-coded media designates each efficiency: yellow (90-95%), pink (80-85%), green (60-65%), and white (45-50%). Both single and double-header models are available.

Sturdy Construction and Dependability

The VariCel RF, with its galvanized steel cell sides and plastic pleat spacers on the air-entering and air-leaving sides, withstands the most demanding applications. The pleat spacers and expanded metal support grid maintain the shape of the synthetic media pack and ensure that both the efficiency and dust-holding capacity are maximized.

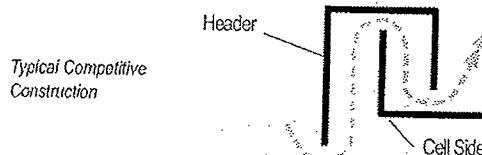
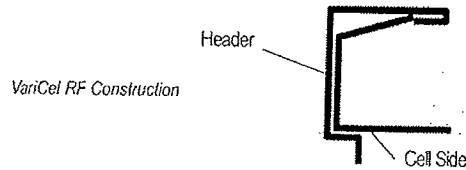
VariCel RF's rigid construction with supported pleat media pack maintains a compact unitized structure under variable air velocities and repeated fan shutdowns. The interlocked header and cell sides, along the entire length of each side, provide maximum sealing. Competitive filters are designed with loose fitting headers that allow greater potential for bypass leakage.

Layered Synthetic Media Pack

The layered media used in the VariCel RF is a meltblown synthetic protected by a scrim on the air-leaving side. Layering the media provides both a high-efficiency final filter layer that effectively filters fine particulate and an integral lofted prefilter layer that captures larger particulate. Meltblown synthetic media is stronger than fiberglass, non-shedding, and is water-resistant.

Open Header Design

AAF's unique open-header design creates a built-in handle that makes carrying and installing VariCel RF easy. As an added safety measure, we roll the edges of the header to eliminate sharp edges that can make handling competitors' products hazardous.



AmericanAirFilter

VariCel® RF

Selection Guide and Performance Data

Class 2 Synthetic

Part Number	Description	Nominal Size (In.)	Actual Size (In.)	Airflow (CFM)	*Resistance (In. W.G.) Initial	Final	Media Area (Ft. Sq.)
3011087-001	VariCel RF DH 90-95%	24x24x12	23.38x23.38x11.50	2000	.56	1.5	62
3011087-004	VariCel RF DH 90-95%	24x12x12	23.38x11.38x11.50	1000	.56	1.5	31
3011087-002	VariCel RF DH 90-95%	24x20x12	23.38x19.38x11.50	1660	.56	1.5	52
3011087-003	VariCel RF DH 90-95%	20x20x12	19.38x19.38x11.50	1400	.56	1.5	41
3011079-001	VariCel RF SH 90-95%	24x24x12	23.38x23.38x11.50	2000	.56	1.5	62
3011079-004	VariCel RF SH 90-95%	24x12x12	23.38x11.38x11.50	1000	.56	1.5	31
3011079-002	VariCel RF SH 90-95%	24x20x12	23.38x19.38x11.50	1660	.56	1.5	52
3011079-003	VariCel RF SH 90-95%	20x20x12	19.38x19.38x11.50	1400	.56	1.5	41
3011087-005	VariCel RF DH 80-85%	24x24x12	23.38x23.38x11.50	2000	.36	1.5	62
3011087-008	VariCel RF DH 80-85%	24x12x12	23.38x11.38x11.50	1000	.36	1.5	31
3011087-006	VariCel RF DH 80-85%	24x20x12	23.38x19.38x11.50	1660	.36	1.5	52
3011087-007	VariCel RF DH 80-85%	20x20x12	19.38x19.38x11.50	1400	.36	1.5	41
3011079-005	VariCel RF SH 80-85%	24x24x12	23.38x23.38x11.50	2000	.36	1.5	62
3011079-008	VariCel RF SH 80-85%	24x12x12	23.38x11.38x11.50	1000	.36	1.5	31
3011079-006	VariCel RF SH 80-85%	24x20x12	23.38x19.38x11.50	1660	.36	1.5	52
3011079-007	VariCel RF SH 80-85%	20x20x12	19.38x19.38x11.50	1400	.36	1.5	41
3011087-009	VariCel RF DH 60-65%	24x24x12	23.38x23.38x11.50	2000	.25	1.5	62
3011087-012	VariCel RF DH 60-65%	24x12x12	23.38x11.38x11.50	1000	.25	1.5	31
3011087-010	VariCel RF DH 60-65%	24x20x12	23.38x19.38x11.50	1660	.25	1.5	52
3011087-011	VariCel RF DH 60-65%	20x20x12	19.38x19.38x11.50	1400	.25	1.5	41
3011079-009	VariCel RF SH 60-65%	24x24x12	23.38x23.38x11.50	2000	.25	1.5	62
3011079-012	VariCel RF SH 60-65%	24x12x12	23.38x11.38x11.50	1000	.25	1.5	31
3011079-010	VariCel RF SH 60-65%	24x20x12	23.38x19.38x11.50	1660	.25	1.5	52
3011079-011	VariCel RF SH 60-65%	20x20x12	19.38x19.38x11.50	1400	.25	1.5	41
3011087-013	VariCel RF DH 45-50%	24x24x12	23.38x23.38x11.50	2000	.23	1.5	62
3011087-016	VariCel RF DH 45-50%	24x12x12	23.38x11.38x11.50	1000	.23	1.5	31
3011087-014	VariCel RF DH 45-50%	24x20x12	23.38x19.38x11.50	1660	.23	1.5	52
3011087-015	VariCel RF DH 45-50%	20x20x12	19.38x19.38x11.50	1400	.23	1.5	41
3011079-013	VariCel RF SH 45-50%	24x24x12	23.38x23.38x11.50	2000	.23	1.5	62
3011079-016	VariCel RF SH 45-50%	24x12x12	23.38x11.38x11.50	1000	.23	1.5	31
3011079-014	VariCel RF SH 45-50%	24x20x12	23.38x19.38x11.50	1660	.23	1.5	52
3011079-015	VariCel RF SH 45-50%	20x20x12	19.38x19.38x11.50	1400	.23	1.5	41

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).
 Headers are 1/4" (21mm).
 Width and height dimensions are interchangeable.

Efficiency

90-95% (Yellow), 80-85% (Pink), 60-65% (Green), 45-50% (White)

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



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 www.aafintl.com

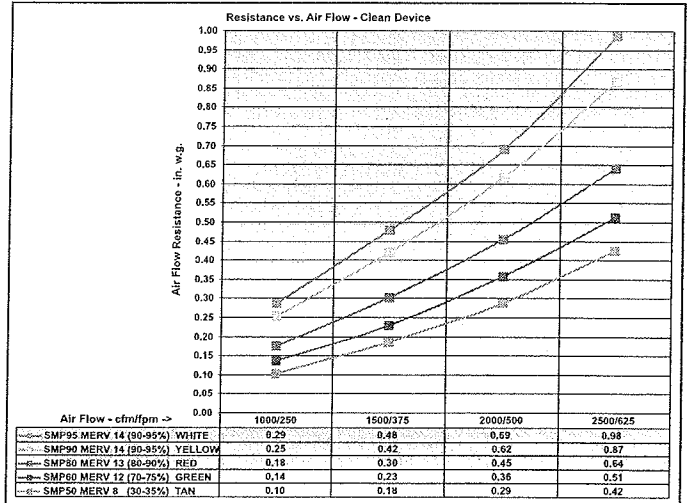
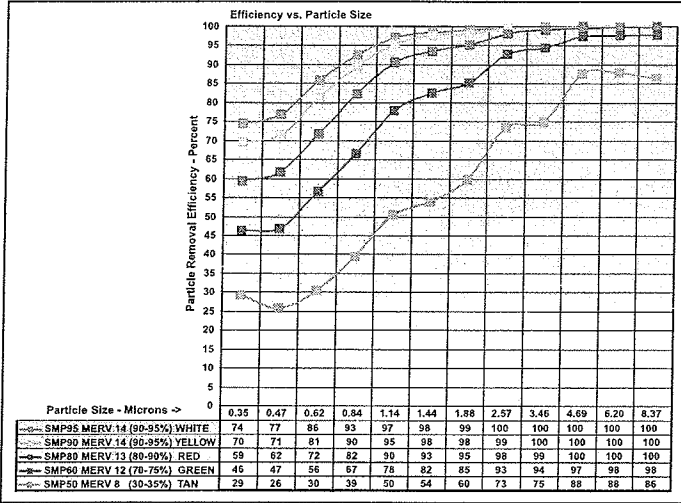
Customer Service 888.AAF.2003
 Fax 888.223.6500

ISO-9001 Certified Firm

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

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 AFP-1-105C NOV '05 QG 2M

4-inch



Testing to ASHRAE 52.2-1999 by an independent laboratory -- Nominal 24 x 24 x 4-inch filters. Minimum composite efficiency at 1968 cfm rated air flow. Note: Numbers in parenthesis are approximate STANDARD 52.1-1992 results per table E-1 ANSI/ASHRAE STANDARD 52.2-1999.

AVAILABLE SIZES (NOMINAL)

→ 24x24x4 20x24x4 20x25x4 20x20x4
 16x25x4 16x20x4 12x24x4

TECHNICAL DATA

Underwriters Laboratories Classification - UL900 Class 1 U.S. - Class 2 Canada
 Inherent antimicrobial properties due to inorganic construction.
 Continuous operating temperature up to 125° F (52°C).
 Can be operated up to 125% of rated air flow.
 Recommended final resistance is 1.50 in. w.g.

BENEFITS

- High efficiency.
- Low air flow resistance.
- Moisture proof construction.
- Resistant to most chemicals.
- Will not support microbial growth.
- High air flow capacity.
- Longer service life
- Durable, damage resistant media packs.
- Will not corrode.
- Can be incinerated for disposal.

Item Part Number	ASHRAE 52.2-1999 Test Results	ASHRAE 52.1-1992 Test Results	Rated Air Flow CFM	Initial Pressure Drop IN. W.G.	Approximate Media Area SQ. FT.
SMP95+24244	MERV 14	90-95% (*)	1968	0.68	119
SMP9524244	MERV 14	90-95% (*)	1968	0.61	119
SMP8524244	MERV 13	80-90% (*)	1968	0.45	119
SMP6524244	MERV 12	70-75% (*)	1968	0.35	119
→ SMP5024244	MERV 8	30-35% (*)	1968	0.28	110

(*) Approximate 52.1-1992 results per table E-1 ANSI/ASHRAE STANDARD 52.2-1999. Independent laboratory test - nominal 24x24x4 filter.

aeolus
CORPORATION

111-C Creek Ridge Road, Greensboro, NC 27406
 Phone (336) 272-1268 Fax (336) 272-1627
 Toll Free (888) 851-1379

The Home of Air Quality!

SYNTHETIC MINI-PLEAT PANEL

4-inch

FIBER TECHNOLOGY

The Patented fiber technology utilized in this filtration media is the latest in "Media Configuration." The media is non-shedding, gradient, density, and 100% polypropylene. It is manufactured by building up progressively smaller and smaller continuous filament non-shedding fibers in a single thermally bonded web. Media fiber size varies from 40 plus microns in diameter on the air entering side to well into the sub-micron range on the air leaving side. This engineered media concept brings into play all the fundamental mechanical principles of particulate capture. Larger particles of dust are caught by larger fibers on the air entering side and progressively smaller particles caught in progressively smaller fibers through the depth of the media. The capture principals of impingement, straining, interception and diffusion are all utilized in harmony.

The "Media Configuration" of this process is a revolutionary single-web media designed and engineered for exceptional performance and durability. Media that has exceptional efficiency, durability, moisture resistance, low resistance to air flow and very good depth loading characteristics.

PACK DESIGN

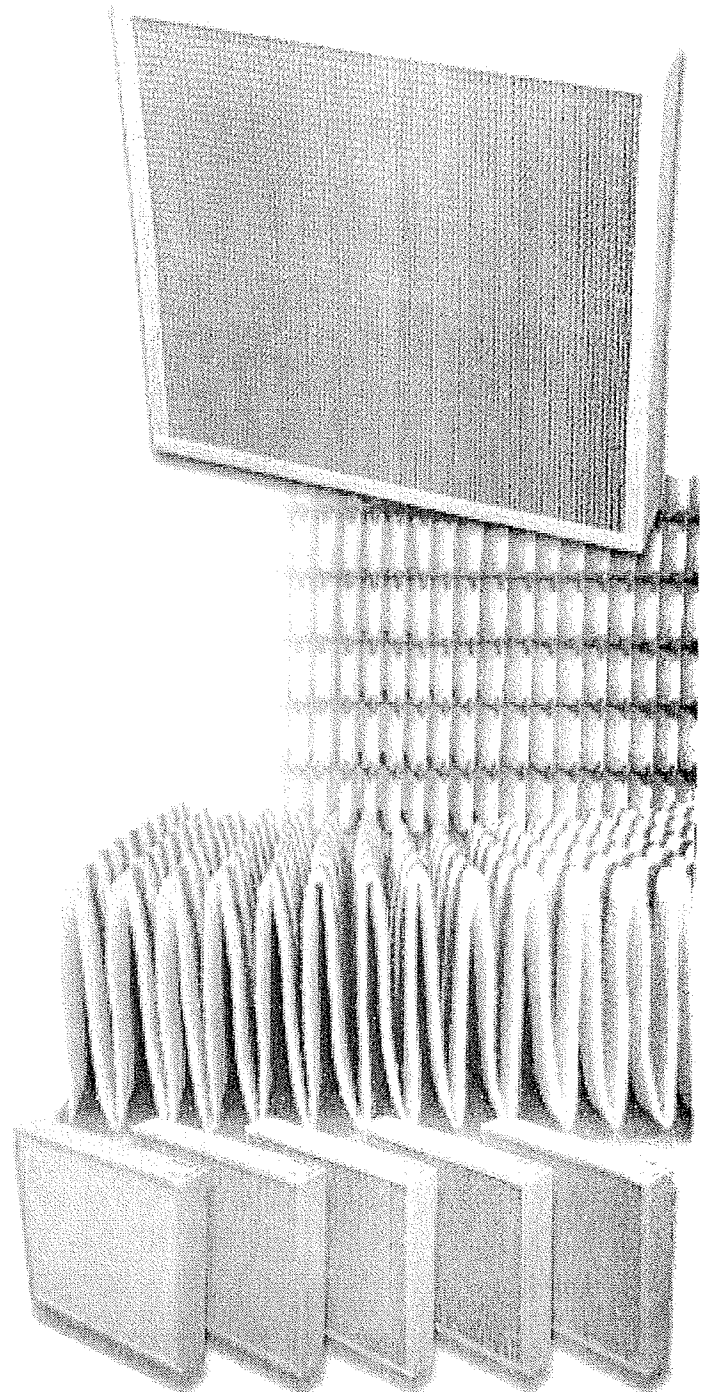
The pleat pack is fabricated from 100% polypropylene media. Continuous 100% polypropylene spacer beads are thermally bonded to both sides of the media. Spacer beads are 3/8 of an inch apart for media support and are color coded to identify efficiency grade. Controlled spacing of pleat tips and spacers are thermally formed to produce a strong aerodynamic shape. This "Design Configuration" controlled spacing allows for the Synthetic Mini-pleat Panel to operate with the principles of filtration in harmony and promoting diffusion of air properly over the entire pleated surface.

The "Design Configuration" of this pleating is a revolutionary Mini-pleat pack designed and engineered for the most demanding applications. A Mini-pleat pack with amazing durability and low aerodynamic pressure loss.

FRAME DESIGN

Frame material for the Synthetic Mini-pleat Panel filter is rigid impact resistant and moisture proof polypropylene foam. The rigid foam board is formed into a U-channel and wrapped around the perimeter of the media pack. Frame and media pack are bonded together with a polypropylene adhesive.

It should be noted that the entire Mini-pleat panel filter is 100% polypropylene. Polypropylene is not affected by moisture and by nature and does not support the growth of microbial organisms such as bacteria, mold, fungi, etc.



MERV 14 to MERV 8
90-95% to 30-35%

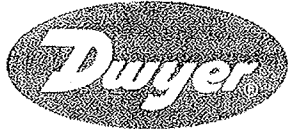
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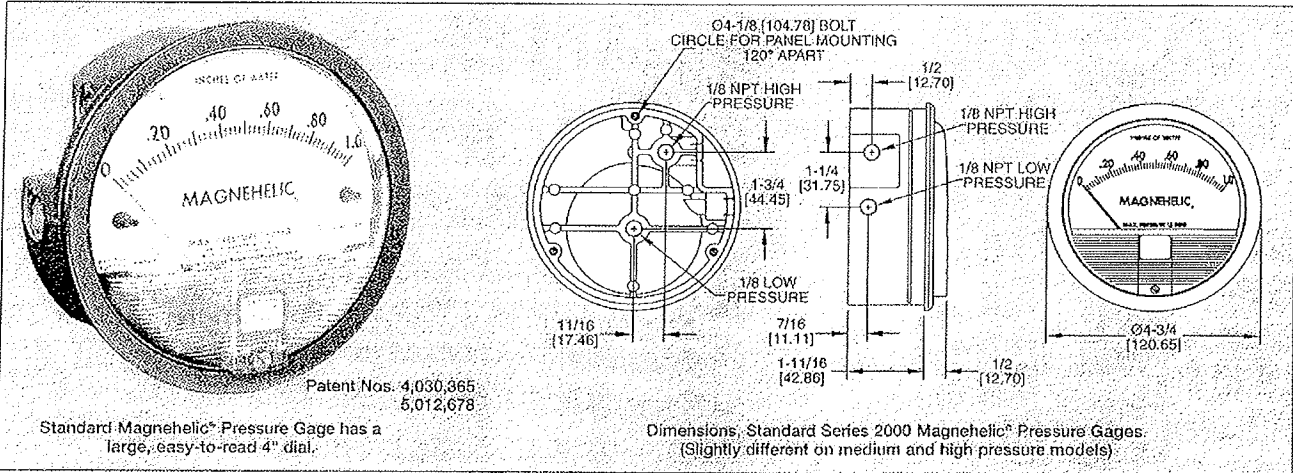


MAGNEHELIC GAGES



Series 2000 Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.

Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen where pressures are less than 35 psi.

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1/2" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4 1/4" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.



Flush ...Surface...or Pipe Mounted

VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.



HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4 1/4" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.



SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on 0 - 100 Pa, 125 Pa, 10MM and ±4% on 0 - 60, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20" Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
Temperature Limits: 20 to 140°F (-6.67 to 60°C).
Size: 4" (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8" female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
*Low temperature models available as special option.
 †For applications with high cycle ratio within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

- Transparent Overlays**
Furnished in red and green to highlight and emphasize critical pressures.
- Adjustable Signal Flag**
Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.
- LED Setpoint Indicator**
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.
- Portable Units**
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft. (2.7 m) of 3/4" I.D. rubber tubing, standhang bracket and terminal tube with holder.
- Air Filter Gage Accessory Package**
Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of 1/2" aluminum tubing two static pressure taps and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

O-ring seal for cover assures pressure integrity of case.

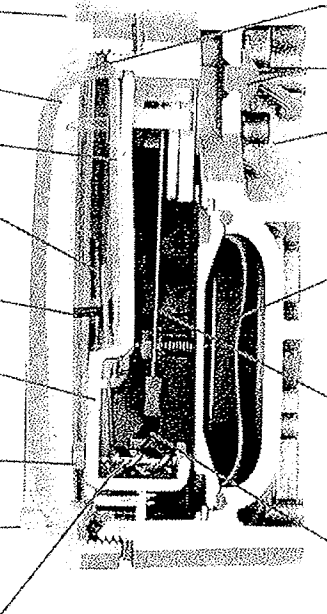
Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.



MODELS

Dual Scale English/Metric Models		
Model Number	Range, In. W.C.	Range, Pa or kPa
2000-00	0-0.5	0-125 Pa
2000-01	0-1.0	0-250 Pa
2000-02	0-2.0	0-500 Pa
2000-03	0-3.0	0-750 Pa
2000-04	0-4.0	0-1.0 kPa
2000-06	0-6.0	0-1.5 kPa
2000-08	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® — MODELS AND RANGES

The models below will fulfill most requirements. Page 11 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range, Inches of Water	Model Number	Range, Zero Center, Inches of Water	Dual Scale Air Velocity Units			Range, CM of Water	Model Number	Range, Pascals			
				Model Number	Range in W.C. Velocity, F.P.M.	Model Number						
2000-00**	0-0.5	2300-01**	25-0-25	2000-00AV**	0-25/300-2500	2000-15CM	0-15	2000-60PA**	0-60			
2000-01**	0-1.0	2301	5-0-5	2000-01AV**	0-50/500-2500	2000-20CM	0-20	2000-100PA**	0-100			
2001	0-1.0	2302	1-0-1	2001AV	0-1.0/500-4000	2000-25CM	0-25	2000-125PA**	0-125			
2002	0-2.0	2304	2-0-2	2002AV	0-2.0/1000-5600	2000-50CM	0-50	2000-250PA	0-250			
2003	0-3.0	2310	5-0-5	2010AV	0-10/2000-12500	2000-80CM	0-80	2000-300PA	0-300			
2004	0-4.0	2320	10-0-10	For use with pitot tube.			2000-100CM	0-100	2000-500PA	0-500		
2005	0-5.0	2330	15-0-15				2000-150CM	0-150	2000-750PA	0-750		
2006	0-6.0						2000-200CM	0-200	Zero Center Ranges			
2008	0-8.0						2000-250CM	0-250	2300-250PA	125-0-125		
2010	0-10						2000-300CM	0-300	2300-500PA	250-0-250		
2015	0-15	2201	0-1				Zero Center Ranges		Model Number			
2020	0-20	2202	0-2	2000-6NMM**	0-6			2300-4CM	2-0-2	2000-1KPA	0-1	
2025	0-25	2203	0-3	2000-10NMM**	0-10			2300-10CM	5-0-5	2000-1.5KPA	0-1.5	
2030	0-30	2204	0-4	2000-25MM	0-25			2300-30CM	15-0-15	2000-2KPA	0-2	
2040	0-40	2205	0-5	2000-50MM	0-50			Zero Center Ranges				
2050	0-50	2210*	0-10	2000-80MM	0-80			2300-1KPA	0-1	2000-3KPA	0-3	
2060	0-60	2215*	0-15	2000-100MM	0-100			2000-4KPA	0-4	2000-4KPA	0-4	
2080	0-80	2220*	0-20	Zero Center Ranges					2000-5KPA	0-5	2000-8KPA	0-8
2100	0-100	2230**	0-30	2300-20MM**	10-0-10			2000-10KPA	0-10	2000-15KPA	0-15	
2150	0-150								2000-20KPA	0-20	2000-25KPA	0-25
Accessories A-299, Surface Mounting Bracket A-300, Flat Flush Mounting Bracket A-310A, 3-Way Vent Valve A-321, Safety Relief Valve A-432, Portable Kit A-605, Air Filter Kit A-610, Pipe Mount Kit				Options -- To order, add suffix: I.E. 2001-ASF ASF (Adjustable Signal Flag) HP (High Pressure Option) LT (Low Temperature to -20°F) MP (Med. Pressure Option) SP (Setpoint Indicator)				Special Purpose Ranges Scale No. 2401 Scale No. 2402 Square Root Blank Scale Specify Range Specify Range Model 2000-00N, range .05 to +20" W.C. For room pressure monitoring				
Scale Overlays — Rad.; Green; Mirrored or Combination; Specify Locations				Zero Center Ranges 2300-1KPA 15-0-15 2300-3KPA								

*These ranges calibrated for vertical scale position.
 • Accuracy +/-3%. ** Accuracy +/-4%

10-1691-0250P



UNIT LIGHTING: MARINE FIXTURES and FLOURESCENT LAMPS

Incandescent Vaportight Fixtures

With or without guards



New!

BWF offers a complete line of industrial grade, factory assembled, fully gasketed fixtures for application in severe service areas where extreme conditions prevail. Vaporproof construction is designed and engineered to protect the interior of the fixture from the deteriorating effects of sleet, ice, corrosive fumes, non-explosive vapors, and other harmful factors.

All fixtures are fabricated of rugged, cast aluminum and zinc and come with special heat-resistant glass globes, fixtures are also available with Lexan® plastic globes in a choice of colors.

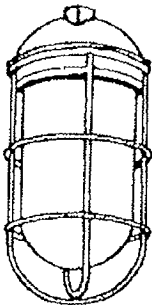
BWF typical Vaportight applications:

- Subways
- Bridges
- Freezers
- Sewerage Treatment Plants
- Stairwells
- Entry Doors
- Walkways
- Food Processing Areas
- Tunnels
- Security Areas
- Waste Water Facilities
- Construction Sites

WEATHERPROOF & VAPORPROOF FIXTURES

PENDANT FIXTURES

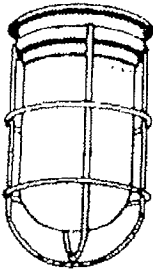
Hub is tapped 1/2" or 3/4". Fully enclosed and gasketed. Selection of glass or Lexan® globes.



Hub Size	Catalog Number	Max. Watts	Description	Attached Globe	Quantity Std. Pkg.	Wgt. Lbs. Std. Ctn.	DCI/NAED VND. NO. 087116--
1/2"	VPKG-11L	75	Fixture and globe less guard	Clear Lexan®	6	10	14020
3/4"	VPKG-21L	75	Fixture and globe less guard	Clear Lexan®	6	10	14025
1/2"	VPKG-11	100	Fixture and globe less guard	Glass	6	13	14030
3/4"	VPKG-21	100	Fixture and globe less guard	Glass	6	13	14035
1/2"	VPKG-11-G	100	Fixture, globe with guard	Glass	6	16	14040
3/4"	VPKG-21-G	100	Fixture, globe with guard	Glass	6	16	14045

SURFACE FIXTURES FOR ROUND AND OCTAGONAL BOXES

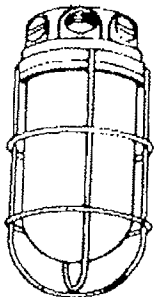
Engineered to fit all 3 1/2" and 4" round boxes. Selection of glass or Lexan® globes.



Catalog Number	Max. Watts	Description	Attached Globe	Quantity Std. Pkg.	Wgt. Lbs. Std. Ctn.	DCI/NAED VND. NO. 087116--
VPAG-01L	75	Fixture and globe less guard	Clear Lexan®	6	7	14050
VPAG-01	100	Fixture and globe less guard	Glass	6	10	14055
VPAG-01-G	100	Fixture, globe with guard	Glass	6	12	14060

4" BOX MOUNTED FIXTURES

For Wall or Ceiling Application. Four side holes tapped 1/2" or 3/4". Fully enclosed and gasketed. Three closure plugs included. Selection of glass or Lexan® globes.



Hub Size	Catalog Number	Max. Watts	Description	Attached Globe	Quantity Std. Pkg.	Wgt. Lbs. Std. Ctn.	DCI/NAED VND. NO. 087116--
1/2"	VPXG-11L	75	Fixture, box, globe less guard	Clear Lexan®	6	10	14065
3/4"	VPXG-21L	75	Fixture, box, globe less guard	Clear Lexan®	6	10	14070
1/2"	VPXG-11	100	Fixture, box, globe less guard	Glass	6	13	14075
3/4"	VPXG-21	100	Fixture, box, globe less guard	Glass	6	13	14080
1/2"	VPXG-11-G	100	Fixture, box, globe with guard	Glass	6	16	14085
3/4"	VPXG-21-G	100	Fixture, box, globe with guard	Glass	6	16	14090

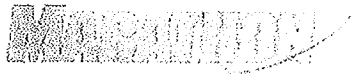
IMPORTANT: **Vaportight fixtures are not for use in hazardous locations.
 *Standard Lexan® units have "Clear" Lexan® globes. To order any of these units with either Red, White or Amber Lexan; add the suffix "R", "W", or "A" to the catalog number.
 *To order above units in "ARCHITECTURAL BRONZE" add suffix AB to catalog number.
 *To order above units in "BLACK" add suffix B to catalog number.

*LEXAN is a registered trademark of General Electric Co.

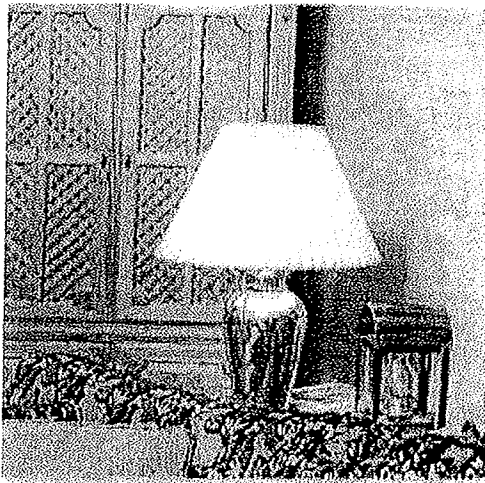


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Universal— Compact Fluorescent Lamps



Ideal for...

- Table Lamps
- Wall Sconces
- Recessed Lighting
- Ceiling Fixtures
- Surface Mounted Fixtures
- Hanging Lamps
- Enclosed Outdoor Fixtures



■ Super Long Life

Reduces maintenance costs with average rated life of 10,000 hours

■ Energy Savings

Saves up to 70% in electricity costs compared to incandescent lamps

■ Amalgam Technology

Provides stable light output over broad range of temperatures for both indoor and outdoor applications

■ Integrated, Electronic Ballast

Compact, efficient, and lightweight

■ Soft, White Light

Tri-chromatic phosphors provide light similar to soft white incandescent lamps

■ Medium Screw Base

Direct retrofit into existing incandescent applications

Philips Lighting Company



PHILIPS

Let's make things better



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Philips Lighting
 181 Hillmount Road
 Markham, Ontario L6C 1S3
 A Division of Philips Electronics Limited

Marathon™ Universal—Compact Fluorescent Lamps
Electrical, Technical and Ordering Data (Subject to change without notice)

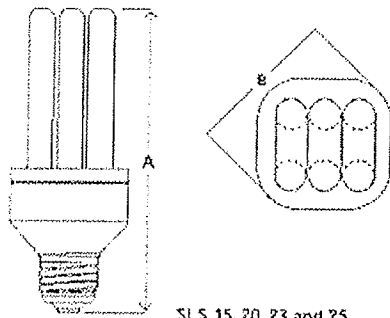
Product Number	Description	Volts	Nominal Watts	Base	Std. Pkg. Qty.	Color Temp. (Kelvin)	Color Rendering Index (CRI)	Approx. Initial Lumens	Max. Overall Length (inches)	Rated Average Life (Hrs) ¹	Lamp Current (mAmps)	Power Factor	Min. Starting Temp (°F) ²	Max. Ambient Temp (°F)
Universal – Boxed														
371047	Universal SLS 15	120	15	Med.	6	2700	82	900	4.9	10,000	230	.55 to .62	-10°F	140°F
371088	Universal SLS 20	120	20	Med.	6	2700	82	1200	5.6	10,000	285	.55 to .62	-10°F	140°F
371120	Universal SLS 23	120	23	Med.	6	2700	82	1500	6.2	10,000	315	.55 to .62	-10°F	140°F
371120	Universal SLS 25	120	25	Med.	6	2700	82	1750	6.2	10,000	335	.55 to .62	-10°F	140°F
Universal – Blister Carded														
371054	Universal BC-SLS 15	120	15	Med.	6	2700	82	900	4.9	10,000	230	.55 to .62	-10°F	140°F
371096	Universal BC-SLS 20	120	20	Med.	6	2700	82	1200	5.6	10,000	285	.55 to .62	-10°F	140°F
371153	Universal BC-SLS 25	120	25	Med.	6	2700	82	1500	6.2	10,000	335	.55 to .62	-10°F	140°F

¹ Lamps operated in extreme environments will have reduced life (ie: recessed or enclosed lighting fixtures with elevated line voltage).
² Suitable for indoor or outdoor use down to -10°F. UL listed for damp locations. Outdoor use requires an enclosed fixture.
³ Percentage of initial lumens at 40% of rated average life (4000 hours).

NOTE:The Universal SLS 25 should not be used in recessed cans or totally enclosed ceiling fixtures. The Universal SLS 23 may be used, but shorter lamp life could result.

CAUTION: Do not use with dimmers.
 Before using this product with electronic timing or photocell devices, check to determine whether device is compatible with electronic compact fluorescent lamps. Use with incompatible devices will cause premature lamp failure. This product complies with Part 18 of the FCC rules. These products may cause interference with radios, cordless telephones, and remote control devices. Interference may cease after a brief 90 second lamp warm-up period. If interference continues, relocate the lamp away from the device or plug into a different outlet.

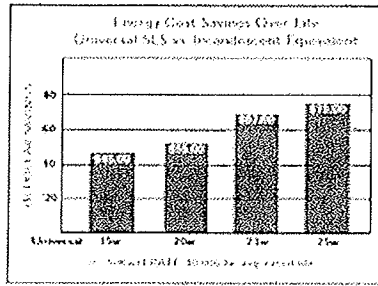
Lamp Dimensions



SLS 15, 20, 23 and 25

Dimensions					
		SLS 15	SLS 20	SLS 23	SLS 25
Max Overall Length (mm)	A	4.90	5.60	6.20	6.20
Max Diameter (mm)	B	2.30	2.30	2.30	2.30
Wedge (mm)		3.60	3.90	4.20	4.20
Lamp Cap (in)		8"	8"	9"	9"

Energy Savings

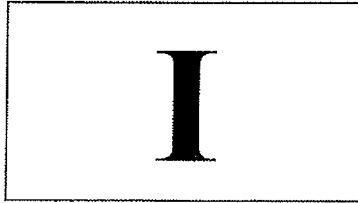


Philips
Lighting
Company



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CONSTRUCTION: DOORS, INSULATION, SEALANT, and PAINT



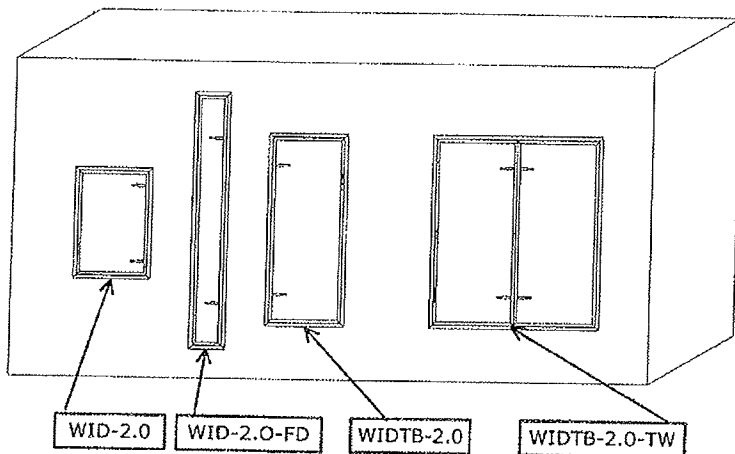
CONSTRUCTION: DOORS

Leaf Industries, Inc.

The "WID" Series Walk-in Doors

"The Best Performing, Independently Rated and Certified Door"

Built In Accordance With Our ISO 9002's Strictest of Standards



Doors are tested in accordance to ASTM Standards C236, E283-91 and E331-86

Lowest leakage rate of tested and certified HVAC, Independent, Door Manufacturers for a 24" x 60" door.

Each door, and that includes all components, is individually inspected prior to shipment.

Each door is custom built to your required size and appropriate material requirement.

Lead times for most door orders, of 50 doors or less, will be completed and shipped in 5 to 10 work days.

Closed end aluminum rivets are standard on all doors.

Mounting frame **corners are stitch welded** for added strength and durability.

Most doors, depending on weight and/or height, can be mounted by one person if mounting flange holes are ordered and mounting instructions followed.

Your option of either the In (IO) or Out opening design allows for **pressure assisted closing**.

You have a **field mounting option** of a left or right hinge for non-viewport doors by rotating the assembly 180°.

Doors with viewports **require that you specify either a left or right hand hinge** when ordering. The swing of the door may create opening problems.

Left hand or right hand hinge is always **determined by looking at the flange side** of the door assembly.

All doors mount to the outside of your AHU, or plenum wall.

Sound attenuation options are available on all models except WIDTB-2.0 models.

Panel, latch, hinge, insulation and viewport options are listed on the **Available Optional Components** sheet, Page 11.

AHU Section Descriptions

Door Models


- | | |
|---|---|
| <p>* RA/FAI Section
Standard Out Opening 2" Door</p> <p>** Filter Section
Modified Non Penetrating Latches Swing Open or Removable</p> <p>*** Coil Section
Out Opening Thermal Break Design For Low Temperature Discharge in High Humidity Areas</p> <p>**** Discharge Section
Out Opening Thermal Break Design Incorporating a Removable Mullion Twin Door Designed for Rapid Removal and Replacement of Plug Fan, or Conventional Assemblies</p> <p>***** Not Illustrated, but Available, are Stamped Louver Panels For Ventilation of Non Pressurized Compartments That Contain Heat Producing Machinery (typically an inverter) or Other Electrical Equipment</p> <p>***** Interior and Exterior Door Panel Materials are Matched to AHU or Plenum Walls of Built Up Systems</p> <p>***** An Alternate Single Operator Multiple Latch Assembly may be Advisable for Doors 72" High and Taller</p> | <p>WID-2.0</p> <p>WID-2.0-FD</p> <p>WIDTB-2.0</p> <p>WIDTB-2.0-TW</p> |
|---|---|

Leaf Industries, Inc.

HVAC Product Model Identification


13310 Industrial Park Boulevard Minneapolis, Minnesota 55441
 Telephone 612-559-4470 FAX 612-559-0633

Walk-in Doors

	WID-1.0	Nominal 1.0" deep, out opening, walk in door	
	WID-1.0-IO	Nominal 1.0" deep, in opening, walk in door	
	WID-1.5	Nominal 1.5" deep, out opening, walk in door	
	WID-1.5-IO	Nominal 1.5" deep, in opening, walk in door	
	WID-2.0	Nominal 2.0" deep, out opening, walk in door	
	WID-2.0-IO	Nominal 2.0" deep, in opening, walk in door	
	WID-4.0	Nominal 4.0" deep, out opening, walk in door	
	WID-4.0-IO	Nominal 4.0" deep, in opening, walk in door	
	WIDTB-2.0	Nominal 2.0" deep, Thermal Break, out opening, walk in door	
	WIDTB-2.0-IO	Nominal 2.0" deep, Thermal Break, in opening, walk in door	
	New	WILPD-1.0	Nominal 1.0" deep, out opening, walk in louvered panel door
	New	WILPD-1.5	Nominal 1.5" deep, out opening, walk in louvered panel door
	New	WILPD-2.0	Nominal 2.0" deep, out opening, walk in louvered panel door
	New	WIFD-1.0**	Nominal 1.0" deep, out opening, walk in all fabricated door
New	WIFD-1.5**	Nominal 1.5" deep, out opening, walk in all fabricated door	
New	WIFD-2.0**	Nominal 2.0" deep, out opening, walk in all fabricated door	
New	WIFSPD-1.0**	Nominal 1.0" deep, out opening, single panel all fabricated door	

**WIFD Series Doors require 4 to 5 week lead times

Viewport Assemblies

	VA-1W	Single pane, wireglass, viewport assembly
	VA-1P	Single pane, plexiglass, viewport assembly
	VA-2W	Double pane, wireglass, viewport assembly
	VA-2P	Double pane, plexiglass, viewport assembly
	VA-2-TP	1 pane clear, 1pane wireglass, sealed thermal pane assembly
	WID(V1, 2, TP)	Viewport -- 1 pane, 2 pane, Thermal Pane Exterior Frames only

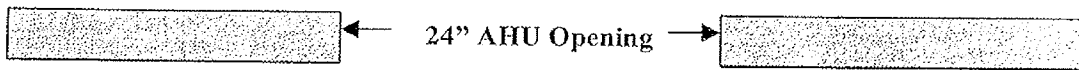
Leaf Industries, Inc. WID Door Net Opening

Determining the net opening pass-through dimension.

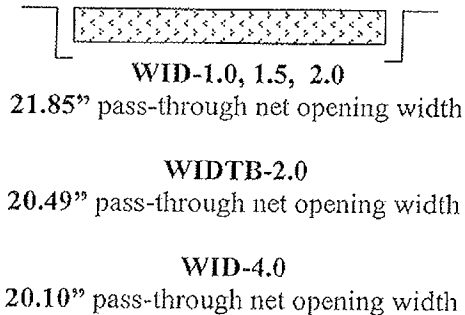
- I **WID-1.0, 1.5 and 2.0 -- In and Out Opening**
Scanted (.25") door assemblies net pass-through opening, height and width, are **2.15" less than your wall opening.**

- II **WIDTB-2.0 -- In and Out Opening**
Scanted (.25") door assemblies net pass-through opening, height and width, are **3.51" less than your wall opening.**

- III **WID-4.0 -- In and Out Opening**
Scanted (.25") door assemblies net pass-through opening, height and width, are **3.90" less than your wall opening.**



Net pass-through dimensions



The above illustrations are not to scale.

LII Customer Service Contact
LII Engineer Contact
LII Sales Manager

Terri Toft 612-551-5210
Thad Briol 612-551-5220
Warren Roberts 612-551-5201

Leaf Industries, Inc.
13310 Industrial Park Boulevard
Minneapolis, MN 55441

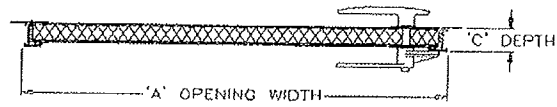
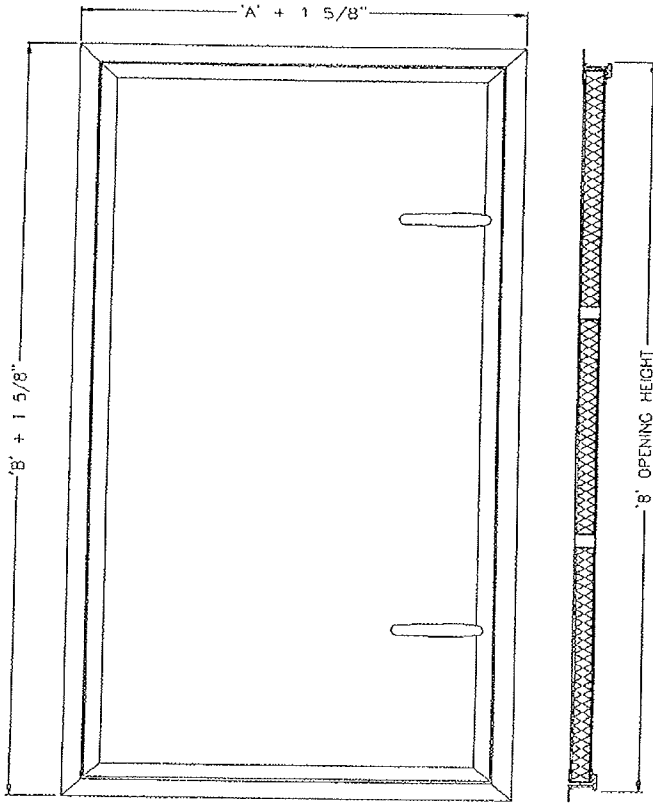
FAX 612-559-0633

Leaf Industries, Inc.

Submittal Form for 1.0, 1.5 & 2.0" Out Opening Doors

13310 Industrial Park Boulevard
Telephone 612-559-4470

Minneapolis, Minnesota 55441
FAX 612-559-0633



MODEL	DEPTH 'C'
WID-1.0	1.0 INCH
WID-1.5	1.5 INCH
WID-2.0	2.0 INCH

Specifications

Models WID(G)-1.0, 1.5, 2.0

Flanged Frames (Out Opening)
.080-6063-T5 Extruded Aluminum with Stitch welded corners

Door Panel Frames
.060-6063-T5 Extruded Aluminum

Hat Channel Frames
.050-5052-H32 Formed Aluminum

Door Panels
20 ga Galvanized Steel

Handles
Dual Acting Handles

Gasket
Extruded EPDM Mechanically Linked

Hinge
Zinc Plated Steel Continuous Type

Insulation
.75 pcf fiberglass

Viewport Frames
20 gauge, 304-2B Stainless Steel

Viewport Glass Inserts (1/4" Wire)

- SW Single Wire
- DW Double Wire
- TP Thermal Pane -- 1 Wire, 1 Clear
- SP Single Plexiglass
- DP Double Plexiglass

Nominal Viewing Area
9" x 9" Min. 18" wide door
12" x 12" Min. 24" wide door

Viewport Location
Doors that are 20" to 60" high: 11" down to center of viewport
Doors that are 60", or higher: 48" from door bottom to viewport center

Special Notes

1. Unless otherwise directed, all doors are to be scanted a .25" under listed size
2. Hinges are always on "B" dimension opposite latch side
3. RHH is a right hand hinge as viewed from flange side
4. LHH is a left hand hinge as viewed from flange side
5. (G) indicates a viewport has been added to the door. Example -- WIDG-1.0
6. 9x9 viewports will fit 18" wide, or larger doors
12x12 viewports will fit 24" wide, or larger doors
7. Refer to Optional Components for alternate materials
8. Refer to Installation Instructions for mounting of door assemblies and latches
9. Minimum Door size -- 12"w x 12"h
Maximum Door size -- 48"w x 96"h

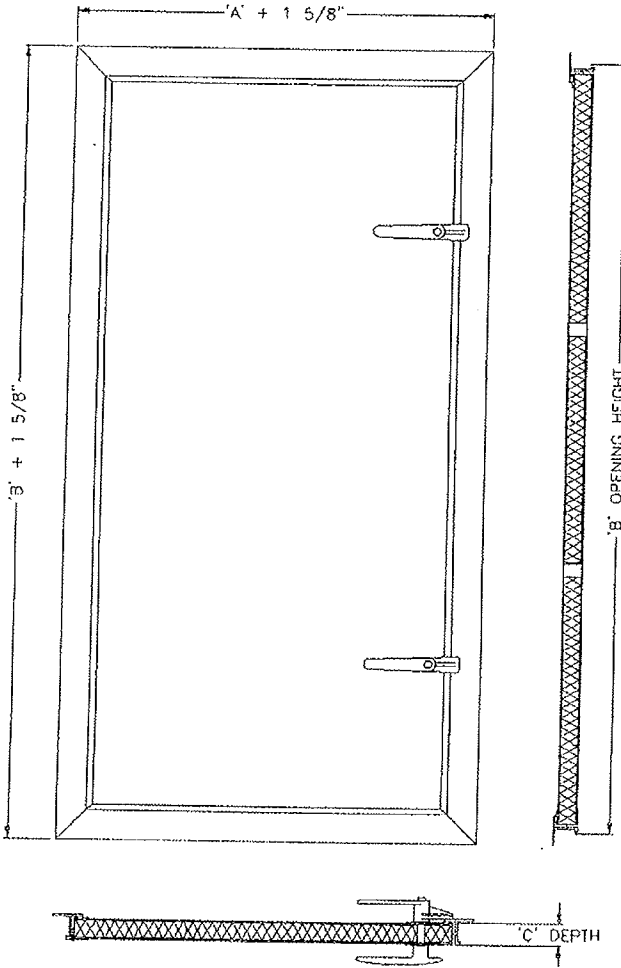
Schedule											Customer Information									
Item	Qty.	Dimension		Model							Tagging	Project:								
				Model		Option		Identify Model							Viewport					
		Width	Height	WID	(G)	LHH	RHH	-1.0	-1.5	-2.0		Size	Style	Customer:						
		x		WID																
		x		WID																
		x		WID																
		x		WID																
		x		WID																
		x		WID																
Access Door Models -- WID(G) -1.0, -1.5, -2.0											Engineer:			Contractor:						

Leaf Industries, Inc.

Submittal Form for 1.0, 1.5 & 2.0" In Opening Doors

13310 Industrial Park Boulevard
Telephone 612-559-4470

Minneapolis, Minnesota 55441
FAX 612-559-0633



MODEL	DEPTH 'C'
WID-1.0	1.0 INCH
WID-1.5	1.5 INCH
WID-2.0	2.0 INCH

Specifications

Models WID(G)-1.0, 1.5, 2.0 (IO)

Flanged Frames (In Opening)
.080-6063-T5 Extruded Aluminum with Stitch welded corners

Door Panel Frames
.060-6063-T5 Extruded Aluminum

Hat Channel Frames
.050-5052-H32 Formed Aluminum

Door Panels
20 ga Galvanized Steel

Handles
Dual Acting Handles

Gasket
Extruded EPDM Mechanically Linked

Hinge
Zinc Plated Steel Continuous Type

Insulation
.75 pcf fiberglass

Viewport Frames
20 gauge, 304-2B Stainless Steel

Viewport Glass Inserts (1/4" Wire)
SW Single Wire
DW Double Wire
TP Thermal Pane -- 1 Wire, 1 Clear
SP Single Plexiglass
DP Double Plexiglass

Nominal Viewing Area
9" x 9" Min. 18" wide door
12" x 12" Min. 24" wide door

Viewport Location
Doors that are 20" to 60" high: 11" down to center of viewport
Doors that are 60", or higher: 48" from door bottom to viewport center

Special Notes

1. Unless otherwise directed, all doors are to be scanted a .25" under listed size
2. Hinges are always on "B" dimension opposite latch side
3. RHH is a right hand hinge as viewed from flange side
4. LHH is a left hand hinge as viewed from flange side
5. (G) Indicates a viewport has been added to the door. Example -- WIDG-1.0-
6. 9x9 viewports will fit 18" wide, or larger doors
12x12 viewports will fit 24" wide, or larger doors
7. Refer to Optional Components for alternate materials
8. Refer to Installation Instructions for mounting of door assemblies and latches
9. Minimum Door size -- 12"w x 12"h
Maximum Door size -- 48"w x 96"h

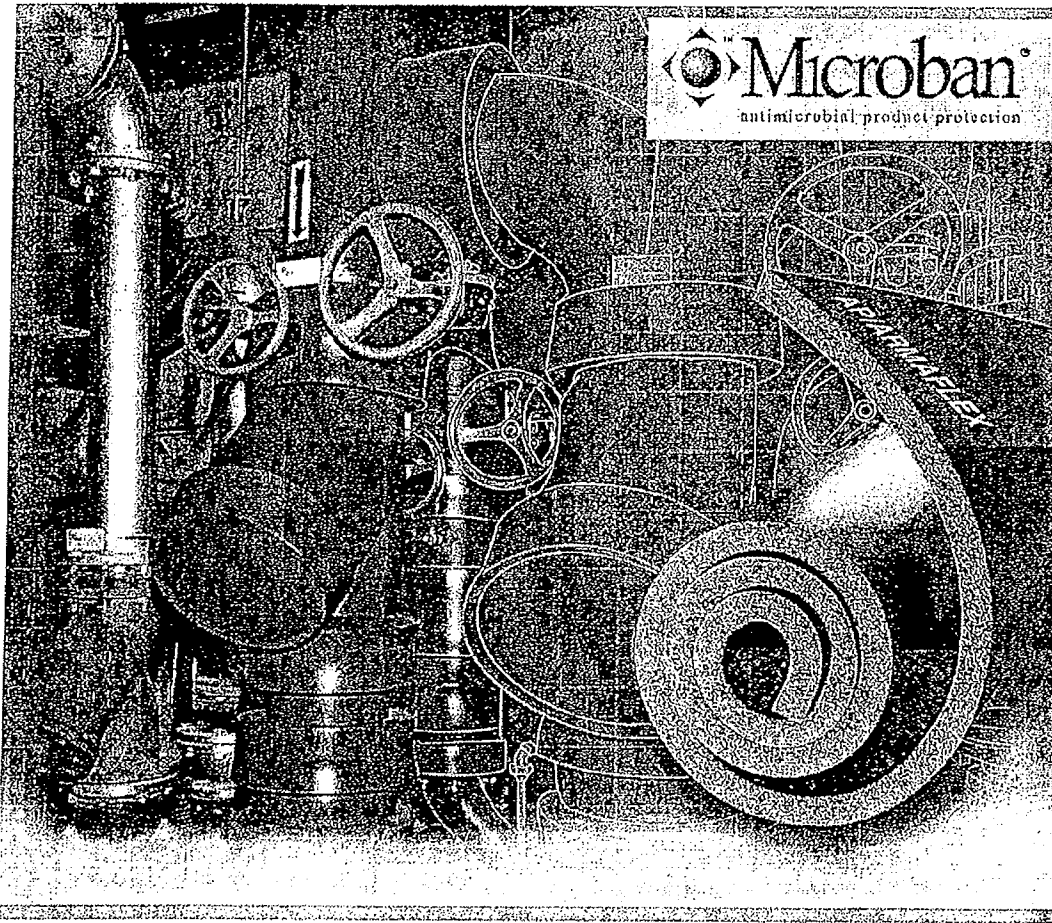
Schedule												Customer Information			
Item	Qty.	Dimension		Model								Tagging	Project:		
				Model		Option		Identify Model						Viewport	
		Width	Height	WID	(G)	LHH	RHH	-1.0	-1.5	-2.0	-IO			Size	Style
			X	WID								-IO		Engineer:	
			X	WID								-IO			
			X	WID								-IO			
			X	WID								-IO			
			X	WID								-IO			
			X	WID								-IO			Contractor:
Access Door Models -- WID(G) -1.0, -1.5, -2.0 -IO															



CONSTRUCTION: CABINET INSULATION

Armacell
engineered foams

THE MAKERS OF
Armaflex®



API/Armaflex®
SHEET & ROLL

BIG-TIME PERFORMANCE, MOLD RESISTANT

Made with
Microban®
antimicrobial
product protection

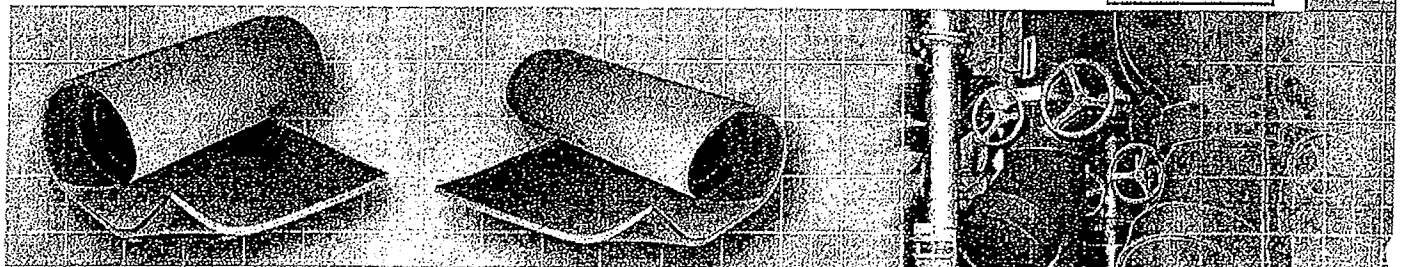
Faster for
tanks, vessels

The "IAQ"
Insulation™

Dust-free, fiber free
closed cell



ALL ARMACELL
FACILITIES IN
NORTH AMERICA
ARE ISO 9001:2000
CERTIFIED.



AP/Armaflex®

SHEET & ROLL

Description

Mold resistant AP Armaflex Sheet and Roll Insulation is a flexible, elastomeric thermal insulation, black in color. It is furnished with a smooth skin on one side which forms the outer exposed insulation surface. The expanded closed-cell structure of Armaflex makes it an efficient insulation. It is manufactured without the use of CFC's, HCFC's, or HFC's. It is also formaldehyde-free, low VOCs, dust free, fiber free and resists mold and mildew. All AP Armaflex products are made with Microban® antimicrobial product protection for added defense against mold on the insulation.

- AP Armaflex Sheet is supplied in flat sheets 36" x 48" (915m x 1.22m); in nominal wall thicknesses of 1/8", 1/4", 3/8", 1/2", 3/4", 1", 1-1/2" and 2" (3, 6, 10, 13, 19, 25, 38, and 50mm)
- AP Armaflex Roll is supplied in 48" wide (1.22m) continuous rolls in nominal wall thicknesses of 3/8", 1/2", 3/4", 1", 1-1/2" and 2" (10, 13, 19, 25, 38 and 50mm). It is also available in 60" (1.53m) in 1" thickness.

Factory Mutual (FM) Approvals

AP Armaflex is approved through continuing supervision by Factory Mutual Approvals to consistently provide actual values on these key performance criteria for mechanical system insulation:
Thermal Conductivity: 0.27 BTU-in/hr. ft² °F
Water Vapor Transmission: 0.08 perm-inch
Fire Rating: will not contribute significantly to fire (simulated end use testing)

As tested by ASTM E 84 "Method of Test for Surface Burning Characteristics for Building Materials" and CAN/ULC S-102, AP Armaflex insulation in thicknesses through 2" (50mm) have a flame-spread index of less than 25 and a smoke-developed index of less than 50.

Note: Numerical flammability ratings alone may not define the performance of products under actual fire conditions. They are provided only for use in the selection of products to meet limits specified.

Uses

AP Armaflex is used to retard heat gain and control condensation drip from chilled water and refrigeration systems. It also efficiently reduces heat flow on hot systems. Flexible AP Armaflex Sheet and Roll Insulation is used for all applications that cannot be accomplished by AP Armaflex Pipe Insulation. It is particularly adaptable for insulating:

- ductwork, large piping and fittings
- tanks
- vessels
- curved and irregular surfaces
- all types of fitting covers

The recommended temperature usage range for AP Armaflex Sheet is: -297°F to +220°F (-183°C to +105°C) according to method of application. With full adhesive coverage attachment, the surface to which it is applied may operate to a limit of 180°F (82°C). When used for pipe insulation with adhesive adhering seams and joints only, AP Armaflex Sheet can be applied to lines that will operate to a limit of 220°F (105°C).

For use on cold systems, AP Armaflex thicknesses have been calculated to control condensation on the insulation outer surface, as shown in the table of thickness recommendations.

AP Armaflex Sheet and Roll Insulation is acceptable in thicknesses through 2" for use in air plenums. Conforms to NFPA 90A and NFPA 90B requirements.

Resistance To Moisture Vapor Flow

The closed-cell structure of Armaflex insulation prevents moisture from wicking and makes it an efficient insulation. For many applications, Armaflex needs no supplementary protection.

Additional vapor-retarder protection may be necessary for Armaflex when installed on very low-temperature surfaces or piping or where exposed to continually high humidity conditions.

Application

AP Armaflex Sheet is installed using Armaflex 520, 520 Black Adhesive or, where a low V.O.C. adhesive is required, Armaflex 520 BLV or Armaflex Low VOC Spray Contact Adhesive. For application to large, flat or curved metal surfaces such as ducts, very large pipes, tanks, and vessels, full adhesive coverage attachment is used. For application as pipe insulation and fitting covers, only the seams and joints are adhered with Armaflex 520, 520 Black Adhesive or Armaflex 520 BLV Adhesive. 520 Adhesives are contact adhesives; therefore, in all cases, both surfaces to be joined are coated with adhesive. Exterior ductwork must be pitched to allow rainwater to run off the insulation.

AP Armaflex is designed for installation above ground. Outdoors, a weather-resistant protective finish is to be applied. Armaflex WB Finish is recommended. For exterior applications, consider maintenance-free ArmaTuff products.

Armaflex insulation products must be installed according to "Installation of Armaflex Insulations" brochure. Proper installation is required to assure Armaflex insulation performance.

Specification Compliance

AP Armaflex developed to meet:
ASTM C-534, Type II - Sheet Grade 1
ASTM C-1534
ASTM E 84
NFPA 255
UL 723
CAN/ULC S-102
UL 94 5V-A, V-0, File E 55798
NFPA 90A, 90B
UL 181
ASTM G21/C1336
ASTM G22
ASTM D 1056, 2B1
MIL-P-15280J, FORM S
MIL-C-3133C (MIL-STD 670B), Grade SBE-3
MEA 107-89-M
City of Los Angeles - RR 7642

AP/Armaflex Sheet and Roll Insulation meet the energy code requirements of International Energy Conservation Code (IECC) and ASHRAE for R-Value 4 at 1" wall thickness and R-Value 8 at 2" wall thickness.

Physical Data		
Physical Properties	Test Method	
Thermal conductivity, Btu • in./h • ft ² • °F (W/m•K) 75°F mean temp (24°C) 90°F mean temp (32°C)	0.27 (0.039) 0.276 (0.040)	ASTM C 177 or C 518
Water vapor permeability, perm-in. (Kg/(s•m•Pa))	0.08 (1.16 x 10 ⁻¹⁷)	ASTM E 96 Procedure A
Flame spread and smoke developed index through 2" (50mm)	25/50	ASTM E 84 CAN/ULC S102
Mold growth Fungal resistance Bacterial resistance	UL181 ASTM G21/C1338 ASTM G22	Meets requirements Meets requirements Meets requirements
Water absorption, % by volume	0.2%	ASTM C 209
Upper use limit ϕ	180/220°F (82°C/105°C)	—
Lower use limit ϕ	-297°F (-183°C)*	—
Ozone resistance	GOOD	—
Sizes - Sheet Width and length Thickness (nominal)	36" x 48" (.915m x 1.22m) 1/8", 1/4", 3/8", 1/2", 3/4", 1", 1-1/2" & 2" (3, 6, 10, 13, 19, 25, 38 & 50mm)	—
Sizes - Roll Width Thickness (nominal) x Length	48" (1.22m) and 60" (1.53m)† 3/8" x 100' (10mm x 30.5m) 1/2" x 70' (13mm x 21.4m) 3/4" x 50' (19mm x 15.2m) 1" x 35' (25mm x 10.7m) 1-1/2" x 25' (38mm x 7.6m) 2" x 18' (50mm x 5.4m) † 1" thickness only	—
Density, typical range ϕ	3.0 to 6.0 lbs./ft ³	ASTM D 1622 D 1667

Notes

① When AP Armaflex Sheet is installed by adhering butt joints and seams only, the upper temperature limit is 220°F (105°C) using 520, 520 Black, or 520 BLV or Armaflex VOC Spray Contact Adhesive. AP Armaflex Sheet adhered with complete adhesive coverage on flat or curved metal surfaces may be applied to surfaces that will operate as high as 180°F (82°C) using 520, 520 Black, 520 BLV or Armaflex Low VOC Spray Contact Adhesive.

② At temperatures below -20°F (-29°C), elastomeric insulation starts to become less flexible. However, this characteristic does not affect thermal efficiency or water vapor permeability of Armaflex Insulation.

③ Reference ONLY

For applications of -40°F to -297°F (-40°C to -183°C), contact Armacell.

Performance approved through continuing supervision by Factory Mutual (FM) Approvals.

Thickness Recommendations

For Controlling Outer Insulation Surface Condensation (Based upon available manufactured thicknesses, and not intended to supersede any state or local building codes.)

	Ducts—Tanks—Vessels—Equipment Metal Surface Temperature		
	50°F (10°C)	35°F (2°C)	0°F (-18°C)
BASED ON NORMAL DESIGN CONDITIONS AP Armaflex in the thicknesses noted and within the specified temperature ranges will control outer insulation surface condensation indoors under normal design conditions, a maximum severity of 85°F (29°C) and 70% RH. Armacell research and field experience indicate that indoor conditions anywhere in the United States seldom exceed this degree of severity.	Nom. 3/8" (10mm)	Nom. 3/4" (19mm)	Nom. 1-1/2" (38mm)
BASED ON MILD DESIGN CONDITIONS AP Armaflex in the thicknesses noted and within the specified temperature ranges will control outer insulation surface condensation indoors under mild design conditions, a maximum severity of 80°F (27°C) and 50% RH. Typical of these conditions are most air-conditioned spaces and arid climates.	Nom. 1/8" (3mm)	Nom. 1/4" (6mm)	Nom. 1/2" (13mm)
BASED ON SEVERE DESIGN CONDITIONS AP Armaflex in the thicknesses noted and within the specified temperature ranges will control outer insulation surface condensation indoors under severe design conditions, a maximum severity of 90°F (32°C) and 80% RH. Typical of these conditions are indoor areas in which excessive moisture is introduced or in poorly ventilated confined areas where the temperature may be depressed below ambient.	Nom. 1" (25mm)	Nom. 1-1/2" (38mm)	Nom. 2" (50mm)
For VERY SEVERE DESIGN CONDITIONS which Armacell would consider temperatures above 90°F (32°C) and/or above 80% RH.	Consult Armacell for recommended insulation thickness	Consult Armacell for recommended insulation thickness	Consult Armacell for recommended insulation thickness

Microban is a registered trademark of Microban Products Company.



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INTERNET www.armacell.com

For any updates on this document, please refer to our website.

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CLEANPAK International Description:

SEALANT

UNIT PANELS

CLEANPAK applies Sika® Sikaflex1a white sealant between all unit roof and wall panels to provide a complete seal at all panel joints. CPI will also provide Sikaflex 1a caulking ship loose for field applications.

Please refer to the following page(s) for manufacturer's product information.

Sikaflex® 1a

One-Component, Polyurethane Sealant

Description

Sikaflex 1a is a premium-grade, high performance, moisture-cured, one-component, polyurethane-based, non-sag elastomeric sealant.

Where to use

- Designed for all types of joints with maximum depth of 13 mm and a maximum expansion of 25%.
- Excellent for small joints and fillets: windows, door frames, reglets, flashing, glazing, and many construction adhesive applications.
- Suitable for vertical and horizontal joints; readily placeable at 4°C.
- Many applications as an elastic adhesive between materials with dissimilar thermal coefficients of expansion.

Advantages

- Available in Sika's unique, low-cost, sausage packaging system.
- Eliminates time, effort, and equipment for mixing, filling cartridges and cleaning of equipment.
- High elasticity - Cures to a tough, durable, flexible consistency with exceptional cut and tear resistance.
- Excellent adhesion - Bonds to most construction materials without primer in most cases.
- Long life
- Excellent resistance to aging, weathering.
- Proven in tough climates around the world.
- Canadian Food Inspection Agency acceptance for use in establishments registered by the Food Production and Inspection Branch.

TECHNICAL DATA				
Packaging	305 mL cartridge, 24/case 590 mL sausage, 20/case			
Colours	Standard: Aluminum Grey, Dark Bronze, Limestone, White, Colonial White, Capitol Tan, Black.			
Yield	Joint size	Linear meter/unit		
		Cartridge	Sausage	
	6 x 6 mm	8.4	16.3	
	13 x 6 mm	3.9	7.5	
	19 x 13 mm	1.2	2.4	
Shelf Life	15 months in original, unopened packaging. Store between 5° - 32°C. Condition product to 18° - 30°C before using.			
PROPERTIES (23°C AND 50% R.H.)				
Specific Gravity	1.237			
Base	Moisture-curing polyurethane pre-polymer			
Application Temperature	4° - 38°C Sealant should be installed when joint is at mid-range of its anticipated movement			
Service Range	-40° to 77°C			
Curing Rate TT-S-00230C				
Tack-free to touch	3 h			
Final cure	4-7 days			
Recovery ASTM C719	>90%			
Shore A Hardness ASTM D2240				
21 days	40 ± 5			
Tensile Properties ASTM D412				
21 days	Tensile Stress	1.37 MPa		
	Elongation at Break	500%		
	Modulus of Elasticity	25%	0.24 MPa	
		50%	0.41 MPa	
	100%	0.59 MPa		
Adhesion in Peel TT-S-00230C				
Substrate	Peel Strength	Adhesion Loss		
		N/mm	%	
Aluminum	3.4	0		
Glass	3.4	0		
Concrete	3.4	0		
Weathering Resistance	Excellent			
Ozone Resistance	Excellent			
Tear Strength	Excellent			
Chemical Resistance	Long Term	Medium Term	Short Term	
	Water	Mineral oil	Paint diluents	
	Dilute acids	Vegetable oil	Strong acids	
	Dilute alkalis	Fats	Strong alkalis	
	Sewage	Fuels		

Sikaflex® 1a

One-Component, Polyurethane Sealant

7
07920 CONTROL/EXPANSION
JOINT SEALANTS



The information, and in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions, within their shelf life. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any recommendations, or from any other advice offered. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users should always refer to the most recent issue of the Technical Data Sheet for the product concerned, copies of which will be supplied on request or can be accessed in the Internet under www.sikacanada.com.

Sikaflex® 1a One-Component, Polyurethane Sealant

7

07920 CONTROL/EXPANSION
JOINT SEALANTS

Sikaflex® 1a

One-Component, Polyurethane Sealant

- USDA approved. Chemically acceptable to the U. S. Department of Agriculture for use in meat and poultry processing area under federal inspection.
- NSF and EPA approved for potable water contact.
- Resists fuel, mineral oils, and dilute minerals, plant and animal fats.
- Odorless, non-staining, can be painted over with water, oil, and rubber-base paints. Since some paints dry slowly and the surface may remain slightly tacky, a preliminary test is essential.
- Meets CAN/CGSB 19.13-M87, Classification MCG-2-25-B-N.
- Meets Federal Specification TT-S-00230C, Type II, Class A.
- Meets ASTM C920 Type S, Grade NS, Class 25.
- Jet fuel resistant
- Urethane based, suggested by EPA for radon reduction.

How to use

SURFACE PREPARATION

Clean all surfaces. Joint walls must be sound, clean, dry, and free from oil and grease. Curing compound residues and any other foreign matter must be completely removed. Install bond breaker to prevent sealant from adhering to bottom of joint slot.

Priming - Priming is not usually necessary. Most substrates only require priming if testing indicates a need or where sealant will be subjected to water immersion after cure. Consult Sikaflex Primers technical data sheet for additional information

APPLICATION

Recommended application temperatures between 4° - 38°C. For cold-weather application, store units at approximately 20°C remove just prior to using. Make sure joint is frost-free.

Cut plastic tip on cartridge to desired joint size. Puncture airtight seal at base of tip. Install with hand or power operated caulking gun. For best performance, Sikaflex 1a should be gunned into joint when joint slot is at mid-point of its designed expansion and contraction.

CURING

Allow 1 week curing time at 23°C and 50% R.H. when using Sikaflex 1a in total water-immersion situations.

CLEAN UP

Uncured Sikaflex 1a may be removed from tools with Sika Equipment Cleaner and hands cleaned with Sika Hand Cleaner.

LIMITATIONS

Do not use in joints deeper than 13 mm.

Avoid exposure to high levels of chlorine.

Do not cure in the presence of curing silicone sealants.

Avoid contact with alcohol, and other solvent cleaners, during cure.

Do not apply when a moisture vapour transmission condition exists at time of application, as this can cause bubbling within the sealant.

Use opened cartridges the same day. When applying sealant, avoid air entrapment.

Since Sikaflex 1a is a moisture curing sealant system, permit sufficient exposure to air.

Slight yellowing may occur with white sealant exposed to ultra-violet rays.

The ultimate performance of Sikaflex 1a depends on good joint design, proper application and cure. Maximum expansion and contraction should not exceed 25% of average joint width.

Caution

Avoid contact with skin. Wash hands thoroughly with warm water and soap. According to FHSLA Toxicity rating, Sikaflex 1a is a skin irritant, an eye irritant, not toxic orally, not toxic by inhalation and not toxic dermally. Consult product label for additional information.

First Aid

In case of skin contact, wash with soap and water. For eye contact flush immediately with plenty of water for at least 15 minutes. Contact a physician. For respiratory problems, transport victim to fresh air. Remove contaminated clothing and wash before re-use.

For more information, consult Sika Material Safety Data Sheet.

KEEP OUT OF REACH OF CHILDREN
FOR INDUSTRIAL USE ONLY



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www.sikacanada.com

ISO 9001-94
ISO 14001-96
MONTREAL

ISO 9002-94
EDMONTON



CLEANPAK International Description:

Powder Coating

All sheet metal panels and steel tube assemblies are individually dry powder coated on all sides prior to assembly. Exceptions are stainless steel liners, the aluminum wheel, and parts called out to be galvanized or uncoated. This provides a complete protective coating for all cabinetry components. The polyester TGIC powder, manufactured by H.B. Fuller, is "Wet White" in color.

Please refer to the following page(s) for manufacturer's product information.



H.B. Fuller Company

Product Specification
Powder Coatings

Technical Information

H. B. Fuller Company
Industrial Coatings Division
Technical Data Sheet

Product: IF8488

Powder Characteristics

Color: Wet White

Chemistry: TGIC

Specific gravity: 1.85

Cured Film Characteristics

Recommended film thickness: 1.8 - 2.8 Mils

Recommended cure schedule: 10 min(s) @ 375 °F

Gloss 20° (ASTM D523): 0 - 0 unit(s)

Gloss 60° (ASTM D523): 85 - 100 unit(s)

Forward Impact: 100 @ 1.8 Mils

Reverse Impact: 100 @ 1.8 Mils

Mandrel bend (ASTM D522): 0.1250

Smoothness rating: 6 PCI

Contrast ratio (ASTM D2805): 0% 0 Mils

Special Instructions:

Recommended Storage and Shelf Life

Time / Temperature: 6 month(s) @ 70 °F

Misc. Information

ADEQUATE TESTS: The information contained in this bulletin we believe is correct to the best of our knowledge and tests. The recommendations and suggestions herein are made without guarantee or representation as to results. We recommend that adequate tests be made in your laboratory or plant to determine if this product meets all of your requirements.

H.B. Fuller's acceptance of any orders for this product is expressly conditional upon purchaser's assent to the terms shown on the reverse side.

03/19/01 3:40p

H.B. Fuller Company
Global Coatings Division

2900 Granada Lane
Oakdale, Minnesota 55128
(651) 236-3700

Form 2302 (6/00)



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UNIT INSTALLATION MANUAL

CLEANPAK™ AHU

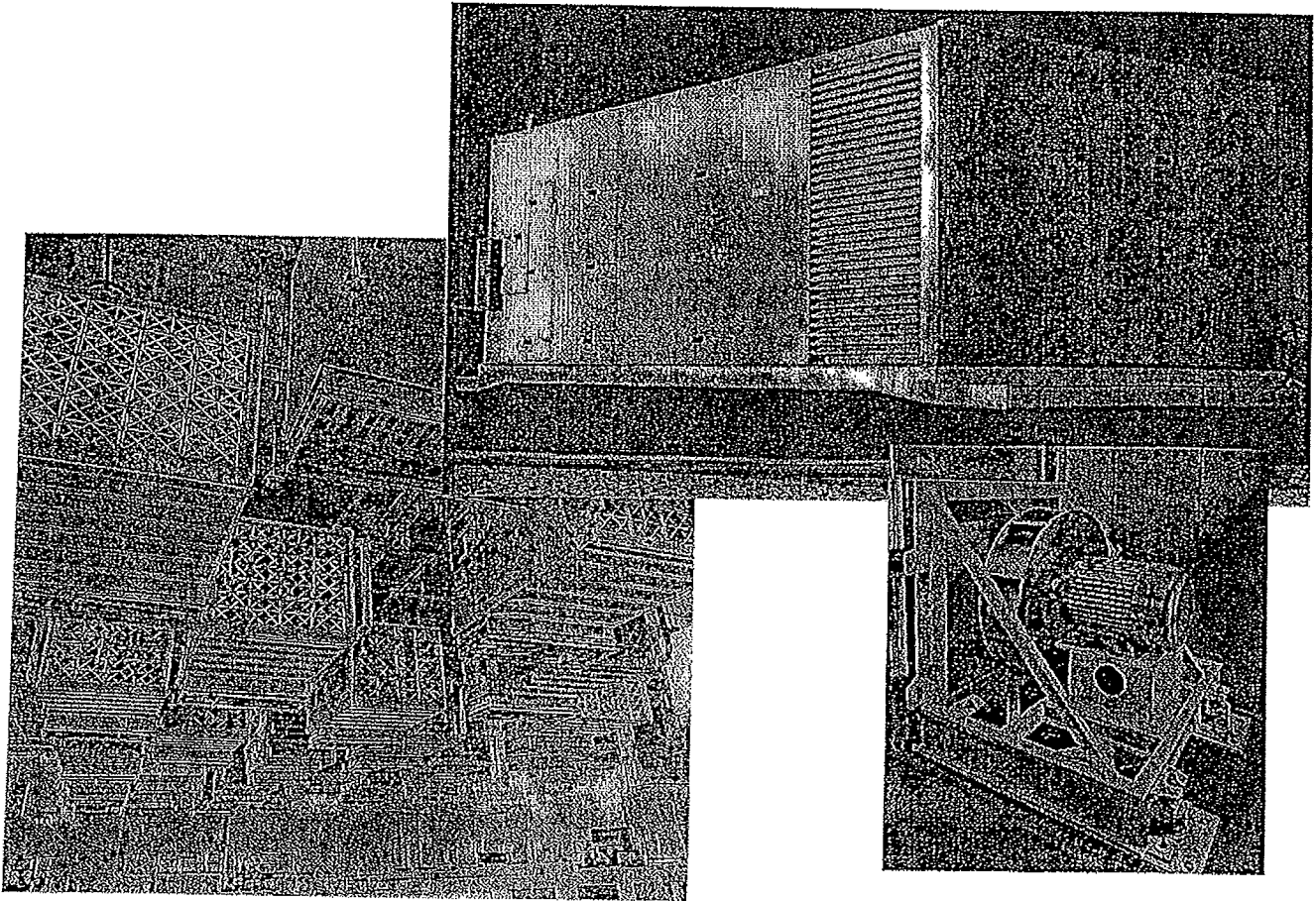
INCLUDING:

CLEAN-PAK® RECIRCULATION AIR HANDLERS

CLEAN-PAK® MAKE-UP AIR HANDLERS

CLEAN-PAK® AIR HANDLERS

INSTALLATION & OPERATION MANUAL



Products may be protected by one or more of the following US patents: 5,613,759; 5,794,397; 5,014,608; 5,161,941; 5,088,886; 5,192,348; 5,207,614; 5,454,756; 5,586,861; 5,628,581; 5,681,143. Patents pending. All rights reserved.

CLEANPAK™
INTERNATIONAL

11241 SE Hwy 212
Clackamas, OR 97015 USA
Tel:503.557.4500 Fax:503.557.4501

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GENERAL

The information in this application booklet is provided as a guideline for the installer. It is the installer's responsibility to ensure proper installation, safety and adherence to the specifications as the owner or structural engineer outlines them. Do not alter CLEANPAK™ products without prior written approval from CLEANPAK International. CLEANPAK is not responsible for any unauthorized bracing or loading to the systems. The statements and diagrams contained herein are non-specific and do not necessarily reflect actual projects.

Safety

- A. The installer is responsible for providing qualified, trained personnel to install and operate the equipment. Consult all local building, occupational safety, electrical, gas and other codes applicable to the installation. Safety considerations include, but are not limited to, the accessibility of the equipment to non-service personnel, the provision of electrical switches and maintenance procedures.
- B. This manual has been prepared for the installer and operator of CLEANPAK equipment. Due to the custom nature of CLEANPAK products, there may be areas beyond the scope of this manual. If there are any questions about a special application lacking coverage, please contact CLEANPAK International's Service Department.
- C. The customer is responsible for providing qualified and trained personnel to install and operate the Clean-Pak equipment. Never open an access door while the unit is in operation. Consult all local building, occupational safety, electrical, gas and other codes applicable to the installation. Safety considerations include, but are not limited to:
 - a. The accessibility of the equipment to non-service personnel
 - b. The provision of electrical lockout switches
 - c. Maintenance procedures
 - d. Automatic control sequences
 - e. Equipment wired to automatic control devices may start without warning, resulting in personal injury or property damage. In many instances, a unit will have multiple electrical and compressed-air connection points. To prevent unforeseen start-up, always lockout all power supplies prior to beginning work on a Clean-Pak unit in accordance with the electrical safety guidelines. A fan, even though locked out electrically, can rotate in a seemingly insignificant airflow. The impeller should be secured during maintenance to restrict rotation, making sure that the restrictive device is removed before putting the fan back into service.
 - f. Always replace any protective covers removed for servicing.
 - g. Always lock or replace bolt on access door for doors that provide access to moving parts.

Service and Warranty

For service on CLEANPAK products, contact:
CLEANPAK International
Service Department
11241 S.E. Highway 212
Clackamas, Oregon 97015
Phone: 503.557.4500 Fax: 503.557.4501
Refer to Limited Warranty at the end of this document.

Receiving and Inspection

- A. CLEANPAK's cleanroom products are double-wrapped in the factory. Ship-loose hardware is not wrapped unless otherwise specified.
- B. Carefully inspect all parts after receiving them from the transporting agent. Since CLEANPAK cleanroom products are pre-cleaned and then wrapped, do not unwrap them outdoors or in a dirty environment. Components should be unwrapped in a clean area and the receiver is responsible for inspecting for damage.
- C. Some ship loose items may be supplied with the units. These may include nuts, bolts and caulking for split assembly, extra fan belts, lifting lugs, filters, filter clips.
- D. Compare parts with the shipping documentation to make sure your shipment is correct, free of damage and complete. Your signature verifies that you have received all equipment in satisfactory condition.
- E. If shipping damage has occurred, notify the freight carrier and CLEANPAK International's Service Department immediately. Provide photographs of the damaged freight and call the freight claims inspector to inspect the damage and submit a damage report. After the claims inspector has released the shipment, perform a 100% inspection of the product. Isolate damaged equipment in a separate holding area to prevent it from being installed.

Storage

- A. Cleanroom units must be stored indoors, never outdoors.
- B. Store units designed for the outdoors unit in dry, protected areas, preferably indoors being sure that the internal components are protected against dust and corrosion. Take special care to prevent moisture, corrosion, and dust or dirt accumulation. Use tarps or weatherproof covers to protect the exterior of the cabinet. This will prevent the weather from entering through louver and openings. Always keep all access door closed.
- C. Protect the units from excessive vibration and accidental impact. Do not store other equipment on top of or inside the unit. During extended storage periods, manually rotate the fan wheels periodically and follow motor manufacturer's instructions to avoid bearing damage.

Clearances

- A. Check location and clearances between the Clean-Pak® unit and adjacent object. The national electrical code (NEC or CEC) requires a minimum of working clearances between the face of any electrical enclosure and any wall or obstruction.
- B. Be sure there is sufficient clearance to open doors as well as install piping and ducting. There must be no obstruction to prevent airflow through the hoods or louvers. Allow a distance equal to the horizontal width of the louver between the louver and any wall facing the louver.
- C. Allow sufficient space around the unit for removing access panels and other components. A minimum clearance equal to the width of the unit should be provided on one side of the unit for removing items such as coils, fan wheels and motors.

Lifting and Handling Requirements

- A. The unit may ship as already assembled, as a subassembly (collection of sections) or as individual sections.
- B. Units are factory pre-cleaned prior to shipment. Do not unwrap Clean-Pak units outside after being unloaded from the truck or store in unprotected or high-traffic areas. CLEANPAK recommends that units be stored in a controlled environment when delivered to jobsites in variable or humid climates. Visually inspect plastic wrapping daily to insure that no condensation has formed inside wrap and any rips in plastic have been sealed.
- C. Examine equipment carefully before lifting to determine if there are split points. **Do not lift multiple sections at the same time**, as they are not designed to support a moment at the split point. Sometimes, split unit sections may be shipped bolted together to reduce shipping costs. These sections must be disassembled and lifted individually.
- D. To prepare for lifting the Clean-Pak units, estimate the approximate center of gravity. Internal placement of components may cause the weight to be unevenly distributed with more weight in the coil and fan areas. The factory lifting lugs are provided to raise the unit. Spreader bars are required to prevent damage to the cabinet and protruding components during a lift.
- E. Use all lifting lugs on the base channels. Adjust the tension in each

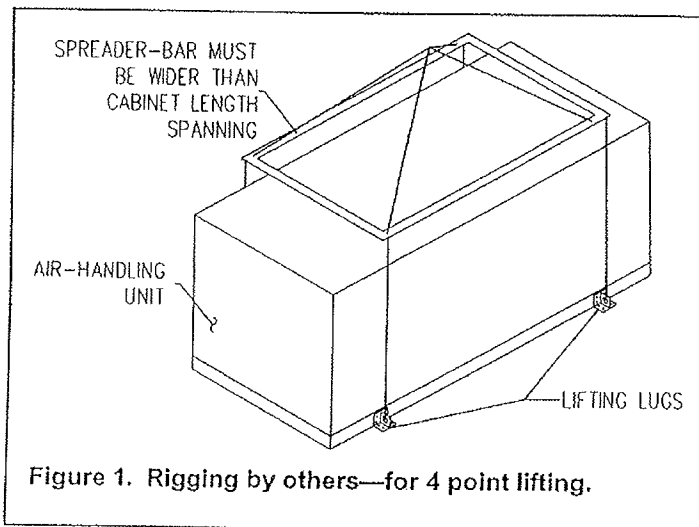


Figure 1. Rigging by others—for 4 point lifting.

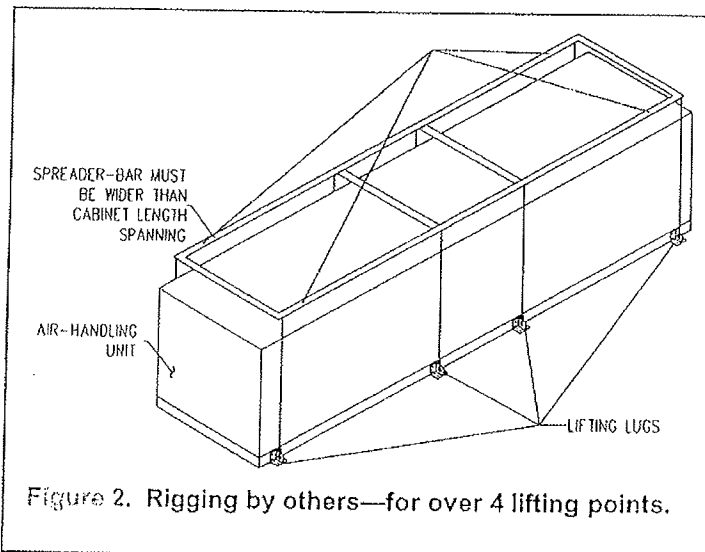


Figure 2. Rigging by others—for over 4 lifting points.

line for proper load distribution. (See Figure 1 and Figure 2 for recommended lifting of Clean-Pak units.)

- F. Do not lift non-base units or subassemblies by attaching clevis, hooks, pins, bolts, etc. to casing, casing hardware, angles, tabs or flanges. Rig non-base units only as shown in Figure 3.
- G. It may be possible to tow units with 40" forklift forks, providing the end tips of the forks contact the bottom of the intermediate supports of the base rail. A forklift may be used for lifting single sections or small subassemblies, providing the forks support both ends of the base rail. (See Figure 4 for towing base rail units and subassembly guidelines.) Exercise caution when using forklifts to prevent damage to the unit.
- H. Lift the Clean-Pak unit only in an upright position. Never lift or move a unit on its side or upside-down. If you do not rig or lift the unit carefully, you could hurt yourself or damage the unit.

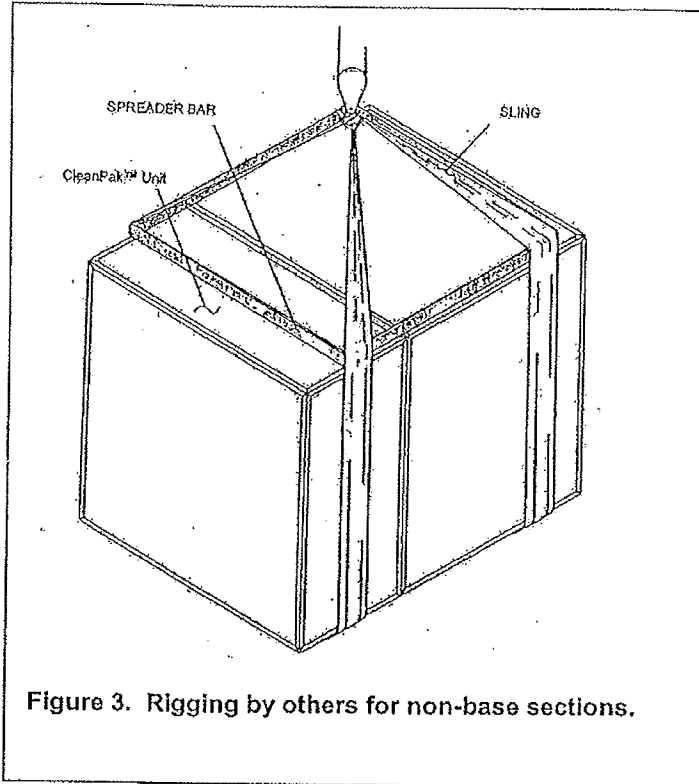


Figure 3. Rigging by others for non-base sections.

Location Considerations

- A. The floor, foundation, housekeeping pad or curb on which the units are to be located should be rigid and level (shim as required). The structure should be capable of supporting the weight of the unit, including all components (including water or refrigerant within the coils), plus the load imposed by the rotating fans. The installer is responsible for securing the unit to the housekeeping pad in accordance with applicable building and seismic codes.
- B. Ceiling suspended units are designed to be supported from the welded base. Use all suspension points pointed out in the submittal. The casing is not intended to support the unit. The installer is responsible for hanging and bracing the unit to the structure in accordance with applicable building and seismic codes.

Split Assembly

- A. Disassembled Clean-Pak units for shipment/handling must be reassembled at the jobsite. Adequate supplies of nuts, bolts and caulking

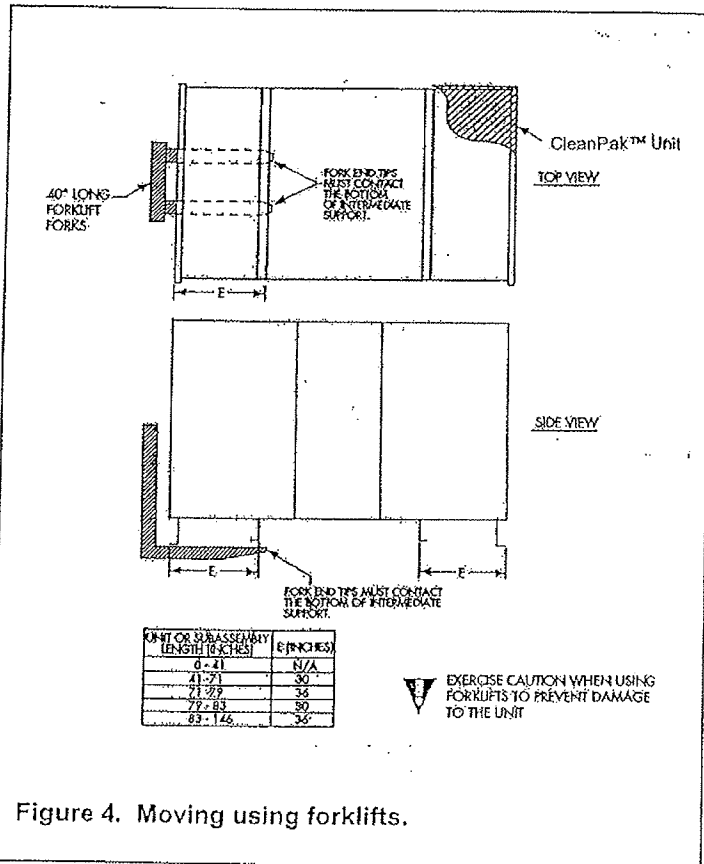


Figure 4. Moving using forklifts.

- have been supplied for proper reassembly. Insure that all seams are caulked before and after assembly.
- B. Caulk all panel joints prior to assembly and again after bolting together. For outdoor units, caulk and bolt roof panel joints and then caulk and install caps over the roof joints.
 - C. It is the installer's responsibility to connect all internal and external electrical or piping splits. Perform all necessary safety checks prior to energizing the electrical circuits.
 - D. It is the installing contractor's responsibility to ensure that adequate controls exist on dampers so that the dampers do not shut (either intentionally or accidentally) while the fan is running. This could lead to over-pressurization of the unit cabinet and damage to components and/or the unit cabinet.

Condensate Drain Trap Sizing

- A. All condensate drain connections and floor drains must be trapped at the jobsite location by the installer. Failure to properly trap a drain may result in flooding and potential damage to the air handler and other building facilities.

Fan Hold-downs, Spring Isolators, and Econo-Disk

- A. After fan is placed in final location, all fan shipping tie-downs (four per fan assembly), must be removed and the seismic restraints set up according to instructions on the fan frame. Verify that fan is standing free on the spring isolators and that no obstructions impair the isolation. Check flexible connection between fan assembly and between the intake wall. Make sure the flexible conduit to the motor and the bearing lubrication lines do not restrict the isolation.
- B. Visually inspect fan wheel for any damage or obstructions and rotate the wheel by hand to be sure it is spinning freely.
- C. Check variable volume devices (Econo-Disk®, dampers, etc.) to insure smooth operation and no binding. Check to see that actuators and linkage are mounted without obstructing the fan operation or short circuiting isolation. Actuators should be hand operated through their entire cycle to confirm proper alignment and avoid over-torque of mechanisms, which can cause damage.

Preliminary Cleaning

- A. Vacuum and clean unit of all foreign objects.
- B. For cleanroom units, do a preliminary wipe down using a 10:1 solution of deionized water and isopropyl alcohol.

Fan start-up

- A. Refer to manufacturer's start-up instructions for fan units using variable frequency drives.
- B. Prior to starting fan, insure that wiring is correct (wire size, voltage and connections should be verified). Overload device(s) should be inspected to make sure

that the correct thermal elements are installed. The initial fan test run should include a "bump start" to verify correct rotation (rotation direction is indicated on motor). Any unusual mechanical noises or wiring problems should be investigated and corrected before performing a full speed test.

- C. During the full speed test, check all motors with an amp meter and compare reading with motor rating. Do not run equipment in overload condition. The fan has been factory vibration tested, but visual inspection during the full speed test will determine if any vibration problems exist. The fan thrust springs are designed to compensate for fan thrust away from the discharge. On plug fans, adjust fan base spring clips closest to the fan wall so they do not bottom out.

Final Cleaning

- A. For cleanroom units, perform final cleanroom-approved wipe down using a 10:1 solution of deionized water and isopropyl alcohol. Do not use this solution on plastic.

Maintenance

- A. For components requiring maintenance, follow the maintenance instructions from the original equipment manufacturers' manuals.
- B. Components such as shaft grounding devices for motors from Shaft Grounding Systems or Mercotac require routine checking of their effectiveness (checking continuity) and this should be performed on a maintenance schedule (suggested every 6 months).
- C. Electrical panels should be under a routine maintenance plan for checking of integrity of connections.

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WARRANTY



LIMITED WARRANTY -- Standard CLEANPAK International, Inc. ("Company") Warranty

Company warrants that on the date the equipment is delivered by the Company to the carrier for shipment to the Purchaser that the equipment will be of the kind and quality described in the initial contract, bid, purchase order or other solicitation (the "Order"), and free from defects in workmanship and materials.

If within the earlier of (i) 12 months from date of first operation or (ii) 18 months from the date the first item of equipment is delivered by the Company to the carrier for shipment to Purchaser (the "Warranty Period"), Purchaser discovers that such equipment was not as warranted above and notifies Company in writing thereof promptly and in any event prior to the last day of the Warranty Period, then Company shall remedy such defect by, at Company's option, adjustment, repair or replacement of the item and any affected part of the equipment. Purchaser assumes all responsibility and expense for removal, reinstallation and freight charges (both for return and delivery of new parts) in connection with the foregoing remedy. The same obligations and conditions shall apply to replacement items furnished by Company pursuant to this warranty. Company shall have the right to dispose of items replaced by it. Purchaser shall grant Company access to the premises at which the equipment is located at all reasonable times so that Company can evaluate any defect in the equipment and make any repairs or replacements it may choose to make on-site. If adjustment, repair or replacement does not remedy the defect, Company and Purchaser shall negotiate in good faith an equitable adjustment in contract price; although any such adjustment shall (i) not exceed the purchase price for the defective equipment (ii) not include incidental or consequential damages (iii) not include costs for removal, reinstallation or freight, all in accordance with CLEANPAK International Standard Terms and Conditions of Sale. If Company and Purchaser are unable to agree upon an equitable adjustment, then such adjustment shall be determined by binding arbitration in accordance with the Oregon Arbitration Rules of the American Arbitration Association. Any arbitration proceeding shall occur in Clackamas County, Oregon.

Company's responsibility does not extend to any item of the equipment that was not manufactured and sold by Company ("Out-Sourced Items"). Out-Sourced Items shall be covered only by the express warranty, if any, of the manufacturer thereof and Company hereby expressly disclaims any and all warranties, whether express or implied, including the warranties of merchantability and fitness for a particular purpose, with respect to Out-Sourced Items.

Neither Company nor the suppliers of Out-Sourced Items shall have any responsibility or liability if (i) the equipment has been improperly stored, handled or installed, (ii) the equipment was not operated or maintained according to its ratings and/or according to instructions in Company and/or supplier furnished manuals, (iii) unauthorized repairs or modifications have been made to the equipment, or (iv) the equipment is used in a manner that exceeds design specifications.

No liability under this warranty shall exist unless the following conditions are met:

1. The initial startup and checkout must be performed in accordance with Company instructions.
2. Company must be given the opportunity to make modifications to the equipment at any time during the Warranty Period, as long as said modifications do not interfere with the intended purpose of the equipment.

This warranty, if activated, does not cover the following terms:

1. Labor, travel time and expense incurred at any time after the initial startup of the equipment.
2. Any and all items of a housekeeping and/or maintenance type required for the proper operation of the equipment.
3. Any causes outside the control of Company, such as fires, explosions, negligence or intentional acts of any party or parties and acts of God.

During the Warranty Period, if replacement parts are deemed justified then Purchaser must submit a formal purchase order and Purchaser will be invoiced for the parts so ordered. Credit will be issued on that invoice upon receipt by Company of the replaced part(s).

This warranty shall not be construed as providing Purchaser an avenue to assess liquidated, incidental or consequential damages that arise from an actual or perceived defect in the equipment.

THIS WARRANTY IS PURCHASER'S SOLE REMEDY AND IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES (EXCEPT TITLE), INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND CONSTITUTES THE ONLY WARRANTY OF CLEANPAK INTERNATIONAL, INC. WITH RESPECT TO THE EQUIPMENT.

The foregoing states Purchaser's exclusive remedy against Company and the supplier for any defects in the equipment or for failure of the equipment to be as warranted, whether Purchaser's remedy is based on (i) contract, (ii) warranty, (iii) negligence with regard to recommendations regarding the equipment and installation advice or service related thereto, (iv) failure of such remedy to achieve its essential purpose, (v) tort (including negligence), (vi) strict liability, (vii) indemnity, or (viii) any other legal theory, and whether arising out of warranties, representations, instructions, installations or defects from any cause whatsoever.

Replacement Warranty

Should a replacement of a defective item be the solution to a warranty claim, the part shall be under warranty for the later of (i) the duration of the Warranty Period or (ii) ninety (90) days following the date the replacement equipment is delivered by the Company to the carrier for shipment to the Purchaser, whichever is longer (the "Extended Warranty Period").

A remanufactured part (other than original warranty replacement) carries a ninety (90) day warranty only.

Second Party Warranties

If the equipment incorporates Out-Sourced Items purchased by Company for the purpose of incorporating in the equipment, the express warranty, if any, of the Out-Sourced Items manufacturer shall prevail. Such Out-Sourced Items will include, but not be limited to, electric motors, variable frequency drives (a.k.a., drives, VFD's, AFD's, VSD's), sprinkler heads, and high-purity air filters (a.k.a., HEPA or ULPA filters). If any of these Out-Sourced Items are not as warranted in the Out-Sourced Items manufacturer's warranty, Purchaser shall contact the appropriate party as specified by the Out-Sourced Items manufacturer's warranty, and make all necessary arrangements for adjustment, repair or replacement as indicated. Company shall in no way be held liable for any conditions or repercussions arising from a warranty claim that involves such Out-Sourced Items. This exclusion of liability includes that which is a result of a failure on the part of a Out-Sourced Items manufacturer to adjust, repair, or replace their equipment under the terms of its warranty. If the Out-Sourced Items manufacturer's warranty period expires prior to expiration of the Warranty Period (or Extended Warranty Period, as applicable), the Out-Sourced Items shall no longer be warranted.

Project Plans and Specifications

Company will assist Purchaser in developing equipment specifications for an Order by the preparation of quotations and submittals (collectively, the "Submittals"). The Submittals are provided by Company for the sole purpose of showing additional detail to allow Purchaser to determine whether the equipment is suitable and appropriate for Purchaser's application. Regardless of any express or implied opinions of Company's salespersons and/or engineers, Purchaser shall have sole responsibility to ensure that the equipment (as detailed in the Submittals) complies with any project plans and specifications. The submission of an Order by Purchaser shall be deemed a warranty and agreement by Purchaser that the equipment so complies notwithstanding any contrary statements in the Order. If Company provides the equipment in accordance with the Purchaser approved Submittals, Purchaser agrees to accept full and sole responsibility for any deviations from the project plans and specifications that later become apparent or evident.



New England Air Systems

Complete Mechanical Systems & Service

UNIVERSITY OF VERMONT
Cosmogenic Nuclide Laboratory at Delehanty Hall

Job # O200212

VENDOR INDEX

MECHANICAL

New England Air Systems, Inc.
43 Krupp Drive
Williston, Vermont 05495
24-hour service (802) 864-5959

FIXTURES/ PUMPS

Blodgett Supply Co., Inc.
100 Avenue D
P.O. Box 759
Williston, Vermont 05495-0759
Louise Daigle
802.859.2229

HUMIDIFIER

Emerson Swan
300 Pond Street
Randolph, MA 03268
Mike Tobin
781.986.2555

HEATING COILS

R.F. Peck Company
22 Computer Drive West
Albany, New York 12205
Mike Bronder
518.869.3541 Ext. 114

AIR HANDLER

CleanPak International
11241 S.E. Highway 212
Clackamas, OR 9705
Andrew Hall
203.364.9896

EXHAUST FANS
(EX-4 & EX-5)

Hartzell Fan, Inc.
c/o Air Industries
181 Hurricane Road
Falmouth, ME 04105
207.650.8807

EXHAUST FANS (EX-6)

Buckley Associates, Inc.
120 Railroad Avenue
Albany, New York 12205
John Whitbread
800.370.0870

COATED EXHAUST
DUCT NOZZLE

BETE Fog Nozzle, Inc.
50 Greenfield Street
Greenfield, Massachusetts 01301
413.772.0846
413.772.6729

PSP FLANGE

Fab-Tech, Inc.
480 Hercules Drive
Colchester, Vermont 05446
802.655.8800

ULPA DIFFUSERS

Filters Sales and Service
15 Adam Street
Burlington, MA 01803
Alan Ouellet
800.848.9305

FUSEAL WASTE PIPING,
POLYPRO (R.O.) PIPING

Network Piping, Inc.
6 Jefferson Drive
Coventry, Rhode Island 02816
401.304.1234

CONTROLS
BALANCE REPORT

Control Technologies, Inc.
121 Park Avenue
Suite 10
Williston, Vermont 05495
Terry Reynolds
802.764.2200



New England Air Systems

Complete Mechanical Systems & Service

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Cosmogenic Nuclide Laboratory at Delehanty Hall

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O&M MANUAL

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