OPERATION AND MAINTENANCE MANUAL

COMBAT VEHICLE MAINTENANCE SHOP

MARINE CORPS BASE

CAMP LEJEUNE, NORTH CAROLINA

CONTRACT NO. N62470-84-C-4096

<u>MECHANICAL CONTRACTOR</u>

SNEEDEN, INC.

P.O. BOX 3548

WILMINGTON, NC 28406

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DESCRIPTION:

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6. Hot Water Heater.

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LOCAL REPRESENTATIVE

1.	Air Handling Units, Condensing Units, Unit Heaters, Coils, Radiation, etc.	The Trane Company 5214 Western Blvd. Raleigh, NC 27606 919-851-4131
2.	Plumbing Fixtures, Steam Meter, and Hot Water Heater.	Noland Company P.O. Box 3069 Kinston, NC 28501 800-682-7736
3.	Pumps, Convertors, and Steam Specialties	Heat Transfer Sales, Inc. 901-G Norwalk St. Greensboro, NC 27407 919-294-3838
4.	Pipe and Duct Insulation	Ellington Insulation Co. 2013 North Kerr Avenue Wilmington, NC 28405 919-291-7223
5.	Control System	Honeywell, Inc. P.O. Box 220487 Charlotte, NC 28222 704-364-4770
6.	Testing and Balancing of Air and Water System	T.A. Services, Inc. 539 Armour Circle, N.E. Atlanta, Georgia 30324
7.	Air Compressor, and Air Dryer	Jones and Frank, Inc. 622 Maywood Avenue Raleigh, NC 919-832-3081
8.	Exhaust Fans and CO_2 Exhaust System	Chet Adams Co. P.O. Box 5218 Cary, NC 27511 919-851-6331

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SUBCONTRACTORS

1.	Pipe and Duct Insulation	Ellington Insulation Co. 2013 North Kerr Ave. Wilmington, NC 28405 919-791-7223
2.	Control System	Honeywell, Inc. P.O. Box 220487 Charlotte, NC 28222 704-364-4770
3.	Testing and Balancing of Air and Water System	TAB Services, Inc. 539 Armour Circle, NE Atlanta, GA 30324

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Submittal Data

The Trane Company
A Division of
American Standard Inc.

3600 Pammel Creek Road
La Crosse WI 54601-7599

Customer Order Number

Date
November 21, 1986

Trane Order Number
F4-M322A

Sold To
Sneeden, Inc.

Project
Combat Vehicle Maintenance Shop

Architect

Engineer

Total Qty. Per Order	Model Specifications and Tagging
5	Trane draw thru air handling units with coils, filter boxes, external face 7 bypass (AHU-4, AHU-6), motor, and drive. All voltage is 200/60/3Ø.

CAPACITY DATA

TAG	AHU-1	AHU-2	AHU-3	AHU-4	AHU-6
SIZE	3A	6A	3A	8A	14A
CFM	760	1950	900	5860	9510
ccMBH	27.0	61.0	32.1		
EAT	79.3/67.7	79.3/67.7	78.9/67.8		
LAT	55.5/55.1	59.3/58.8	57.3/56.8		
APD	.40	.58	.52		
SST	45	47	45		
hcMBH	15.47	23.67	8.72	290 mbH	470.7 mbH
EAT	62.1	63.4	64.7	23	23
LAT	80.9	74.6	73.7	68	68
APD	.07	.12	.10	.15	.14
GPM	1.5	2.4	.9	29	47.1
EWT/LWT	180/160	180/160	180/160	180/160	180/160
HP	3/4	1½	3/4	3	7½
BHP	.1	.76	.26	2.2	3.1

Cool

Heat

Trane Sales Office/Sales Engineer:

Raleigh / Suggs

Approved By:

"It is hereby certified that the (material) (equipment) shown and marked in this submittal is that approved proposed to be incorporated into Contract Number [illegible], is in compliance with the contract drawings and specifications, and can be installed in the allocated spaces and is (approved for use) submitted for [illegible] approval.

Authorized Reviewer ______________ Date ______

Signature CQC Rep. Dan Parlett Date 1-12-87

Drawings in this submittal package describe the equipment we propose to furnish for this project and are submitted for approval to manufacture.

1-30.195-3—(185)

TRANE

Submittal Data

The Trane Company
A Division of
American Standard Inc.

3600 Pammel Creek Road
La Crosse WI 54601-7599

Customer Order Number	Date: November 21, 1986
	Trane Order Number: F4-M325
Sold To: Sneeden, Inc.	Project: Combat Vehicle Mx. Shop
Architect	Engineer

Total Qty. Per Order	Model Specifications and Tagging
8	Trane hot water wall fin with type S enclosure, 1½" copper aluminum element, 16 gauge enclosure, end panels, and access extension. Finish is standard light grey.

	8 UNITS	8 UNITS
TAG:	Unit # 1-4, 8	Unit # 7, 10-16
MODEL:	12S	12S
ELEMENT LENGTH:	3'	2'
BTUH:	3810	2540
EWT:	180	180
EAT:	65	65
MAX VELOCITY:	.25	.25
	19,050 BTU	20,320 BTU
	1.905 gpm	2.032 gpm

Trane Sales Office/Sales Engineer:

Raleigh / Suggs

Approved By:

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Authorized Reviewer ______________ Date ________

Signature CQC Rep Dan Parlett Date 1-12-87":

Drawings in this submittal package describe the equipment we propose to furnish for this project and are submitted for approval to manufacture.

1-30.195-3—(185)

TRANE™

The Trane Company
Division of American Standard Inc.

La Crosse WI 54601-7599
Clarksville TN 37040

10-30-86

Page Number	Trane Order Number
15	F4M323A

Trane Job Number	Customer Order Number	Number of Prints	Date to Ship	Type of Order
F4-10461	TO FOLLOW	12 LIT 06	00-00-00HA	SUB

Architect

Engineer

Trane Salesman: J SUGGS

Job Name/Location: COMBAT BEHICLE MAINT. SHOP
CAMP LEJEUNE, NC

Sold To:
SNEEDEN INCORPORATED
P.O. BOX 3548
WILMINGTON, NC 28401

Ship To Project:
SNEEDEN, INC.
C-C COMBAT VEH. MX. SHOP
CAMP LEJEUNE, NC
28542

Mark Packages — Project Name

Item	Quantity	Trane Ordering Number	Specifications
10.00	0001	BTD730A1C0B	2-1/2-TON SPLIT SYSTEM CONDENSING UNIT 230/60/1
			TAG: CU-1
20.CC	0001	BTD760A1C0A	5-TON SPLIT SYSTEM CONDENSING UNIT 230/60/1
			TAG: CU-2
[illegible]0.CC	CCC1	BTD736A1C0B	3-TON SPLIT SYSTEM CONDENSING UNIT 208/230/60/1
			TAG: CU-3
30.C1	CCC2	BAY71X004A	SWEAT ADAPTER 7/8 DIA. SUCTION / 3/8 DIA. LIQUID
			TAG: CU-1 & 3
30.02	0001	BAY71X006A	SWEAT ADAPTER 1 1/8 DIA. SUCTION / 3/8 DIA. LIQUID
			TAG: CU-2

"It is hereby certified that the (material) (equipment) shown and marked in this [illegible] (approved) [illegible] to be incorporated into [illegible], is in compliance with the contract drawings and [illegible] can be installed in the [illegible], and is (approved for use) submitted for Government approval.

Authorized Reviewer ______ Date ______

Signature CQC Rep. Dan Parlett Date 1-12-87.

Submittal Approval Drawings:
BTD-SQ-203.00* BTD-IN-2
BTD-SC-207.00 BTD-IN-3
BTD-SC-204.00* BTD-IN-2

Service Literature

Submittal Data

TRANE™

The Trane Company
Division of American Standard Inc.

La Crosse WI 54601-7599
Clarksville TN 37040

10-30-86

Page Number	Trane Order Number
15 1 OF 1	S F4-M324A

Trane Job Number	Customer Order Number	Number of Prints	Date to Ship	Type of Order
F4-10461	TO FOLLOW	12 LIT 6	02-15-87 HA	STK

Architect

Engineer

Trane Salesman
J. SUGGS
RALEIGH

COMBAT VEHICLE MAINT. SHOP
CAMP LEJEUNE, NC

Sold To

SNEEDEN INCORPORATED
P.O. BOX 3548
WILMINGTON, NC 28401

Ship To Project

SNEEDEN, INC.
C-O COMBAT VEH. MX. SHOP
CAMP LEJEUNE, NC 28542

Mark Packages — Project Name

CALL 919-791-3137 ATTN. JAMES SNEEDEN 24 HRS. BEFORE

Item	Quantity	Trane Ordering Number	Specifications	
10.00	18	0136-0143-01-00	UHPA42P TAG: UH-1-5,7-19	UHPA042P4ABAB
20.00	1	0136-0144-01-00	UHPA64P TAG: UH-6	UHPA064P4ABAC

Submittal Approval Drawings
UH-SU-001.02

Service Literature

Submittal Data

1-30.11-2—(585)

u H

Submittal Data

...NE™

...e Company
...n of
...Standard Inc.

3600 Pammel Creek Road
La Crosse WI 54601-7599

Customer Order Number

Date: November 21, 1986

Trane Order Number: F4-M324

Sold To:
Sneeden, Inc.

Project:
Combat Vehicle Mx. Shop

Architect

Engineer

Total Qty. Per Order: 19

Model Specifications and Tagging

Trane vertical hot water unit heaters with standard fan, hot water coil, and 115/60/1 standard totally enclosed motor.

TAG	MODEL	CFM	RPM	HP	MBH	GPM	PD	EAT	VOLTAGE
UH-2 - 5 -4 7 - 18 -12	UHPA-42P	436	1150	1/25	14.2 227.2	1.46 23.36	.03	68	115/1
UH-1, 19 -2	UHPA-42P	595	1150	1/25	17.8 35.6	1.83 3.66	.04	68	115/1
UH-6 -1	UHPA-64P	706	1150	1/20	25.1 25.1	2.58	.08	68	115/1

~~287.9~~ 29.6

Trane Sales Office/Sales Engineer:

Raleigh / Suggs

Approved By:
"It is hereby certified that the (material) (equipment) shown and marked in this [illegible] proposed to be incorporated into Contract [illegible]-C-4096, is in [illegible] and specifications, and can [illegible] spaces, and is (approved for use) submitted for [illegible] approval.

Authorized Reviewer ______ Date ______

Signature CQC Rep Dan Parlitt Date 1-12-87".

Drawings in this submittal package describe the equipment we propose to furnish for this project and are submitted for approval to manufacture.

1-30.195-3-(185)

Submittal Data

TRANE™

The Trane Company
A Division of
American Standard Inc.

3600 Pammel Creek Road
La Crosse WI 54601-7599

Customer Order Number	Date	Trane Order Number
	November 21, 1986	F4-M324

Sold To

Sneeden, Inc.

Project

Combat Vehicle Mx. Shop

Architect

Engineer

Total Qty. Per Order	Model Specifications and Tagging
19	Trane vertical hot water unit heaters with standard fan, hot water coil, and 115/60/1 standard totally enclosed motor.

TAG	MODEL	CFM	RPM	HP	MBH	GPM	PD	EAT	VOLTAGE
UH-2 - 5 4 7 - 18 -12	UHPA-42P	436	1150	1/25	14.2 227.2	1.46 23.36	.03	68	115/1
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UH-6 -1	UHPA-64P	706	1150	1/20	25.1 25.1	2.58	.08	68	115/1
					~~287.9~~	29.6			

Trane Sales Office/Sales Engineer:

Raleigh / Suggs

Approved By:

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Authorized Reviewer ______________ Date ________

Signature CQC Rep Dan Parlitt Date 1-12-87

Drawings in this submittal package describe the equipment we propose to furnish for this project and are submitted for approval to manufacture.

1-30.195-3—(185)

TRANE™

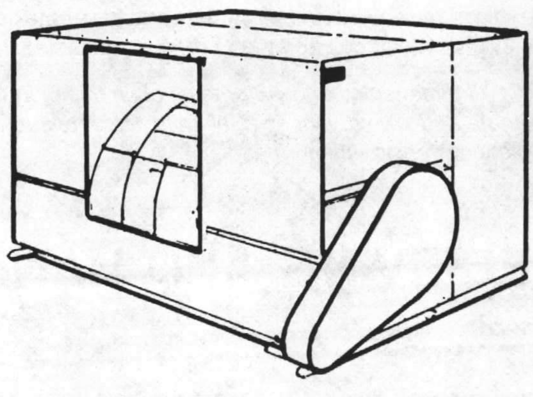
Installation CLCH-IN-3A

Library	Service Literature
Product Section	Air Handling
Product	Central Station Air Handlers
Model	Climate Changers
Literature Type	Installation
Sequence	3A
Date	August 1986
File No.	SV-AH-CLCH-CLCH-IN-3A-886
Supersedes	CLCH-IN-3 (186)

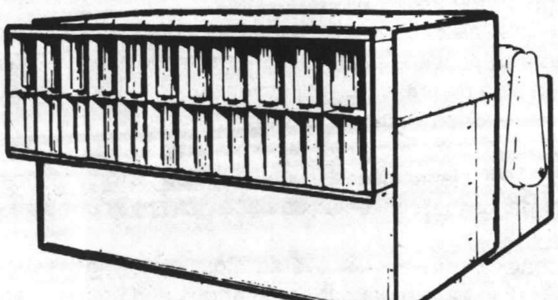
CLIMATE CHANGER® CENTRAL STATION AIR HANDLERS

DRAW-THRU, BLOW-THRU SPRAYED COIL AND HIGH PRESSURE UNITS

B DEVELOPMENT SEQUENCE



DRAW-THRU



BLOW-THRU

X39640290-02

The Trane Company
La Crosse, Wisconsin 54601-7599
Printed in U.S.A.

Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.

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Literature Change History:

CLCH-IM-10 (June 81)

Introduce infinity variable fin series. Change design sequence to "C".

CLCH-IN-2 (August 84)

Change bearing type (opposite drive side) on unit sizes 17 thru 31 w/stub shaft. Include weights for units with wide coils. Specific instructions for units shipping with optional coilless. Convert CLCH-IM-10C into separate Installation and Maintenance Manuals (CLCH-IN-2 & CLCH-M-1). Change design sequence to "D".

CLCH-IN-3 (January 1986)

Added level coils and Delta-Flo coils to units. Added cradle dimensions for wide coil unit sizes 3 thru 31. Added and updated Tables (4, 8A and 12). Change design sequence to "E".

CLCH-IN-3A (August 1986)

Corrected Figure 49.

GENERAL INFORMATION

Central Station Climate Changers® are air handlers designed to provide complete heating, cooling and dehumidifying by means of a wide variety of unit sizes, coils, fans and efficiency capabilities. This manual will cover all vertical and horizontal, draw-thru, blow-thru, sprayed coil and high pressure units.

***NOTE:** All dimensions and weights given in this manual are approximate and will vary for special units. Refer to submittal data for exact dimensional information.*

An Installation Checklist is given at the end of the Installation section of this manual to be used by the installing contractor to verify proper installation procedures. These checklists should not be substituted for the detailed information and procedures contained in appropriate sections of the manual.

RECEIVING AND HANDLING

SHIPPING

Central Station Climate Changers® are shipped either assembled or in sections, depending on unit size and accessories. All units or sections of units are attached securely to skids. Nuts, bolts and washers necessary for unit assembly are attached to one of the skids. Motors ship separately when their size or location on the unit prevents safe transit. Access section is shipped unassembled.

To protect against loss from in-transit damage, complete the following upon receipt of the unit:

1. Inspect individual pieces of the shipment before accepting it. Check for rattles, bent corners on cartons or other visible indications of shipping damage.
2. If a carton or unit has apparent damage, open it immediately and inspect the contents before accepting the unit. Do not refuse the shipment. Make specific notations concerning the damage on the freight bill.
3. Inspect the unit for concealed damage before it is stored and as soon as possible after delivery. Refer to the checklist given in step 8 for internal inspections. Concealed damage must be reported within 15 days.
4. Do not move damaged material from the receiving location if possible. It is the receiver's responsibility to provide reasonable evidence that concealed damage was not incurred after delivery.
5. If concealed damage is discovered, stop unpacking the shipment. Retain all internal packing, cartons and crates. Take photos of the damaged material if possible.
6. Notify the carrier's terminal of the damage immediately by phone and mail. Request an immediate joint inspection of the damage by the carrier and consignee.
7. Notify the Trane sales representative of the damage and ar-

range for repair. Do not repair the unit, however, until damage is inspected by the carrier's representative. Trane is not responsible for shipping damage.

8. Complete the following inspections before installing the unit:
   a. Verify that the correct unit has been received by comparing nameplate and model number information with submittal data.
   b. Rotate the fan manually to be sure that it is free to operate. Inspect the fan housing for obstructions which may have entered the unit during shipment.
   c. Check all dampers in the unit and accessories to be sure they are free to move and have not been damaged in transit.
   d. Make sure the inlet vanes operate freely. Check that all sets of vanes operate together when opening and closing.

Refer to the Unit Location Recommendations in this manual before setting the unit in place. It is recommended that units are left on their skids for protection and ease of handling until set in place. For proper rigging and hoisting procedures, refer to the Rigging section of this manual and the instruction label on the unit.

RIGGING

Before preparing the unit or component for lifting, estimate the approximate center of gravity for lifting safety. Because of placement of internal components, the unit weight may be unevenly distributed, with more weight in the coil area. Approximate unit weights are given in Tables 1, 2 and 3.

Before hoisting the unit, be sure that the proper method of rigging is used, with straps or slings and spreader bars for protection during lifting. See Figure 1. Refer to the unit label for recommended rigging procedures. Always test-lift the unit to determine exact unit balance and stability before hoisting it to the installation location.

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

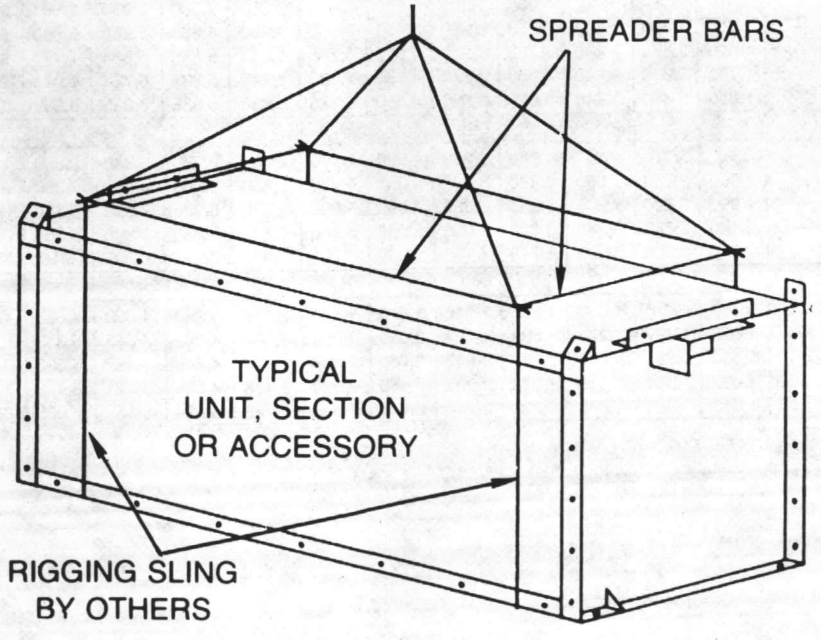


FIGURE 1 - Recommended Rigging Procedure

TABLE 1 - Climate Changer Unit Operating Weights In Pounds (Less Motors)

	UNIT SIZE															
	3	6	8	10	12	14	17	21	25	31	35	41	50	63	73	86
Draw-Thru Climate Changers																
Casing Only	205	275	400	460	700	750	1,015	1,225	1,380	1,455	2,100	2,540	2,750	4,270	4,710	5,030
2 Row	291	424	570	677	978	1,060	1,429	1,639	1,850	2,117	2,832	3,558	,3708	5,529	5,850	6,390
4 Row	328	487	657	785	1,108	1,213	1,618	1,876	2,219	2,453	3,198	3,797	4,260	6,218	6,710	7,420
6 Row	368	552	742	891	1,243	1,369	1,807	2,018	2,381	2,813	3,616	4,261	4,794	6,929	7,560	8,440
8 Row	406	618	828	988	1,373	1,520	1,981	2,321	2,643	3,143	3,984	4,699	5,330	7,611	8,320	9,330
Draw-Thru Climate Changer w/Wide Coil																
Casing Only	225	295	425	490	730	780	1045	1260	1415	1505	2190	2715	2950	4845	4850	5170
With 2 Row	365	495	665	779	1089	1166	1535	1738	1951	2262	3041	3959	4121	5781	6157	6697
With 4 Row	426	579	788	922	1257	1357	1759	2005	2372	2647	3467	4251	4796	6578	7142	7854
With 6 Row	491	666	908	1063	1431	1552	1982	2246	2557	3058	3953	4818	5448	7401	8117	9448
With 8 Row	553	754	1030	1192	1599	1740	2188	2526	2856	3436	4381	5354	6103	8190	8988	9998
Blow-Thru Climate Changers																
Casing Only	—	605	765	810	880	1,095	1,260	1,425	1,600	1,810	3,250	3,650	4,025	4,580	5,030	5,530
2 Row	—	754	935	1,027	1,158	1,405	1,614	1,839	2,070	2,472	3,982	4,463	4,983	5,839	6,436	7,142
4 Row	—	817	1,022	1,135	1,288	1,558	1,803	2,070	2,339	2,808	4,348	4,907	5,535	6,528	7,240	8,114
6 Row	—	882	1,107	1,241	1,423	1,714	1,992	2,298	2,609	3,168	4,766	5,367	6,069	7,239	8,018	9,046
8 Row	—	948	1,193	1,338	1,553	1,865	2,166	2,521	2,863	3,498	5,134	5,809	6,605	7.921	8,824	9.998
Single-Zone Blow-Thru Climate Changers																
Casing Only	—	386	544	631	760	900	1,080	1,235	1,370	1,560	2,780	3,115	3,435	4,425	4,870	5,280
2 Row	—	535	714	848	1,038	1,210	1,434	1,629	1,840	2,222	3,512	3,928	4,393	5,684	6,276	6,892
4 Row	—	598	801	956	1,168	1,363	1,623	1,860	2,109	2,558	3,878	4,372	4,945	6,373	7,080	7,864
6 Row	—	663	886	1,062	1,303	1,519	1,812	2,088	2,379	2,918	4,296	4,832	5,479	7,084	7,858	8,796
8 Row	—	729	972	1,159	1,473	1,670	1,986	2,311	2,673	3,248	4,664	5,274	6,015	7,766	8,664	9,748
Sprayed Coil Climate Changers																
Casing Only	690	915	1,105	1,270	1,880	2,130	3,100	3,285	3,305	3,485	4,950	5,700	6,230	9,050	10,485	12,355
4 Row	815	1,125	1,360	1,595	2,290	2,595	3,745	4,125	4,145	4,485	6,050	6,950	7,740	10,100	11,700	13,787
6 Row	855	1,190	1,445	1,700	2,425	2,750	3,925	4,285	4,305	4,855	6,465	7,420	8,275	11,710	13,560	15,985
8 Row	890	1,260	1,535	1,800	2,555	2,900	4,195	4,550	4,570	5,175	6,835	7,860	8,810	12,390	14,355	16,910
High Pressure Sprayed Coil Climate Changers																
Casing Only	—	—	1,590	2,130	2,500	2,670	3,210	3,840	4,350	5,100	5,350	6,000	7,200	9,400	12,250	14,910
4 Row	—	—	1,845	2,455	2,910	3,135	3,755	4,485	5,190	6,100	6,450	7,250	8,710	11,350	14,250	17,300
6 Row	—	—	1,930	2,560	3,045	3,290	3,940	4,665	5,350	6,460	6,865	7,720	9,245	12,060	15,100	18,320
8 Row	—	—	2,020	2,660	3,175	3,440	4,115	4,935	5,615	8,790	7,235	8,160	9,780	12,740	15,950	19,210
High Pressure Draw-Thru Climate Changers																
Fan Section Only	—	—	610	770	920	1,060	1,290	1,580	1,870	2,060	2,200	2,330	2,580	2,950	4,090	5,400
Fan and Coil Section	—	—	1,250	1,800	2,150	2,250	2,650	3,400	3,950	4,250	4,600	5,250	5,650	6,850	8,260	10,400
4 Row	—	—	1,590	2,170	2,440	2,765	3,210	4,010	4,795	5,055	5,535	6,335	7,180	8,600	10,260	12,790
6 Row	—	—	1,720	2,310	2,690	3,030	3,370	4,180	4,930	5,445	5,935	6,785	7,930	9,350	11,110	13,810
8 Row	—	—	1,850	2,450	2,740	3,095	3,530	4,350	5,325	5,835	6,335	7,235	8,680	10,000	11,960	14,700
High Pressure Blow-Thru Climate Changers																
Fan Section Only	—	—	610	770	920	1,060	1,290	1,580	1,870	2,060	2,200	2,330	2,580	2,950	4,090	5,400
Fan and Coil Section	—	—	1,650	2,250	2,600	2,850	3,300	4,250	4,850	5,400	6,000	6,850	7,300	9,300	12,140	14,900
4 Row	—	—	1,990	2,620	2,900	3,365	3,860	4,860	5,595	6,205	6,935	7,935	8,830	11,050	14,140	17,290
6 Row	—	—	2,120	2,760	3,240	3,630	4,020	5,030	5,860	6,595	7,335	8,385	9,580	11,800	14,990	18,310
8 Row	—	—	2,250	2,900	3,290	3,745	4,180	5,200	6,225	6,985	7,735	8,835	10,180	12,450	15,840	19,200
Three Deck Multizone Climate Changers																
Casing Only	—	725	885	930	1,000	1,255	1,440	1,615	1,830	2,060	3,350	4,000	4,385	4,950	—	—
2 Row	—	874	1,055	1,147	1,278	1,560	1,794	2,029	2,300	2,722	4,082	4,813	5,343	6,219	—	—
4 Row	—	937	1,142	1,255	1,408	1,718	1,983	2,260	2,669	3,058	4,448	5,257	5,895	6,908	—	—
6 Row	—	1,002	1,227	1,361	1,543	1,874	2,232	2,488	2,839	3,418	4,866	5,721	6,429	7,609	—	—
8 Row	—	1,068	1,313	1,458	1,673	2,025	2,346	2,711	3,093	3,748	5,234	6,159	6,965	8,291	—	—

NOTE: Inlet vane weights will vary from 38 to 93 pounds per fan.

NOTE: Units with Delta-Flo coils will weigh approximately 10% lighter than standard coil weights.

TABLE 2 - Approximate Motor Weights*

Motor Horsepower	¼	⅓	½	1	1½	2	3	5	7½	10	15	20	25	30	40	50	60	75
Motor Weight (Lbs.)	20	20	25	33	44	44	71	82	127	144	187	214	263	300	409	460	560	660

*Standard Open Ball Bearing T-Frame Motor.

TABLE 3 - Accessory Weights (LBS.)

UNIT SIZES	3	6	7	8	9	10	12	14	17	21	25	31	35	41	50	63	73	86
Flat Filter Box																		
Throwaway	28	38	42	45	54	68	73	76	92	113	120	135	170	180	210	335	388	457
Low Velocity Permanent	33	47	52	56	67	84	91	97	117	145	155	183	222	234	284	426	494	582
High Velocity Permanent	51	63	69	75	91	108	120	131	156	193	207	257	306	338	365	582	674	794
Medium Filter Box																		
Throwaway	76	101	131	144	167	171	178	228	247	303	324	355	370	456	520	565	655	775
Low Velocity Permanent	84	117	149	162	191	195	204	260	284	348	373	413	429	546	631	695	805	950
High Velocity Permanent	96	141	181	190	227	231	248	312	347	428	456	513	557	706	799	935	1,085	1,275
High Capacity Box																		
Throwaway	111	148	155	170	180	192	229	260	278	330	398	425	470	535	590	680	788	928
Low Velocity Permanent	120	166	184	194	208	223	261	305	324	393	468	512	574	660	735	865	1,002	1,180
High Velocity Permanent	136	198	217	230	257	271	317	360	396	489	576	648	742	852	950	1,160	1,344	1,583
Roll Filter	80	114	—	142	—	158	187	204	219	250	290	363	430	475	500	750	870	1,025
Comb. Filt./Mix Box																		
Throwaway	115	168	200	248	255	286	300	215	358	400	490	620	710	790	885	1,133	1,310	,550
Low Velocity Permanent	122	184	217	266	279	310	324	345	393	441	540	686	780	874	997	1,165	1,465	1,730
High Velocity Permanent	134	208	249	298	315	346	368	397	456	521	635	786	906	1,035	1,265	1,505	1,740	2,060
Deluxe Comb. Filter/Mix Box																		
Throwaway	193	240	263	352	369	376	407	474	501	586	604	732	986	—	—	—	—	—
Low Velocity Permanent	200	256	280	370	393	400	431	504	536	627	654	798	1,056	—	—	—	—	—
High Velocity Permanent	212	280	312	402	429	436	475	556	600	707	739	898	1,182	—	—	—	—	—
Mixing Box	82	118	122	169	175	182	256	270	319	340	380	437	519	623	750	869	1,010	1,185
High Efficiency Bag Filter																		
Filter Sections	—	—	—	191	—	227	249	319	329	403	454	592	606	682	718	751	—	—
Bag Filters	—	—	—	11	—	14	18	23	25	30	41	50	64	64	75	100	—	—
Prefilters	—	—	—	2	—	3	4	5	5	6	9	11	13	13	17	22	—	—
*Diffuser Section	—	—	—	55	—	79	84	88	107	130	138	153	191	202	232	357	—	—
External Face and Bypass	40	58	79	96	100	112	154	161	170	216	292	417	457	470	618	925	1,070	1,265
Internal Face and Bypass	30	53	74	77	92	100	109	113	124	184	223	327	334	363	441	535	620	730
Face Dampers	39	55	65	91	102	106	111	115	142	225	232	297	312	370	446	543	630	742
Straight Thru Discharge Plenum	50	65	90	100	130	110	130	150	170	180	200	300	400	400	—	—	—	—

*Weight given is sum of diffuser section, duct extension and canvas duct.

INSTALLATION

UNIT LOCATION RECOMMENDATIONS

When selecting and preparing the unit operating site, consider the following:

1. Consider the weight of the unit. Tables 1, 2 and 3 list operating weights.
2. Allow sufficient space for the recommended clearances, access panel removal, and maintenance access. Refer to Figure 2. Zero clearance to combustible materials is approved for units with or without steam or hot water heating coils.
   NOTE: For units with optional wide coil, always maintain a 2-foot clearance from coil section end panel to permanent wall or obstruction.
3. The foundation or mounting platform must be large enough to include unit and accessory dimensions, given in specific sales submittals.
4. Rubber-in-shear or spring isolators are recommended. For floor-mounted units, anchor the unit to the floor or foundation to prevent strains on the piping and ductwork.
5. Installer must provide suspension or support frame for ceiling-mounted units size 35 and larger. Use the weights given in Tables 1, 2 and 3.
6. Prepare the floor or foundation so that it is level. The unit must be mounted level to ensure proper hydronic coil drainage and condensate flow.
7. Coil piping and condensate drain requirements must be considered. For units with Type F cooling coils, the installer must provide and install a condensing unit and piping. Allow room for proper ductwork and electrical connections. Support all piping and ductwork independently of unit to prevent excess noise and vibration.
8. Optional coilless horizontal draw-thru unit sizes 3, 6, 8, 10, 14 and 21 require the contractor to field install coil in unit per COIL INSTALLATION INSTRUCTIONS given in the installation manual (included with coil shipment). On ceiling-mounted unit applications it is recommended to install coil in unit **before** hoisting unit to operating position.

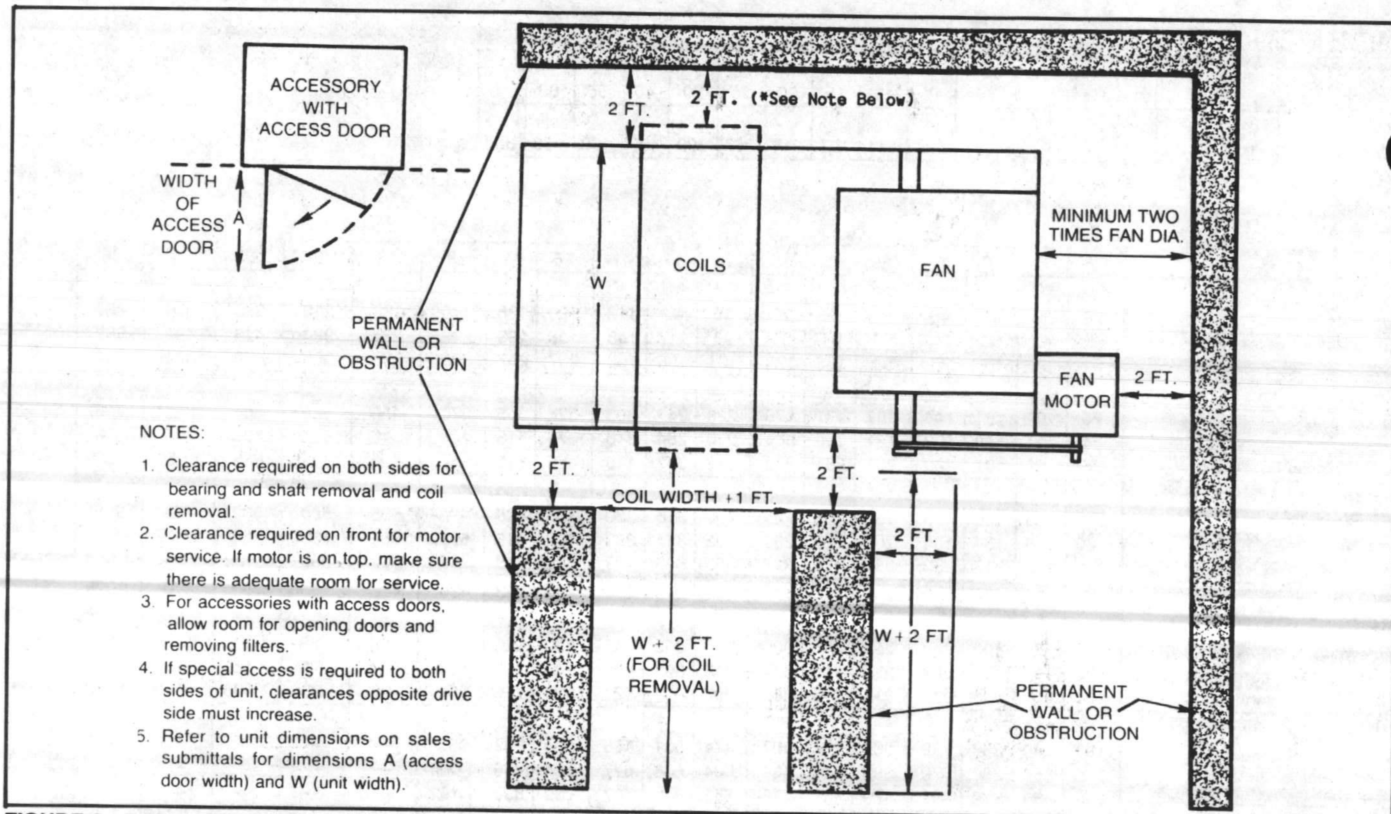


FIGURE 2 - Recommended Clearances

*NOTE FOR WIDE COIL UNITS: Always maintain a 2-foot clearance from coil section end panel to permanent wall or obstruction.

MOUNTING

VIBRATION ISOLATORS

Vibration isolators and isolator mounting legs, when supplied, are shipped with the unit and attached to the shipping skid. Locate the mounting legs at all corners of the unit or component section or at appropriate support sites. Fasten the isolators to the floor securely before mounting the unit. See Figure 3.

NOTE: *If mounting the unit on a raised platform or foundation, be sure to allow room for the mounting legs and isolators, which extend beyond the unit dimensions.*

Level the unit after installation by adjusting the isolator levelling bolts. For ceiling-mounted units, use threaded rods or adjustable isolators to level the unit.

Be sure to consider the additional unit height if isolators are used when making duct, piping and electrical connections. For large Draw-Thru and Sprayed Coil units, the coil section must be mounted on a higher base than the fan section in order to compensate for the height of the fan section isolators.

NOTE: *Non-Trane isolators must be properly sized to ensure adequate support of the unit. Allow at least 20 percent weight addition when sizing isolators.*

If using spring-type isolators, the isolator levelling bolt must be adjusted to provide adequate isolation, as unit weight may cause the upper isolator housing to rest on the lower housing. See Figure 4. Clearance B must be between 1/4-inch and 1/2-inch under full unit weight. To increase the clearance, lift the unit off the mountings and turn the levelling bolt clockwise. Recheck the unit level and shim as necessary under the isolators.

After the isolator height is adjusted correctly, adjust the horizontal snubber bolt to minimize any horizontal movements.

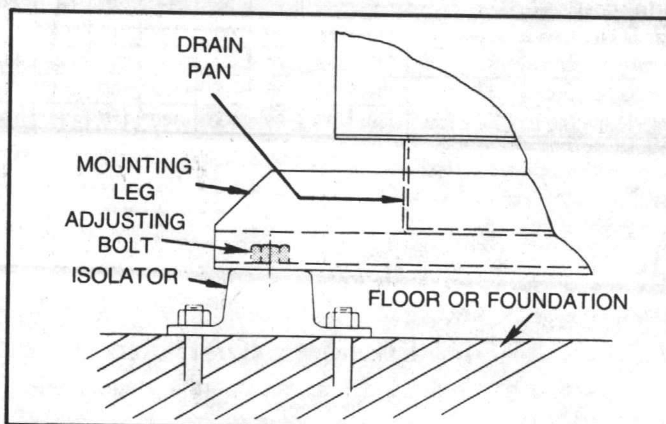


FIGURE 3 - Anchoring the Unit

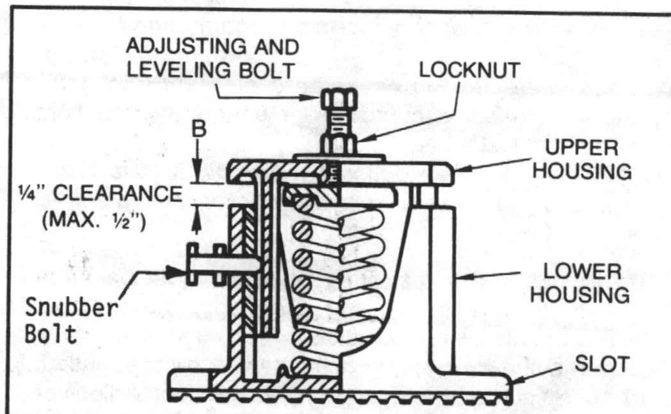


FIGURE 4 - Spring-Type Isolator Adjustment

MOUNTING — CLIMATE CHANGER AIR HANDLERS

DRAW-THRU UNITS

NOTE: No draw-thru units and or accessories have factory gasketed panels or drain pan gasketing unless specified on the order.

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL, DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

NOTE: On certain horizontal draw-thru units that ship from the factory in sections, a splash angle must be field installed connecting the coil section to the fan section. See Figure 9. The following units apply,
- Horizontal D. T. Unit size 50 (with back vertical discharge).
- Horizontal D. T. Unit Size 63 (with front or back vertical discharge).
- Horizontal D. T. Unit size 63 (with extra length casing).

NOTE: Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.

Floor-Mounted — Horizontal Unit Sizes 3-50 and Vertical Unit Sizes 3-31. Ship from factory as one assembly (Fan Section, Coil Section and Drain Pan).

NOTE: For optional coilless horizontal draw-thru units (size 3, 6, 8, 10, 14 and 21) refer to COIL INSTALLATION INSTRUCTIONS given in the installation manual to properly install coil in unit.

1. Remove the diagonal shipping angles which secure coil(s) if they interfere with the use of access doors.
2. Attach accessories, if used. Gasketing not provided unless specified on sales order.
3. Anchor the isolators to the floor and mount the unit on the isolators. See Figure 3. For some applications it may be necessary to shorten the isolator adjusting bolt to properly secure unit to isolator.
4. Level the unit for proper coil drainage and condensate removal from the drain pan.
5. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.
6. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight. Refer to the "Start-Up" section of the maintenance manual.

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

Floor-Mounted — Horizontal Unit Sizes 63-86 and Vertical Unit Sizes 35-50. Ship from factory in 2 sections, (fan section and coil section).

NOTE: On certain horizontal draw-thru units that ship from the factory in sections, a splash angle must be field installed connecting the coil section to the fan section. See Figure 9. The following units apply,
- Horizontal D. T. Unit size 50 (with back vertical discharge).
- Horizontal D. T. Unit Size 63 (with front or back vertical discharge).
- Horizontal D. T. Unit size 63 (with extra length casing).

NOTE: Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.

1. Remove the diagonal shipping angles which secure coil(s) if they interfere with the use of access doors.
2. Fasten isolators to floor.
3. Horizontal Units Size 63 — To assemble multi-section horizontal units, remove the drain pan from the coil section discharge flange and set in place. Then set the fan and coil sections on the drain pan, as shown in Figure 5. Bolt the sections together, attach gasketing if supplied. Make sure that the coil section support channels are also attached to the fan section. Mount assembled unit on isolators and fasten unit to isolators.
4. Horizontal Units Size 73 and 86 — To assemble unit, mount the fan section on the isolators and fasten. Attach flexible connector to the fan section. Then fasten the splash guard to the fan section. See Figure 8. Mount the coil section on the base with the required distance between fan and coil sections. See Figure 7. Each fan section and coil section have separate factory assembled drain pans. Each drain pan must be trapped separately.

NOTE: Coil section base is provided by the installer. Height of coil section base should be equal to working height of fan section isolators. Be sure the base is high enough to allow room for a piping trap. See Figure 7. Refer to drain trap sketches in piping section.

Attach flexible connection to the coil section.

Fasten splash guard to coil section. Panel removal may be necessary to attach splash guard to coil section on size 86 units.

5. Vertical Units Size 35-50 — To assemble multi-section vertical discharge units, attach the fan section to the top of coil section. Removal of front panel on coil section is necessary to assemble fan section. Install gasketing if supplied. Drain pan is factory assembled to coil section. Mount assembled unit on isolators and fasten unit to isolators. See Figure 6.
6. Attach accessories, if used. Gasketing not provided unless specified on sales order.
7. Level the unit, fan and or coil sections to assure proper coil drainage and removal of condensate from the drain pan.

8. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.

9. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.

Floor-Mounted — Horizontal and Vertical Spray Coil Unit Sizes 3-31. Ship from factory as one assembly (Fan Section, Coil Section and Drain Pan).

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

NOTE: *The complete spray section is gasketed on all vertical and horizontal sizes. Also, the factory installs a gasket at the joint between the spray section and coil section.*

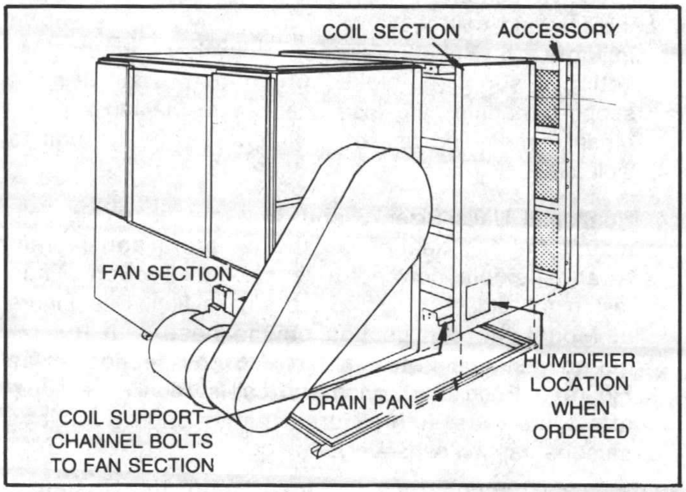


FIGURE 5 - Exploded View of the Horizontal Draw-Thru Unit Size 63

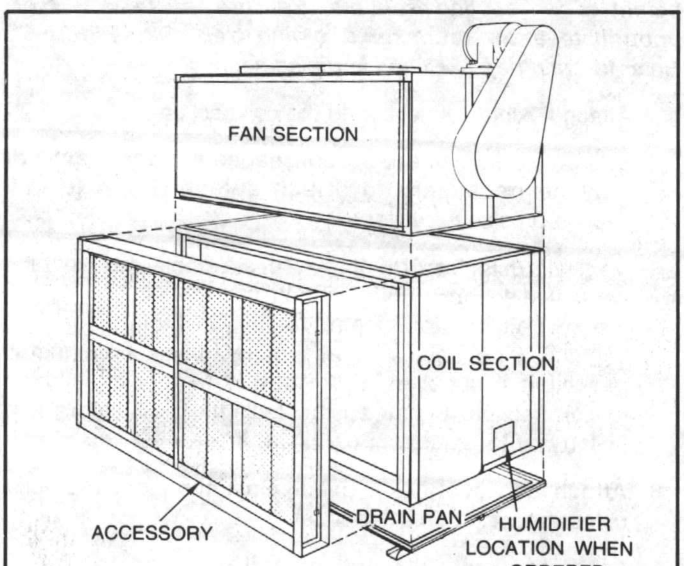


FIGURE 6 - Exploded View of the Vertical Draw-Thru Unit Sizes 35 through 50

NOTE: *Check the bearing, and sheave setscrews for proper torque settings. Refer to Applicable section in this manual.*

1. Remove the diagonal shipping angles which secure coil(s) if they interfere with the use of access doors.

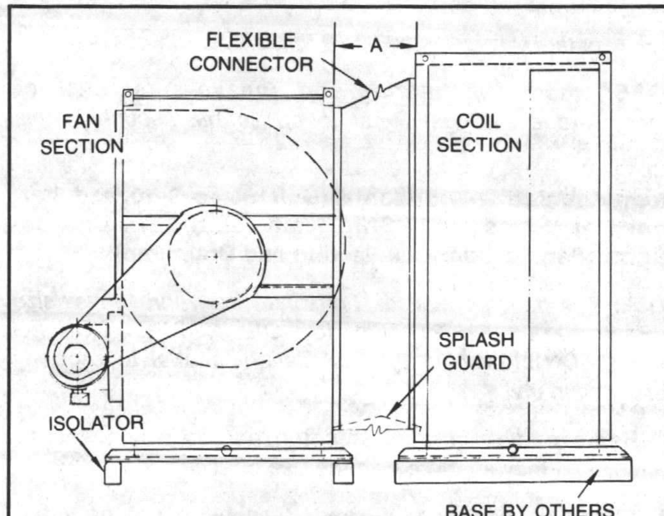
2. Attach accessories, if used. Gasketing not provided unless specified on sales order.

3. Anchor the isolators to the floor and mount the unit on the isolators. See Figure 3. For some applications it may be necessary to shorten the adjusting bolt to properly secure unit to isolator.

4. Level the unit for proper coil drainage and condensate removal from the drain pan. On horizontal units the drain pan empties back into the sump.

5. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.

6. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight. Refer to the "Start-Up" section of this manual.



UNIT SIZE	A
73	9"
86	24"

FIGURE 7 - Mounting Clearance Dimensions for Draw-Thru Units Sizes 73-86

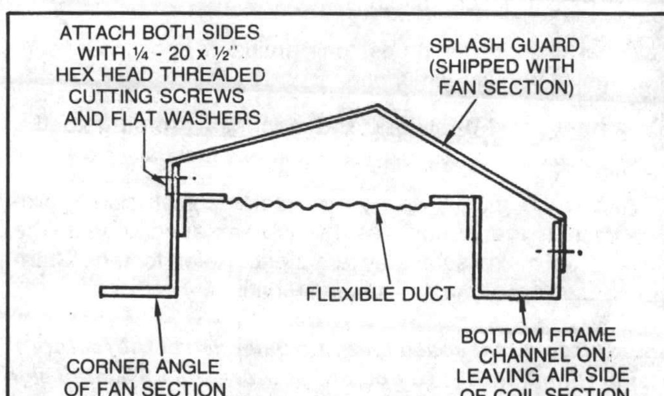


FIGURE 8 - Splash Guard Installation

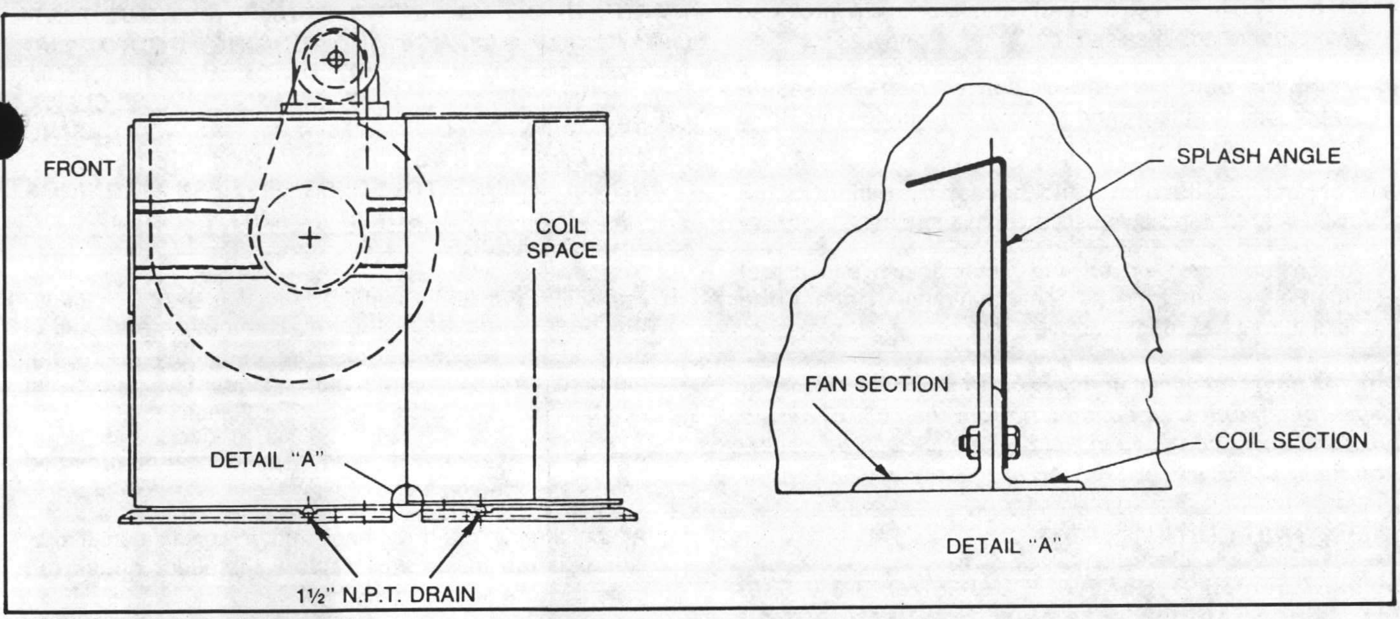


FIGURE 9 - Splash Angle Installation

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

Floor-Mounted — Vertical Spray Coil Unit Sizes 35-50 ship from factory in 2 sections (fan section, coil section). Horizontal Spray Coil Unit Sizes 35-63 ship from factory in 3 sections (coil section, fan section, fan drain pan section). Horizontal Spray Coil Unit Sizes 73-86 ship from factory in 2 sections (fan section, coil section).

Note: The complete spray section is gasketed on all vertical and horizontal sizes. Also, the factory installs a gasket at the joint between the spray section and coil section.

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Remove the diagonal shipping angles which secure coil(s) if they interfere with the use of access doors.
2. Fasten isolators to floor.
3. Horizontal Units Size 35-63 — Attach the spray section to isolators. Fasten the two mounting legs to the fan section drain pan. Set the fan section on the drain pan and bolt in place. Attach the drain pan and fan section to the spray section. See Figure 10.
4. Horizontal Units Size 73 and 86 — To assemble unit, mount the fan section on the isolators and fasten. Attach flexible connector to the fan section. Mount the coil section on the base with the required distance between fan and coil sections. See Figure 7. Drain pan is factory assembled to each section.

NOTE: *Coil section base is provided by the installer. Height of coil section base should be equal to working height of fan section isolators. Be sure the base is high enough to allow room for a piping trap. See Figure 7. Refer to drain trap sketches in piping section.*

Attach flexible connection to the coil section.

5. Vertical Units Size 35-50 — Set the spray section over the isolators and bolt together. Place the fan section on top of the coil section and bolt together. Gasketing not provided between fan section and coil section unless specified on the sales order. Drain pan (sump assembly) is factory assembled to spray coil section.

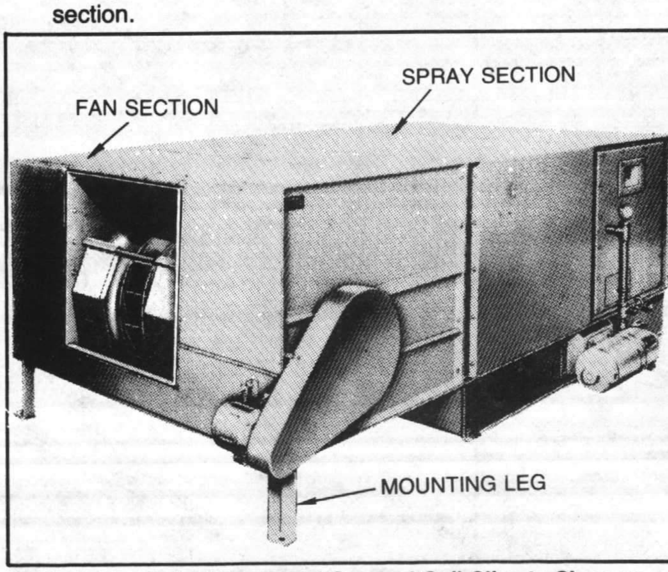


FIGURE 10 - Typical Horizontal Sprayed Coil Climate Changer

6. Attach accessories, if used. Gasketing not provided unless specified on sales order.

7. Level the unit, fan and or coil sections to assure proper coil drainage and removal of condensate from the drain pan.

8. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.

9. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

DRAW-THRU UNITS

Ceiling-Mounted — Horizontal Unit Sizes 3-31. Ship from factory as one assembly (Fan Section, Coil Section and Drain Pan).

NOTE: *For optional coilless horizontal draw-thru units (size 3, 6, 8, 10, 14 and 21) refer to COIL INSTALLATION INSTRUCTIONS given in CLCH-IN-1 to properly install coil in unit. On ceiling-mounted unit applications it is recommended to install coil in unit* ***before*** *hoisting unit to operating position.*

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

Note: *All ceiling suspended units with wide coil application* ***must*** *use a cradle (angle iron). See Figure 11A for details.*

Note: *Because of their weight, unit sizes 3-31 (wide coil only) and 35-86 (wide coil and standard units) require suspension support frames, to be provided by the installer. Figures 11A, 12 and 13 give the configuration and dimension of these frames. Note that two frames are required for sizes 73 and 86. See Figure 13.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Determine the unit mounting hole dimensions. Prepare the hanger rod and isolator assemblies and install them in the selected area. Threaded rods are recommended for leveling the unit. Tables 1, 2 and 3 list approximate operating weights. See Figure 11.

2. Attach accessories, if used. Gasketing not provided unless specified on sales order.

3. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

NOTE: *Check to determine that the motor is clean and dry prior to start-up.*

4. Hoist the unit to the hanger or suspension rods and attach. See Figure 11.

5. Level the unit for proper coil drainage and condensate removal from the drain pan. Refer to drain trap sketches in piping section.

6. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual. Isolate piping separately.

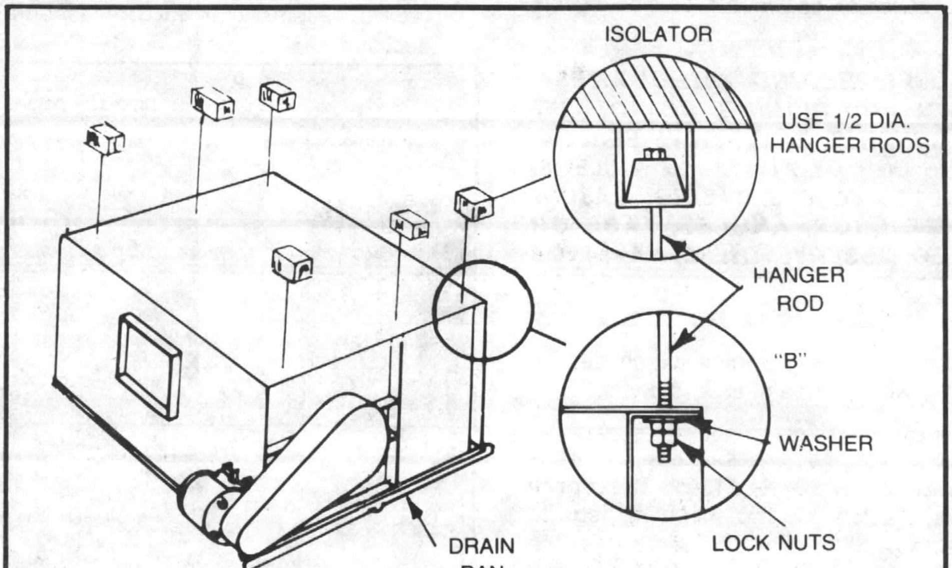
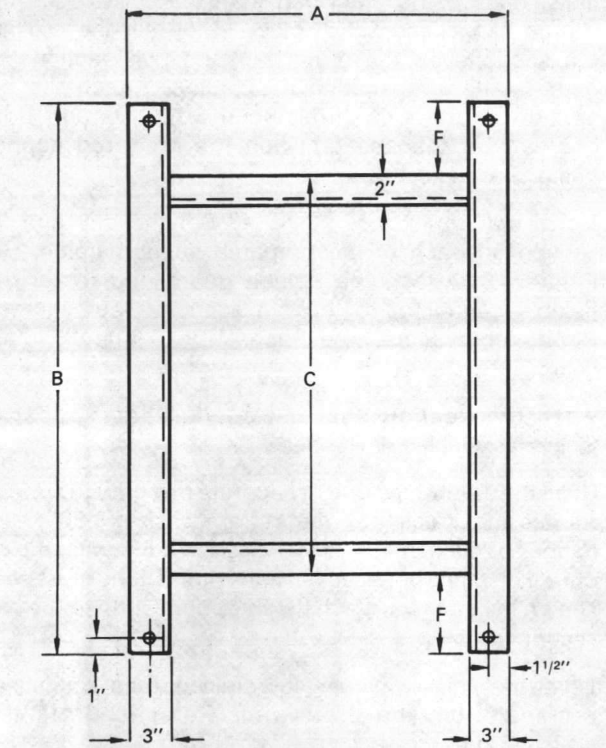


FIGURE 11 - Suspension Method for Horizontal Units Up to Size 31



Vertical Dimensions (Inches) With Wide Coil

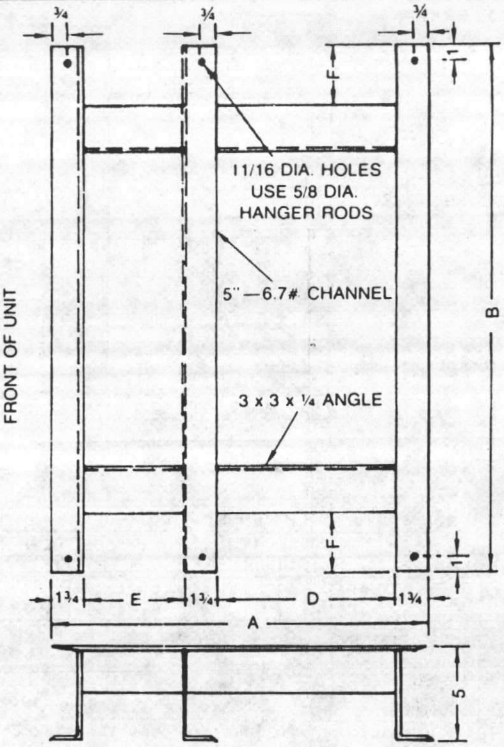
UNIT SIZE	A	B	C	F
3	$23\frac{7}{8}$	54	34	10
6	$23\frac{7}{8}$	75	55	10
8	$28\frac{7}{8}$	66	46	10
10	$28\frac{7}{8}$	75	55	10
12	$32\frac{7}{8}$	81	61	10
14	$32\frac{7}{8}$	90	70	10
17	$32\frac{7}{8}$	111	91	10
21	$36\frac{7}{8}$	129	109	10
25	$42\frac{7}{8}$	135	115	10
31	$42\frac{7}{8}$	135	115	10

Horizontal Dimensions (Inches) With Wide Coil

UNIT SIZE	A	B	C	F
3	$32\frac{3}{4}$	54	34	10
6	$34\frac{3}{4}$	75	55	10
8	$44\frac{3}{4}$	66	46	10
10	$44\frac{3}{4}$	75	55	10
12	$48\frac{3}{4}$	81	61	10
14	$48\frac{3}{4}$	90	70	10
17	$48\frac{3}{4}$	111	91	10
21	$52\frac{3}{4}$	129	109	10
25 Arr. 1 & 2	$52\frac{3}{4}$	135	115	10
25 Arr. 3 & 4	$58\frac{3}{4}$	135	115	10
31 Arr. 1 & 2	$52\frac{3}{4}$	135	115	10
31 Arr. 3 & 4	$58\frac{3}{4}$	135	115	10

Figure 11A — Ceiling Suspension Mounting Frame and Dimensions for Wide Coil Unit Sizes 3 thru 31.

CEILING-MOUNTED — Horizontal Unit Sizes 35-50 ship from factory as one assembly (fan section, coil section, and drain pan). Horizontal Unit Sizes 63-86 ship from factory in 2 sections (fan section and coil section).



UNIT SIZE	DIMENSIONS (INCHES) A	B	D	E	F
#35	$79\frac{1}{2}$	$132\frac{5}{8}$	$40\frac{1}{16}$	$34\frac{3}{16}$	$10\frac{1}{2}$
#41	$84\frac{1}{2}$	$135\frac{5}{8}$	$43\frac{1}{16}$	$36\frac{3}{16}$	$10\frac{1}{2}$
#50	$90\frac{1}{2}$	$135\frac{5}{8}$	$46\frac{1}{16}$	$39\frac{3}{16}$	$10\frac{1}{2}$
#63	$97\frac{1}{2}$	$143\frac{5}{8}$	$50\frac{1}{16}$	$42\frac{3}{16}$	$14\frac{1}{2}$

DIMENSIONS (INCHES) WITH WIDE COIL

UNIT SIZE	A	B	D	E	F
35	$79\frac{1}{2}$	$149\frac{5}{8}$	$40\frac{1}{16}$	$34\frac{3}{16}$	$19\frac{1}{2}$
41	$84\frac{1}{2}$	$159\frac{5}{8}$	$43\frac{1}{16}$	$36\frac{3}{16}$	$22\frac{1}{2}$
50	$90\frac{1}{2}$	$159\frac{5}{8}$	$46\frac{1}{16}$	$39\frac{3}{16}$	$22\frac{1}{2}$
63	$97\frac{1}{2}$	$152\frac{5}{8}$	$50\frac{1}{16}$	$42\frac{3}{16}$	$19\frac{1}{2}$

NOTE: Above sketch does not apply to Sprayed Coil Units.

FIGURE 12 - Ceiling Suspension Mounting Frame and Dimensions for Unit Sizes 35 to 63

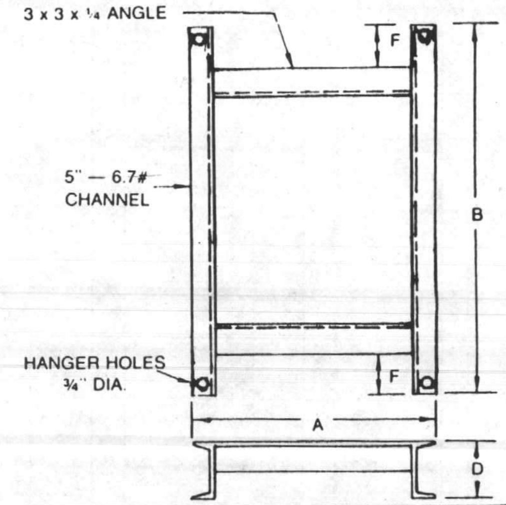
NOTE: *On certain horizontal draw-thru units that ship from the factory in sections, a splash angle must be field installed connecting the coil section to the fan section. See Figure 9. The following units apply,*

- Horizontal D. T. Unit size 50 (with back vertical discharge).

- Horizontal D. T. Unit Size 63 (with front or back vertical discharge).

- Horizontal D. T. Unit size 63 (with extra length casing).

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL, DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.



	DIMENSIONS (INCHES)							
	COIL SECTION				FAN SECTION			
UNIT SIZE	A	B	D	F	A	B	D	F
73	51	129-3/8	5	3-1/2	61	150-5/8	5	18
86	51	151-5/8	5	3-1/2	61	150-5/8	5	18

DIMENSIONS (INCHES) WITH WIDE COIL				
UNIT SIZE	A	B	D	F
73	51	146 3/8	5	12
86	51	168 5/8	5	12

NOTE: Fan section dimensions are same for std. units and/or units with wide coil.

FIGURE 13 - Ceiling Suspension Mounting Frame and Dimensions for Unit Sizes 73 and 86 (Two Frames are Required for Each Unit)

1. Determine the unit mounting hole dimensions. Prepare the hanger rod and isolator assemblies and install them in the selected area. Threaded rods are recommended for leveling the unit. Tables 1, 2 and 3 list approximate operating weights.
2. Remove the diagonal shipping angles which secure coil(s) if they interfere with the use of access doors.
3. Attach accessories, if used. Gasketing not provided unless specified on the sales order.
4. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight. Refer to the "Start-Up" section of the maintenance manual.

***Note:** All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.*

***NOTE:** Check to determine that the motor is clean and dry prior to start-up.*

5. Horizontal Unit Sizes 3-50 — Attach the coil section support channels to the fan section base angles. Set the assembly on the prepared support frame. Reference Figures 11A and 12.
6. Horizontal Unit Size 63 — To assemble multi-section units, remove the drain pan from the coil section discharge flange and set in place. Then set the coil and fan sections on the drain pan and bolt sections together, attach gasketing if supplied. Attach the coil section support channels to the fan section base angles. Set the assembly on the prepared support frame. See Figure 12.
7. Horizontal Unit Sizes 73-86 — Set the coil and fan section on each of the prepared support frame. See Figure 13. Attach the splash guard and fasten the flexible connector to the fan section. See Figure 8. Panel removal may be necessary to attach splash guard.

   Each fan section and coil section have separate factory assembled drain pans.
8. Hoist the assembled unit or separate pieces with support frames and attach the support frames (sizes 3-86) to the hanger or suspension rods. For size 73-86 units, the required distance between fan and coil sections must be as shown in Figure 7. Attach flexible connection to the coil section.
9. Level the unit for proper coil drainage and condensate removal from the drain pan. Refer to drain trap sketches in piping section.
10. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual. Isolate piping separately.

BLOW-THRU UNITS

Floor-Mounted — Three-Deck Unit Sizes 6-25 and Multizone Unit Sizes 6-31 ship from factory as one assembly (fan section, coil section w/drain pan and zone damper section).

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

***NOTE:** Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

1. Fasten isolators to the floor.
2. Mount the unit on the isolators and fasten.
3. Install accessories.
4. Level the unit for proper coil drainage and condensate removal from the drain pan.
5. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.

   ***NOTE:** See Figure 30 for duct installation.*

6. *Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.*

Floor-Mounted — Multizone Blow-Thru Unit Sizes 35-41 and Three Deck Unit Sizes 31-35 ship from factory in 3 sections (coil section, fan section and zone damper section).

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Fasten isolators to floor.
2. If ordered, mount zone damper assembly to discharge opening of coil section. First remove shipping angle in discharge opening. Attach zone damper with gasketing factory provided. Attach splitter panel (dividing plate) to zone damper. Gasketing not provided for dividing plate.

CAUTION: When installing the damper assembly to the hot deck and bypass section, make sure it is mounted squarely, otherwise the damper blades may twist and fail to operate.

3. Remove the 90° cover panel.
4. Apply gasketing to the fan section mounting flange.
5. Set the assembled coil and damper sections on the isolators and fasten in place.
6. Gain access thru the 90° cover panel (removed previously) and bolt the fan section to the coil section through the gasketing. Be sure to bolt the fan section to the tie angle assembly, mounted on the coil section.

NOTE: *Horizontal bolting across top and bottom of fan section to coil section require internal access through the 90° cover panel. Vertical bolting along side of fan section to coil section does not require internal access.*

7. Apply gasketing to the 90° cover panel.
8. Attach the coil section 90° cover panel.
9. Install accessories.
10. Level the unit for proper coil drainage and condensate removal from the drain pan.
11. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.

NOTE: *See Figure 30 for duct installation.*

12. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

Floor-Mounted — Multizone Blow-Thru Unit Sizes 50-63 ship from factory in 4 sections (fan section, cooling coil section, heating coil section and zone damper section). Refer to Figure 15.

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Fasten isolators to floor.
2. Remove the shipping angles attached to the front or top of the coil section.
3. Vertical Discharge Units: Place hot deck on top of cold deck and bolt in place with gasketing factory provided. The front panel of coil section ships attached across the discharge opening. It must be removed and installed with gasketing to the front of the coil section. (This does not apply to horizontal discharge units.) Next, bolt the splitter panel (dividing plate) to the panel over the cooling coil.
4. Horizontal Discharge Units: Place the hot deck on top of cold deck and bolt in place with gasketing factory provided. Next, bolt the splitter panel (dividing plate) to the panel over the cooling coil.
5. Apply gasketing to the damper section or double-duct frame. Refer to Figure 14. Gasketing is not required at the center of the damper section where the dividing plate will be fastened.
6. Assemble the damper or double duct frame to the coil section bolting through the gasketing.

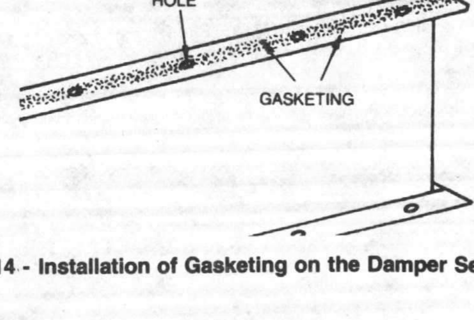


FIGURE 14 - Installation of Gasketing on the Damper Section

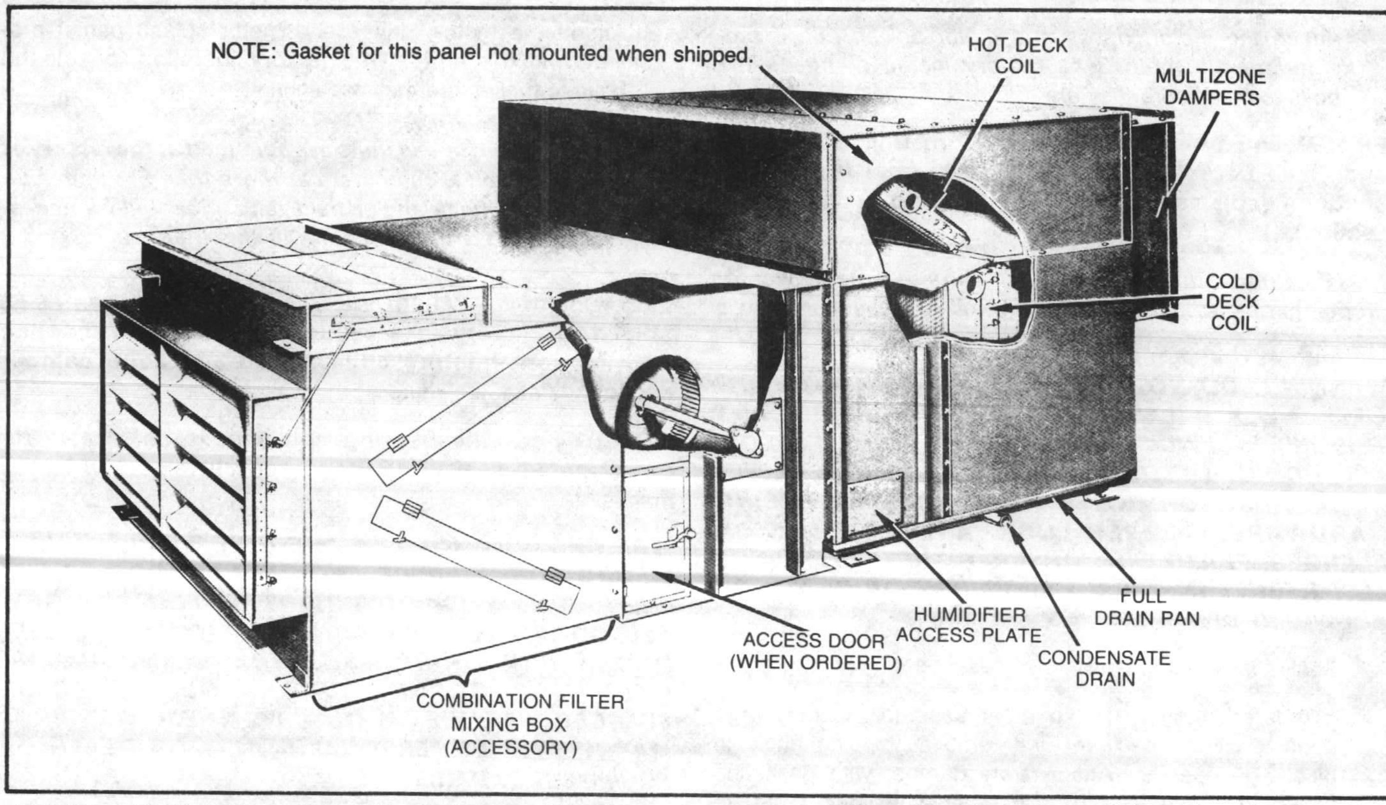


FIGURE 15 - Multizone Blow-Thru Climate Changers

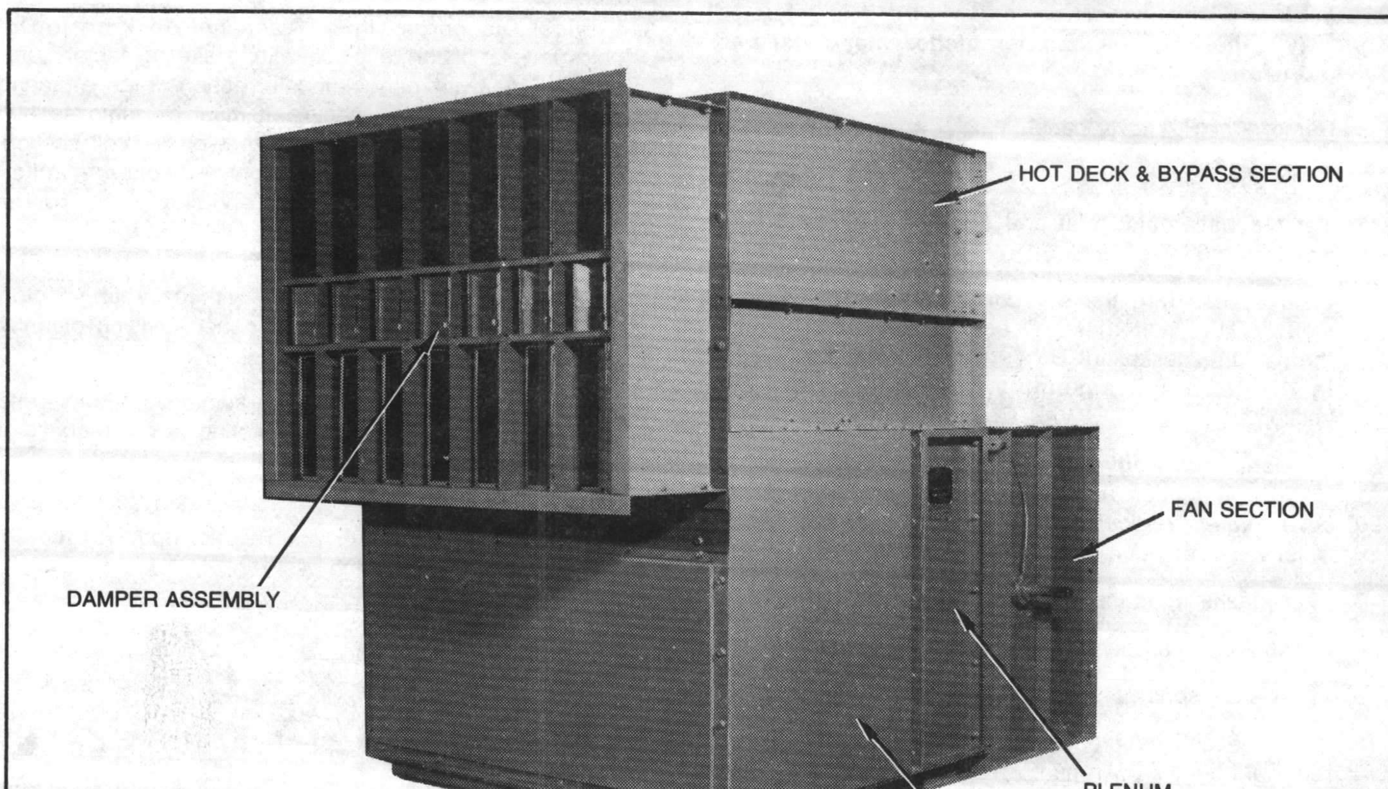


FIGURE 16 - Typical Three Deck Horizontal Discharge Climate Changer

CAUTION: When installing the damper assembly to the hot deck and bypass section, make sure it is mounted squarely, otherwise the dampers may twist and fail to operate.

7. Bolt the hot and cold deck dividing plate to the center of the damper section.
8. Remove the 90° cover panel of the coil section.
9. Apply gasketing to the fan section mounting flange. Set the assembled coil and damper sections on the isolators and fasten in place.
10. Gain access thru the 90° cover panel (removed previously) and bolt the fan section to the coil section through the gasketing. Be sure to bolt the fan section to the tie angle assembly mounted on the coil section.

Note: Horizontal bolting across top and bottom of fan section to coil section requires internal access through the 90° cover panel. Vertical bolting along side of fan section to coil section does not require internal access.

11. Apply the gasketing to the 90° cover panel.
12. Attach the coil section 90° cover panel.
13. Install accessories.
14. Level the unit for proper coil drainage and condensate removal from the drain pan.
15. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.
16. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight. Refer to the "Start-Up" section of this manual.

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

Floor-Mounted — Three Deck Blow-Thru Unit Sizes 41-63 ship from factory in 4 sections (cooling coil section, fan section, vent and heating coil section, and zone damper section). See Figure 16 for assembly.

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Fasten the isolators to the floor.
2. With gasketing applied to the top of the cooling coil section, mount the hot deck and bypass section to the cooling coil section. Bolt the bypass deck divider plate to the panel over the cooling coil.
3. Remove the shipping angles used to support the hot deck and bypass zone divider plates.
4. Vertical Discharge Units — Apply gasketing to the mounting flange of the fill-in section and mount the fill-in section to the cooling, bypass and hot deck section.
5. Apply gasketing to the damper assembly. See Figure 14. Gasketing is not required at the center of the damper section where the divider plate will be fastened.
6. Attach the damper section to the coil section, bolting through the gasketing.

CAUTION: When installing the damper assembly to the hot deck and bypass section, make sure it is mounted squarely, otherwise the damper blades may twist and fail to operate.

NOTE: *Be sure control rods are in correct position.*

7. Bolt the hot deck and bypass zone divider plates to the center dividers of the damper assembly. These must be bolted from the hot deck and cold deck side only. Gasketing not required.
8. Remove the 90° cover panel of the coil section.
9. Apply gasketing around the fan section mounting flange.
10. Set the assembled coil and damper sections over the isolators. Fasten in place.
11. Gain access thru the 90° cover panel (removed previously) and bolt the fan section to the coil section through the gasketing. Be sure to bolt the fan section to the tie angle assembly mounted on the coil section.

NOTE: *Horizontal bolting across top and bottom of fan section to coil section require internal access through the 90° cover panel. Vertical bolting along side of fan section to coil section does not require internal access.*

12. Apply the gasketing to the 90° cover panel.
13. Attach the coil section 90° cover panel.
14. Attach any accessories.
15. Level the unit for proper coil drainage and condensate removal from the drain pan.
16. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.
17. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight. Refer to the "Start-Up" section of this manual.

Floor-Mounted — Multizone Blow-Thru Unit Sizes 73-86 ship from factory in 6 sections (fan section, cooling coil section, heating coil section, canvas duct section, inlet panel (size 73), extended plenum (size 86), and either double duct frame section or zone damper section).

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Fasten isolators to the floor.
2. Remove the shipping angles attached to the front or top of the coil section.
3. Vertical Discharge Units: Place hot deck on top of cold deck and bolt in place with gasketing, factory provided. The front panel of coil section ships attached across the discharge opening. It must be removed and installed with gasketing to the front of the coil section. (This does not apply to horizontal discharge units.) Next, bolt the splitter panel (dividing plate) to the panel over the cooling coil.
4. Horizontal Discharge Units: Place the hot deck on top of cold deck and bolt in place with gasketing factory provided. Next, bolt the splitter panel (dividing plate) to the panel over the cooling coil.
5. Apply gasketing to the damper section or double-duct frame. Refer to Figure 14. Gasketing is not required at the center of the damper section where the dividing plate will be fastened.
6. Assemble the damper or double duct frame to the coil section bolting through the gasketing.

CAUTION: When installing the damper assembly to the hot deck and bypass section, make sure it is mounted squarely, otherwise the damper blades may twist and fail to operate.

7. Bolt the hot and cold deck dividing plate to the center of the damper section.
8. Attach inlet panel (size 73) or extended plenum (size 86) to coil section inlet with gasketing, factory provided. Bolting for these sections is accomplished from exterior of the unit. See Figure 17.
9. Attach flex connector between fan section and coil section (size 73). Attach flex connector between fan section and extended plenum coil section (size 86). Refer to Figure 17 for dimensions.
10. Level the unit, fan and/or coil sections to assure proper coil drainage and removal of condensate from the drain pan.
11. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.
12. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.

NOTE: *All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% design rpm a balance check and/or field rebalance will be necessary. Refer to the "Start-Up" section.*

HIGH PRESSURE CLIMATE CHANGER — ALL SIZES

NOTE: *Check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.*

WARNING: DO NOT LIFT THE UNIT WITHOUT TEST-LIFTING FOR BALANCE AND RIGGING. DO NOT LIFT THE UNIT IN WINDY CONDITIONS OR ABOVE PERSONNEL. DO NOT LIFT THE UNIT BY ATTACHING A CLEVIS, HOOKS, PINS OR BOLTS TO THE CASING, CASING HARDWARE, CORNER LUGS, ANGLES, TABS OR FLANGES. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY OR DEATH OR EQUIPMENT DAMAGE.

1. Attach the mounting legs (Spray Coil Units only) and spring isolators to the fan section, as illustrated in Figure 18.
2. Set the fan section in place and fasten isolators to the floor.
3. Blow-Thru Units — Apply factory provided gasketing to the sections where canvas duct is to be attached.
4. Set the coil section in place. Attach the flexible connection. Place the bottom flange of the flexible connection in the V channel of the coil section.
5. Attach the splash guard to the bottom of the fan inlet opening, as in Figure 8.
6. Attach flexible connection to the fan section. Place the bottom flange of the flexible connection in the V channel of the fan section. Tighten bolts from exterior of the unit.
7. Blow-Thru Units — Attach horizontal tension restraints (installer-supplied) to the coil section. Span the flexible connection and anchor the restraints to the fan section. See Figure 17. These restraints will counteract reaction forces due to airflow and will relieve pressure from the flexible connection.
8. Install accessories.
9. Level the unit, fan and/or coil sections to assure proper coil drainage and removal of condensate from the drain pan.
10. Connect the ductwork and necessary piping to the unit. Refer to applicable section in this manual.
11. Attach the motor, drives and motor splash pan if provided. If the motor was factory installed, check the bolts to make sure they are tight.

Note: All constant speed units are balanced at the factory at design rpm. If unit is to operate at more than 5% of design rpm a balance check and/or field rebalance will be necessary. Refer to "Start-Up" section in this manual.

DISTANCE BETWEEN FAN & COIL SECTIONS	
SIZE 73 — 1'-2 13/16"	SIZE 86 — 3'-4 1/4"

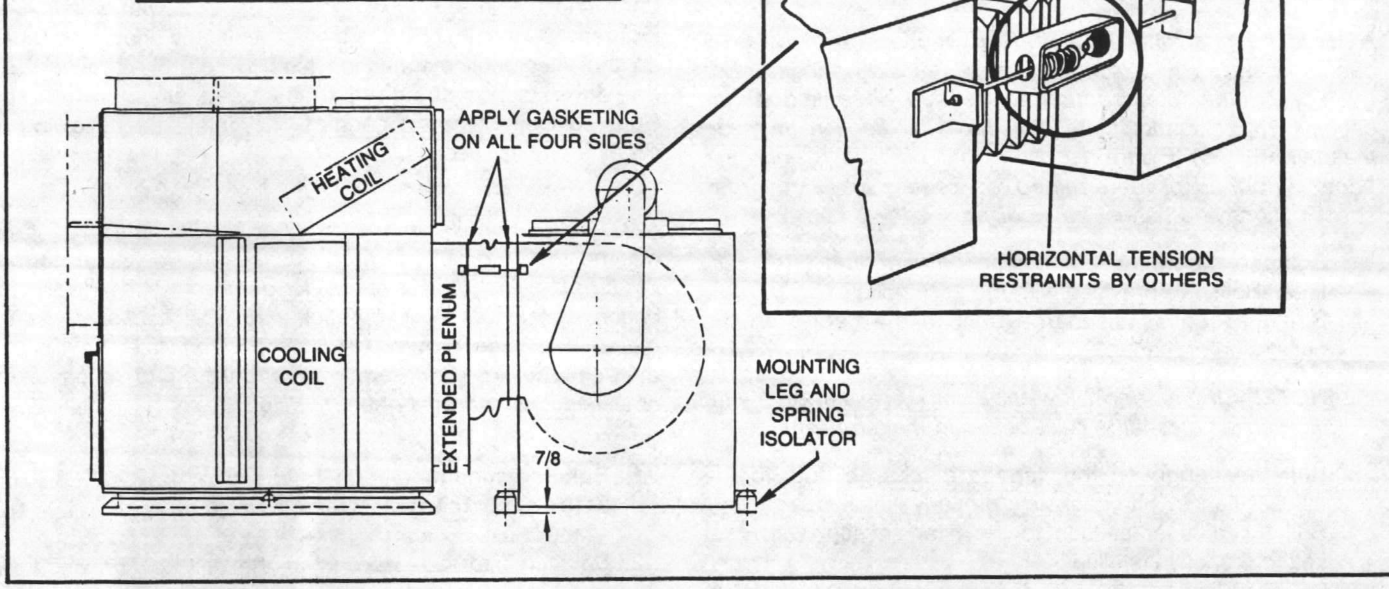


FIGURE 17 - Fan and Coil Section Ductwork Connections for Blow-Thru High Pressure Units

ACCESSORIES

Matching bolt holes are provided on all accessories for attachment to the unit or to other accessories. Mounting hardware is shipped with each accessory. Mounting legs on filter boxes and mixing boxes are to be attached to isolators and fastened to the floor or suspension device.

HIGH EFFICIENCY BAG FILTER

Before installing the bag filter accessory, be sure adequate clearance is provided to open the filter box and remove filters. Four feet of clearance on the access side of the filter section is recommended. Table 3 lists filter, filter section and diffuser section weights.

The high efficiency bag filter can be used as a prefilter when placed on the inlet side of the fan, a final filter when placed on the outlet of the fan, or as both when placed in both locations. When used as a prefilter, the canvas duct and diffuser sections are not used, but isolators should be installed by the contractor to ease vibration. When used as a final filter, the canvas duct and diffuser sections are used, but isolators are not required. Installation instructions for both applications follow.

NOTE: *The high efficiency bag filters can be operated at up to 100 percent relative humidity, but must not make direct contact with water droplets. Care must be taken to ensure that these filters are not used as prefilters with Sprayed Coil Climate Changers and to avoid water carry-over in standard units.*

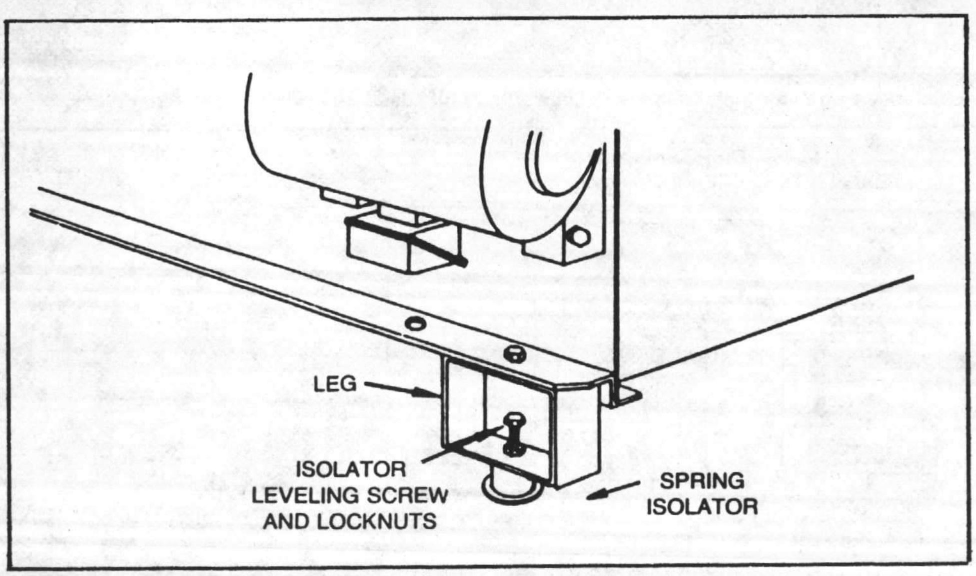


FIGURE 18 - Attaching the Mounting Leg and Spring Isolator to the High Pressure Sprayed Coil Unit

Final Filter Section

When the high efficiency bag filter is used as a final filter, it must be mounted on the outlet side of the fan with the canvas duct and diffuser sections, as shown in Figures 19 and 20. Complete the following to install the final filter section:

NOTE: *The final filter and prefilter section on sizes 6-86 can be installed with a right side or left side access door by flipping the filter section to desired access door location. Proper air flow direction thru filter section must be maintained. See Figure 19. Note that on size 3 units the access door is predetermined according to sales order specifications and cannot be modified.*

1. Bolt the mounting legs to the diffuser and filter sections. Bolts are provided with the assemblies.
2. Bolt the canvas discharge duct to the flange on the outlet side of the fan.

   NOTE: *Single-zone blow-thru units are shipped with the canvas discharge duct bolted to the fan flange.*

3. Bolt the flange on the canvas discharge duct to the diffuser flange, with gasketing properly installed.
4. Bolt the diffuser section to the filter section, with gasketing properly installed.
5. For U.L. listed units, the canvas discharge duct is not provided. Install a field-provided connector which meets the requirements of NFPA 90A Sect. 2.1.1 to 2.1.2.3.
6. Level the unit.

Prefilter Section

When the high efficiency bag filter is to be used as a prefilter, it must be mounted to the coil section of a draw-thru unit or to the inlet side of the fan on a blow-thru unit. See Figures 19 and 20. Field-supplied isolators should be used on the filter section mounting legs to control vibration. The bag filter is not designed to be used as a prefilter on Sprayed Coil Climate Changers. Complete the following to install a prefilter section:

NOTE: *The final filter and prefilter section on sizes 6-86 can be installed with a right side or left side access door by flipping the filter section to desired access door location. Proper air flow direction thru filter section must be maintained. See Figure 19. Note that on size 3 units the access door is predetermined according to sales order specifications and cannot be modified.*

1. Bolt the mounting legs to the filter box section and attach isolators. Bolts are provided with the assemblies.
2. Bolt the filter box section to the coil section on draw-thru units, or to the fan inlet with gasketing installed on blow-thru units.
3. Level the unit.

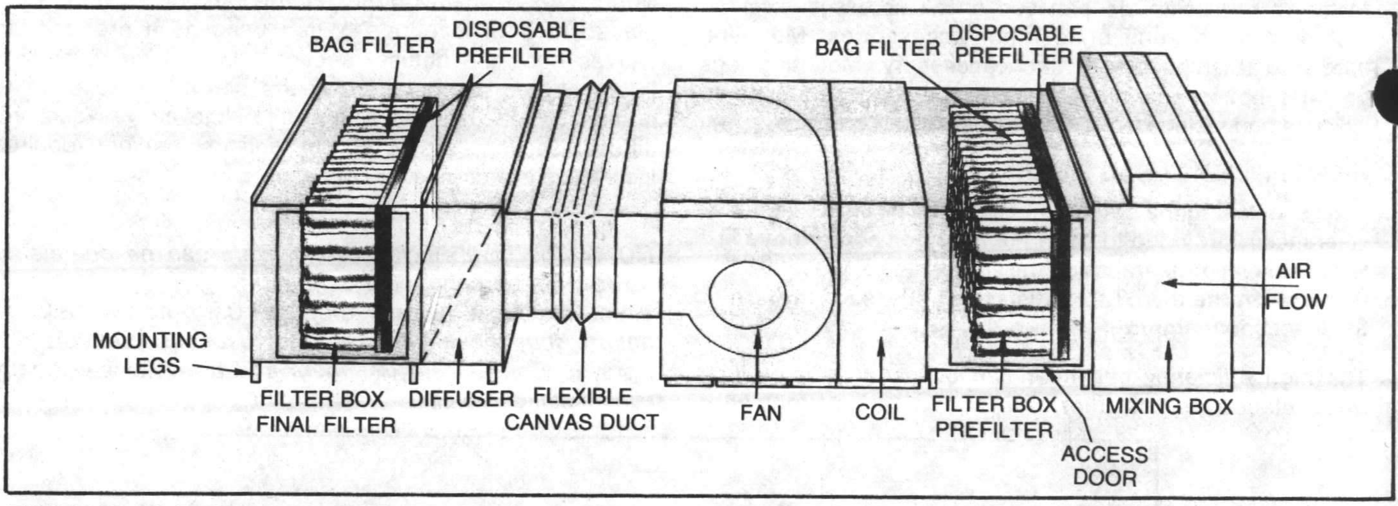


FIGURE 19 - High Efficiency Bag Filter Installation with Draw-Thru Unit (Used as Pre-Filter and Final Filter)

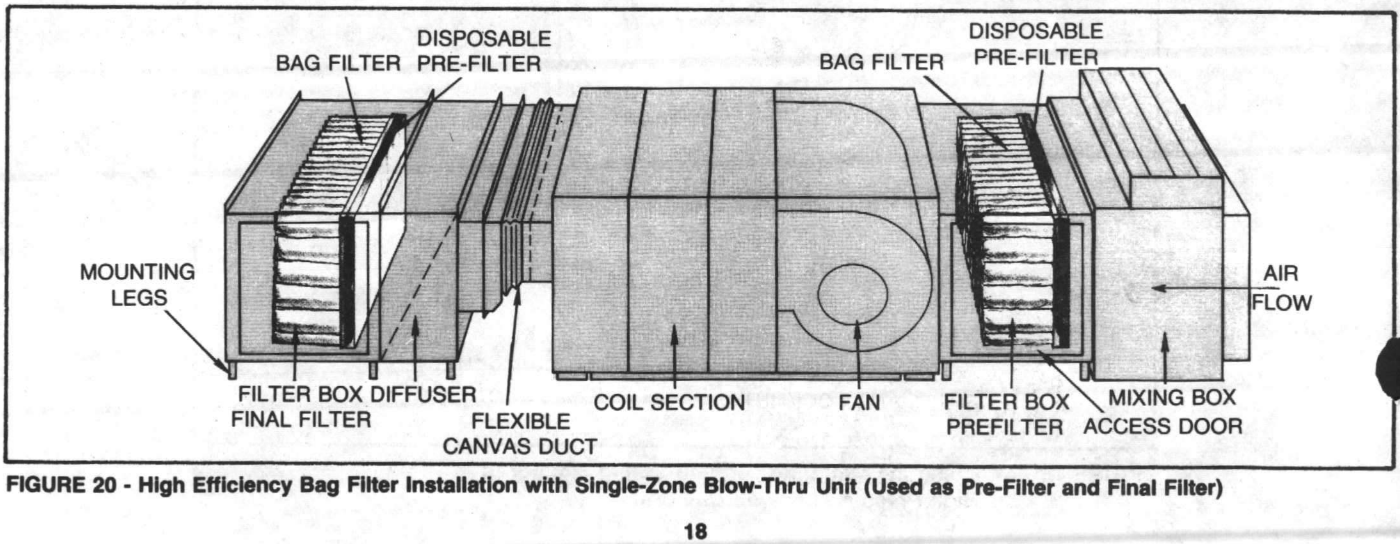


FIGURE 20 - High Efficiency Bag Filter Installation with Single-Zone Blow-Thru Unit (Used as Pre-Filter and Final Filter)

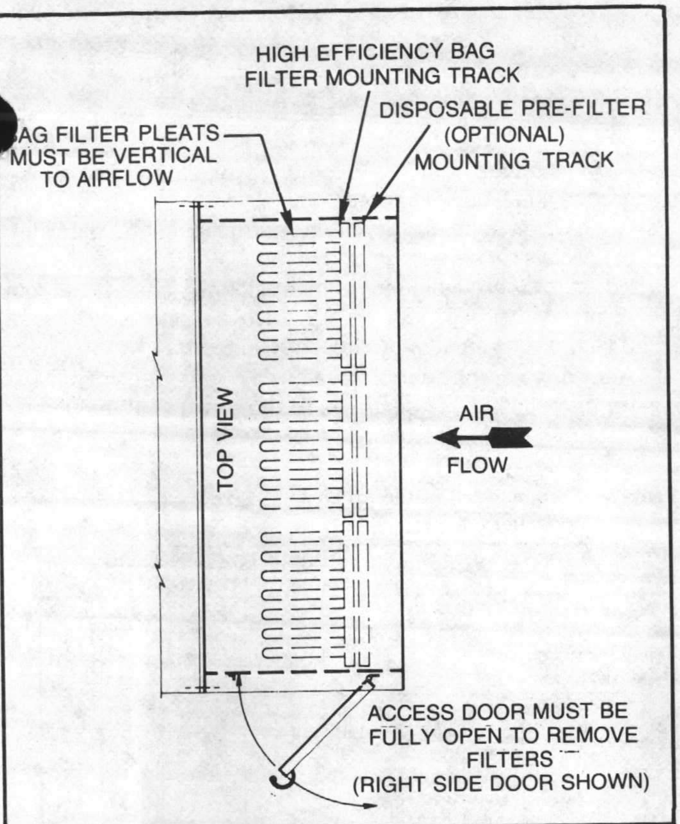


FIGURE 21 - Filter Mounting Track Location (Top View)

Filter Installation

Trane recommends the use of disposable prefilters with high efficiency bag filters. Prefilters slide into mounting tracks just ahead of the bag filter. Bag filter and prefilter size and quantity requirements are the same. See Figure 21 for filter arrangement and complete the following:

1. Ensure power is disconnected. Open filter section access door.

   WARNING: DISCONNECT POWER SOURCE BEFORE OPENING FILTER SECTION ACCESS DOOR. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK, HIGH PRESSURE OR MOVING PARTS.

2. Remove adjustable blockoff from filter track.
3. Slide bag filters and flat prefilters into the appropriate filter tracks. Bag filters must be installed with pleats vertical to airflow.
4. Slide adjustable blockoff into filter track.
5. Close the access door. If door can be closed without compressing the filters, adjust the blockoff by loosening its adjusting screws, moving the blockoff and tightening the screws. The door should squeeze the blockoff against the filters, compressing them.

NOTE: *Filters must have an airtight seal to prevent air bypass. If using other filters, apply foam gasketing to the vertical edges of the filter-holding frame to ensure a tight fit.*

For roll filter installation and operation checks, refer to RF-IM-1.

MANOMETER INSTALLATION

A manometer should be used with each bag filter accessory to monitor filter loading and is available from Trane. It should be located to read the pressure drop between the inlet and outlet of the filters. A 1-inch wg pressure difference indicates clogged filters.

WARNING: BAG FILTER FINAL RESISTANCE IS 1 INCH WATER GAUGE. FAILURE TO CHANGE BAG FILTERS AT THIS POINT MAY CAUSE PERSONAL INJURY, DEATH OR EQUIPMENT DAMAGE AS FILTERS WITH DUST MAY BE COMBUSTIBLE.

Five feet of double-column plastic tubing is provided with the gauge along with adapters for connection to 1/8" NPT fittings. To install the manometer, complete the following:

1. Mount the manometer in the two 27/64-inch diameter holes drilled in top or side wall of the filter box, using the self-tapping screws provided. Turn the screws down snug, but not tight.
2. Adjust the gauge until the bubble is centered in the spirit level. Tighten the mounting screws and check to be sure that the gauge remained level.
3. Turn the zero adjust knob counterclockwise until it stops. Then turn it clockwise approximately three full turns so that there is room for adjustment in either direction.
4. Remove the fill plug and pour in the provided gauge fluid until the fluid level is visible in the vicinity of zero on the scale. Adjust for exact zero setting with the zero knob and replace the fill plug.
5. Install a tubing adapter on each side of the filter.
6. Connect the coded red striped tube to the high pressure connection at the top of the gauge (left side) and insert the other end into the field-drilled port and adapter upstream of the bag filters.
7. Connect the uncoded tube to the low side connection at the top of the gauge (right side) and insert the other end into the field-drilled port and adapter downstream of the filter bags.

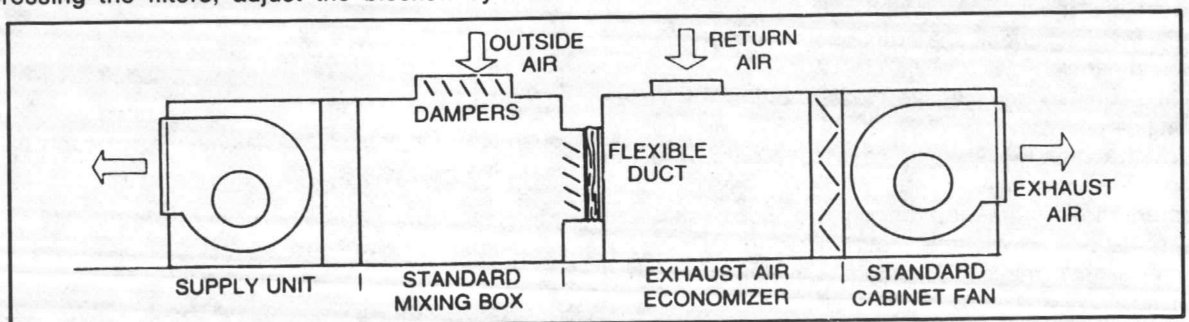


FIGURE 22 - Exhaust Air Economizer Installation

EXHAUST AIR ECONOMIZER

The Exhaust Air Economizer system consists of the economizer section and a Cabinet Fan. The accessory is attached to a Climate Changer with a standard or combination mixing box accessory, as shown in Figure 22. Cabinet Fan size should be identical to Climate Changer size, except as noted below.

NOTE: *Unit sizes 35 to 63 can use either the same size Cabinet Fan or a size 31 Cabinet Fan.*

The economizer section contains a single damper set, similar to a face damper, which is used to prevent backwheeling of the exhaust fan when it is shut off. Low leak and Ultra-low leak dampers can be used on the damper assembly. Refer to the Dampers section of this manual for operating torques.

CAUTION: To avoid equipment damage, the pressure differential across the damper must not exceed 3 inches during operation.

To install the Exhaust Air Economizer, complete the following:

1. Bolt the Exhaust Air Economizer to the Cabinet Fan with the bolts and gasketing provided.
2. If the unit is floor-mounted, fasten the isolators to the floor and mount the accessory on the isolators. If the unit is ceiling-mounted, follow proper safety precautions and hoist the accessory into position, attaching it to the hanger rods.
3. Attach the contractor supplied canvas duct to the mixing box flange with sheet metal screws (not provided).
4. Screw the canvas duct flange onto the economizer section flange from inside the economizer with sheet metal screws (not provided).
5. Attach the return air intake to the economizer section.
6. Level the unit. Secure all fasteners.

FAN MOTOR ASSEMBLY

On units that ship motors separately, the fan shafts, sheaves and drive assembly must be checked and aligned before unit operation. Complete the following:

WARNING: DISCONNECT ELECTRICAL POWER BEFORE INSPECTING FAN MOTOR ASSEMBLY. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK OR MOVING PARTS.

1. Check that the fan shafts fully penetrate the bore of sheaves or sheave bushings. Bushed sheaves should have the bushing flange outboard of the sheave.
2. Use a level to check that fan and motor shafts are level and parallel.
3. Position the fan sheaves as closely to the drive side bearing as possible.
4. Check that the fan sheave keys fully penetrate the bushing or sheave bore.
5. Position the motor sheaves on the motor shaft as closely as possible to the motor housing. All sheave setscrews must make full contact with the motor shaft or shaft key.

NOTE: *In some cases, motor shafts may not fully penetrate the sheave bore, but the sheave width must never exceed the recommended maximum per NEMA (MG1-14.43 a) for the respective motor size.*

6. Align sheaves with a straightedge or string. For multigroove sheaves, align center lines.
7. Check belt tension. Detailed instructions are given in the Maintenance section of this manual.
8. When properly aligned and tensioned, check that no point on the belt nearest the drive bearing is within 1/2-inch of unit flanges or structural supports.
9. After drive components have been positioned correctly, tighten all sheave setscrews to the torque values given Table 4.

Table 4 - Torques for Tightening Locking Screws, Bearings and Sheaves

TORQUE FOR TIGHTENING SETSCREWS				TORQUE FOR TIGHTENING SEALMASTER LOCKING COLLAR				
SET SCREW DIA.	HEX SIZE ACROSS FLATS	RECOM. TORQUE INCH LBS.	RECOM. TORQUE FOOT LBS.	COL-LAR	SCREW DIA.	HEX SIZE ACROSS FLATS	RECOM. TORQUE INCH LBS.	RECOM. TORQUE FOOT LBS.
1/4"	1/8"	66	5.5	2-015B	8-32	1/8"	70	5.8
5/16"	5/32"	126	10.5	2-13B	8-32	1/8"	70	5.8
3/8"	3/16"	228	19.0	2-17B	10-24	9/64"	90	7.5
7/16"	7/32"	348	29.0					
1/2"	1/4"	504	42.0					
5/8"	5/16"	1,104	92.0					

NOTE: Tighten bearing setscrews to the torque shown before running unit. Setscrews can loosen in shipment.

DAMPERS

DRIVE ROD ASSEMBLY — BLOW-THRU MULTIZONE UNITS

On all Blow-Thru Multizone units, the zone damper drive rods are recessed to prevent damage during shipment. Before attaching ductwork, complete the following steps and then set the damper zones as instructed after this list. Refer to Figures 23 to 24B.

1. Loosen the damper rod clip screws and extend each drive rod 2-1/2 inches beyond the edge of the damper assembly flange. See Figure 23.
2. Check each set of damper blades to make sure that they are at 90-degree angles to each other. Move the dampers to be sure they are not binding.
3. Tighten all damper rod clip screws.
4. Under certain operating conditions, condensate may form on the cold deck portion of the damper section. To prevent this, insulate around the damper rods. Be sure that the insulation does not affect damper operation.

SETTING THE DAMPERS

Dampers on all units must be adjusted to ensure proper operation. Complete the instructions for each damper section. See Figure 24A.

1. Select the number of damper segments required for the first zone. Loosen the damper lever set screws and turn all of the damper blades within the zone to the same position.

2. Tighten the damper lever set screws for this zone.
3. Cut the damper linkage bar at the last lever. Figure 24A illustrates an example that uses two damper segments.
4. Set all other zones with the same procedure given above.

NOTE: *Damper operators must be connected to damper drive rods on the linkage side of the zone damper section.*

DAMPER OPERATORS

Damper operators, levers and linkages, if not factory provided, are to be provided and installed by the contractor. Tables 5 through 8 list approximate values of damper torques to size the damper operators. When two motors are required, use synchronous motors. See Table 8A for actuator torques used with Multizone and 3-Deck Multizone damper units.

To install the operators, connect the motor to the damper drive rods on the linkage side of the zone damper section. Mount damper levers as close to the side of the unit as possible.

High-efficiency mixing box damper torques, given in Table 8, will vary with blade position (percent open), damper arrangement (top/back or top/bottom), pressure differential, cfm conditions and installation. The values given in Table 8 represent the maximums for all of the above conditions up to 0.4 inches of pressure difference and at a blade setting of 25 to 75 percent open. Greater pressure differences or incorrect adjustment will not be compensated for.

When low leak and ultra-low leak dampers are installed, operators should be sized according to operating torques given in Tables 5 through 7. Since low leak and ultra-low leak damper operating torques are much higher than those for standard dampers, care must be taken to choose a properly sized operator. Stroke distance from full-closed to full-open is 90 degrees.

Low leak dampers with blade seal material, should not be installed in positions where temperatures might exceed 150 F.

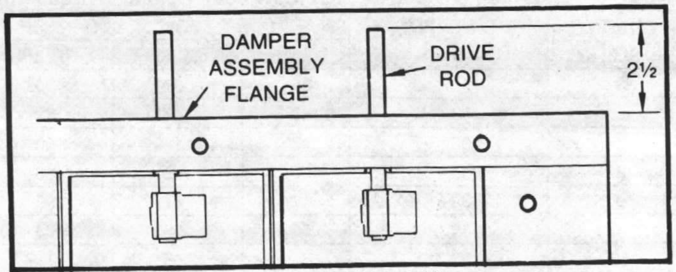


FIGURE 23 - Zone Damper Blade Assembly

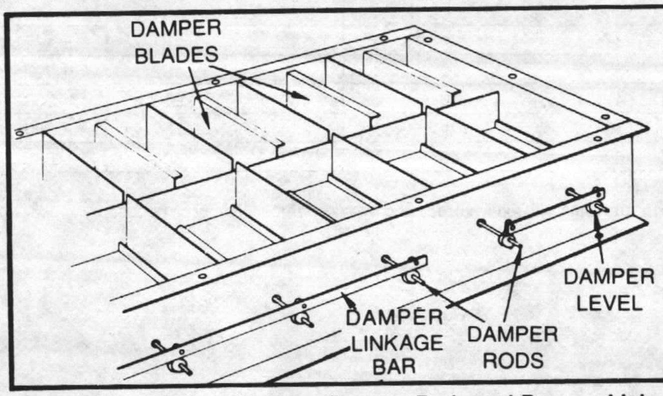


FIGURE 24A - Setting the Zone Damper Rods and Damper Linkage

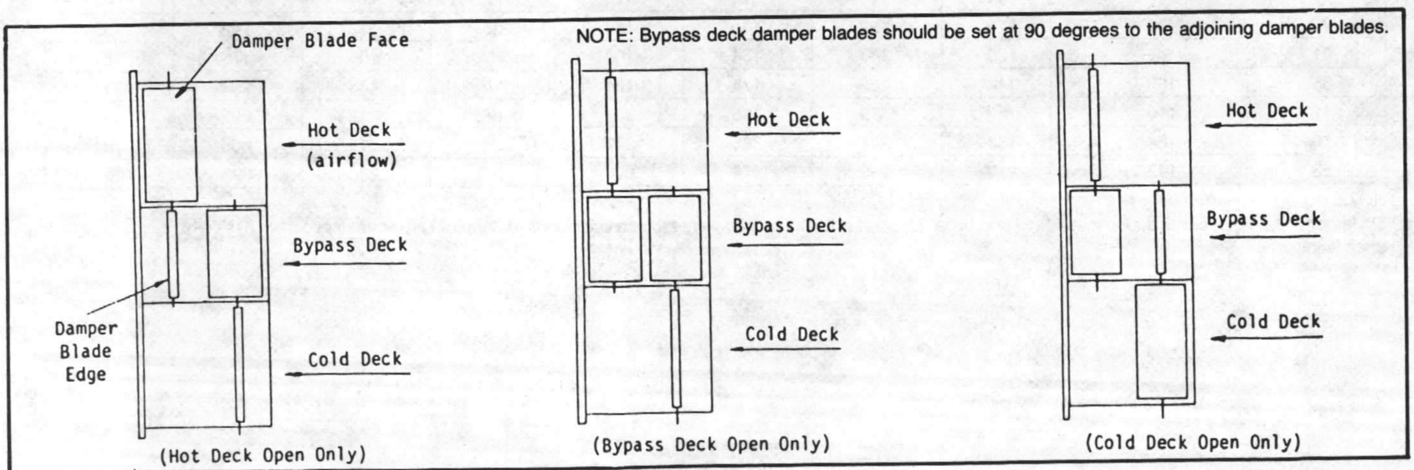


FIGURE 24B - Proper Three-Deck Multizone Damper Blade Configuration

TABLE 5 - External Face and Bypass Low Leak Damper Torques (In./Lbs.)

UNIT	STANDARD	LOW LEAK DAMPER				ULTRA-LOW LEAK DAMPER			
SIZE	DAMPER	1" ΔP	2" ΔP	3" ΔP	4" ΔP	1" ΔP	2" ΔP	3" ΔP	4" ΔP
3	30	36	37	39	41	39	41	43	44
6	33	43	47	50	53	50	54	57	60
7	33	43	47	50	52	49	53	56	59
8	35	47	52	56	59	55	60	64	67
9	36	47	51	55	58	54	58	62	65
10	36	52	58	63	67	62	68	73	77
12	38	67	65	71	76	70	77	83	88
14	40	63	71	79	85	77	86	94	100
17	42	68	78	87	93	85	95	103	110
21	77	108	120	131	139	128	141	151	159
25	84	121	136	149	159	146	161	173	183
31	93	142	161	177	190	174	193	210	222
35	100	159	182	202	217	198	221	241	256
41	110	190	216	239	256	234	261	283	300
50	124	214	250	280	304	273	310	339	363
63	145	259	305	343	373	335	381	419	449

NOTE:
On larger units with external face and bypass dampers it may be necessary to use two opposed damper operators to avoid excessive bending of damper shaft linkage.

TABLE 6 - Internal Face and Bypass Low Leak Damper Torques (In./Lbs.)

UNIT	STANDARD	LOW LEAK DAMPER				ULTRA-LOW LEAK DAMPER			
SIZE	DAMPER	1" ΔP	2" ΔP	3" ΔP	4" ΔP	1" ΔP	2" ΔP	3" ΔP	4" ΔP
3	30	33	35	36	37	35	37	38	39
6	33	40	43	45	47	44	47	49	51
7	33	39	42	44	46	44	46	48	50
8	35	45	48	52	54	51	55	58	60
9	36	44	46	49	51	48	51	54	56
10	36	48	53	57	60	56	61	65	68
12	38	52	57	62	65	61	66	71	74
14	40	56	63	68	72	67	73	78	83
17	42	62	70	77	82	76	84	90	96
21	77	101	111	119	125	118	127	135	142
25	84	111	122	130	138	129	139	148	155
31	93	129	143	154	164	152	166	178	187
35	100	143	160	174	186	171	188	203	214
41	110	159	179	195	208	192	212	228	241
50	124	183	206	226	242	222	245	265	281
63	145	219	249	274	293	269	298	323	343

NOTE:
On larger units with internal and external face and bypass dampers it may be necessary to use two opposed damper operators to avoid excessive bending of damper shaft linkage.

TABLE 7 - Mixing Box, Combination Filter Mixing Box Low Leak Damper Torques (In./Lbs.)

UNIT SIZE	STANDARD DAMPER	LOW LEAK DAMPER				ULTRA-LOW LEAK DAMPER			
		1" ΔP	2" ΔP	3" ΔP	4" ΔP	1" ΔP	2" ΔP	3" ΔP	4" ΔP
3	7	11	13	14	15	14	15	17	18
6	9	16	18	20	22	20	23	25	27
7	10	17	20	23	25	22	25	27	29
8	11	20	23	26	28	25	29	32	34
9	12	20	23	25	27	25	28	30	32
10	13	24	28	32	35	31	35	39	42
12	14	27	32	37	40	35	41	45	48
14	16	31	38	43	47	42	48	53	57
17	18	36	44	50	54	48	56	62	67
21	40	62	71	78	84	77	85	93	98
25	47	73	83	91	98	90	100	108	115
31	57	87	99	109	117	107	119	129	137
35	64	99	112	124	133	122	135	147	156
41	74	114	130	144	154	141	157	170	181
50	89	139	158	174	188	171	191	207	221
63	110	169	192	212	227	208	231	251	266

NOTE:
On larger units with internal and external face and bypass dampers it may be necessary to use two opposed damper operators to avoid excessive bending of damper shaft linkage.

TABLE 8 - High Efficiency Mixing Box Damper Torque

UNIT SIZE	TORQUE (FT.-LBS.) AT 0.4" ΔP 25 TO 75% OPEN
3	0.65
6	1.10
8	1.50
10	1.85
12	2.25
14	2.70
17	3.15
21	3.75
25	4.50
31	5.30
35	6.20
41	7.20
50	9.10
63	10.75

TABLE 8A — Multizone and Three-Deck — Multizone Zone Damper — Actuator Torques (In./Lbs)

UNIT SIZE	3	6	8	10	12	14	17	21	25	31	35	41	50	63
Torque (In./Lbs)	27	29	31	32	33	34	36	38	41	45	48	51	57	66

VARIABLE INLET GUIDE VANES

Inlet vanes are used to regulate fan capacity and to reduce horsepower at lower system requirements.

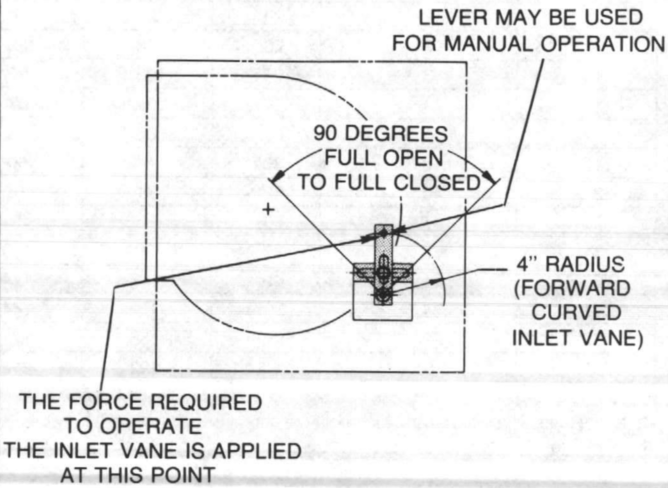
Inlet guide vane operator motors, if not factory provided, are to be provided and installed by the contractor, according to the operating torques given in Tables 9, 10, and 11. Control lever stroke and radius is given in Figure 25.

Before operation, check the vanes and assembly for freedom of movement. If resistance above the torques given in Tables 9, 10 and 11 is encountered, check for vane damage or linkage misalignment. **Do not force the vanes.** See Figure 25 for typical inlet vane operation. Figures 26 and 27 illustrate FC and AF inlet vanes.

TABLE 9 - Torque and Force Required to Operate Inlet Vanes - AF Fans - Unit Sizes 35-86

UNIT SIZE	TO OPEN OR CLOSE INLET VANES	FAN OUTLET VELOCITY 2,000 FPM TORQUE (IN.-LBS.)	FAN OUTLET VELOCITY 2,000 FPM FORCE (LBS.)	FAN OUTLET VELOCITY 3,000 FPM TORQUE (IN.-LBS.)	FAN OUTLET VELOCITY 3,000 FPM FORCE (LBS.)
35	Open	70.0	7.7	158.0	16.7
	Close	17.0	1.9	39.0	4.3
41	Open	94.0	10.3	214.0	23.5
	Close	23.0	2.6	53.0	5.9
50	Open	128.0	14.1	287.0	31.5
	Close	31.0	3.4	71.0	7.8
63	Open	172.0	18.9	388.0	42.6
	Close	42.0	4.6	96.0	10.6
73	Open	172.0	18.9	388.0	42.6
	Close	42.0	4.6	96.0	10.6
86	Open	172.0	18.9	388.0	42.6
	Close	42.0	4.6	96.0	10.6

When automatic vane control is used, adjustment must be made to avoid forcing the vanes past either the full-open or full-closed positions. A locking lever is furnished if the inlet vanes are to be used with manual control.



USE THE ⅜" DIA. HOLE FOR DAMPER OPERATOR (PNEUMATIC OR ELECTRIC, IF BY OTHERS)

(OPPOSITE DRIVE SIDE ONLY)

NOTES:
1. Lever is furnished with the inlet vanes.
2. To open the inlet vanes, rotate the control lever clockwise for left-hand mount and counterclockwise for right-hand mount.

FIGURE 25 - Inlet Vane Operation

TABLE 10 - Torque and Force to Operate Inlet Vanes - FC Fans - Unit Sizes 6-31

NO. OF FANS AND FAN SIZE	TO OPEN OR CLOSE INLET VANES	FAN OUTLET VELOCITY 2,000 FPM TORQUE (IN.-LBS.)	FAN OUTLET VELOCITY 2,000 FPM FORCE (LBS.) 4" ARM	FAN OUTLET VELOCITY 3,000 FPM TORQUE (IN.-LBS.)	FAN OUTLET VELOCITY 3,000 FPM FORCE (LBS.) 4" ARM
1-10½	Open	5.7	2.2	19.6	5.1
	Close	2.9	0.8	6.5	1.9
1-12¼	Open	10.0	2.5	22.5	5.7
	Close	3.5	0.9	7.8	2.1
1-13½	Open	10.9	2.8	24.5	6.2
	Close	3.9	1.0	8.7	2.3
1-15	Open	14.1	3.6	31.9	8.0
	Close	5.0	1.3	11.4	3.0
1-16½	Open	18.0	4.5	40.5	10.3
	Close	6.4	1.6	14.4	3.7
1-18¼	Open	23.1	5.8	52.2	13.3
	Close	8.3	2.1	18.6	4.8
1-20	Open	24.0	6.0	54.0	13.7
	Close	9.0	2.3	19.5	5.1
1-22	Open	25.0	6.3	56.0	14.2
	Close	9.5	2.4	21.0	5.3
1-25	Open	26.5	6.7	59.7	15.1
	Close	10.0	2.5	22.5	5.6
2-13½	Open	21.8	5.5	49.1	12.4
	Close	7.8	2.0	17.5	4.6
2-15	Open	28.3	7.1	63.9	16.0
	Close	10.1	2.6	22.8	5.7
2-16½	Open	36.0	9.0	81.1	20.3
	Close	12.8	3.2	28.9	7.3
2-18¼	Open	46.3	11.6	104.4	26.3
	Close	16.5	4.2	37.3	9.4
2-20	Open	48.0	12.0	108	27.2
	Close	18.0	4.5	39.0	9.9

TABLE 11 - Torque and Force Required to Operate Inlet Vanes — FC Fans — Unit Sizes 35-63

UNIT SIZE	FAN SIZE	TO OPEN OR CLOSE INLET VANES	FAN OUTLET VELOCITY 2000 FPM TORQUE (IN.-LBS.)	2000 FPM FORCE* (LBS.)	3000 FPM TORQUE (IN.-LBS.)	3000 FPM FORCE* (LBS.)	4000 FPM TORQUE (IN.-LBS.)	4000 FPM FORCE* (LBS.)
35	25	Open	26.5	6.7	59.7	15.1	—	—
		Close	10.0	2.5	22.5	5.6	—	—
	27	Open	115	29	190	48	240	60
		Close	40	10	90	23	140	35
41	27	Open	115	29	190	48	240	60
		Close	40	10	90	23	140	35
	30	Open	120	30	200	50	260	65
		Close	50	13	100	25	150	38
50	30	Open	120	30	200	50	260	65
		Close	50	13	100	25	150	38
63	30	Open	120	30	200	50	260	65
		Close	50	13	100	25	150	38

*NOTE: Force is calculated using a 4" lever arm.

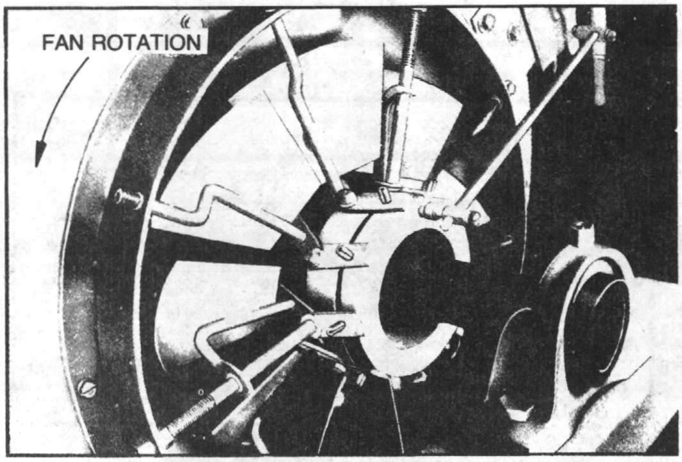


FIGURE 26 - Forward Curved Inlet Vanes

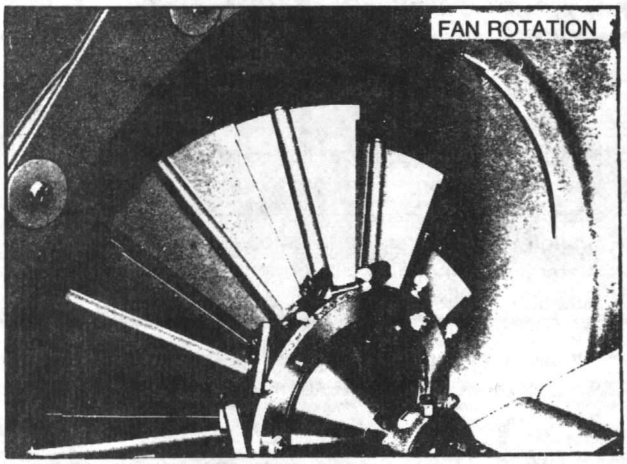


FIGURE 27 - Airfoil Inlet Vanes

DUCT CONNECTIONS

All air ducts should be installed in accordance with the standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems Other than Residence Type (NFPA 90A), and Residence Type Warm Air Heating and Air Conditioning Systems (90B).

***NOTE:** Installations that have supply ductwork without return ductwork may be restricted by local codes to serve a space exceeding 25,000 cubic feet in volume.*

All inlet and discharge air duct connections to the unit should be made with a flexible material. Typically, about three inches is needed for this connection to rigid ductwork. Do not draw the flexible material tight; leave it sufficiently loose to prevent the transmission of any noise or vibration to the ductwork.

Duct turns and transitions must be made carefully to minimize air friction losses. Avoid sharp turns and use splitters or turning vanes when elbows are necessary, as shown in Figure 28. Make turns in the same direction of rotation as the fan. Discharge ductwork should run in a straight line, unchanged in size or direction, for at least a distance of 1-1/2 fan diameters. See Figure 28.

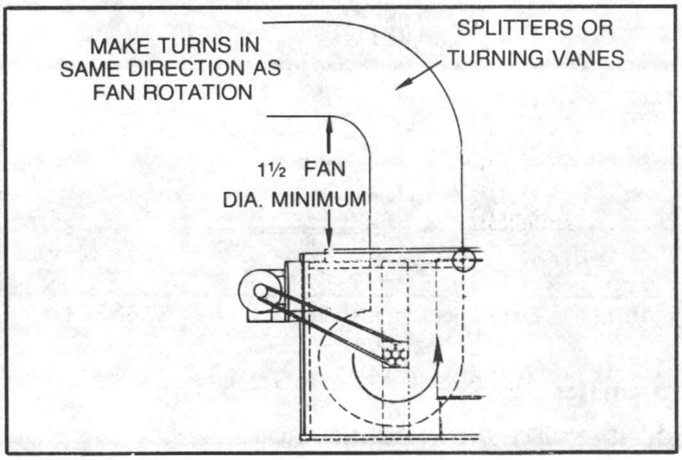


FIGURE 28 - Discharge Ductwork Recommendations

On two-fan units, both fan discharge openings should be jointed to a common duct after the recommended length of straight run. Figure 29 illustrates a proper duct run that will prevent unequal handling of air by the fans. Maximum duct transition should be 30 degrees. The included angle between joining ducts should not exceed 60 degrees. If necessary, split the duct at any point beyond the common connection.

For multizone units, zone duct clips are provided for attaching the ductwork to each zone. Refer to Figure 30. Inset the clips on the damper partitions as required for the number of zones. Approximately 7/16-inches of space will be left between each zone when the duct collar is placed in the duct clip.

***NOTE:** When attaching the ductwork to multizone units,* *ensure that the duct connection does not interfere with damper blade travel. If necessary, attach the ductwork to the outside of the fan discharge in order to leave the damper clear of obstructions. A clearance of one inch (minimum) is required between ductwork and low leak dampers for proper damper operation.*

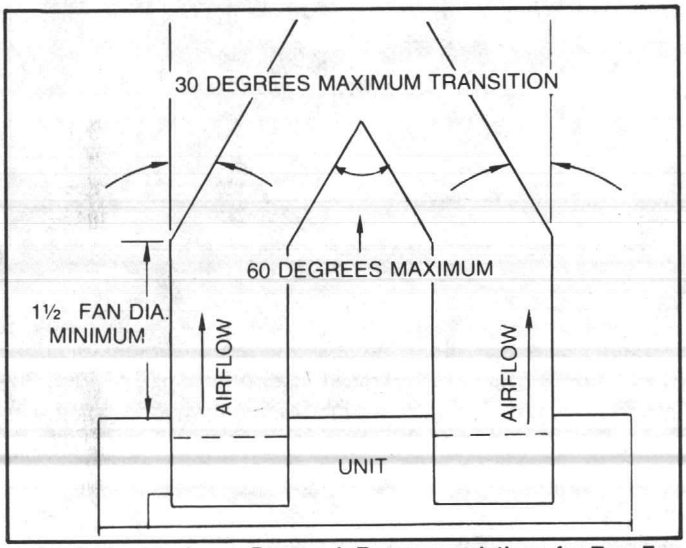


FIGURE 29 - Discharge Ductwork Recommendations for Two-Fan Units

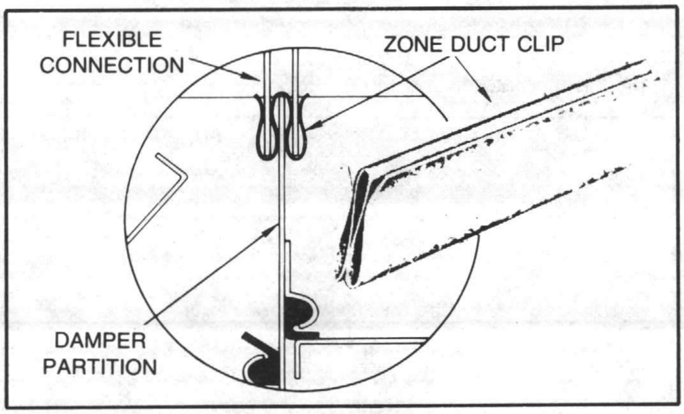


FIGURE 30 - Zone Duct Clip Installation

PIPING

CONDENSATE DRAIN CONNECTIONS

CAUTION: Failure to provide adequate condensate piping may result in water damage to the equipment or building.

Threaded condensate drain connections are provided on both sides of the coil section drain pan. Pitch the line downward toward an open drain and install a plugged tee to facilitate cleaning. Make sure the drain pan connection openings are unobstructed. Trap the drain line as shown in Figure 31 for draw-thru units and Figure 32 for blow-thru units. Draw-thru units size 73 and 86 have additional drain connections on both sides of the fan section. Run these drain connections into the coil section drain line or to a separate open drain.

Drain connection size on unit sizes 3 through 31 is 1-1/4-inch NPT (external). Drain connections on units size 35 to 86 is 1-1/2-inch NPT (internal). Install pipe caps or plugs on all unused unit drain connections.

Note: For units with optional wide coil, the contractor will need to extend the drain pan nipples under the extended drain pan before connecting the drain trap. Nipple length extension is determined by unit size. For size 3-31 units, add an additional 7½-inches in length. Size 41-50 units, add an additional 12-inches in length. Size 35, 63, 73 and 86 units, add an additional 8½-inches in length.

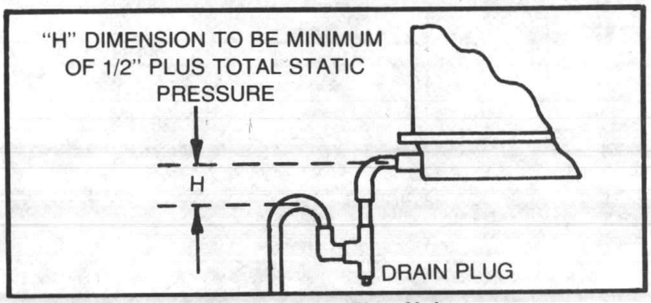


FIGURE 31 - Drain Trap for Draw-Thru Units

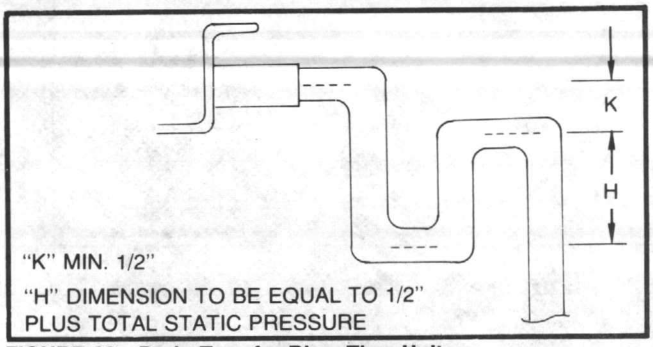


FIGURE 32 - Drain Trap for Blow-Thru Units

SPRAY SECTION PIPING — SPRAYED COIL CLIMATE CHANGER

Sprayed coil units require the following piping to the spray section:

1. Make-up water to the float line. See Figure 33A.
2. Water line from overflow connection to a trapped drain.
3. Shutoff valve and piping to an open or trapped drain.
4. Water line to the quick-fill connection.
5. Insulation of external piping around the spray pump to prevent condensate runoff.
6. Fill the spray tank.
7. Adjust the float valve to maintain a level 1/2-inch below the overflow outlet.

NOTE: *Air must be purged from the system and spray pump vavle must be adjusted for proper water flow. Instructions are given in the Start-Up section of the CLCH maintenance manual.*

CAUTION: Water treatment is required for Sprayed Coil Climate Changers if the supply water is scale forming or corrosive. If neccessary, engage the services of a qualified water treatment specialist. The object of water treatment is to prevent the fouling of the coil surfaces or undue metal damage. THE TRANE COMPANY CAN ASSUME NO RESPONSIBILITY FOR EQUIPMENT FAILURES WHICH ARE THE RESULT OF UNTREATED OR IMPROPERLY TREATED WATER.

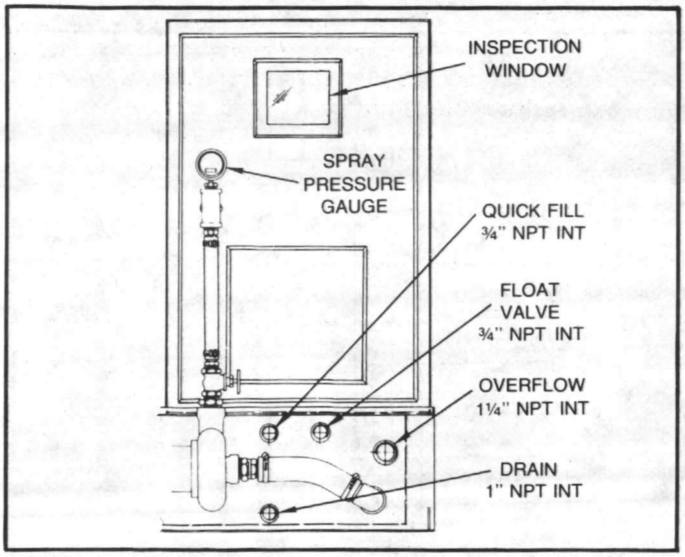


FIGURE 33A - Sprayed Coil Unit Tank Connections

GENERAL COIL PIPING RECOMMENDATIONS

1. Proper installation, piping and trapping is necessary to insure satisfactory coil operation and to prevent operational damage.
2. When selecting coil location, allow sufficient space for access to the coil for routine maintenance and service.
3. Support all piping independently of the coils.
4. Provide swing joints or flexible fittings in all connections that are adjacent to heating coils in order to absorb thermal expansion and contraction strains.
5. The Trane Company recommends that a short pipe nipple be used on coil headers prior to making up any welded flange or welded elbow type connections. This allows the use of a back-up pipe wrench when it is necessary to further rotate the welded flange or elbow when lining up bolt holes on the prefabricated piping.

   NOTE: *Use a "Back-Up Wrench" when attaching piping to coils with copper headers. Do not use brass fittings or brass pipe connectors. Brass distorts easily and causes connection leaks.*

   Delta-Flo coils have copper headers which extend outside the unit casing so that back-up pipe wrenches can be used.

6. When attaching the piping to the coil header, make the connection only tight enough to prevent leaks. Maximum recommended torque is 200 foot-pounds. Use pipe sealer on all threaded connections. **The use of Teflon tape or paste is not recommended by Trane.**
7. After completing the piping connections, seal the gap between the pipe and casing with tape or mastic before insulating the pipes.
8. To connect supply and return coil piping, outer coil panels must be removed. If not ordered, drain and vent access holes must be drilled. See Item 9.
9. Provisions must be made to drain those coils that are not in use when subjected to freezing temperatures.

   CAUTION: Failure to properly drain and vent coils when not in use during freezing temperatures may result in coil freeze-up damage.

   Coil types N, NS and A may be adequately drained in their pitched position in the unit. In coilless units, the coil, after field installation, is not pitched (unless special pitching coil support channel is ordered for steam coils) and may be adequately drained in their position in the unit. (Type N is drainable through the return connection.) The installer must provide appropriate piping for adequate drainage.

Type WL coils are not drainable in either pitched or level position. To drain these coils remove the vent and drain plugs and blow the coils out as completely as possible with compressed air. The coils should then be filled and drained several times with full strength ethylene gylcol so that it will mix thoroughly with the water retained in the coil. Drain the coil out as completely as possible.

Coil types D, DD, and K, plus W, P2, P4, P8, DL and LL are drainable in their factory-installed level position. Coil types D, DD, DL and LL also have Trane factory-installed drain and vent connections. Figures 34 through 39 illustrate coil drain and vent connections.

Drainable coils installed in units containing coil types DL or LL will also have factory-installed drain and vent connections.

NOTE: *On units with stacked coils, there is a condensate follower located at each end of the coil connection. Figure 33B illustrates the condensate follower provided at the end of the stacked coils.*

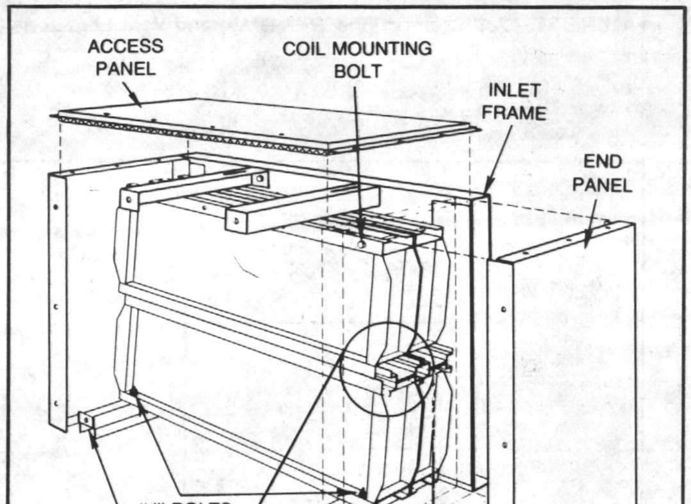
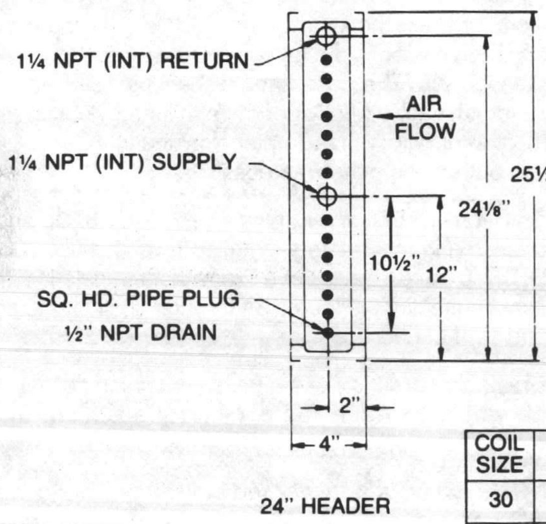
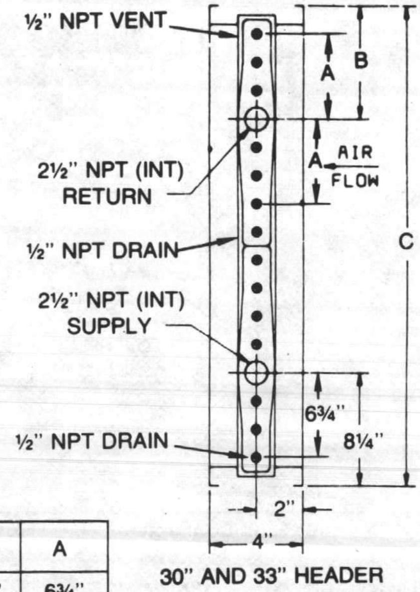


FIGURE 33B - Draw-Thru Unit Coil Section Details with View of Condensate Follower

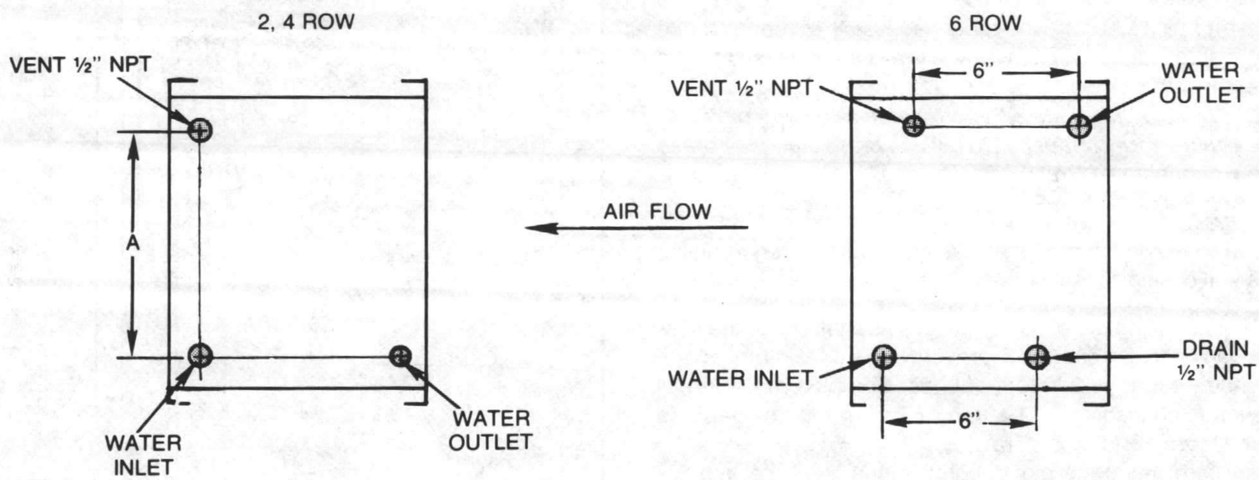




COIL SIZE	C	B	A
30	31½"	8¼"	6¾"
33	34½"	9¾"	8¼"

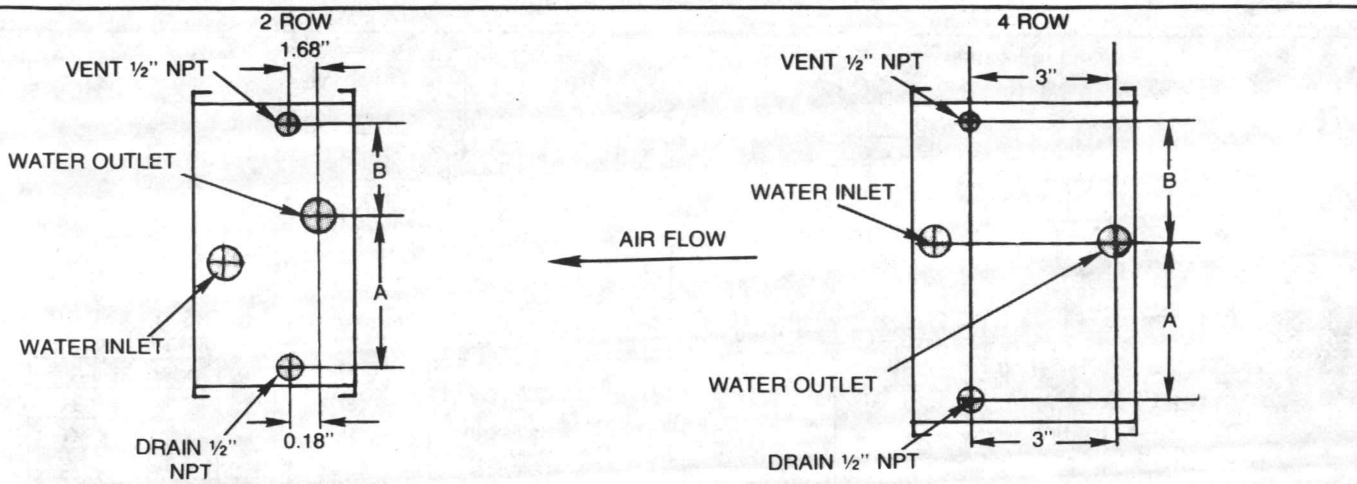
NOTE: COIL CONNECTIONS AVAILABLE RIGHT OR LEFT HAND (DETERMINED BY FACING INTO AIRFLOW)

FIGURE 34 - Coil Connections With Drain and Vent Locations (Type WC 24" and Type WS 30" and 33" Headers)



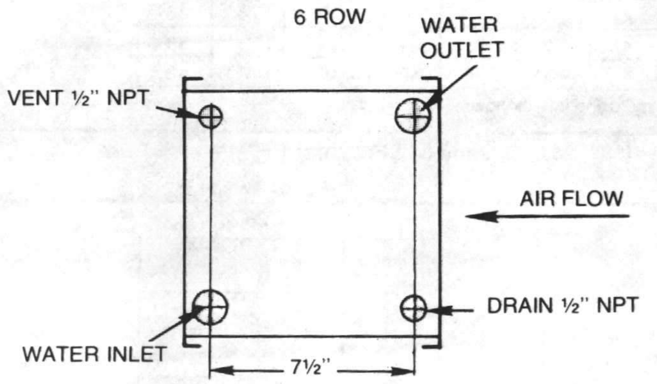
HEADER	A
18"	16½"
24"	22½"
30"	28½"

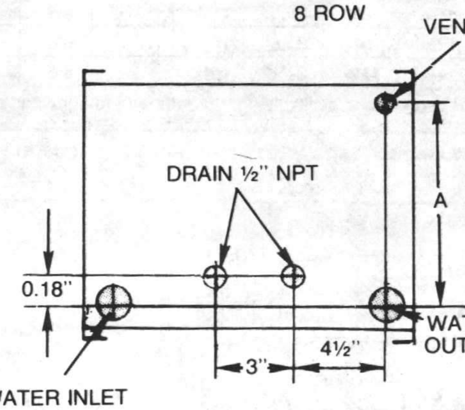
FIGURE 35 - Coil Type P2 Connections with Drain and Vent Locations (18", 24" and 30" Headers)



HEADER	A	B
18"	10½"	6"
24"	13½"	9"
30"	16½"	12"

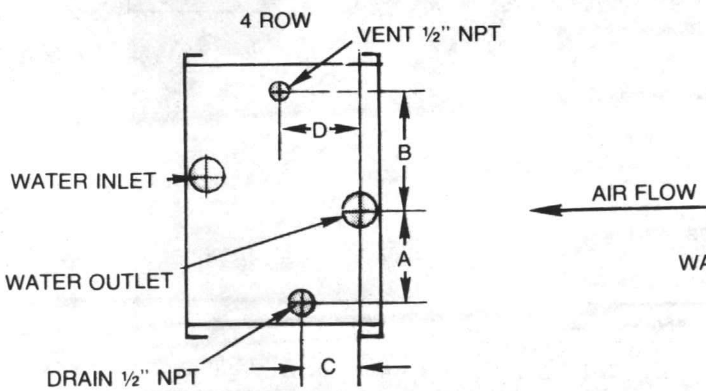
HEADER	A	B
18"	7½"	9"
24"	10½"	12"
30"	13½"	15"



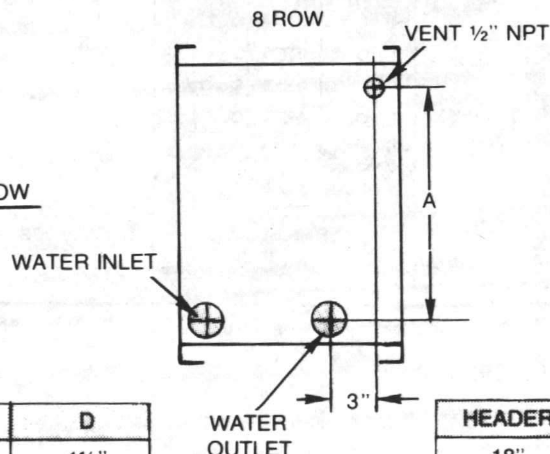


HEADER	A
18"	16 11/16"
24"	22 11/16"
30"	28 11/16"

FIGURE 36 - Coil Type P4 Connections with Drain and Vent Locations (18", 24", and 30" Headers)

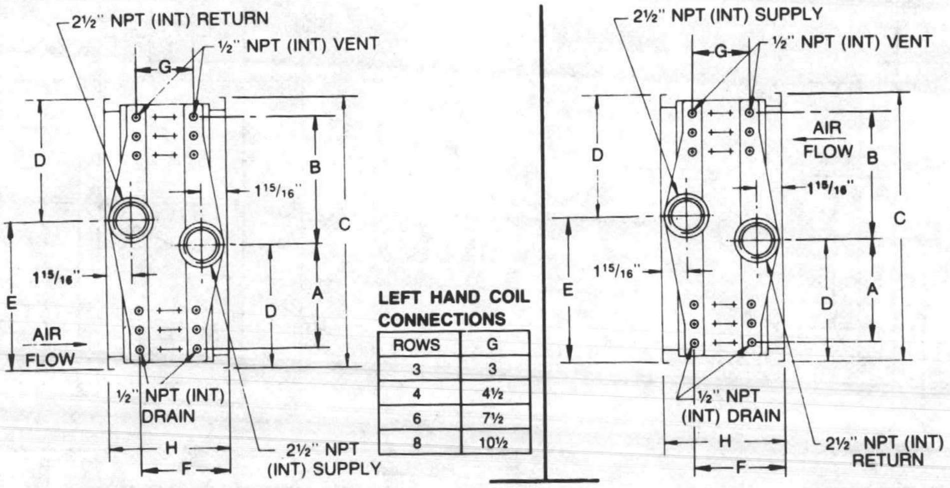


HEADER	A	B	C	D
18"	7½"	9"	1½"	1½"
24"	10½"	12"	0"	4½"
30"	13½"	15"	1½"	1½"



HEADER	A
18"	16½"
24"	22½"
30"	28½"

FIGURE 37 - Coil Type P8 Connections with Drain and Vent Locations (18", 24", and 30" Headers)



LEFT HAND COIL CONNECTIONS

ROWS	G
3	3
4	4½
6	7½
8	10½

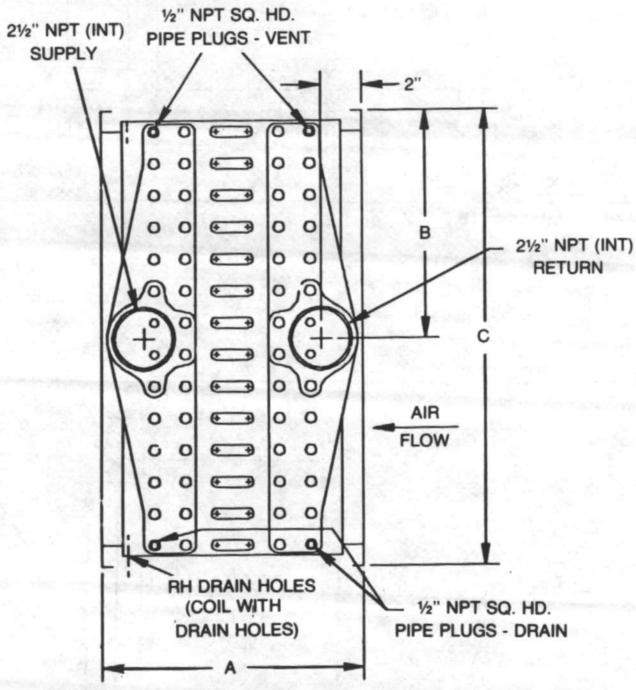
RIGHT HAND COIL CONNECTIONS

ROWS	G
3	3
4	4½
6	7½
8	10½

					2-ROW		4-ROW		6-ROW		8-ROW	
COIL SIZE	A	B	C	D	E	H	F	H	F	H	F	H	F
18	6¾"	9¾"	19½"	8¼"	11¼"	6½"	4"	9½"	7"	12½"	10"	15½"	13"
24	9¾"	12¾"	25½"	11¼"	14¼"	6½"	4"	9½"	7"	12½"	10"	15½"	13"
30	12¾"	15¾"	31½"	14¼"	17¼"	6½"	4"	9½"	7"	12½"	10"	15½"	13"
33	14¼"	17¼"	34½"	15¾"	18¾"	6½"	4"	9½"	7"	12½"	10"	15½"	13"

NOTE: Coil connections available right or left hand (determined by facing into air flow).

FIGURE 38 - Coil Type W Connections With Drain and Vent Locations (18", 24", 30", and 33" Headers)



COIL SIZE	B	C
18	9¾"	19½"
24	12¾"	25½"
30	15¾"	31½"
33	17¼"	34½"

ROWS	A
6	12½"
8	15½"
10	18½"
12	21½"

FIGURE 39 - Right Hand Coil Type WD Connections with Drain and Vent Locations (6, 8, 10, and 12 Rows)

STEAM COIL PIPING

Refer to Figures 40 to 45 for typical steam coil piping.

CAUTION: Condensate must flow freely from the coil at all times in order to prevent coil damage from water hammer, unequal thermal stresses, freeze-up and corrosion. Complete the following recommendations to prevent coil damage.

CAUTION: Failure to properly drain and vent coils when not in use during freezing temperatures may result in coil freeze-up damage.

1. Check that the coil is installed correctly, with airflow in the same direction as indicated on the nameplate or coil casing.
2. Install a 1/2-inch, 15-degree swing-check vacuum breaker in the unused condensate return tapping as close as possible to the coil.

TABLE 12 — Cooling and Heating Coil — Connection Sizes (Inches NPT)

COIL TYPE	HEADER HEIGHT	SUPPLY	RETURN	VENT	DRAIN
W	18, 24, 30, 33	2.5	2.5	0.5	0.5
D	18, 24, 30, 33	2.5	2.5	0.5	0.5
DD	18, 24, 30, 33	2.5	2.5	0.5	0.5
WD	18, 24, 30, 33	2.5	2.5	0.5	0.5
K	18, 24, 30, 33	2.5	2.5	0.5	0.5
P2	18, 24, 30	0.75	0.75	0.5	0.5
P4	18, 24, 30	1.0	1.0	0.5	0.5
P8	18, 24, 30	1.25	1.25	0.5	0.5
WC	18	1.0	1.0	0.5	0.5
	24	1.25	1.25	0.5	0.5
	30, 33	2.5	1.5	0.5	0.5
WA	18, 24, 30, 33	2.5	2.5	0.5	0.5
N, NS	18	2.0	1.0	NA	NA
	24	2.5	1.25	NA	NA
	30, 33	3.0	1.25	NA	NA
A, AA	18	2.5	1.0	NA	NA
	24, 30, 33	2.5	1.25	NA	NA
TT	18, 24, 30, 33	0.75	0.75	NA	NA
DL	18, 24, 30, 33	1.5	2.0	0.375	0.375
WL	18, 24, 30, 33	1.5	2.0	0.375	0.375
LL	18, 24, 30, 33	2.5	2.5	0.375	0.375

Notes:
1. Connections are NPT internal.
2. Coil Type NS drains through supply connections.

3. Vent the vacuum breaker line to the atmosphere or connect it to the return main at the discharge side of the steam trap.

   NOTE: Vacuum breaker relief is mandatory when the coil is controlled by a modulating steam supply or a two-position (ON-OFF) automatic steam supply valve.

4. Run the return pipe at the full size of the steam trap connection except for the short nipple screwed directly into the coil condensate connection. **Do not bush or reduce the coil return tapping size.**
5. With automatic controls, or where the possibility of low pressure supply steam exists, use float and thermostatic traps with atmospheric pressure gravity drain and continuous discharge operation. Locate the steam trap discharge at least 12 inches below the condensate return tapping. Use bucket traps **only** when supply steam is unmodulated and pressure is 25 psig or higher.
6. When coils are installed in a series, size the steam traps for each coil using the capacity of the first coil in airflow direction.
7. Always trap each coil separately to prevent holdup in one or more coils.
8. Always install strainers as close as possible to the inlet side of the trap.
9. Use a V-port modulating valve to obtain gradual modulating action.
10. Control each coil bank separately when installing coils for series airflow with automatic steam control valves.

CAUTION: Always open the steam supply control valve slowly to prevent possible coil damage.

11. Do not modulate systems with overhead or pressurized returns unless the condensate is drained by gravity to a receiver (vented to the atmosphere) and returned to the main by a condensate pump.
12. At start-up on units with fresh air dampers, slowly turn the steam on full for at least 10 minutes before opening the fresh air intake.
13. Pitch all supply and return steam piping down a minimum of 1 inch per 10 feet in the direction of flow.
14. Do not drain the steam mains or take-offs through the coils. Drain the mains ahead of the coils through a steam trap to the return line.
15. Overhead returns require 1 psig of pressure at the steam trap discharge for each 2-foot elevation to assure continuous condensate removal.

TABLE 13 - Refrigerant Coil (Type F) Piping Sizes (Inches)

HEADER HEIGHT	NO. OF CIRCUITS	CONNECTION SIZE (INCHES) LIQUID	SUCTION
18	2	⅞	1⅜
	3	⅞	1⅝
	6	1⅛	2⅛
	12	1⅜	2⅛
24	2	⅞	1⅝
	4	⅞	1⅝
	8	1⅛	2⅛
	16	(2)1⅛	(2)2⅛
30	2	⅞	1⅜
	4	⅞	1⅝
	5	⅞	2⅛
	10	1⅜	2⅛
	20	(2)1⅜	(2)2⅛
33	3	⅞	1⅝
	7	1⅛	2⅛
	11	1⅜	2⅛
	22	(2)1⅜	(2)2⅛

NOTE: Connections are piping OD.

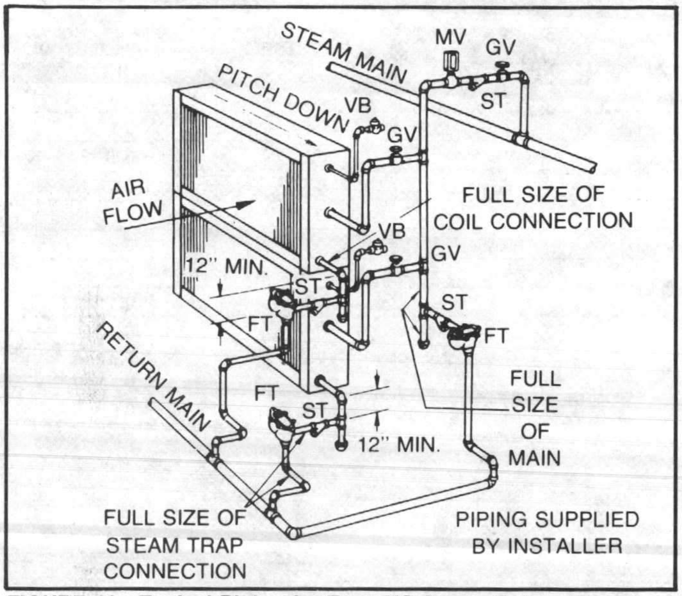


FIGURE 40 - Typical Piping for Type NS Steam Coils and Horizontal Tubes for Horizontal Airflow

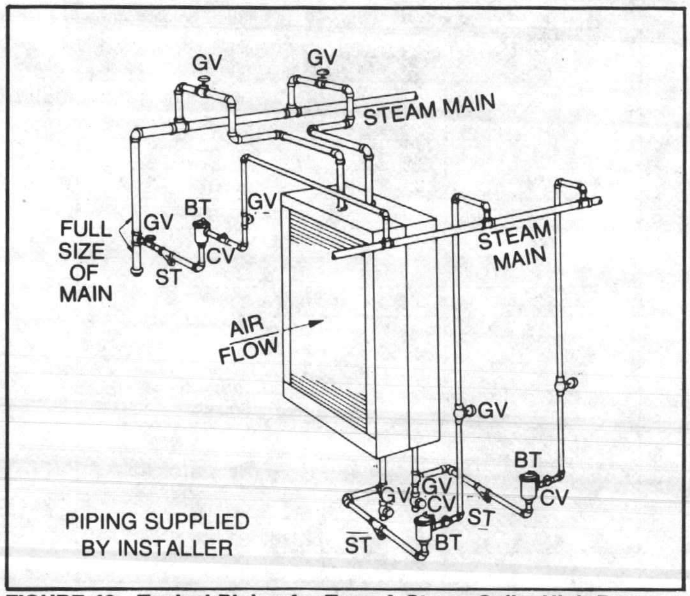


FIGURE 43 - Typical Piping for Type A Steam Coils, High Pressure, Vertical Tubes for Horizontal Airflow

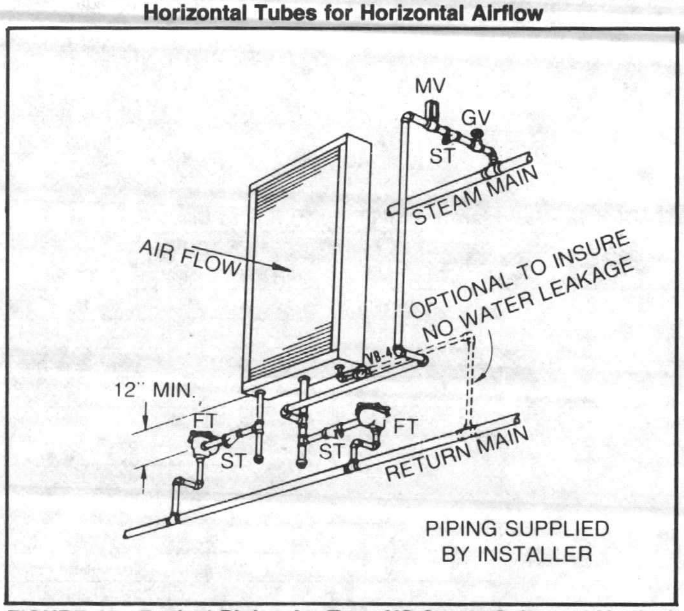


FIGURE 41 - Typical Piping for Type NS Steam Coils and Vertical Tubes for Vertical Airflow

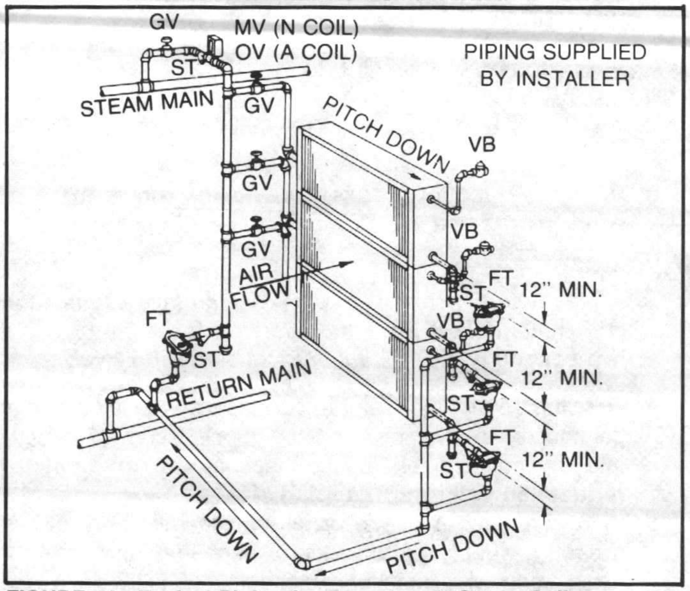


FIGURE 44 - Typical Piping for Type A or N Steam Coils, Horizontal Tubes for Horizontal Airflow

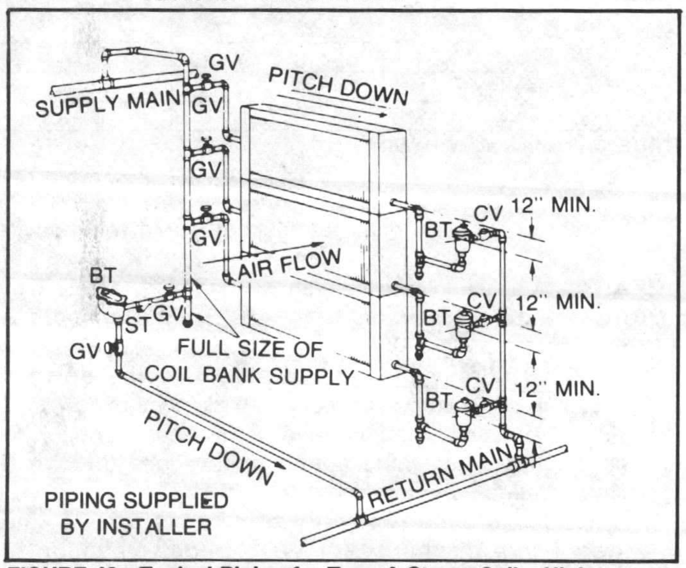


FIGURE 42 - Typical Piping for Type A Steam Coils, High Pressure, Horizontal Tubes for Horizontal Airflow

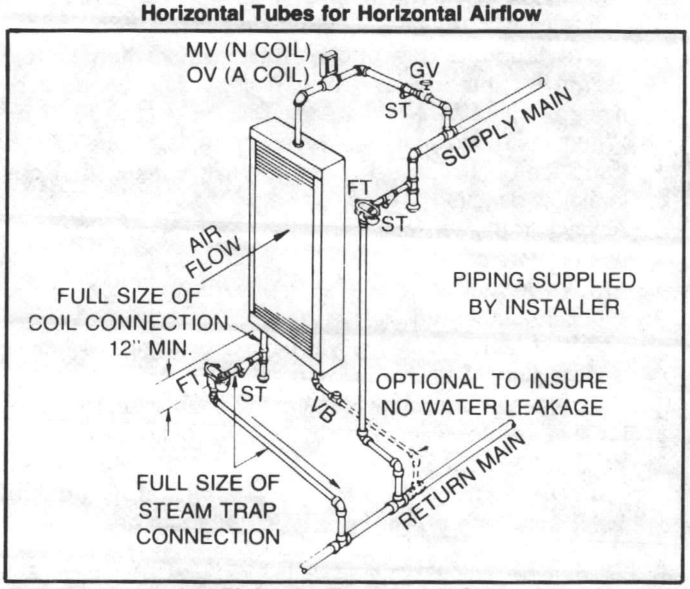


FIGURE 45 - Typical Piping for Type A or N Steam Coils, Vertical Tubes for Horizontal Airflow

HOT WATER COIL PIPING

Refer to Figures 46 to 48 for typical hot water coil piping.

1. Check that the coil is installed correctly, with airflow in the same direction as indicated on the nameplate or coil casing.
2. Type W, WL, DL, and WC hot water coils are self-venting only if the water velocity exceeds 1.5 feet per second. If it is below this rate, vent the coils by either of the following methods:

   a. Install an air vent in the top pipe plug tapping of the return header.
   b. Vent from the top of the return header horizontally to the return piping if the return line rises and is above the top of the coil.

CAUTION: Do not throttle or modulate the water flow for coils that are exposed to freezing air. Coil damage may result from freeze-up.

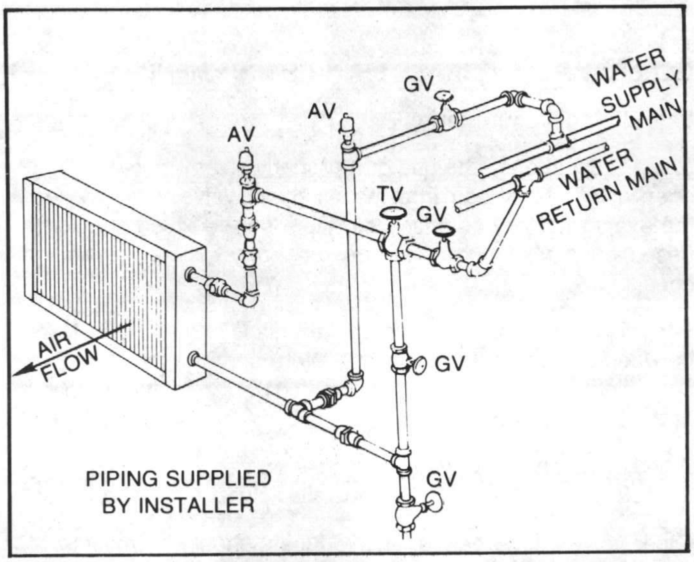


FIGURE 46 - Typical Piping for Type WC Water Coil

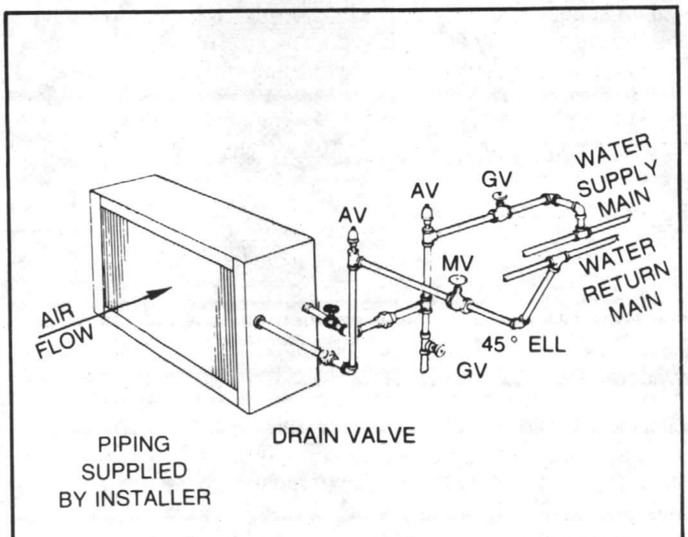


FIGURE 47 - Typical Piping for Type W, Two-Row Water Coil

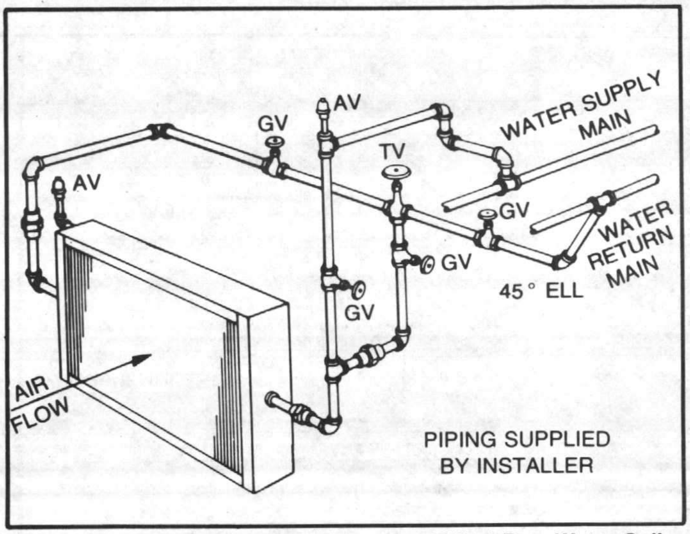


FIGURE 48 - Typical Piping for Type W or WA, 1-Row Water Coil

WATER COOLING COIL PIPING

Refer to Figures 49, 50 and 50A for typical water cooling coil piping.

1. Check that the coil is installed correctly, with airflow in the same direction as indicated on the nameplate or coil casing.
2. Vent both supply and return lines.
3. Install a strainer ahead of the control valve, if used.
4. Install a drain line and shutoff valve in the supply line near the coil.
5. Check for coil fin damage and straighten if necessary.
6. Type W, D, K, DL, WL and LL water coils are self-venting only if the water velocity exceeds 1.5 fps. Type DD and WD coils are self-venting only if the water velocity exceeds 2.5 fps. If water velocity is below these minimum values, vent by one of the following methods.

   a. Install an air vent in the top pipe plug tapping of the return header, or;
   b. When the return line rises above the top of the coil, vent from the top of the return header horizontally to the return piping.

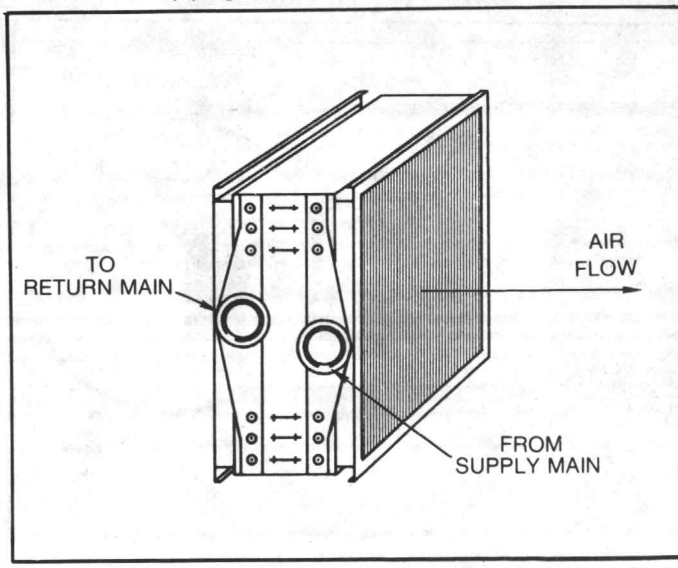


Figure 49 - Typical Piping for Type D, W or K Water Cooling Coils with End Connections.

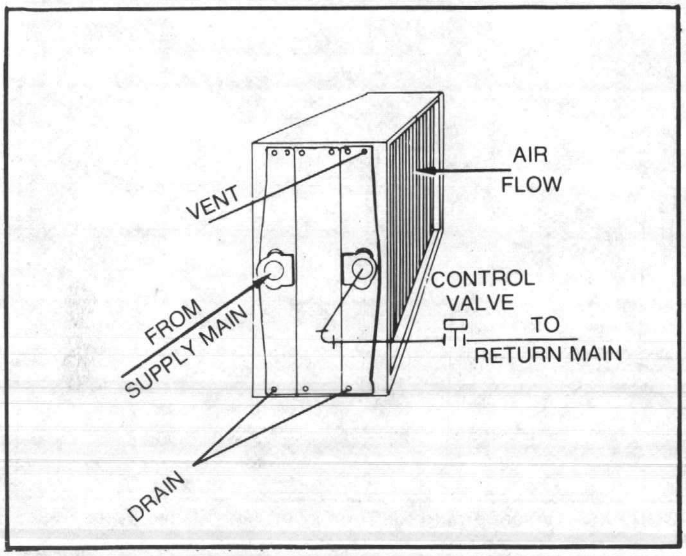


Figure 50 - Typical Piping for Type DD Water Cooling Coil with Center Connections.

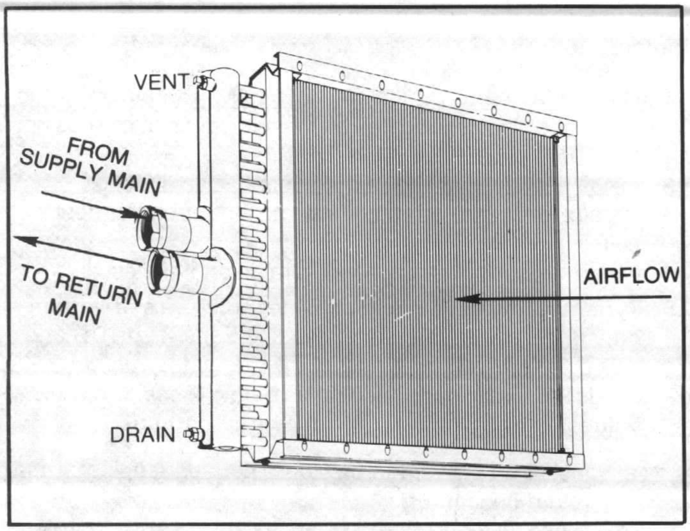


Figure 50A - Typical Piping for 2-Row, Type WL and DL Water Coil with Drain and Vent Locations.

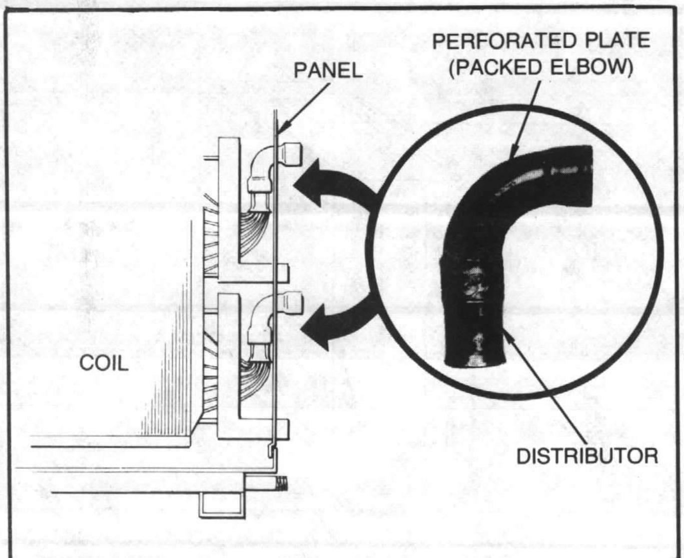


FIGURE 51 - Type F Refrigerant Coil

REFRIGERANT COIL PIPING

NOTE: *This coil has been dehydrated and charged with a holding charge. To prevent leaks and system contamination, do not break the seals until the coil is installed.*

Check that the coil is installed correctly, with airflow in the same direction as indicated on the coil nameplate or casing. The suction connection must be at the bottom of the suction header.

Follow accepted refrigeration piping practices and safety precautions. See Figure 51 for typical refrigerant coil piping. General refrigerant piping recommendations for component selection and line sizing follow. Specific recommendations should be provided with the high-side components, including instructions for pressure testing, evacuation, and system charging.

Leak-test the entire refrigeration system after piping is complete. Charge the unit according to approximate weight requirements and operating pressures. Measure superheat and adjust the thermal expansion valve setting if necessary.

GENERAL REFRIGERANT PIPING RECOMMENDATIONS

Liquid Line Components

Trane recommends the use of a properly sized liquid line filter-drier, installed upstream from the expansion valve and as close to the evaporator coil as possible. Filter-drier selection should be based on a maximum pressure drop of 2 psi at the design condition.

In addition, a moisture indicator/sight glass should be installed between the expansion valve and filter-drier. The moisture indicator/sight glass must be sized to match the size of the liquid line at the thermal expansion valve.

A liquid line shutoff valve with access port should be sized with the selected liquid line OD, and installed close to the condenser.

Other valves, tube bends, and reducers should be minimized, since these items tend to increase pressure drop and reduce subcooling at the expansion valve.

The Thermal Expansion Valve (TEV) must be selected for proper size and capacity. A slightly oversized valve will allow the unit to operate satisfactorily at low-load conditions. The use of a hot gas bypass valve should be taken into account when sizing the TEV.

Liquid line receivers, other than those factory-installed, are **not** recommended.

Suction Line Components

A suction line pressure tap should be installed on the leaving side of the evaporator coil near the TEV sensing bulb location. Accurate superheat measurement and thermal expansion valve adjustment demands that suction pressure be measured near the evaporator coil.

Suction line filter-driers are usually only necessary on systems that have experienced a severe compressor motor burn-out or other failure which results in extremely high refrigerant temperatures. This filter-drier should not be left in the suction line permanently.

Liquid Line Sizing

All compressors have a Refrigerant Charge Limit (RCL) that must not be exceeded. Since the RCL and pressure drop are in direct conflict with each other, Trane recommends that the liquid line be sized as small as possible, while maintaining a low enough pressure drop to ensure 5 degrees F of subcooling at the expansion valve.

Suction Line Sizing

Suction line tubes must be sized to maintain refrigerant vapor velocities that are high enough to ensure oil entrainment under all operating conditions.

Although not harmful, it is not necessary to pitch horizontal suction lines toward the compressor when the refrigerant coil is used with Trane condensing units, which are designed with a gas trap in the suction line just prior to the compressor. This gas trap helps the crankcase heater to stop temperature-induced migration during the off cycle. However, it also eliminates gravity flow to the compressor sump.

WIRING

WARNING: DISCONNECT ELECTRICAL POWER SOURCE BEFORE SERVICING THE UNIT OR CONNECTING ELECTRICAL WIRES. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR ENTANGLEMENT IN MOVING PARTS.

Wiring to the unit fan motor and the spray pump motor (sprayed coil units only) must be provided by the installer and must comply with all national and local electrical codes. The installer must also furnish a fused disconnect switch in compliance with national and local electrical codes.

CAUTION: Use copper conductors only for terminal connections. Use of aluminum or other type of wiring may result in galvanized corrosion or overheating and resultant equipment damage.

Fan motors require motor overload protective devices that are rated or selected in compliance with the National Electric Code. Specific unit and motor connection diagrams are provided on the unit. If wiring directly to the motor, provide a flexible connection at the motor to permit fan belt adjustment. Fractional-horse-power motors may be factory-connected to a terminal box on the unit. If this construction is provided, complete field wiring to this connection box.

INSTALLATION CHECKLIST

Complete this checklist as the unit is being installed to verify that all recommended installation procedures are accomplished before the unit is started. This checklist does not replace the detailed instructions given in appropriate places in the Installation section of this manual. Read the entire section carefully to become familiar with the installation before installing the unit.

WARNING: DISCONNECT ELECTRICAL POWER BEFORE SERVICING OR INSPECTING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR ENTANGLEMENT IN MOVING PARTS.

RECEIVING AND HANDLING

- ☐ 1. Unit and accessories are inspected for shipping damage or material shortage. Report any claims immediately.
- ☐ 2. Unit nameplate data agrees with submittal and ordering information.

LIFTING

- ☐ 1. Center of gravity is approximated.
- ☐ 2. Proper rigging devices are installed, including slings and spreader bars.
- ☐ 3. Unit is hoisted to its approximate location.

UNIT LOCATION

- ☐ 1. Floor or foundation is prepared to support unit weight and to be level.
- ☐ 2. Sufficient access is provided for unit size, clearances and maintenance access.
- ☐ 3. Foundation or mounting platform is sized for unit, accessories and mounting legs.
- ☐ 4. For ceiling-mounted units, suspension frame is selected and prepared.

MOUNTING

☐ 1. Vibration isolators are installed and fastened to the floor.

☐ 2. Shipping angles are removed.

☐ 3. Multi-section units are assembled.

NOTE: *Some units require further assembly after part of the unit is mounted.*

☐ 4. Support frame are constructed and attached for ceiling-mounted units.

☐ 5. Assembled units are mounted on isolators or ceiling supports.

☐ 6. Unit assembly is complete.

☐ 7. Mutli-section units are joined with flexible connection material.

☐ 8. Tension restraints are installed on high-pressure units.

☐ 9. Splash guards are installed where necessary.

☐ 10. Unit is fastened to isolators.

☐ 11. Unit is level.

ACCESSORIES

☐ 1. Bag filter section is installed.

☐ 2. Filters are installed.

☐ 3. Manometers, if necessary, are installed.

☐ 4. Exhaust Air Economizer is installed.

☐ 5. All accessories are installed.

FAN MOTOR ASSEMBLY

☐ 1. Shafts are properly installed in bearings.

☐ 2. Sheaves are properly located on shafts.

☐ 3. Shafts are level and parallel.

☐ 4. Sheaves are aligned.

☐ 5. Belt tension is correct.

☐ 6. Belt is at least 1/2-inch from unit flanges or structural supports.

☐ 7. **All sheave and bearing set screws are tightened to the correct torques.**

☐ 8. Belt guard is installed.

DAMPERS

☐ 1. Blow-Thru Mutlizone units — Drive rod assembly is adjusted.

☐ 2. Cold deck damper rods are insulated (if necessary).

☐ 3. Dampers are set for each zone.

☐ 4. Damper operators (furnished by the installer) are installed and adjusted.

INLET VANES

☐ 1. Vanes and rod assemblies move freely. Lubricate if necessary.

☐ 2. Operators and linkage (furnished by the installer) are installed and adjusted.

DUCTWORK

☐ 1. Intake and discharge connections are made with flexible connection.

☐ 2. Discharge ductwork is unchanged in size or direction for at least 1-1/2 fan diameters in length.

☐ 3. Adequate clearance is allowed between duct connections and dampers.

PIPING

☐ 1. Condensate drain lines are trapped, installed and connected to the coil drain pan.

☐ 2. Unused drain connections are plugged.

☐ 3. Spray section piping is complete for sprayed-coil units.

☐ 4. Provisions are made for properly draining and venting all coils.

☐ 5. Supply and return coil connections are made.

☐ 6. Supply and return piping is complete.

WIRING

☐ 1. Supply power is connected to fan motor.

☐ 2. Wiring direct to fan motor is flexible connection.

☐ 3. If terminal box is provided, field-wiring to terminal box is complete.

☐ 4. Supply power is connected to spray pump motor (sprayed-coil units only).

☐ 5. Fused disconnect switch is installed within sight of unit.

☐ 6. Motor overload protective devices are installed.

START-UP

WARNING: DISCONNECT ELECTRICAL POWER AND ALLOW ALL ROTATING PARTS TO STOP COMPLETELY BEFORE SERVICING OR INSPECTING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK, ENTANGLEMENT IN MOVING PARTS OR PRESSURE DIFFERENTIAL WITHIN THE UNIT.

PREPARATION

Perform the following checks and inspections before operating the unit:

1. **With the system de-energized,** check that the electrical connections are complete and tight at the terminals.
2. Make sure the belt guard is in place.
3. Inspect the fan wheels. They should turn freely in the proper direction of rotation.
4. As mentioned previously in the Installation section, check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.
5. Inspect fan belt tension and sheave setscrews. Belt tension, sheave alignment and setscrew torques for the motor assembly are given in this manual.
6. Check the piping and valves for leaks. Open or close the valves, depending on their function in the system. Drain lines should be open. If a refrigerant coil is used, the system must be evacuated, leak-tested with dry nitrogen, and charged with refrigerant.
7. Check that the air filters are in place and that all dampers are set properly.
8. Remove all foreign material from the drain pan. Check the drain pan and condensate line to make sure they are not obstructed.
9. All unit access panels must be in place. All screws, nuts and bolts must be tightened to their proper torques.
10. On high-pressure units, the coil piping hole gaskets must be installed properly.
11. If the unit includes fan paralleling control, open it fully.
12. Inspect fan motor and bearing lubrication.

CAUTION: To prevent fan motor or bearing failures, it is necessary that they are lubricated properly. This must be checked before the unit is started for the first time. See the label on the side of the unit, the tag attached to the motor and the Climate Changer Maintenance Manual.

START-UP PROCEDURES

After completing all the items uner "Pre-Start-Up," the unit may be started and the following checks and adjustments performed:

***NOTE:** High Pressure units with self-locking collar fan bearings. During start-up check rotation of fan shaft to determine if fan motor is wired correctly. Incorrect rotation of fan may cause premature bearing and shaft failure.*

1. Measure the motor voltage and amps on all phases to insure proper operation. Compare these readings with the motor nameplate.

2. If the unit includes a spray pump, open the spray pump air valve and purge air from the system. Adjust the spray pump valve until the spray pattern diameter equals the finned height of the top cooling coil. The resulting gauge pressure should be between 7 and 10 psig.

3. If the unit includes fan paralleling control (two-fan, blow-thru units only), adjustment may be required. An indication of an incorrect setting is paralleling of the fan (pulsating operation) and erratic fan motor amperage readings. Adjust the fan paralleling control until fan operation is smooth and the amperage reading is steady.

   The fan paralleling control should be closed only far enough to eliminate erratic operation. Rarely should adjustment exceed two inches on either fan. If the devices are closed too far, unit capacity will be reduced.

   Each fan paralleling control device has two rods per fan extending upward through the top of the blow-thru fan section. To adjust fan operation for a smooth airflow condition, the following should be done:

   a. Loosen the locking nut on one rod, lower the rod ½-inch and retighten. Repeat for the other rod on the fan.
   b. If the unstable condition still exists, repeat Step A.
   c. If the unstable condition still exists, relocate the fan paralleling control to the original position and perform Steps A and B on the other fan.
   d. If the unstable condition still exists, lower both fan paralleling devices to 1-inch from the original position. Repeat Steps A, B, and C, using 1-inch as a base reference.

4. Measure voltage at all three wires. Maximum allowable voltage imbalance is two percent. Voltage imbalance is defined as 100 times the sum of the deviation of the three voltages from the average, divided by twice the average voltage. For example, if the three measured voltages are 221, 230 and 227, the average voltage would be 226 volts. The percent of voltage imbalance is then calculated:

$$\frac{100 \times \{ [226-221] + [230-226] + [227-226] \}}{2 \times 226} =$$
$$2.2\% \text{ (Unacceptable)}$$

   In this example, 2.2 percent imbalance is not acceptable and the power company should be notified to correct it.

5. If the fan speed is changed more than 5% from the original designed rpm, or if parts such as shafts, fan wheels, bearings, or other drive components are replaced, the unit vibration should be checked.

   The unit vibration, measured horizontally and vertically directly on the fan shaft bearing (perpendicular to the shaft centerline), should not exceed 0.2 in/sec. or 3.0 mils, whichever is the lower displacement at the unit operating speed.

SHEAVE ALIGNMENT

To prevent interference of the fan frame with the belt, make sure that the belt edge closest to the motor has the proper clearance from the fan frame, as shown in Figure 52.

Align the fan and motor sheaves by using a straightedge as shown in Figure 53. The straightedge must be long enough to span the distance between the outside edges of the sheaves. When the sheaves are aligned, the straightedge will touch both sheaves at points A through D. A string, drawn tight, may be used in the same manner. For uneven width sheaves, place a string in the center groove of both sheaves and pull tight. Adjust sheaves and tighten the sheave setscrews to the proper torques, given in Table 4.

Parallel operation of the fan and motor shafts is necessary to prolong belt life. Place a level on the shafts to check horizontal alignment. Shim if necessary.

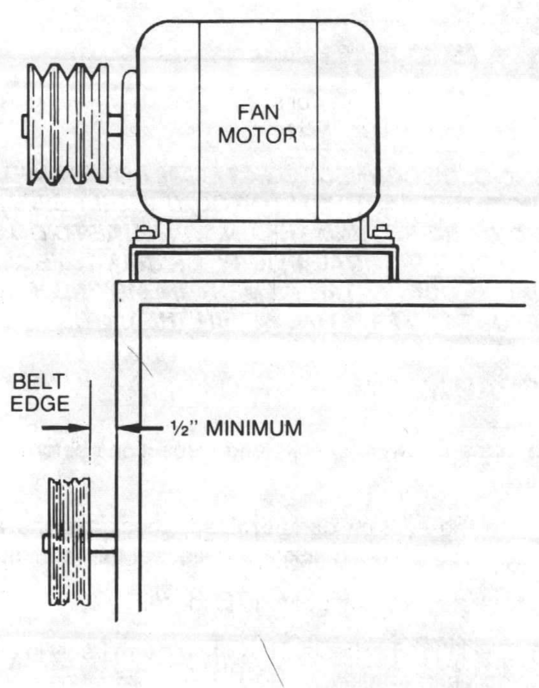


Figure 52 - Minimum Allowable Distance Between Frame Work and Fan Sheave.

FAN ASSEMBLY SETSCREWS

Check and adjust fan wheel, bearing and sheave setscrews whenever a component is removed or an adjustment is made. Refer to Table 4 for recommended Torques.

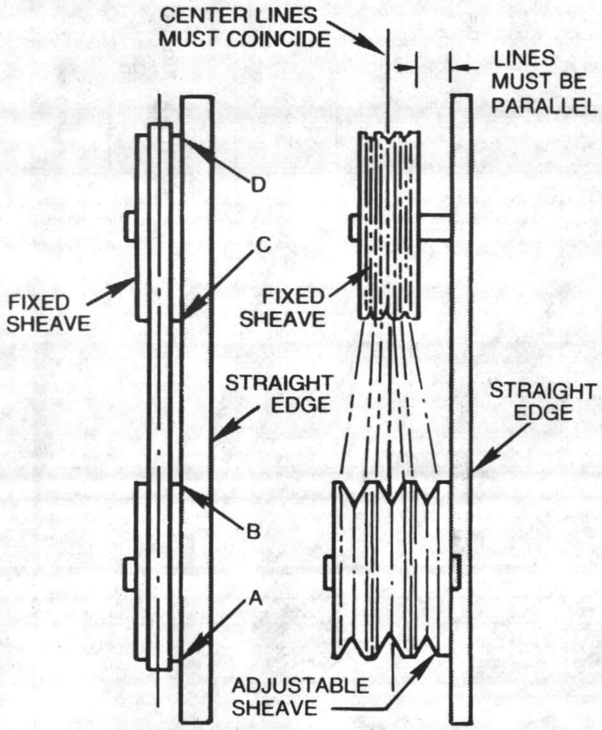


Figure 53 - Sheave Alignment

FAN WHEEL CLAMPS

The clamps that hold the fan hub on the shaft must be properly positioned and tightened to ensure safe fan operation.

NOTE: *On fans that are 20 inches or smaller, the clamps should be replaced whenever the wheel or shaft is replaced.*

On fans that are 20 inches or smaller, locate the two-piece clamp over the hub so that the hub tabs go through the clamp slots. Finger-tighten the two bolts evenly, then torque down both bolts **evenly** in small increments to 25 foot-pounds. The clamp flanges should meet at both bolt locations before 25 foot-pounds is reached.

On fans that are larger than 20 inches, finger-tighten the three bolts evenly, then torque down all three bolts **evenly,** in small increments, to 35 to 40 foot-pounds. Visually check the spacing between the three clamp flanges to make sure they are consistently tightened.

FAN BELT TENSION

NOTE: *Fan belt tension should be checked at least twice during the first days of operation, since there is a rapid decrease in tension until belts are run in.*

WARNING: DISCONNECT ELECTRICAL POWER SOURCE AND ALLOW ALL ROTATING EQUIPMENT TO STOP COMPLETELY BEFORE INSPECTING OR SERVICING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR MOVING PARTS.

Proper belt tension is required to ensure maximum bearing and drive component life and is based on fan brake horsepower requirement. Use Chart 1 to find the proper tension and refer to the inset for an example. To use the chart, you must know:

1. Fan design bhp per belt (**not** motor hp)
2. Fan rpm
3. Fan sheave pitch diameter (Figure 54 - found by measuring where the middle of the belt rides in the sheave).
4. Type of belt cross-section (stamped on the belt)

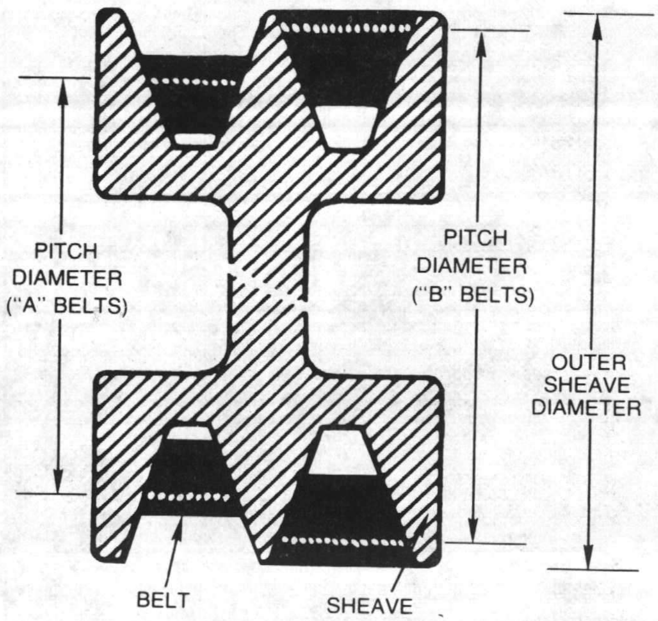


Figure 54 - Fan Sheave Pitch Diameter

As shown in the example of Chart 1, the correction tension (pounds force) is 9.6 pounds, at ½-inch deflection. Deflection is determined by dividing the belt span distance by 64, as shown in Figure 55.

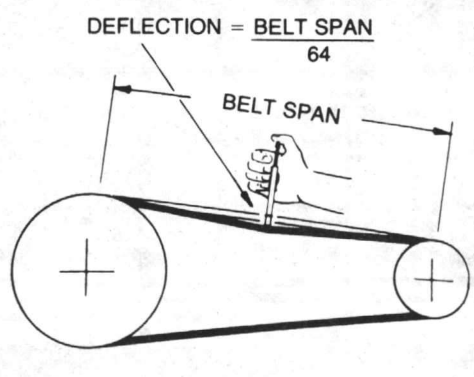
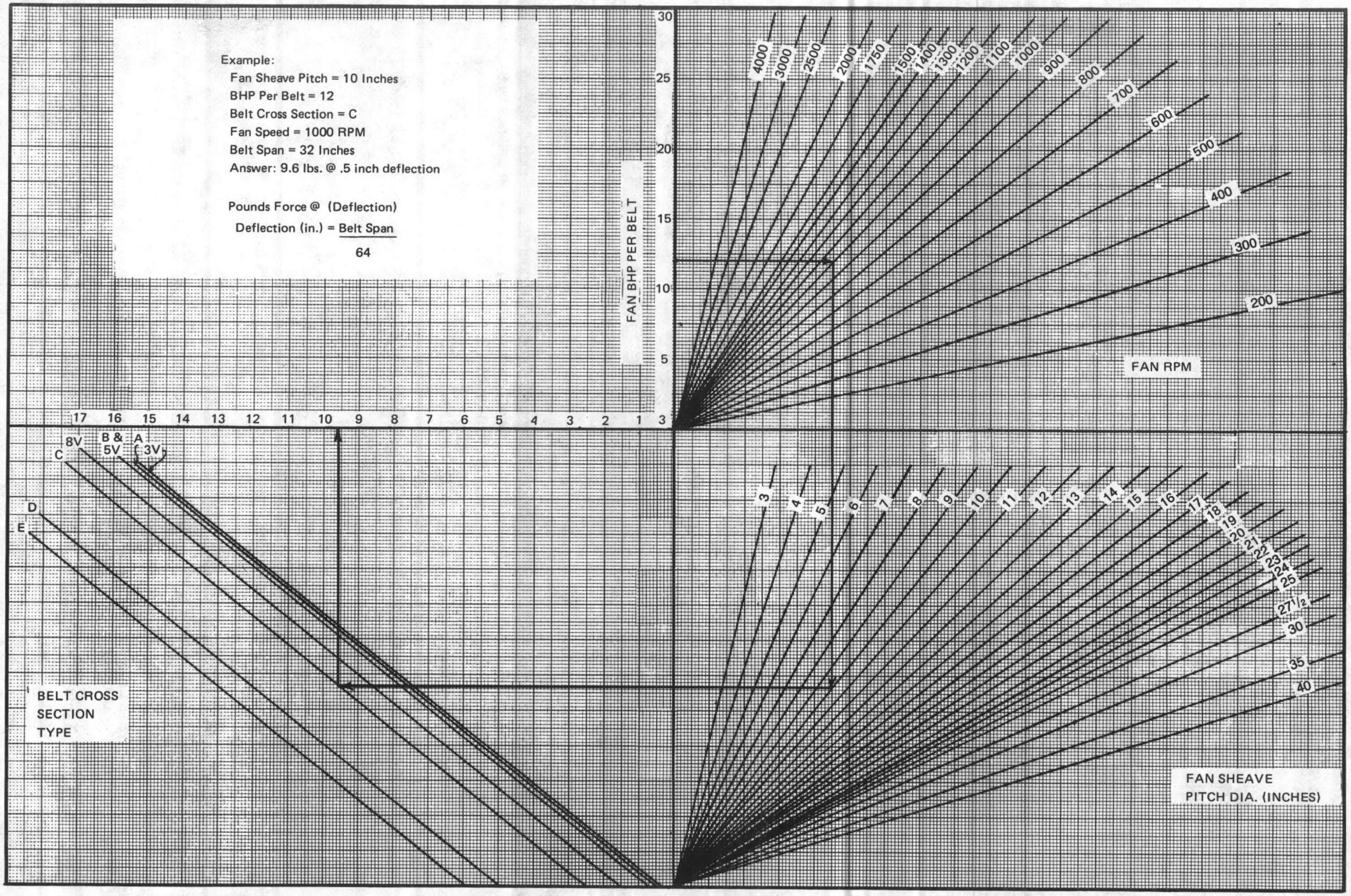


Figure 55 - Belt Tension Measurement

Table 14 — Values for K Factor (Belt Cross-Section Types)

BELT TYPE	A	B	C	D	E	3L	4L	5L	3V	5V	8V	AX	BX	CX	DX
"K" FACTOR	8	13	40	80	95	6	6	6	6	12	25	11	18	54	101

CHART 1 - Belt Tension



To measure belt tension, use a belt tensioner as shown in Figure 56. Determine actual deflection by depressing one belt with the belt tensioner and measuring the deflection relative to the other belts or to belt line. Adjust the belt tension to the correct pounds force and tighten all setscrews to the proper torques.

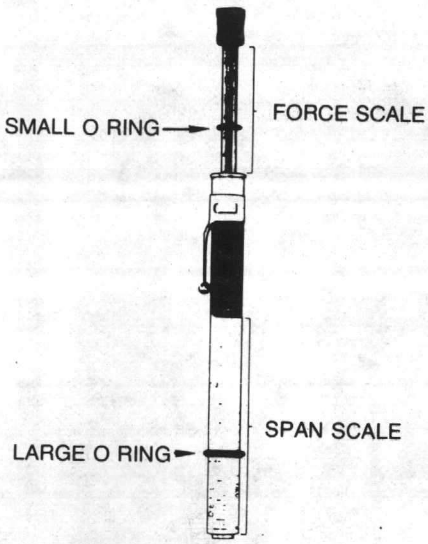


Figure 56 - Belt Tensioner

For belt cross-section types not given in Chart 1, refer to Table 14 and use the following equations to calculate correct belt tension:

$$F = \frac{T + K}{16}$$

where F = force measured in pounds at specific deflection

K = constant determined by belt cross-section type (See Table 14).

$$T = 24{,}750 \times \frac{\text{(fan hp per belt)}}{\text{(belt speed)}}$$

$$\text{Belt speed} = \frac{\text{(fan pitch diameter)}}{12} \times (\pi) \times \text{fan rpm (ft/min)}$$

For example, given the following:

Motor sheave pitch diameter: 16.8 inches, eight groove
Fan sheave pitch diameter: 19.8 inches, eight groove
Fan horsepower: 262.4 bhp
Fan rpm: 983 rpm
Belt type: 8V
Sheave span: 60.9 inches

$$\text{Belt speed} = \frac{19.8}{12} \times 3.14 \times 983 = 5092$$

$$T = 24{,}750 \times \frac{(262.4 \text{ bhp/8 belts})}{5092} = \frac{24{,}750 \times 32.8}{5092} = 159.4 \text{ lbs}$$

$$F = \frac{159.4 + 25}{16} = 11.5 \text{ lbs}$$

$$\text{Also, } D = \frac{\text{Belt span (inches)}}{64} = \frac{60.9}{64} = .95 =$$

approximately 15/16 inches

Therefore, the belt tensioner should read 11.5 pounds force at 15/16-inch deflection. This will yield 159.4 pounds force belt tension.

Belt tensions determined by using Chart 1 and Table 14 are minimum values. The correct operating tension for a V-belt drive is the lowest tension at which the belts will not slip under start-up or peak load conditions. It may be necessary, however, to increase the tension of some drives to reduce excessive belt flopping.

CAUTION: Do not over-tension the belts. Excessive tension will reduce fan and motor bearing life, accelerate belt wear and possibly cause shaft failure.

Remove the belt guard and clean the sheaves and belts with a dry cloth. Oil and gease should be kept away from the belts because they can cause deterioration and slippage. The use of belt dressing is **not** recommended.

For further information on this product or other Trane products, refer to the "Trane Service Literature Catalog", ordering number IDX-IOM-1. This catalog contains listings and prices for all service literature sold by Trane. The catalog may be ordered by sending a $20.00 check to: The Trane Company, Service Literature Sales, 3600 Pammel Creek Road, La Crosse, WI 54601.

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TRANE

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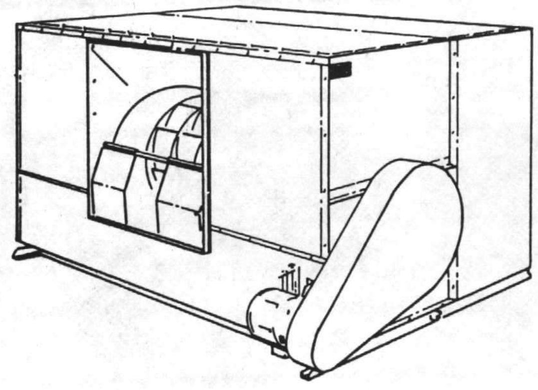
Supersedes	

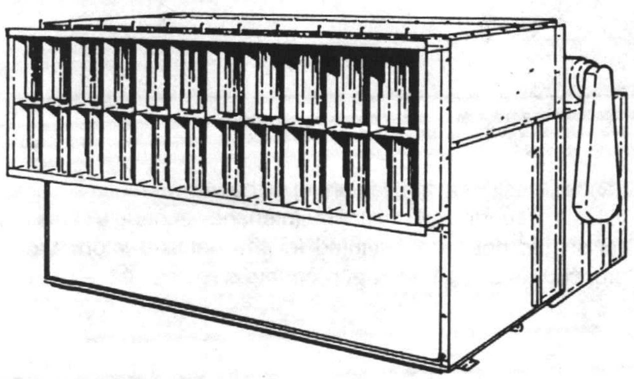
CLIMATE CHANGER® CENTRAL STATION AIR HANDLERS

DRAW-THRU, BLOW-THRU SPRAYED COIL AND HIGH PRESSURE UNITS

B DEVELOPMENT SEQUENCE



DRAW-THRU



BLOW-THRU

X39640291-01

LITERATURE HISTORY CHANGE:
Delta—Flow Coils added to units, changing design sequence to 'E'.

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GENERAL INFORMATION

Central Station Climate Changers® are air handlers designed to provide complete heating, cooling and dehumidifying by means of wide variety of unit sizes, coils, fans and efficiency capabilities. This manual will cover all vertical and horizontal, draw-thru, blow-thru, sprayed coil and high pressure units. A Periodic Maintenance Checklist at the beginning of the Maintenance section provides the suggested routine maintenance schedule. This checklist should not be substituted for the detailed information and procedures contained in appropriate sections of the manual.

The Trane Company
La Crosse, Wisconsin 54601-7599
Printed in U.S.A.

START-UP

WARNING: DISCONNECT ELECTRICAL POWER AND ALLOW ALL ROTATING PARTS TO STOP COMPLETELY BEFORE SERVICING OR INSPECTING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK, ENTANGLEMENT IN MOVING PARTS OR PRESSURE DIFFERENTIAL WITHIN THE UNIT.

PREPARATION

Perform the following checks and inspections before operating the unit:

1. **With the system de-energized,** check that the electrical connections are complete and tight at the terminals.
2. Make sure the belt guard is in place.
3. Inspect the fan wheels. They should turn freely.
4. As mentioned previously in the Installation Manual, check the bearing and sheave setscrews for proper torque settings. Refer to applicable section in this manual.
5. Inspect fan belt tension. Belt tension, sheave alignment and setscrew torque information is given in the applicable section of this manual.
6. Check the piping and valves for leaks. Open or close the valves, depending on their function in the system. If a refrigerant coil is used, the system must be evacuated, leak-tested with dry nitrogen and charged with refrigerant.

8. Remove any foreign material from the drain pan. Check the drain pan and condensate line to make sure they are not obstructed.
9. All unit access panels must be in place. All screws, nuts and bolts must be tight.

11. If the unit includes fan paralleling controls, open them fully.
12. Inspect fan motor and bearing lubrication.

CAUTION: To prevent fan motor or bearing failures, it is necessary that they are lubricated properly. This must be checked before the unit is started for the first time. See the label on the side of the unit, the tag attached to the motor, and the Maintenance section of this manual.

START-UP PROCEDURES

After completing all the items uner "Pre-Start-Up," the unit may be started and the following checks and adjustments performed:

NOTE: *High Pressure units with self-locking collar fan bearings. During start-up check rotation of fan shaft to determine if fan motor is wired correctly. Incorrect rotation of fan may cause premature bearing and shaft failure. Refer to bearing section in this manual.*

1. Measure the motor voltage and amps on all phases to insure proper operation. Compare these readings with the motor nameplate.
2. If the unit includes a spray pump, open the spray pump air valve and purge air from the system. Adjust the spray pump valve until the spray pattern diameter equals the finned height of the top cooling coil. The resulting gauge pressure should be between 7 and 10 psig.
3. If the unit includes fan paralleling control (two-fan, blow-thru units only), adjustment may be required. An indication of an incorrect setting is paralleling of the fan (pulsating operation) and erratic fan motor amperage readings. Adjust the fan paralleling control until fan operation is smooth and the amperage reading is steady.

   The fan paralleling control should be closed only far enough to eliminate erratic operation. Rarely should adjustment exceed two inches on either fan. If the devices are closed too far, unit capacity will be reduced.

   Each fan paralleling control device has two rods per fan extending upward through the top of the blow-thru fan section. To adjust fan operation for a smooth airflow condition, the following should be done:

   a. Loosen the locking nut on one rod, lower the rod ½-inch and retighten. Repeat for the other rod on the fan.
   b. If the unstable condition still exists, repeat Step A.
   c. If the unstable condition still exists, relocate the fan paralleling control to the original position and perform Steps A and B on the other fan.
   d. If the unstable condition still exists, lower both fan paralleling devices to 1-inch from the original position. Repeat Steps A, B, and C, using 1-inch as a base reference.

4. Measure voltage at all three wires. Maximum allowable voltage imbalance is two percent. Voltage imbalance is defined as 100 times the sum of the deviation of the three voltages from the average, divided by twice the average voltage. For example, if the three measured voltages are 221, 230 and 227, the average voltage would be 226 volts. The percent of voltage imbalance is then calculated:

$$\frac{100 \times \{ [226\text{-}221] + [230\text{-}226] + [227\text{-}226] \}}{2 \times 226} =$$
$$2.2\% \text{ (Unacceptable)}$$

   In this example, 2.2 percent imbalance is not acceptable and the power company should be notified to correct it.

5. If the fan speed is changed more than 5% from the original designed rpm, or if parts such as shafts, fan wheels, bearings, or other drive components are replaced, the unit vibration should be checked.

   The unit vibration, measured horizontally and vertically directly on the fan shaft bearing (perpendicular to the shaft centerline), should not exceed 0.2 in/sec. or 3.0 mils, whichever is the lower displacement at the unit operating speed.

MAINTENANCE

PERIODIC MAINTENANCE CHECKLIST

WARNING: DISCONNECT ELECTRICAL POWER AND ALLOW ROTATING PARTS TO STOP BEFORE SERVICING THE UNIT OR REMOVING THE FAN BELT GUARD. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR ENTANGLEMENT IN MOVING PARTS.

The following checklist describes the suggested maintenance schedule to maintain proper operation of the unit. Detailed procedures for owner-operator maintenance checks are given after this checklist. For more information on the unit, refer to the Service Guide or contact a local Trane Service Company.

EVERY MONTH

☐ 1. Inspect air filters. Clean or replace if clogged.

☐ 2. Inspect air filter manometer for bag filters or roll filters with manual controls. Change bag filters when manometer reading is 1 inch wg. Change roll filters when manometer reading is ½ inch wg.

☐ 3. Check sump water concentration in Sprayed Coil units to make sure that no corrosive or scaling conditions have been created by poorly treated water.

EVERY THREE TO SIX MONTHS

NOTE: *The procedures listed in this section should be completed every three to six months. The frequency of their completion will depend on load and ambient conditions. Detailed procedures following this Maintenance Checklist will give more information on suggested conditions and schedules.*

☐ 1. Check that fan bearing grease lines are tight to the bearings so no grease leaks at the connection.

☐ 2. Lubricate fan bearings.

☐ 3. Check bearing locking setscrews and other setscrews for proper tightness. All bearing races must be secure.

☐ 4. Lubricate fan motors.

☐ 5. Check sheave alignment and level of shafts.

☐ 6. Check fan belt tension. Adjust if belts slip. Replace worn or frayed belts with a new matched set.

☐ 7. Inspect coils for frost or dirt built-up. Clean fins if airflow is clogged.

☐ 8. Inspect spray humidifier for lime deposits in the spray nozzle. Clean if flow is clogged.

☐ 9. Inspect steam grid humidifier wrapping. Replace if flow is clogged.

EVERY YEAR

☐ 1. Inspect electrical wiring for condition. Tighten all connections.

☐ 2. Inspect the unit casing and accessories for chipping or corrosion. If damage is found, clean and repaint with a good grade of rust resistant zinc chromate paint.

☐ 3. Inspect the drain pan for sludge or other foreign material. Clear the drain openings and drain line to ensure adequate flow.

☐ 4. Check damper linkages, setscrews and blade adjustment for proper tightness and operation. Do not lubricate nylon damper rod bushings.

☐ 5. Check inlet vane linkages, setscrews and vane adjustment for proper tightness, operation, and alignment.

☐ 6. Recalibrate the filter manometer.

☐ 7. Clean and check the water system on Sprayed Coil Climate Changers.

MAINTENANCE PROCEDURES

FILTERS

Table 1 lists air filter sizes and quantities required for all filter boxes. Replace with UL Class 2 approved filters only. Always install filters with directional arrows pointing in direction of airflow.

To clean permanent filters, wash under a stream of hot water to remove dirt and lint. Follow with a wash of mild alkali solution to remove old filter oil. Rinse thoroughly and let dry. Recoat both sides of the filter with Air Maze filter oil or an equivalent and let dry. Replace filter element in the unit.

Bag filters should be replaced when pressure differential across the filter is 1 inch wg. A manometer should have been installed for surveillance of pressure drop across the filter.

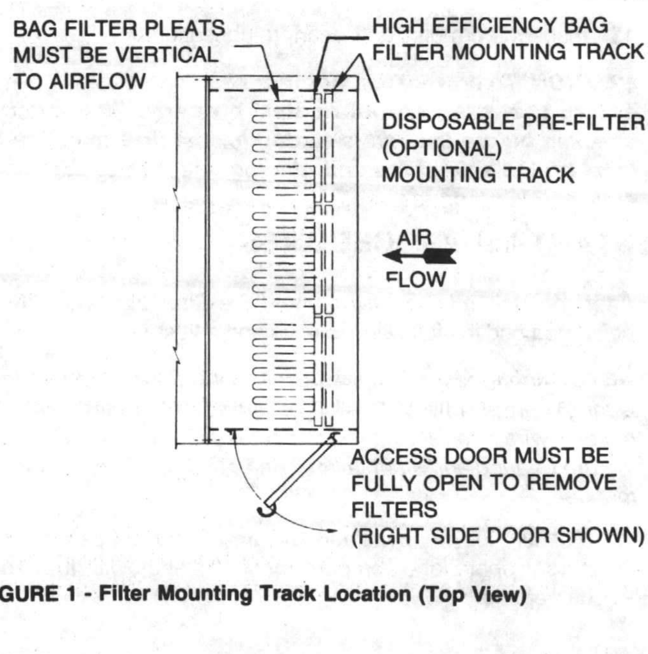


FIGURE 1 - Filter Mounting Track Location (Top View)

TABLE 1 - Filter Sizes and Quantities Per Set

UNIT SIZE	2-INCH FLAT FILTER BOX	COMBINATION & MEDIUM FILTER BOX	HIGH CAPACITY BOX	BAG FILTER AND PREFILTER (HXW)	4-INCH PLEATED FILTER BOX
3	1-20x25	2-16x25	2-20x25	—	—
6	2-20x25	4-16x25	4-20x25	—	—
8	4-16x20	4-20x25	6-20x20	1-24x12 1-24x24	4-16x20
10	4-16x25	6-16x25	6-20x25	2-24x24	4-16x25
12	2-20x20 2-16x25 1-16x20	4-20x25 2-16x25	6-16x20 3-20x25	2-24x12 2-20x20	1-16x20 2-16x25 2-20x20
14	4-16x20 2-20x25	8-16x25	6-20x20 3-20x25	2-24x12 3-20x20	4-16x20 2-20x25
17	6-16x20 2-16x25	8-20x25	3-20x25 9-20x20	1-24x12 3-24x24	6-16x20 2-16x25
21	8-16x20 2-16x25	10-20x25	3-20x25 12-20x20	5-24x20	8-16x20 2-16x25
25	12-16x20	6-20x25 6-16x25	6-20x25 9-20x20	4-24x12 5-20x20	12-16x20
31	7-16x20 7-16x25	8-16x25 12-16x20	8-20x25 12-20x20	10-20x20	7-16x20 7-16x25
35	14-16x25	16-20x25	28-16x25	2-24x12 8-24x24	14-16x25
41	6-16x20 12-20x20	20-20x25	32-16x25	2-24x12 8-24x24	6-16x20 12-20x20
50	7-16x20	28-16x25 14-16x25	35-16x25	15-20x20	7-16x20 14-16x25
63	10-16x25 12-20-25	30-20x25	49-16x25	20-20x20	10-16x25 12-20x25
73	6-20x20 18-20x25	36-20x25	42-20x25	—	—
86	21-20x25 7-20x20	42-20x25	49-20x25	—	—

WARNING: MAXIMUM BAG FILTER PRESSURE DROP IS 1 INCH WG. OPERATION OF THE UNIT AT A PRESSURE DIFFERENTIAL GREATER THAN THIS MAY CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE FROM COMBUSTION.

Trane recommends the use of optional disposable prefilters with high efficiency bag filters. Prefilters slide into mounting tracks just ahead of the bag filter and serve to prolong the life of bag filters. Figure 1 illustrates bag filter and prefilter installation. Complete the following to install high efficiency bag filters:

1. Ensure power is disconnected. Open filter section access door.

   WARNING: DISCONNECT POWER SOURCE BEFORE OPENING FILTER SECTION ACCESS DOOR. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK, HIGH PRESSURES OR MOVING PARTS.

2. Slide bag filters and flat prefilters into the appropriate filter tracks. Bag filters must be installed with pleats vertical to airflow.

3. Slide adjustable blockoff into filter track.

4. Close access door. If door can be closed without compressing the filters, adjust the blockoff by loosening its screws and sliding it towards the door. The door should squeeze the blockoff against the filters, compressing them together. Tighten the adjusting screws.

NOTE: *Filters must have an airtight seal to prevent air bypass. If using other than recommended filters, apply foam gasketing to the vertical edges of the filter holding frame for a tight seal.*

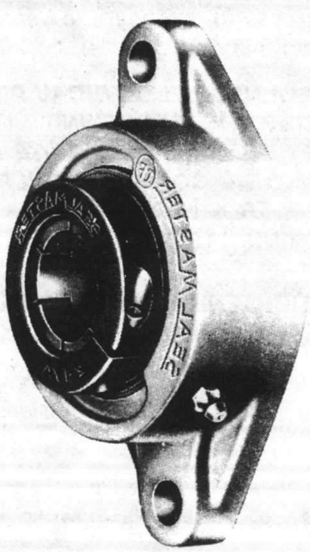


FIGURE 2 - Flange Type Bearing with Grease Fitting and Squeezeloc Tightener

TABLE 2 - Recommendations for Grease Lubricated Fan Bearings

OPERATING CONDITIONS	GREASING INTERVALS -20 F To 140 F	140 F To 200 F
Clean, Dry	3-6 Months	1-3 Months
Dirty, Dry	1-3 Months	1-4 Weeks
Dirty, Wet, High Humidity	1-4 Weeks	1-14 Days
RECOMMENDED GREASES	**RECOMMENDED OPERATING RANGE**	
Texaco-Multi Fak #2	-20 F to 250 F	
Shell Alvania #2	-20 F to 250 F	
Mobil Mobilux #2	-20 F to 250 F	
Exxon Unirex #2	-20 F to 250 F	
Texaco Premium RB	-20 F to 250 F	
Mobil 532	-20 F to 250 F	
Exxon Beacon	-65 F to 250 F	
Keystone Keystone 84 H	-40 F to 225 F	

NOTE: Greases used should conform to NLGI No. 2 penetration.

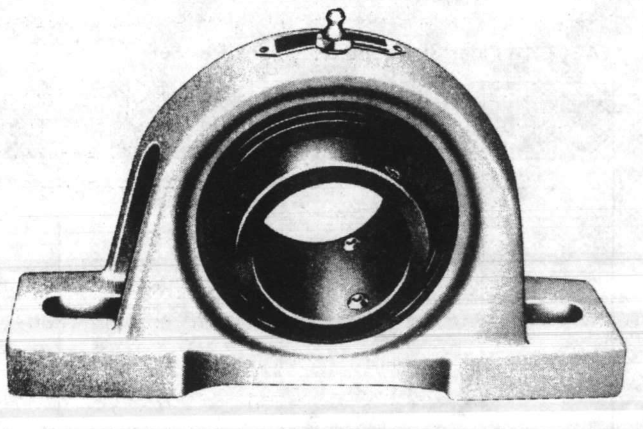


FIGURE 3 - Pillow Block Type Bearing with Grease Fitting and Double Lock Setscrew Arrangement

FAN BEARING LUBRICATION

Fan bearings (see Figure 2) with grease fittings or with grease line extensions should be lubricated with a lithium base grease which conforms to NLGI Number 2 for consistency and which is free of chemical impurities. See Table 2 for recommended lubricants. Improper lubrication can result in early bearing failure.

To lubricate the fan bearings, complete the following:

1. Bearings are to be lubricated while unit is not running, disconnect main power switch.
2. Connect a manual grease gun to the grease line or fitting.
3. While turning the fan wheel manually, add grease, preferably when bearing is warm, until a light bead of grease appears at the bearing grease seal.

   NOTE: *On sizes 35 thru 86 CLCH or other size units with internal opposite drive side bearings, it will be necessary to remove unused bearing plate for observation of bearing grease seal.*

CAUTION: Do not over-lubricate bearings. Excessive pressure caused by overlubrication can displace bearing grease seals or cause grease to overheat the bearing, resulting in premature bearing failure.

WARNING: DISCONNECT ELECTRICAL POWER SOURCE BEFORE SERVICING THE UNIT. IF UNIT MUST BE ON FOR MAINTENANCE PROCEDURES, EXERCISE EXTREME CAUTION. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR ENTANGLEMENT IN MOVING PARTS.

FAN BEARING TIGHTENING INSTRUCTIONS (DOUBLE LOCK SETSCREW)

The pillow block bearing with double setscrew locking arrangement requires specific tightening instructions. See Figure 3. Complete the following.

1. Rotate the shaft until the double lock bearing setscrews are in the vertically up position as shown in Figure 4.
2. Without V-Belt tension, snug (hand tight) all four setscrews of the double lock bearing in the numerical sequence as shown in Figure 4.
3. Torque each setscrew of the double lock bearing in the numerical sequence to 66 inch-pounds. See Figure 4.

FAN BEARING SELF-LOCKING COLLAR INSTALLATION

The pillow block bearing with self-locking collar arrangement is used on size 8-35 High Pressure Climate Changer Units. See Figure 5.

NOTE: *At or before start-up check the wiring of the three phase fan motor to assure proper shaft rotation. Incorrect fan rotation may loosen the locking collar resulting in pre-mature bearing failure.*

Complete the following recommended steps for bearing replacement.

1. Slip the shaft through the pillow block. Be certain the bearing is aligned in position along the shaft to eliminate any possibility of cramping loads.
2. Fasten the unit securely to the base using the proper bolt size.

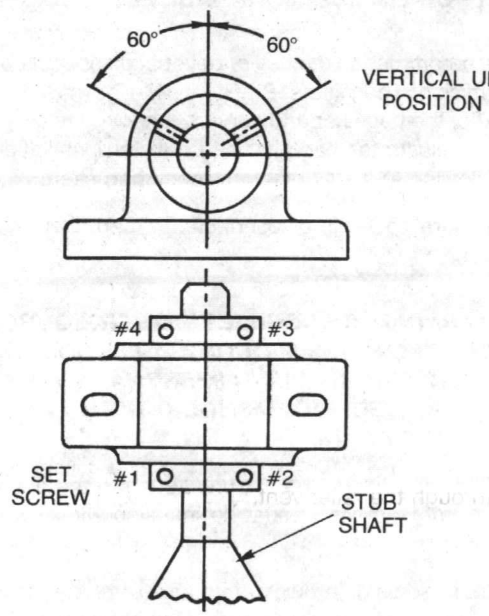


FIGURE 4 - Instruction Sketch for Pillow Block Bearing with Double Lock Setscrew

3. Manually rotate fan shaft several times to assure bearing alignment.
4. Place the self-locking collar on the shaft with its cam adjacent to the cam on the end of bearing's inner ring. Turn the collar in the direction of shaft rotation. The eccentric recessed cam will drop over and engage the corresponding cam on the bearing inner ring.
5. Using a light-weight hammer and drift pin inserted in the drift pin hole strike in the direction of shaft rotation to positively engage the collar. The wide inner ring is now locked to the shaft.
6. Tighten the setscrew to recommended torque. See Table 5.

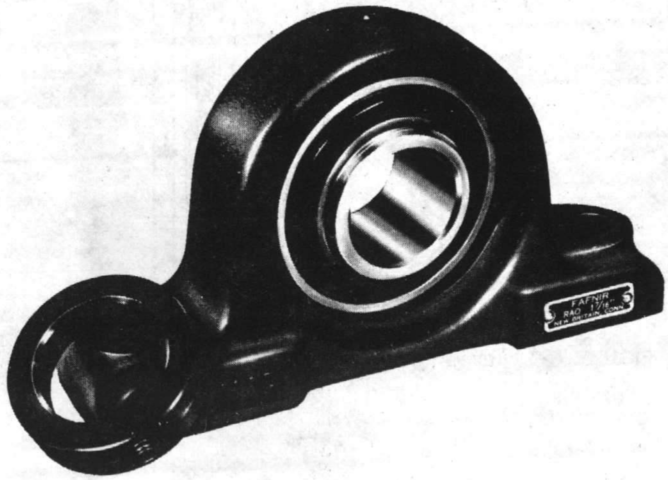


FIGURE 5 - Pillow Block Type Bearing with Grease Fitting and Self-Locking Collar Arrangement

FAN MOTORS

Inspect periodically for excessive vibration or temperature. Operating conditions will vary the frequency of inspection and lubrication. Table 3 lists recommended motor greasing intervals. Motor lubrication instructions are found on the motor tag or nameplate. If not available contact the motor manufacturer for instructions.

To relubricate the motor, complete the following:

WARNING: DISCONNECT POWER SOURCE FOR MOTOR LUBRICATION. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK OR MOVING PARTS.

1. Turn the motor off. Make sure it cannot accidentally restart.
2. Remove the relief plug and clean out any hardened grease.
3. Add fresh grease through the fitting with a low pressure grease gun.
4. Run the motor for a few minutes to expel any excess grease through the relief vent.
5. Stop the motor and replace the relief plug.

NOTE: *If excessive grease is plugged at the motor shaft, use less grease and/or extend the greasing interval.*

Refer to Table 4 for minimum torques of motor mounting and bearing bolts.

TABLE 3 - Motor Greasing Intervals

TYPE OF SERVICE	UP TO 7.5 HP MOTORS	10-40 HP MOTORS	50-150 HP MOTORS
8-16 Hrs., Clean, Dry	5 Years	3 Years	1 Year
12-24 Hrs., Moderate Dirt Or Moisture	2 Years	1 Year	6 Months
Severe - Very Dirty, High Temperature	6 Months	3 Months	2 Months

TABLE 4 - Minimum Hex Head Bolt Torques

BOLT SIZE	TORQUE - FOOT/POUNDS	
	GRADE 2	GRADE 5
¼" - 20 UNC	4	6
¼" - 28 UNF	4	7
5/16" - 18 UNC	8	14
5/16" - 24 UNF	9	16
⅜" - 16 UNC	14	24
⅜" - 24 UNF	16	28
7/16" - 14 UNC	30	42
7/16" - 20 UNF	35	45
½" - 13 UNC	40	69
½" - 20 UNF	47	83
9/16" - 12 UNC	57	99
9/16" - 18 UNF	68	118
⅝" - 11 UNC	86	150
⅝" - 18 UNF	101	176
¾" - 10 UNC	146	254
¾" - 16 UNF	173	301
⅞" - 9 UNC	206	358
⅞" - 14 UNF	244	422
1" - 8 UNC	289	500
1" - 14 UNF	347	602

NOTE: Grade 2 bolts have no markings on the capscrew. Grade 5 bolts have 3 radial dashes, 120 degrees apart.

TABLE 5 - Torques for Tightening Locking Screws, Bearings and Sheaves

TORQUE FOR TIGHTENING SETSCREWS				TORQUE FOR TIGHTENING SEALMASTER LOCKING COLLAR				
SET SCREW DIA.	HEX SIZE ACROSS FLATS	RECOM. TORQUE		COL-LAR	SCREW DIA.	HEX SIZE ACROSS FLATS	RECOM. TORQUE	
		INCH LBS.	FOOT LBS.				INCH LBS.	FOOT LBS.
¼"	⅛"	66	5.5	2-015B	8-32	⅛"	70	5.8
5/16"	5/32"	126	10.5	2-13B	8-32	⅛"	70	5.8
⅜"	3/16"	228	19.0	2-17B	10-24	9/64"	90	7.5
7/16"	7/32"	348	29.0					
½"	¼"	504	42.0					
⅝"	5/16"	1,104	92.0					

NOTE: Tighten bearing setscrews to the torque shown before running unit. Setscrews can loosen in shipment.

Fan motors should be stored indoors in a clean and dry atmosphere and on solid ground. The motor shaft should be turned occasionally to prevent brinelling of the bearings. If motors must be stored outdoors in varying, humid climate, use space heaters and cover the motors as completely as possible to keep them dry. If space heaters have not been installed and motors have been subjected to the elements for several months, the following steps are recommended before operating the motors:

1. Inspect bearings for moisture and rust. Replace bearings if necessary and repack with new grease.
2. Check motor winding. An acceptable reading is from 6 megohms to infinity. If reading is less than 5 megohms, windings should be dried out in an oven or by a blower.

3. Inspect the entire motor for rust and corrosion.

4. Lubricate the motor as instructed in this Maintenance manual, or as indicated by the maintenance tag on the motor.

SHEAVE ALIGNMENT

To prevent interference of the fan frame with the belt, make sure that the belt edge closest to the motor has the proper clearance from the fan frame, as shown in Figure 6.

Align the fan and motor sheaves by using a straightedge as shown in Figure 7. The straightedge must be long enough to span the distance between the outside edges of the sheaves. When the sheaves are aligned, the straightedge will touch both sheaves at points A through D. A string, drawn tight, may be used in the same manner. For uneven width sheaves, place a string in the center groove of both sheaves and pull tight. Adjust sheaves and tighten the sheave setscrews to the proper torques, given in Table 5.

Parallel operation of the fan and motor shafts is necessary to prolong belt life. Place a level on the shafts to check horizontal alignment. Shim if necessary.

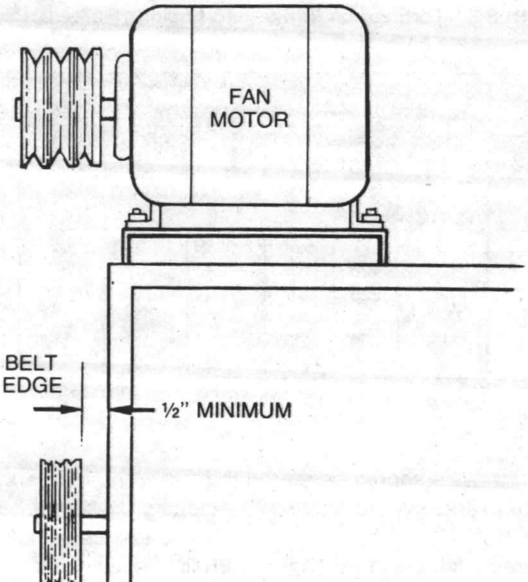


FIGURE 6 - Minimum Allowable Distance Between Frame Work and Fan Sheave

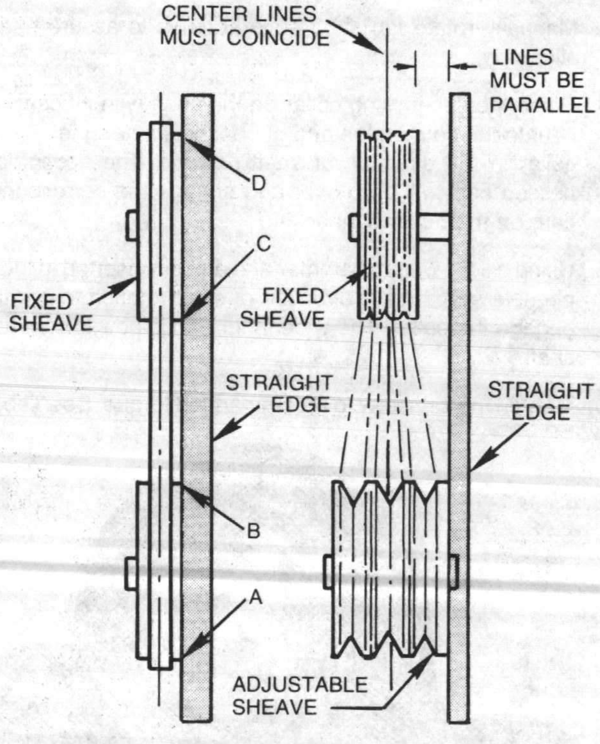


FIGURE 7 - Sheave Alignment

FAN ASSEMBLY SETSCREWS

Check and adjust fan wheel, bearing and sheave setscrews whenever a component is removed or an adjustment is made. Refer to Table 5 for recommended torques.

FAN WHEEL CLAMPS

The clamps that hold the fan hub on the shaft must be properly positioned and tightened to ensure safe fan operation.

NOTE: *On fans that are 20 inches or smaller, the clamps should be replaced whenever the wheel or shaft is replaced.*

On fans that are 20 inches or smaller, locate the two-piece clamp over the hub so that the hub tabs go through the clamp slots. Finger-tighten the two bolts evenly, then torque down both bolts **evenly** in small increments to 25 foot-pounds. The clamp flanges should meet at both bolt locations before 25 foot-pounds is reached.

On fans that are larger than 20 inches, finger-tighten the three bolts evenly, then torque down all three bolts **evenly,** in small increments, to 35 to 40 foot-pounds. Visually check the spacing between the three clamp flanges to make sure they are consistently tightened.

TABLE 6 - Values for K Factor (Belt Cross-Section Types)

BELT TYPE	A	B	C	D	E	3L	4L	5L	3V	5V	8V	AX	BX	CX	DX
"K" FACTOR	8	13	40	80	95	6	6	6	6	12	25	11	18	54	101

FAN BELT TENSION

NOTE: *Fan belt tension should be checked at least twice during the first days of operation, since there is a rapid decrease in tension until belts are run in.*

WARNING: DISCONNECT ELECTRICAL POWER SOURCE AND ALLOW ALL ROTATING EQUIPMENT TO STOP COMPLETELY BEFORE INSPECTING OR SERVICING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR MOVING PARTS.

Proper belt tension is required to ensure maximum bearing and drive component life and is based on fan brake horsepower requirement. Use Chart 1 to find the proper tension and refer to the inset for an example. To use the chart, you must know:

1. Fan design bhp per belt (**not** motor hp)
2. Fan rpm
3. Fan sheave pitch diameter (Figure 8 - found by measuring where the middle of the belt rides in the sheave)
4. Type of belt cross-section (stamped on the belt)

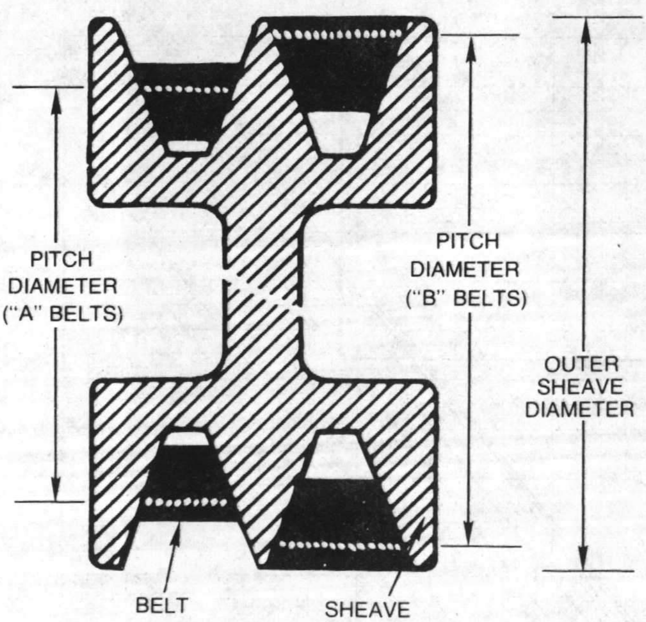


FIGURE 8 - Fan Sheave Pitch Diameter

As shown in the example of Chart 1, the correction tension (pounds force) is 9.6 pounds, at ½-inch deflection. Deflection is determined by dividing the belt span distance by 64, as shown in Figure 9.

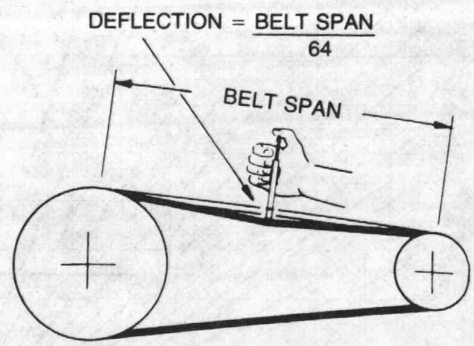


FIGURE 9 - Belt Tension Measurement

To measure belt tension, use a belt tensioner as shown in Figure 10. Determine actual deflection by depressing one belt with the belt tensioner and measuring the deflection relative to the other belts or to belt line. Adjust the belt tension to the correct pounds force and tighten all setscrews to the proper torques.

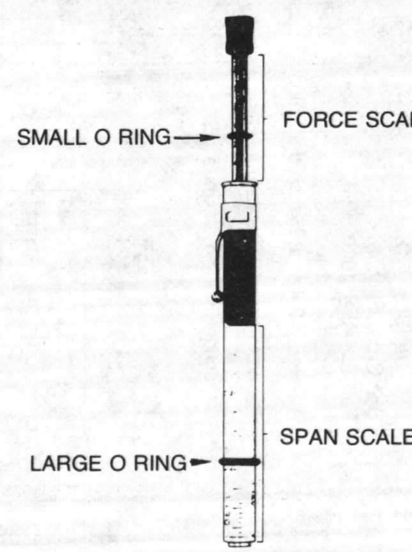
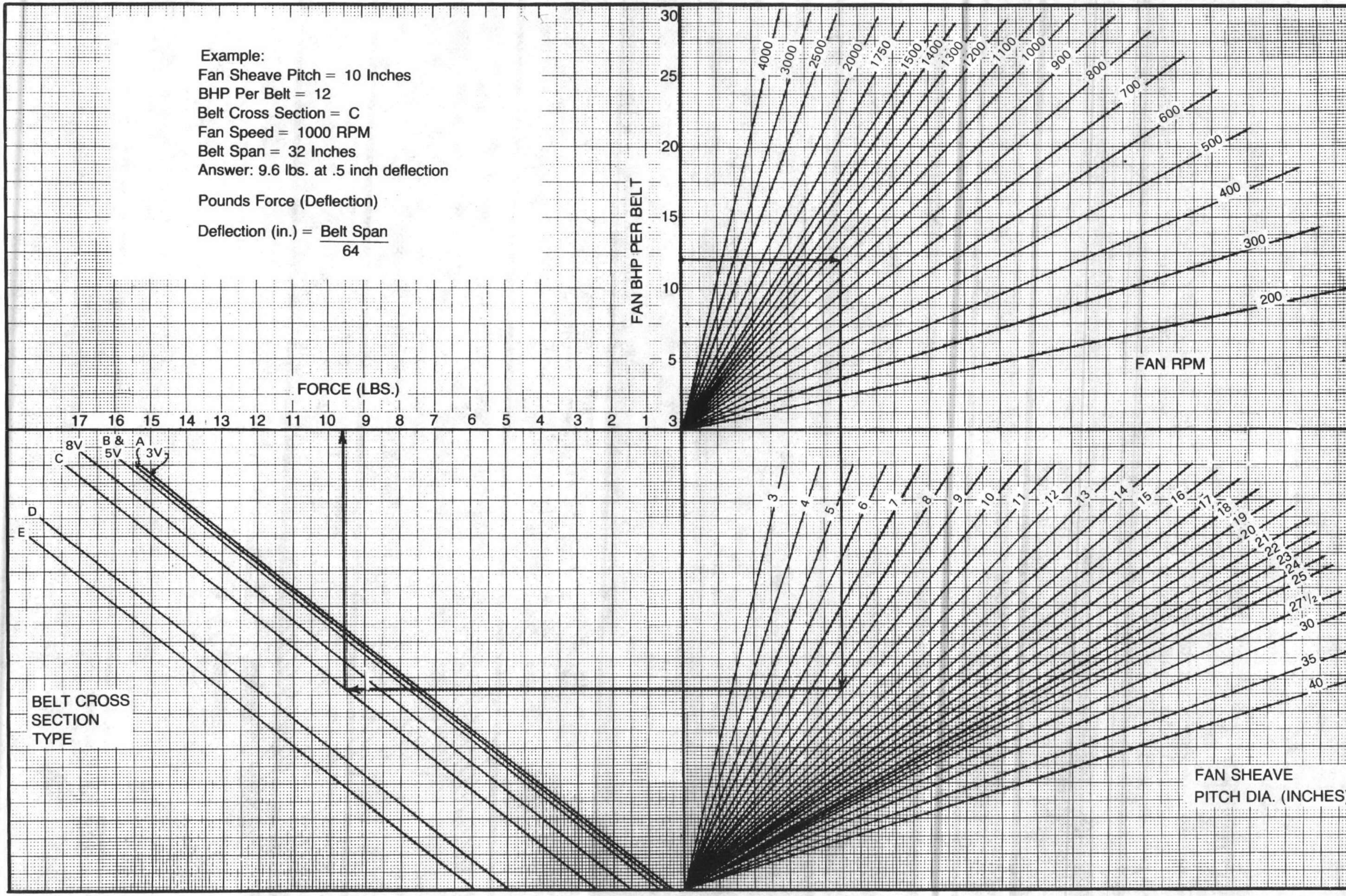


FIGURE 10 - Belt Tensioner

CHART 1 - Belt Tension



For belt cross-section types not given in Chart 1, refer to Table 6 and use the following equations to calculate correct belt tension:

$$F = \frac{T + K}{16}$$

where F = force measured in pounds at specific deflection

K = constant determined by belt cross-section type (See Table 6)

$$T = 24{,}750 \times \frac{\text{(fan hp per belt)}}{\text{(belt speed)}}$$

$$\text{Belt speed} = \frac{\text{(fan pitch diameter)}}{12} \times (\pi) \times \text{fan rpm (ft/min)}$$

For example, given the following:

Motor sheave pitch diameter: 16.8 inches, eight groove
Fan sheave pitch diameter: 19.8 inches, eight groove
Fan horsepower: 262.4 bhp
Fan rpm: 983 rpm
Belt type: 8V
Sheave span: 60.9 inches

$$\text{Belt speed} = \frac{19.8}{12} \times 3.14 \times 983 = 5092$$

$$T = 24{,}750 \times \frac{(262.4 \text{ bhp/8 belts})}{5092} = \frac{24{,}750 \times 32.8}{5092} = 159.4 \text{ lbs}$$

$$F = \frac{159.4 + 25}{16} = 11.5 \text{ lbs}$$

$$\text{Also, } D = \frac{\text{Belt span (inches)}}{64} = \frac{60.9}{64} = .95 =$$

approximately 15/16 inches

Therefore, the belt tensioner should read 11.5 pounds force at 15/16-inch deflection. This will yield 159.4 pounds force belt tension.

Belt tensions determined by using Chart 1 and Table 6 are minimum values. The correct operating tension for a V-belt drive is the lowest tension at which the belts will not slip under start-up or peak load conditions. It may be necessary, however, to increase the tension of some drives to reduce excessive belt flopping.

CAUTION: Do not over-tension the belts. Excessive tension will reduce fan and motor bearing life, accelerate belt wear and possibly cause shaft failure.

Remove the belt guard and clean the sheaves and belts with a dry cloth. Oil and grease should be kept away from the belts because they can cause deterioration and slippage. The use of belt dressing is **not** recommended.

COIL CLEANING

Coils should be kept clean to maintain maximum performance. If fins become dirty, they should be cleaned. Clean steam, hot water and water cooling coils with steam and detergent, hot water spray and detergent, or one of the commercially available chemical coil cleaners. Clean refrigerant coils with cold water and detergent or one of the commercially available chemical coil cleaners. Rinse coils thoroughly after cleaning.

WARNING: DO NOT USE STEAM OR HOT WATER TO CLEAN A REFRIGERANT COIL. IMPROPER APPLICATION OF HEAT MAY RESULT IN PERSONAL INJURY, DEATH OR EQUIPMENT DAMAGE DUE TO HIGH PRESSURE AND EXPLOSION.

COIL WINTERIZATION

Provisions must be made to drain those coils that are not in use when subjected to freezing temperatures.

CAUTION: Failure to properly drain and vent coils when not in use during freezing temperatures may result in coil freeze-up damage.

Coil types N, NS, and A, may be adequately drained in their pitched position in the unit. In coilless units, the coil, after field installation, is not pitched (unless special pitching coil support channel is ordered for steam coils) and may be adequately drained in their position in the unit.

(Type N is drainable through the return connection.) The installer should have provided appropriate piping for adequate drainage.

Type WL coils are not drainable in either pitched or level position. To drain these coils remove the vent and drain plugs and blow the coils out as completely as possible with compressed air. The coils should then be filled and drained several times with full strength glycol so that it will mix thoroughly with the water retained in the coil. Drain the coil out as completely as possible.

Coil types D, DD and K, plus W, P2, P4, P8, DL and LL are drainable in their factory-installed level position. Coil types D, DD, DL and LL also have Trane factory-installed drain and vent connections. See the Installation Manual for illustrated drain and vent connection locations.

Drainable coils installed in units containing coil types DL or LL will also have factory-installed drain and vent connections.

NOTE: *On units with stacked coils, there is a condensate follower located at the end of each coil connection. Figure 11 illustrates the location of the condensate follower provided at the end of the stacked coils.*

NOTE: *Coil type TT is drainable through its supply connection.*

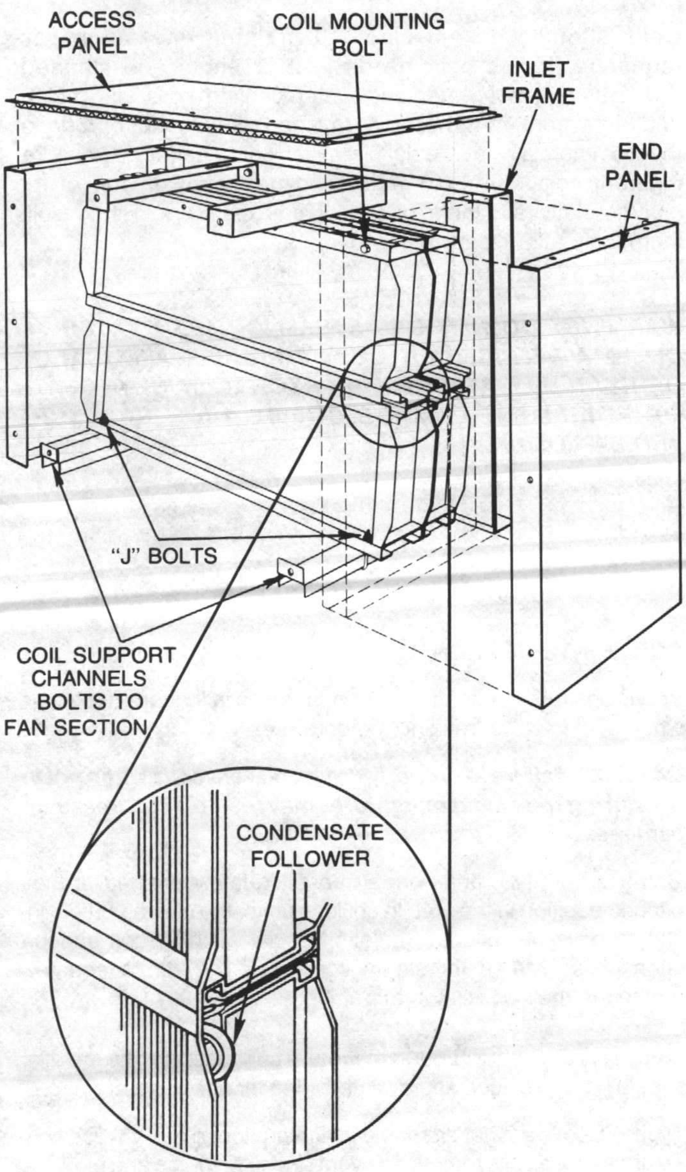


FIGURE 11 - Draw-Thru Coil Section Details with View of Condensate Follower

SPRAY HUMIDIFIER NOZZLE

If lime deposits have developed, clean by soaking the nozzle in an industrial cleaning solution intended for that purpose. Rinse thoroughly with water. Follow the application, safety and cleaning instructions of the industrial cleaner.

MANOMETER CALIBRATION

To check and adjust the calibration of the bag filter or roll filter manometer, complete the following:

1. Make sure the manometer is properly installed on the unit wall within three feet of the filter section. Drain oil from the gauge. Disconnect top tube.
2. Adjust the gauge until the bubble is centered in the spirit level. Tighten the mounting screws and check to be sure that the gauge remained level.
3. Turn the zero-adjust knob counterclockwise until it stops. Then turn it clockwise approximately three full turns so that there is room for adjustment in either direction.
4. Remove the fill plug and pour in needed gauge fluid until the fluid level is visible in the vicinity of zero on the scale. Adjust for exact zero setting with the zero knob and replace the fill plug.

CAUTION: Use Dwyer red or blue oil only. Other fluids may damage the gauge.

5. Clean the gauge with a soft cloth and soap and water. Rinse carefully.

SPRAYED COIL WATER SYSTEM

To complete the yearly cleaning and check for sprayed coil spray systems, complete the following:

1. Clean the spray tank and the spray pump return line strainer. See Figure 12.
2. Check the spray float valve and pump pressure. Adjust the float so that the water level is 1/2-inch below the overflow pipe.
3. Check that the copper pipe is properly located in the overflow drain and is free of dirt, so that the spray tank water is continually being changed.
4. Clean spray nozzles, if necessary, and check for corrosion. Replace damaged nozzles.

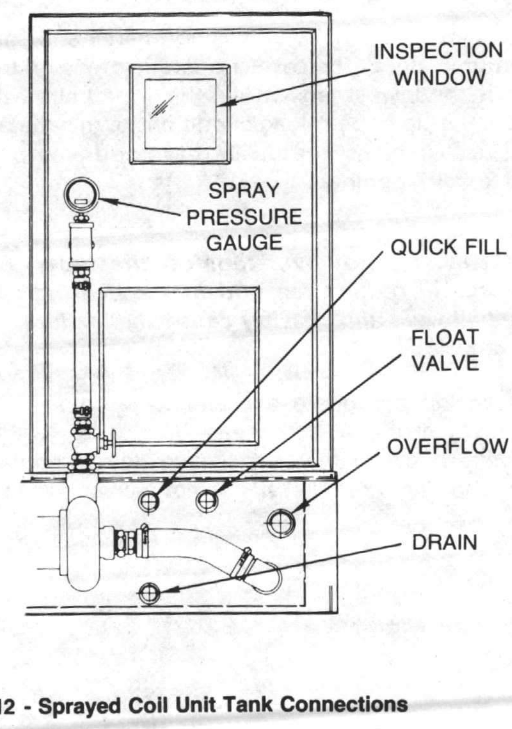


FIGURE 12 - Sprayed Coil Unit Tank Connections

THERMAL EXPANSION VALVE ADJUSTMENT

The importance of proper suction gas superheat cannot be over-emphasized. Accurate superheat measurements should be taken with other trouble analysis procedures to monitor refrigerant flow, coil efficiency and compressor protection. **Refer to compressor or condensing unit service literature for recommended superheat setting.**

Instruments

Because of the importance and sensitivity of superheat measurement and adjustment, the gauges used to measure suction pressure should be of the best quality available. Gauges that are permanently installed on the equipment should not be used. Trane recommends a good quality gauge on a standard refrigerant manifold set. To measure suction temperature, an electronic temperature tester is sufficient.

Measurement

In order to determine suction gas superheat, the pressure at the evaporator outlet must be measured and converted to saturated vapor temperature. Use a Refrigerant-22 pressure temperature conversion chart as given in Table 7 to convert pressure (psig) to temperature (degrees F). The computed saturated vapor temperature is then subtracted from the actual suction temperature, which is also measured on the suction line at the expansion valve sensing bulb location. The difference between these two temperature readings is the suction gas superheat reading.

NOTE: *If a pressure tap is not provided at the thermal expansion valve sensing bulb location, suction pressure may be measured at the compressor, if suction line pressure is added to the compressor pressure reading. Suction pressure at the compressor plus estimated suction line pressure loss equals an estimate of suction pressure at the thermal expansion valve sensing bulb location.*

To determine actual superheat, complete the following:

1. Cut the suction line insulation to gain access to the suction line at the sensing bulb. If Armaflex insulation is used, slit the insulation for the length of the temperature sensor.
2. Clean the line carefully and attach the electronic temperature sensor. Make sure the sensor is making good contact with the tube. Black electrical tape may be used to prevent sensor contact with ambient air.

   NOTE: *For accurate measurement, the temperature sensor* ***must*** *be properly installed and insulated. Make sure that the insulation covers the sensor completely and seal all connections to the pipe to keep ambient air from affecting the temperature readings.*

3. Install the pressure gauge to monitor suction pressure at the expansion valve sensing bulb location. If no pressure tap is provided, install the pressure gauge at the compressor and estimate the suction line pressure loss between the compressor and sensing bulb.
4. Operate the system for approximately 10 to 15 minutes in order for the expansion valve to stabilize.
5. To calculate superheat from pressure and temperature readings, compare the actual vapor temperature of the refrigerant as converted from the suction pressure reading (plus suction line pressure loss, if applicable) to the suction temperature measured by the electronic tester. See the examples given below.

EXAMPLE 1:

SUCTION PRESSURE = 66.0 psig (measured at expansion valve sensing bulb)
SUCTION TEMPERATURE = 52 F
SUCTION PRESSURE CONVERTED TO SATURATED VAPOR TEMPERATURE = 38 F
SUCTION SUPERHEAT = 52-38 = 14 F

EXAMPLE 2:

SUCTION PRESSURE = 65.0 psig (measured at the compressor)
ESTIMATED SUCTION LINE PRESSURE LOSS = 3 psi
TOTAL ESTIMATED SUCTION PRESSURE = 68 psig (at the sensing bulb)
SUCTION TEMPERATURE = 52 F
SUCTION PRESSURE CONVERTED TO SATURATED VAPOR TEMPERATURE = 40 F
SUCTION SUPERHEAT = 52-40 = 12 F

Adjustment

To increase the superheat reading, turn the adjusting stem of the expansion valve to close the valve and to limit the amount of refrigerant flowing into the evaporator. **Adjustment should be made at one-half turn at a time.** To

TABLE 7 - Refrigerant-22 Pressure/Temperature Conversion Chart

TEMPERATURE (DEGREES F)	SUCTION PRESSURE (PSIG)
26	49.9
27	51.2
28	52.4
29	53.6
30	54.9
31	56.2
32	57.5
33	58.8
34	60.1
35	61.5
36	62.8
37	64.2
38	65.6
39	67.1
40	68.5
41	70.0
42	71.4
43	73.0
44	74.5
45	76.0
46	77.6
47	79.2
48	80.8
49	82.4
50	84.0

decrease the superheat reading, increase refrigerant flow to the evaporator. Continue with tests and adjustments, one-half turn at a time, until an acceptable reading is obtained. Allow the system to re-stabilize for 10 minutes after each adjustment.

CAUTION: Incorrect superheat readings may be due to plugged filters or blocked refrigerant flow. Before making major adjustments to the expansion valve, check refrigerant level and filter/driers to ensure proper flow. Blocked filters may cause floodback to the compressor, damaging internal components.

TROUBLE ANALYSIS

SYSTEM CHECK

Before repairing or replacing any Climate Changer unit or component, complete the following simple checks. A trouble analysis chart follows this checklist. For more detailed information on the unit, refer to the Service Guide available through your local Trane Sales Office.

WARNING: DISCONNECT ELECTRICAL POWER BEFORE SERVICING OR INSPECTING THE UNIT. DISCONNECT POWER BEFORE REMOVING OR CONNECTING ELECTRICAL WIRES. ALLOW ALL ROTATING EQUIPMENT TO STOP BEFORE SERVICING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR ENTANGLEMENT IN MOVING PARTS.

- ☐ 1. Electrical power is available to unit.
- ☐ 2. Unit is turned on.
- ☐ 3. Electrical routing and connections are correct. Refer to specific wiring diagrams provided on the unit.
- ☐ 4. Filters are clean and properly positioned.
- ☐ 5. Fan belt is not broken or slipping.
- ☐ 6. Fan sheaves are properly aligned.
- ☐ 7. Fan is not hitting housing or inlet cone.
- ☐ 8. Dampers are not stuck open or closed.
- ☐ 9. Ductwork connections are secure and airtight.
- ☐ 10. Piping has no leaks.
- ☐ 11. Coils are not clogged or frozen.

TROUBLE ANALYSIS CHARTS

Use the tables in this section to assist in identifying the cause or causes of a malfunction in Climate Changer® operation. The column headed RECOMMENDED ACTION will suggest repair procedures.

NOTE: *These tables are intended as a diagnostic aid only. For detailed repair procedures, contact your local Trane Service Company.*

WARNING: DISCONNECT ELECTRICAL POWER BEFORE INSPECTING OR SERVICING THE UNIT AND ALLOW ALL ROTATING EQUIPMENT TO STOP COMPLETELY. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK OR MOVING PARTS.

CLIMATE CHANGER® TROUBLE ANALYSIS

SYMPTOM	POSSIBLE CAUSE	RECOMMENDED ACTION
Motor fails to start.	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker.
	Overload trip.	Check and reset overload.
	Improper wiring or connections.	Check wiring with diagram supplied on unit.
	Improper current supply.	Compare actual supply power with motor nameplate recommendations. Contact power company for adjustments.
	Mechanical failure.	Determine that motor and drive turn freely. Check bearings and lubrication.
	Short-circuited stator.	Indicated by blown fuses. Motor must be rewound.
	One phase of a three-phase motor is open.	Check line for open phase.
	Overloaded motor.	Reduce load or replace with larger motor.

SYMPTOM	POSSIBLE CAUSE	RECOMMENDED ACTION
Motor stalls.	Low line voltage.	Check across AC line. Correct voltage if possible.
	Overloaded motor.	Reduce load or replace with a larger motor.
Motor runs and then dies down.	Partial loss of line voltage.	Check for loose connections. Determine adequacy of main power supply.
	Stator shorts when motor warms up.	Replace stator.
Motor does not come up to speed.	Low voltage at motor terminals.	Check across AC line and correct voltage loss if possible.
	Line wiring to motor too small.	Replace with larger sized wiring.
	60 cycle motor connected to 50 cycle supply.	Replace with a 50 cycle motor.
Motor overheats.	Overloaded motor.	Reduce load or replace with a larger motor.
	Motor fan is clogged with dirt, preventing proper ventilation.	Remove fan cover, clean fan and replace cover.
	Three-phase motor has one phase open.	Check wiring. Secure all connections.
	Improper line voltage.	Check across AC line. Consult power company. Step transformer may be necessary.
	Worn bearings.	Replace bearings and seals.
Excessive motor noise.	Motor mounting bolts loose.	Tighten motor mounting bolts.
	Rigid coupling connections.	Replace with flexible connections.
	Worn motor bearings.	Replace bearings and seals.
	Fan rubbing on fan cover.	Remove interference in fan housing.
Rapid motor bearing wear.	Excessive overhung load due to over-tensioned drive.	Check belt tension and overhung load.
	Excessive overhung load due to a small diameter motor sheave.	Replace sheave with larger one.
Loose fan belt.	Motor is poorly positioned.	Adjust tension.
	Worn or damaged belt.	Replace belt or belt set. Check sheave alignment.
	Worn sheaves.	Replace sheaves.
Short belt life.	Worn sheaves.	Replace sheaves.
	Misaligned belt.	Realign drive with MVP sheave set at mean pitch diameter.
	Grease or oil on belts.	Check for leaky bearings. Clean belts and sheaves.
	Belt slipping.	Adjust tension.
	Belts rubbing.	Remove obstruction or realign drive for clearance.
	High ambient temperature.	Provide ventilation. Shield belts. Use gripnotch belts.

SYMPTOM	POSSIBLE CAUSE	RECOMMENDED ACTION
Low coil capacity. (CHILLED WATER)	Air is bypassing coil.	Prevent bypass with blockoffs.
	Coil tubes are blocked.	Clean and unblock tubes.
	Incorrect airflow.	Check fan operating conditions.
	Incorrect gpm.	Check water pumps, valves and lines for obstructions.
	Incorrect water temperature.	Provide proper water temperature.
Low coil capacity. (REFRIGERANT)	Air is bypassing coil.	Prevent bypass with blockoffs.
	Coil tubes are blocked.	Clean and unblock tubes.
	Incorrect airflow.	Check fan operating conditions.
	Expansion valve not operating.	Check sensing bulb location and TEV operation.
	Poor refrigerant distribution.	Check for blockage in distributor and tubes.
Low coil capacity. (STEAM)	Air is bypassing coil.	Prevent bypass with blockoffs.
	Tubes are blocked.	Clean and unblock tubes.
	Incorrect airflow.	Check fan operating conditions.
	Incorrect steam pressure.	Adjust pressure supply.
Fan does not operate.	Electrical.	Check fuses, electrical on-off switch, overload protector and voltage output.
	Mechanical.	Look for broken belts or loose pulleys. Make sure the fan blades are not stopped or obstructed by the fan housing.
Noisy fan.	Fan hitting inlet cone, cutoff, or housing.	Center fan in inlet cone. Secure cutoff in housing. Secure fan on shaft. Repair or replace damaged parts.
	Drive belts not operating properly.	Adjust belt tension. Check for matched set. Replace worn or broken belts and clean oily or dirty belts.
Bearing is excessively hot.	First start after relubrication. (grease distribution)	Allow machine to cool down and restart.
	Over-lubrication.	Clean surface of grease and purge.
	No lubricant.	Apply lubricant. Check bearings for damage.
	Excessive load or speed.	Replace with a larger bearing.
	Misaligned bearing.	Correct alignment. Check shaft level.

For further information on this product or other Trane products, refer to the "Trane Service Literature Catalog", ordering number IDX-IOM-1. This catalog contains listings and prices for all service literature sold by Trane. The catalog may be ordered by sending a $20.00 check to: The Trane Company, Service Literature Sales, 3600 Pammel Creek Road, La Crosse, WI 54601.

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TRANAE™ **INSTALLER'S GUIDE**

BTA-IN-2
18-AC31D1
1st Printing, 1983

BTA—D CONDENSING UNITS
(36,000 BTUH)

ALL phases of this installation must comply with NATIONAL, STATE AND LOCAL CODES.

These instructions do not cover all variations in systems nor provide for every possible contingency to be met in connection with installation. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to The Trane Company, Dealer Products Group.

A. GENERAL

Check for transportation damage after unit is uncrated. Report promptly, to the carrier, any damage found to the unit.

To determine the electrical power requirements of the unit, refer to the nameplate of the unit. The electrical power available must agree with that listed on the nameplate.

B. LOCATION & PREPARATION OF THE UNIT

1. The unit should be set on a level, reinforced concrete pad 2" larger than the unit on all sides. (Approximate pad size is 27" x 27".)

2. The concrete pad must NOT be in direct contact with any structure. Unit must be positioned a minimum of 12" from any wall or surrounding shrubbery to insure adequate airflow. Clearance must be provided in front of control box (access panels) and other sides requiring service access in accordance with National and Local Codes. Also, the unit location must be far enough away from any structure to prevent roof run-off water from pouring directly on the unit.

3. The top discharge area must be unrestricted for at least five (5) feet above the unit.

4. Mount the unit on mounting pads (shipped with condensing unit) and install in accordance with instruction included with mounting pads.

5. When the outdoor unit is mounted on a roof, be sure the roof will support the unit's weight. Vibration isolation is recommended to prevent transmission to the building structure.

6. The maximum length of refrigerant lines from outdoor to indoor unit should NOT exceed eighty (80) feet.

7. If outdoor unit is mounted above the air handler, maximum lift should not exceed 80 ft. (suction line). If air handler is mounted above condensing unit, maximum lift should not exceed 60 ft. (liquid line).

NOTE: Refer to "Refrigerant Piping Guide" Pub. No. 22-3040 Tab 16 in "APPLICATION MANUAL".

8. Locate and install indoor coil or air handler in accordance with instruction included with that unit.

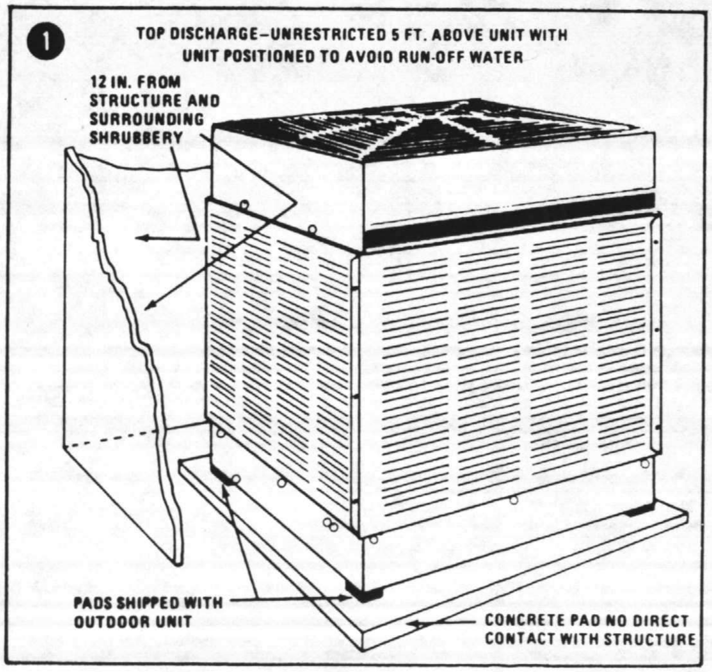
C. INSTALLING REFRIGERANT LINES

The following steps are to be considered when installing the refrigerant lines (steps apply to both "Precharged Quik-Attach Lines" and "Field Fabricated Lines").

Standard tire-valve type pressure taps are provided on the precharged lines for installation and service use.

The indoor end of recommended refrigerant lines may be straight or with a 90 degree bend, depending upon situation requirements. This should be thoroughly checked out before ordering refrigerant lines.

The suction (gas) line must always be insulated.

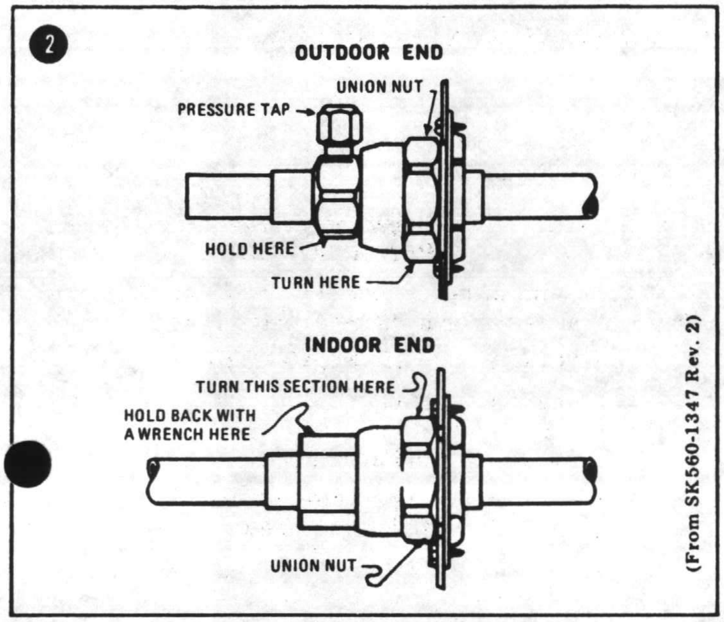


dwg. no. 21A124641 PO5

C. INSTALLING REFRIGERANT LINES (Cont.)

The units are factory charged with the system charge required when using 10 feet of connecting line. The precharged lines are provided with the proper charge to accommodate their length. Unit nameplate charge is the total system charge with 25 feet of interconnecting lines.

If refrigerant charge adjustment is considered necessary, use the Charge Charts (Operating Instructions) accompanying the outdoor unit.



1. Determine the most practical way to run the lines.

2. Consider types of bends to be made and space limitations. *NOTE: Large diameter tubing will be very difficult to rebend once it has been shaped.*

3. Determine the best starting point for routing the refrigerant tubing — INSIDE OR OUTSIDE THE STRUCTURE.

4. Provide a pull-through hole of sufficient size to allow both liquid and suction (gas) lines plus fittings to clear. The location of this hole (if practical) should be just above the wall plate which is resting on the foundation.

5. Be sure the roll of tubing is of sufficient length.

6. Uncoil the tubing — do not kink or dent. The Quik-Attach fittings with pressure tap connect to the outdoor unit.

DO NOT REMOVE DUST PLUGS FROM COUPLINGS BEFORE ROUTING COPPER TUBING.

Route the tubing making all required bends and properly secure the tubing before making Quik-Attach connections.

NOTE: Lines must be isolated from the structure and pull-through hole must be sealed weather-tight after installation.

ATTACHING COUPLING (QUIK-ATTACH)

1. Remove the protective plugs from all fittings.

2. Oil the face and threads of the couplings with clean refrigerant oil before mating. Make sure that no dirt, water or other foreign material is permitted to adhere to the mating surfaces of the couplings before the halves are connected.

3. Engage the fittings by hand tightening the union nut until snug.

CAUTION: The male and female Quik-Attach fittings must be properly aligned to prevent cross threading.

4. Continue tightening, using a wrench until the coupling halves bottom. A firm metal to metal contact will be felt.

5. Advance the union nut another 1/4 turn. This final turn is necessary to insure a proper metal seal of the coupling halves, forming a leak-proof joint. Do NOT continue to tighten the coupling as distortion of the coupling nut will result in a leak.

CAUTION: Correct tightening of the coupling is very important. Undertightening or overtightening will result in a coupling leak.

NOTE: For attaching the indoor connection, follow the instructions packaged with the indoor unit. See Figure 2 as a reference to the appearance of completed indoor Quik-Attach coupling installation.

D. FIELD FABRICATED REFRIGERANT LINES

The routing of the field fabricated lines is done making the same observations as for the precharged lines.

1. Minimize the use of sharp 90° bends.

2. Cut and fit tubing, then braze using accepted good brazing techniques.

3. Use a dry nitrogen purge and brazing alloy without flux for brazing.

4. Insulate the entire suction (gas) line and its fittings.

5. Do NOT allow uninsulated lines to come into contact with each other.

Upon completion of installation, evacuate, and/or purge the refrigerant lines before connecting to the outdoor unit. If purging with R-22 refrigerant, connect the indoor fittings and purge from the liquid line through the indoor coil and out the suction (gas) line pressure tap.

6. Using a manifold gauge, connect an external supply of R-22 to the gauge port tap on the liquid line valve. Position R-22 supply container so only the gas is used in purging.

7. Charge connecting lines and indoor coil to the gas pressure of R-22 supply.

8. Leak check brazed line connections using soap bubbles or halogen leak detector. Repair leaks (if any) after relieving pressure.

9. Close manifold gauge valve, depress valve stem in gauge port on suction (gas) line valve and bleed-off gas pressure in connecting lines and indoor coil down to 2 PSIG.

10. Repeat this purging described in steps 7 and 9 two additional times.

NOTE: When the outdoor temperature is below 60°F. and above 40°F., purge the connecting lines and indoor coil four times. When the outdoor temperature is below 40°F., purge the connecting line and indoor coil five times.

If refrigerant lines are to be field fabricated or if precharged lines have been altered in length, it will be necessary to adjust refrigerant, to the system upon completion of installation. Use the following table for recommended amount.

Tubing Sizes			Additional
Suction	**Liquid**	**Tubing Length**	**Refrigerant**
1-1/8″	3/8″	15′	5 oz.
1-1/8″	3/8″	25′	12 oz.
1-1/8″	3/8″	32′	18 oz.
1-1/8″	3/8″	40′	24 oz.
7/8″	3/8″	15′	4 oz.
7/8″	3/8″	25′	11 oz.
7/8″	3/8″	32′	16 oz.
7/8″	3/8″	40′	22 oz.
7/8″	5/16″	15′	3 oz.
7/8″	5/16″	25′	8 oz.
7/8″	5/16″	32′	11 oz.
7/8″	5/16″	40′	15 oz.
3/4″	5/16″	15′	2 oz.
3/4″	5/16″	25′	7 oz.
3/4″	5/16″	32′	10 oz.
3/4″	5/16″	40′	13 oz.
5/8″	1/4″	15′	-3 oz.
5/8″	1/4″	25′	0 oz.
5/8″	1/4″	32′	+2 oz.
5/8″	1/4″	40′	+4 oz.

Tubing lengths in excess of forty (40) feet use the following amount:
1-1/8″ and 3/8″ uses 3 oz. per each 4 ft.
7/8″ and 5/16″ uses 5 oz. per each 10 ft.
7/8″ and 3/8″ uses 7 oz. per each 10 ft.
3/4″ and 5/16″ uses 4 oz. per each 9 ft.
5/8″ and 1/4″ uses 1 oz. per each 4 ft.

E. LEAK CHECK

Check for leaks with an electronic leak detector or liquid soap. If no leaks are present, insulate the suction (gas) line fittings and exposed tubing to prevent sweating.

F. ELECTRICAL CONNECTIONS

WARNING: When installing or servicing this equipment, ALWAYS exercise basic safety precautions to avoid the possibility of electric shock.

1. All electrical lines, sizing, protection, and grounding must be in accordance with national and local electrical codes. The power supply lines should be in a weathertight conduit, or equivalent, to the control box.
2. Install a separate disconnect switch at the outdoor unit.
3. Isolate conduit whenever vibration transmission may cause a noise problem within the building structure.
4. Be sure all connections are made tight and no wires exposed.
5. All electrical accessories must be installed and wired according to the instructions packaged with that accessory, (see typical Hook-Up diagrams on pages 4, 5 & 6).
6. Use color coded, low voltage, multi-wire cable to simplify low voltage connections between outdoor unit, indoor unit and room thermostat for easy identification.

G. ELECTRIC HEATERS

Electric heaters, if used, are to be installed in the air handling device according to the instructions accompanying the air handler and the heaters.

H. OPERATIONAL AND CHECKOUT PROCEDURES

Final phases of this installation are the unit Operational and Checkout Procedure which are found on pages 7 & 8 of this instruction.

I. COMPRESSOR SUMP HEAT

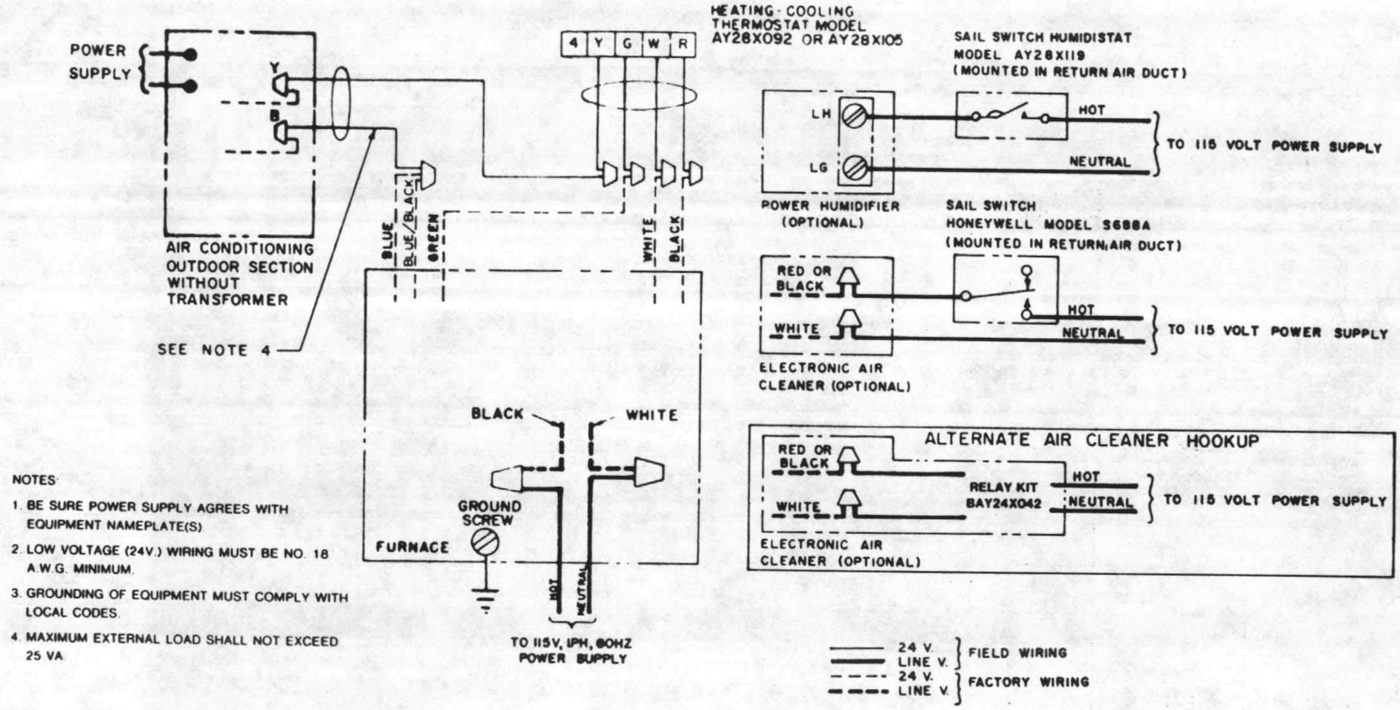
After all electrical wiring is complete, SET THE THERMOSTAT SYSTEM SWITCH IN THE OFF POSITION SO COMPRESSOR WILL NOT RUN, and apply power by closing the system main disconnect switch. This will activate the compressor sump heat. Do not change the Thermostat System Switch until power has been applied long enough to evaporate any liquid R-22 in the compressor (30 minutes for each pound of R-22 in the system as shown on the nameplate). Following this procedure will prevent compressor damage at the initial startup.

Record the "POWER APPLIED DATA" on the designated lines below:

Time ______________ A.M./P.M. Date ______________

By ______________________________
(Electrician)

FIELD WIRING DIAGRAM FOR BTA WITH FURNACE (TRANSFORMER IN FURNACE)

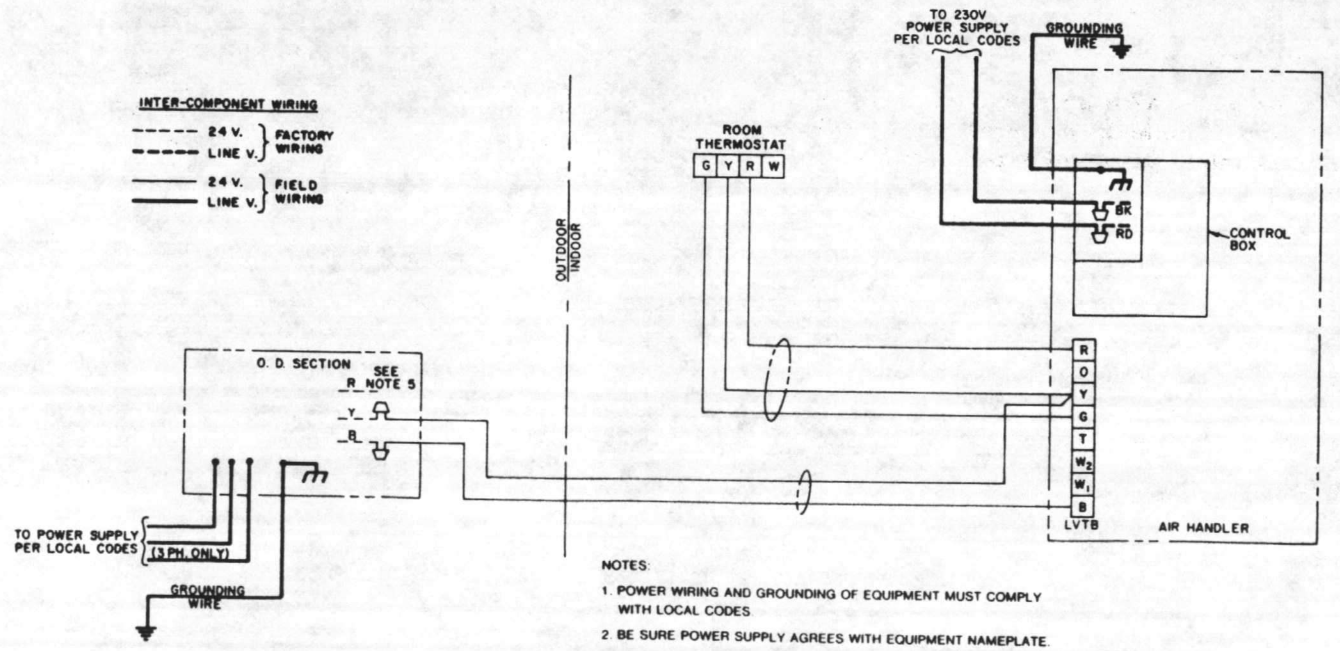


NOTES:

1. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE(S).
2. LOW VOLTAGE (24V.) WIRING MUST BE NO. 18 A.W.G. MINIMUM.
3. GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
4. MAXIMUM EXTERNAL LOAD SHALL NOT EXCEED 25 VA.

From Dwg. 21B308116 Rev. 0

FIELD WIRING DIAGRAM FOR BTA WITH BWV, BWH BWE-C AIR HANDLERS, NO SUPPLEMENTARY HEAT



NOTES:

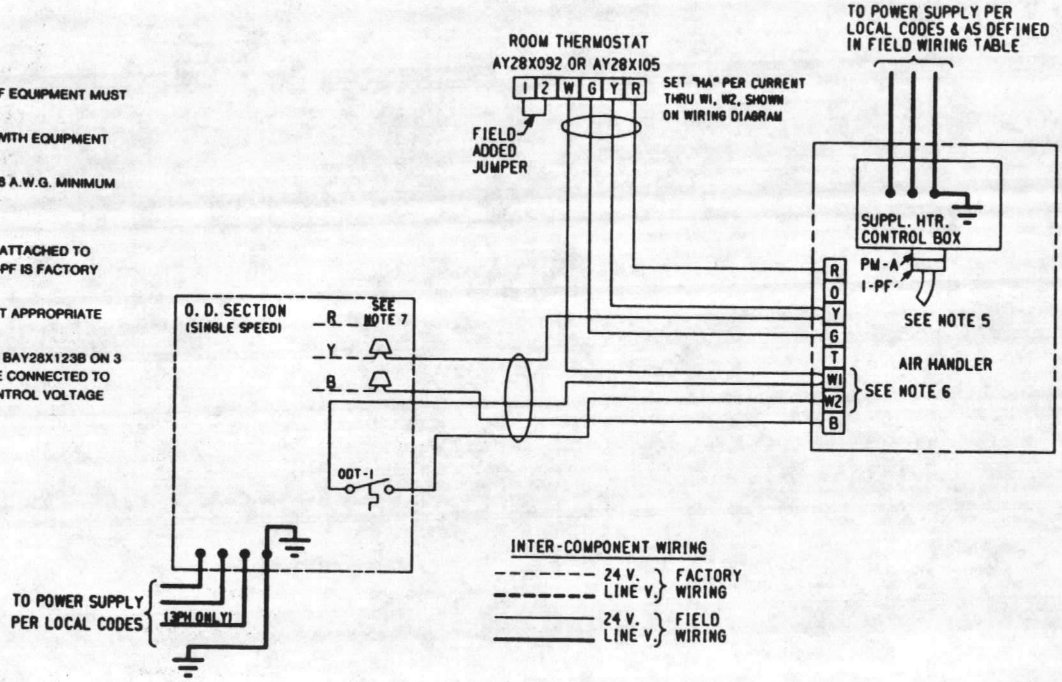
1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. USE COPPER CONDUCTORS ONLY.
5. TO USE LOW AMBIENT COOLING KIT BAY28X123A ON 3 PHASE MODELS, "R" LEAD MUST BE CONNECTED TO "Y" LEAD IN ORDER TO SUPPLY CONTROL VOLTAGE FOR KIT.

From Dwg. 21C126333 Rev. 1

FIELD WIRING DIAGRAM FOR BTA WITH BWV,BWH-A or P AIR HANDLERS, NO SUPPLEMENTARY HEAT

NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. USE COPPER CONDUCTORS ONLY.
5. POLARIZED PLUG SECTION PM-A IS ATTACHED TO HEATER CONTROL BOX. SECTION 1-PF IS FACTORY WIRED INTO AIR HANDLER.
6. IF ODT IS NOT USED, THEN CONNECT APPROPRIATE JUMPER FROM W1 TO W2 ON LVTB.
7. TO USE LOW AMBIENT COOLING KIT BAY28X123B ON 3 PHASE MODELS, "R" LEAD MUST BE CONNECTED TO "Y" LEAD IN ORDER TO SUPPLY CONTROL VOLTAGE FOR KIT.

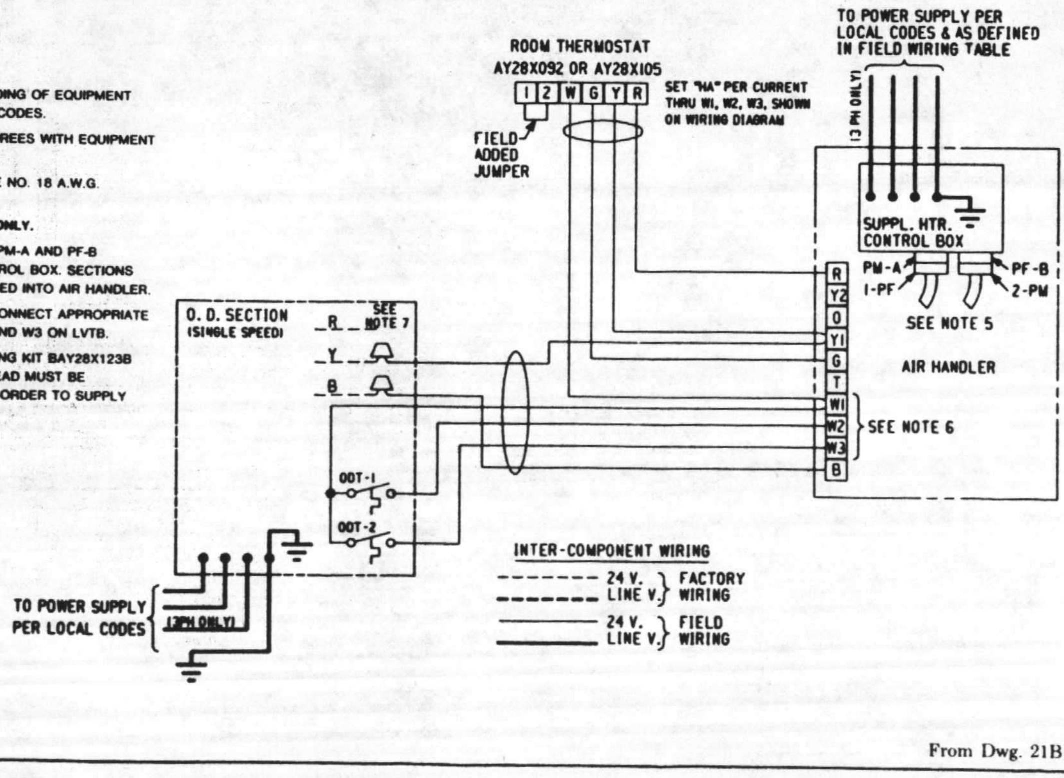


From Dwg. 21B131075 Rev. 1

FIELD WIRING DIAGRAM FOR BTA WITH BWV,BWH-A or P AIR HANDLERS AND SUPPLEMENTARY HEATERS

NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. USE COPPER CONDUCTORS ONLY.
5. POLARIZED PLUG SECTIONS PM-A AND PF-B ATTACHED TO HEATER CONTROL BOX. SECTIONS 1-PF AND 2-PM FACTORY WIRED INTO AIR HANDLER.
6. IF ODT IS NOT USED, THEN CONNECT APPROPRIATE JUMPERS FROM W1 TO W2 AND W3 ON LVTB.
7. TO USE LOW AMBIENT COOLING KIT BAY28X123B ON 3 PHASE MODELS, "R" LEAD MUST BE CONNECTED TO "Y" LEAD IN ORDER TO SUPPLY CONTROL VOLTAGE FOR KIT.

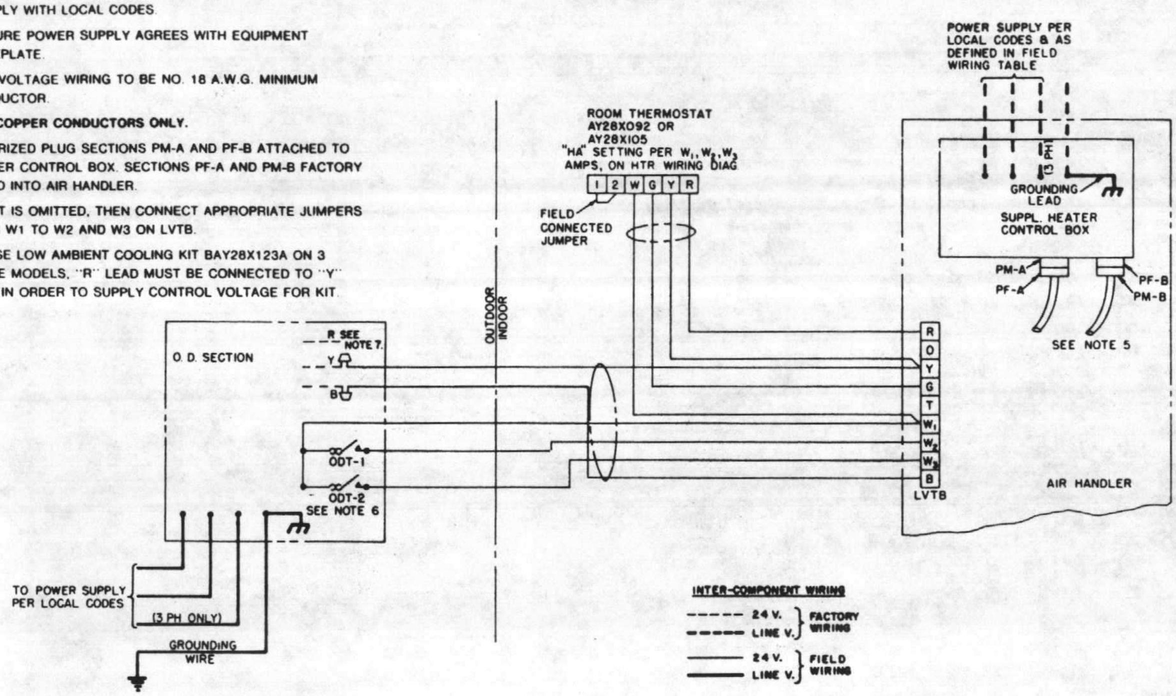


From Dwg. 21B131067 Rev. 1

FIELD WIRING DIAGRAM FOR BTA WITH BWE-C1 AIR HANDLERS AND SUPPLEMENTARY HEATERS

NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. **USE COPPER CONDUCTORS ONLY.**
5. POLARIZED PLUG SECTIONS PM-A AND PF-B ATTACHED TO HEATER CONTROL BOX. SECTIONS PF-A AND PM-B FACTORY WIRED INTO AIR HANDLER.
6. IF ODT IS OMITTED, THEN CONNECT APPROPRIATE JUMPERS FROM W1 TO W2 AND W3 ON LVTB.
7. TO USE LOW AMBIENT COOLING KIT BAY28X123A ON 3 PHASE MODELS, "R" LEAD MUST BE CONNECTED TO "Y" LEAD IN ORDER TO SUPPLY CONTROL VOLTAGE FOR KIT.

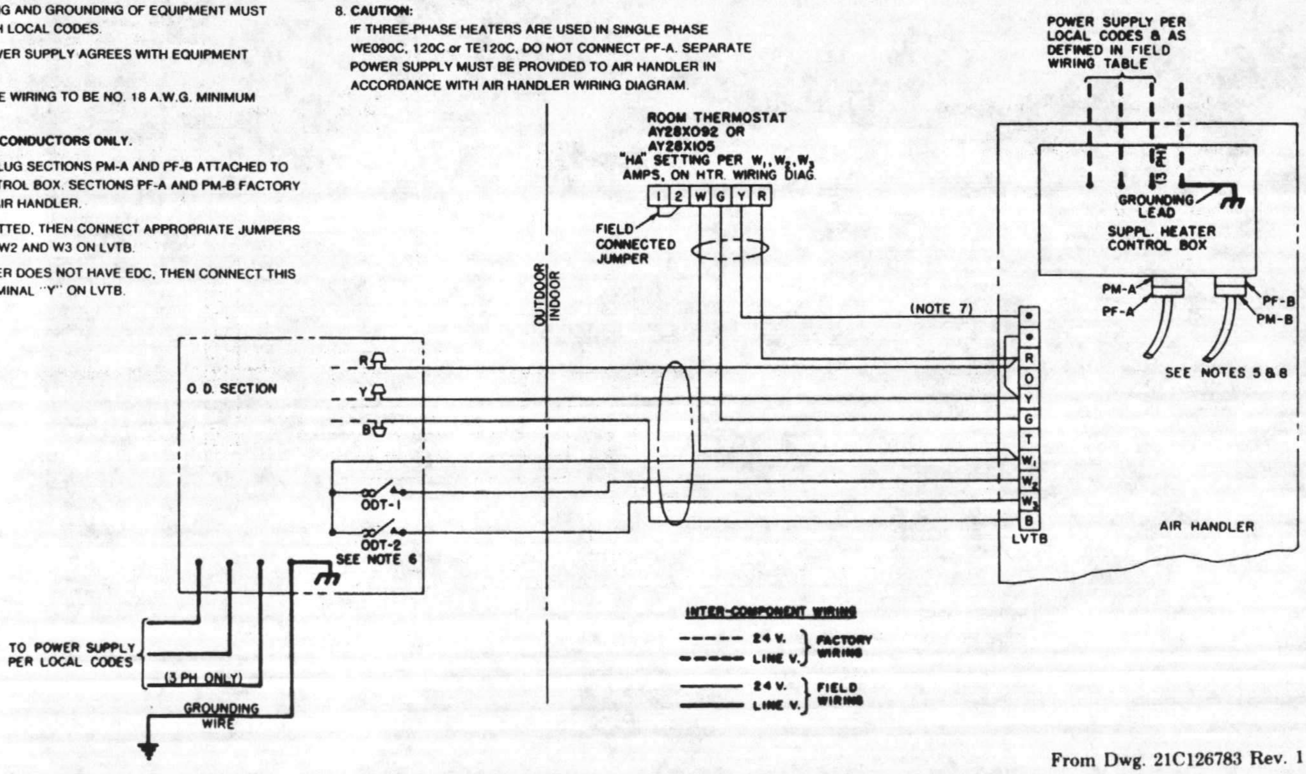


From Dwg. 21C126746 Rev. 1

FIELD WIRING DIAGRAM FOR BTA WITH BWE-C4 AIR HANDLERS AND SUPPLEMENTARY HEATERS

NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. **USE COPPER CONDUCTORS ONLY.**
5. POLARIZED PLUG SECTIONS PM-A AND PF-B ATTACHED TO HEATER CONTROL BOX. SECTIONS PF-A AND PM-B FACTORY WIRED INTO AIR HANDLER.
6. IF ODT IS OMITTED, THEN CONNECT APPROPRIATE JUMPERS FROM W1 TO W2 AND W3 ON LVTB.
7. IF AIR HANDLER DOES NOT HAVE EDC, THEN CONNECT THIS LEAD TO TERMINAL "Y" ON LVTB.
8. **CAUTION:** IF THREE-PHASE HEATERS ARE USED IN SINGLE PHASE WE090C, 120C or TE120C, DO NOT CONNECT PF-A. SEPARATE POWER SUPPLY MUST BE PROVIDED TO AIR HANDLER IN ACCORDANCE WITH AIR HANDLER WIRING DIAGRAM.



From Dwg. 21C126783 Rev. 1

dwg. no. 21A124641 P05

CHECKOUT PROCEDURE WITH MAIN POWER DISCONNECTS CLOSED (ON)

Step No.	To Check	Indoor Thermostat Switch Setting: System Switch: Off	Cool①	Heat①	Fan Switch: Auto	On	Component Operation: Indoor Blower Runs	Outdoor Fan Runs	Compress. Runs	Comp. Sump Heat	Furnace Heat Comes On
1	Sump Heat	X			X					X	
2	Indoor Fan Operation	X				X	X			X	
3	Cooling Operation		X		X		X	X	X	X	
4	Check Performance & Charge		X		X		X	X	X	X	
		← USE CHARTS ATTACHED TO O.D. UNIT →									
5	Heating ②			X	X		X③			X	X
6	Inform owner on how to operate system and what to expect of it. At the same time deliver Owner's Use and Care Booklet.										

① Also set thermostat dial to call for cooling or heating as necessary.

② Check only necessary if heating unit is used for indoor section and wiring has been disturbed during installation of cooling equipment.

③ Allow time for furnace bonnet switch to heat and close.

CHECKOUT PROCEDURE

After installation has been completed, it is recommended that the entire system be checked against the following list:

1. Refrigerant Line, Leak checked .... [ ]
2. Suction Lines and Fittings properly insulated .... [ ]
3. Have all Refrigerant Lines been secured and isolated properly? .... [ ]
4. Have passages through masonry been sealed? If mortar is used, prevent mortar from coming into direct contact with copper tubing .... [ ]
5. Indoor coil drains freely. Pour water into drain pan .... [ ]
6. Supply registers and return grilles open and unobstructed .... [ ]
7. Return air filter installed .... [ ]
8. Thermostat thermometer accuracy. Check against a reliable thermometer. Adjust per instructions with thermostat .... [ ]
9. Is correct speed tap being used? (Indoor blower motor) .... [ ]

SYSTEM OPERATIONAL CHECK

IMPORTANT: To prevent compressor damage which may result from the presence of LIQUID refrigerant in the crankcase these procedures should be followed at initial Start-Up and at anytime the power has been off for 12 hours or more.

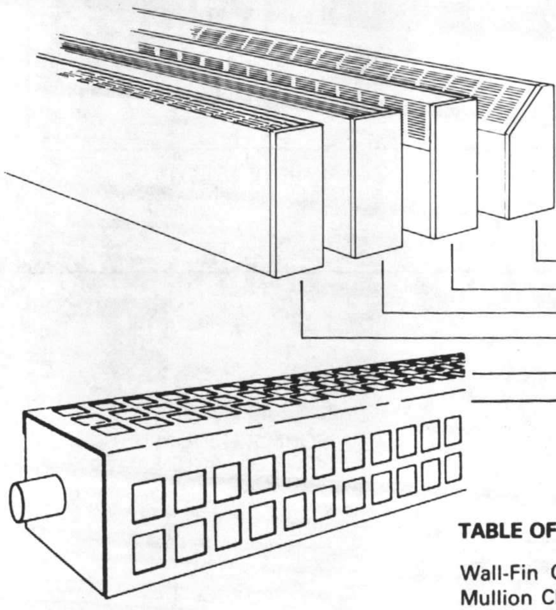
1. Before proceeding with this "Operational Check", go to "Electrical Section" of this instruction to determine the time compressor heat has been "ON", and make entry on the designated lines, in Step 2.
2. Start-Up Time __________ A.M./P.M. Power Applied Time __________ A.M./P.M. Time Lapse ________ Hours ________ Minutes.
3. If step 1 and 2 cannot be used, then place thermostat's system switch in the "OFF" position and apply power by closing system disconnect switch. This energizes compressor heat and evaporates the liquid in the crankcase. TO EVAPORATE LIQUID ALLOW AT LEAST ONE-HALF HOUR PER POUND (R-22), AS SHOWN ON UNIT NAMEPLATE.
4. Except as required for safety while servicing: DO NOT OPEN SYSTEM DISCONNECT SWITCH.
5. **After completing above procedures, turn to page 7 for Operational checkout of system(s).**

TRANE

Installation WF-IN-3C

Library	**Service Literature**
Product Section	**Air Term Devices and Htg Prod**
Product	**Finned Tube Radiation**
Model	**WF**
Literature Type	**Installation**
Sequence	**3C**
Date	**December 1985**
File No.	**SV-TD-FIN-WF-IN-3C-1285**
Supersedes	**WF-IN-3B 384**

HYDRONIC ARCHITECTURAL WALL-FIN



NOTE: This installation manual covers the Trane Hydronic Architecural Wall-Fin models shown above.

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WALL-FIN COMPONENTS

For proper wall-fin installation, the components should be installed in the sequence outlined in this manual. Note that some items are optional and may not be required for each specific job.

Figures 1 and 2 identify the components used in a typical wall-fin installation. Detail drawings of mounting locations are shown on page 3.

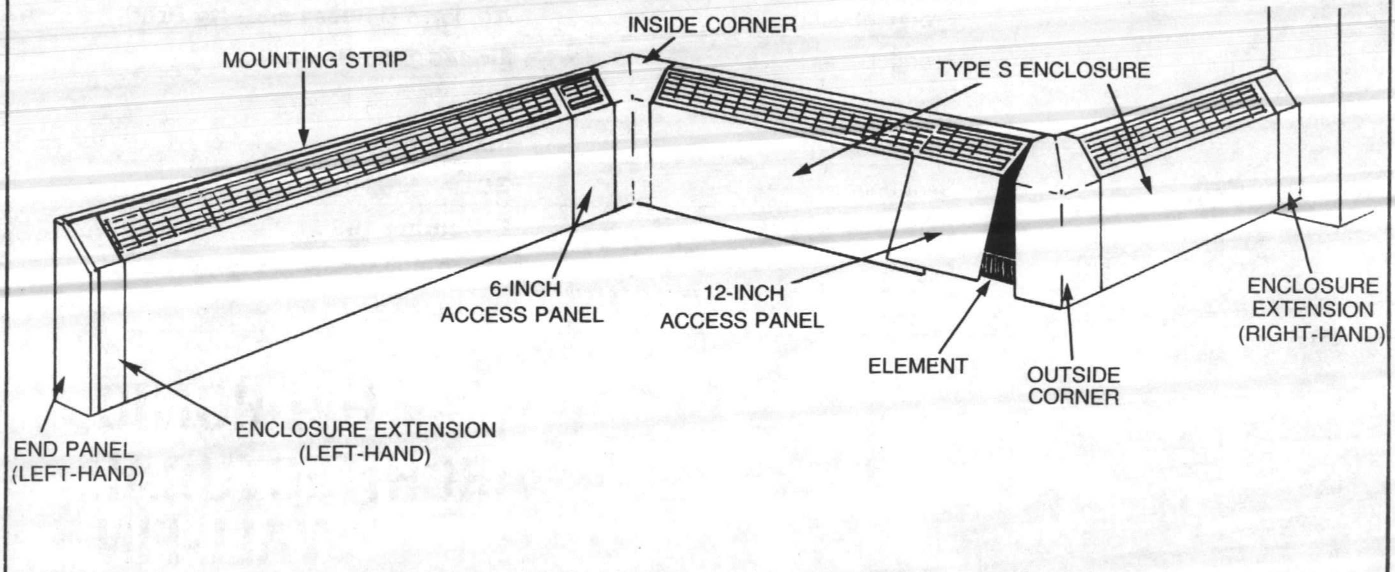


FIGURE 1 - Exterior Component Identification

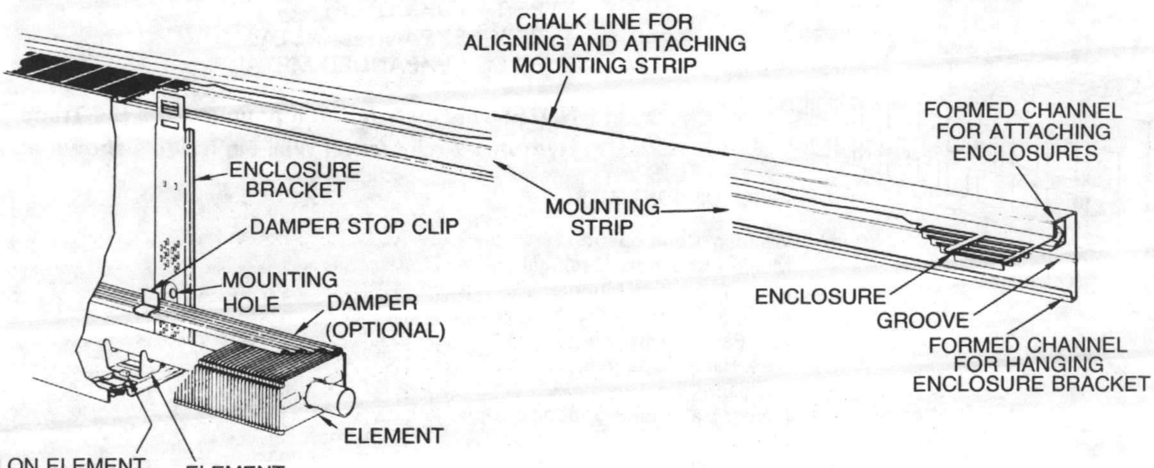
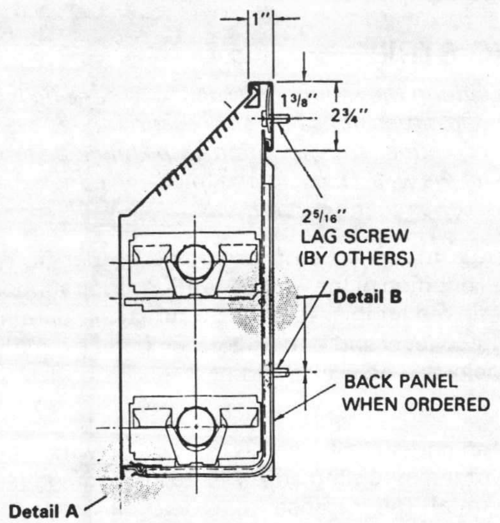
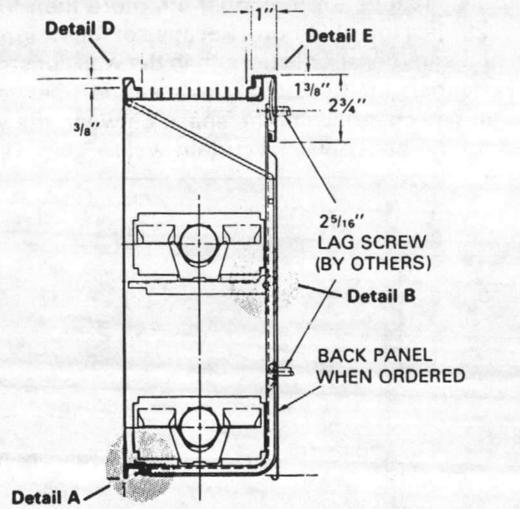


FIGURE 2 - Interior Component Identification

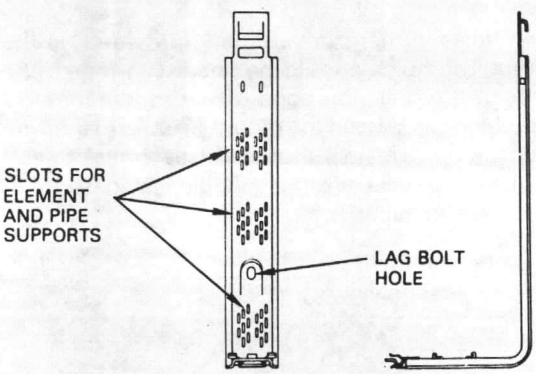
S-Enclosure



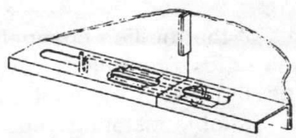
TA-Enclosure



Enclosure Bracket

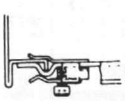


Detail C



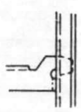
Panel to panel connection showing slide bolt.

Detail A



Front panel enclosure bracket connection.

Detail B

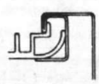


Element support to enclosure bracket mounting.

Detail D

TA - Front panel mounting to extruded aluminum grille.

Detail E



TA - Extruded aluminum grille and mounting strip connection.

MULLION CHANNELS

Mullion channels are used on panel walls or curtain walls where the wall studs (or mullions) are more than four feet apart and project into the room. Because of the weight of the wall-fin unit and the lack of strength in the wall construction, mullion channels are used to provide support between the wall studs. The channels fill the space between the wall-fin cabinet and the panel wall or curtain wall.

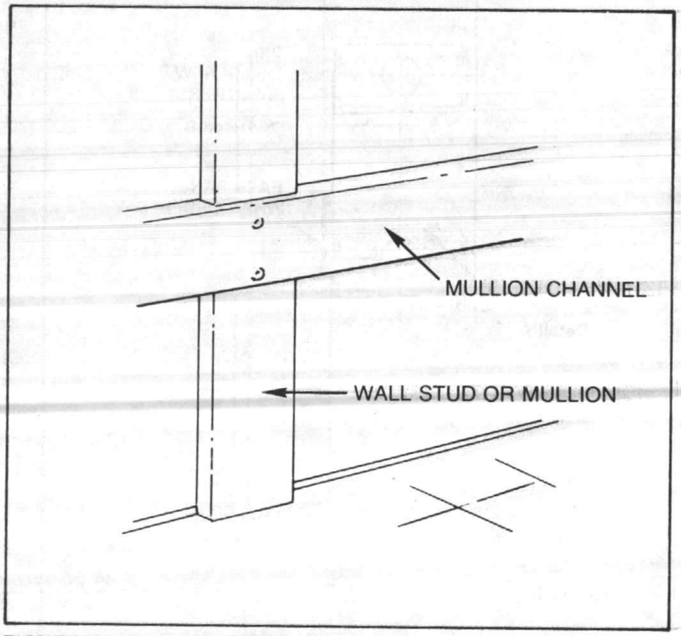


FIGURE 3 - Installing Mullion Channels

The top and bottom edges of the mullion channels should be notched to fit the wall studs or mullions. Attach the channels to the wall studs and fasten the wall-fin mounting strips to the channels. Suitable fasteners must be provided by the installer. See Figure 3.

Attach the bottom of the enclosure brackets to the mullions, to furring strips, or to additional mullion channels.

SILL EXTENSIONS

Sill extensions are used to extend the top of the cabinet back to the wall or window sill. They can add up to 14 inches of continuous surface to the top of the unit.

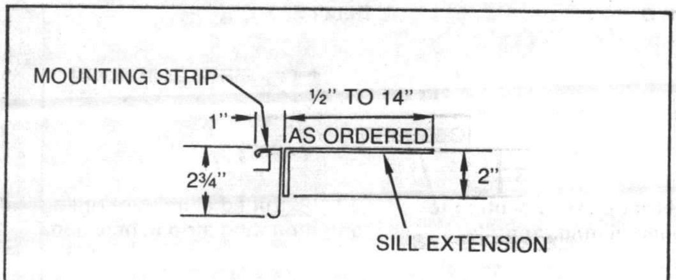


FIGURE 4 - Installing the Sill Extension

The sill extension is a separate angle piece and is to be installed at the same time as the mounting strip. The front 90-degree edge of the sill extension should be butted up to the back side of the mounting strip, as shown in Figure 4.

Both the sill extension and the mounting strip are secured at the same time, using the installation procedure outlined in the "Mounting Strips" section of this manual.

MOUNTING STRIPS

NOTE: *Before cutting the mounting strips for a specific job, make sure that the dimensions of the accessories have been taken into consideration. The mounting strip should be long enough to mount the wall-fin enclosure, plus end panels and any other accessories that are required.*

The straight-edge mounting strip assures a proper fit, regardless of the condition of the wall. Mounting strips support the entire wall-fin radiation assembly. Be sure the mounting strips are mounted level and butt up to each other properly. Enclosures, enclosure brackets, and accessories attach directly to the mounting strip.

Begin by "snapping" a chalk line on the wall to which the rear, top edge of the mounting strip will be aligned and fastened (see Figure 2). The distance from the chalk line to the floor should equal the height of the enclosure, plus an allowance of either four, five, or six inches, depending on the enclosure height. Mounting heights are shown in Figure 5. For example, with a 12-inch high enclosure the chalk line should be 18 inches above the floor line, and with a 16-inch high enclosure the chalk line should be 21 inches from the floor line.

Drill 5/16 inch holes in the grooved guide provided on the mounting strip. The holes should be spaced to match the wall studs. Align the rear, top edge of the mounting strip flush with the chalk line. Attach the mounting strip to the wall using the rectangular washers provided (see Figure 6) and 1/4-inch lag bolts. Lag bolts or other suitable fasteners are to be provided by the installer.

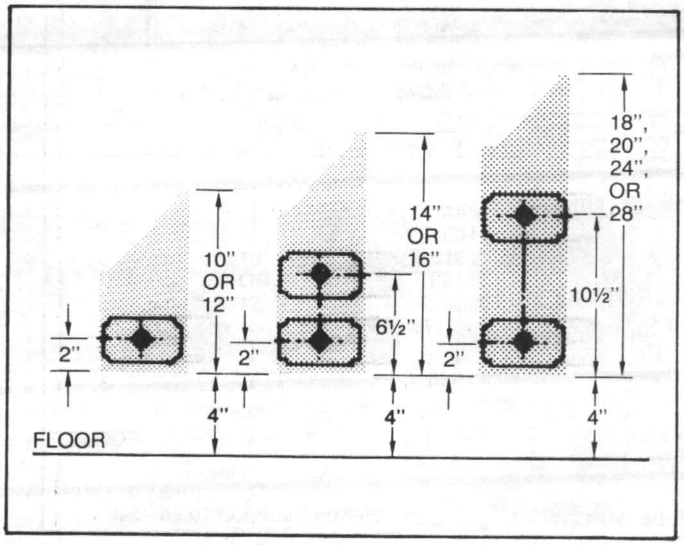


FIGURE 5 - Wall-Fin Mounting Heights

The rectangular washers must be used to provide a stiffening effect and help prevent any distortion of the strip should excessive weight be applied to the installed unit.

Mounting strips may be butted together or cut as necessary to provide the required length of run along the wall.

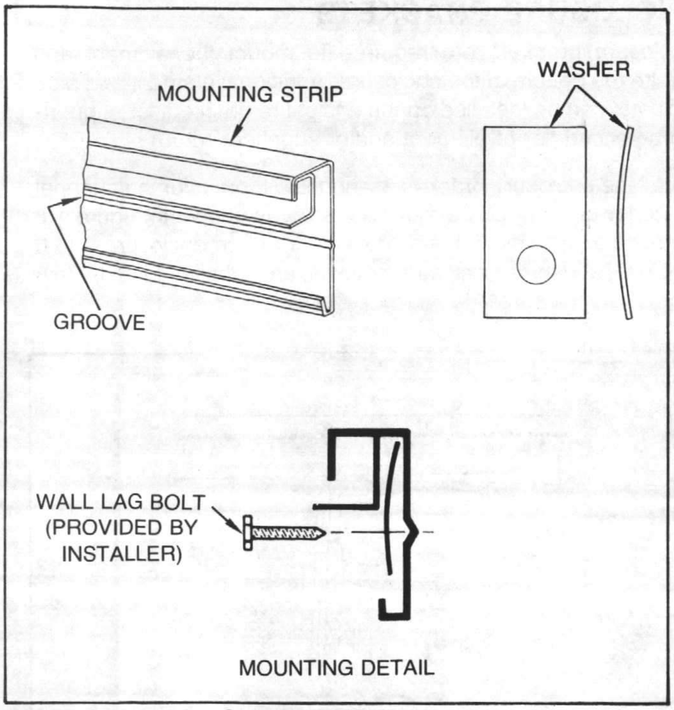


FIGURE 6 - Mounting Strip Installation

END PANELS

Install end panels at the same time as the mounting strip. Each end panel requires 3/4-inch on the mounting strip for proper mounting. Slide the formed tongue on the top back of the end panel (shown in Figure 8) into the space formed by the top and bottom channels of the mounting strip (shown in Figure 6).

Each end panel should be nailed to the wall through the nail holes provided in the rear flange. See Figure 8.

As shown in Figure 8, a hole is provided in the bottom flange for a sliding bolt. If the end panel is attached next to an enclosure or next to 6-inch or 12-inch access panels, engage the slide bolt into the end panel slide bolt hole for proper alignment.

WALL-TO-WALL INSTALLATION WITH END PANELS

End panels are one inch wide and take up 3/4-inch on the mounting strip. (See the "End Panels" section of this manual for proper mounting procedure.) Allow 1/4-inch clearance at the wall so there will be enough room to properly mount each end panel. Make sure the mounting strip is 1/2-inch shorter and the enclosure is two inches shorter than the wall-to-wall dimension. Refer to the example in Figure 7.

The mounting strip can be cut if necessary to provide the required length of run.

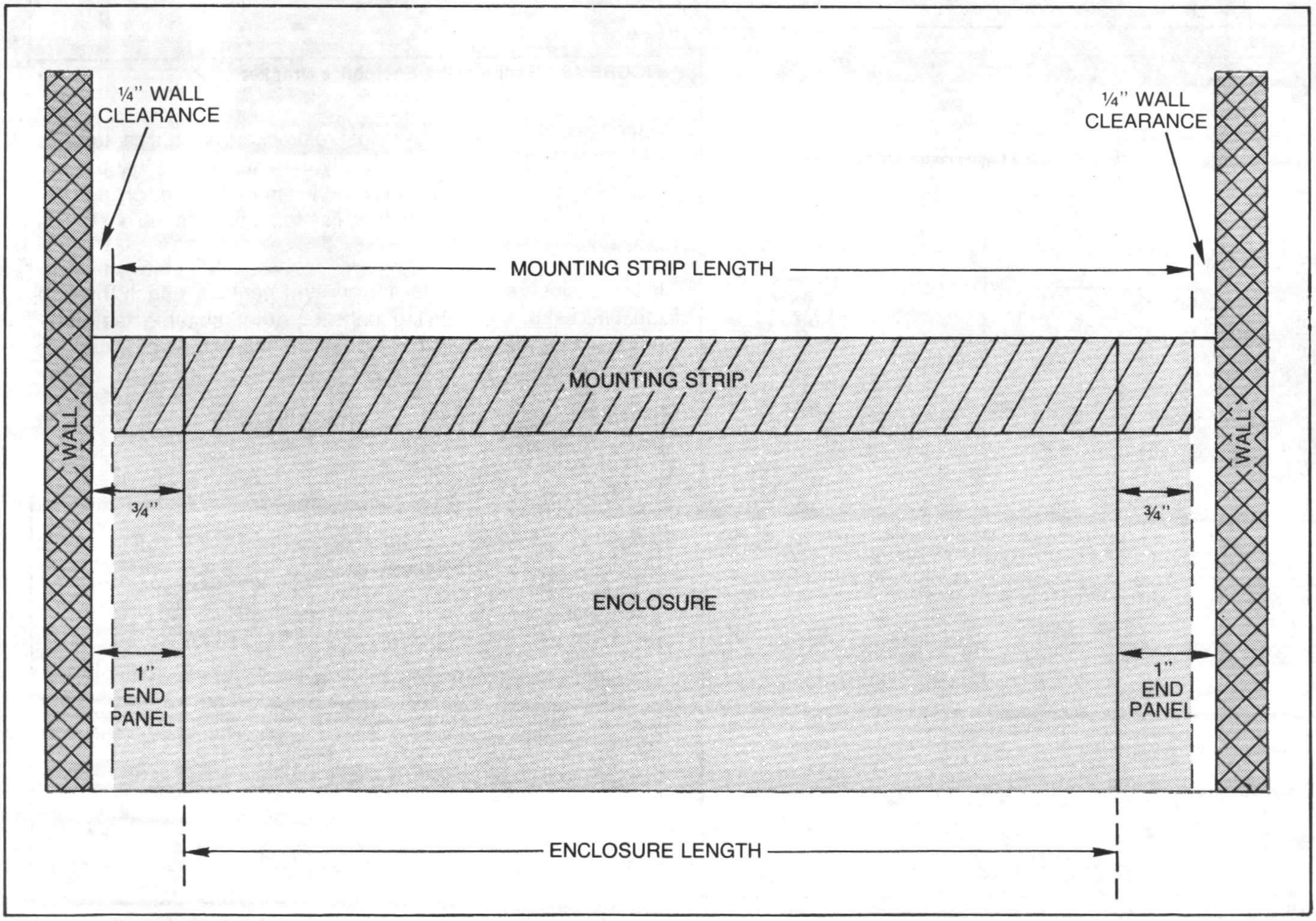


FIGURE 7 - Wall-to-Wall Installation with End Panels (Front View)

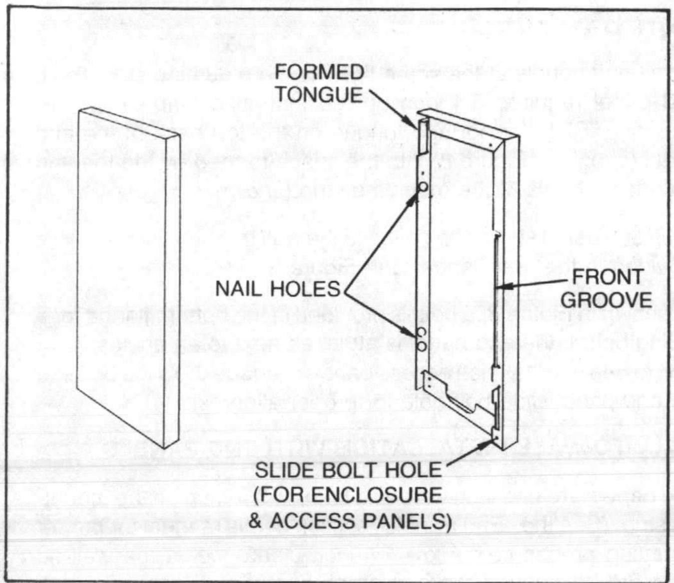


FIGURE 8 - End Panels

BACK PANEL

Install the back panel, if required, by hooking it over the channel at the lower edge of the mounting strip. See Figure 9.

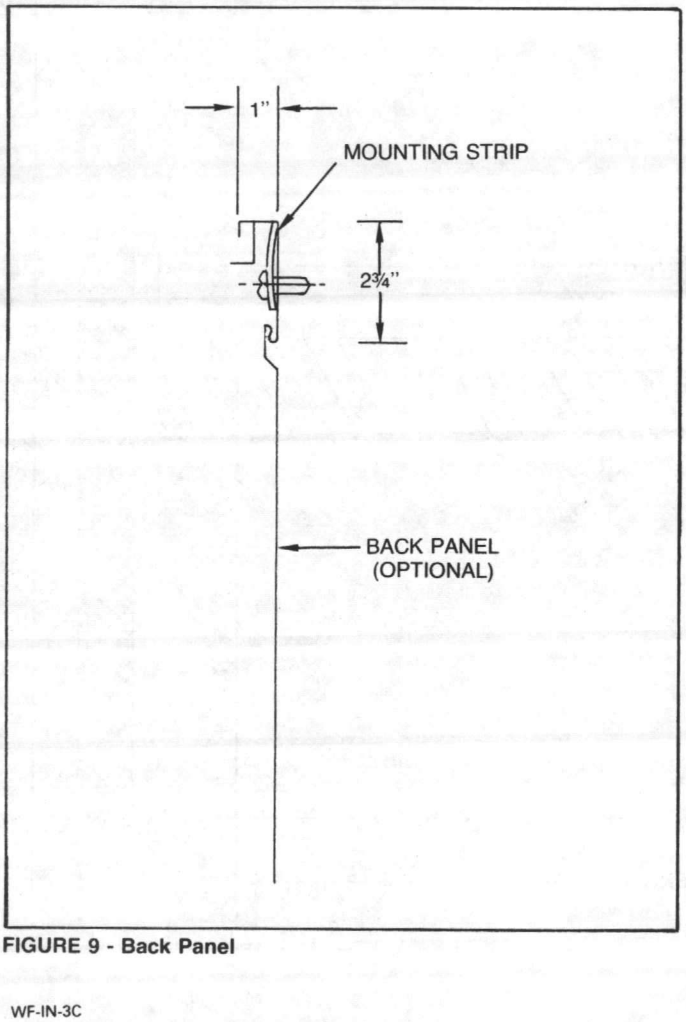


FIGURE 9 - Back Panel

ENCLOSURE BRACKETS

Enclosure brackets are required to mount the element and secure the bottom of the enclosure. Additional element and pipe supports can be installed on the enclosure brackets for supporting a second tier of element and/or supply or return piping.

Install the enclosure brackets by hooking them over the channel at the lower edge of the mounting strip as shown in Figure 10. Two enclosure brackets are provided for each enclosure 2 to 6 feet long, and three enclosure brackets are supplied for 6-1/2 to 8 foot long enclosures.

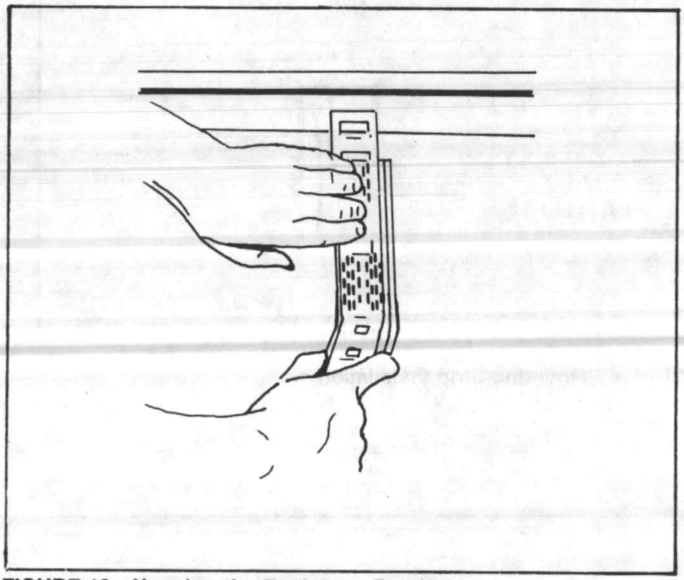


FIGURE 10 - Hanging the Enclosure Bracket

When possible, space the enclosure brackets on stud centers. To ensure that enclosures fit properly, it is suggested that the enclosure brackets be about three inches from the ends of each enclosure panel, with no more than five feet between the enclosure brackets.

If the enclosure brackets are on stud centers, attach them to the wall with 1/4-inch lag bolts or other suitable fasteners (supplied by the installer). Use the mounting hole provided, as shown in Figure 11.

Install element cradles in the nylon guides by sliding them into place. Refer to Figure 12.

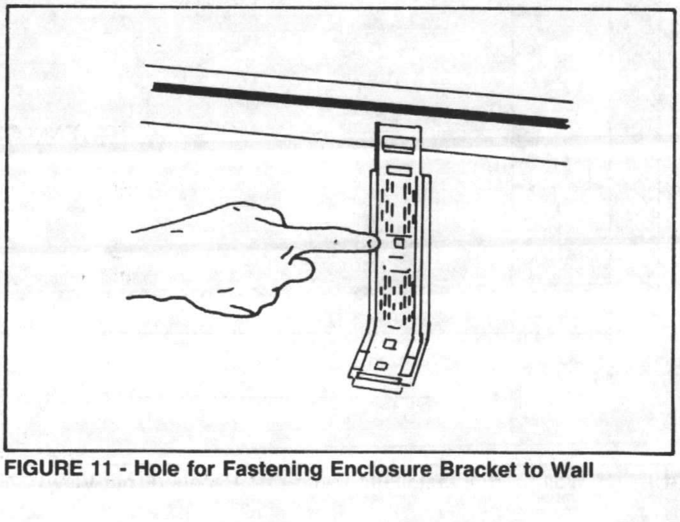


FIGURE 11 - Hole for Fastening Enclosure Bracket to Wall

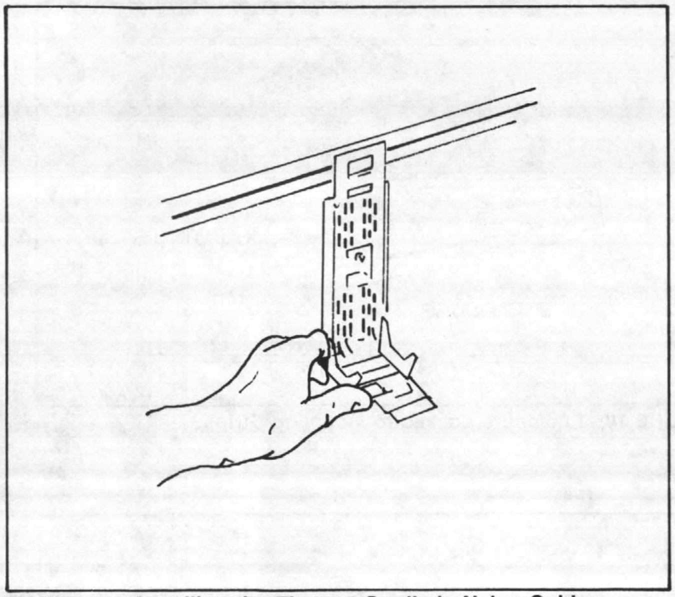


FIGURE 12 - Installing the Element Cradle in Nylon Guides

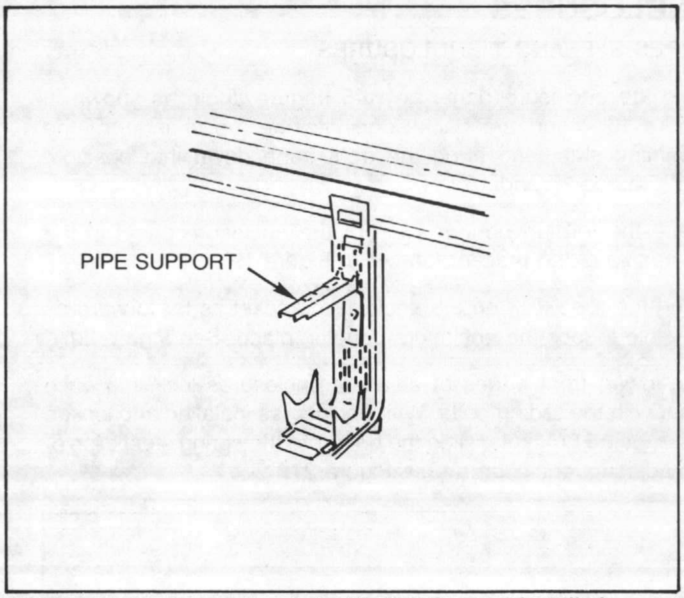


FIGURE 14 - Enclosure Bracket with Pipe Support Installed

ELEMENT AND PIPE SUPPORTS

ELEMENT SUPPORTS

Element supports are used to pitch the heating element on steam installations, or to mount a second tier of element if required. The element supports provided will clip and lock into the graduated slots in the enclosure brackets. Refer to Figure 13. Install element cradles in the nylon guides by sliding them into place.

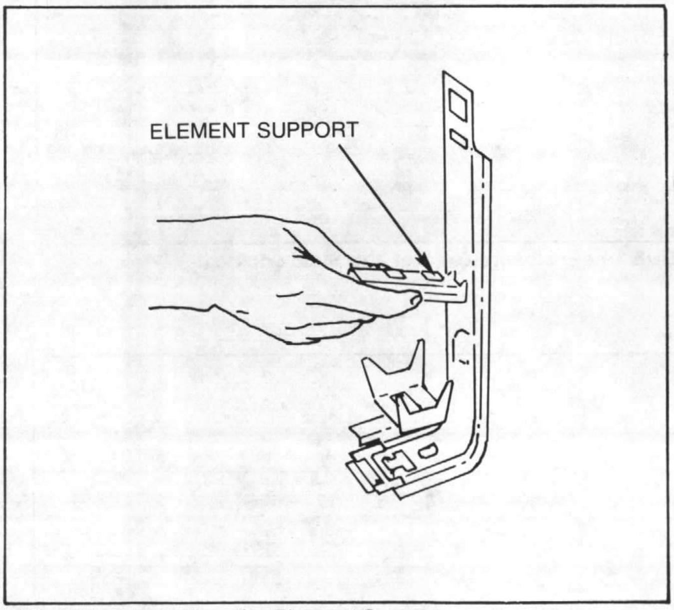


FIGURE 13 - Installing the Element Support

PIPE SUPPORTS

For installations with supply or return piping with one or two pipes, use the pipe supports provided. These pipe supports clip and lock into the graduated slots in the enclosure brackets. See Figure 14. Pipe supports do not have nylon guides and element cradles.

ELEMENTS

Set the element in the cradles with the fin louvers facing downward (aluminum fins only). Refer to Figure 15.

NOTE: *If the elements include dampers, the elements should be level front-to-back to avoid damper hang-up during operation.*

On one row installations, the element should be mounted at the bottom of the enclosure on the enclosure bracket to obtain catalog capacity ratings.

Complete the installation of all elements and make the required piping connections. Nonferrous elements have one tube end belled for ease of sweat connection to the adjacent element. Steel element tube ends may be chamfered or threaded, as ordered, for welded or screwed connections.

With the elements in place, install the enclosures, enclosure extensions, access panels or access extensions. If the installation includes dampers, refer to the "Dampers" section of this manual before attaching the enclosures.

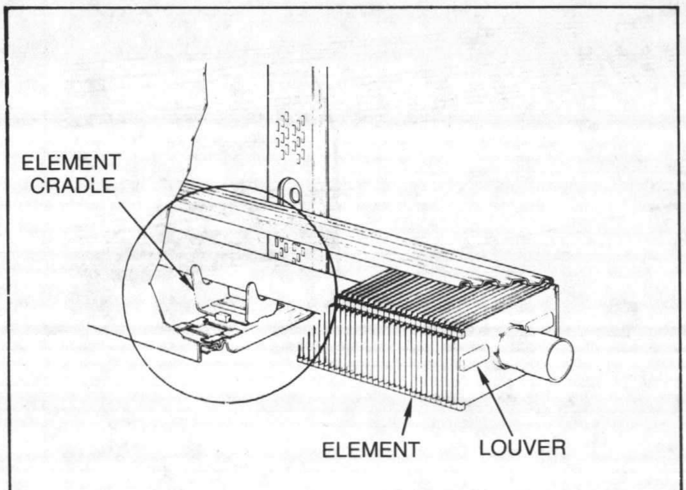


FIGURE 15 - Element and Cradle in Position

ENCLOSURES

TYPES S, F, AND T ENCLOSURES

Hold the enclosure panel at a 45 degree angle as shown in Figure 16. Insert the back edge into the top channel of the mounting strip, and bring the front edge down into position. See Figures 17 and 18.

Place the formed bottom edge of the enclosure panel in the formed lip of the bracket (shown in Figure 19).

Bring the slide lock on the enclosure bracket as far forward as possible to lock the enclosure panel in place. See Figure 20.

The lower, front edges of adjacent enclosures lock into each other with the sliding bolts. With enclosures installed and locked in enclosure brackets, slide the bolts into the spring steel clips of the adjacent enclosures. See Figure 21.

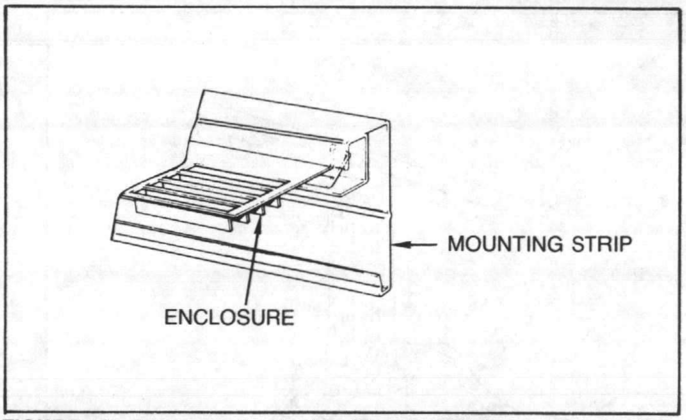


FIGURE 18 - Enclosure Locked to Mounting Strip

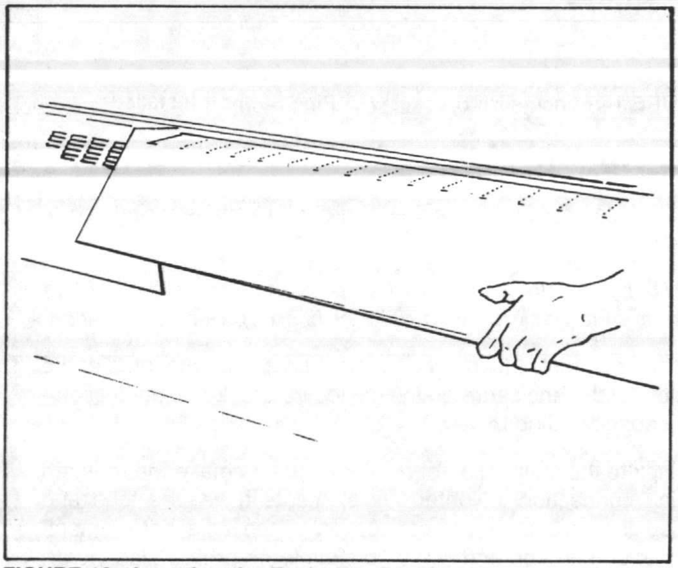


FIGURE 16 - Inserting the Enclosure Panel

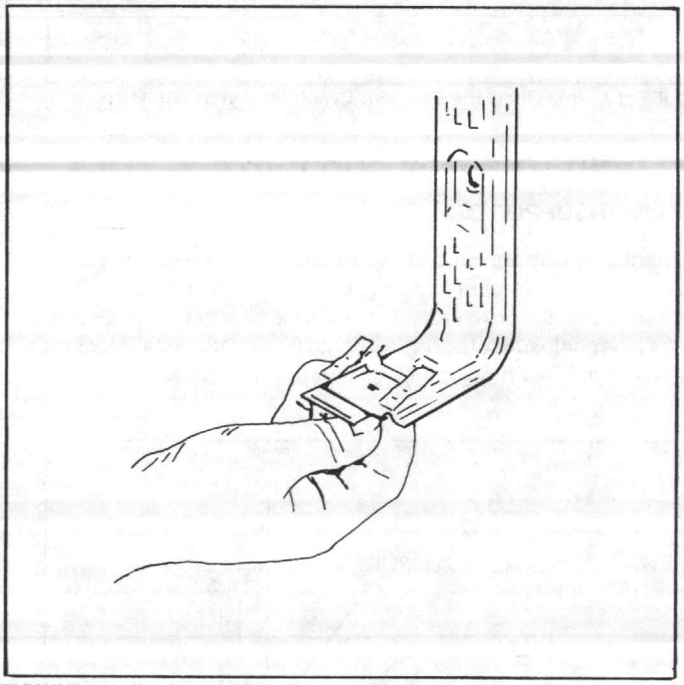


FIGURE 19 - Enclosure Bracket and Slide Lock

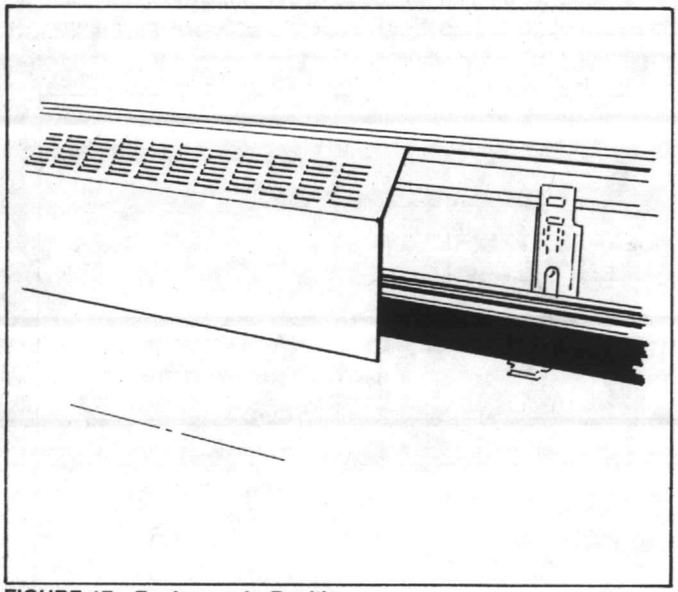


FIGURE 17 - Enclosure in Position

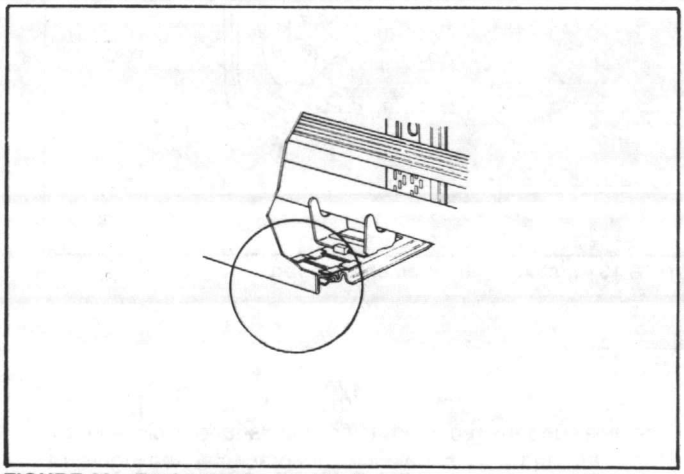


FIGURE 20 - Enclosure Locked to Bracket

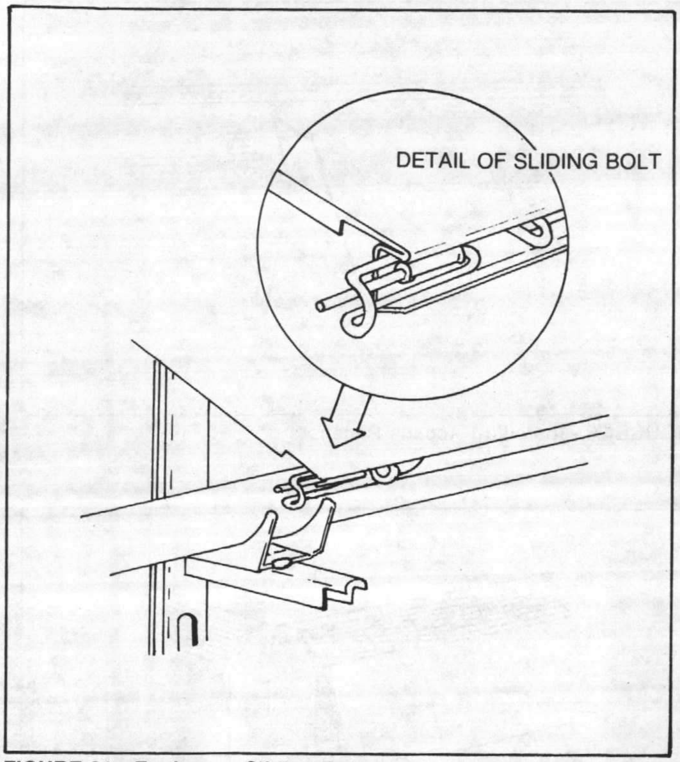


FIGURE 21 - Enclosure Sliding Bolt

TYPE TA ENCLOSURES

Type TA enclosures consist of an extruded aluminum grille and a separate front panel. In addition to the enclosure bracket, a rod loop is used to support the grille and front panel at the upper, front edge. See Figure 22.

Remove the enclosure bracket and insert the rod loop in the hole provided at the top of the bracket. Reinstall the bracket on the mounting strip as shown in Figure 23.

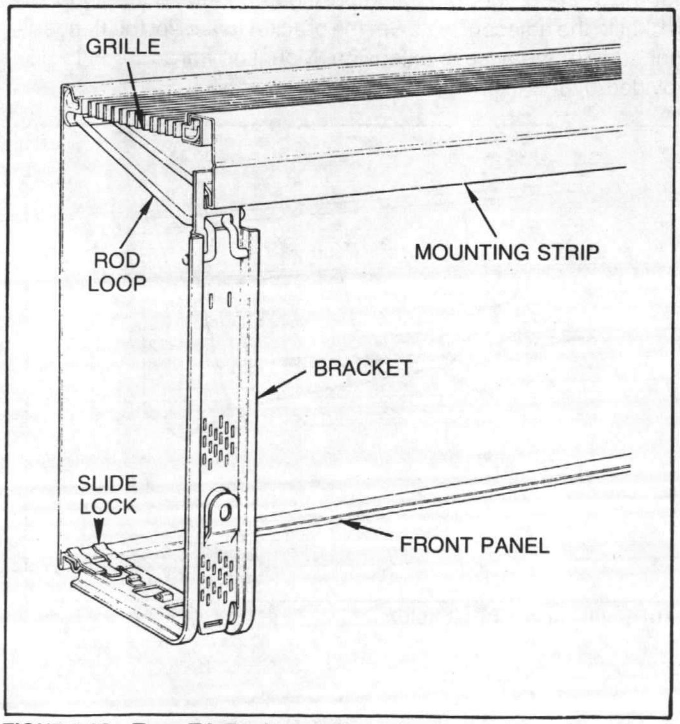


FIGURE 22 - Type TA Enclosure Mounting Detail (View from Rear)

Hold the grille in an upward position, 45 degrees from vertical, and insert the back edge of the grille into the top channel of the mounting strip. Bring the front edge of the grille downward and engage the rod loop. The front edge of the grille is formed to accept the rod loop.

If the installation includes dampers, attach the damper control mechanism at this time (see the "Dampers" section of this manual).

Insert the formed top edge of the front panel into the channel provided at the top, front edge of the grille. See Figure 24.

Bring the lower edge of the front panel down against the enclosure bracket and place the formed panel edge over the top of the bracket. Slide the slide lock as far forward as possible to lock the panel to the enclosure bracket.

Lock adjacent enclosures to each other with the sliding bolts as described for Type S, F, and T enclosures. Refer to Figure 21.

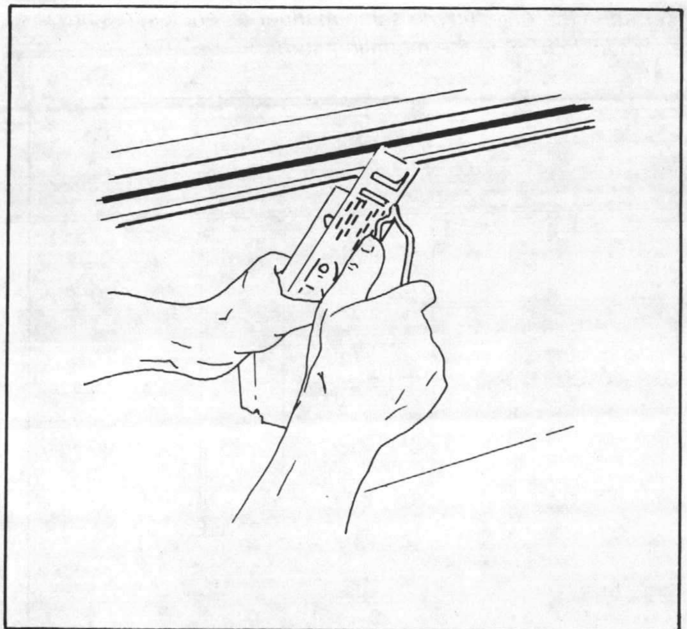


FIGURE 23 - Inserting Type TA Rod Loop Support

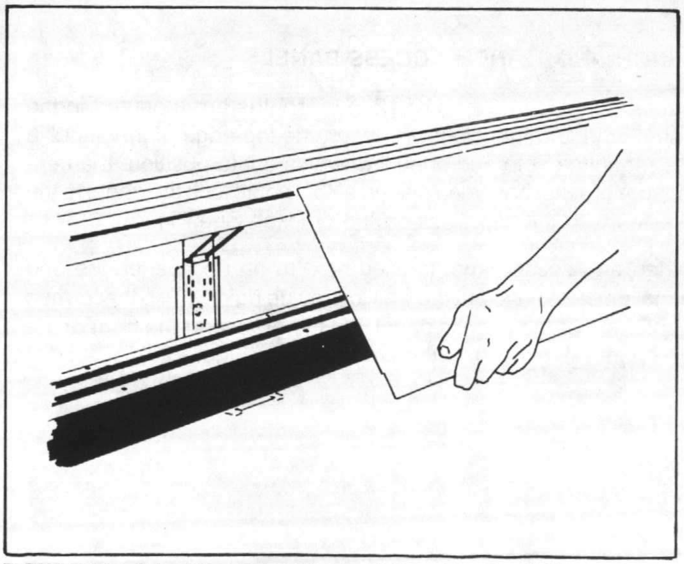


FIGURE 24 - Attaching Type TA Front Panel to the Grille

ACCESSORIES

ENCLOSURE EXTENSIONS

Enclosure extensions, shown in Figure 25, are designed to provide additional length to standard enclosures on wall-to-wall installations or when additional length is required to fully cover elements and piping.

The enclosure extension should lay over the top of the installed enclosure, with the flanged end positioned to butt up to the next enclosure, end cap, or corner piece.

Allow one inch overlap for a satisfactory joint. Remove the enclosure, place the enclosure extension over the edge of the enclosure, and snap the lower edge of the extension over the lower edge of the enclosure to form an assembly. Hold the assembly at an angle, insert it in the mounting strip, and bring the lower, front edge down into position. Lock the enclosure to the enclosure brackets (see Figure 20).

NOTE: *On Type TA enclosures the enclosure extension is to be inserted in the grille (in the same manner as enclosures are inserted) instead of in the mounting strip.*

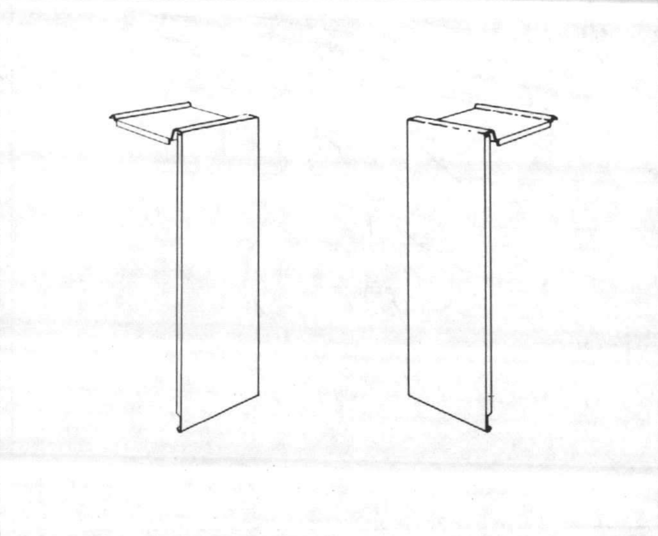


FIGURE 25 - Enclosure Extensions (Left-hand and Right-hand)

6-INCH AND 12-INCH ACCESS PANELS

Access panels in 6-inch or 12-inch lengths are mounted in the same manner as enclosures. Insert the top edge of the panel in the mounting strip and bring it downward into position. If an enclosure bracket has been placed at this point, lock the panel to the bracket with the slide lock on the bracket. See Figure 26.

When an access panel is used next to an end panel, the end panel must be nailed to the wall to provide rigidity. Slip the formed front edge of the access panel into the groove at the front of the end panel (Figure 8) or the corner piece (Figure 27).

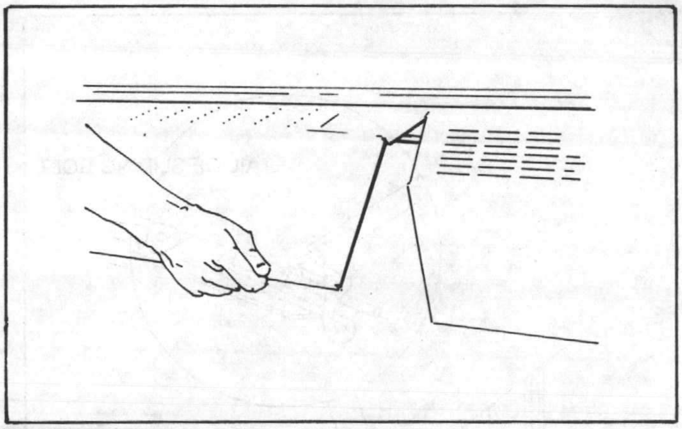


FIGURE 26 - Installing Access Panel

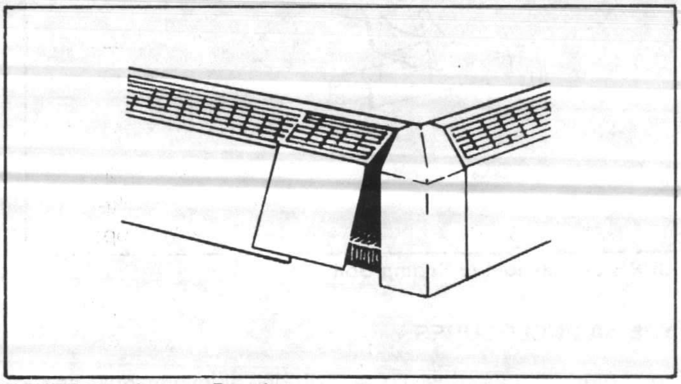


FIGURE 27 - Access Panel

ACCESS EXTENSIONS

The 12-inch access extension with a 4 x 6 inch access door is shown in Figure 28. A front support bracket is provided for mounting purposes when the extension is next to an adjacent wall.

Determine the proper mounting position and attach the support bracket to the adjacent wall. Set the bracket to accept the flanged front edge of the access extension. Mounting hardware is to be provided by the installer.

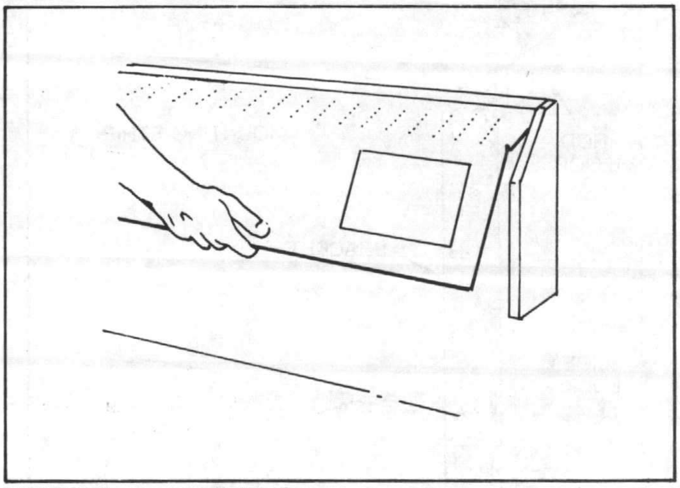


FIGURE 28 - Access Extension

Remove the adjacent enclosure and lay the extension over the edge of the enclosure. Snap the lower edge of the extension over the lower edge of the enclosure. Hold the access extension and enclosure assembly in an upward position 45 degrees from vertical and insert the formed top edge of the extension into the top channel of the mounting strip.

Allow at least one inch overlap on the adjoining enclosure to provide a satisfactory joint. The flanged front edge of the extension, however, must fit in the support bracket or an adjacent wall-fin end panel, inside corner, or outside corner.

Bring the lower front edge of the extension down into position and snap the formed lower edge over the bottom, front edge of the adjoining enclosure. See Figure 29.

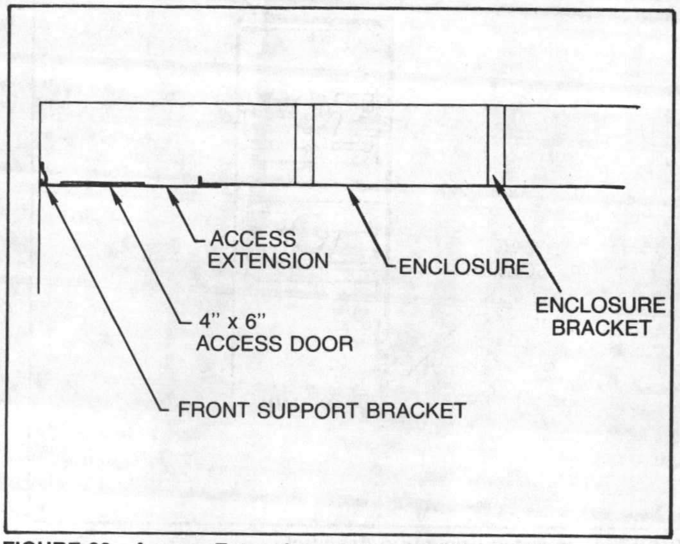


FIGURE 29 - Access Extension next to an Adjacent Wall

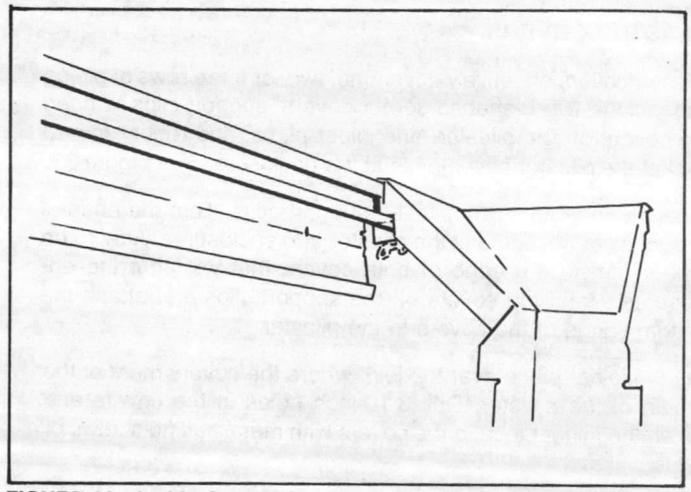


FIGURE 30 - Inside Corner, Mounting Strip, and Locking Clamp (Front View)

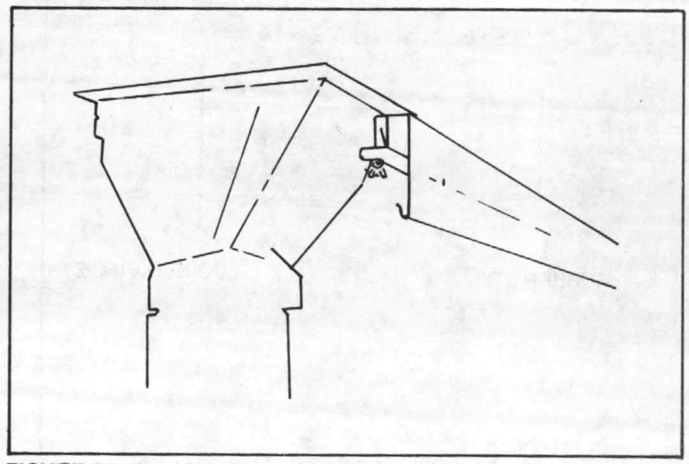


FIGURE 31 - Locking Clamp in Position (Rear View)

OUTSIDE AND INSIDE CORNERS

When an outside or inside corner is to be used, the mounting strip on both sides should be brought to within 1/2-inch of the corner. Place locking clamps (two provided with each corner piece) on both mounting strips at the corner. Set the corner piece on the mounting strip with the slots of the corner piece fitting into the mounting strip.

Slide the two locking clamps along the mounting strip until they are tight against the flange of the corner piece. Tighten the thumbscrews. Refer to Figures 30, 31, and 32.

Insert the formed flange on the edge of each adjacent enclosure into the grooves at either side of the corner piece. Install sliding bolts in the front, bottom edge of the adjacent enclosures and engage the bolt holes provided in the corner piece.

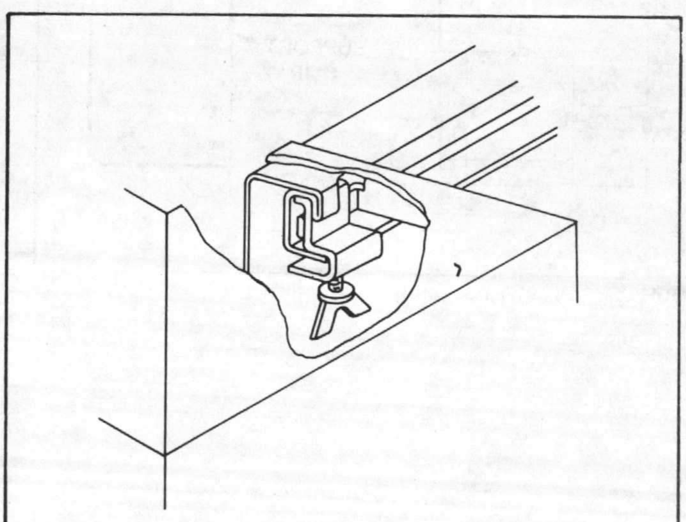


FIGURE 32 - Locking Clamp and Outside Corner

PILASTER COVERS

Pilaster covers effectively cover one, two, or three rows of piping and include two L-shaped corner covers, support clips to hang the covers on the pilaster, one joiner piece, and rubber trim to gasket the pilaster cover joints at the enclosure. See Figure 33.

Position and mount the pilaster support clips. Trim the ends of both pilaster covers to fit the pilaster and enclosures. Attach the rubber trim to the edge of both covers that will abut the enclosures. Hang the covers on the support clips and attach the bottom flange of the covers to the pilaster.

Lay the joiner piece over the joint where the covers meet at the middle of the pilaster. Drill 3/16-inch holes in the covers and fasten the joiner piece to the covers with metal cutting screws or rivets.

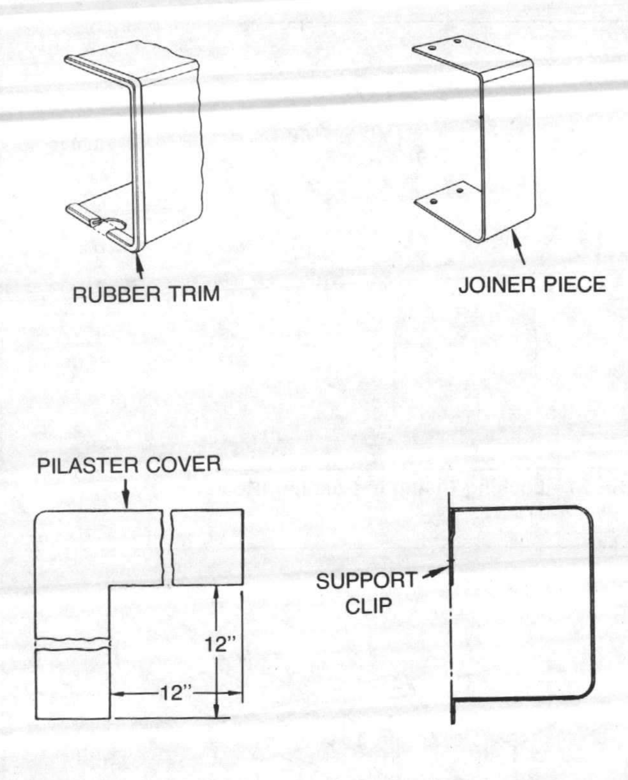


FIGURE 33 - Pilaster Assembly

INVERTED ENCLOSURES

Inverted enclosures are installed in a manner similar to the upright enclosures, except that the bottom of the inverted mounting strip is aligned to the chalk line. Since the inverted enclosure brackets cannot hang from the mounting strip, fasten them to the wall with lag bolts.

Tamper-proof fasteners are provided to secure and lock enclosures to the enclosure brackets. Use element supports to mount the element cradles and elements as shown in Figure 34.

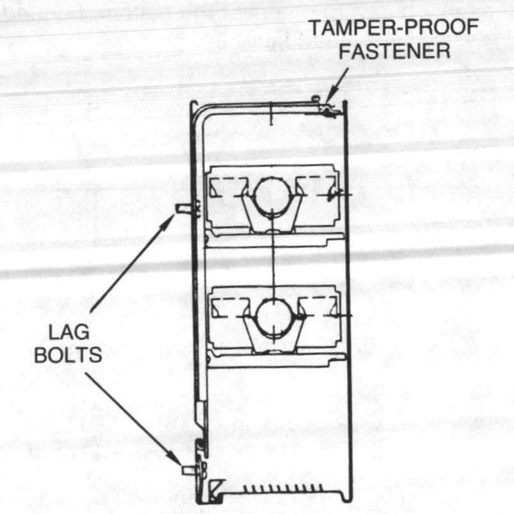


FIGURE 34 - Inverted Enclosure Assembly

TAMPER-PROOF FASTENERS

Tamper-proof fasteners are supplied to fasten the enclosures to the enclosure brackets for tamper-proof and inverted enclosure installations. Slide the lock forward as far as possible and tighten the socket head screw. See Figure 35.

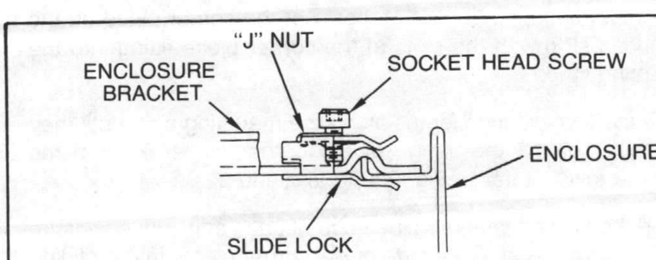


FIGURE 35 - Tamper-proof Fastener

FRONT AND BOTTOM INLET GRILLES

FRONT INLET GRILLES

Figures 36 and 37 illustrate two suggested methods of installing enclosures with front inlet grilles.

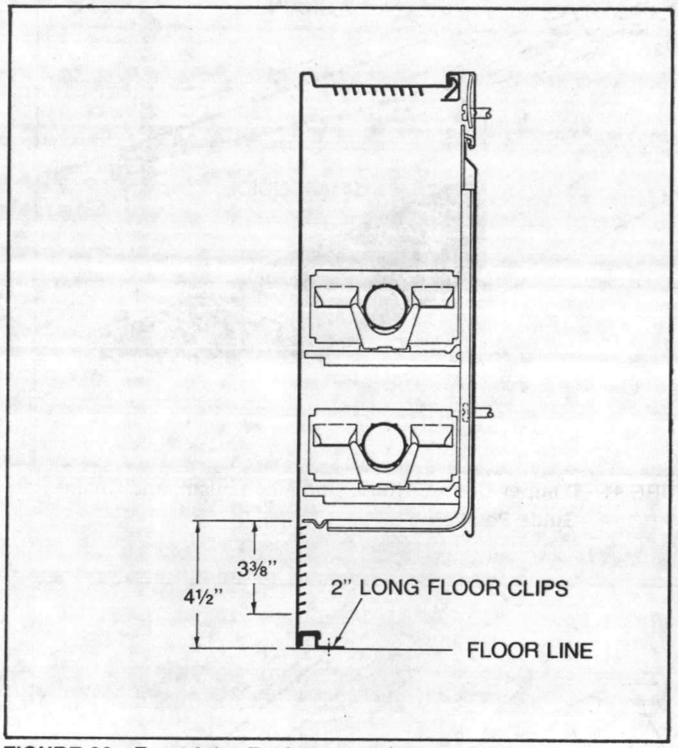


FIGURE 36 - Front Inlet Enclosure with Floor Clips

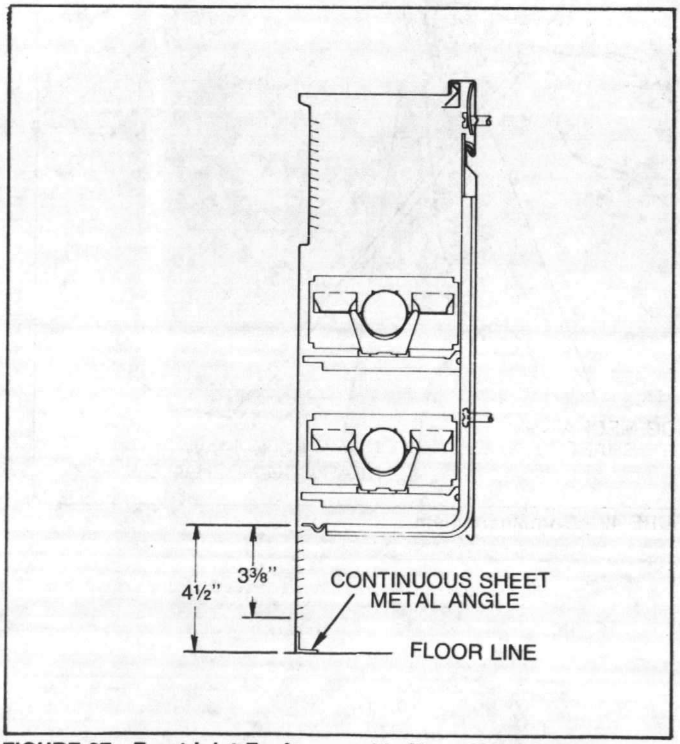


FIGURE 37 - Front Inlet Enclosure with Sheet Metal Angle

In the first method, two inch long metal clips are attached to the floor, and the enclosure formed edge slips over the clips. In the second method, a continuous sheet metal angle is used at the floor line and the enclosure is attached to the angle with sheet metal screws.

BOTTOM INLET GRILLES

Bottom inlet grilles are separate pieces that attach to the wall and the enclosure bracket. As shown in Figure 38, the "J" Nut (A) is factory installed and contains threads for the screw (B). To install, attach the front edge of the grille to the bracket with the bolts and washers provided and secure the back of the grille to the wall.

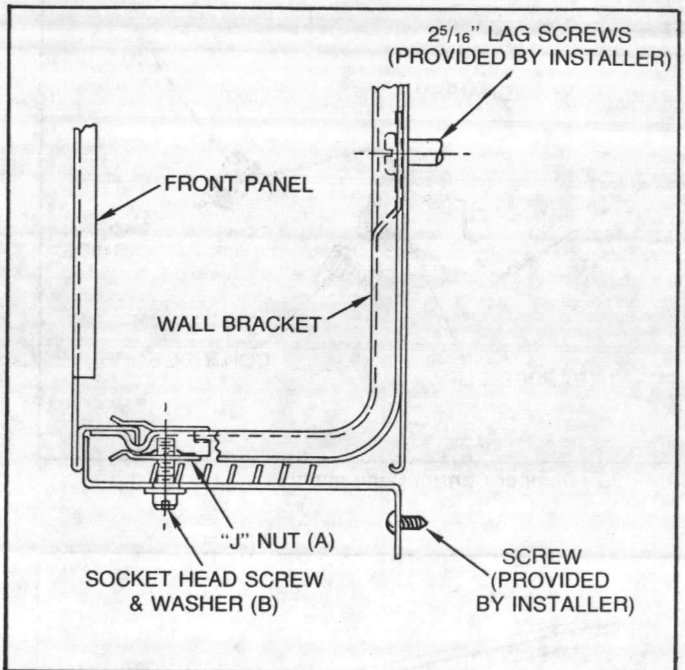


FIGURE 38 - Bottom Inlet Grille

DAMPERS

Dampers are shipped attached to the elements, except for the 3/4-inch Copper/Aluminum Series 60 element. The damper for a 3/4-inch element must be field installed. (See Figures 54 and 55 for installing the field mounted damper.) The damper control assembly is shipped separately in a cloth bag. Refer to Figure 39.

DAMPER INSTALLATION WITH TYPE S, F, AND T ENCLOSURES

Place the enclosure ahead of and below the element, as shown in Figure 40.

NOTE: Before installing the damper control knob cog mechanism on the enclosure, make sure there will be 24 inches between the cog mechanism and the chain guide, which is secured to the mounting strip. (See Figure 41.) This distance is necessary to provide a proper angle for the chain for damper operation.

Set the metal retainer of the cog mechanism so that it will not obstruct the four slots, two at the top and two at the bottom of the plastic part. Be sure the enclosure is face downward with the top toward the installer. Position the cog mechanism so that the shaft is pointed toward the grille. See Figure 42.

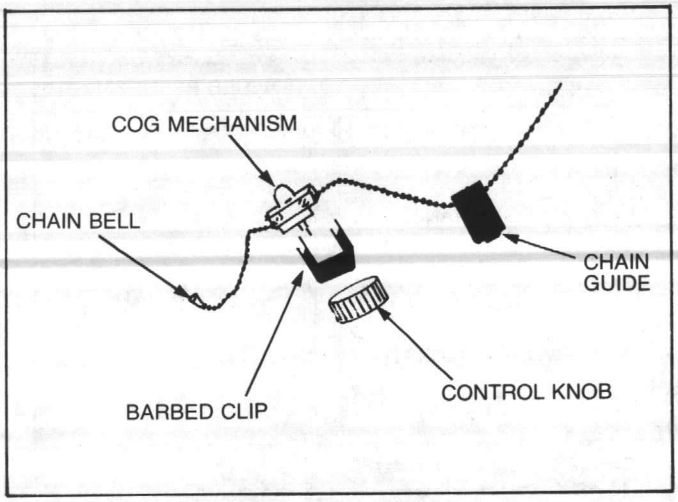


FIGURE 39 - Damper Control Components

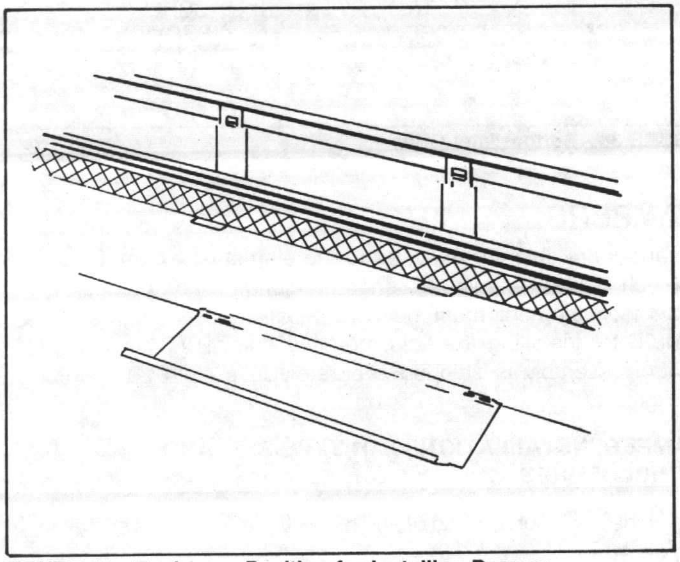


FIGURE 40 - Enclosure Position for Installing Damper

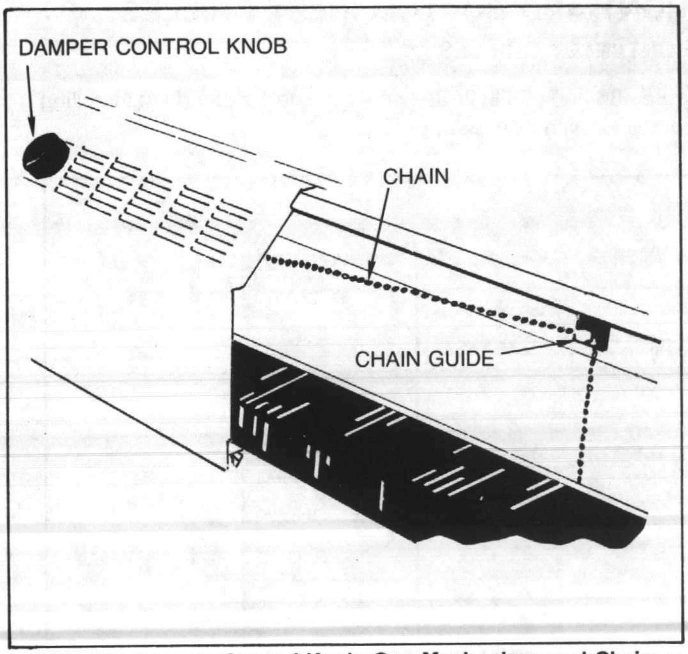


FIGURE 41 - Damper Control Knob, Cog Mechanism, and Chain Guide Position

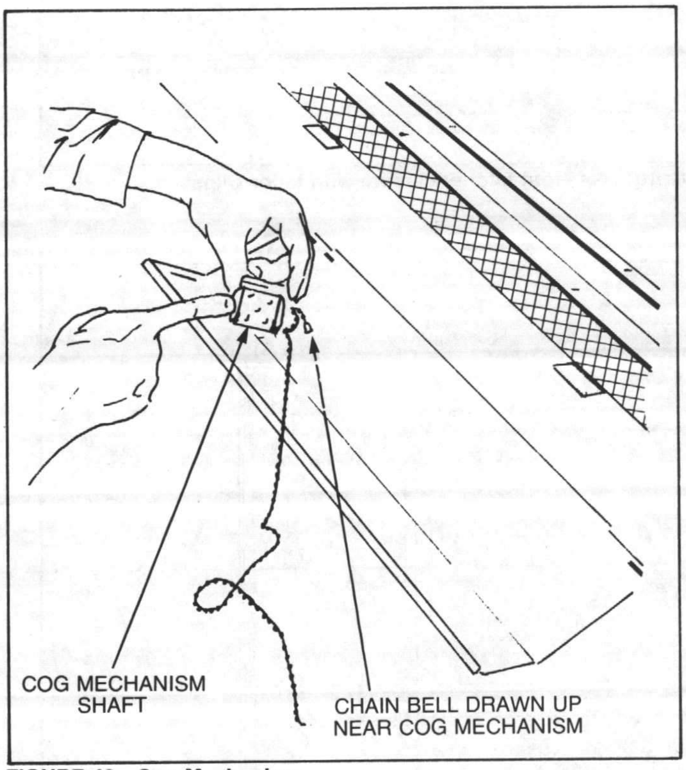


FIGURE 42 - Cog Mechanism

With the shaft of the cog mechanism pointed toward the enclosure grille, insert the shaft between the center segments of the grille. See Figure 43.

Hold the cog mechanism in place and insert the barbed clip through the grille from the outside of the enclosure. Place it over the shaft and into the four slots of the plastic part. The barbed clip usually slips into the slots easily, locking the cog mechanism into position. On the stamped grille, the second set of barbs from the end should be engaged. See Figure 44.

If the barbed clip will not slip into place easily, spring it open slightly. If difficulty is still encountered, insert the barbed clip through the grille and guide the slots of the cog mechanism over the prongs of the clip. See Figure 45.

Figure 46 shows the cog mechanism and barbed clip properly mounted on the enclosure grille.

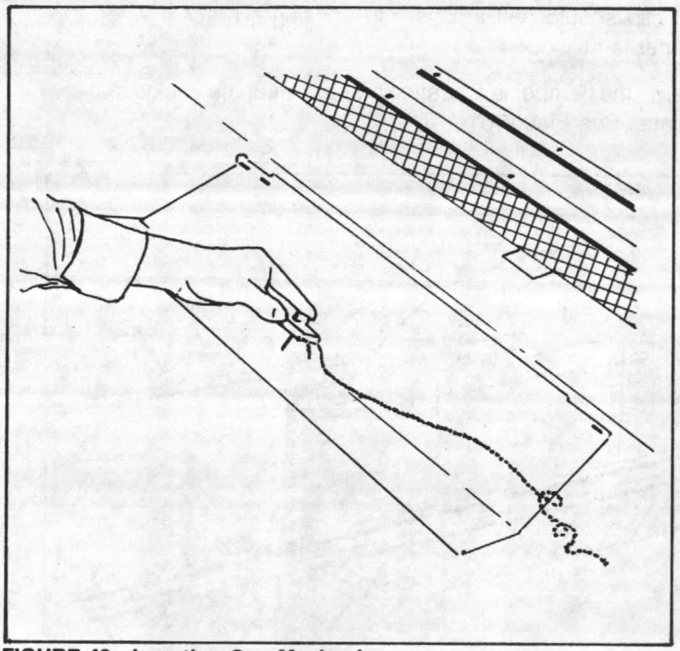


FIGURE 43 - Inserting Cog Mechanism

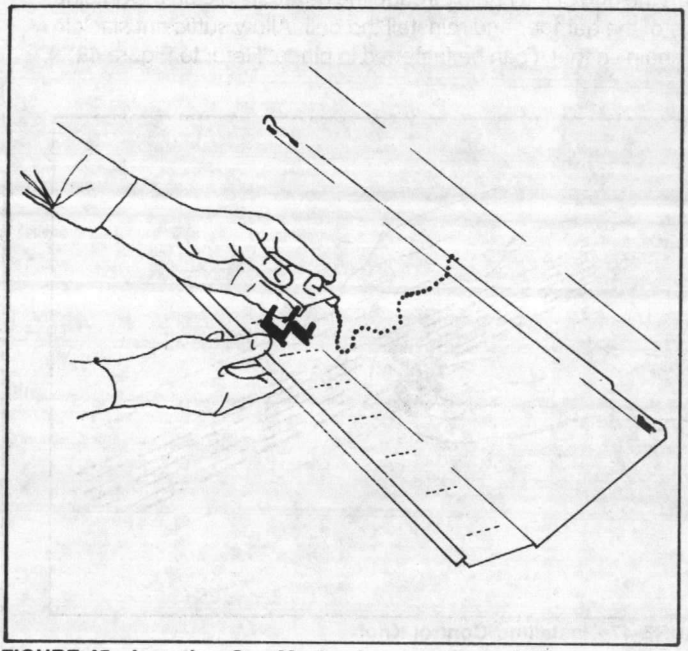


FIGURE 45 - Inserting Cog Mechanism into Barbed Clip

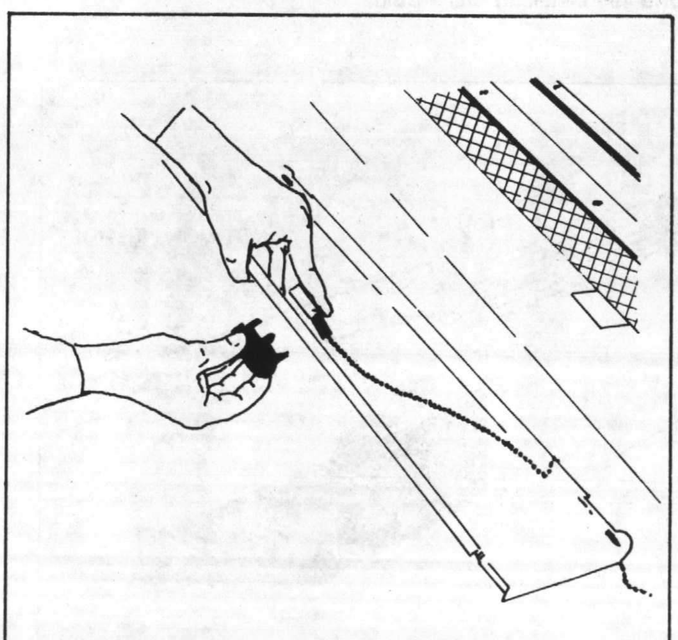


FIGURE 44 - Inserting Barbed Clip

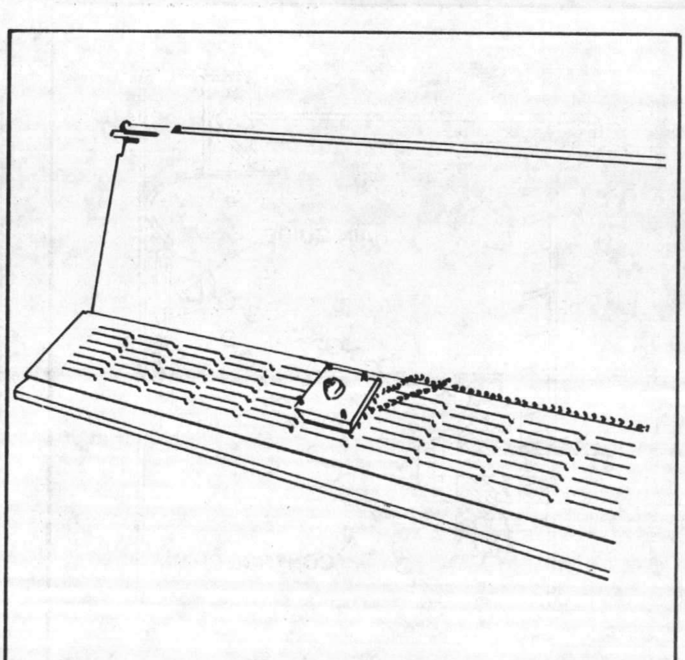


FIGURE 46 - Position of Installed Control

Install the control knob on the shaft now projecting through the grille, as shown in Figure 47. Tighten the set screw to secure the control knob to the shaft.

Extend the chain, without crossing the cog mechanism, either to the right or left for at least two feet. Be sure the chain guide is correctly placed on the chain. It may be necessary to remove the bell, slip the chain guide off, reverse it, return it to the chain, and refasten the bell. Remove the bell from the long end of the chain. Insert the end of the chain through the nearest hole on the outside edge of the damper and reinstall the bell. Allow sufficient slack in the chain so that it can be fastened in place. Refer to Figure 48.

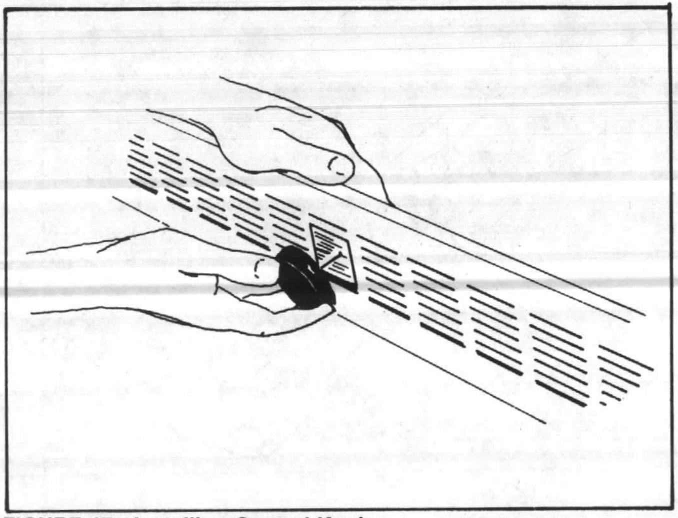


FIGURE 47 - Installing Control Knob

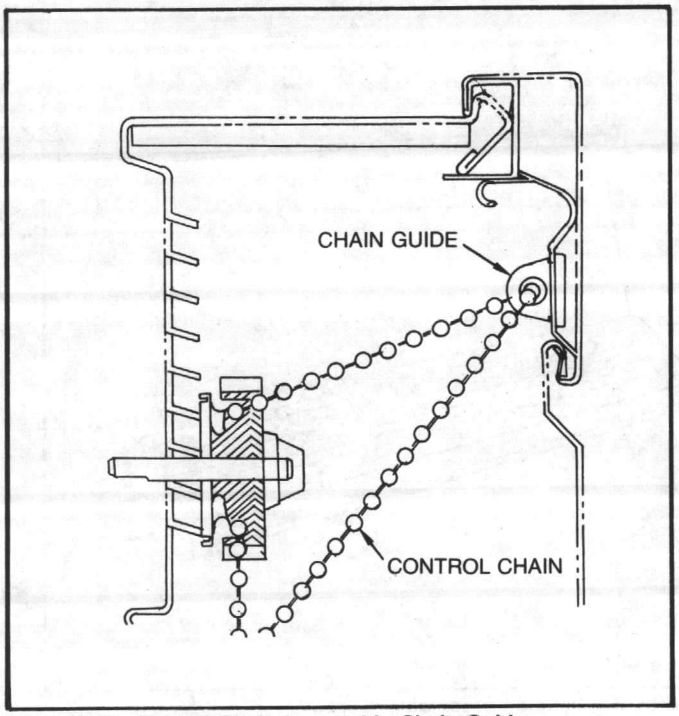


FIGURE 48 - Control Chain Inserted in Chain Guide

Position the chain guide with the plastic guide down and outward, and snap it into place on the mounting strip. See Figure 49.

The chain guide should be located between the cog mechanism and the point where the chain is attached to the damper. **The location must be no more than two inches from the point where the chain is attached to the damper.** See Figure 50.

Place the damper stop clip over the front edge of the damper, exactly in front of one of the enclosure brackets. In operation, the stop clip should rest against the enclosure bracket when the damper is fully open.

Be sure the damper is operating properly after the enclosures are in place. See Figure 51.

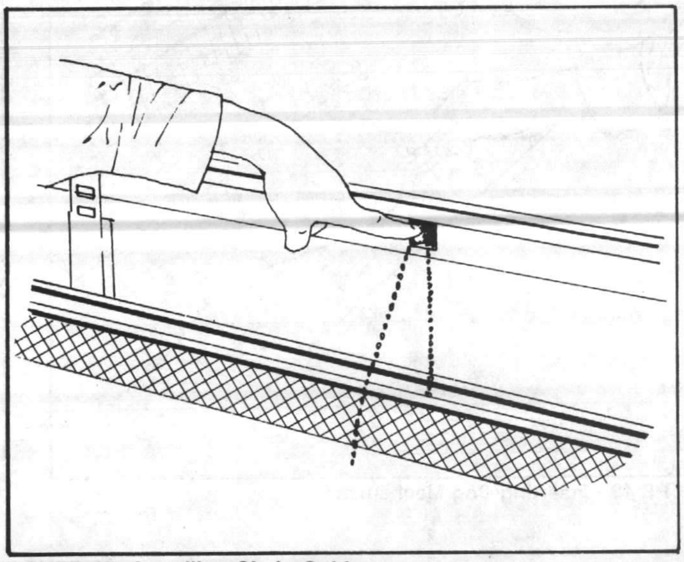


FIGURE 49 - Installing Chain Guide

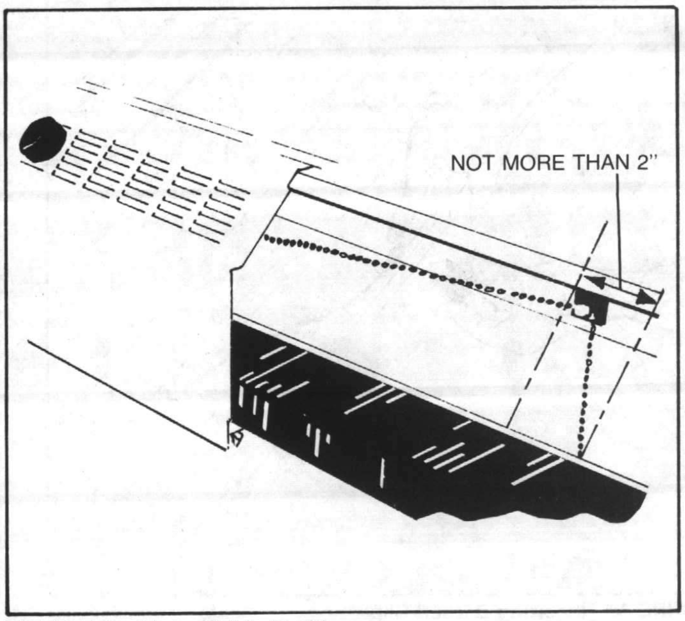


FIGURE 50 - Chain Guide Position

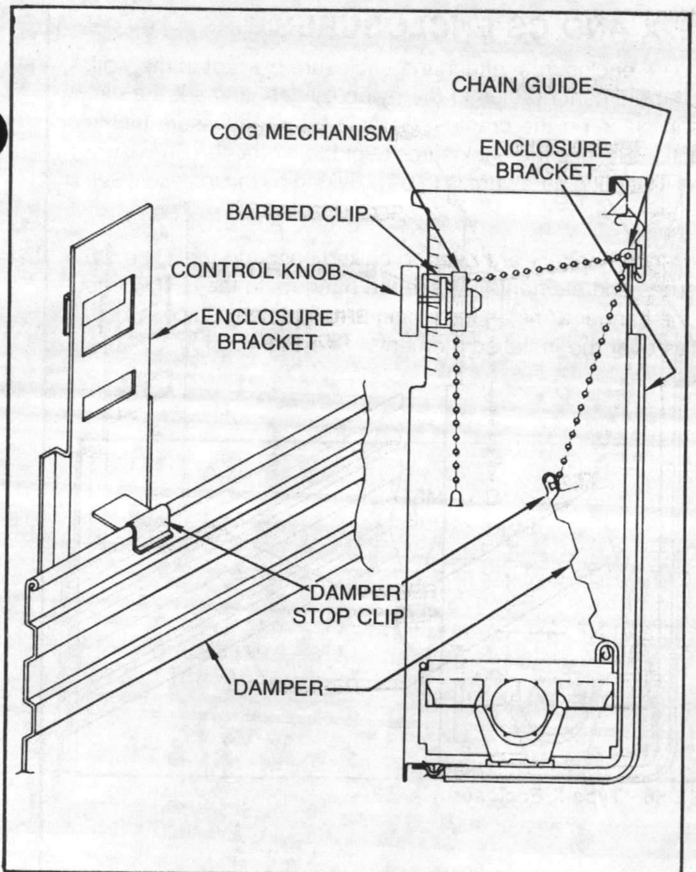


FIGURE 51 - Attaching Damper Stop Clip

DAMPER INSTALLATION WITH TYPE TA ENCLOSURES

For Type TA enclosures, install the damper control mechanism as described for Type S, F, and T enclosures, except with the extruded aluminum grille in place on the mounting strip. Only the first set of barbs on the barbed clip should be engaged in the cog mechanism. See Figure 52.

Position the chain guide with the plastic guide down and outward, and snap it into place on the mounting strip. The chain guide should be located between the cog mechanism and the point where the chain is attached to the damper. The location must be no more than two inches from the point where the chain is attached to the damper. See Figure 53.

FIELD-MOUNTED DAMPERS

To field install the damper blade, a simple utility hook with a threaded end will be needed. The utility hook is to be furnished by the installing contractor.

First install the mounting strip, the enclosure brackets, and the heating element according to the instructions in this manual.

The damper blade is furnished with pre-punched holes. Lay the damper blade on top of the heating element. Drill a small hole in the wall, in the same location as each damper blade hole, for the installation of the utility hooks. Remove the damper from the top of the heating element. Install the utility hooks just above the heating element. Make sure the open ends of the utility hooks are in the upright position. Position the damper blade on each utility hook and close the open end of the hook to keep the damper blade secure when it is in operation. See Figures 54 and 55.

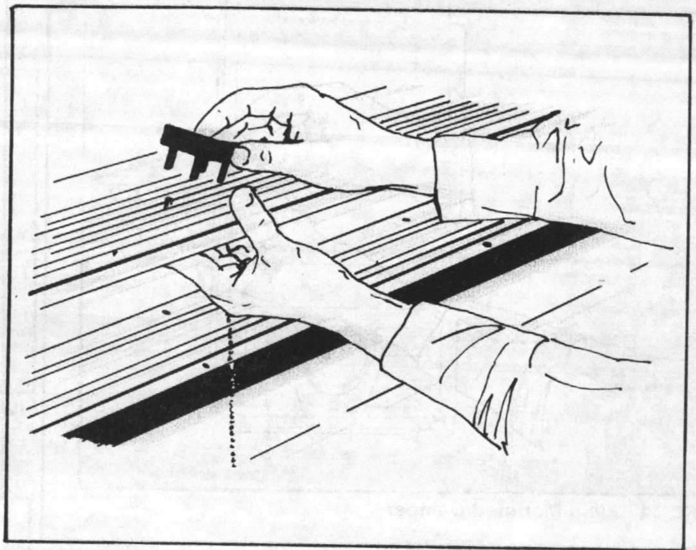


FIGURE 52 - Attaching Barbed Clip (Type TA Enclosures)

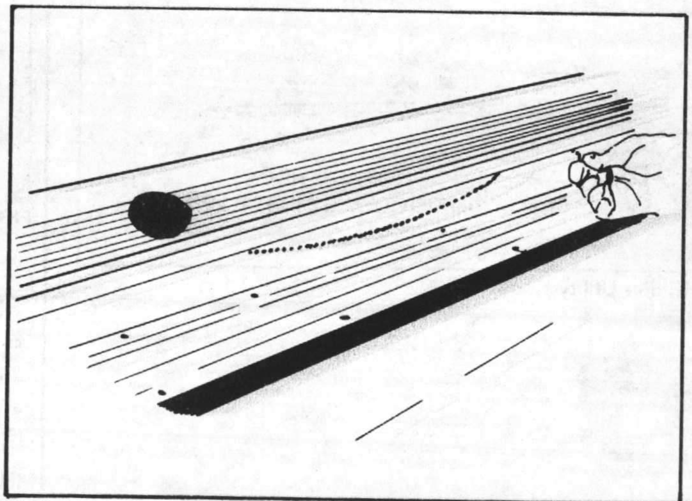


FIGURE 53 - Installing Chain Guide (Type TA Enclosures)

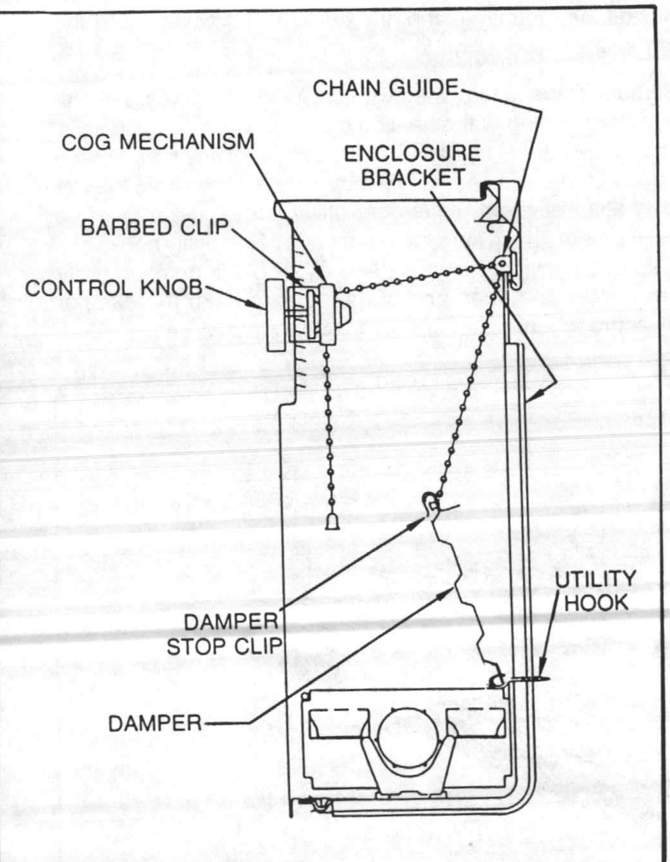


FIGURE 54 - Field-Mounted Damper

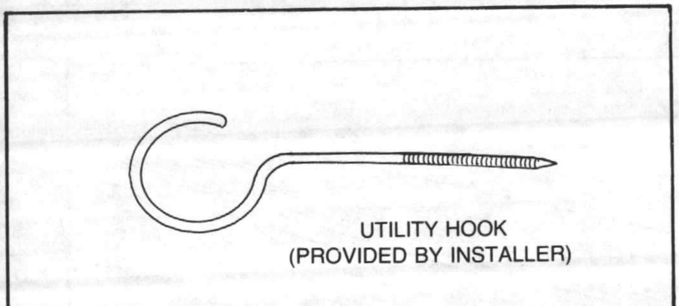


FIGURE 55 - Utility Hook

TYPE X AND CS ENCLOSURES

On Type X enclosures, attach the enclosure bracket to the wall, insert the element cradles in the nylon guides, and set the elements in place on the cradles. Complete the necessary piping connections. Place the enclosures over the elements. Enclosure bracket mounting hardware is to be provided by the installer. See Figure 56.

Scissor-type hangers are used to ceiling suspend the Type CS enclosures and elements. Attach the hangers to the ceiling and close the hanger arms as the piping is completed. Place the enclosures over the installed elements. See Figure 57.

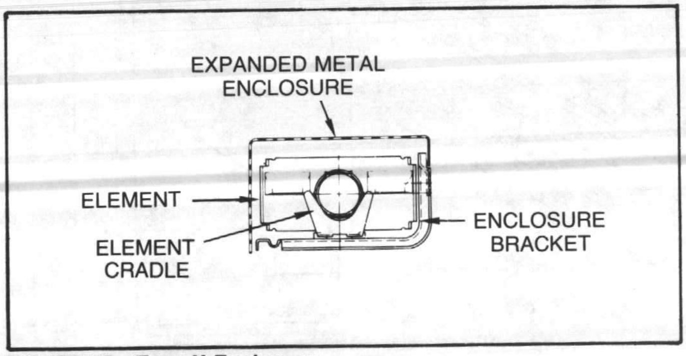


FIGURE 56 - Type X Enclosure

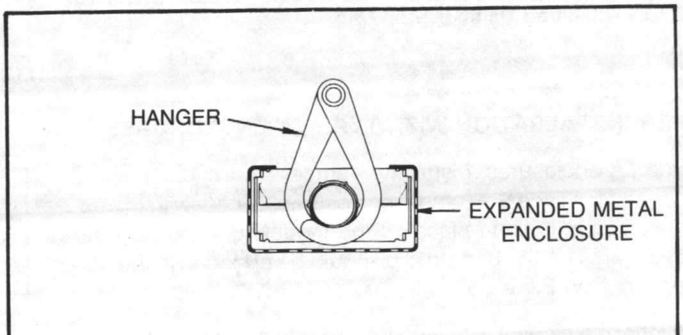


FIGURE 57 - Type CS Enclosure

FIELD PAINTING

Special surface preparation may be required when field painting the unit. The surface should be free of oil, grease, and dirt and should be scuff sanded prior to painting. This surface preparation is sufficient when alkyd enamels are used.

If Latex paints are used, an intermediate alkyd primer must be applied after proper surface preparation to improve adhesion. In lieu of the intermediate alkyd primer coat, such surface preparation methods as liquid sandpaper or hand sanding will provide good adhesion in some cases. However, this is true only when a high grade Latex paint is used.

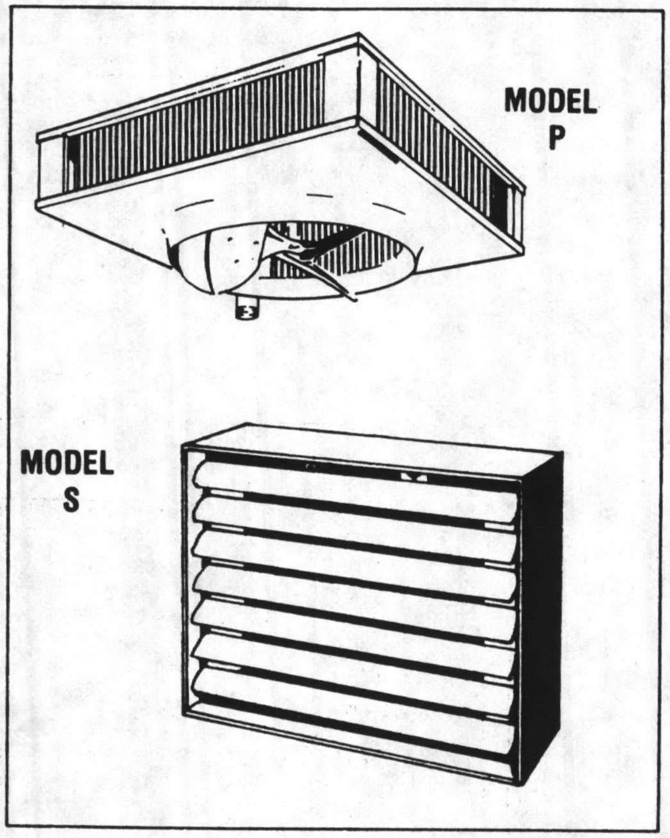
TRANE

Installation Maintenance

Library	**Service Literature**
Product Section	**Air Term. Dev. and Heating Prod.**
Product	**Unit Heaters**
Model	**Hydronic**
Literature Type	**Inst.-Main.**
Sequence	**2A**
Date	**February 1985**
File No.	**SV-TD-UH-UH-IM-2A-285**
Supersedes	**UH-IM-2 179**

Ordering No. **UH-IM-2A**

Since the Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.



PROPELLER UNIT HEATERS

MODELS S AND P

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Installation 3
Dimensions 4
Weights 7
Mounting 7
Piping 7
Motors 10
Coils 11
Maintenance 12

TRANE

Installation Maintenance

Library	**Service Literature**
Product Section	**Air Term. Dev. and Heating Prod.**
Product	**Unit Heaters**
Model	**Hydronic**
Literature Type	**Inst.-Main.**
Sequence	**2A**
Date	**February 1985**
File No.	**SV-TD-UH-UH-IM-2A-285**
Supersedes	**UH-IM-2 179**

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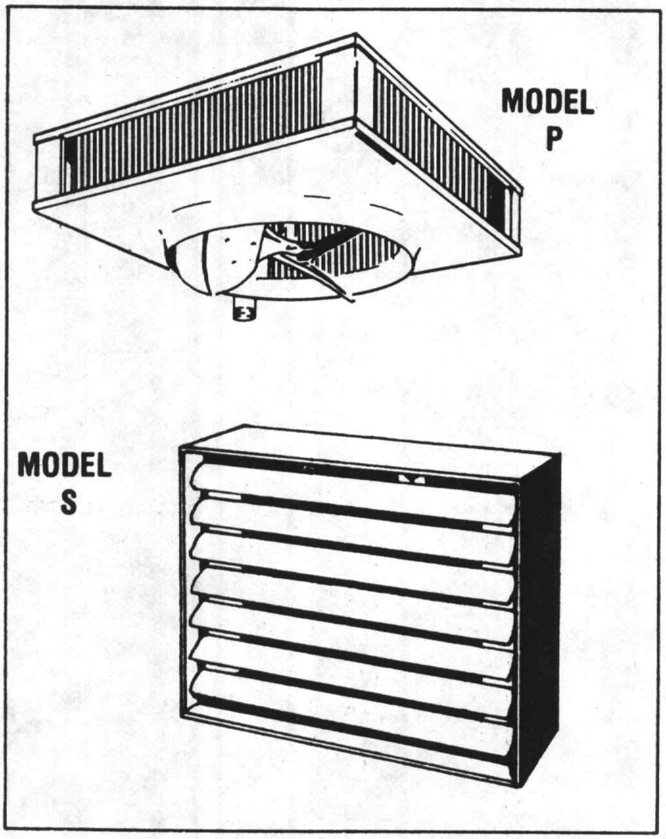

PROPELLER UNIT HEATERS

MODELS S AND P

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MODEL NUMBER DESCRIPTION

MODEL "P" UNIT HEATERS

UHPA-042P-4A-BAB

UNIT HEATER
MODEL P

DEVELOPMENT SEQUENCE

UNIT SIZE

BTU		BTU	
042	41,300	252	249,800
064	65,500	280	283,800
080	80,600	336	333,400
102	101,800	384	386,000
122	124,400	500	496,000
146	152,000	600	585,000
166	173,000	720	705,000
202	201,200		

COIL TYPE
P - STEAM OR HOT WATER **

FIN SERIES
4 - 144**
9 - SPECIAL

DESIGN SEQUENCE

MOTOR

	H.P.	TYPE*	RPM	VOLTAGE
B	1/25	ENCL	1550	115/60/1 **
C	1/20	ENCL	1550	115/60/1 **
D	1/8	ENCL	1070	115/60/1 **
F	1/6	ENCL	1100	115/60/1 **
G	1/6	EXPL	1140	115/60/1 **
H	1/6	ENCL	1140	230-460/60/3
J	1/4	ENCL	1100	115/60/1 (202 ONLY)**
K	1/4	ENCL	1100	115/60/1 (252 ONLY)**
L	1/4	EXPL	1100	115/60/1
M	1/4	ENCL	1100	230-460/60/3
P	1/2	ENCL	1100	115/60/1
R	1/2	EXPL	1100	115/60/1
S	1/2	ENCL	1100	230-460/60/3
T	3/4	ENCL	1100	230-460/60/3**
U	1-1/2	ENCL	1100	230-460/60/3
W	3	ENCL	1100	230-460/60/3
X	SPECIAL			

FIN MATERIAL
A - ALUMINUM **
S - SPECIAL

TUBE MATERIAL
B - .025 COPPER **
C - .049 RED BRASS
E - .049 CUPRO-NICKEL
F - .049 STEEL

* ENCL - Totally Enclosed Motor
EXPL - Explosion Proof Motor

** STANDARD EQUIPMENT

MODEL "S" UNIT HEATERS

UHSA-018S-8C-AAA

UNIT HEATER
MODEL S

DEVELOPMENT SEQUENCE

UNIT SIZE

FULL COIL	BTU	MODIFIED COIL	BTU
018	17,400	019	19,300
020	20,000	031	30,400
038	38,700	045	45,800
042	41,600	053	53,300
060	60,500	069	69,400
070	68,200	077	76,600
090	87,600	091	91,000
100	96,000	127	125,800
126	125,700	137	135,800
168	172,000	181	180,700
186	185,200	207	206,900
230	229,700	243	238,700
260	256,300	273	272,200
320	324,000		
354	355,500		
400	404,000		

COIL TYPE
S - STEAM**
W - HOT WATER - WITH FIN SERIES 132 ONLY **

* ENCL - Totally enclosed motor
EXPL - Explosion proof motor

** STANDARD EQUIPMENT

MOTOR

	H.P.	RPM	VOLTAGE	TYPE*
A	1/25	1050	115/60/1**	ENCL
C	1/20	1550	115/60/1**	ENCL
E	1/8	1550	115/60/1**	ENCL
F	1/6	1100	115/60/1**	ENCL
G	1/6	1140	115/60/1**	EXPL
H	1/6	1140	230-460/60/3	ENCL
J	1/4	1100	115/60/1**	ENCL
L	1/4	1100	115/60/1	EXPL
M	1/4	1100	230-460/60/3	ENCL
N	1/2	1100	115/60/1**	ENCL
R	1/2	1100	115/60/1	EXPL
S	1/2	1100	230-460/60/3	ENCL
T	3/4	1100	230-460/60/3	ENCL
X	SPECIAL			

FIN MATERIAL
A - ALUMINUM**
S - SPECIAL

TUBE MATERIAL
A - .031 COPPER**
C - .049 RED BRASS
D - .031 CUPRO-NICKEL
F - .049 STEEL

DESIGN SEQUENCE

FIN SERIES
2 - 132-WITH COIL TYPE "W" ONLY **
8 - 108**
9 - SPECIAL

All Trane Model P and S Unit Heaters are shipped fully assembled and may be used for steam or hot water applications. Coils are factory tested at 300 psig air under water, fans are balanced and motors are prelubricated.

Each unit is packaged individually and marked for proper identification. Use normal care in handling and during installation to prevent damage to the coil fins, fan and casing. Do not set the Model P Unit on the floor with the weight of the unit resting against the fan blades. In this position, the blades may be forced out of balance.

Figures 1, 2 and 3 and Tables 1, 2 and 3 give unit dimensions. Unit weights are listed in Table 6.

INSTALLATION

Place the units at points of greatest heat loss. Blanket outside doorway and provide ample coverage of window areas. Keep units away from obstructions that will impede the full and natural air delivery of the units.

To insure delivery of the heated air to the desired area, follow the maximum distance of throw and mounting heights given in Tables 4 and 5. Mounting heights are to be measured from the floor to the bottom of the unit.

The discharge air temperature on Model P Units may be adjusted after installation. The top of all Model P Units contain a pattern of easily removed air port openings. To lower the discharge air temperature, it is only necessary to open the desired number of air ports.

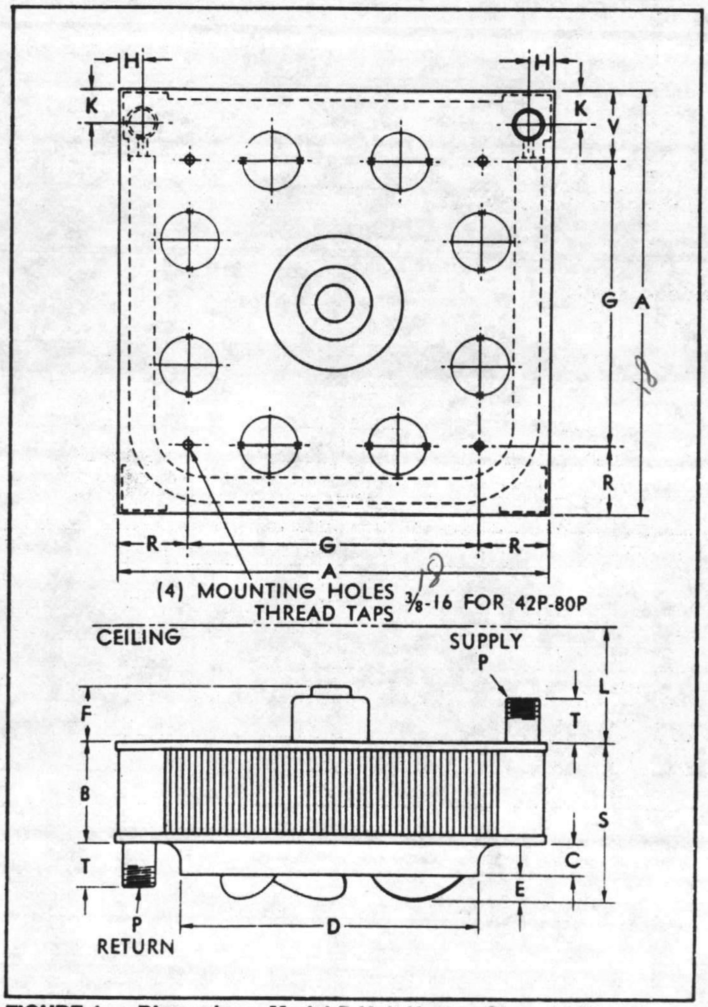

FIGURE 1 — Dimensions, Model P Unit Heater, Sizes 42-80

TABLE 1 - Model P Unit Heater Dimensions* (Figure 1)

Model P	Fan Dia.	A	B	C	D	E	F	G	H	K	L (Min)	P (NPT)	R	S	T	U	V
42P	11¼	18¼	4⅝	1¼	11¾	¾	4	11	1⅜	1⅞	6	1½	3⅝	6⅝	2¾	11	3⅝
64P	13½	21¼	4⅝	1⅝	14	1	4	14	1⅜	1⅞	6	1½	3⅝	7⅛	2¾	14	3⅝
80P	13½	21¼	6⅛	1⅝	14	1	3	14	1⅜	1⅞	6	1½	3⅝	8⅝	2¾	14	3⅝

*INCHES

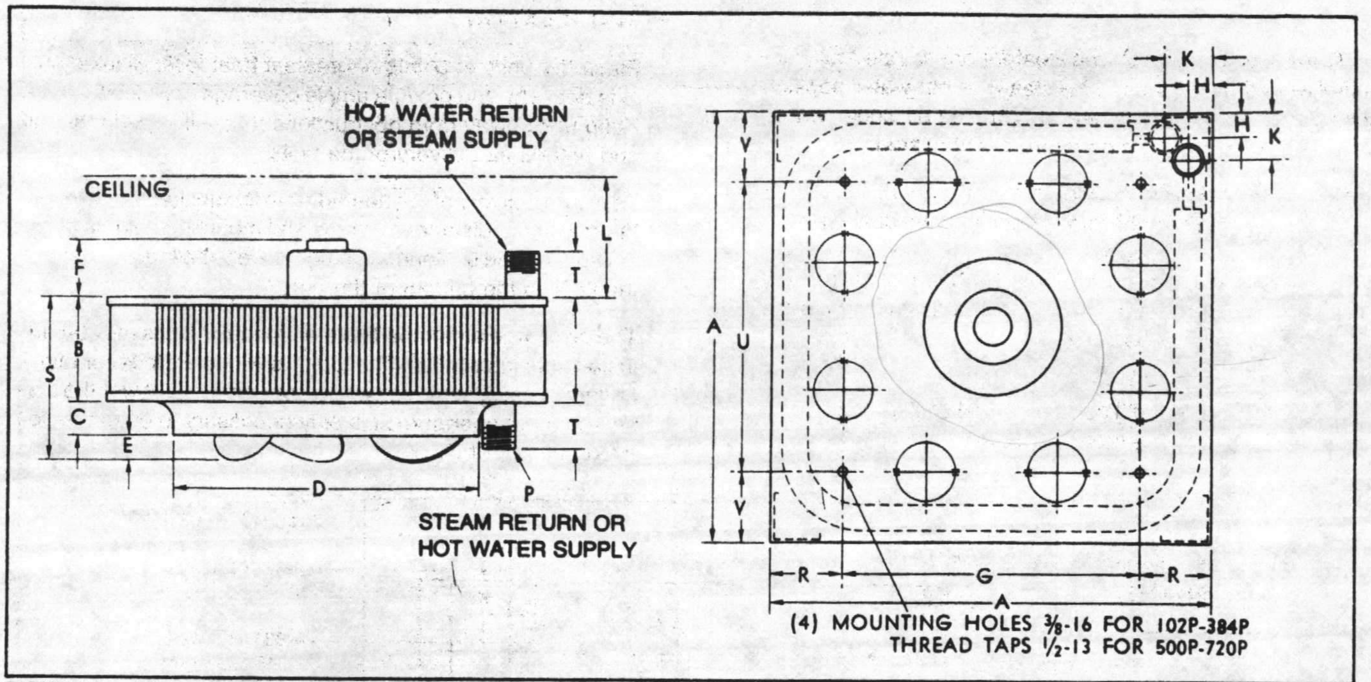

FIGURE 2 — Dimensions, Model P Unit Heater, Sizes 102-720

TABLE 2 - Model P Unit Heater Dimensions* (Figure 2)

Model P	Fan Dia.	A	B	C	D	E	F	G	H	K	L(Min)	P(NPT)	R	S	T	U	V
102P	16¾	25¼	6⅛	2	17½	1⅛	3	17	1⅜	2¾	6	1½	4⅛	9⅛	2¾	17	4⅛
122P	16¾	25¼	6⅛	2	17½	1¾	3	17	1⅜	2¾	6	1½	4⅛	9¾	2¾	17	4⅛
146P	19¾	29½	6⅛	2⅜	20⅝	1¼	4	20½	1¾	3½	6	2	4½	9⅝	2¾	20½	4½
166P	19¾	29½	6⅛	2⅜	20⅝	1¾	4	20½	1¾	3½	6	2	4½	10⅛	2¾	20½	4½
202P	19¾	29½	7⅝	2⅜	20⅝	2	4	20½	1¾	3½	6	2	4½	12	2¾	20½	4½
252P	25¼	37½	7⅝	3	26⅜	1	3½	28	1¾	3½	6	2	4¾	11⅝	2¾	18	9¾
280P	25¼	37½	7⅝	3	26⅜	1¼	3½	28	1¾	3½	6	2	4¾	11¾	2¾	18	9¾
336P	25¼	37½	7⅝	3	26⅜	2⅛	4	28	1¾	3½	6	2	4¾	12¾	2¾	18	9¾
384P	25¼	37½	9⅛	3	26⅜	2	3½	28	1¾	3½	6	2	4¾	14⅛	2¾	18	9¾
500P	30	42	9⅛	3½	31¼	1⅝	3	30	2¼	4¼	7	2½	6	14¼	3	30	6
600P	30	42	12⅛	3½	31¼	2⅛	3	30	2¼	4¼	7	2½	6	17¾	3	30	6
720P	30	42	13⅝	3½	31¼	3	4	30	2¼	4¼	7	2½	6	20¼	3	30	6

*INCHES

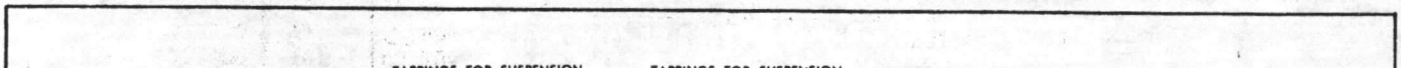

FIGURE 3 — Dimensions, Model S Unit Heater

TABLE 3 — Model S Unit Heater Dimensions (Figure 3)

Model S	Fan Dia.	A	B	C	D	DD	E	EE	F	G	H	J	K	L	No. of Horizontal Louvers Std.	No. of Louver Fin Diffusers
18, 19 & 20S	11¼	20⅞	14¼	9⅜	15⅜	20⅝	6	11¼	3⅛	8⅝	2⅝	—	1¾	1¼		
31S	11¼	20⅞	14¼	9⅜	16⅛	20⅝	6¾	11¼	3⅛	8⅝	—	2⅝	1¾	1¼		
38 & 42S	11¼	20⅞	14¼	9⅜	16⅛	20⅝	6¾	11¼	3⅛	11⅝	2⅝	—	1¾	1¼	4	3
45S	13½	23⅞	17¼	10	17	21¼	7	11¼	3½	11⅝	2⅝	—	2	1¼		
60S	13½	23⅞	17¼	10	17	21¼	7	11¼	3½	14⅝	—	2⅝	2	1¼		
53S	13½	23⅞	17¼	10	17¼	21¼	7¼	11¼	3½	11⅝	2⅝	—	2	1¼		
70S	13½	23⅞	17¼	10	17¼	21¼	7¼	11¼	3½	14⅝	—	2⅝	2	1¼	5	4
69S	13½	26¾	20¼	11¼	18½	22½	7¼	11¼	4⅛	14⅝	—	2⅝	2	1¼		
90S	13½	26¾	20¼	11¼	18½	22½	7¼	11¼	4⅛	17⅝	2⅝	—	2	1¼	6	5
77S	16¾	26¾	20¼	11¼	18¾	22½	7½	11¼	4⅛	14⅝	—	2⅝	2	1¼		
100S	16¾	26¾	20¼	11¼	18¾	22½	7½	11¼	4⅛	17⅝	2⅝	—	2	1¼	6	5
91S	16¾	31⅛	23¼	11¼	21	22½	9¾	11¼	4⅛	14⅝	—	2⅝	2½	1½		
126S	16¾	31⅛	23¼	11¼	21	22½	9¾	11¼	4⅛	20⅝	—	2⅝	2½	1½	7	6
168S	19¾	33¾	26¼	12⅜	22⅛	23⅝	9¾	11¼	4⅝	23⅝	2⅝	—	2½	1½		
186S	19¾	33¾	26¼	12⅜	22⅛	24⅝	9¾	12¼	4⅝	23⅝	2⅝	—	2½	1½		
127S	19¾	33¾	26¼	12⅜	22⅛	23⅝	9¾	11¼	4⅝	17⅝	2⅝	—	2½	1½		
137S	19¾	33¾	26¼	12⅜	22⅛	24⅝	9¾	12¼	4⅝	17⅝	2⅝	—	2½	1½	8	7
181S	19¾	39⅜	32¼	13¼	23	25½	9¾	12¼	5⅛	23⅝	2⅝	—	2½	1½		
230S	19¾	39⅜	32¼	13¼	23	25½	9¾	12¼	5⅛	22⅛	—	2⅝	2	1½	10	9
207S	25¼	39⅜	32¼	13¼	24½	26	11¼	12¾	5⅛	23⅝	2⅝	—	2½	1½		
260S	25¼	39⅜	32¼	13¼	24½	26	11¼	12¾	5⅛	22⅛	—	2⅝	2	1½	10	9
320 & 354S	25¼	52⅛	32¼	13¾	25	26½	11¼	12¾	5⅜	22⅛	—	2⅝	2	1½		
243 & 273S	25¼	52⅛	32¼	13¾	25	26½	11¼	12¾	5⅜	23⅝	2⅝	—	2½	1½	10	9
400S	25¼	52⅛	32¼	13¾	—	26½	—	12¾	5⅜	22⅛	—	2⅝	2	1½	10	9

*INCHES

TABLE 4 — Maximum Distance of Throw and Mounting Height Feet For Model S Unit Heaters

Unit	Outlet Velocity	CFM	Final Temp (F)	Mounting Height	Maximum Throw: Without Diffuser	Maximum Throw: With Louver Fin Set For Maximum Throw
18-S	162	280	117	8	12	15
20-S2	186	318	118	8	15	18
38-S	319	544	126	9	18	22
42-S	347	590	125	9	20	25
60-S	343	815	129	9	22	27
70-S	454	1100	117	10	28	35
90-S	382	1214	127	11	28	35
100-S	476	1535	118	12	28	35
126-S	411	1760	126	13	32	40
168-S	452	2380	127	14	40	50
186-S	528	2808	121	14	45	56
230-S	431	3300	124	15	40	50
260-S	529	4100	118	15	50	62
320-S	442	4480	127	15	50	62
354-S	550	5660	118	15	60	75
400-S	583	6017	122	15	65	80
19-S2	220	390	106	8	18	22
31-S	359	635	104	8	20	25
45-S	363	897	107	9	25	31
53-S	439	1090	105	10	28	35
69-S	407	1337	108	12	30	37
77-S	458	1510	107	13	32	40
91-S	394	1740	108	14	32	40
127-S	448	2440	108	15	40	50
137-S	495	2700	107	15	45	56
181-S	430	3392	109	15	42	52
207-S	514	4059	107	15	48	60
243-S	439	4607	108	15	55	68
273-S	536	5644	105	15	60	75

NOTE: The above is based on 2 psig Steam Pressure, 60 F Entering Air.

TO MEET OSHA REQUIREMENTS, MODEL "S" UNIT HEATERS MUST BE MOUNTED NO LOWER THAN 7.5 FEET FROM THE FLOOR.

TABLE 5 — Maximum Mounting Height In Feet For Model P Unit Heaters

Unit Size	Steam Pressure (PSI) 2	5	10	50	100	150
42-P	10.5	10.0	10.0	9.0	7.5	7.5
	12.5	12.0	12.0	11.0	9.5	8.5
42-P LS*	7.5	7.5	7.5	7.5	7.5	7.5
	9.0	8.5	8.5	7.5	7.5	7.5
42-P-L**	12.5	12.0	12.0	10.5	9.0	8.5
	14.5	14.0	13.5	12.0	11.0	10.0
42-P-L LS	9.0	8.5	8.5	7.5	7.5	7.5
	10.5	10.0	10.0	9.0	8.0	7.5
64-P	12.0	11.5	11.5	10.0	9.0	8.0
	14.5	14.0	14.0	12.0	11.0	10.5
64-P LS	9.5	9.0	9.0	8.0	7.5	7.5
	11.5	11.0	11.0	9.5	8.5	8.0
64-P-L	15.0	14.5	14.5	12.5	11.0	10.0
	19.0	18.5	18.5	16.5	16.0	14.0
64-P-L LS	11.5	11.0	11.0	9.5	8.5	8.0
	14.0	13.5	13.5	12.0	11.0	10.0
80-P	15.0	14.5	14.0	12.0	11.0	10.0
	18.5	18.0	17.5	15.5	14.0	13.0
80-P LS	11.0	10.5	10.5	9.0	8.5	8.0
	13.5	13.0	13.0	11.5	11.0	10.0
80-P-L	18.0	17.5	17.5	15.0	13.5	12.0
	22.0	21.0	21.0	19.0	17.0	16.0
80-P-L LS	13.0	12.5	12.0	11.0	10.0	9.0
	17.0	16.5	16.0	14.0	13.0	12.0
102-P	14.0	13.5	13.0	11.5	11.0	10.0
	17.0	16.5	16.0	14.0	13.0	12.0
102-P LS	11.0	10.5	10.5	9.5	8.5	8.0
	13.5	13.0	13.0	12.0	11.0	10.0
102-P-L	17.5	17.0	16.5	15.0	14.0	13.0
	21.5	21.0	20.5	18.5	16.5	16.0
102-P-L LS	15.0	14.5	14.5	13.0	12.0	11.0
	18.5	18.0	18.0	16.0	14.5	13.5
122-P	16.0	15.5	15.5	14.0	13.0	12.0
	19.5	19.0	18.5	17.0	15.5	14.0
122-P-L	21.0	20.5	20.0	17.5	17.0	16.0
	26.0	25.5	25.0	22.5	20.5	19.0
146-P	15.5	15.0	14.5	13.0	11.5	11.0
	19.0	18.5	18.0	16.0	15.0	14.0

Unit Size	Steam Pressure (PSI) 2	5	10	50	100	150
146-P-L	18.0	17.5	17.5	15.0	13.5	12.5
	22.5	22.0	21.5	18.5	17.5	16.0
166-P	18.0	17.5	17.0	14.5	13.5	13.0
	22.5	22.0	21.5	19.0	17.5	16.0
166-P-L	22.0	21.5	21.0	18.5	16.5	15.5
	27.5	27.0	26.5	23.5	21.5	20.0
202-P	22.0	21.5	21.0	18.5	16.5	16.0
	27.5	27.0	26.5	24.0	22.0	20.0
202-P-L	25.5	25.0	24.5	22.0	20.0	18.0
	31.5	31.0	30.5	27.0	25.0	23.0
252-P	20.0	19.5	19.0	17.0	15.5	14.0
	25.0	24.0	23.5	20.5	18.5	17.5
252-P-L	24.0	23.5	23.0	20.0	18.0	17.0
	29.5	28.5	28.0	24.5	22.5	21.0
280-P	21.0	20.5	20.0	17.5	16.0	15.0
	26.0	25.5	25.0	22.0	20.0	18.0
280-P-L	25.0	25.0	24.5	21.0	19.0	18.0
	32.0	31.0	30.0	26.0	24.0	23.0
336-P	24.0	23.0	22.0	20.0	18.5	17.0
	30.0	29.0	28.0	25.0	23.5	22.0
336-P-L	29.0	28.5	28.0	25.0	23.0	21.0
	36.0	35.0	34.0	30.0	28.0	26.0
384-P	28.5	28.0	27.5	24.0	22.0	20.0
	35.5	35.0	34.0	30.0	28.0	26.0
384-P-L	32.5	31.5	30.5	27.5	25.5	24.0
	41.0	40.0	39.0	35.0	32.0	30.0
500-P	29.5	29.0	28.5	25.0	23.0	21.0
	36.5	36.0	35.5	32.0	29.0	26.0
500-P-L	35.0	34.0	33.0	29.0	27.0	25.0
	43.5	42.5	41.5	35.0	33.0	31.0
600-P	34.0	33.0	32.0	28.0	26.0	24.0
	42.5	41.5	40.5	36.0	33.0	30.0
600-P-L	37.0	36.0	35.0	31.0	29.0	27.0
	46.5	45.5	44.5	39.0	35.0	33.0
720-P	38.5	37.5	36.5	32.0	29.0	27.0
	48.0	47.0	46.0	40.0	38.0	35.0
720-P-L	42.5	41.5	40.5	35.0	32.0	30.0
	53.0	52.0	51.0	44.0	40.0	37.0

NOTES: *LS = Low Speed
**PL = Model P Low Final Temperature Model With All Air Ports Open.

Figures in shaded areas give maximum mounting height with louver cone diffuser blades set vertically.

The above table is based on 60 F entering air temperature. In providing for the use of diffusers, it must be remembered that adjustment of a LCD to deflect air toward horizontal immediately lowers the mounting height.

TO MEET OSHA REQUIREMENTS, MODEL "P" UNIT HEATERS MUST BE MOUNTED NO LOWER THAN 7.5 FEET FROM THE FLOOR.

TABLE 6 — Unit Weights — Lbs.

Model P*		Model S			
Unit	Weight lbs.	Unit	Weight lbs.	Unit	Weight lbs.
42P	30	18S	40	19S2	40
64P	35	20S2	40	31S	40
80P	40	38S	40	45S	55
102P	55	42S	40	53S	55
122P	55	60S	55	69S	70
146P	80	70S	60	77S	80
166P	80	90S	75	91S	95
202P	85	100S	85	127S	135
252P	135	126S	100	137S	135
280P	135	168S	145	181S	180
336P	135	186S	145	207S	185
384P	175	230S	190	243S	230
500P	250	260S	195	273S	235
600P	260	320S	245		
720P	325	354S	250		
		400S	280		

* P and PL Units

DUCTWORK

Propeller unit heaters are designed primarily for free air delivery and, basically, the propeller fan is not efficient when used with extensive ductwork. However, short runs of duct may be used by observing the following restrictions:

1. Do not use hot water units when entering outside air may be below the freezing point. Use full sized coil with at least 5 psig steam or a modified coil with 10 psig steam for freezing conditions. Steam must be at full pressure during low temperatures.
2. Under no conditions should air filters be used.
3. All ductwork should be kept straight and as simple as possible.
4. The next size larger motor should be used.

The use of ductwork will present a reduction in air volume and unit capacity. Contact the local Trane representative for performance data and ducting recommendations.

UNIT MOUNTING

To meet Occupational Safety and Health Act (OSHA) requirements Model P Unit Heaters must be mounted no lower than 7.5 feet from the floor.

Weld nuts are provided at the top of all units for suspension purposes. See Figures 1, 2 and 3. Figure 4 shows the 2 weld nuts and steel channels provided on Model S Units. Support rods should support the total unit weight to assure that no strain is placed on supply and return piping. Provisions for removal of the unit from the suspension rods may be desirable for servicing purposes.

Units must hang level vertically and horizontally.

Provide sufficient clearance around units for maintenance purposes. This includes at least 7 inches above all Model P Unit Heaters even though the motor is removable through the bottom.

Isolators are not required but may be desirable for some applications. For these special cases, contact the local Trane representative. Refer to Table 6 for Unit Weights.

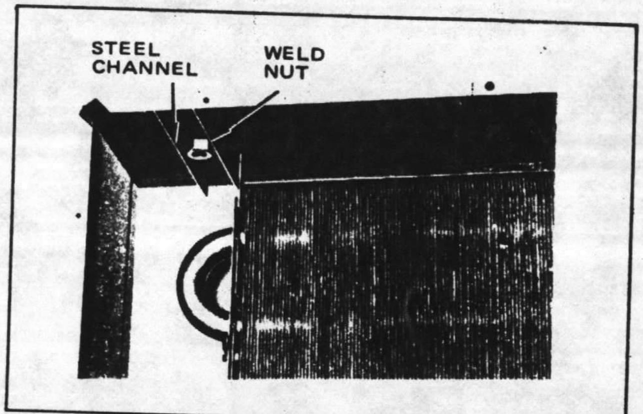

FIGURE 4 — Model S Unit Mounting Channel and Weld Nut

PIPING

To provide proper coil operation, follow all piping recommendations listed in this manual.

Threaded pipe headers are provided on all Model P Units for piping connections. See Figure 5. Connections are given in Figures 1 and 2 and Tables 1 and 2.

Model S Units have male type threaded pipe connections that are bolted to the casing backplate while pipe connections are being made. See Figure 6. Connection sizes are given in Figure 3 and Table 3.

Follow standard practices and codes when installing the piping. Provide swing joints for expansion purposes, unions and shut-off valves for servicing purposes and, as illustrated in Figures 7 through 11, valves and traps for control purposes. Use 45 degree angle run-offs from all supply and return mains.

Dirt pockets should be the same pipe size as the return tapping of the unit heater. Also, pipe size in the branch-off should be the same size as the tapping in the traps. Beyond the trap, the return lateral pipe should be increased one size up to the return main.

Tables 7 and 8 list recommended steam trap selections.

WIRING

The installer shall furnish all wiring to the fan motor. Connections are shown in Figures 12 and 13. See "Operating Information — Motors" for a discussion of the standard motors used with model S and P unit heaters.

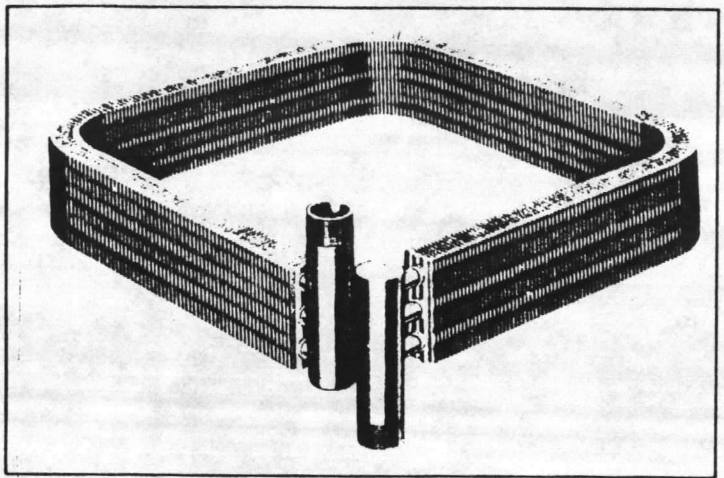

FIGURE 5 — Model P Unit Heater Coil and Headers

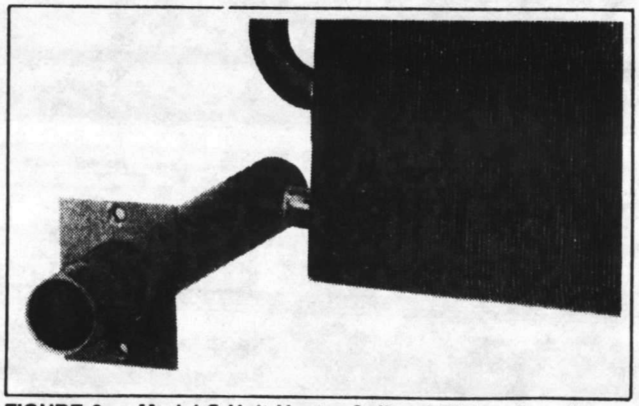

FIGURE 6 — Model S Unit Heater Coil and Piping Coupling

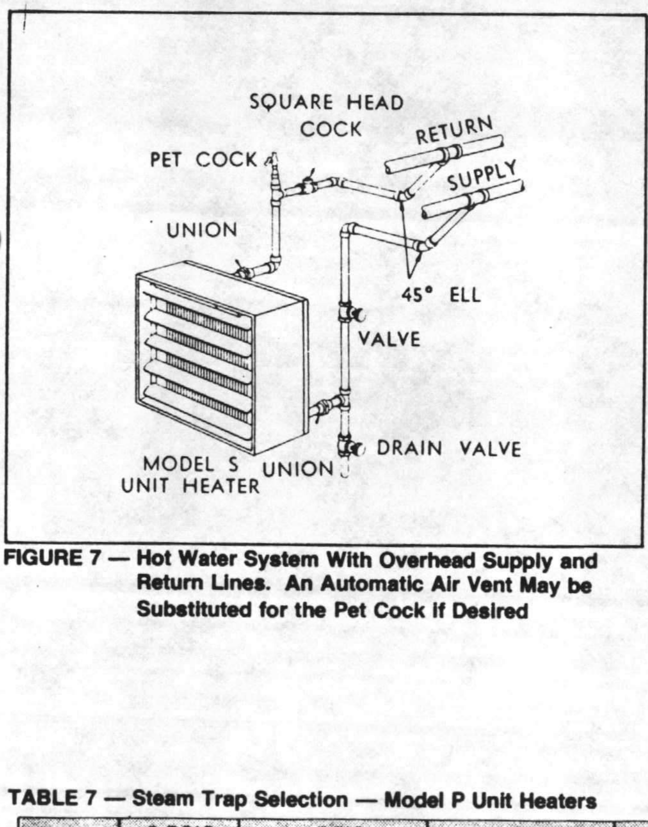

FIGURE 7 — Hot Water System With Overhead Supply and Return Lines. An Automatic Air Vent May be Substituted for the Pet Cock if Desired

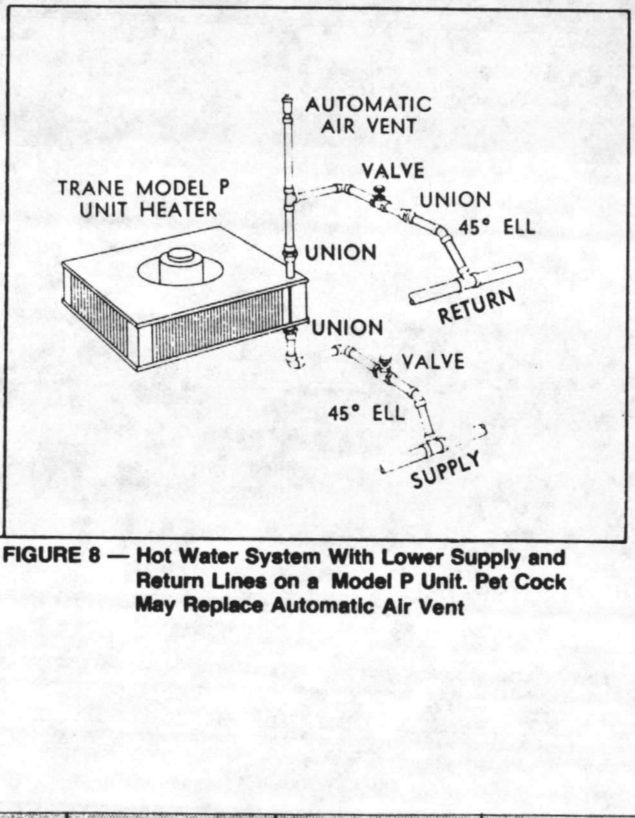

FIGURE 8 — Hot Water System With Lower Supply and Return Lines on a Model P Unit. Pet Cock May Replace Automatic Air Vent

TABLE 7 — Steam Trap Selection — Model P Unit Heaters

Model P Size	2 PSIG	5 PSIG		10 PSIG		15 PSIG		30 PSIG		50 PSIG		100 PSIG	
	F-T Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap
42-166	¾" 55AL	¾" 55 AL	No. 62	¾" 55AL	No. 62	¾" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No. 62
202-252	1" 55AL	1" 55AL	No. 62	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No.191
280	1" 55AL	1" 55AL	No. 62	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No. 191
336	1" 55AL	1" 55AL	No. 62	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 191	¾" 55AM	No. 191	1¼" 66CH	No. 191
384	1" 55AL	1" 55AL	No. 191	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 191	¾" 55AM	No. 191	1¼" 66CH	No. 191
500	1¼" 66CL	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CL	No. 62	1¼" 66CM	No. 191	1¼" 66CM	No. 191	1¼" 66CH	No. 351
600	1¼" 66CL	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CM	No. 191	1¼" 66CM	No. 191	1¼" 66CH	No. 351
720	1¼" 66CL	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CM	No. 191	1¼" 66CM	No. 191	1½" 77HH	No. 351

NOTE: Above selections of Trane Company Traps are based on cataloged unit capacities. A load factor of 2 has been used.

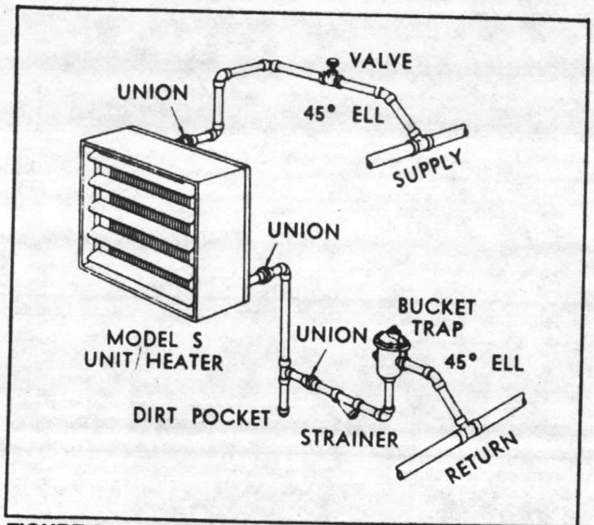

FIGURE 9 — High Pressure Steam System. Top of Bucket Trap Must Be Located Below Return Outlet of Coil to Assure Complete Drainage of Condensate

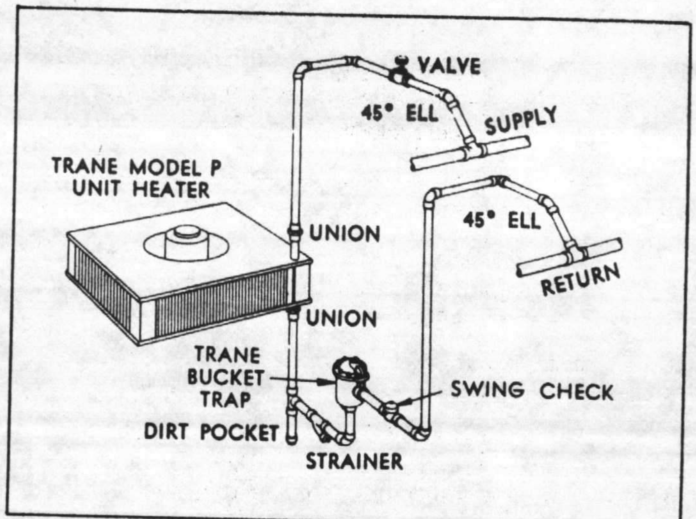

FIGURE 10 — High Pressure Steam System With Overhead Supply and Return Mains. Place Bucket Trap Below Coil Return Outlet for Proper Condensate Drainage

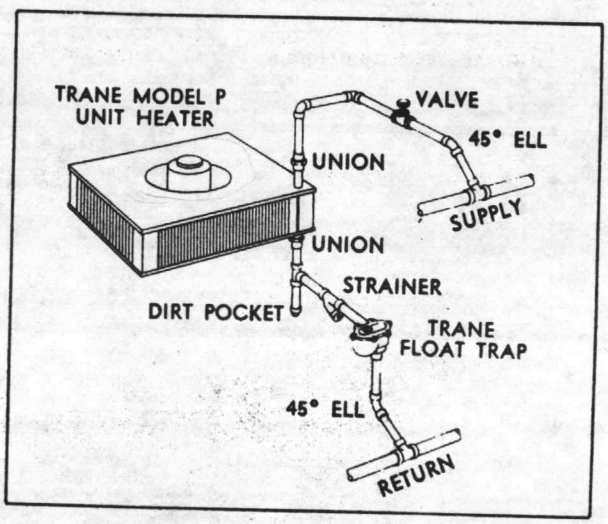

FIGURE 11 — Vapor or Vacuum System With Lower Supply and Return Mains

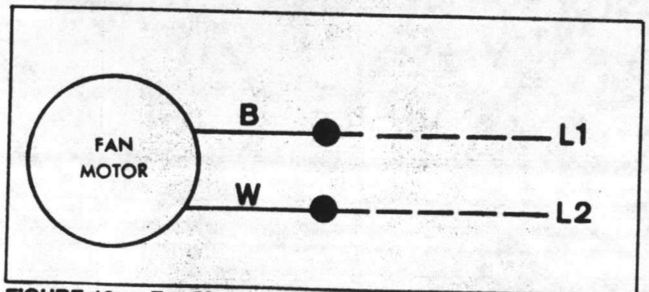

FIGURE 12 — Fan Motor Connections, 115/60/1, Constant Speed, Two Lead (G.E., Marathon, Universal)

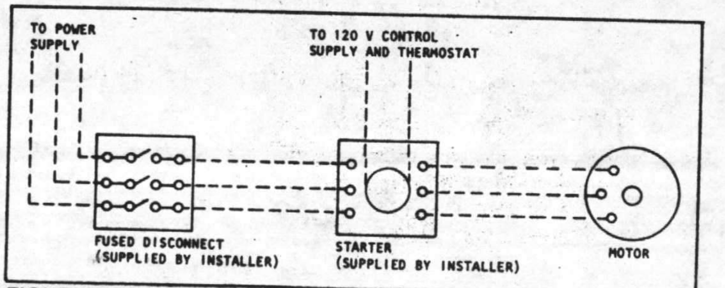

FIGURE 13 — Fan Motor Connections 3 Phase Wiring

TABLE 8 — Steam Trap Selection — Model S Unit Heaters

Model P Size	2 PSIG	5 PSIG		10 PSIG		15 PSIG		30 PSIG		50 PSIG		100 PSIG	
	F-T Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap	F-T Trap	Bucket Trap
18-137	¾" 55AL	¾" 55AL	No. 62	¾" 55AL	No. 62	¾" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No. 62
160-186	¾" 55AL	¾" 55AL	No. 62	¾" 55AL	No. 62	¾" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No. 191
207-243	1" 55AL	1" 55AL	No. 62	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No. 191
260-273	1" 55AL	1" 55AL	No. 62	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 62	¾" 55AM	No. 62	¾" 55AH	No. 191
320	1" 55A1	1" 55AL	No. 62	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 191	¾" 55AM	No. 62	1¼" 66CH	No. 191
354	1" 55AL	1" 55AL	No. 191	1" 55AL	No. 62	1" 55AL	No. 62	¾" 55AM	No. 191	¾" 55AM	No. 191	1¼" 66CH	No. 191
400	1¼" 66CL	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CL	No. 191	1¼" 66CM	No. 191	1¼" 66CM	No. 191	1¼"66CH	No. 351

NOTE: Above selections of Trane Company Traps are based on cataloged unit capacities. A load factor of 2 has been used.

MOTORS

The standard 115/60/1 motors provided on S and P Unit Heaters are totally enclosed, Class "B" insulated and have built-in thermal overload protection.

NOTE: Motors rated ½ H.P. and smaller are interchangeable between S and P models. This assures simplified and economical maintenance.

Models 53S through 100S — use permanent split capacitor motors with sleeve bearings.

Model S Units, 18 through 60 and model P Units, 42 through 80, use sleeve type bearings.

Models 91S through 354S and model P units, 122 through 280, use permanent split capacitor motors with ball bearings. Model 400S uses 230/460/60/3 motor with sealed ball bearings.

All sleeve bearing motors have oil holes to allow lubrication. Ball bearing motors are permanently lubricated although some three phase or special motors have removable plugs which will allow field installation of grease fittings.

The standard 42P through 102P and 18S through 100S motors can be converted to variable speed operation with the addition of the solid state speed control.

See Figures 12 and 13 for typical wiring diagrams.

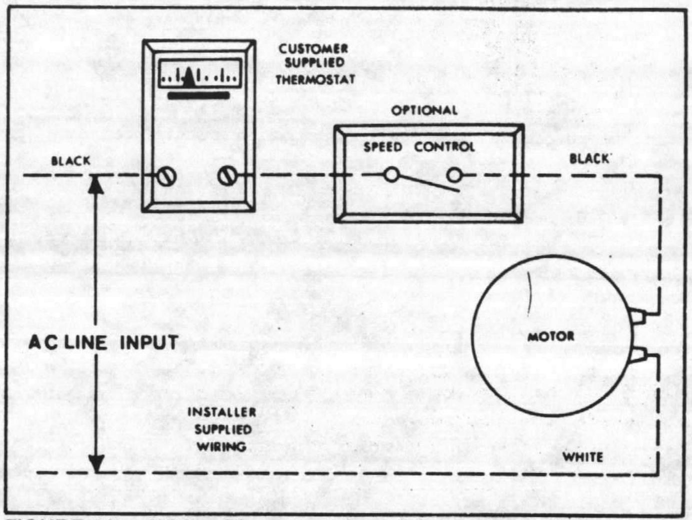

FIGURE 14 — Wiring Diagram of Speed Control Installation

VARIABLE SPEED CONTROL

The solid state speed controller may be installed at any convenient location and is suitable for surface or flush type mounting. A standard electrical single or double gang wall box is recommended as in Figure 14.

Installation procedure:

1. Attach the control's leads to the electrical leads in the control box using wire nuts. The speed control is to be wired in series with the motor. See wiring diagram in Figure 14.
2. Make certain wire nuts are tight with no copper wire being exposed.
3. Place wires and wire nuts back into box allowing room for the control to fit in box also.
4. Mount speed control to box using Number 6 flathead screws provided.

Setting speed control:

1. Turn the control shaft fully clockwise. If the motor is not running at the desired low speed, adjust the trim on the face of the control for low speed setting using a small screwdriver.
2. Rotate the control shaft counter clockwise. The speed will increase smoothly from minimum to maximum and then switch off.
3. Mount face plate with screws provided and attach control knob. See Figure 15.

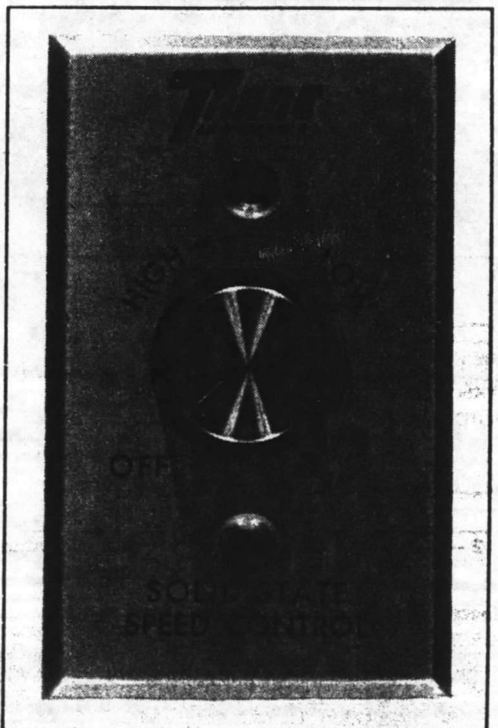

FIGURE 15 — Solid State Speed Control

DIFFUSERS (Optional Equipment)

MODEL P LOUVER CONE DIFFUSER

Rubber mounts and mounting nuts and bolts are provided with each louver cone diffuser. Attach the diffuser to the bottom of the unit heater as shown in Figure 16. Mounting holes are provided in the unit base plate.

Adjust the diffuser to provide the desired air pattern.

MODEL S LOUVER FIN DIFFUSER

Turn all horizontal louvers on the unit heater, except the top louver, downward to allow installation of the diffuser.

Starting with the second horizontal louver from the top, position a diffuser between the louvers with the collar of the diffuser over the rear edge of the louver. The diffuser fins should be extended upward between the first and second horizontal louvers. Press the diffuser collar down over the louver. The dimples on the collar will hold the row of diffusers firmly in place. See Figures 17, 18 and 19.

FIGURE 16 — Louver Cone Diffuser Attached to Model P Unit Heater

OPERATING INFORMATION

COILS

Standard Model S Unit Heater coils have 1" O.D. x .031" wall copper tubing and standard Model P Unit Heater coils use ⅝" O.D. x 0.25" wall copper tubing. Maximum recommended steam pressure for standard units is 75 psig at 325 F temperature. For hot water applications, the maximum recommended pressure is 200 psig for Model S and 225 psig for Model P Units with 325 F water temperature for both units.

For higher operating temperatures and pressures, special coils are required. Table 9 outlines the limitations for various coil tube materials.

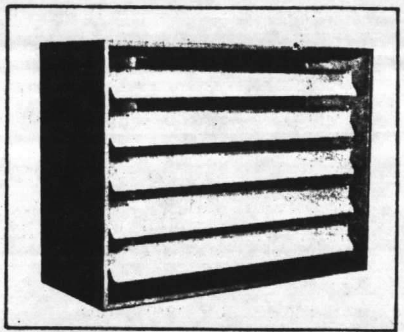

FIGURE 17 — Horizontal Louvers

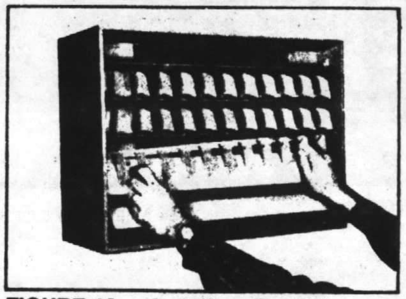

FIGURE 18 — Installing Fin Diffusers

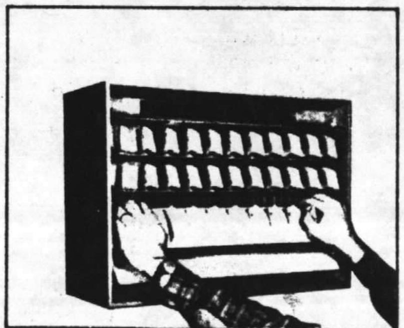

FIGURE 19 — Installing Collar

TABLE 9 — Coil Tube Limitations (Pressure/Temperature)

Tube Material	Tube		Steam		Hot Water	
Model S	O.D.	Wall	Pres. PSIG	Deg. F	Pres. PSIG	Deg. F
Copper (Std.)	1"	.031	75	325	200	325
Red Brass	1"	.049	200	400	260	390
90-10 Cupronickel	1"	.031	300	450	400	450
Steel	1"	.049	600	450	600	450
Model P						
Copper (Std.)	⅝"	.025	75	325	225	325
Red Brass	⅝"	.049	200	425	300	425
90-10 Cupronickel	⅝"	.049	400	450	600	450
Steel	⅝"	.049	600	450	600	450

MAINTENANCE

Allow rotating fans to stop before servicing to avoid injury to fingers and hands.

MOTOR LUBRICATION

Sleeve Bearings

Motors with oilers or oil holes are lubricated before shipment with a good grade of electric motor oil. Refill when necessary with the motor at a stand-still until oil reaches the proper level.

Use SAE 20W oil for motors operating in ambient temperatures of 32 F to 100 F. Above 100 F, use an SAE 30 to SAE 50 oil. Below 32 F, a SAE 10W oil will be required.

The frequency of oiling will depend upon operating conditions and length of running time. Inspect the oilers or oil holes when cleaning the unit. If the unit has a fractional horsepower motor, lubricate at least once a year. Under high ambient conditions or constant fan operation, fractional horsepower motors should be lubricated every 90 days.

On those motors without oilers or oil holes, follow the instructions given on the motor nameplate.

Ball Bearings

Ball bearing motors are pre-lubricated and normally not equipped with grease fittings. However, motors are equipped with removable grease plugs to allow installation of grease fittings if desired by the owner.

Motor manufacturers do not recommend or require on the job lubrication of ball bearing motors. If on the job lubrication is required by the owner, use the following procedure:

With the motor at a stand-still, remove the vent and grease plugs. Install grease fitting and add grease sparingly. Remove the old grease from the vent relief chamber. Operate the motor a few minutes before reinstalling the vent plug to allow excess grease to escape. If there is evidence of grease working out around the motor shaft, less grease should be added and the greasing periods lengthened. If grease continues to appear, take the motor to the motor manufacturer's authorized service station for repair.

NOTE: Consult local motor manufacturer's service facility for information on type of grease and oil to be used.

FAN AND MOTOR ASSEMBLY

For cleaning or maintenance purposes, the fan and motor assembly may be removed easily from the Unit Heater. The motor is attached to the fan guard which is, in turn, mounted to the top or back panel of the unit as shown in Figures 20 and 21.

On Model P Units, reach up through the fan and remove the fan guard mounting screws. Lower the motor, fan and fan guard assembly down through the fan outlet. If desired, the top and bottom panels may be removed from the coil by taking out the four panel mounting bolts. See Figure 21.

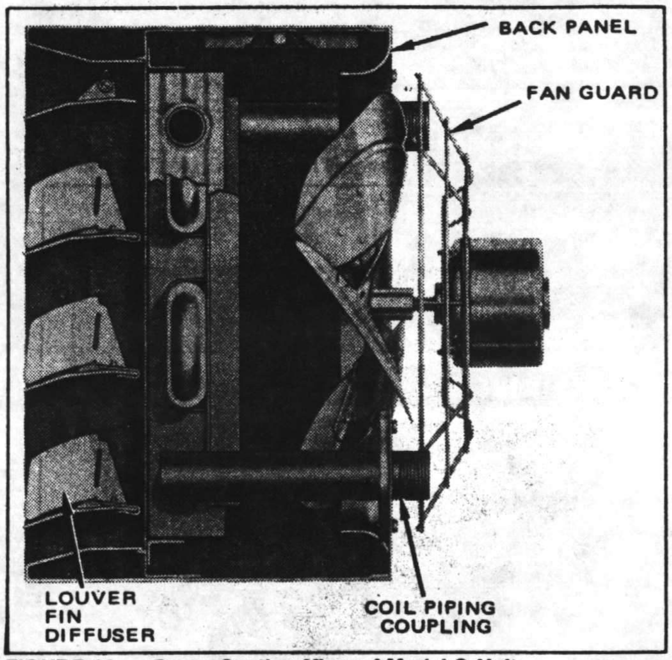

FIGURE 20 — Cross Section View of Model S Unit

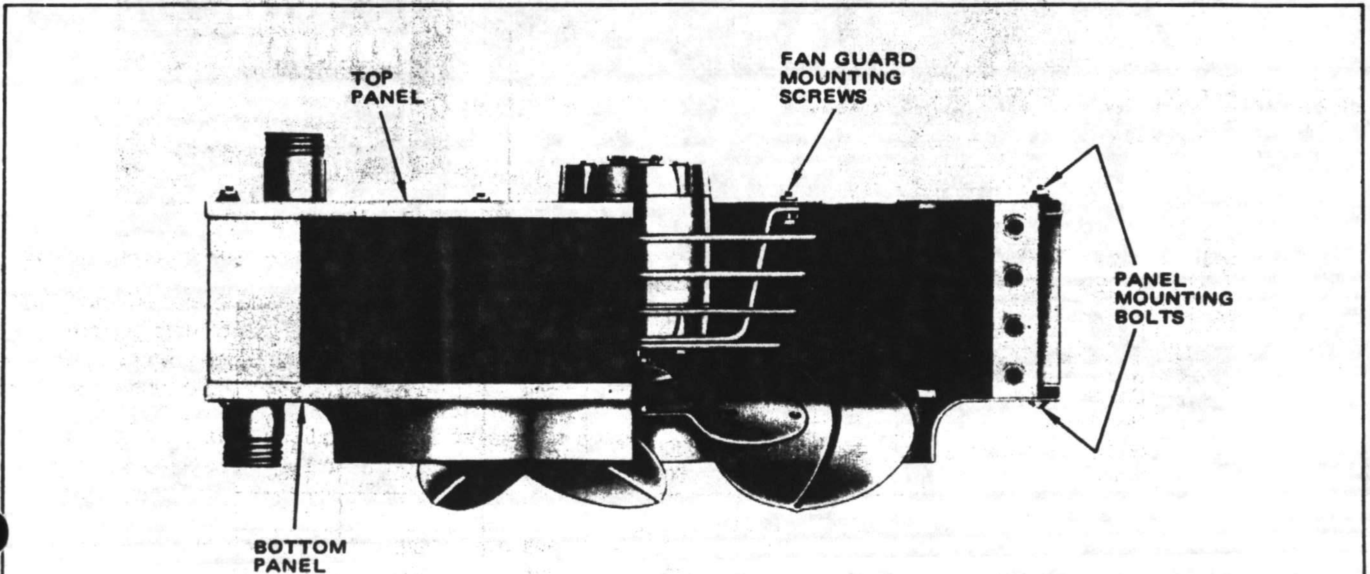

FIGURE 21 — Cross Section View of Model P Unit

On Model S Units, loosen the fan guard mounting screws and lift the motor, fan and fan guard assembly away from the unit. The one-piece back panel may also be removed and slid back over the connecting piping for greater access. See Figure 20.

CLEANING THE UNIT

The unit casing, fan, diffuser and coil should be cleaned thoroughly once a year.

Coil heat transfer efficiency depends on cleanliness. The following recommended procedures may be performed when lubricating the motor and cleaning the coil.

1. Wipe all excess lubricant from the motor, fan and casing. Clean the motor thoroughly. A dirty motor will run hot and eventually cause internal damage.
2. Clean the coil:
   a. Loosen the dirt with a brush on the fan side of the coil. Operate the motor allowing the fan to blow the loosened dirt through the unit.
   b. Use high pressure air or steam on the side of the coil away from the fan.

      NOTE: A piece of cheesecloth or burlap bag may be used to collect the large particles during the cleaning process.
3. Clean the casing, fan blades, fan guard and diffuser using a damp cloth. Any rust spots on the casing should be cleaned and repainted.
4. Tighten the fan guard, motor frame and fan bolts. Check the fan for clearance in the panel orifice and free rotation.

REPLACEMENT PARTS

Should service or replacement of parts be required, give complete nameplate identification including the unit serial number. Motors and motor controls supplied with these units are not manufactured by The Trane Company. Service instructions issued by the manufacturers of these items supersede the previous instructions and should be followed in maintaining the units.

FOR FURTHER INFORMATION ON THIS PRODUCT OR OTHER TRANE PRODUCTS, REFER TO THE "TRANE SERVICE LITERATURE CATALOG", ORDERING NUMBER IDX-IOM-1. THIS CATALOG CONTAINS LISTINGS AND PRICES FOR ALL SERVICE LITERATURE SOLD BY TRANE. THE CATALOG MAY BE ORDERED BY SENDING A $15.00 CHECK TO: THE TRANE COMPANY, SERVICE LITERATURE SALES, 3600 PAMMEL CREEK ROAD, LA CROSSE, WI 54601.

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HEAT TRANSFER SALES, INC.

901-G NORWALK ST.
GREENSBORO, N.C. 27407
PHONE 919-294-3838

SUBMITTAL NO. S1360-6275

03-03-03

DATE: NOVEMBER 13, 1986

JOB: COMBAT VEHICLE MAINTENANCE SHOP
CAMP LEJEUNE, N.C.

CONTRACTOR:

SNEEDEN, INC.
BOX 3548
WILMINGTON, N.C. 28406

ENGINEER: DOUGLAS Y. PERRY & ASSOC.

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<u>HOT WATER AIR CONTROL SYSTEM</u>

1-40 GAL ASME EXPANSION TANK
1-439 TANK FITTING
1-440 TANK DRAINER
1-4" AIR SEPARATOR WITH STRAINER
1-335 P.R.V.

<u>PUMPS</u>

<u>P-1</u>

1-TACO MODEL BB3008, 3" BASE MTD END SUCTION PUMP.
235 GPM @ 46 FT HD 5 HP ODP MOTOR 1750 RPM 208/3/60
7 1/2" DIAMETER IMPELLER

<u>P-2</u>

1-WEINMAN MODEL D20C-4ACV15P, DUPLEX COND. PUMP UNIT
WITH 20 GAL C.I. RECEIVER MECH. ALTERNATOR, 15 GPM
@ 40 PSI 1 1/2 HP MOTORS, 3500 RPM 208/3/60
4 3/4" DIAMETER IMPELLER.

<u>CONVERTOR NO.1</u>

1-TACO MODEL G10208S, 10" DIA. 2 PASS, 4 FT LONG
STM/WATER HEAT EXCHANGER WITH SADDLES, 3/4" O.D. COPPER
TUBES, C.I. HEAD STEEL TUBE SHEET. 150 PSI ASME W.P.
235 GPM, 160 -180 , 15 PSI STEAM. .0005 F.F.
55 SQ FT HEAT SURFACE.

<u>MULTI-PURPOSE VALVE</u>

1-TACO MODEL MPV-040, 4" FLANGED MULTI-PURPOSE VALVE

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03-03-03

DATE: NOVEMBER 13, 1986

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SHOP
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SNEEDEN, INC.
BOX 3548
WILMINGTON, N.C. 28406

ENGINEER: DOUGLAS Y. PERRY
& ASSOC.

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PLUMBING
RECIRC. PUMP
1-TACO MODEL 111B, ALL BRONZE PUMP. 5 GPM @ 8FT. HD.
1/8 HP, 115/1/60

SUMP PUMP
1-PEABODY BARNES MODEL CPS33, SUBMERSIBLE SUMP PUMP. 10 GPM
@ 15 FT. HD. 1/3 HP 115/1/60 WITH H.W. ALARM

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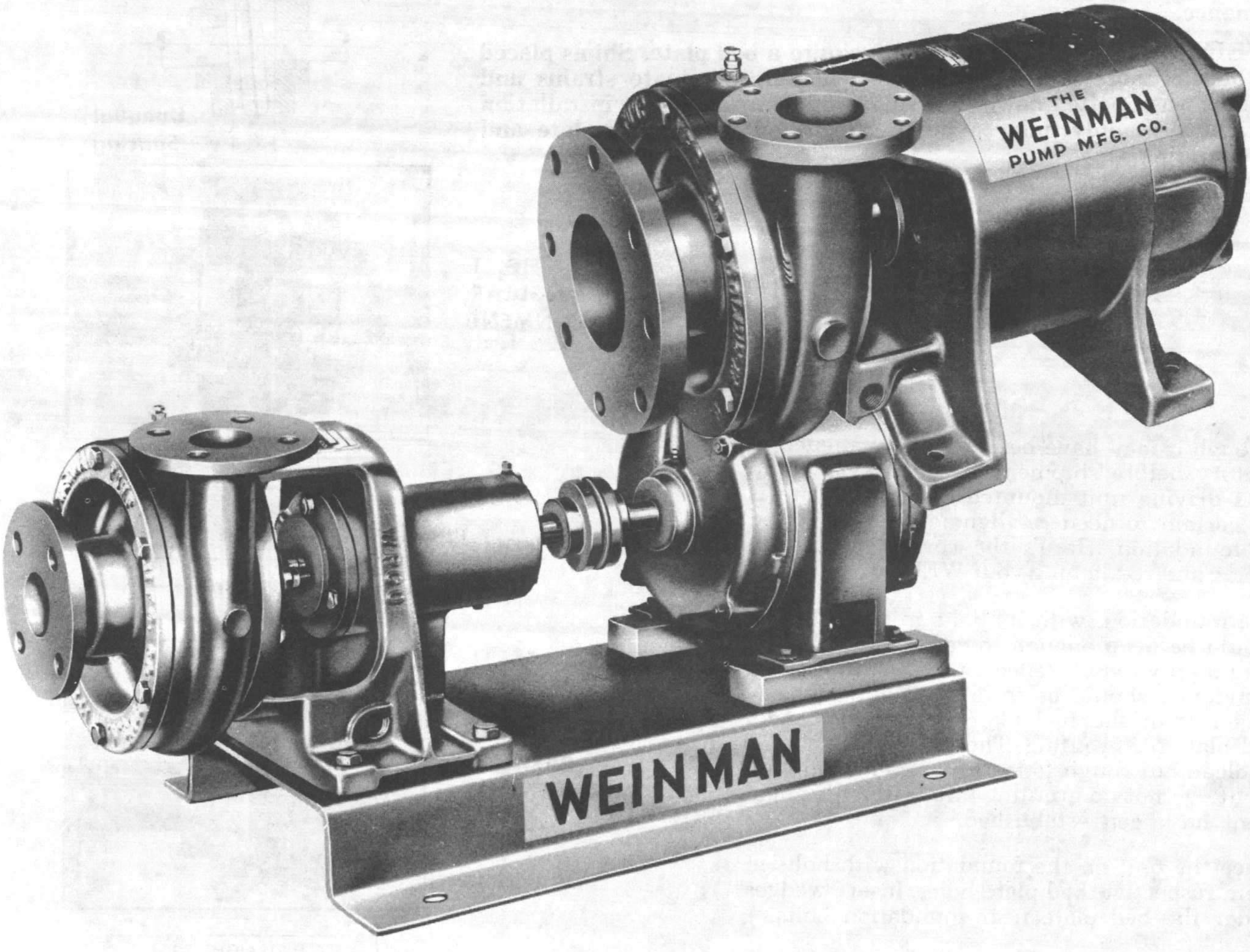
WEINMAN

UNIPUMPS and END SUCTION PUMPS



These instructions are important . . . please read them thoroughly before installing your WEINMAN PUMP. Quiet and successful operation depends on proper installation and operating procedure. The paragraphs on **alignment** and **suction piping** are particularly essential. Misalignment and improper suction piping are the cause of a majority of pump troubles. In this manual, we have covered these two subjects with extreme thoroughness.

Keep these instructions on hand for future use, together with the enclosed parts list which may be helpful should you need replacement parts.

Mueller Pump
AERMOTOR-MIDLAND-WEINMAN
A MUELLER COMPANY
P.O. BOX 1364 COMMERCE & EXCHANGE
CONWAY, ARKANSAS 72032 501-329-9811

Section Nos. 100, 200, 300 and 500

WEINMAN INSTALLATION and OPERATING INSTRUCTIONS for UNIPUMPS and END SUCTION PUMPS

INSTRUCTIONS FOR ALIGNING PUMPS WITH WOOD'S SURE-FLEX COUPLINGS

Your WEINMAN PUMP is a modern, high quality, precision designed and manufactured unit capable of superior performance and long life under even the toughest conditions. The following instructions on installation and alignment are vitally essential for obtaining this peak performance.

WEINMAN UNIPUMPS do not require a bed plate. Shims placed under one or more of the motor feet will help eliminate strains and distortions when bolted down. The following instructions for installation and alignment apply only to pumps furnished with a bed plate and Wood Coupling.

Although it may have been perfectly aligned at the factory before shipment, a centrifugal pump with its driving unit mounted on a bed plate is almost certain to need re-alignment when placed on its foundation. Here's the correct procedure for setting and re-aligning your WEINMAN Pump.

1. The foundation, with its bolts in pipe sleeves, should be deep enough to carry the weight of the pump without deflection or vibration. The foundation should be from 3″ to 6″ wider and longer than the bed plate. Allow ¾″ under bed plate for grouting. The top surface should be clean but rough to insure proper bond with grout. Do not do grouting until **after** the alignment has been established.

2. Place the unit on the foundation with bolts in their respective bed plate holes. Insert wedges under the bed plate near foundation bolts.

3. If a standard Sure-Flex with split insert is provided, force the ring away from the center over next to one of the hubs with a blunt screwdriver.

4. Adjust the wedges to bring the coupling into alignment. To check the alignment, just check the distance between the hubs at 90° intervals. When this spacing is unequal you have angular misalignment (Fig. 1).

   It is the result of the bed plate not being on a true plane. Adjustment must be made by manipulating the wedges or using additional wedges to correct the situation.

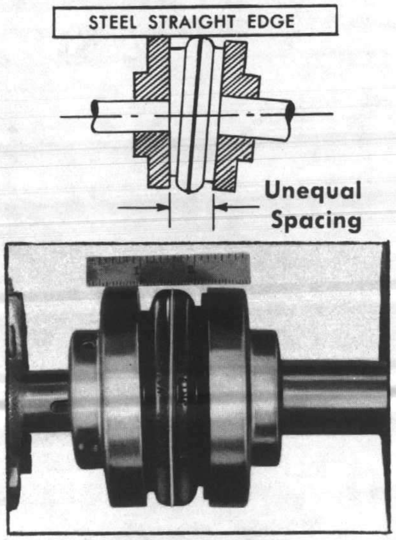


FIG. 1 ANGULAR MISALIGNMENT

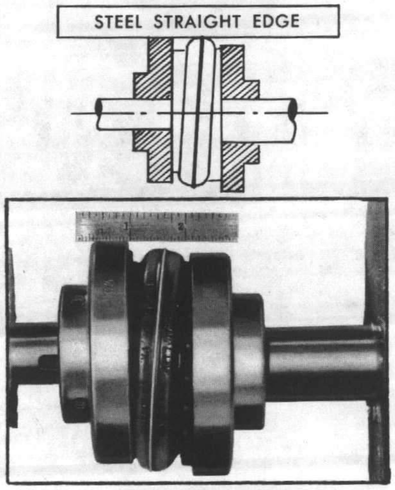


FIG. 2 PARALLEL MISALIGNMENT

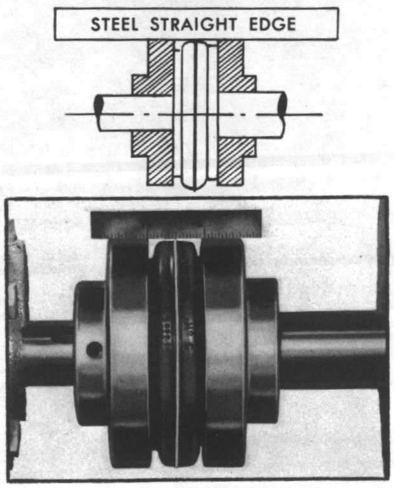


FIG. 3 CORRECT ALIGNMENT

5. Now, check for parallel misalignment. An ordinary 6″ scale will suffice on the Sure-Flex couplings. Lay the alignment tool or scale across the outside flanges. If parallel misalignment is found, (Fig. 2) it is caused by one of the four corners of the bed plate being too high. Withdraw slightly the wedge under the bed plate nearest the "high" corner. It is also possible that the motor may have shifted over the hold-down bolts during shipment or handling. In this case, loosen the hold-down bolts and bump the motor slightly in the direction necessary to bring its shaft with coupling into perfect alignment with pump shaft.
6. Perfect alignment (Fig. 3) exists only when the hub faces are parallel and concentric. The Sure-Flex coupling has been selected for use with WEINMAN Split Case Pumps because of its outstanding features. Sure-Flex Couplings are die cast or precision machined and all keyways and set screws are furnished as standard equipment. These lightweight couplings are simple to assemble and dis-assemble and require no lubrication. A particularly worthwhile feature of the Sure-Flex Coupling is its ability to absorb minor misalignment up to 4°, without damaging the coupling.
7. To complete the setting of your WEINMAN Pump, draw down slightly on the foundation bolt nuts. Provide a form or dam around the contour of the bed plate. Pour grout through holes, provided for this purpose, in sufficient quantity to reach a level of ¾″ to 1″ above the bottom of the bed plate. Allow grouting to set thoroughly, then proceed with pipe connections.

SUCTION PIPING: The illustrations on page 7 are offered as a help in avoiding errors frequently made in suction piping . . . such as abrupt changes in pipe size, the use of concentric reducer, and the placing of an elbow in a horizontal plane next to the suction nozzle of a single suction type of pump, etc.

The following are of equal importance and should be carefully observed:

1. Never use pipe of a smaller size than that for which the pump is fitted. Almost invariably, it is necessary to use one pipe size larger, and sometimes several sizes larger in order to avoid excessive frictional loss with a resultant prohibitorily high working suction lift. Refer to frictional table page 8 for frictional loss in pipe and fittings. Select the size pipe necessary so that when the frictional loss is added to the actual static suction lift, the total working or dynamic suction lift will not exceed 15 to 18 ft. When centrifugal pumps are subjected to a higher suction lift, they are likely to fall short of capacity . . . unless specifically ordered for an abnormal suction condition.
2. The suction pipe, from the source of water supply, should be laid with a gradual incline . . . not on a level . . . toward the pump, with the highest point in the line at the pump suction connection. If the pipe is level and if there are any high points in the line which will form air pockets, it is sometimes difficult to secure proper priming.
3. If conditions require the use of a foot valve and strainer, the area of the foot valve should be from 1½ to 2 times the area of the suction pipe; and the strainer should have a free-opening area equal to 3 to 4 times the area of suction pipe. Otherwise excessive frictional loss will result.
4. If a gate valve is used on the suction line to a pump operating under a suction lift, the valve stem should be placed in a horizontal plane, or preferably in a vertical, downward position in order to avoid a possible air leak.
5. The end of the suction pipe should always be submerged from 18″ to 4 or 5 ft., depending upon the size of pump and the entrance velocity. If only limited submergence can be had, the end of pipe should be belled or flared. A board floating on the surface of water surrounding the suction pipe will even be helpful against the formation of a vortex permitting air to enter the suction pipe.
6. Especially with pumps operating under high suction lift, the suction piping should be tested thoroughly against air leaks. A small volume of air will materially reduce the capacity of pump, and a larger volume will frequently unprime the pump.
7. Installations which will be subjected to considerable temperature variation should be provided with some means for compensating for expansion and contraction. A 50° temperature change means an expansion or contraction of approximately ⅜″ in a pipe line of 100 ft. length. This will result in distortion and misalignment of pump, and sometimes actual breakage.
8. The pipe should not be pulled into position by drawing down on the flange bolts. The pipe should meet the pump and the pump should not be required to meet the pipe. All piping should be supported independently of the pump.Pumps are not designed for carrying heavy loads imposed by piping and its contents.
9. If other than cold water is to be handled, refer to table on page 4 for limit of suction lift and/or amount of positive suction head . . . sometimes required in order to avoid vaporization.
10. In making installation, guard against the possibility of foreign material such as nails, bolts or pieces of waste being left in the line, likely to lodge in the impeller and cause loss of capacity.
11. When the suction supply is taken from a tank or sump, incoming water should never be allowed to fall from above the water level near the end of suction pipe. This will carry air down into the suction pipe.

TABLES for SUCTION LIFT for Centrifugal Pumps for Water at Different Elevations and Temperatures

ATMOSPHERIC PRESSURE, BAROMETER READING AND EQUIVALENT HEAD OF WATER AT DIFFERENT ALTITUDES

Altitude Above Sea Level in Feet	Atmospheric Pressure Pounds Per Sq. In.	Barometer Reading Inches of Mercury	Equivalent Head of Water Feet	Maximum Practical Suction Lift of Pumps in Feet
0	14.7	29.929	33.95	25
1000	14.2	28.8	32.7	23
2000	13.6	27.7	31.6	23
3000	13.1	26.7	30.2	22
4000	12.6	25.7	29.1	21
5000	12.1	24.7	27.9	20
6000	11.7	23.8	27.0	19
7000	11.2	22.9	25.9	19
8000	10.8	22.1	24.9	18
9000	10.4	21.2	24.0	17
10000	10.0	20.4	23.1	16

For Ft. Hd. of liquid divide Ft. Hd. of water by specific gravity of liquid pumped.
NOTE — Barometer in inches multiplied by 0.4908 equals pressure per square inch.
Suction lift is vertical distance from center of cylinder to water level plus pipe friction and other losses, if any.

SUCTION HEAD REQUIREMENTS WHEN PUMPING HOT WATER

Suction Head Required for Both Centrifugal and Reciprocating Pumps when Handling Hot Water at Different Altitudes.

Minimum Allowable Head in Ft. on Suction	Temperatures of Water in Degrees F.									
	120	130	140	150	160	170	180	190	200	210
At sea level	....	....	....	....	0	3	5	7	10	12
At 2,000 alt.	....	....	....	1	3	5	7	10	12	15
At 4,000 alt.	....	0	1	3	5	7	10	12	14	....
At 6,000 alt.	0	1	3	5	7	10	12	14	16	....
At 8,000 alt.	0	3	5	7	9	12	14	16	....	....
At 10,000 alt.	2	4	7	9	11	14	16	18	....	....

PROPERTIES OF WATER AT VARIOUS TEMPERATURES FROM 40 TO 540 F

Temp F	Temp C	Specific Volume Cu Ft/Lb	Specific Gravity	Wt in Lb/Cu Ft	Vapor Pressure Psi Abs
40	4.4	.01602	1.0013	62.42	0.1217
50	10.0	.01603	1.0006	62.38	0.1781
60	15.6	.01604	1.0000	62.34	0.2563
70	21.1	.01606	0.9987	62.27	0.3631
80	26.7	.01608	0.9975	62.19	0.5069
90	32.2	.01610	0.9963	62.11	0.6982
100	37.8	.01613	0.9944	62.00	0.9492
120	48.9	.01620	0.9901	61.73	1.692
140	60.0	.01629	0.9846	61.39	2.889
160	71.1	.01639	0.9786	61.01	4.741
180	82.2	.01651	0.9715	60.57	7.510
200	93.3	.01663	0.9645	60.13	11.526
212	100.0	.01672	0.9593	59.81	14.696
220	104.4	.01677	0.9565	59.63	17.186
240	115.6	.01692	0.9480	59.10	24.97
260	126.7	.01709	0.9386	58.51	35.43
280	137.8	.01726	0.9293	58.00	49.20
300	148.9	.01745	0.9192	57.31	67.01
320	160.0	.01765	0.9088	56.66	89.66
340	171.1	.01787	0.8976	55.96	118.01
360	182.2	.01811	0.8857	55.22	153.04
380	193.3	.01836	0.8736	54.47	195.77
400	204.4	.01864	0.8605	53.65	247.31
420	215.6	.01894	0.8469	52.80	308.83
440	226.7	.01926	0.8328	51.92	381.59
460	237.8	.0196	0.8183	51.02	466.9
480	248.9	.0200	0.8020	50.00	566.1
500	260.0	.0204	0.7863	49.02	680.8
520	271.1	.0209	0.7674	47.85	812.4
540	282.2	.0215	0.7460	46.51	962.5

Computed from Keenan & Keyes' Steam Table.

DISCHARGE PIPE: The discharge pipe should never be of a smaller size than that for which the pump is fitted and, in most cases, should be one and sometimes two sizes larger in order to avoid excessive frictional loss. Avoid sudden or abrupt changes in pipe sizes which cause shock or frictional losses. Use increasers of the concentric type. Eccentric increasers are not required for the discharge line.

Gate and check valves should be installed in the line with the check placed between pump and gate valve. A check valve, under most conditions of service, is required as a protection to the pump against excessive surge pressure when a foot valve is used on the suction, as well as for protection against reversed rotation if no foot valve is used.

In installations where noise is highly objectionable, such as hospitals, hotels and apartment buildings, the discharge pipe should not be attached to steel work or hollow walls without being insulated properly against vibration. In extreme cases, it is desirable that the discharge line be provided with a flexible connection.

PRIMING: Centrifugal pumps of the conventional type must be primed before they will start pumping. With a foot valve on the suction, the simplest method of priming is to fill the suction line and pump, including enough of the discharge line to bring the water level up a foot or two above the top of the casing or volute. The air vents should be left open until water flows several times with no trace of air. The shaft with impeller should be turned several times by hand in order to release air which may be trapped in the impeller.

If a portion of the suction line is laid on a near-level, several minutes may be required for the air to find its way to the highest point and escape through the air vents in top of casing. If the pump fails to pump when first started, it should be stopped and after a delay of a few minutes, the air vents should be reopened until a full stream of water, without any trace of air, flows out.

Do not allow a pump . . . especially a new one . . . to operate for a long period of time without being properly primed.

ROTATION: The rotation is indicated by arrow on the casing, and the correct rotation of three phase motors should be established before assembling coupling. The pump should not be operated backwards or in reverse rotation. If the motor operates in the wrong rotation, interchange any two of the lead wires and the opposite rotation will result.

STARTING: For initial starting, the gate valve in the discharge line should be closed, and opened gradually as the motor approaches full speed . . . usually in from five to ten seconds. After the pump has once been in operation so that the discharge line has been completely filled, it is then unnecessary to close the gate valve in starting.

STUFFING BOX PACKING: After starting the pump, adjust gland nuts evenly until leakage is a stream about the size of a pencil lead. This amount of leakage is required to provide cooling, lubrication and to avoid rapid wear of shaft sleeves. When packing becomes so worn that gland is fully entered and can no longer compress the packing, one ring of packing may be added. After further wear however, the box should be repacked by the following procedure:

1. Clean out all old packing from the box and remove seal cage if pump is so equipped. Note location of sealing water hole in stuffing box and when repacking be sure seal cage is installed opposite the hole. Failure to do this will block the flow of sealing liquid.
2. Inspect sleeve for wear and if it is scored or grooved it should be replaced.
3. Fit packing neatly around the shaft with ends fitting in a tight joint.
4. Force first ring firmly and evenly to the bottom of the box. Dipping rings in oil and graphite will aid running in of the packing.
5. Insert remaining rings with joints staggered 180° apart. Compress each ring firmly as described above. Rotate shaft by hand each time a ring is inserted to aid in seating packing. If pump is equipped with seal cage, install it opposite sealing water connection.
6. When the box is full, compress the packing with the gland. Be sure to adjust gland evenly and also be sure that the gland has entered the box at least 1/8". If the packing will not compress enough to allow this amount of gland entrance, remove one ring of packing.
7. After pump is started, adjust gland nuts so that leakage is as described above. Care should be taken during the first hour of operation to take up on the packing gradually just enough to maintain this amount of leakage. The "breaking in" period of the packing is most important in the satisfactory performance of a stuffing box.

STUFFING BOX—MECHANICAL SEAL: With the exercise of a few precautions a mechanical seal can furnish very satisfactory operation in pumps. Precautions which should be observed are:

1. Do not run the pump dry. The flat faces of the seal are lubricated by the liquid being pumped.
2. Vent the seal housing if it is the high point in the pump.
3. Maximum water temperatures are 225° F. when using seals without additional cooling.
4. Purge the system thoroughly to remove welding slag, scale, or dirt which may injure the seal prematurely due to the abrasive condition of liquid.

CARE OF BALL BEARINGS: The ball bearings on pump and motor, as shipped from factory, are furnished with sufficient lubricant for from two to three months' operation. Do not add more lubricant when putting the unit in service.

Injury to ball bearings is more likely to result from over-greasing than from under-greasing. The real purpose of a lubricant for ball bearings is to form a coating on the highly polished surfaces as a protection against corrosion, rather than for lubrication. An over supply of grease in ball bearings produces heating . . . due to friction . . . and causes the grease to ooze out of bearing housing along the shaft, as the bearing becomes warm.

Under usual conditions, ball bearings will reach a temperature of from 10° to 55°F. above surrounding temperature. Unless the bearing temperature reaches 125°F. above surrounding temperature, there is no cause for alarm.

Ball bearings require additional lubricant only two or three times per year, depending upon the continuity of service. Do not use more grease than necessary to fill the bearing housing one-fourth to one-third full.

If bearings are removed from housing for cleaning, use extreme care to see that they are thoroughly dry before being re-installed. Use carbon-tetrachloride, or kerosene to clean bearings. Water or moisture is destructive to all ball bearings.

The particular brand of grease is unimportant, providing it is a lithium base grease, especially if the bearing is used in a location where there is excessive moisture or danger of water getting into the housing.

For temperatures of from 32° to 200°F. at the bearings, the following brands of lubricant are suggested:

Grease Lubricated Pumps and Motors:

American Oil Company	Amolith No. 2
Cities Service Oil Co.	Trojan H2
Continental Oil Co.	Conoco Super Lube
Humble Oil & Refining Co.	Nebula EP No. 2
Fiske Bros.	Lubriplate 630-2
Shell Oil Co.	Alvania No. 2
Sinclair Refining Co.	Litholine 2
Standard Oil of Ohio	Sohitran 2
Texaco Inc.	Multifak 2
Union Oil Co.	UNOBA No. 2

Oil Lubricated Pumps:

American Oil Co.	American No. 31
Cities Service Oil Co.	Pacemaker No. 3
Continental Oil Co.	Conoco Dectol Medium
Humble Oil & Refining Co.	Teresso 52
Fiske Bros.	Lubriplate No. 2
Shell Oil Co.	Tellus Oil 33
Sinclair Refining Co.	Rubilene Medium
Standard Oil of Ohio	Sohiois 52
Texaco Inc.	Regal Oil PC (R & O)
Union Oil Co.	Red Line-Turmaco 300

MUELLER PUMP is prepared to supply suitable grease put up in foil tubes, about 1" diameter × 5" long . . . containing 1¾ ounces. Approximately ½ ounce of grease, or a teaspoonful for bearings of small size, and a tablespoonful for larger sizes, is needed each time a bearing is lubricated.

PUMP TROUBLES and THEIR CAUSES

FAILURE TO PUMP

1. Pump not properly primed.
2. Wrong direction of rotation.
3. Speed too low.
4. Total head too high.

REDUCED CAPACITY AND/OR HEAD

1. Air pockets or leaks in suction line.
2. Clogged impeller.
3. Foot-valve-strainer too small or clogged.
4. Insufficient submergence for suction pipe.
5. Excessive suction lift . . . much over 15 ft.
6. Insufficient positive suction head (for hot water).
7. Total head more than that for which pump is intended.
8. Excessively worn impeller and wearing rings.

RAPID WEAR OF COUPLING CUSHIONS

1. Always the result of misalignment or a bent shaft.

PUMP LOSES PRIMING

1. Air leaks in suction line.
2. Excessive amount of air in water.
3. Water seal in stuffing box not functioning.
4. Excessive suction lift and pump operating too near shut-off point.

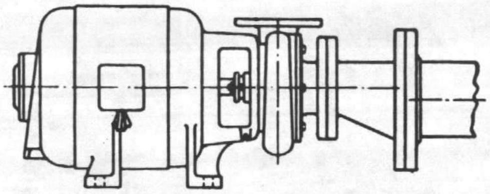
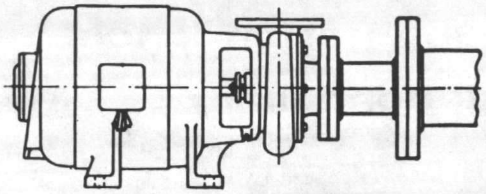
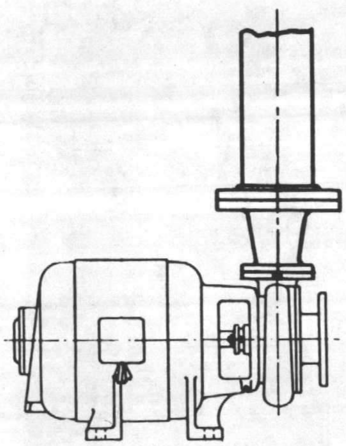
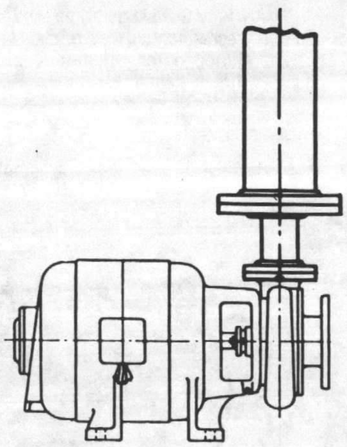
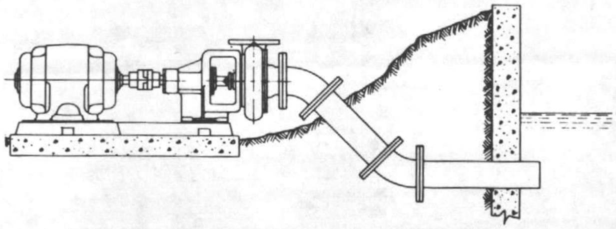
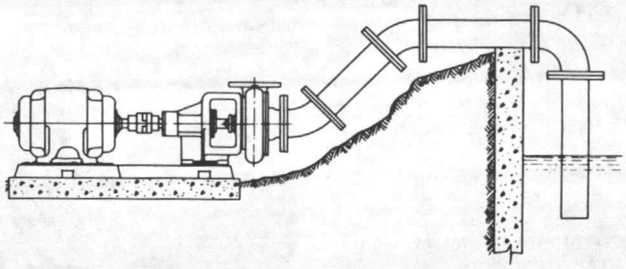
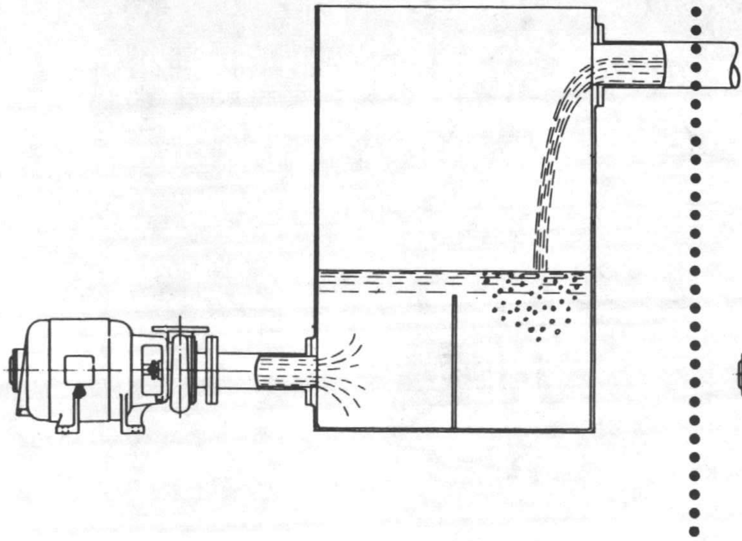
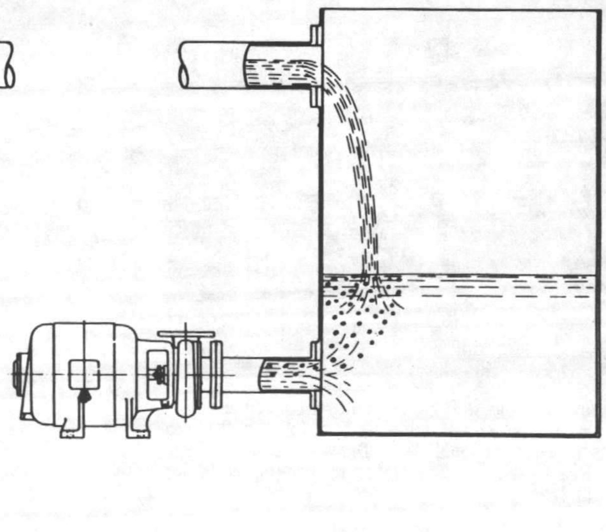
OVERLOADED DRIVING UNIT

1. Head much lower than that for which pump is designed.
2. Speed too high . . . higher than that contemplated.
3. Liquid handled of high specific gravity and greater viscosity than that of water.

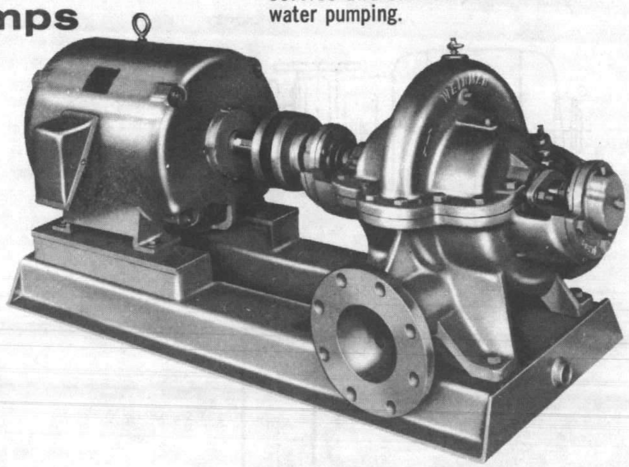
MECHANICAL TROUBLES AND NOISE

1. Misalignment.
2. Excessive suction lift or vapor binding (hot water).
3. Bent shaft and/or damaged bearings.
4. Suction and discharge piping not properly supported and anchored.

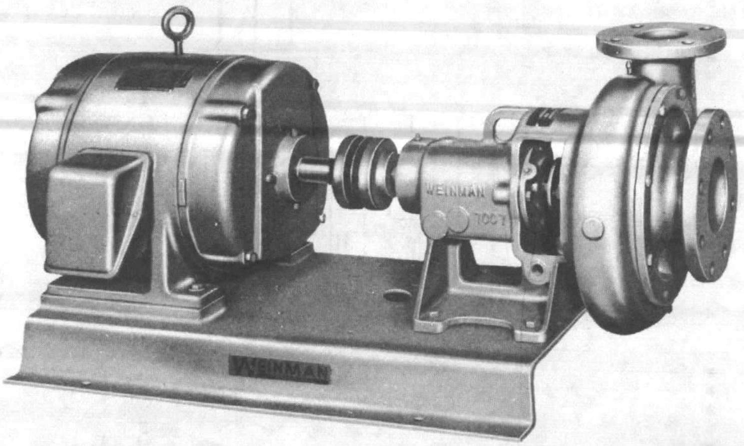
SUCTION PIPING

RIGHT	WRONG
	
	
	
	

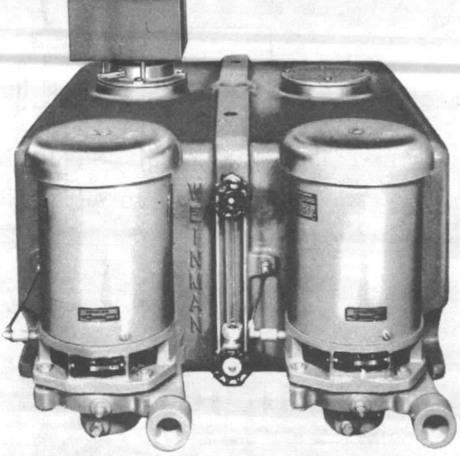
All types of industries rely on **WEINMAN** Centrifugal Pumps for top performance ...dependability



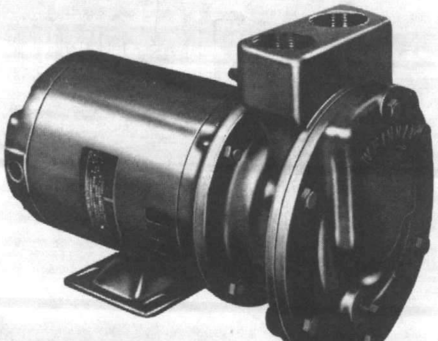
Type L Single Stage Split Case Pump for water works pumping, booster service and chilled or condenser water pumping.



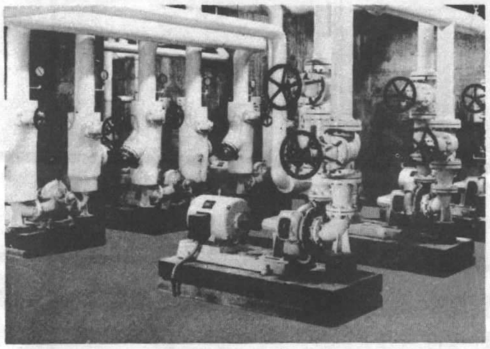
WEINMAN Type G-B single stage, end suction centrifugal pump is recommended for refrigeration plant service; hot and chilled water circulation . . . for virtually every phase of liquid handling.



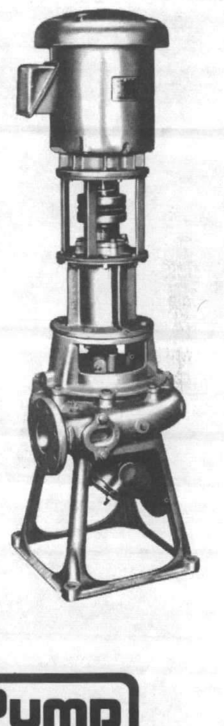
Type ACV and ADV Condensate Return Units with cast-iron receivers and vertically mounted Unipumps.



Revolutionary Vortex Liquid Ring Type Y self-priming uni-pump. Pumps liquid, air, vapor or any mixture of these three.



Type 4K-3B pumps (foreground) control condenser water flow in the air conditioning system for the first 16 floors of First National Bank, Denver, Colorado. Type 4L-3 (rear) pump chilled water to cooling coils for cool air fans.



Type U-VBM single stage vertical non-clog, ball-bearing centrifugal pump for dry pit and pump rooms where floor space is at a premium or subject to seasonal flooding.

Mueller Pump
AERMOTOR-MIDLAND-WEINMAN

A MUELLER COMPANY
P.O. BOX 1364 COMMERCE & EXCHANGE
CONWAY, ARKANSAS 72032 501-329-9811

2500281CPC
Printed in U.S.A.

Taco

NUMBER

PL300-2.3

REPLACEMENT PARTS LIST

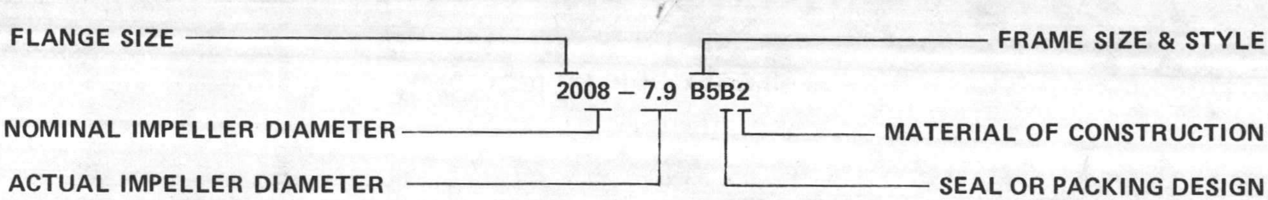
Effective: June 1, 1983
Supersedes: PL300-2.3
dated 2/1/81

FOR FOLLOWING MODEL NUMBERS:

BM or CC:	2 - 8 2½ - 8 2½ - 10 3 - 8 & 4 - 6
BM or CC:	2008 2010 2012 2508 2510 3008 & 4006
SB or BB:	2008 2010 2012 2508 2510 3008 & 4006

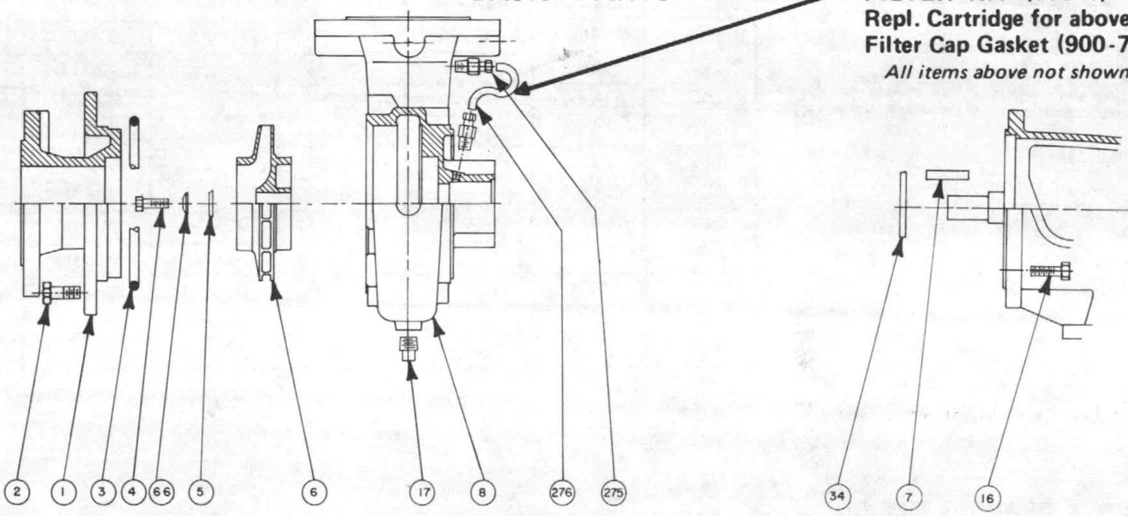
WHEN SELECTING AND ORDERING PARTS, ALWAYS REFER TO SERIAL NUMBER ON NAME PLATE

—Example—



BASIC PARTS

FILTER KIT (900-1)
Repl. Cartridge for above (900-439)
Filter Cap Gasket (900-783)
All items above not shown on this sheet.



Item No.	No. Reqd.	DESCRIPTION	PART NO. PER PUMP SIZE						REMARKS
			2 - 8 2008	2 - 12 2012	2½ - 8 2508	2½ - 10 2510	3 - 8 3008	4 - 6 4006	
1	1	Suction Cover	920-003	884-003	928-003	922-003	934-003	938-003	Add 'B' for Brz.
2	8	Suction Cover Bolts	10-216	10-211	10-216	10-211	10-216	10-230	
3	1	Suction Cover 'O' Ring	912-005	868-004	912-005	862-005	912-005	918-005	
4	1	Impeller Bolt (SS)	10-257	10-259	10-257	10-257	10-257	10-257	3/8-16x11/2 SS
5	1	Impeller Washer	926-004	926-004	926-004	926-004	926-004	926-004	
6	1	Impeller	920-002	884-002	928-002	922-002	934-005	938-002	Add 'B' for Brz.
7	1	Impeller Key (SS)	13-104A	13-105A	13-104A	13-104A	13-104A	13-104A	
8	1	Casing	920-001	884-001	928-001	922-001	934-001	938-001	Add 'B' for Brz.
16	4	Casing Bolt	10-201	10-201	10-201	10-201	10-201	10-201	3/8-16x1-1/8
17	1	Drain Plug	16-102	16-104	16-102	16-102	16-102	16-102	3/8 NPT
34	1	Slinger Ring	900-044	900-044	900-044	900-044	900-044	900-044	
66	1	Belleville Washer	900-053	900-053	900-053	900-053	900-053	900-053	
222	1	Fitting	900-566	900-566	900-566	900-566	900-566	900-566	
275	2	Fitting	900-798	900-798	900-798	900-798	900-798	900-798	
276	1	Tube	900-728	900-728	900-728	900-728	900-728	900-728	

(1) Throttle Bushing (Item 10), found in Seal Section, must be ordered with each casing.

Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627

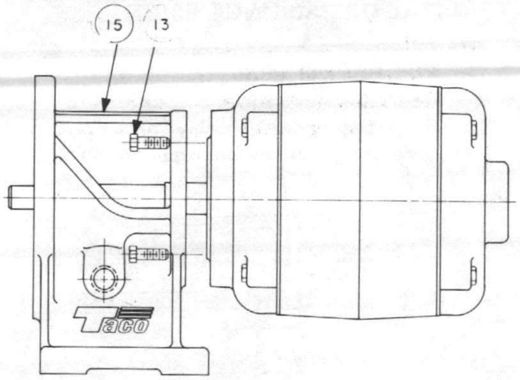
Litho in U.S.A.

Taco (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario Telephone: (416) 625-2160 Telex: 06-961179

FRAME SIZE & STYLE – 0000-00-XX00

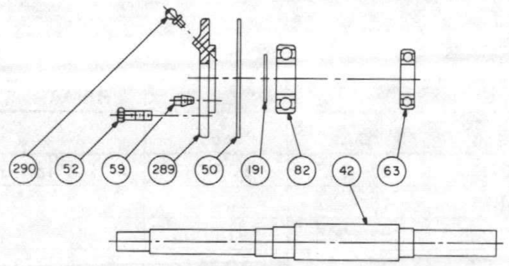
B1	**BALL BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.
B2	**SLEEVE BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.
B3	**SLEEVE BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.
B6	**SLEEVE BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.

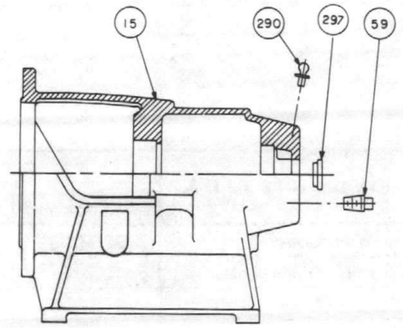
B4 **CLOSE COUPLED (CC)**



NEMA FRAME Size "T"	NEMA FRAME Size "U"	ITEM 13 FR. BOLT Part No.	ITEM 15 PUMP FR. 1750 "T"	ITEM 15 PUMP FR. 3450 "T"	ITEM 15 PUMP FR. 1750 "U"	ITEM 15 PUMP FR. 3450 "U"
	48	10-201			920-004	920-004
	56	10-201			920-004	920-004
143	182	10-201			920-004	920-004
145	184	10-201	920-004		920-004	920-004
182	213	10-223	928-004		928-004	928-004
184	215	10-223	928-004		928-004	928-004
213	254	10-223	928-004	928-004	928-004	928-004
215	256	10-223	928-004	928-004	928-004	928-004
254	285	10-223		928-004		900-126
256	286	10-223		928-004		900-126
284		10-223		900-126		

B5 **BALL BEARING DESIGN:**

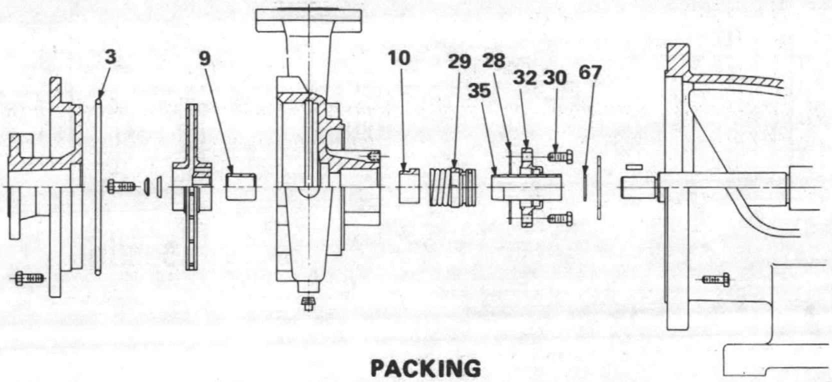




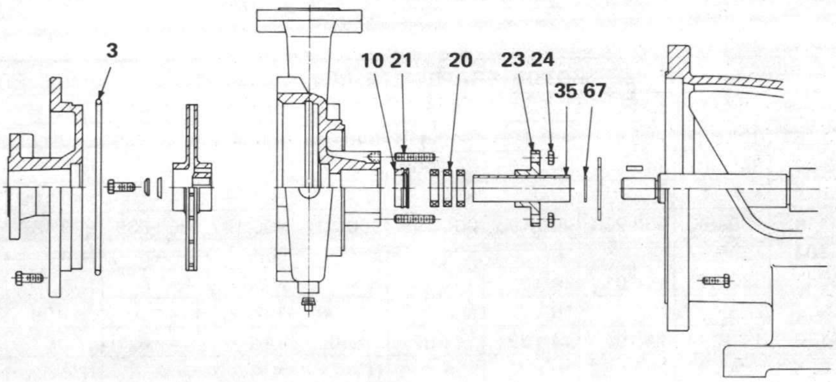
Item No.	No. Req.	DESCRIPTION	PART NO.	REMARKS REMARKS
74	1	Frame Assembly (complete)	840-124RP	
15	1	Frame	840-111	
42	1	Shaft	840-113	Add SS for Stainless Steel
50	1	Bearing Plate Gasket	840-123	
52	4	Bearing Plate Bolt	10-230	3/8 - 16 x 1
59	2	Drain Plug	16-111C	1/8 NPT Brass
63	1	Ball Bearing	840-114	
82	1	Ball Bearing	840-071	
191	1	Retainer Ring	15-105	
289	1	Bearing Cover Plate Assembly	840-120	
290	2	Lubrication Fitting	15-200	
297	1	End Cap	820-368	

SEAL OR PACKING DESIGN – 0000-00-00X0

MECHANICAL SEAL



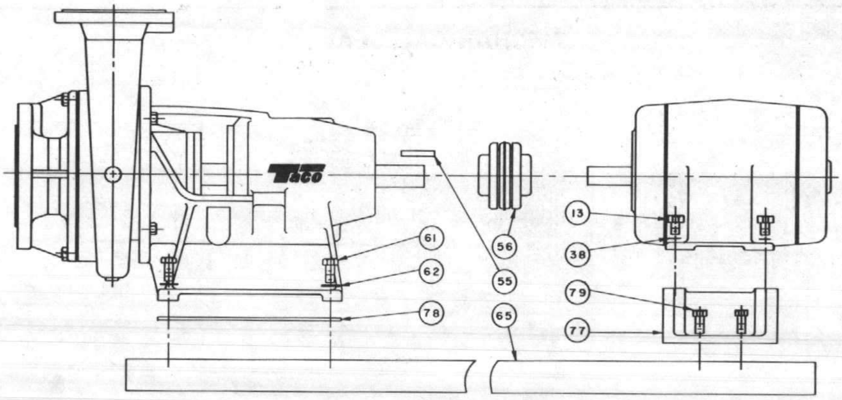
PACKING



TYPE B STANDARD. TYPE D HI-TEMP. TYPE P PACKED. TYPE E CERAMIC.

Item No.	No. Reqd.	DESCRIPTION	SEAL OR PACKING DESIGN				REMARKS
			Type 'B'	Type 'D'	Type 'P'	Type 'E'	
3	1	'O' Ring	*See Page 1*				
9	1	Impeller Spacer	900-026RP	900-026RP	Not Used	900-026RP	
10	1	Throttle Bushing	920-016	920-016	920-008	920-016	
20	1	Packing Set			900-241RP		
21	2	Studs			900-029		
22	1	Filler Ring (Not shown)	Not Used	Not Used	900-030		
23	1	Gland			920-015		Add 'B' For Bronze
24	2	Hex Nuts			12-129		3/8 – 16
28	1	Retainer Cap Gasket	920-014RP	920-014RP		920-014RP	
29	1	Water Seal	900-024RP	900-087RP		900-215RP	
91	1	WATER SEAL KIT	840-128BRP	840-128DRP	Not Used	840-128ERP	Incl. Items No. 28, 29, 35 & 67
30	4	Retainer Cap Bolts	10-208	10-208		10-208	3/8 – 16 x 7/8
32	1	Seal Retainer Cap	920-020	920-020		920-020	
35	1	Sleeve	900-027BRP	900-027BRP	920-006	900-027BRP	
67	1	Sleeve Gasket	920-007RP	920-007RP	920-007RP	920-007RP	

MOTOR PARTS – NOT PART OF SERIAL NUMBER
–Motor Frame Sizes Must be Specified When Ordering Parts Shown Below–



Item No.	No. Reqd.	DESCRIPTION	MOTOR FRAME SIZE (NEMA STD.) 'T'										REMARKS
			143-145T	182T	184T	213T	215T	254T	256T	284T	284TS	286TS	
65	1	Base Plate (1)	820-957	820-957	820-957	840-418	840-418	840-418	840-418	840-419	840-419	840-419	
77	2	Spacer	840-098	840-003	840-004	840-005	840-006	840-041	840-040	N/A	N/A	N/A	
78	2	Frame Spacer	N/A	N/A	N/A	N/A	N/A	N/A	N/A	840-106	840-106	840-106	
56	1	Coupler	900-193	900-206	900-206	900-195	900-195	900-197	900-197	900-538	900-197	900-199	
38	4	Mtr. Lck. Wshr.	14-104	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5/16
38	4	Mtr. Lck. Wshr.	N/A	14-101	14-101	14-101	14-101	N/A	N/A	N/A	N/A	N/A	3/8
38	4	Mtr. Lck. Wshr.	N/A	N/A	N/A	N/A	N/A	14-100	14-100	14-100	14-100	14-100	7/16
62	4	Frm. Lck. Wshr.	14-102	14-102	14-102	14-102	14-102	14-102	14-102	14-102	14-102	14-102	1/2
13	4	Mtr. Hx. Hd. Blt.	10-254	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5/16-18x1¼
13	4	Mtr. Hx. Hd. Blt.	N/A	10-221	10-221	10-221	10-221	N/A	N/A	N/A	N/A	N/A	3/8-16x1¼
13	4	Mtr. Hx. Hd. Blt.	N/A	N/A	N/A	N/A	N/A	10-209	N/A	N/A	N/A	N/A	7/16-14x1½
13	4	Mtr. Hx. Hd. Blt.	N/A	N/A	N/A	N/A	N/A	N/A	10-202	10-202	10-202	10-202	7/16-14x1¼
61	4	Fr. Hex. Hd. Blt.	10-238	10-238	10-238	10-238	10-238	10-238	10-238	N/A	N/A	N/A	1/2-13x1-5/8
61	4	Fr. Hex. Hd. Blt.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10-217	10-217	10-217	1/2-13x2½
79	4	Spr. Hx. Hd. Blt.	10-230	10-230	10-230	10-230	10-230	N/A	N/A	N/A	N/A	N/A	3/8-16x1
55	1	Coupler Key	13-100	13-100	13-100	13-100	13-100	13-100	13-100	13-100	13-100	13-100	1/4x1/4x1½
47	1	Coupler Guard	820-796	820-796	820-796	820-796	820-796	820-796	820-796	820-796	820-796	820-796	
48	4	CG. RdHd. Scw.	10-400	10-400	10-400	10-400	10-400	10-400	10-400	10-400	10-400	10-400	1/4-20x3/8
111		Coup. Insert	900-512	900-512	900-512	900-513	900-513	900-514	900-514	900-515	900-514	900-515	

(1) Add "A" to base plate number when coupler guard is to be used.

MATERIALS OF CONSTRUCTION – – – 0000-00-000X

DESCRIPTION	1 STANDARD CONSTRUCTION	2 BRONZE FITTED	3 ALL BRONZE	4 ALL IRON	REMARKS
Casing	Iron	Iron	Bronze	Iron	Add Suffix 'B' for Bronze
Suction Cover	Iron	Iron	Bronze	Iron	Add Suffix 'B' for Bronze
Impeller	Iron	Bronze	Bronze	Iron	Add Suffix 'B' for Bronze
Wear Ring	Bronze	Bronze	Bronze		Only When Required
Seal Retainer Cap	Iron	Iron	Bronze	Iron	Add Suffix 'B' for Bronze
Packing Gland	Iron	Iron	Bronze	Iron	Add Suffix 'B' for Bronze
Throttle Bushing	Bronze	Bronze	Bronze	Iron	Add Suffix 'C' for Iron
Sleeve	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	
Shaft	Steel	Steel	Steel	Steel	Add 'SS' for St. Steel

INSTALLATION AND OPERATION INSTRUCTIONS

NUMBER
IS 300-2.2

Effective: September 1, 1982
Supersedes: IS300-4
dated 3/31/68

TACO BASE MOUNTED PUMPS (SLEEVE AND BALL BEARING)

Plant ID No. 001-922

A–INSTALLATION

A1-LOCATION

Locate pump in an easily accessible place with sufficient space around it for maintenance and servicing. On larger pumps allow head room for the use of hoists or overhead cranes. Locate pump on a dry and clean place so that motor will be protected from moisture and dust.

On closed heating systems place compression tank at the suction side of the pump. When pump head is less than 20 feet, it is permissible to connect compression tank to discharge side of pump.

On open systems, install pump close to liquid supply and make suction piping as short and as straight as possible.

A2-FOUNDATION

The foundation serves to carry the pump weight and to absorb vibration. Normally, the foundation is made of concrete block, preferably tied in with the floor or ground. Make the foundation block about 4" longer and 4" wider than the base of the frame. Height of the block may vary from 2/3 to 1 times the *width* of the foundation (Fig. 1). When foundation is poured, provide a hole near each of the four (4) corners. To simplify installation and maintenance use lead Anchors. Place the front Anchor about 2" from the edge of the foundation to clear overhanging casings (Fig. 2).

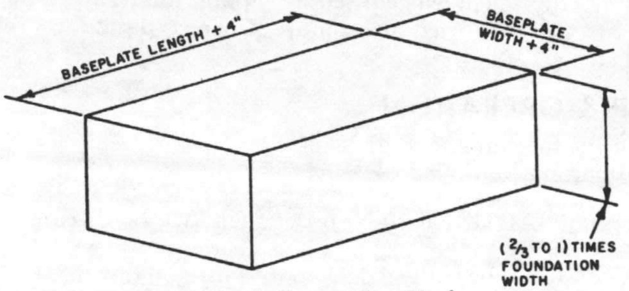


Fig. 1–Foundation Block

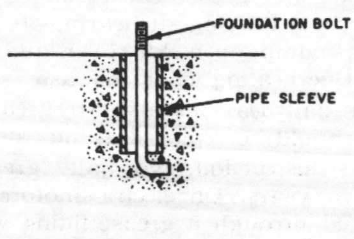


Fig. 2–Foundation Bolt

A3-PIPING

Correct piping is of prime importance for the proper operation and long life of the pump. Stresses induced by piping will cause excessive wear of seals, bearings, and couplings that could ultimately destroy these elements.

Both suction and discharge piping should be suspended close to the pump connections, so that no pipe weight rests on the pump. Pipe flanges and pump flanges should align perfectly before connections are made, piping should never be drawn by force into place.

Thermal expansion of piping requires special attention on heating installations. If no room is provided for pipe expansion, stresses are induced in the piping that will exert a load on the pump. Forces created by pipe stresses can exceed by far the load exerted through pipe and water weight. Stress forces can distort pump, bend shafts, wear out seals, and impeller wear rings, and ultimately burn out bearings. To protect pump from thermal pipe stresses, provide spring hangers and flexible connectors that are suitable to compensate for pipe expansion. (See Fig. 3).

Install gate valves on both suction and discharge side of the pump to allow servicing without draining the system. Also provide a flanged nipple (spool) between gate valve and suction end of the pump to enable you to take the pump apart without disturbing piping (Fig. 3). In order to have them easily accessible, the pump and flange nipples should not be covered with insulation.

On open pumping systems drawing water from a level below the pump (suction lift) install a foot valve with strainer. On open systems where the pump is located below the suction water level (suction head) install a check valve in the discharge line close to the pump.

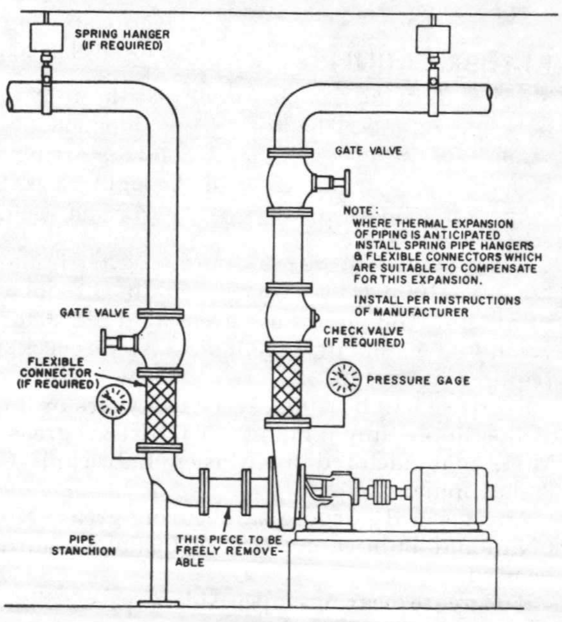


Fig. 3–Typical Installation–Vertical Piping

A–INSTALLATION-Continued

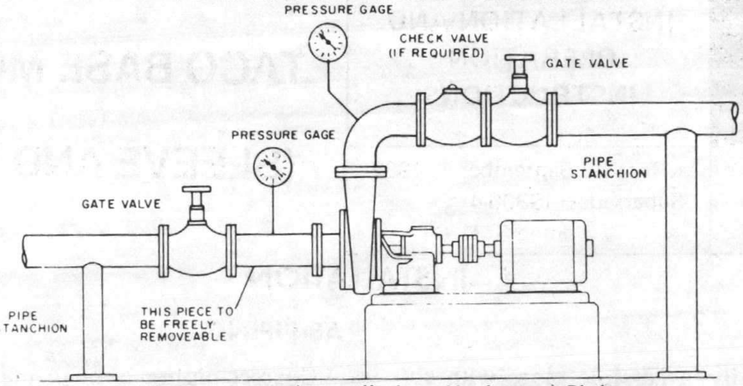


Fig. 3–Typical Installation–Horizontal Piping

A4-PUMP SETTING

When pump is set on its foundation, make sure to have it properly levelled. Place baseplate over foundation bolts provided for it, place shims at corners of baseplate when required and level with a spirit gauge. Tighten baseplate firmly to its foundations. Check also level of suction and discharge flanges.

A5-COUPLING ALIGNMENT

Proper alignment of pump and driver will assure trouble-free operation and long life of the pump. Misalignment will cause rapid wear of seals, couplings, and bearings. All pumps are carefully aligned before leaving the factory. However, experience indicates that alignment invariably changes in shipping and handling. Therefore, it is of utmost importance that alignment be checked at various steps of the installation process. i. e., **after leveling, after piping, and after first few weeks of operation.**

Check alignment by placing a slotted straight edge across the coupling halves at top, bottom, and at the sides. If any light is seen between the straight edge and one of the coupling flanges, it means the unit is out of alignment. (Fig. 4)

If light is seen at top and bottom position of the straight edge, alignment is out of height. Usually shims are placed under the motor feet. Loosen the four motor bolts, remove or add shims as required to correct proper height. Tighten the motor bolts and check to make sure alignment was corrected properly.

If alignment is out on the sides of the coupling, loosen the four motor bolts and lightly tap the motor in the direction required. Tighten the four motor bolts and check to make sure alignment was corrected properly.

As alignment in one direction may alter the alignment in another, be sure to check all alignments made.

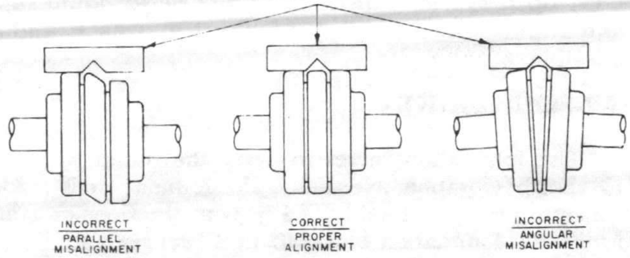


Fig. 4–Coupling Alignment

A6-CONNECTING PIPING

Piping may now be connected to pump. Make sure that pump and pipe flanges are strictly parallel and properly spaced for the gasket that will be used. Also check that pipes are supported properly and do not rest on pump flanges. Never draw pipes by force to pump flanges. Recheck alignment after piping connections are made. If misalignment was caused by piping, it is a sign that pipe stresses distorted the pump. Correct piping to relieve stresses.

B–PUMP START-UP & OPERATION

Before starting up pump for the first time several items are to be checked to avoid damaging pump.

B1-LUBRICATION

Sleeve Bearing pumps are filled with oil at the factory but some oil might be lost during shipment. As a matter of precaution, check oil level before starting up pump. Proper level is at the center of the sight glass. If oil level is too low, remove top cover (Fig. 5) and refill.

Drain and refill oil well once a year. Initial filling is Socony Mobil DTE Heavy Medium Oil, but any premium SAE Grade 20 Non-Detergent Motor Oil can be used.

Motor bearings also might loose oil during shipment. Check oil level as indicated on motor instruction. Electric motors have either an oil cup or a pipe plug for filling. An overflow is located at the side of the bearing area. Before starting unit, fill motor bearing with an oil can until oil flows out of overflow.

Ball Bearing pumps are greased at the factory. Grease will not flow out during shipment, so no checking will be required at startup.

Regrease ball bearings every two years or 3,000 hours of operation. Initial filling is LUBRIKO-grease, Density M31, manufactured by Master Lubricants Company, Philadelphia.

Any general purpose ball bearing grease No. 3 NLGI (National Lubricating Grease Institute) hardness may be used.

To grease bearings open side covers (Fig. 5), slide them about 1/2" to the side and introduce grease thru the opening with a putty knife. Fill grease chamber 2/3 high. Excessive grease causes unnecessary friction and will overheat bearing. If bearings run hot after regreasing, stop pump, open side cover, and wipe out excessive grease. Overheating will then cease.

Motor ball bearings also are greased at the factory. Grease should be replaced as indicated by motor manufacturer's instruction. Normally greasing is required every two years. On electric motors grease is usually introduced through a grease fitting with a grease gun.

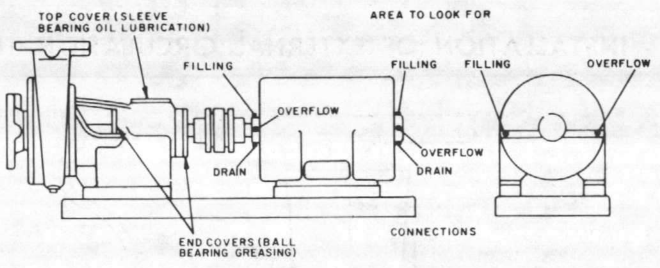


Fig. 5—Lubrication Points

B2-MOTOR WIRING & SENSE OF ROTATION

Check wiring of motor before starting to make sure that connections are wired properly for the voltage in use. Overvoltage can burn out motor windings. Check heater element in magnetic starter to see that it is rated the same as the motor.

AMP RATING FOR 3 PHASE SQUIRREL CAGE INDUCTION MOTORS

Motor	220 Volt		440 Volt	
HP	1750 RPM	3450 RPM	1750 RPM	3450 RPM
1/4	1.0	–	.5	–
1/3	1.4	–	.7	–
1/2	1.8	–	.9	–
3/4	2.4	2.2	1.2	1.1
1	3.6	3.4	1.8	1.7
1 1/2	4.8	4.6	2.4	2.3
2	6.2	5.6	3.1	2.8
3	9.0	8.0	4.5	4.0
5	14.4	13.4	7.2	6.7
7 1/2	20.0	19.2	10.0	9.6
10	26.4	25.6	13.2	12.8
15	39.0	38.0	19.5	19.0
20	51.0	50.0	25.5	25.0
25	62.0	60.0	31.0	30.0
30	74.0	72.0	37.0	36.0
40	96.0	–	48.0	–
50	120.0	–	60.0	–

Before attempting to check out sense of rotation of pump, fill pump with water to provide lubrication of the seal. <u>Do not operate pump dry for motor checkout.</u>

Next throw the switch and see if direction of rotation corresponds with arrows on frame of pump. The direction of rotation is counterclockwise facing the suction end of pump. Direction of rotation of three phase motors can be easily reversed by interchanging two of the three wires at the terminal board of the motor. Reversing of single phase motors is done by interchanging some internal wires or clamps. Instructions for reversing are found either on the motor nameplate or inside the motor terminal cover.

B3-PUMP START-UP

After you have checked lubrication and wiring you are ready to start the pump.

Open the gate valve in the suction side and close the valve on the discharge side. Start motor, wait until unit has come to full speed and then open discharge valve slowly. Do not run pump for more than a few minutes with completely shut valves. If system conditions call for part-time operation against shut valves, install a bypass line from discharge to suction.

B4-MECHANICAL SEAL AND STUFFING BOX CARE

Mechanical Seal (See caution below)*

Mechanical seals are the most delicate component of the pump. Special care has to be given to them to assure trouble-free operation.

The sealing element of a mechanical seal consists of a carbon washer rotating against a stationary ceramic ring.

Surfaces of both are highly lapped to assure sealing. Any dirt that penetrates between the two mating parts will cause a rapid wear of the seal faces and will ultimately result in seal leakage.

New heating systems are usually contaminated by various materials such as construction debris, welding slugs, pipe joint compound, mill scale, etc. It is of utmost importance that such systems be cleaned out thoroughly before putting pump into continuous operation.

Cleaning of a heating system is simple and easy. First flush out system with cold water at city pressure to remove all loose foreign matter that penetrated into the system. Afterwards boil out system with chemicals to remove dirt adhering to pipes.

Chemicals most commonly used for this procedure are sodium triphosphate, sodium carbonate, or caustic soda, but any nonfoaming detergents as used in dishwashers can be applied.

Fill system with clean water, add cleaning chemicals (1) lb. for every 40 to 50 gallons of water, (or Mfrs. Instruction) start pump and heat up system. Let system run for a few hours, then drain and refill with fresh water. Your pumps are now ready for continuous duty. (See caution below).*

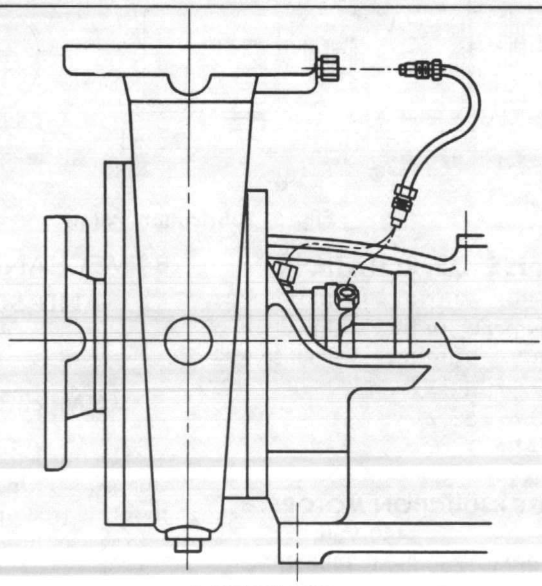
Stuffing boxes are less delicate in operation than mechanical seals. No chemical cleaning is necessary as on mechanical seal pumps, but flushing out with cold water is beneficial on this type of pump too.

After pump is started up adjust gland of stuffing box evenly so that it drips from one to three drops of water per minute. This drip is absolutely essential to prevent damage to packing and shaft sleeve. It also prevents overloading of motor. Excessive dripping may cause air to enter pump under certain conditions.

Sump of pump should be piped to any convenient sewer or drain. A pipe tapping is provided for this purpose at the side of the sump. Never plug this drain tapping.

*CAUTION: The addition of certain chemical additives to systems utilizing TACO Equipment, voids the warranty.

INSTALLATION OF EXTERNAL CIRCULATION TUBE

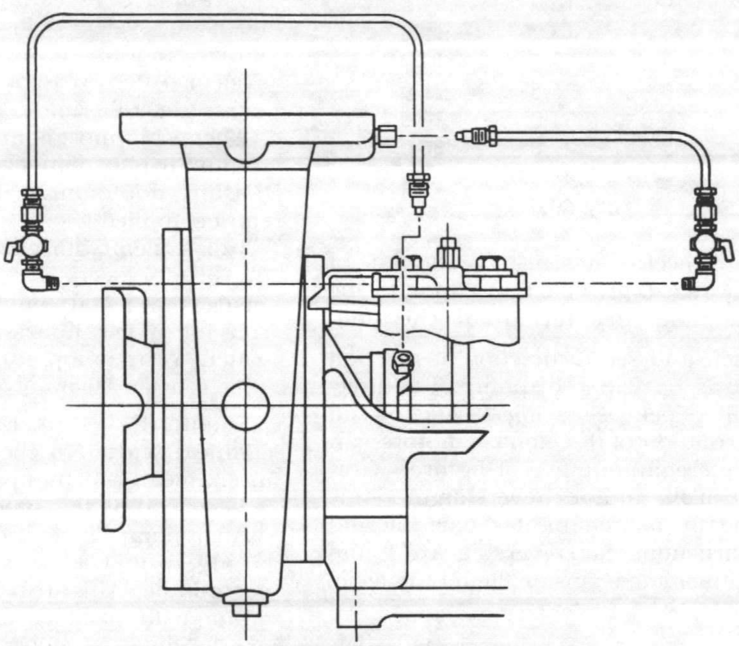


IMPORTANT

Before filling system with water, assemble external circulation tube to pump casing as follows:

1. Screw nut into body until hand tight.
2. With a wrench continue tightening for about one and one-half full additional turns. (It is not necessary to tighten nut all the way down)

INSTALLATION OF PUROCELL FILTER



IMPORTANT

1. Attach Filter to the pump by loosening the top bolt on the frame and casing and slip bracket under bolt and tighten.
2. If Recirculating line is installed — remove from frame and insert this end into inlet of Filter.
3. Attach line from outlet of the filter to seal retainer cap.

Taco	INSTRUCTION SHEET
NUMBER IS 100-1.2	Effective: September 1, 1982 Supersedes: IS 100-21 dated 7/1/68

HORIZONTAL & VERTICAL CIRCULATORS

Nos. 110 thru 120 and all Vertical Models

Plant ID No. 001-318

TO REPLACE MOTOR

1 — Disconnect wiring.
2 — Loosen the two set screws at pump end of spring coupling, remove bolts between bracket and motor and separate.
3 — Loosen other set screw of coupling and remove coupling from old motor.
4 — Slide coupler with single set screw over new motor shaft and tighten against flat surface of shaft.
5 — Place new motor assembly into bracket and replace bolts (also springs on Verticle Models).
6 — Extend pump end of spring coupling over impeller shaft 3/16" Horizontal Models or 5/16" on Verticle Models and tighten both set screws. If impeller and shaft move into body during this operation, water will flow from weep hole in bracket. If this does occur, extend spring coupler a little more or until water stops flowing. CAUTION: UNDER NO CIRCUMSTANCES SHOULD THE WEEP HOLE BE PLUGGED.
7 — Rewire motor.

TO REPLACE SPRING COUPLING

Follow same procedure outlined above.

LUBRICATION INSTRUCTIONS

Re-oil pump and motor annually with SAE No. 30 oil.

REPLACING SEALS

Water flowing from weep hole in bracket normally indicates dirt on the seat or seal needs replacement. Before taking pump apart extend spring coupling and impeller shaft into body as far as it will go. This will separate the seal halves and permit a greater flow thru the weeping hole and wash any foreign matter off the seats. Release and if flow stops, it indicates that the seals do not require replacement. If the flow does not stop, loosen the two set screws on the coupling and extend as far as it will go. If leak stops it means there was insufficient tension on the coupling. If leak continues, indications are that the seal needs replacement. Proceed as follows: —

1 — Disconnect wiring.
2 — Valve off or drain system.
3 — Remove body bolts and pull entire assembly out of body.
4 — Loosen the two set screws at pump end of spring coupler, file off any burrs on shaft and pull impeller and shaft from bracket.
5 — Pry out old seal seat from bracket with a screwdriver and old part from impeller shaft with a pair of pliers.
6 — Clean shaft and seal bearing surfaces thoroughly with clean cloth.
7 — Dip CARBON part of seal in water to lubricate, place on top of impeller shaft with carbon facing up. Push down on shaft with palm of hand as far as it will go. Then with both thumbs push all the way down making certain that prongs engage the two holes in the impeller. If there are no holes in the impeller, break off the prongs with a pair of pliers and smooth burrs with a file.
8 — Separate rubber from ceramic part, wet it and set into recess in bracket. Set ceramic seal into rubber with seat facing out by starting at a slight angle first, then pushing away and down simultaneously. The rubber ring should not be folded over during this operation. Make certain that both the rubber and ceramic are "bottomed" squarely.
9 — Clean both seal surfaces with a clean lintless cloth.
10 — Place a few drops of oil along the impeller shaft and push slowly with a twisting motion through ceramic part into bracket and spring coupling.
11 — While holding impeller and shaft with seal faces mating, insert an Allen wrench into one of the set screws in the coupling, extend spring — 3/16" for Horizontal Models or 5/16" for Vertical Models and tighten set screw. Then tighten the second set screw.
12 — Remove old body gasket, clean surfaces and replace with new gasket.
13 — Place entire assembly into body, replace and tighten bolts gradually and evenly all around.
14 — Refill system. If water leaks from weep hole in bracket increase tension on spring coupling slightly more or until leak stops.
15 — Rewire Motor.

*CAUTION: The addition of certain chemical additives to systems utilizing TACO Equipment, voids the warranty.

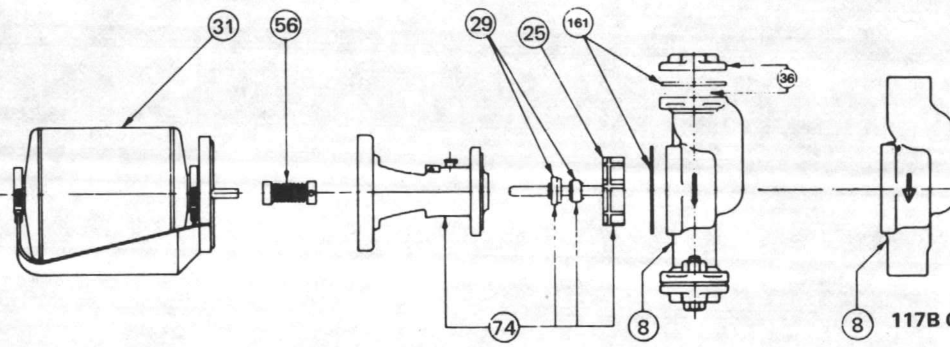
Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627
Litho in U.S.A.
Taco (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario Telephone: (416) 625-2160 Telex: 06-961179

Taco	REPLACEMENT PARTS LIST
NUMBER **PL100-1.2**	Effective: June 1, 1983 Supersedes: PL100-1.2 dated 3/25/83

REPLACEMENT PARTS FOR 110 Through 120

110 - 111 - 112 - 113 - 117B - 120

REFER TO 100RL-7 for LIST PRICES



117B Circulator Only

PARTS FOR 110 to 120 CIRCULATORS

NAMEPLATE MODEL NO.	ITEM 8 BODY	ITEM 25 IMPELLER & SHAFT	ITEM 31 MOTOR	ITEM 74 BEARING BRACKET	ITEM 161 GASKETS
CAST IRON					
HC, 110, 110C	110-226RP (1)	110-207RP	110-223RP	110-361RP	110-127RP
HDH, 111, 111C	111-004RP	111-053RP	110-185RP	111-058RP	110-127RP
112	110-226RP	112-043RP	112-074RP	112-120RP	110-127RP
113	113-001RP	113-009RP	110-185RP	113-013RP	110-127RP
120-1 to 120-5	120-083RP	120-056RP	120-105RP	120-076RP	120-073RP
120-6 to 120-12	120-083RP	120-038RP	120-105RP	120-067RP	120-073RP
CAST IRON WITH NON-FERROUS IMPELLER					
112C	110-226RP	112-055RP	112-074RP	112-103BRP	110-127RP
113C	113-001RP	113-009RP	110-185RP	113-013RP	110-127RP
120C-1 to 120C-5	120-083RP	120-060RP	120-105RP	120-078RP	120-073RP
120C-6 to 120C-12	120-083RP	120-054RP	120-105RP	120-069RP	120-073RP
BRONZE					
HCB, 110B	110-226BRP	110-207RP	110-223RP	110-362BRP	110-127RP
111B	111-004BRP	111-053RP	110-185RP	111-059BRP	110-127RP
112B	110-226BRP	112-055RP	112-074RP	112-103BRP	110-127RP
113B	113-001BRP	113-009RP	110-185RP	113-012BRP	110-127RP
117B	117-001BRP	110-207RP	110-223RP	110-362BRP	110-127RP
117B-S2, -S3	117-002BRP	110-207RP	110-223RP	110-362BRP	110-127RP
120B-1 to 120B-5	120-083BRP	120-060RP	120-105RP	120-077BRP	120-073RP
120B-6 to 120B-12	120-083BRP	120-054RP	120-105RP	120-068BRP	120-073RP

Replacement Parts Kits Listed on this sheet fit all models, 110 – 120 Circulators except as noted.

ITEM 29 – Water Seal 110-275RP

ITEM 56 – Coupler, 110-009RP

ITEM – Flange Set ¾'', 1'', 1¼'', & 1½'' Interchangeable. Refer to Price Sheets 100-T or 100-W. For 120 models with 2 holes, specify 1600-032BRP for Bronze, 1600-032RP for Cast Iron.

For 120 models with 4 holes, specify 120-044RP for Cast Iron, 120-044BRP for Bronze.

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Taco Instruction Sheet

202-001

Heat Exchangers

INSTALLATION

1. Allow sufficient clearance for removal of tube bundle.
2. After initial start and run at operating temperatures and pressures, shut down and tighten head bolts.
3. Make certain that tubing is full of water before introducing steam or hot water into shell, otherwise flashing or noise may occur.

CLEANING

Shell and tube bundle should be flushed out periodically. If cleaning is necessary, remove head and bundle to clean inside of shell and outside of tubes. Replace gaskets if necessary.

If unit is installed in a hard water area, inside of tubing can be cleaned as follows: –

1. Break water connections and plug bottom opening.
2. Fill the tubes with a solution of 1 part muriatic acid to 10 parts of water and allow to stand for 2 hours:
   CAUTION: A longer period may cause damage to the copper tubing.
3. Drain off and flush **thoroughly** with clean water.
4. Re-assemble unit.

NOTE

Commercially available cleaners may also be used.

REPLACEMENT PARTS

When ordering replacement parts specify

1) Complete Model Number
2) Date of Manufacture
3) Special Materials if Required

Normally, the only replacement parts required would be:

1 — Tube Bundle
1 — Set of Gaskets

NOTE: When ordering replacement tube bundles care must be take to insure correct construction and proper materials. **Units** manufactured prior to 1974 should have the prefix RUX.

Example: A replacement bundle for a B10212-L built in 1970 would be a RUX10212-L.

Replacement heads are also available if required.

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TACO (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario, Canada Telex: 06-961179

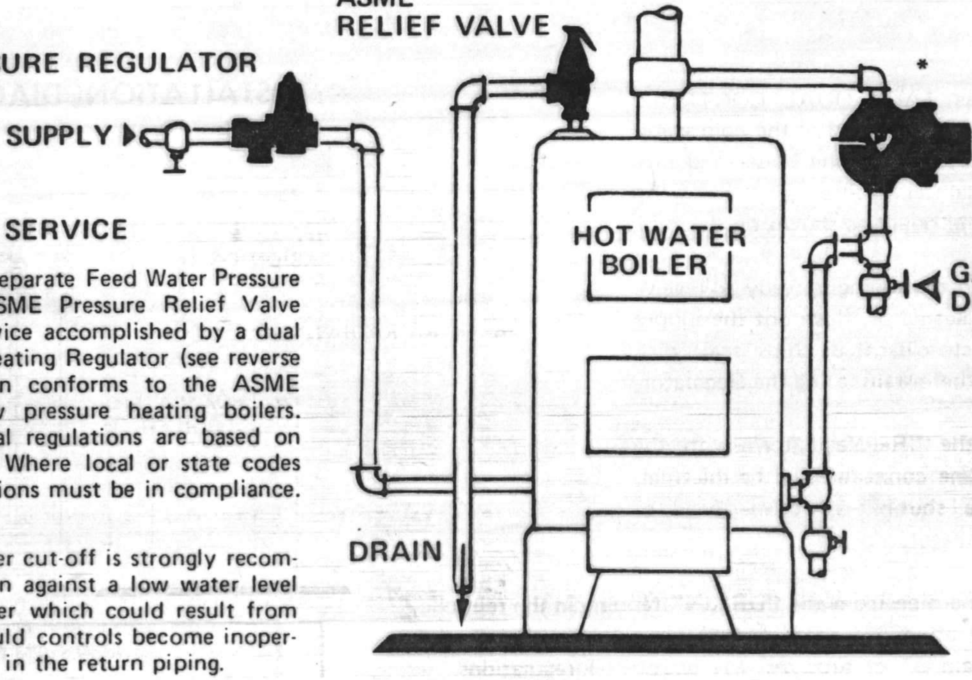
Form No. F202-001 Effective 5/1/81

Supersedes IS200-1

Taco	INSTRUCTION SHEET
NUMBER **IS-100-2.2A**	Effective: May 1, 1983 Supersedes: IS100-2.2A dated 8/1/81

TACO REDUCING VALVE PRESSURE REGULATORS

INSTRUCTIONS FOR INSTALLING



DUAL CONTROL SERVICE

The installation of a separate Feed Water Pressure Regulator and an ASME Pressure Relief Valve provides the dual service accomplished by a dual control Hot Water Heating Regulator (see reverse side) and, in addition conforms to the ASME requirements for low pressure heating boilers. (Many state and local regulations are based on ASME boiler codes.) Where local or state codes are in effect, installations must be in compliance.

*The use of a low water cut-off is strongly recommended for protection against a low water level condition in the boiler which could result from continuous firing should controls become inoperative or a break occur in the return piping.

FEED WATER PRESSURE REGULATORS

These regulators must be installed in the cold water supply line to the boiler and in a horizontal position. When piping is ready to receive the regulator, flush out the supply pipe to clear it of chips scale, dirt, etc. before installing regulator. Install regulator with the supply line connected to the inlet. Install a shut-off valve ahead of the regulator. Regulator is set to feed water at approximately 15 lbs. pressure. To readjust regulator, follow instruction No. 7 on reverse side of this sheet. These regulators have a strainer screen which should be removed and cleaned at least twice a year.

SERIES WITH FAST FILL AND PURGE LEVER

These valves are equipped with a unique and simple "fast fill and purge lever" . . . which permits rapid filling of the system . . . and sustained flow for air purging.

This advanced design incorporates a removable "push" rod which is actuated by the position of the "purge lever." When the lever is raised to the vertical position, it presses the "push" rod down which manually forces the valve wide open for maximum flow. Returning the lever to its normal position releases tension on the rod permitting the valve to maintain normal pressure in the system automatically.

*LOW WATER CUT-OFF

Install a low water cut-off so that the raised line cast on float chamber body is on a level with the top of the boiler. Top of switch box should be reasonably level. Piping to the top and bottom float chamber connections should conform to that shown on installation diagram. Keep the float chamber clean by periodically opening the valve below the float chamber to flush out mud and sediment. Do this at least once each month.

IMPORTANT:

When water main pressure exceeds 100 lbs. or is variable, a domestic service type water pressure reducing valve should also be installed in addition to this feed valve regulator. This reduces the pressure for accurate, longer life feed valve performance, as well as providing quiet, economical service pressure to the domestic fixtures.

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TACO HOT WATER
HEATING DUAL CONTROLS

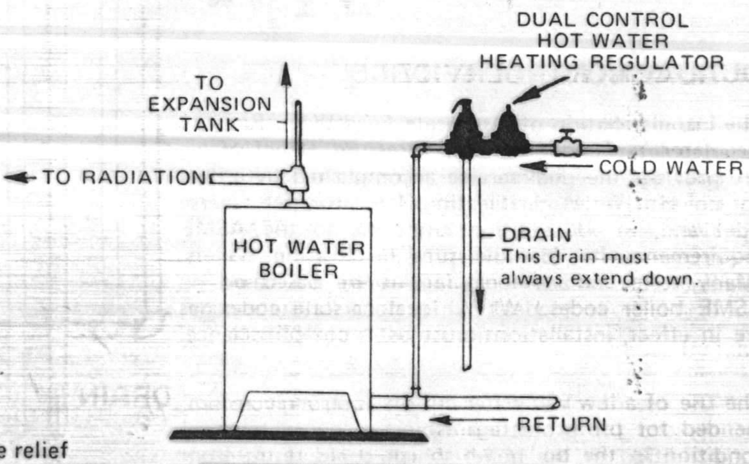
INSTRUCTIONS FOR INSTALLING

1. These TACO DUAL CONTROLS must be installed in the cold water supply line to the boiler and in a horizontal position above the top of the boiler as shown on diagram.

2. When the piping is ready to receive the Regulator, flush out the supply pipe to clear it of chips, scale, dirt, etc. before installing the Regulator.

3. Install the "Regulator" with the supply line connected to the inlet. Install a shut-off valve ahead of the Regulator.

INSTALLATION DIAGRAM



IMPORTANT

Please Note Footnote at Bottom of Reverse Side of This Sheet

4. Connect a pipe from the "DRAIN" tapping in the relief valve to above some convenient open drain such as a floor drain or set tubs. Always obey local regulations.

   Do not install a valve of any kind in this line. This drain must always pitch down from the regulator. No portion of the drain line should be above the regulator. Drain pipe must not be smaller than the drain tapping provided. The relief valve is non-adjustable and set to relieve at 30 lbs.

5. To fill the system, open the shut-off valve ahead of the Regulator. This valve must always be kept open when the system is in operation. Water will flow into the system until it is full and under pressure.

6. The pressure reducing valve of the Regulator is set to deliver water to the boiler at approximately 15 lbs. pressure. This pressure is sufficient for a 3-story building.

7. To reset the reducing valve for higher pressure (when the pressure is not sufficient to lift the water to highest radiation), calculate the number of feet from the regulator to the top of highest radiation. Multiply this by .43 and add 3 lbs. This will give the pressure needed to raise the water to the highest radiator and keep it under pressure — loosen lock nut. Turn adjusting screw clockwise slowly until the gauge indicates the pressure calculated. Then lock adjustment.

8. The regulator screen should be cleaned at beginning of each heating season.

9. The air cushion tank sometimes becomes filled with water (waterlogged). This is usually indicated by dripping of the relief valve when the burner is running. To recharge with air, close gate valve between tank and system and open gate valve in drain pipe. Allow tank to completely drain (this requires from 10 to 15 minutes), then close drain valve and open valve between tank and system.

Taco	INSTRUCTION SHEET
NUMBER IS-400-1.1 (281)	Effective: March 1, 1981 Supersedes: IS400-2-1 dated 7/30/76

AIR CONTROL

1 — Select proper size based on flow (GPM) thru System

Taco Air Control Less Strainer	Maximum Flow GPM	Taco Air Control With Strainer
AC2	80	AC2F
AC25	130	AC25F
AC3	190	AC3F
AC4	330	AC4F
AC5	550	AC5F
AC6	900	AC6F
AC8	1500	AC8F
AC10	2600	AC10F
AC12	3400	AC12F
AC14	4700	AC14F
AC16	6000	AC16F
AC18	8000	AC18F
AC20	10000	AC20F

2 — Install Air Control in Supply Line between boiler and pump(s) as indicated in Diagram on reverse side.

3 — Install Expansion Tank (s) as close to Air Control as possible with horizontal pipe (if any) pitching up to tank.

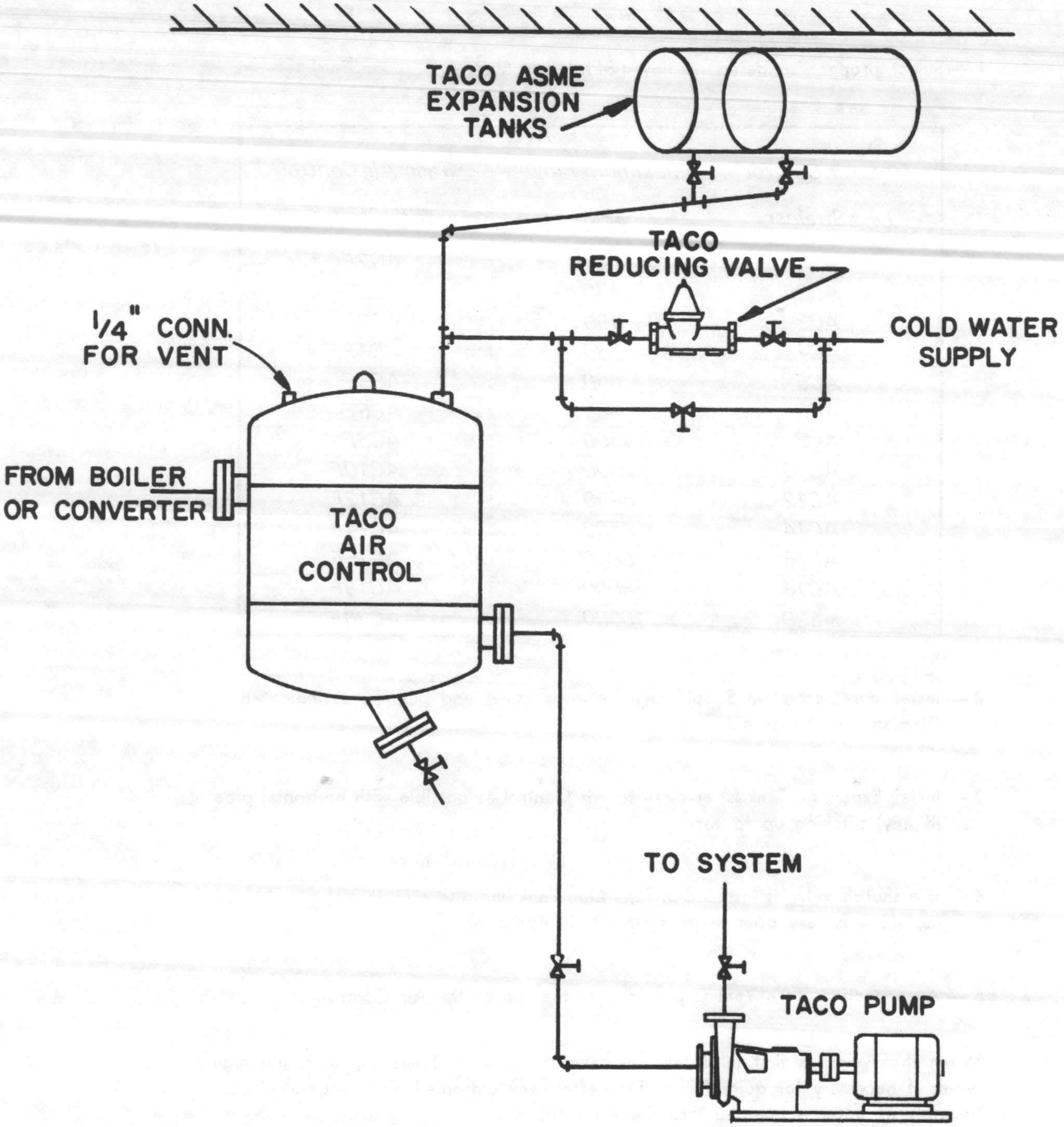
4 — If a shutoff valve is installed in Expansion Tank line, use a Gate Valve and make certain it is fully open when system is in operation.

5 — A connection for a Vent is provided at the top of the Air Control.

When the system is first filled, all you have to do is Vent heating units and high points if necessary for quick filling. Thereafter, any entrained air is separated continuously as water is pumped thru the Air Control.

Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627
Litho in U.S.A.
Taco (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario Telephone: (416) 625-2160 Telex: 06-961179

AIR CONTROL



TACO ASME
EXPANSION
TANKS
TACO
REDUCING VALVE
1/4" CONN.
FOR VENT
COLD WATER
SUPPLY
FROM BOILER
OR CONVERTER
TACO
AIR
CONTROL
TO SYSTEM
TACO PUMP

Taco **Instruction Sheet**

302-007

Multi-Purpose Valve (MPV)

Plant I.D. No. 001-920

APPLICATION:

The Taco Multi-purpose Valve is a quarter turn, non-lubricated shut-off valve, flow control valve, non-slam check valve and flow meter, all-in-one. The MPV can be used as a service valve in either direction. The valve stem is sealed with dual O-rings and does not need any adjustment. The standard seals are ethylene propylene. DO NOT USE IN SYSTEMS THAT CONTAIN HYDROCARBONS. Consult factory for other seal compounds.

Operating limits: 175 psi cold water, 125 psi at 250°F.

INSTALLATION:

1. Vertical flow up in direction of arrow.
2. Horizontal – flow with direction of arrow.

   Valve may be rotated around the pipe centerline looking at the inlet and stem vertical: 20° clockwise or 160° counter-clockwise.
3. If flow meter feature is to be used, install at least 10 diameters of straight pipe, sized to the MPV, upstream of valve and at least 5 diameters of straight pipe downstream of MPV.
4. Place the MVP in a position which provides for convenient connection of the hoses from the differential pressure gage.
5. Remove plastic threat protectors from the HI and LO meter connections and install brass valves supplied with MPV.
6. Once flow rate has been set, the memory clamp may be set by rotating clockwise, looking at stem, against the stop. This will prevent anyone from changing the setting. The memory clamp can be rotated counter-clockwise against the stop, which will allow the valve to be reset to its original setting if valve has to be closed at any time.

FLOW METER OPERATION:

1. Remove caps from the valves at the HI & Lo pressure taps.
2. Connect the high pressure hose (red) of the differential pressure gage to the upstream of HI pressure connection on the MPV and the low pressure hose (green) to the downstream of LO pressure connection. Note: Hose ends to be connected require valve depressors. Check opposite end of hose if not visable inside hose end. Valves are opened automatically as the hose end is screwed on.
3. Prepare the differential pressure gage as per instructions in Gage Kit.
4. The flow can be determined by reading the differential pressure indicated at the gage, noting the valve opening from the scale and pointer and transferring this data to the Flow Chart (published separately).
5. When flow readings are complete, follow directions supplied with differential pressure gage.
6. Replace metal caps on valves at the HI and LO pressure taps.

Quality Through Design — COMPARE.

TACO INC., 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone (401) 942-8000 Telex: 92-7627
TACO (Canada) Ltd. 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 Telephone (416) 625-2160 Telex: 06-961179

Peabody E .rnes

1/3 Horsepower

Automatic Submersible Sump Pump

Model CPS 33

• MIL-P-16077

LISTED

Not recommended for swimming pools

For basement drainage and general dewatering with capacity to 2880 gallons per hour

- Competitively priced, easily installed, high performance sump pump designed for installation in pits as small as 12 inches in diameter × 16 inches deep.
- Energy efficient 1/3 HP, 3.1 amps, 115 volt: 60Hz single phase motor with permanent capacitor and stainless steel shaft.
- Controlled by unique, magnetically controlled micro-switch designed for thousands of on-off cycles.
- Motor and micro-switch enclosed in high-impact rust and corrosion resistant fiber-glass reinforced polypropylene housing.
- Motor housing is completely sealed from pump with three lip seals running in an oil filled chamber.

Pump Characteristics

TOTAL HEAD (IN FEET)	FLOW RATE GPM	GPH
0	48	2880
5	46	2760
10	40	2400
15	30	1800
20	20	1200

Peabody Barnes

Peabody Barnes Model CPS 33 Submersible Sump Pump.

Outstanding Features

- Fiberglass reinforced polypropylene motor and pump housing can't rust, resists corrosive materials.
- Completely sealed magnetic switch. Eliminates possibility of water leakage into the pump housing. As the float rises, a magnet in the float assembly activates the micro-switch mounted inside the motor housing.
- Three lip seals running in an oil-filled chamber completely seal the motor from the pump. Seals never run dry. The oil lubricated seals eliminate damage if the pump runs dry or when the pump is started after long periods of inactivity (dry weather).
- Easily converted from automatic to manual operation.
- Easy to clean. Removable strainer passes solids to 3/8 inch diameter, provides quick access to impeller and impeller housing.

Specifications

Motor: 1/3 HP, 115 volt, 60 Hz, 3.5 amp, single phase with permanent capacitor.

Power Cord: 8 foot with grounded plug is standard. 25 foot cord available as option.

Motor Shaft: Stainless steel

Housing: Unitized, one-piece, 30% fiberglass reinforced polypropylene.

Screen: Removable for cleaning.

Discharge: 1 1/4 inch NPT female coupling standard. 1 1/2 inch NPT female coupling available as option.

Solid Handling: Handles solids to 3/8 inch diameter.

Micro-Switch: Magnetically activated, internally mounted in the motor housing. Controlled by external float. Easily converted to manual operation.

Automatic Pump Down: ON 9 inches, OFF 4 inches.

Manual Pump Down: 1 1/2 inches.

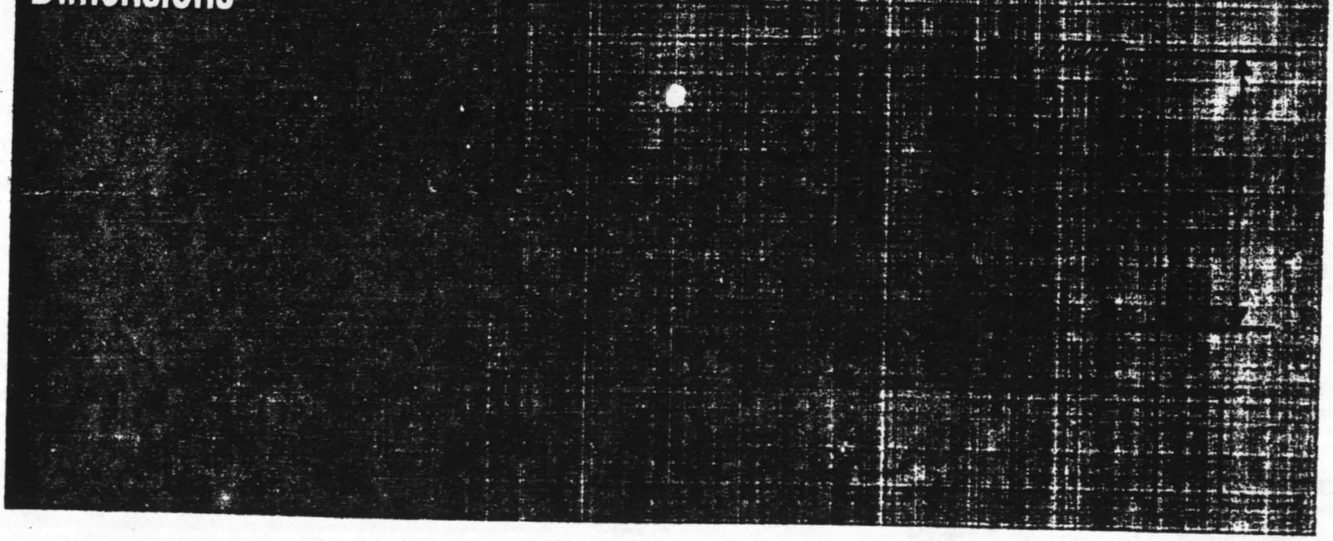
Dimensions: Pump - 6 inches × 12 inches, pump with float - 10 inches × 12 inches.

Weight: 9.5 pounds.

Warranty: One year limited warranty.

Listed by Underwriters Laboratory

Dimensions



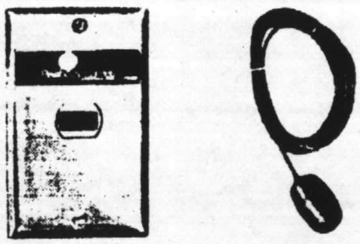
Peabody Barnes

Peabody Barnes, Inc., 651 N. Main St., Mansfield, OH 44902 (419) 522-1511

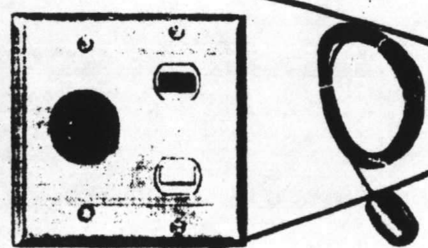
Form CPS33-5M-3/86

SECTION	17
PAGE	20
ISSUED	10/85
SUPERSEDES	

Alarms



61486-High Water Alarm. Includes stainless steel wall plate with red jewel light, and one mercury level control with 10' of 18/2 cord.



~~61487-High Water Alarm (Solid State). Includes stainless steel wall plate, audible and visual alarm with silencer button and one mercury level control with 10' of 18/2 cord. NOTE: Above alarm is flush mounted. Surface mounted alarm is available. Consult factory.~~

TAB PLACEMENT HERE

DESCRIPTION:

NO CONTENTS

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Chet Adams Company

Sales Engineers

HEATING AIR CONDITIONING EQUIPMENT VENTILATING

AIR POLLUTION SYSTEMS ENERGY CONSERVATION

August 10, 1987

MAINTENANCE AND OPERATING INSTRUCTIONS

Project: Combat Vehicle Maintenance Shop
Camp Lejeune, NC

Contractor: Sneeden, Inc.
Wilmington, NC

P.O.# 239

Architect: G. Milton Small & Associates

Engineer: D. Y. Perry and Associates

Sales Rep: Chet Adams Company
Cary, NC

Manufacturer: Ilg Industries
Vent Products Co., Inc.

FANS & INTAKE VENTS

EF-2 — 1 - CRF 135 Centrifugal direct drive PRV, 1060 CFM @ .4" SP, 1/5 HP, 120/1/60 with birdscreen, backdraft damper, speed control, disconnect, and prefab curb.

EF-3,5,8,10 — 4 - CRB 30 Centrifugal belted PRV, 6735 CFM @ .4" SP, 2 HP, 208/3/60 with birdscreen, backdraft damper, disconnect, and prefab curb.

EF-6 — 1 - CWF 100 Centrifugal direct drive wall exhaust fan, 230 CFM @ 1/2" SP, 1/10 HP, 120/1/60 with birdscreen, backdraft damper, speed control and interior wall grille.

EF-7&17 — 2 - CWF 122 DITTO EF-6 except 710 CFM @ 1/2" SP, 1/8 HP, and DOES NOT include speed control.

EF-11 — 1 - CRF 100 DITTO EF-1 except 230 CFM @ .4" SP,1/10 HP.

EF-12 — 1 - CRF 100 DITTO EF-1 except 350 CFM @ .4" SP, 1/10 HP, and speed control NOT NEEDED.

EF-13 — 1 - CRF 122 DITTO EF-1 except 725 CFM @ .4" SP, 1/8 HP.

Chet Adams Company

Sales Engineers

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Cary, NC

Manufacturer: Ilg Industries
Shipman Industries

FANS - ILG INDUSTRIES

EF-14 1 - CRB 18 Belt driven PRV, 1710 CFM @ .75" SP, 987 RPM, 1/2 HP, 115/1/60, with birdscreen, backdraft damper, disconnect and prefab curb.

EF-15 1 - CRF 82 Direct drive centrifugal PRV, 160 CFM @ .2" SP, 1/25 HP, 1250 RPM, 115/1/60, with birdscreen, disconnect, backdraft damper, speed control and prefab curb.

EF-16 1 - CRB 24 DITTO EF-14 except 3600 CFM @ .325" SP, 3/4 HP, 208/3/60.

INTAKE VENTS - SHIPMAN INDUSTRIES & VENT PRODUCTS CO., INC.

2 - 34" x 34" Throat S-RV-1 intake vent, aluminum construction, birdscreen, curb and low leakage motor operated damper with 115/1/60 two position operator.

2 - 12" x 12" Throat S-RV-1 DITTO.

CARY, N.C. 27511 Box 5218 919/851-6331 | GREENSBORO, N.C. 27402 Box 3073 919/273-0566 | CHARLOTTE, N.C. 28299 Box 9158 704/375-4483 | COLUMBIA, S.C. 29210 16 Nob Hill Road 803/798-0602 | CHARLESTON, S.C. 29412 1058 Fort Sumter Dr. 803/762-1045

STANDARD TERMS AND CONDITIONS OF SALE

No provision, term or condition of Buyer's order which is inconsistent with, different from or in addition to Seller's terms and conditions shall be binding upon Seller unless expressly agreed to in writing and signed by a duly authorized representative of Seller. Seller shall not be obligated to Buyer in any way until written acceptance of Buyer's order is made by Seller's duly authorized representative at its offices: 2850 North Pulaski Road, Chicago, Illinois. Seller's quotation shall be considered as an invitation to trade and shall not be construed as an offer to contract. The equipment and products described are herein referred to as the "goods."

PRICE

1. Prices are F.O.B. point of shipment.
2. Prices set forth on Seller's quotation are firm for a period of thirty (30) days from the date of the quotation. In the event of any changes in specifications indicated by Buyer's purchase order, Seller may adjust the price to cover such changes.
3. If, at Buyer's request, shipment is extended beyond six (6) months from date of Seller's written quotation, Seller may increase the stated price of the unshipped goods one percent (1%) per month.
4. Prices of goods not manufactured by Seller are at all times subject to revision to reflect price increases by Seller's suppliers.
5. All prices are subject to the addition of any Federal, State or local taxes which may be applicable to the sale, purchase, delivery, storage, use or processing of the goods sold. Any such tax shall be due and payable to Seller at or before the time the tax is payable by Seller to the taxing authority, or in lieu thereof, Buyer may provide Seller with a tax exemption certificate acceptable to the taxing authority.

PAYMENT TERMS

1. Terms of payment are thirty (30) days net from date of invoice, no discounts, unless otherwise specified.
2. Interest at the rate of one and one-half percent (1.5%) per month (18% per annum), or the maximum lawful rate allowable, will be charged, whichever is less, on all past due invoices.
3. No payments made to representatives or agents will be valid. Payments shall be made directly to Seller, at its home office, Chicago, Illinois.
4. Minimum billing for any goods sold by the Seller shall be $25.00 net, exclusive of all transportation.
5. Pro rate retainage fees or back charges will not be accepted by Seller. Collection of such deductions from payments will be enforced at Buyer's expense.
6. Seller shall not be liable for any liquidated damages or penalties whatsoever unless otherwise agreed to in writing.
7. Seller reserves the right to require full payment in advance of shipment, posting of security for payment, or other payment arrangements when in Seller's judgment, open billing terms are not acceptable.

DELIVERY AND ACCEPTANCE

1. Delivery dates are estimated by Seller and are not guaranteed.
2. Shipments shall be made by the method or carrier deemed most feasible by Seller and Seller reserves the right to ship all or part of the goods from any shipping point other than the points specified herein.
3. Risk of loss or damage passes to the Buyer upon delivery of the goods to the carrier at point of shipment.
4. Buyer shall inspect all goods upon receipt. If Buyer rejects all or part of the goods, Buyer shall give Seller written notice of rejection, specifying the reasons therefore within five (5) days after receipt of the goods. In the event Buyer does not so notify Seller, Buyer shall be deemed to have accepted the goods.

WARRANTY AND LIMITATIONS OF LIABILITY

SELLER WARRANTS THAT THE GOODS SHALL BE FREE FROM DEFECTS IN MATERIALS OR WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF INITIAL INSTALLATION OR FOR A PERIOD OF EIGHTEEN (18) MONTHS FROM DATE OF SHIPMENT, WHICHEVER PERIOD FIRST EXPIRES. NO WARRANTY IS MADE OR OFFERED WITH RESPECT TO ANY PROTECTIVE COATINGS APPLIED TO THE GOODS. SELLER'S WARRANTY OBLIGATIONS WITH RESPECT TO GOODS NOT MANUFACTURED BY SELLER SHALL NOT EXCEED THE OBLIGATIONS UNDERTAKEN BY THE MANUFACTURER THEREOF UNDER EXPRESS WARRANTY TO SELLER.

If, in Buyer's judgment, the goods do not meet the warranties expressed above, and the Buyer notifies Seller of the defect within a reasonable time after discovery of the defect and within the warranty period, Seller agrees to correct the defect by repairing or replacing, F.O.B. point of manufacture, any parts or components of the goods determined by Seller to be defective, or at its option by issuing credit for the defective parts or components. Seller shall not be liable for labor or other charges, costs or expenses related to the removal, shipping, handling, installation or re-installation of any goods or components.

THE EXPRESS WARRANTIES SET FORTH ABOVE ARE GIVEN BY SELLER IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IT IS EXPRESSLY AGREED THAT BUYER'S EXCLUSIVE REMEDY AND SELLER'S LIABILITY SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF, OR THE ISSUANCE OF CREDIT FOR, DEFECTIVE PARTS OR COMPONENTS.

SELLER EXPRESSLY DISCLAIMS ANY AND ALL LIABILITY FOR AND SHALL NOT BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES RESULTING FROM OR ARISING FROM OR OUT OF DEFECTIVE GOODS, SELLER'S NEGLIGENCE, BREACH OF WARRANTY, BREACH OF CONTRACT, ANY TORT, OR CLAIMS BASED UPON STRICT LIABILITY OF THE SELLER. IN NO EVENT SHALL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES OR LOSSES COMMERCIAL IN NATURE.

NUCLEAR USE

1. Buyer covenants, represents and warrants that neither Buyer nor any third party shall use, re-sell or otherwise dispose of any goods or part thereof in connection with any activity or process involving nuclear fission or fusion or any use or handling of any source, special nuclear or by-product material, as those materials are defined in the U.S. Atomic Energy Act of 1954 (as amended), without Seller's prior written consent, and until such time as Buyer, or such third party, at no expense to Seller, shall have arranged for insurance coverage, indemnities, and waivers of liability, recourse and subrogation, all acceptable to Seller, and all fully adequate in the opinion of Seller, to protect Seller (and its subcontractors and suppliers) against liability of any kind whether in contract, tort (including negligence), strict liability or otherwise. The aforesaid covenants, representations and warranties shall survive this contract and sale.
2. Seller shall not be obligated to deliver the goods until such insurance, indemnities and waivers have been procured and are legally operative in Seller's favor. Buyer's failure to comply with any provisions of this paragraph entitled "Nuclear Use" shall be cause for Seller to cancel this contract without liability to Seller, and pursue any remedies provided in law or equity by this contract, the Uniform Commercial Code, or otherwise.

EXCUSABLE DELAY

Seller shall not be deemed to be in default on account of delays in the delivery of goods or in the performance of this contract or any other act to be performed by Seller due to any of the following causes: acts of God; acts of Buyer; insurrections or riots; fires; floods; explosions; earthquake or serious accidents; epidemics or quarantine restrictions; any act of government affecting prices, fuels, materials, facilities or completed goods; strikes, labor troubles causing cessation, slow-down or interruption of work; shipment delays; inability to obtain materials, fuel, accessories, manufacturing facilities, transportation, equipment or parts; any other cause to the extent it is beyond Seller's control.

TERMINATION AND RETURNED GOODS

1. Termination of the order by Buyer, or any part thereof, will not be effective unless agreed to in writing by Seller. Accepted terminations will be subject to all charges incurred by Seller for material consumed, work performed and all other expenses incurred to the date of acceptance.
2. Goods accepted for return and credit are subject to a twenty percent (20%) charge for handling and/or reconditioning, unless otherwise agreed by Seller. Transportation charges for returned goods must be prepaid by Buyer. Before returning goods Buyer must obtain Seller's authorization, and attach Seller's "Return Material Tag" to all shipments. Notice of shipment must be given to Seller on the day of shipment and Buyer must furnish a copy of the Bill of Lading, order number and invoice date.
3. Goods manufactured specifically to order or to specifications of Buyer may not be returned for credit. Changes requested by Buyer in non-stock goods after commencement of manufacturer will be subject to a revision in price to reflect additional costs.
4. Use of materials, parts or equipment furnished by Buyer will subject the order to termination without any liability on the part of Seller if the said materials, parts or equipment are defective or will not perform to Seller's requirements. However, Buyer shall be liable to pay Seller's costs and expenses through date of termination.

PATENTS AND TRADEMARKS

Seller shall indemnify the Buyer against liability for infringement of any United States Letters Patent arising out of the manufacture, sale or use of any of Seller's goods furnished, provided that the Buyer shall promptly notify Seller of any such claim and give Seller the opportunity to defend against such claim. The Buyer shall be responsible for all such loss when a particular process or system, or the goods of a particular manufacturer or manufacturers is specified, or when infringement is incurred by employing the furnished Seller's goods in combination with other parts or goods. All drawings and data furnished by Seller shall remain its property and shall be returned to Seller upon request.

DEVELOPMENT CHANGES, DESIGN AND SPECIFICATIONS

1. Changes in design or specifications may be made at Seller's discretion and Seller has no obligation to incorporate such changes in goods manufactured prior to the change.
2. Seller may furnish Buyer with goods which have been subject to changes in design or specifications provided such changes do not adversely affect price, delivery, or any guaranteed performance of the goods or make unusable or obsolete any other item of goods furnished to Buyer under this contract.
3. All drawings, instructions and/or technical and engineering services which Seller may furnish with respect to installation or use of the goods are furnished solely for the review and approval of the Buyer. Seller makes no representation or warranty with respect to the accuracy or sufficiency of any such information and disclaims all liability in connection with their use or application.
4. Seller reserves the right to correct any factory, engineering, clerical or stenographic errors or omissions which may appear upon review and verification of data referred to in Seller's quotation, or Buyer's order

COMPLIANCE WITH LAWS

No representation or claim is made regarding compliance with the Occupational Safety and Health Act of 1970, or its amendments, or any other federal, state or local laws, ordinances, codes, rules or regulations which may apply to the goods or their installation.

GOVERNING LAW AND SEVERABILITY

1. This agreement shall be governed in all respects by the law of Illinois.
2. This contract shall be binding upon and shall inure to the benefit of the parties, their successor and assigns.
3. If any provision or term herein is found to be invalid or unenforceable as a matter of law or by public policy, it shall be considered to be severed from the remainder of the terms and conditions which shall remain in full force and effect.

ILG

A CHECK IN THE APPROPRIATE SQUARE INDICATES THE TYPE OF BEARINGS USED IN THE MOTOR POWERING THIS EQUIPMENT

GENERAL INSTRUCTIONS FOR FAN MOTORS

☐ RELUBRICATABLE BALL BEARINGS - An instruction tag from the manufacturer is included with the motor and the recommendations contained therein should be followed.

☐ SEALED BALL BEARINGS - The bearings are factory-packed with a general purpose bearing lubricant and require no further attention. The life of the grease is dependent upon the number of operating hours and temperature. Under normal conditions of operation (8 hours per day, 5 days per week and average ambient temperature of 80 deg. F) the expected grease-life will be approximately seven years. The life may be greater or less depending upon the enclosure of the motor, RPM, type of mounting, variation in ambient temperature and operating duty cycle. In terms of hours of operation, expected life may be stated as approximately 30,000 hours for open motors and 20,000 hours for enclosed motors when working in an average ambient temperature of 80 deg. F.

☐ SEALED SLEEVE BEARINGS - Bearings of this type are provided with a large lubricant reservoir and require no attention. Because of the extremely light loads on motors with this type of bearing, the life will compare favorably with larger motors having sealed ball bearings.

☐ RELUBRICATABLE SLEEVE BEARINGS - The bearing is essentially the same as the sealed sleeve bearing with the exception that it may be relubricated to secure extended life. To obtain maximum life, 5 or 6 drops of SAE20 Motor Oil or Electric Motor Bearing Oil should be added after every 1,000 hours of operation.

NOTE: THE STATEMENTS REGARDING EXPECTED LIFE DO NOT CONSTITUTE A GUARANTEE, EXPRESSED OR IMPLIED - BUT SERVE ONLY AS AN INDICATION OF WHAT MAY BE EXPECTED OF THE EQUIPMENT. (REFER TO STANDARD TERMS AND CONDITIONS OF SALE.)

GENERAL NOTES REGARDING FAN EQUIPMENT

1. OVERLOAD PROTECTION - Some motors are provided with built-in overload protection. This fact is so noted on the Motor Rating Plate. If the motor does not contain built-in overload protection, it is mandatory that this protection be provided by starters in the motor circuit. The starters are to be equipped with overload protection devices of a rating suitable for the current rating of the motor.
2. PERIODIC CLEANING - Periodic cleaning of all fan equipment is strongly recommended. Dirt and grease accumulations on the impeller cause vibration which greatly increases stresses and loads on the motor bearings. A program of preventive maintenance will greatly increase fan and motor life.
3. CHECKING DIRECTION OF ROTATION - Care should be taken to insure the proper direction of rotation. This is particularly true in the case of centrifugal type roof ventilators. This type of equipment will deliver air when running in either direction; however, the load is greatly increased when operation is in the wrong rotation. This is a very common cause of overload tripping in centrifugal type roof ventilators. When this trouble is experienced, try reversing fan rotation before increasing the size of the overload protection.
4. MOTOR OVERLOAD - Forward-curve and radial-bladed fans consume maximum horsepower at 0 in. Static Pressure. Some fans of this type are powered so that operation at 0 in. Static Pressure will overload the motor. Check Catalog Ratings to determine minimum Static Pressure operation if overloading is experienced with this type of equipment.
5. CHECKING RUNNING CLEARANCE - To achieve maximum performance and efficiency, fans are precision-built machines. Upon occasion, parts will shift slightly due to mishandling in shipment. This can cause binding of the rotating assembly. Before placing any fan in operation, the impeller should be turned by hand to ensure that no binding or interference is present.

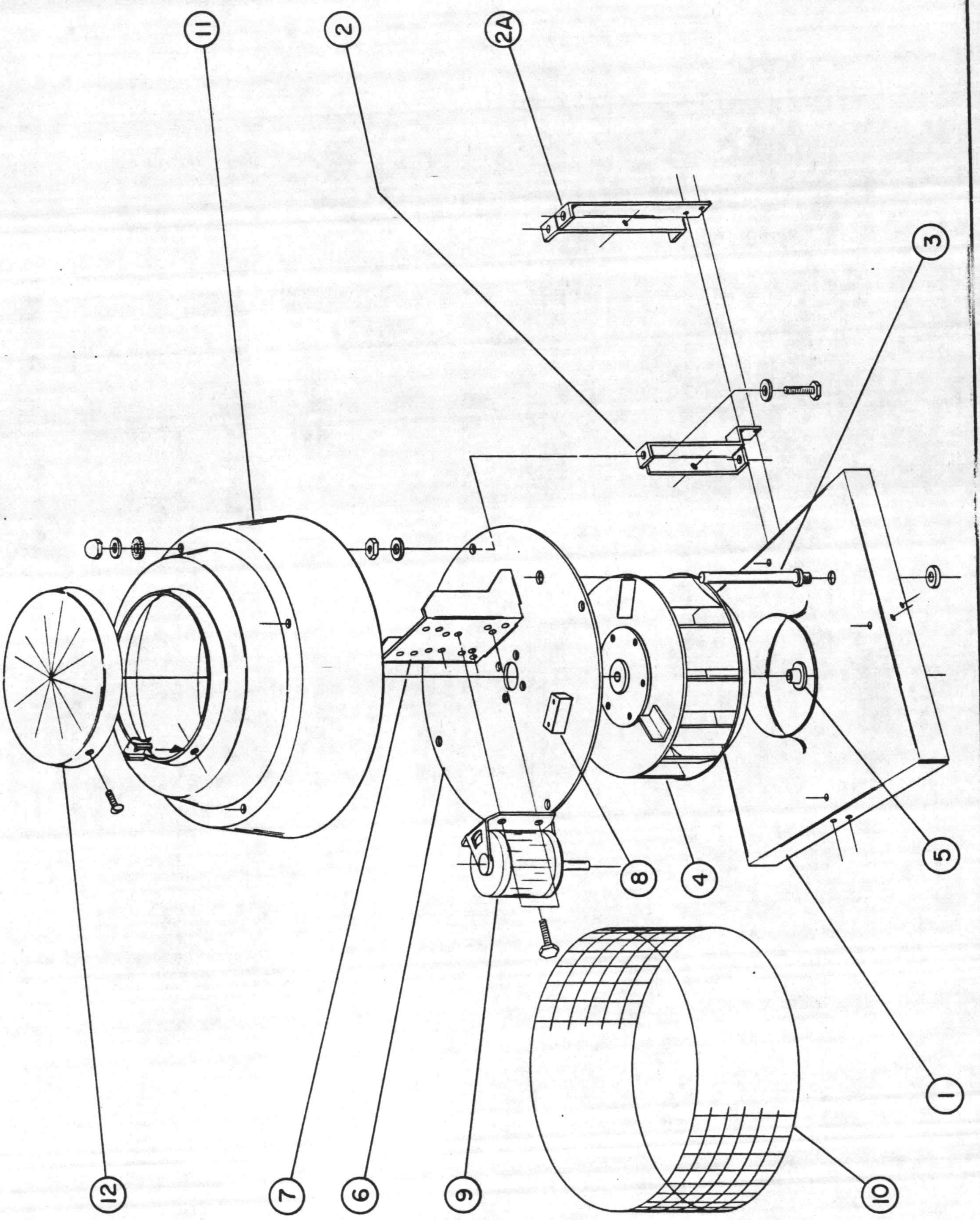
ILG INDUSTRIES INC. 2850 North Pulaski Road, Chicago, Illinois 6064

AN 23741-1

CRF 122 TO 150 ROOF VENTS.
—BASE MOUNTED MOTORS—

ILG

DRAWN BY: AL. LUTZ
DATE: MAY 1985
APPROVED BY: G.R.I.



DRAWN		REV.		
LUTZ		1	CREATED	MAY 1985
CHECKED				
				SHEET 2 OF 2
DATE MAY 1985			CRF 122 TO 150 ROOF VENTS.—BASE MOUNTED MOTORS—	AN 23741-1

CRF 122 TO 150 ROOF VENTS.—BASE MOUNTED MOTORS—

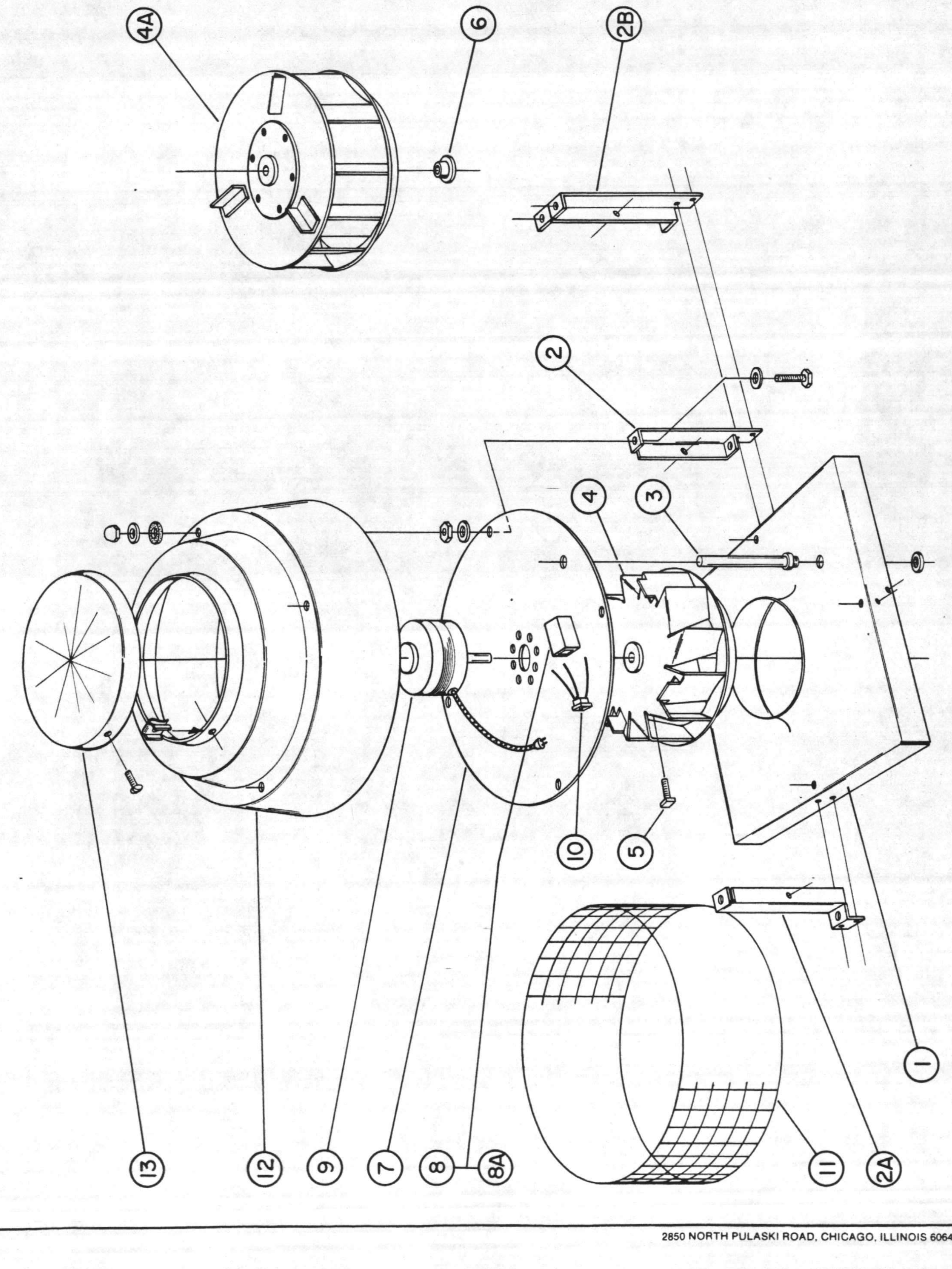
NO.	NAME OF PART		122	135	150
			PART NO.		
1	INLET BASE	CN 21147	2112-1807B	2113-1807B	2115-1805B
2	MOTOR SUPPORT		A2112-5214A	———	———
2A	BRACKET		———	A2113-5210A	
3	CONDUIT & CONNECTOR		A2112-0412A	A2113-0405A	
4	WHEEL		B2112-9406C	———	———
	ASSEMBLY	CN 23417	———	2113-9311B	2115-9306C
5	BUSHING	½″ BORE	———	8000-0107	8000-0107
		⅝″ BORE	8000-0108	8000-0108	8000-0108
		⅞″ BORE	———	———	8000-0109
6	MOTOR PLATE		C2112-1117A	C2113-1115B	
7	MOTOR MOUNT		C2112-1116B		
8	DISCONNECT SWITCH SELECTION SHT.		AN 16512		
9	MOTOR		AS SPECIFIED		
10	BIRDSCREEN	BN 20461	8500-4807		
11	ROOF	CN 20448	2112-2412B	2113-2406B	
12	DOME		B2106-2413B		

AN 23740-1

ILG

CRF 67 TO 150 ROOF VENTS.
—FACE MOUNTED MOTORS—

DRAWN BY: AL. LUTZ
DATE: MAY 1985
APPROVED BY: G.R.I.



2850 NORTH PULASKI ROAD, CHICAGO, ILLINOIS 60641

DRAWN		1	CREATED	MAY 1985
LUTZ				
CHECKED				
DATE MAY 1985				

SHEET 2 OF 2

CRF 67 TO 150 ROOF VENTS. —FACE MOUNTED MOTORS—

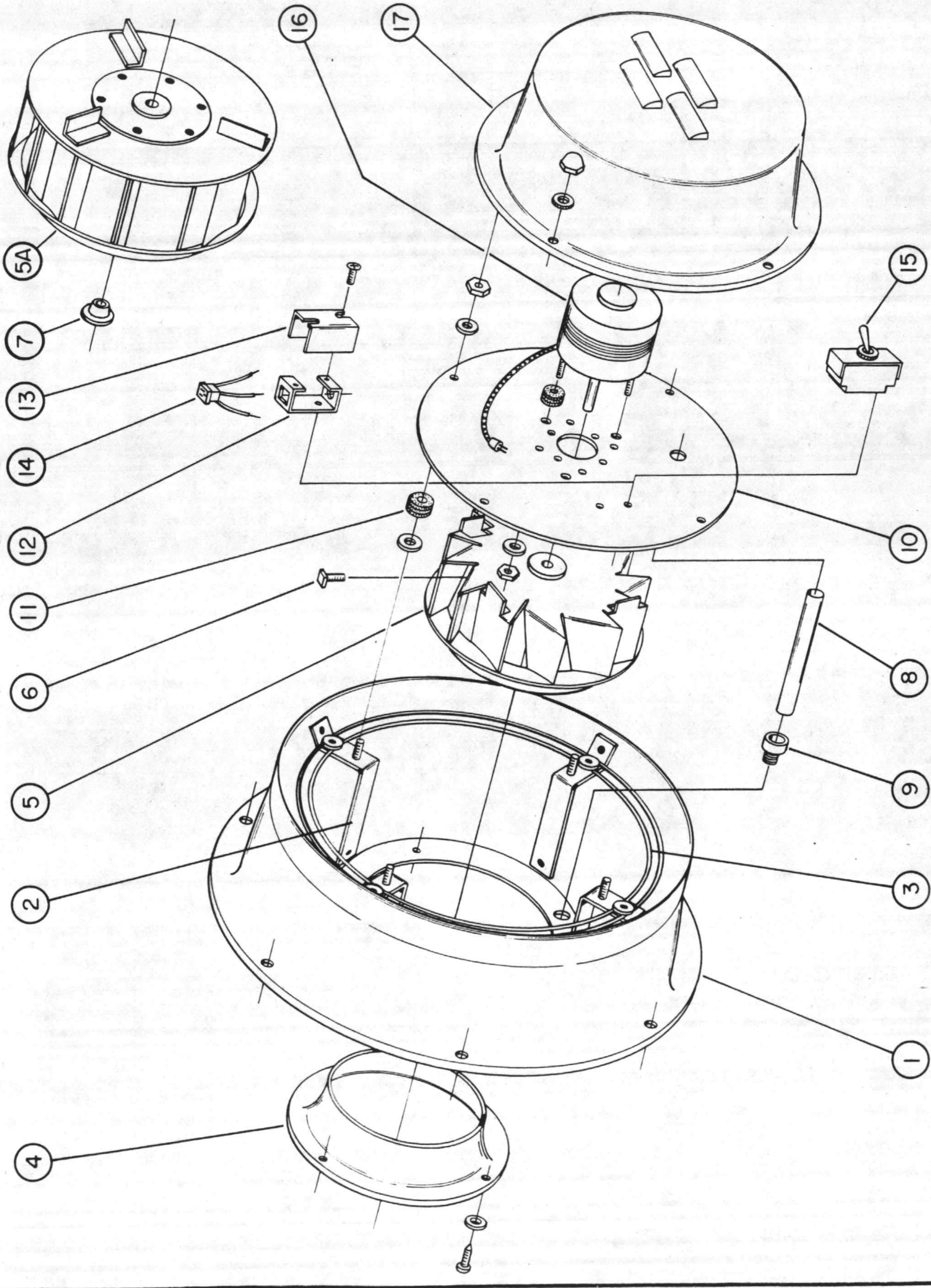
AN 23740-1

<table>
<tr><th></th><th></th><th></th><th>67</th><th>82</th><th>100</th><th>122</th><th>150</th></tr>
<tr><th>NO.</th><th colspan="2">NAME OF PART</th><th colspan="5">PART NO.</th></tr>
<tr><td>1</td><td>INLET BASE</td><td>CN 21147</td><td>2106-1803B</td><td>2108-1803B</td><td>2110-1803B</td><td>2112-1807B</td><td>2115-1805B</td></tr>
<tr><td>2</td><td rowspan="3">MOTOR SUPPORT BRACKET</td><td></td><td colspan="3">A2106-5206A</td><td>—</td><td>—</td></tr>
<tr><td>2A</td><td></td><td>—</td><td>—</td><td>—</td><td>A2112-5214A</td><td>—</td></tr>
<tr><td>2B</td><td></td><td>—</td><td>—</td><td>—</td><td>—</td><td>A2113-5210A</td></tr>
<tr><td>3</td><td>CONDUIT & CONNECTOR</td><td></td><td colspan="3">A2106-0405A</td><td>A2112-0412A</td><td>A2113-0405A</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">WHEEL ASSY.
AN 16771</td><td>5/16" BORE</td><td>2106-9010B</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>3/8" BORE</td><td>—</td><td>2108-9006A</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>1/2" BORE</td><td>2106-9011B</td><td>2108-9005A</td><td>2110-9005B</td><td>—</td><td>—</td></tr>
<tr><td rowspan="2">4A</td><td rowspan="2">WHEEL ASSY.</td><td>—</td><td>—</td><td>—</td><td>—</td><td>B2112-9406C</td><td>—</td></tr>
<tr><td>CN 23417</td><td>—</td><td>—</td><td>—</td><td>—</td><td>2115-9306B</td></tr>
<tr><td>5</td><td>SET SCREW, SQ. HD.</td><td></td><td colspan="3">1/4-20 × 3/4"</td><td>—</td><td>—</td></tr>
<tr><td>6</td><td>BUSHING</td><td></td><td>—</td><td>—</td><td>—</td><td colspan="2">8000-0107</td></tr>
<tr><td>7</td><td>MOTOR PLATE</td><td></td><td colspan="3">C2106-1107A</td><td>C2112-1117A</td><td>C2113-1115B</td></tr>
<tr><td>8</td><td>OUTLET BOX & COVER</td><td></td><td colspan="3">A2106-1601B & A9919-1700A</td><td>—</td><td>—</td></tr>
<tr><td>8A</td><td colspan="2">DISCONNECT SWITCH SELECTION SHT.</td><td>—</td><td>—</td><td>—</td><td colspan="2">AN 16512</td></tr>
<tr><td>9</td><td>MOTOR</td><td></td><td colspan="5">AS SPECIFIED</td></tr>
<tr><td>10</td><td colspan="2">RECEPTACLE & TERMINAL ASSY.</td><td colspan="3">AN 21152</td><td>—</td><td>—</td></tr>
<tr><td>11</td><td>BIRDSCREEN</td><td>BN 20461</td><td colspan="5">8500-4807</td></tr>
<tr><td>12</td><td>ROOF</td><td>CN 20448</td><td colspan="3">2106-2414B</td><td>2112-2412B</td><td>2113-2406B</td></tr>
<tr><td>13</td><td>DOME</td><td></td><td colspan="5">B2106-2413B</td></tr>
<tr><td></td><td></td><td></td><td colspan="5"></td></tr>
<tr><td></td><td></td><td></td><td colspan="5"></td></tr>
</table>

ILG

CWF 67 TO 122 CENT. WALL VENTS. —(FACE MOUNTED MOTORS)—

DRAWN BY: AL LUTZ
DATE: FEB. 1986
APPROVED BY: G.R.I.



2850 NORTH PULASKI ROAD CHICAGO, ILLINOIS 60641

DRAWN		SHEET 2 OF 2
LUTZ		
CHECKED		
DATE FEB. 1986	CWF 67 TO 122 CENT. WALL VENTS.—FACE MOUNTED MOTORS—	AN 23765-1

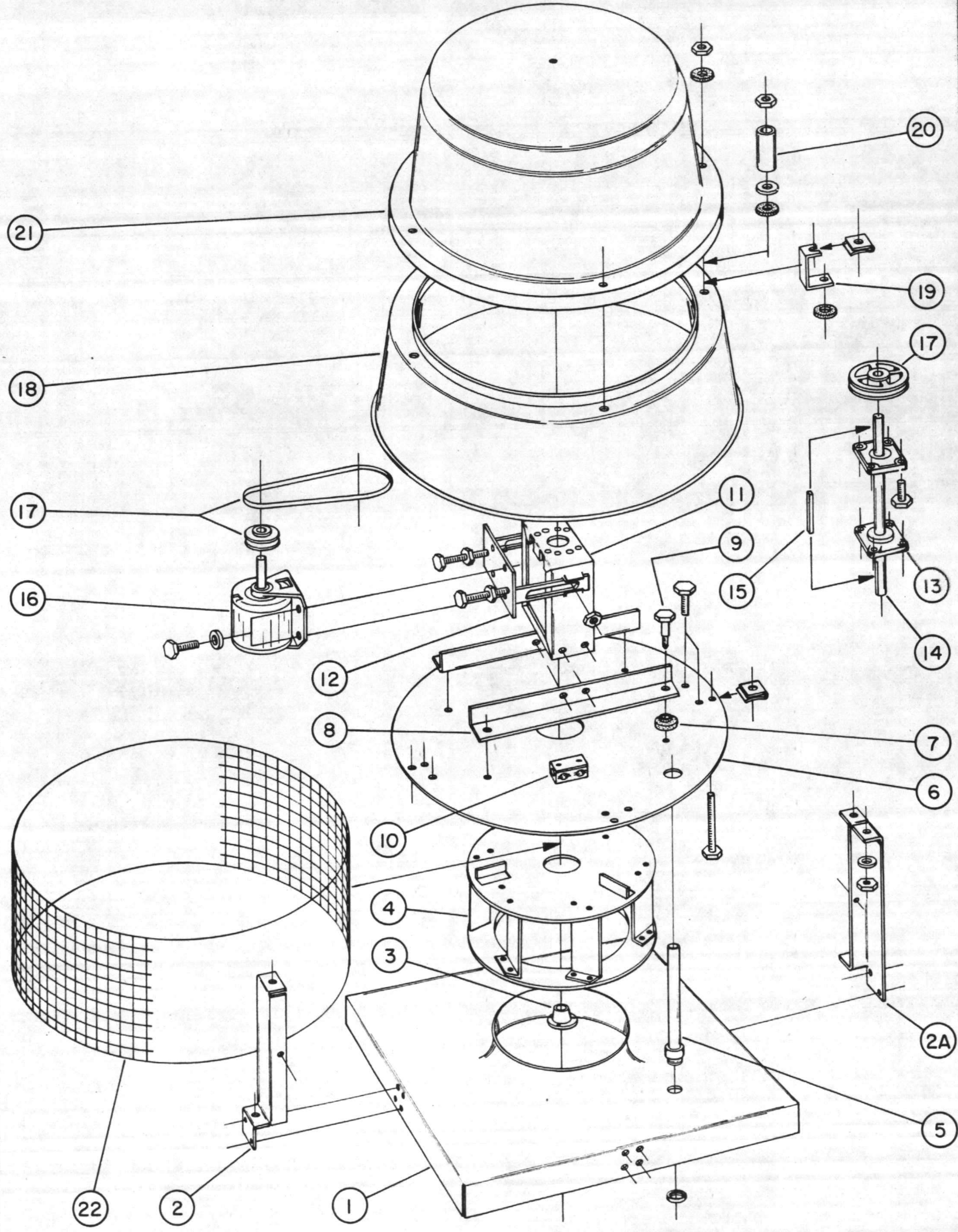
NO.	NAME OF PART		67	82	100	122
			PART NO.			
1	SKIRT	CN 12686	2106-1004B		2110-1003B	2112-1004A
2	MOTOR PLATE SUPPORT BRKT.		B2106-5302B		B2110-5301B	B2112-5308C
3	BIRD SCREEN		A2106-5201A		A2110-5200B	A2112-5202A
4	INLET CONE	BN 12397	2106-1003B	2108-1002B	2110-1003B	2112-1003B
5	WHEEL ASSY. AN 16771	5/16 BORE	2106-9010B	———	———	———
		3/8 BORE	———	2108-9006A	———	———
		1/2 BORE	2106-9011B	2108-9005A	2110-9005B	———
5A	WHEEL ASSY.		———	———	———	B2112-9406C
6	SET SCREW SQ. HD.		1/4-20 × 3/4" LG.			———
7	BUSHING		———	———	———	8000-0107
8	CONDUIT		8500 4217			A2112-0412A
9	CONDUIT CONNECTOR		8500 4052			8500-4053
10	MOTOR PLATE	CN 23381	2106-1108A		2110-1101A	C2112-1115A
11	GROMMET		8500-4729			———
12	OUTLET BOX		A2106-1601B			———
13	OUTLET BOX COVER		A9919-1700A			———
14	RECEPTACLE & TERMINAL ASSY.		AN 21152			———
15	DISCONNECT SWITCH		———	———	———	AN 16512
16	MOTORS		AS SPECIFIED			
17	ROOF	BN 12396	2106-2415A		2110-2402A	2112-2414A

AN 23736-1

CRB 12 TO 18 ROOF VENTILATOR

ILG

DRAWN BY: AL. LUTZ
DATE: FEB. 1985
APPROVED BY: G.R.I.



DRAWN	LUTZ
CHECKED	
DATE	FEB. 1985

I	CREATED	FEB. 1985

CRB 12 TO 18 ROOF VENTILATOR — PARTS CAT. DRG. AN 23736

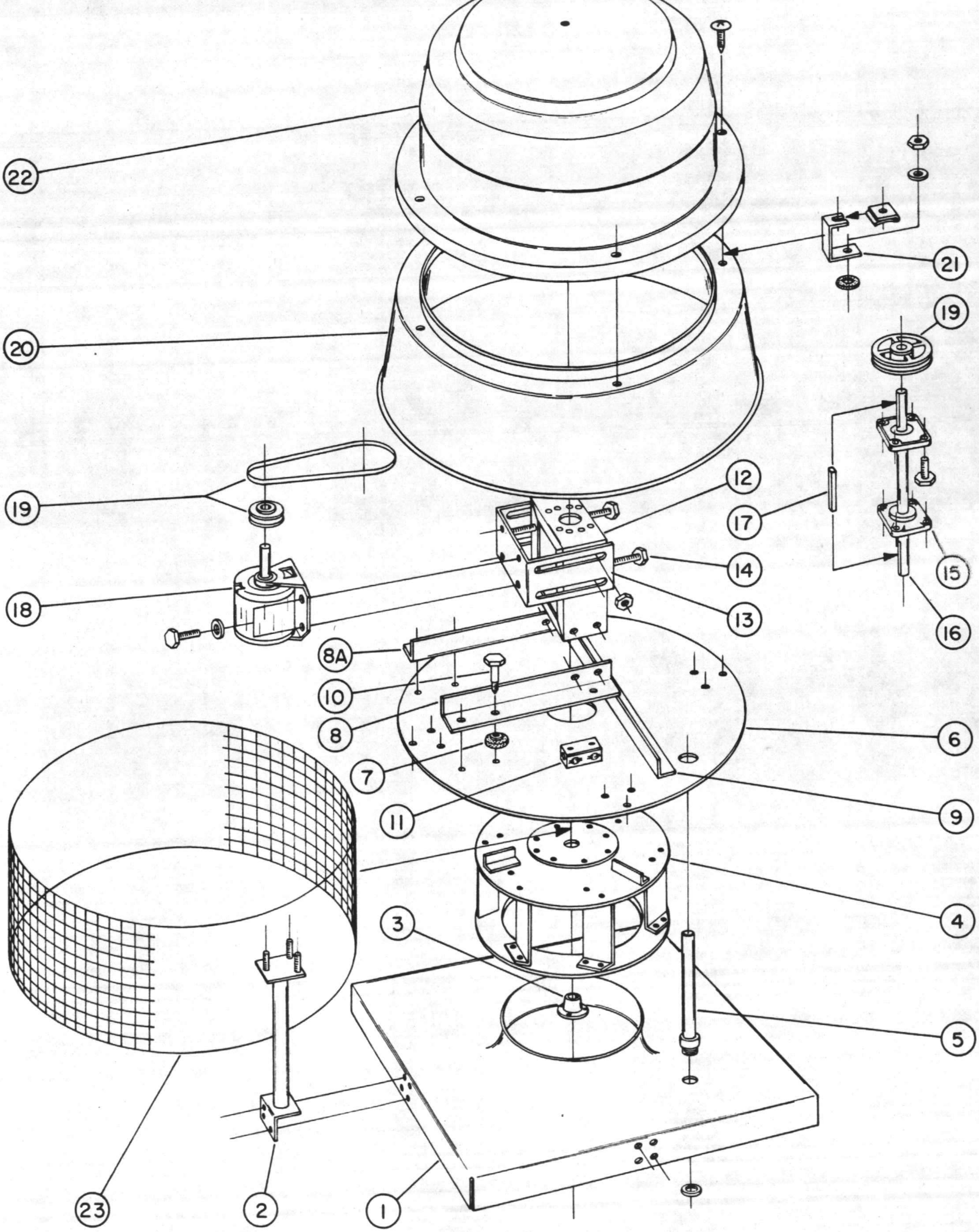
NO.	NAME OF PART		12	15	18
			PART NO.		
1	INLET BASE	CN 23462	2112-1808A	2115-1806A	2118-1802A
2	DISC SUPPORT BRACKET		A2112-5224A	A2115-5208A	—
2A	DISC SUPPORT BRACKET		—	—	A2118-5210A
3	BUSHING	CN 21851	8000-0063		
4	WHEEL ASSY.	CN 23457	2112-9306B	2115-9307B	2118-9304B
5	CONDUIT	AN 23446	2112-0413A	2115-0404A	2118-0401A
6	COMPARTMENT DISC	CN 23454	2112-2606A		2118-2602B
7	VIBRATION ISOLATOR		A8500-6325		
8	DRIVE PAK BASE		A2112-1121A		A2118-1113B
9	ISOLATOR SCREW		A7442-3037		
10	DISCONNECT SWITCH		AS REQUIRED		
11	BEARING FRAME		C2112-1120A		
12	MOTOR PLATE ASSY.		A2112-9032A		
13	BEARINGS	BN 23478	8000-1367		
14	SHAFT	BN 21131	2113-2500B		
15	KEY		7851-0004		
16	MOTOR		AS SPECIFIED		
17	DRIVE		AS REQUIRED		
18	ROOF SKIRT	BN 23449	2112-2415A		2118-2404B
19	ROOF SKIRT BRACKET		—	—	A2118-1114A
20	SPACER		A2112-1122A		—
21	ROOF		C2112-2413A		CN 23450 2118-2405A
22	BIRDSCREEN	AN 23445	2112-5223A	2115-5207A	2118-5204A

AN 23737-1

CRB 24 TO 44 ROOF VENTILATOR

ILG

DRAWN BY: AL. LUTZ
DATE: FEB. 1985
APPROVED BY: G.R.I.



DRAWN			
LUTZ	1	CREATED	FEB. 1985
CHECKED			

SHEET 2 TO 2

DATE FEB. 1985

CRB 24 TO 44 ROOF VENTILATOR — PARTS CAT. DRG.

AN 23737

NO.	NAME OF PART		24	30	36	44
			PART NO.			
1	INLET BASE	CN 23462	2124-1804A	2130-1804A	2136-1804A	2144-1802A
2	DISC SUPPORT ASSY.		BN 23448 2124-9027A	2130-9046A	2136-9024A	B2144-9028B
3	BUSHING	CN 21851	8000-0032		8000-0041	
4	WHEEL ASSEMBLY	CN 23457	2124-9307B	—	—	—
		AN 23481	—	2130-9308A	2136-9308A	2144-9303A
5	CONDUIT	AN 23446	2124-0402A	2130-0402A	2136-0400A	2144-0400A
6	COMPARTMENT DISC	CN 23455	2124-2606A	2130-2611A	2136-2611A	2144-2600A
7	VIBRATION ISOLATOR		A8500-6325			
8	DRIVE PAK BASE	R.H.	A2124-1117A	A2130-1102A	A2136-1103B	A2144-1101A
8A		L.H.	A2124-1118A	A2130-1103A	A2136-1104B	A2144-1102A
9	DRIVE PAK BASE ANGLE		—	—	B2136-1105A	B2144-5206A
10	ISOLATOR SCREW		A7442-3037			
11	DISCONNECT SWITCH		AS REQUIRED			
12	BEARING FRAME ASSY.		B2124-9025A		B2136-9023A	
13	MOTOR PLATE		C2124-1116A		C2136-1102A	
14	ADJUSTING BOLT ASSY.	AN 23567	2124-9026A	2130-9045A	2130-9045A	
15	BEARINGS	BN 23478	8000-1368		8000-1369	
16	SHAFT		BN 16907 1042-2500C	AN 21086 1642-2403B	BN 22316 5718-2503A	
17	KEY		7851-0034			
18	MOTOR		AS SPECIFIED			
19	DRIVE		AS REQUIRED			
20	ROOF SKIRT	BN 23449	2124-2404B	2130-2403B	2136-2400B	2144-2400A
21	ROOF SUPPORT BRACKET		A2124-1119A			
22	ROOF	CN 23450	2124-2405A	2130-2404A	2136-2401A	2144-2401A
23	BIRDSCREEN	AN 23445	2124-5210A	2130-5203A	2136-5203A	2144-5202A

SHIPMAN INDUSTRIES, INC.
530 RIEDLIN AVENUE
COVINGTON, KY. 41012
PHONE 1 (606) 581-2400

SHIPMAN INDUSTRIES RESERVES THE RIGHT TO SUBSTITUTE MATERIAL OR CHANGE PRODUCT SPECIFICATIONS

DATE OF SUBMITTAL- 3-3-87

MODEL - S(E)RV-1 ROOF VENTILATOR - CUSTOMER ORDER NO.-

CUSTOMER:
Sneeden, Inc.
Wilmington, NC

PROJECT:
Combat Vehicle Maintenance Shop
Camp Lejeune, NC

SHIP TO:

ARCHITECT: G. Milton Small

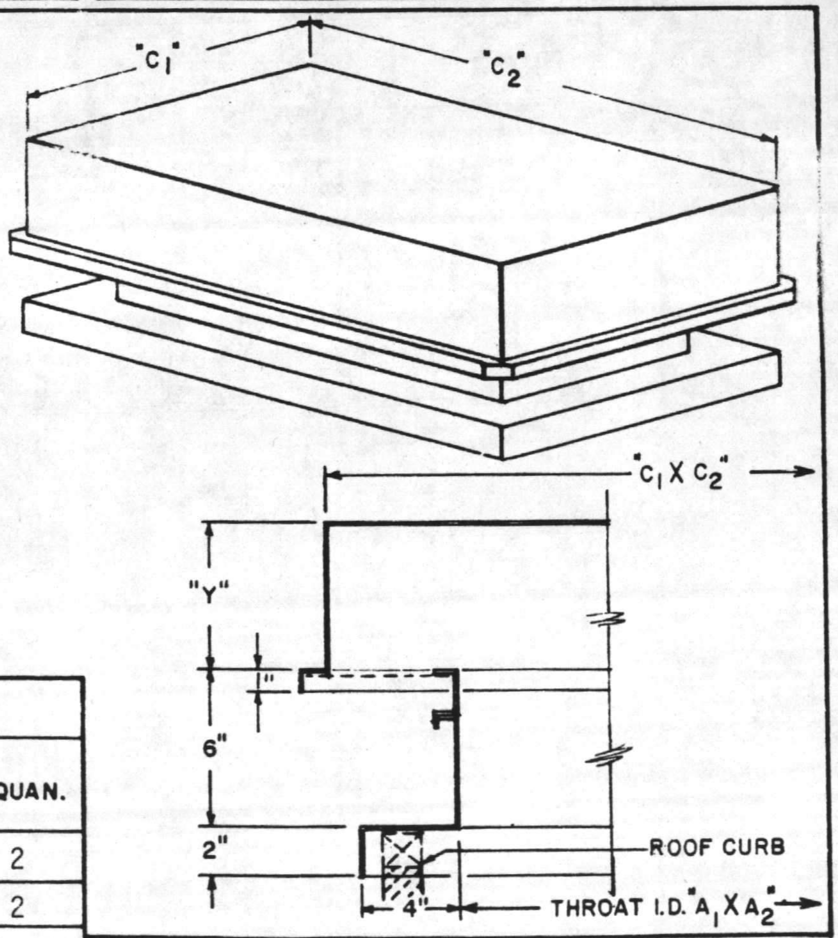
ENGINEER: D. Y. Perry

STANDARD FEATURES

1. HEAVY GA. ALUMINUM CONSTRUCTION
2. LOW SILHOUETTE DESIGN
3. BUILT-IN WATER BAFFLE
4. DESIGNED TO FIT STANDARD ROOF CURBS
5. $\frac{1}{2}$" GALVANIZED WIRE CLOTH BIRD SCREEN

OPTIONS

1.
2.
3.



DIMENSIONS

TYPE (S or E)	"A_1"	"A_2"	"C_1"	"C_2"	"Y"	OPTIONS BY NUMBER	QUAN.
S	34"	34"	58"	62"	12"		2
S	12"	12"	21"	21"	6"		2

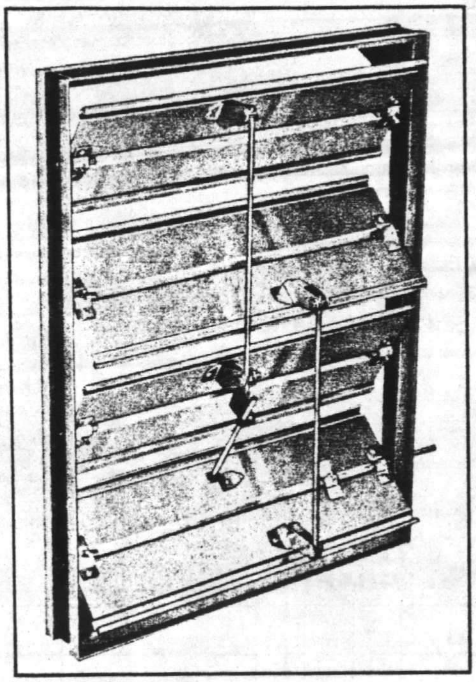
APPROVAL:

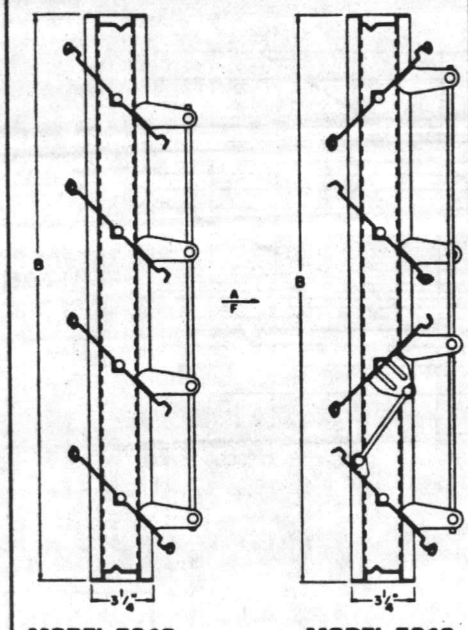
VENT PRODUCTS CO., INC.
1901 South Kilbourn Avenue Chicago, Illinois 60623
Telephone: 312/521-1900
Outside Illinois: 800/368-8368

CERTIFICATIONS & SUBMITTAL

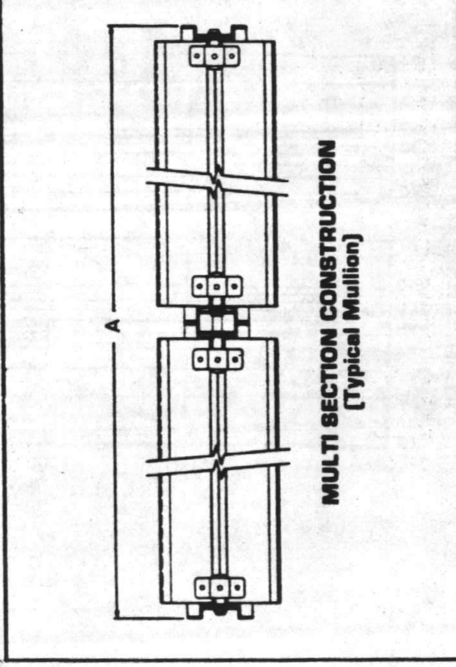
MODEL 5810

Dyn-O-Seal Low Leakage Dampers
Parallel and Opposed Blade





MODEL 5812 MODEL 5813



STANDARD SPECIFICATIONS

- **FRAME:** 14 ga. galv. press formed steel with welded corners.
- **BLADES:** 16 ga. galv. steel with press formed reinforcements.
- **AXLES:** ½" dia. x 2" long plated steel rods.
- **BEARINGS:** ½" dia. self lubricating porous bronze.
- **CONTROL ROD:** ½" dia. x 9" long plated steel.
- **HARDWARE:** Plated steel center brackets, brass pivots, ¼" or ⁵⁄₁₆" dia. plated steel linkage rod.
- **BLADE EDGE SEALS:** Dyn-O-Grip extruded dual durometer vinyl.
- **SIDE SEALS:** Spring Stainless Steel.
- **FINISH:** Standard Mill.
- **MAXIMUM TEMPERATURE:** 160° F.
- **MAX. VELOCITY:** 2000 fpm.
- **MAXIMUM SINGLE SECTION:** 48" x 72".
- **MINIMUM SIZE:** 8" x 12".

OPTIONS

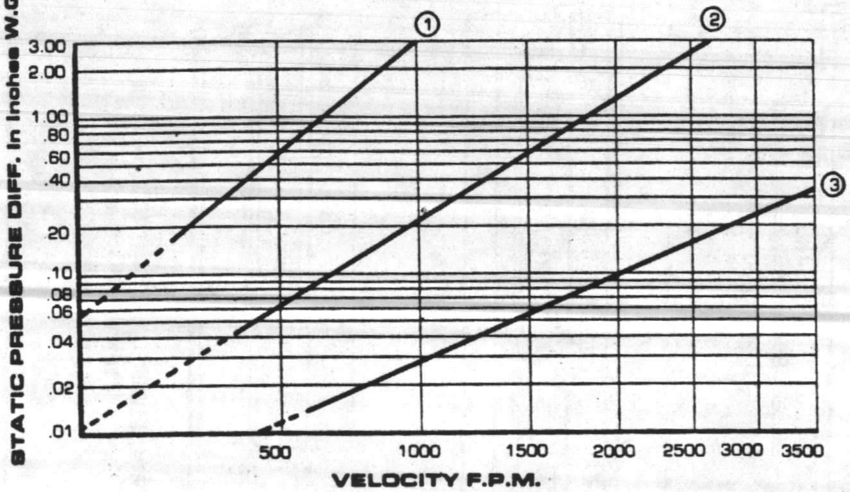
—09 Tack Weld Hardware
—11 Ball Bearings (Side seals not available)
—12 Nylon Bearings (Bushings)
—13 Stainless Steel Bearings (Bushings)
—14 Stainless Steel Bearings Pins (Axles)
—20 Vertical Blades
—24 Right Angle Mixing Set-Up, Internal Linkage
—25 Right Angle Mixing Set-Up, External Linkage
—26 Face & Bypass Set-Up Vertical, Internal Linkage
—27 Face & Bypass Set-Up Vertical, External Linkage
—28 Face & Bypass Set-Up Horizontal, Internal Linkage or Jackshaft
—31 Flange, 1½" fastened to damper frame (opposite linkage)
—89 Sleeve
—90 Jackshaft
—92 Actuators

NOTE: A and B are opening dimensions. Unless otherwise specified, dampers are made ¼" undersize.

PERFORMANCE DATA
MODEL 5810
Low Leakage Dyn-O-Seal Dampers

Vent Products certifies that the Model 5810 dampers are licensed to bear the AMCA Seal. The ratings shown in Airflow Chart 1 and Leakage Chart 2 are based on tests made in accordance with AMCA Standard 500-83 and comply with the requirement of the AMCA certified ratings program for air performance and air leakage performance.

AIRFLOW CHART 1



Test set-up per figure 5.3 and measurement per figure 6.5 of AMCA Standard 500-83.

MODEL 5810 TEST SIZE 24" x 24"

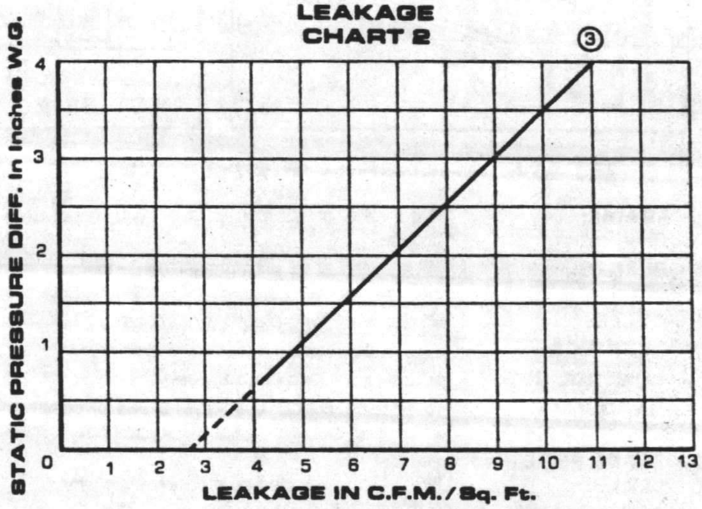
① 30° OPEN ② 60° OPEN ③ 90° FULL OPEN

AMCA Seal applies to Full Open position only.

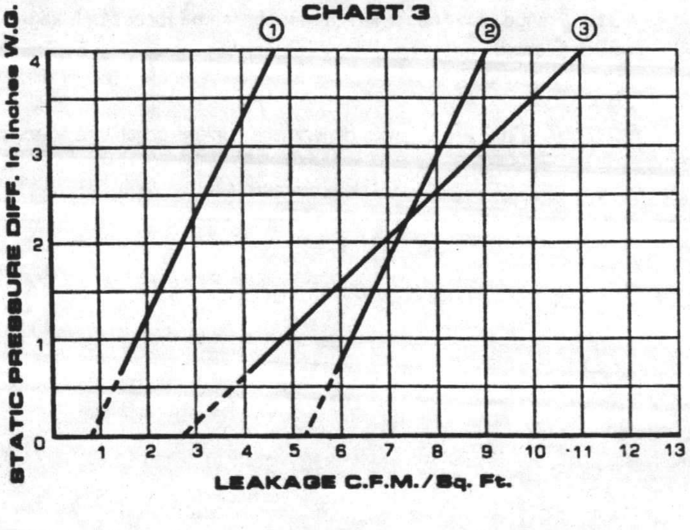
TEST SIZE 12" x 72"

Holding Torque applied was 3 inch-pounds per square foot of damper area. Test set-up per figure 5.3 and measurement apparatus set-up per figure 6.5 of AMCA Standard 500-83.

LEAKAGE CHART 2



LEAKAGE CHART 3



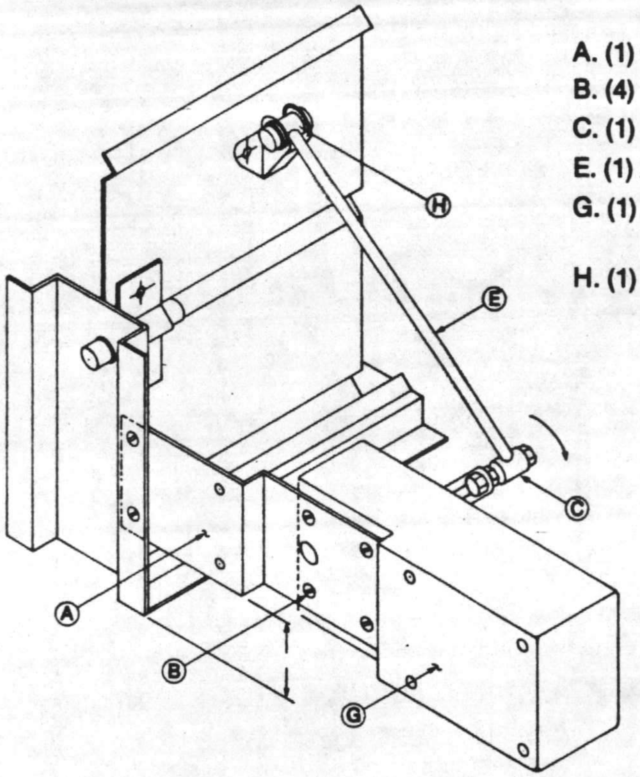
The performance information on Leakage Chart 3 is derived from testing in accordance with AMCA Standard 500-83 with test set-up per figure 5.3 and measurement apparatus set-up per figure 6.5 of this AMCA Standard.

The AMCA Certified Ratings Program (CRP) requires the testing of specific model sizes, then certifying only the least favorable performance to assure the most conservative rating. . . . in this case the 12" x 72" size. This chart shows the performance of two other test sizes as well as the Certified (least favorable) Performance shown as #3. These other aspect ratios are shown for reference only because large damper assemblies are frequently made into multiple sections.

TEST SIZES

① 48" x 72" Holding Torque applied 3 in. lb/S.F. damper area.
② 48" x 12" Holding Torque applied 3 in. lb/S.F. damper area.
③ 12" x 72" Holding Torque applied 3 in. lb/S.F. damper area.

INTERNAL MOUNTING (Hardware Kit #9038)



A. (1) 9031 bracket.

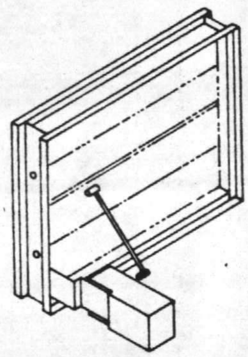
B. (4) ¼″ long #8-32 screws.

C. (1) DC1005FN swivel (actuator arm).

E. (1) 20″ x 5/16″ ϕ linkage rod (trim excess).

G. (1) Multi-Products #2412 actuator.
(not included in hardware kit.)

H. (1) VF440 Blade Mounting Bracket.

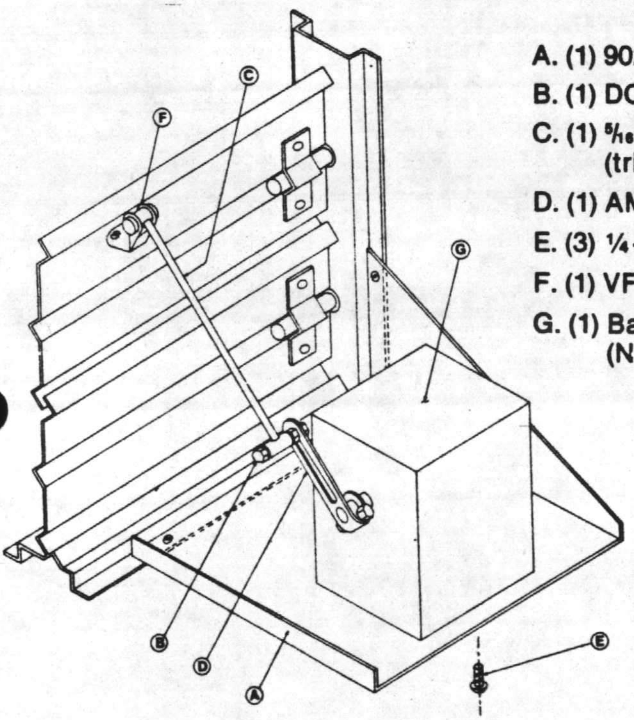


NOTES:

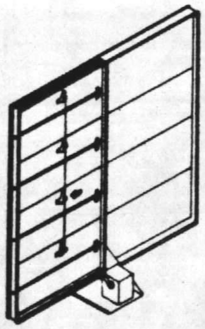
1. Linkage (items C & E) should be adjusted to allow actuator arm to travel 90° to 150° as louver opens or closes 90°.

2. Vent Products reserves the right to substitute equivalent hardware.

INTERNAL MOUNTING (Hardware Kit #9026)*



A. (1) 9020 bracket (see note 1 below).
B. (1) DC1207FN swivel.
C. (1) 5/16" dia. x 20" lg. lkg. rod
(trim excess).
D. (1) AM113 arm.
E. (3) ¼-20 x ¾ lg. nuts & bolts.
F. (1) VF440 blade bracket.
G. (1) Barber Coleman MA400 series actuator
(Not included in hardware kit).



NOTES:
1. Optional mounting bracket #9029 (not shown) is available for "left hand" mounting upon request.

2. Linkage (Items B & C) should be adjusted to allow actuator arm to travel 180° as damper opens or closes a full 90°.

3. Vent Products reserves the right to substitute equivalent hardware.

*Refer to front side for installation instructions.

[illegible]

Chet Adams Company

Sales Engineers

HEATING | AIR CONDITIONING EQUIPMENT | VENTILATING

AIR POLLUTION SYSTEMS | ENERGY CONSERVATION

August 10, 1987

MAINTENANCE AND OPERATING INSTRUCTIONS

Project:	Combat Vehicle Maintenance Shop Camp Lejeune, NC
Contractor:	Sneeden, Inc. Wilmington, NC
P.O.#	239
Architect:	G. Milton Small & Associates
Engineer:	D. Y. Perry and Associates
Sales Rep:	Chet Adams Company Cary, NC
Manufacturer:	Car Mon Products Spiral Pipe of Texas

EXHAUST SYSTEMS

WELDING

FAN #1 — 1 - CMB 20 Belted centrifugal blower, 1680 CFM @ 2.63" SP, 1-1/2 HP, 208/3/60 with adjustable drive, belt guard, acid coating and spring vibration isolators.

DROPS — 3 - 5" Diameter by 15' long weldproof tubing with magnetic fume receptor.

DUCT
- 1 - 14 x 8 Reducer
- 6'- 8" Diameter longitudinal seam pipe
- 11'- 6" Diameter longitudinal seam pipe
- 1 - 8 x 8 x 5 Tl Tee
- 1 - 8 x 6 x 5 TlR tee
- 1 - 6 x 6 x 5 Tl tee
- 1 - 6" Diameter end cap

TAILPIPE

FANS #4&9 — 2 - CMB 30 DITTO #1 above except 4000 CFM, 3 HP.

TAILPIPE SYSTEM (continued)

DROPS

20 - 5" Diameter by 20' long stainless steel flexible tubes and stainless steel tailpipe adapter.

20 - PSW pull up sets with pulleys, 1/8" aircraft cable, and hand winch.

DUCT

2'- 18" Diameter longitudinal seam pipe
16'- 14" Diameter longitudinal seam pipe
44'- 12" Diameter longitudinal seam pipe
65'- 8" Diameter longitudinal seam pipe
2 - 18 x 14 x 12 "Y" Y2R and 45° els
2 - 14 x 12 x 5 x 5 T2R tee
4 - 12 x 8 x 5 x 5 T2R tee
4 - 8 x 8 x 5 x 5 T2 tee
4 - 8" Diameter end caps

CAR-MON BELT DRIVE FANS

All fans on this sheet are rated in accordance with AMCA Standard 210 and bear the AMCA seal.

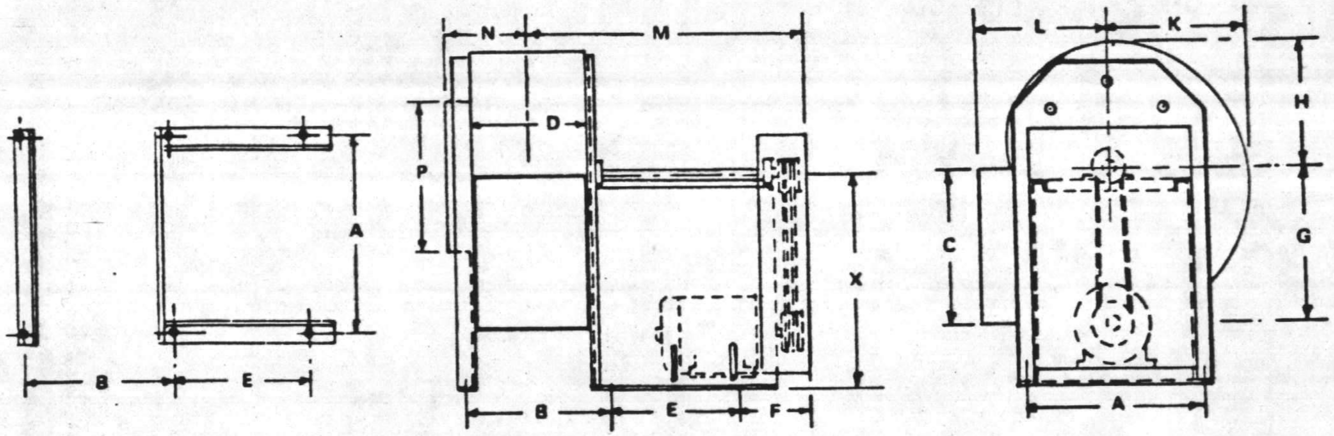
Clockwise rotation wheels and bottom horizontal discharge are standard. If specified at time of order any rotation or any of 8 standard discharge locations can be furnished.

All of these fans are equipped with high efficiency, non-overloading, backward inclined wheels of heavy duty construction. All parts in the air stream are coated with a phenolic resin to prevent acid corrosion. Fan housings are fabricated of heavy gauge steel and are continuously welded.

Standard equipment includes ground and polished fan shafts, variable pitch V-belt drives (2-groove pulleys are standard when fan motors are 1 HP or greater), adjustable motor bases and belt guards.

All fans are run tested at the factory and checked for compliance with our rigid balance standards.

NOTE: For performance data, refer to fan catalog F1-83.



Model No.	Wheel Diam.	CMB Std. HP	CMB Wt.	F Series Std. HP	F Series Wt.	A	B	C	D	E	F	G	H	K	L	M	N	P	X
8	10⅝	½	115	¾	120	12¼		11¾	9	10¾	2½	10⅝	8	9¾	8½	18⅞	5⅞	9	14
10	10⅝	¾	120	1	130	12¼		11¾	9	10¾	2½	10⅝	8	9¾	8½	18⅞	5⅞	9	14
14	12¼	1	195	1½	200	18¼	12⅜	13	9⅞	11	3¼	13	10½	12⅛	11½	24	7	12¾	18
20	13¼	1½	210	2	215	18	13⅜	14⅜	10⅞	11	3¼	14¼	11½	13⅜	11⅝	24½	7½	14⅛	18
25	15	2	215	3	235	18	14⅝	15⅞	12	11	3¼	15⅞	12⅞	14⅞	12¾	25	8⅛	15¾	18
30	18¼	3	325	5	365	22¼	17¾	19⅜	14⅝	11	6¼	19¼	15½	18	15⅛	26⅜	9½	19¾	23
32	20	3	410	5	450	22¼	19⅛	21⅛	16	11	6¼	21⅛	17	19¾	16⅝	27	11¼	21¾	23
35	22¼	5	455	7½	500	28¼	21⅞	23½	17¾	18	7¼	23½	19	22	18½	36⅞	12⅛	24	31
40	27	5	730	7½	775	28¼	25⅝	28⅝	21½	18	7¼	28½	22⅞	26⅝	22	38¾	14	29	31
50	30	7½	960	10	985	28¼	28⅛	31¾	23⅞	18	7¼	31⅝	25½	29⅝	24⅛	40	14¼	32⅜	37

*Additional dimensional data on back of sheet.

CHECK OPTIONAL EQUIPMENT REQUIRED

- ☐ Vibration Pads
- XX Vibration Rails
- ☐ Other
- ☐ Weather Cover
- ☐ Back Draft Damper
- ☐ Aluminum Wheel
- ☐ Expl'n. Res. Motor
- ☐ Fan Platform — See Drwg. 84-F-7A
- ☐ Inlet & Disch. Conn. — See Drwg. 79-F10

Job Name Combat Vehicle Maintenance Shop, Camp Lejeune, NC

Customer Sneeden, Inc., Wilmington, NC

Quantity	Model Number	JOB REQUIREMENTS CFM	SP	HP	Rotation	Discharge	ELECTRICAL Volts	Phase	Hz
1	CMB 20	1680	2.63"	1-1/2			208	3	60
2	CMB 30	4000	2.63"	3			208	3	60

N36139

CAR-MON INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

INTRODUCTION

This manual has been prepared to guide the users of Car-Mon fans in the proper installation, operation and maintenance procedures to insure a maximum equipment life with trouble-free operation.

RECEIVING

Products leaving the Car-Mon plant have been inspected and are in satisfactory operating condition. The carrier assumes full responsibility for material from the time it leaves our plant until it is delivered to the user. Therefore, material received should be inspected for damage immediately so that any damage claims against the carrier can be made before acceptance of the shipment. No equipment is to be returned without an authorized returned goods tag.

HANDLING

All products, whether assembled or dismantled, must be handled with extreme care to avoid misalignment of rotating components. Never lift a fan assembly by using the shaft, coupling, drive pulleys, wheel or motor as a point of attachment. Use the lifting lugs provided. When lifting a wheel and shaft assembly, place protected slings around the shaft on each side of the wheel, being careful to avoid damage to bearing or shaft seal areas. If it is apparent that slings will not clear portions of the product being hoisted, a spreader should be used to avoid damage.

STORAGE

If the fan is to be stored for any length of time, appropriate care should be taken to protect bearings, shaft and finished surfaces from moisture, dirt, dust, etc. Do not store other products on top of fan equipment. Periodic inspections of the unit should be made until it is ready to be put into service.

FOUNDATION

The foundation for a fan should be as rigid and as level as possible. A fan must always be securely fastened down before being operated. When a fan is set upon its foundation it is critically important that the factory alignment of the fan be maintained. Gaps between the fan base and the fan foundation at the mounting bolt locations must be solidly shimmed before tightening the mounting nuts. Failure to properly shim may distort the fan base and cause wheel, shaft, bearing and/or coupling misalignment. This could result in excessive vibration and/or ultimate wheel, bearing or motor failure. A fabricated structural foundation should be of welded or riveted construction. The use of bolts in constructing the fan foundation should be avoided whenever possible, since they have a tendency to loosen during operation.

If a fan is to be mounted above ground, such as inside a building or on a roof, it should be located near or above a rigid wall or column. Avoid mounting on cantilevered or overhung steelwork. When a fan is mounted on existing machinery, care should be taken to reduce transmitted vibration to a minimum.

If the vibration level of a fan will be objectionable because of resonant or transmitted structural vibration or noise, vibration isolation devices should be installed between the fan and its foundation. It is recommended that the foundation mass of large horsepower fans be at least three times the fan weight.

PRE-OPERATION INSPECTION

With the fan mounted in operating position:

1. Lock out electrical power to prevent accidental fan operation.
2. Check recommended wheel and inlet clearance or overlap.
3. Recheck tightness of foundation bolts, wheel setscrews, motor mounting bolts, bearing bolts and setscrews, coupling setscrews, etc. Tighten to proper torque values if necessary. (NOTE: Fan hub setscrews should be tightened when vertically below the shaft.)
4. Rotate wheel manually to make sure it runs freely without binding or striking the inlet or housing.
5. Check bearings for proper lubrication. Refer to, and carefully follow, bearing manufacturers instructions attached to fan.
6. If fan is belt driven, check sheave alignment and proper belt tension. Improper sheave alignment is one of the most frequent causes of excessive fan vibration and improper belt tension is the usual cause of shortened belt and bearing life.
7. If equipped with inlet vanes and/or dampers, check for correct linkage operation. Make sure that the operator opens or closes these control devices to the proper position.
8. If this product was furnished with a motor mounted by the factory, refer to and observe

the motor manufacturers instructions attached to the fan before removing the electrical lock-out on the power source.

START UP

Check for correct direction of rotation by "hitting" the ON button and then the OFF button. Correct the rotation if necessary and the unit can be put into service. Keep a close watch for any unusual vibration, noise, etc.

If you observe any unusual vibration or noise, stop and lock-out the unit and recheck all items in the pre-operation inspection check list above before requesting assistance from our factory representative.

After 24 hours of satisfactory operation – shut down the equipment and check all foundation bolts and setscrews for looseness – tightening where required.

SOME CAUSES OF VIBRATION

(Some possible at start up; some after period of time.)

1. Bearings – misaligned, or worn – loose bolts or setscrews.
2. Motor – misaligned, or unbalanced, worn bearings – loose bolts or setscrews.
3. Bent shaft – equipment dropped during shipment or installation.
4. Coupling – misaligned.
5. Loose foundation mounting bolts.
6. Wheel – loose setscrews – material accumulation or wear and errosion causing unbalance.
7. Fan inlet or outlet volume control devices completely closed off.
8. External source of transmitted vibration.

MAINTENANCE

A planned program of regularly scheduled maintenance will return dividends in averting a possible costly and unexpected period of down time. Following are some of the more important considerations:

1. Proper lubrication of bearings – follow manufacturers instructions including exact type of grease to be used. Do not overlubricate. Too much lubrication will destroy bearings as often as too little.
2. Bolt and setscrew tightness.
3. V-Belt drive – worn belts or sheaves – proper tension. If it is necessary to replace one belt on a multiple belt drive unit, replace all the belts with a matched set.
4. Wheel wear or material build up on wheel causing unbalance will quickly damage bearings or cause self-destruction of the fan wheel.

SAFETY PRECAUTIONS

Any piece of machinery should be treated with respect and not over confidence. Over confidence usually leads to carelessness and carelessness leads to injury. Following is a list of safety DO's and DONT'S:

DO

1. On a belt driven unit, fan should be equipped with either a belt guard or a weather hood.
2. If there is no inlet duct work, fan should be equipped with an inlet screen.
3. If there is no outlet duct work, fan should be equipped with an outlet screen.
4. Make sure fan is stopped and electrical power locked out before putting hands into fan inlet or outlet opening or near belt drive. We suggest a warning sign on START SWITCH cautioning not to start when fan is being serviced and a padlock on the disconnect.
5. Follow maintenance section instructions.

DO NOT

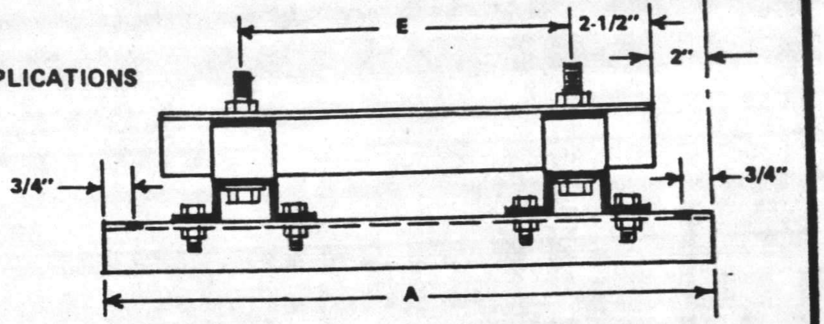
1. Put hands near or allow loose and hanging clothing to be near belts, sheaves, couplings or cooling wheels while fan is running.
2. Put hands into inlet or outlet while fan is running. It is sometimes difficult to tell whether or not a fan is running... be sure it is not running and cannot be operated before any inspection.

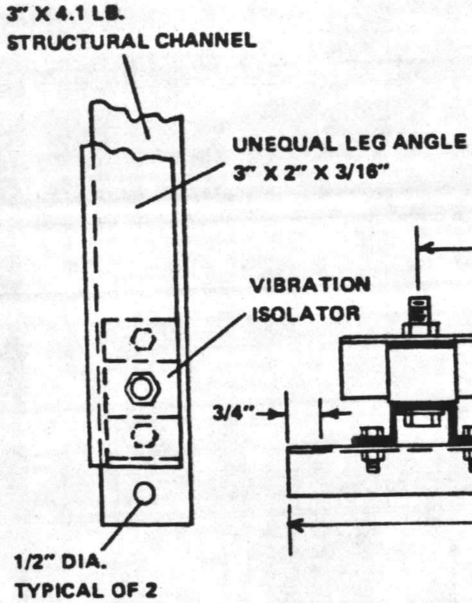
CAR-MON

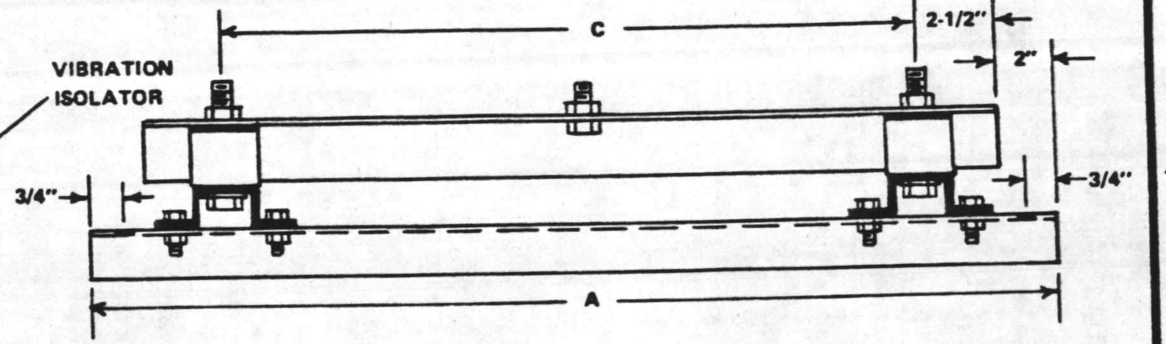
1225 DAVIS ROAD • ELGIN, ILLINOIS 60120
PHONE (312) 695-9000

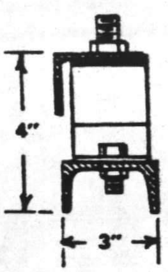
VIBRATION RAILS

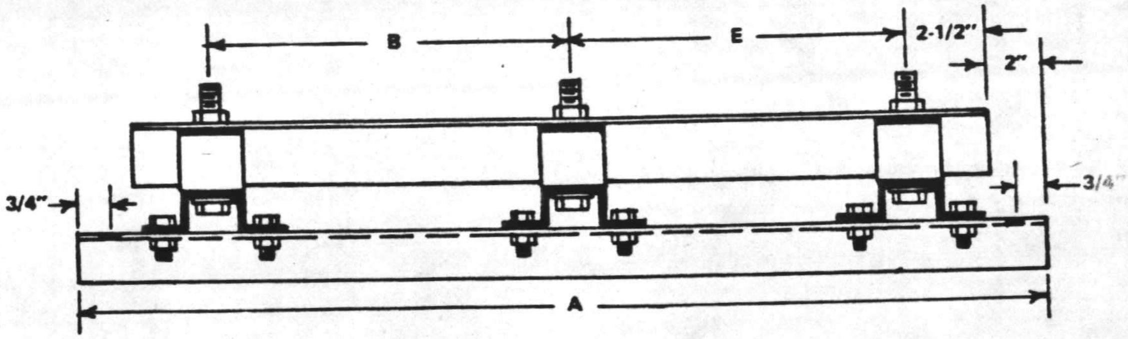
FOR PLATFORM OR ROOF–MOUNTED APPLICATIONS











NOTE: VIBRATION RAILS ARE ALSO AVAILABLE FOR CMSL AND CMD SERIES FANS.

QUANTITY	FAN SIZE	DIMENSIONS A	B	C	E	NO. OF PADS PER RAIL
	CMB-8 or 8-F	19-3/4			10-3/4	2
	CMB-10 or 10-F	19-3/4			10-3/4	2
	CMB-14 or 14-F	32-3/8		23-3/8		2
1	CMB-20 or 20-F	33-3/8		24-3/8		2
	CMB-25 or 25-F	34-5/8		25-5/8		2
2	CMB-30 or 30-F	37-3/4	17-3/4		11	3
	CMB-32 or 32-F	39-1/8	19-1/8		11	3
	CMB-35 or 35-F	48-7/8	21-7/8		18	3
	CMB-40 or 40-F	52-5/8	25-5/8		18	3
	CMB-50 or 50-F	55-1/8	28-1/8		18	3

NOTES:

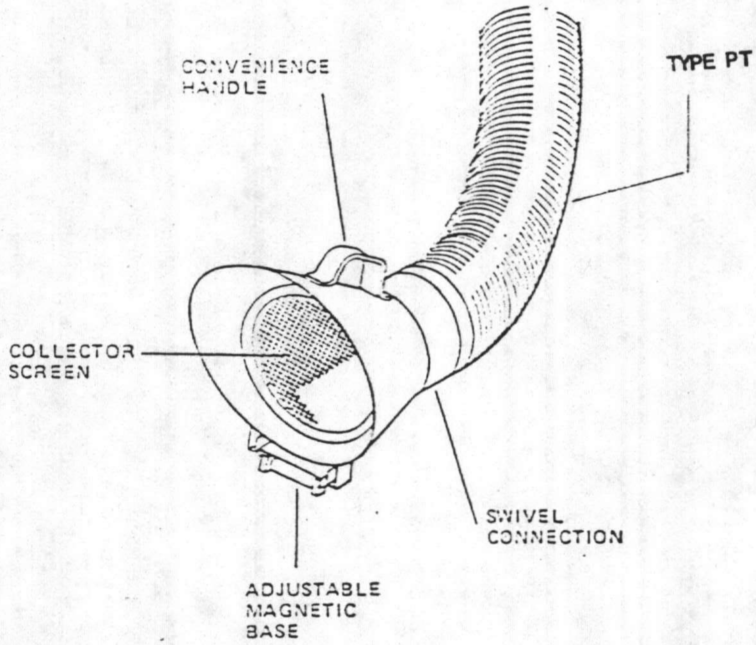
CAR-MON VIBRATION ISOLATION RAILS ARE DESIGNED FOR ATTACHMENT TO PLATFORM OR ROOF. THE EXHAUST FAN MOUNTS DIRECTLY TO THE BOLTS OF THE ISOLATOR ON THE RAILS. ONE PAIR OF ISOLATION RAILS INSTALLED PARALLEL TO THE DIRECTION OF THE FAN SHAFT ARE REQUIRED FOR EACH EXHAUST FAN.

THIS VIBRATION ISOLATION RAIL ALONE IS NOT SUITABLE FOR SUSPENSION APPLICATIONS. SEE CATALOG SHEET NO. 78-F7A FOR CEILING SUSPENSION OR WALL MOUNTING PLATFORMS.

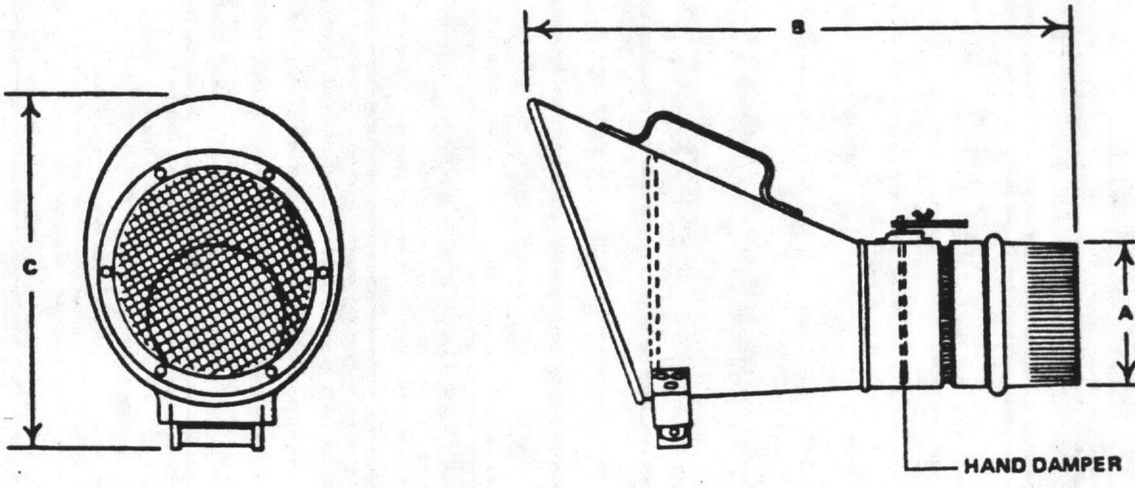
SEE CATALOG SHEET NO. 76-F6 FOR CAR-MON VIBRATION ISOLATOR DETAIL.

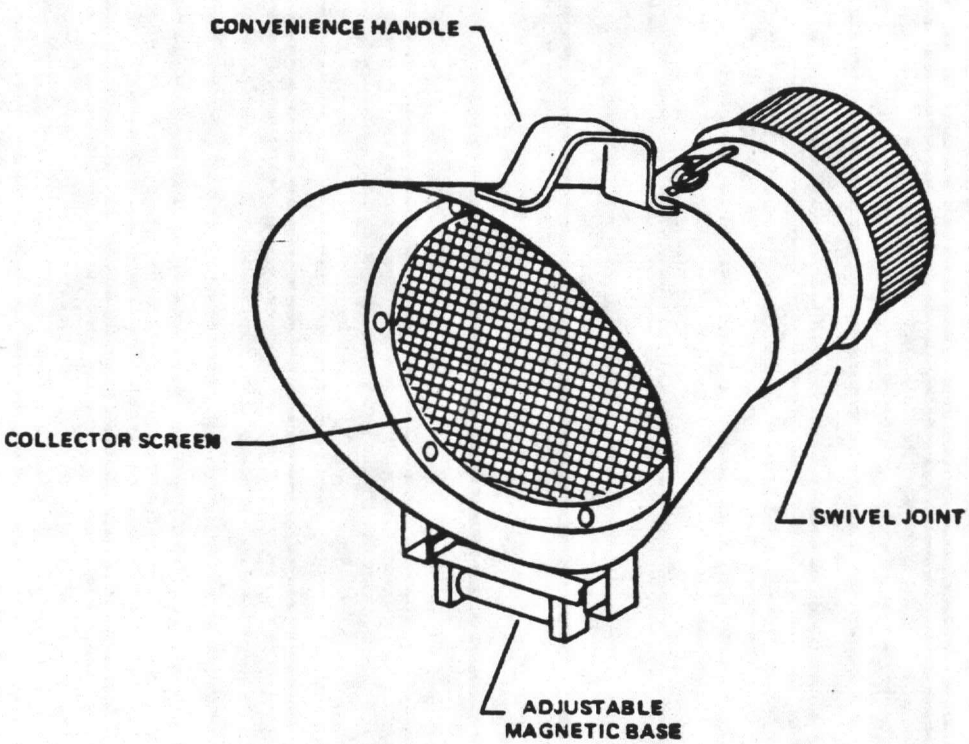
CAR-MON WELDPROOF TUBING

TYPE PT



This tubing is constructed as a triple ply laminate comprised of a 0.5 mil metallized polyester material on the exterior, a 40 X 32 count double thickness high temperature glass fabric core, and a 1.0 mil aluminized polyester material on the interior. The fabric is supported by a helically wound flat metal clinch strip that provides support while allowing complete flexibility. The tubing is burn and spatter resistant, and is self extinguishing.





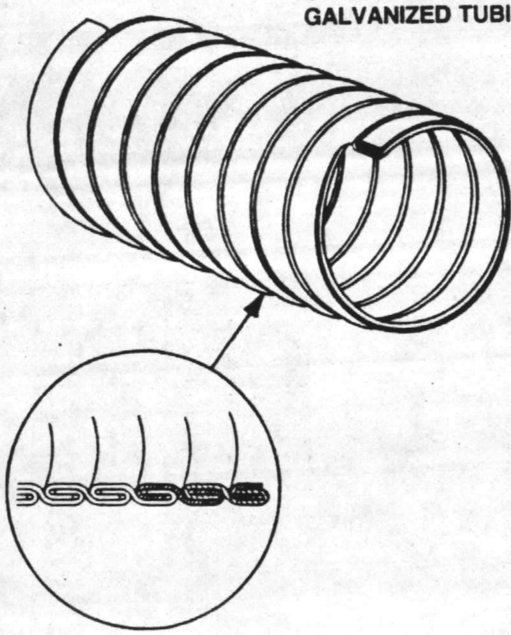
CAR-MON EXHAUST RECEPTOR

QUANTITY	MODEL	A	B	C
	4-MD	4"	17-1/2"	10"
3	5-MD	5"	17-3/4"	11"
	6-MD	6"	17-3/4"	12-1/8"
	8-MD	8"	17-3/4"	13-3/4"

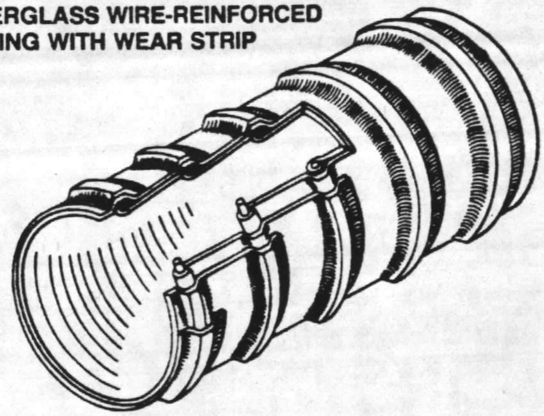
NOTES:
EXHAUST RECEPTORS ARE CONSTRUCTED OF 20 GA. ALUMINUM WITH HAND DAMPER

CAR-MON TUBING

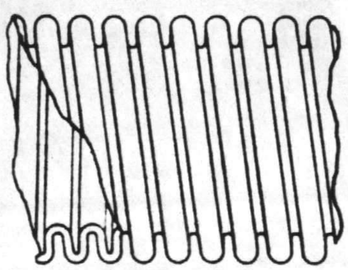
STAINLESS STEEL OR GALVANIZED TUBING

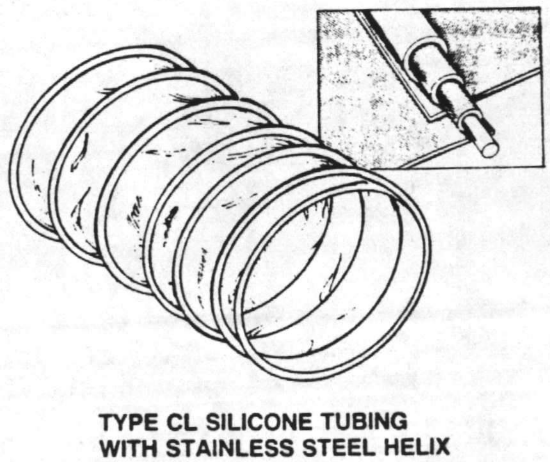


FIBERGLASS WIRE-REINFORCED TUBING WITH WEAR STRIP



NU-FLEX TUBING





TYPE CL SILICONE TUBING WITH STAINLESS STEEL HELIX

FLEXIBLE TUBING

QUANTITY	TYPE	DIAMETER	LENGTH
20	SS	5"	20'

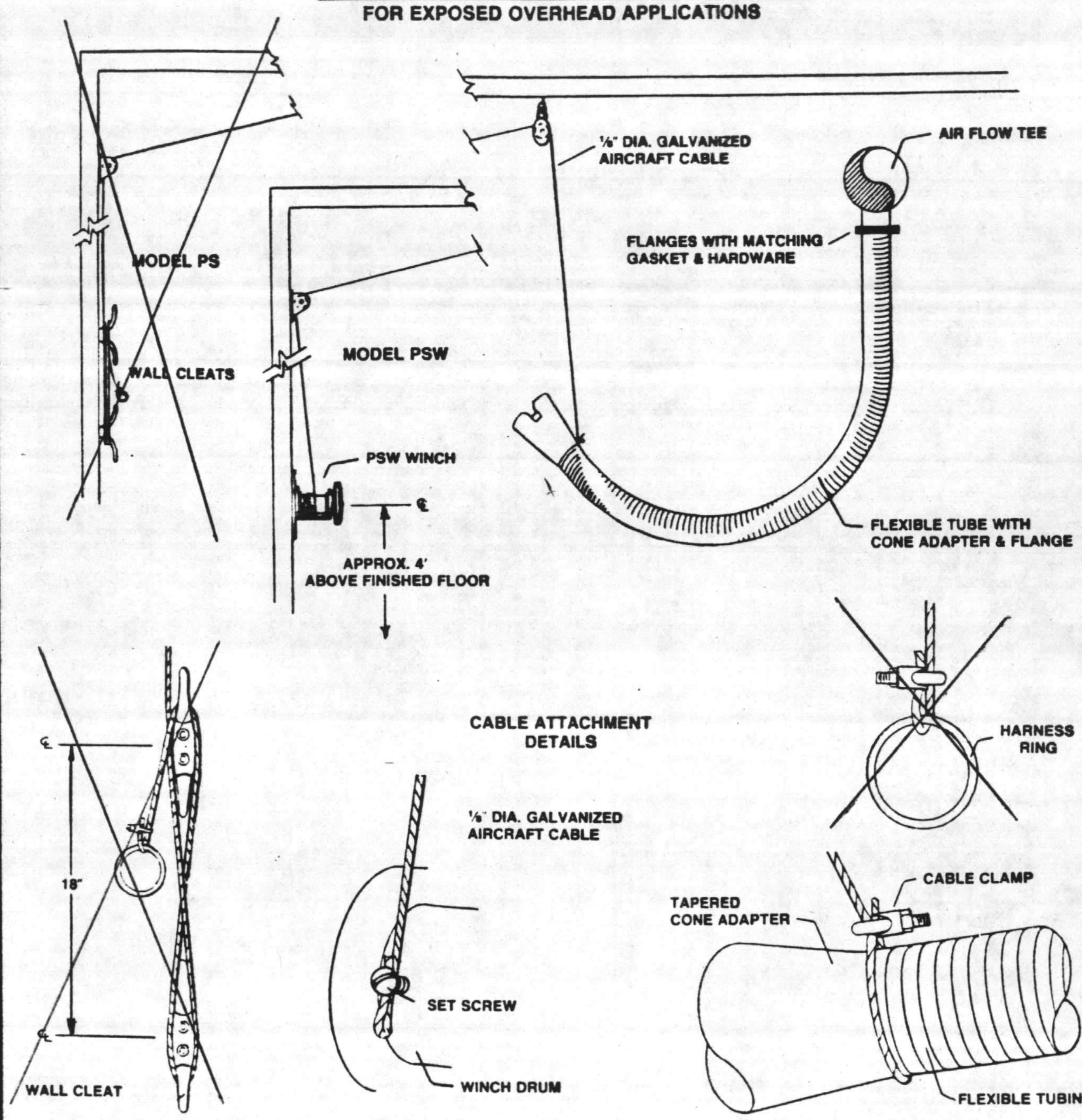
TUBE TYPES

- SS – STAINLESS STEEL
- GA – GALVANIZED STEEL
- NE – FIBERGLASS WIRE-REINFORCED
- NU – NU-FLEX
- CL – SILICONE TUBING WITH STAINLESS STEEL HELIX

N36139

CAR-MON SERIES PS AND PSW PULL-UP SETS

FOR EXPOSED OVERHEAD APPLICATIONS



SUPPLEMENTAL DRAWINGS:
85-A4 — PULL UP SET HARDWARE
85-A5 — PSW WINCH W/ SAFETY WHEEL

QTY	PS	PSW	CABLE LENGTH*	ADDITIONAL PULLEYS PLATFORM	SWIVEL
20		XX	50'		

STANDARD EQUIPMENT:

PS: 50' Cable*
- 1 Platform Pulley
- 1 Swivel Pulley
- 2 6" Wall Cleats
- 1 2" Ø Harness Ring
- 2 Cable Clamps

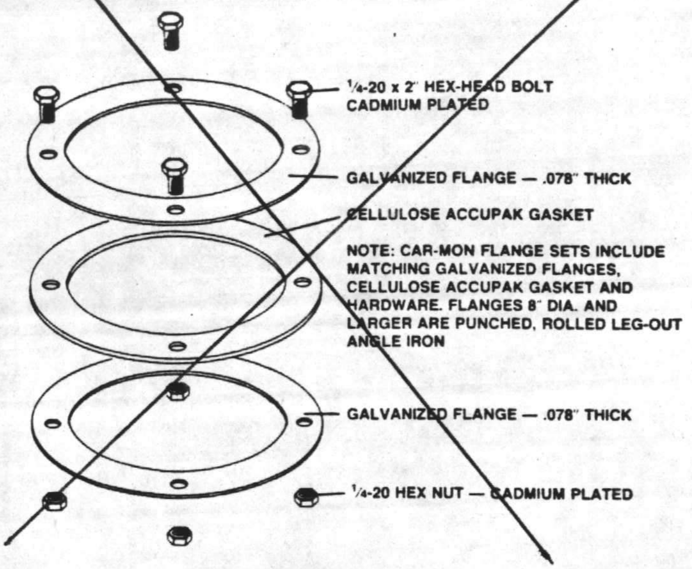
PSW: 50' Cable*
- 1 Platform Pulley
- 1 Swivel Pulley
- 1 Wheel-Operated Winch
- 1 Cable Clamp

*Specify cable length if other than 50'.

TUBING ACCESSORIES

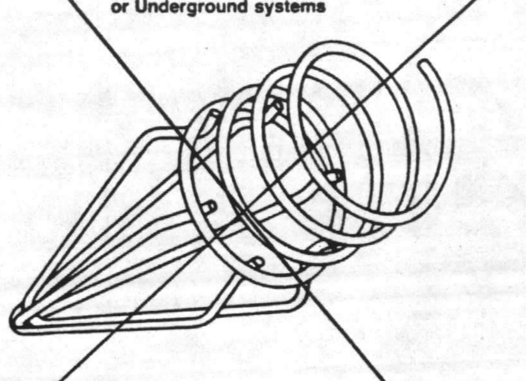
FLANGE SET

for Exposed Overhead systems

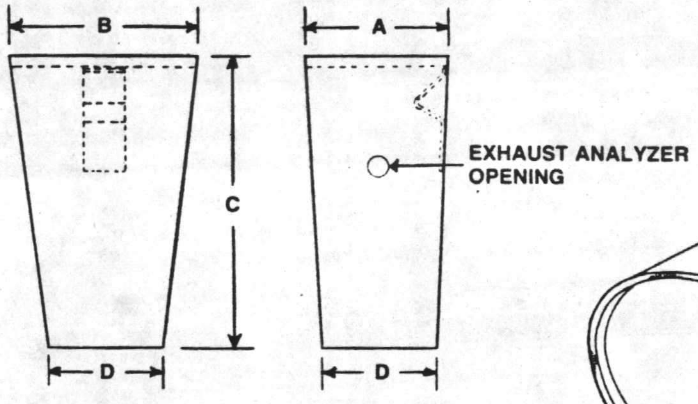


GUIDE RING

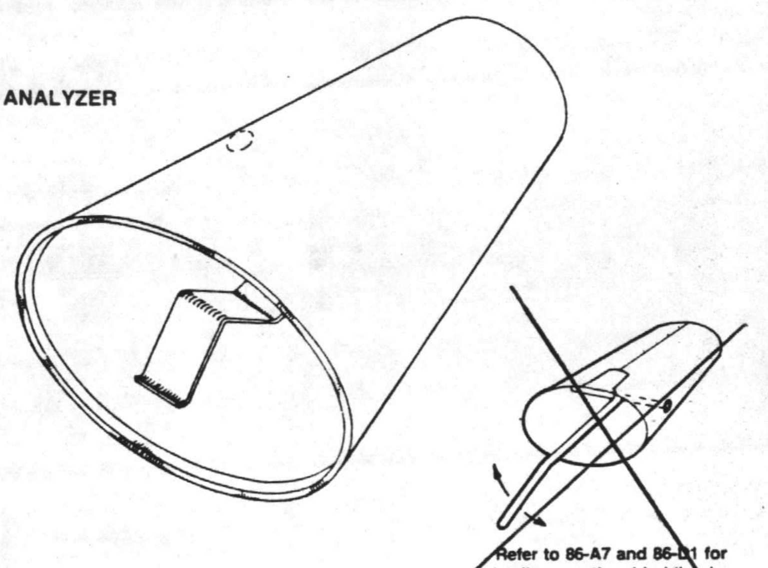
for Disappearing Overhead or Underground systems



NOTE: CAR-MON GUIDE RINGS ARE FABRICATED ON MINIMUM $\frac{3}{16}$" WIRE HELIX WITH NO. 10 WIRE CONE. MATERIAL IS CADMIUM PLATED. CONSTRUCTION VARIES ON SIZES 8" AND LARGER.



FRONT VIEW　　SIDE VIEW



Refer to 86-A7 and 86-D1 for details on optional holding bar and rainguard slot.

ALL DIMENSIONS ARE IN INCHES

TAPERED CONE ADAPTER WITH SAFE-T-EDGE

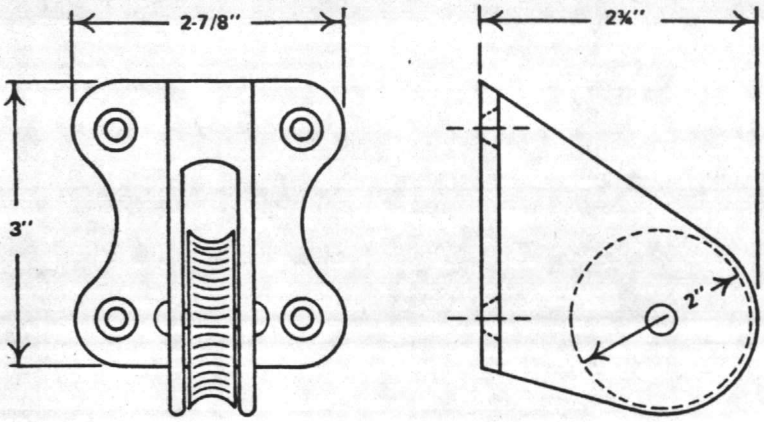
Quantity	Size	A	B	C	D
	3"	4	6¼	11	2¾
	4"	5	6¼	11	3¾
20	5"	6	7¾	12	4¾
	6"	7	7¾	12½	5¾
	8"	9	9¼	14	7¾

CAR-MON TAPERED CONE ADAPTERS are of 20-ga. Stainless Steel construction, specifically designed for Overhead type applications. Standard features include SAFE-T-EDGE for safe handling, Spring Clip for exhaust pipe attachment and an Exhaust Analyzer Opening for emission testing.

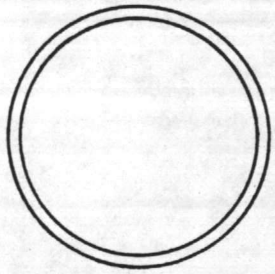
Other sizes and configurations for special applications also avaliable.

N6725B

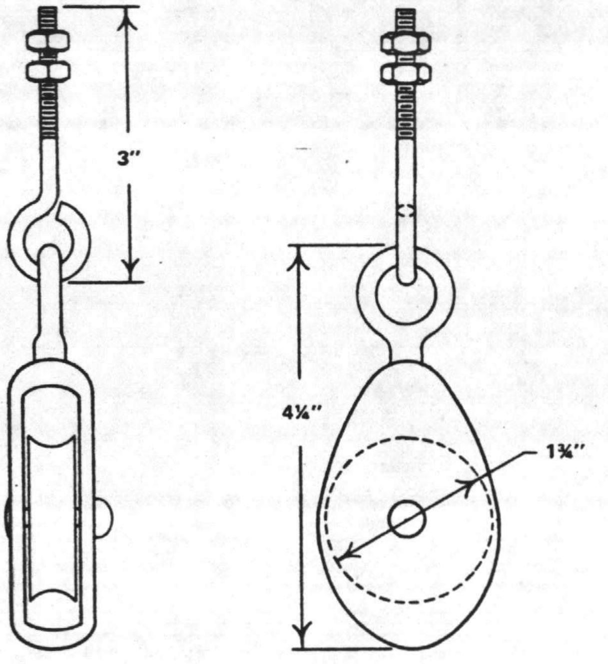
CAR-MON PULL-UP SET HARDWARE



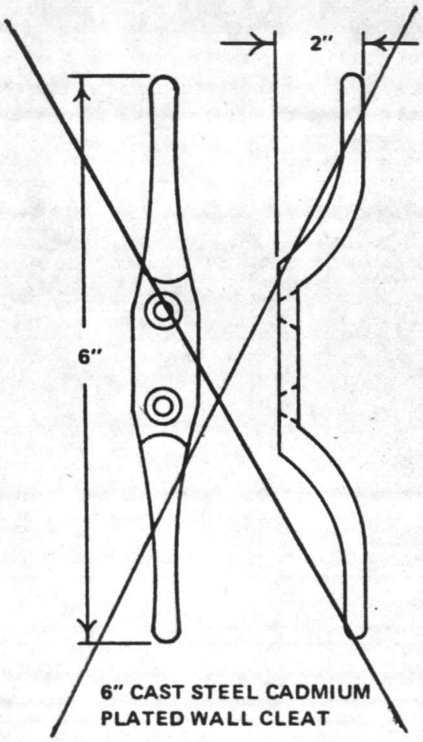
2" CAST STEEL CADMIUM PLATED PLATFORM PULLEY



2" STEEL CADMIUM PLATED LIFT RING

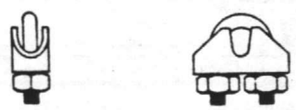


1¾" CAST STEEL CADMIUM PLATED SWIVEL BLOCK PULLEY

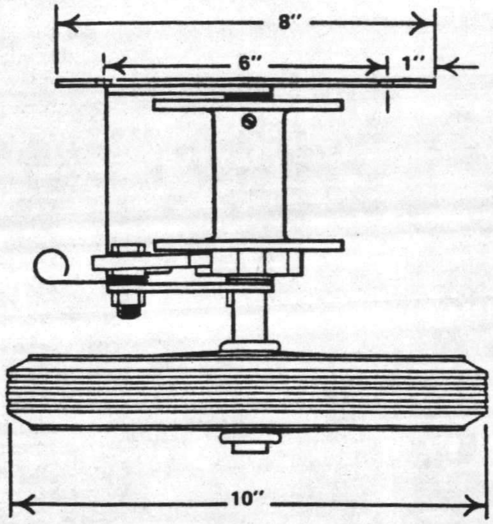


6" CAST STEEL CADMIUM PLATED WALL CLEAT

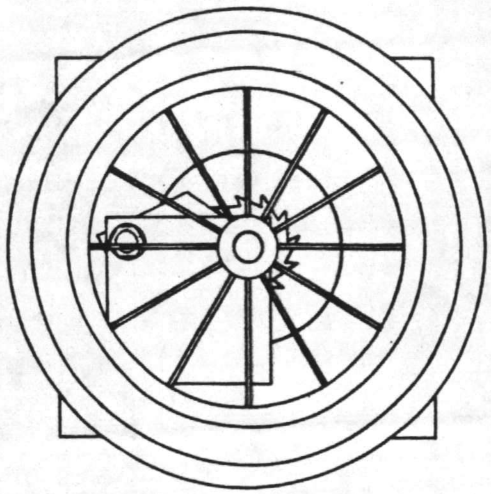
1/8" – 7 x 19 GALVANIZED AIR CRAFT CABLE. STRANDS RUN FROM LEFT TO. RIGHT. INDIVIDUAL WIRES PARALLEL WITH ROPE AXIS.

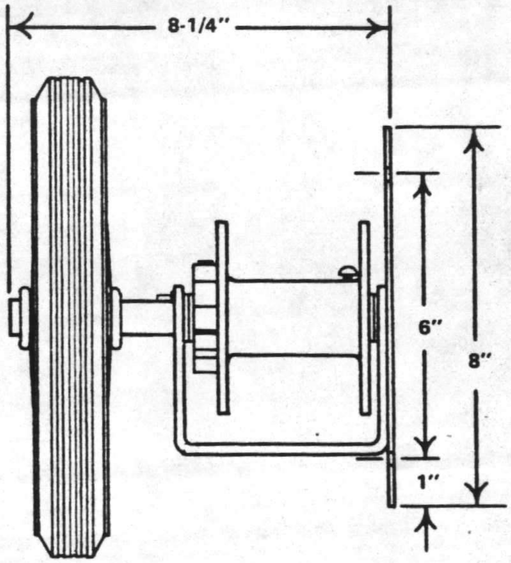


1/8" CAST STEEL CADMIUM PLATED CABLE CLAMP



CAR-MON MODEL PSW WINCH
SAFETY WHEEL OPERATED



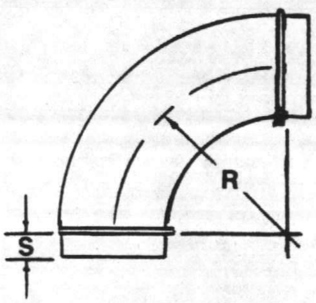


CAR-MON PSW WINCH INCLUDES THE FOLLOWING FEATURES:

- DIRECT DRIVE ONE PIECE CAST DRUM AND GEAR
- DRUM CAPACITY: 125' 1/8" Ø CABLE
- THREADED CABLE ATTACHMENT
- SPRING ACTUATED SAFETY RATCHET
- 3/16" STEEL BASE FRAME
- 3/16" STEEL BACK PLATE
- 10" WHEEL WITH RUBBERIZED HAND GRIP
- 5/8" STEEL DRUM AXLE

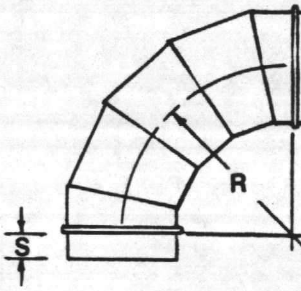
ELBOWS

SE90



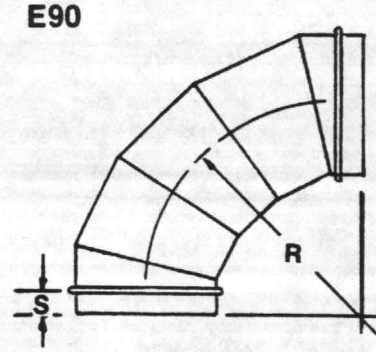
A = 3" THRU 10"

E90



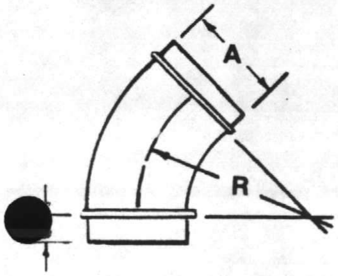
A = 11" THRU 24"

E90



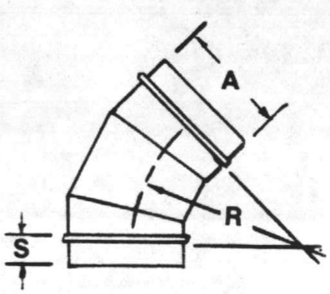
A = 26" THRU 60"

SE45



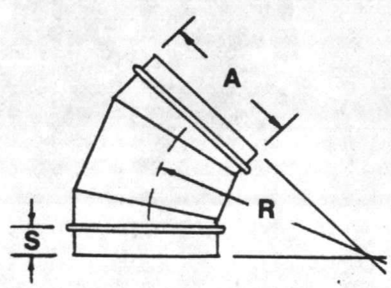
A = 3" THRU 10"

E45



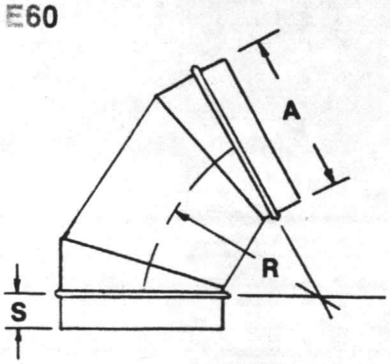
A = 11" THRU 24"

E45



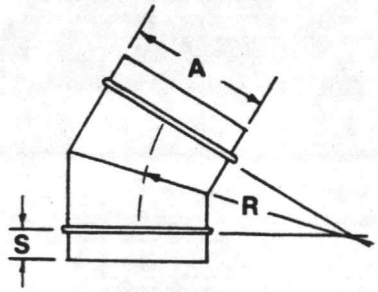
A = 26" THRU 60 "

E60



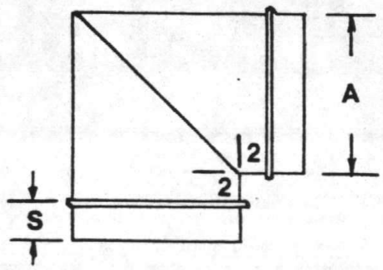
A = 3" THRU 24"

E30



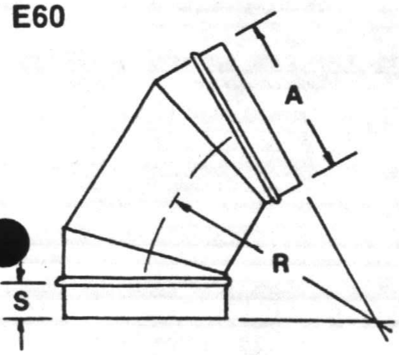
A = 3" THRU 24"

EV90

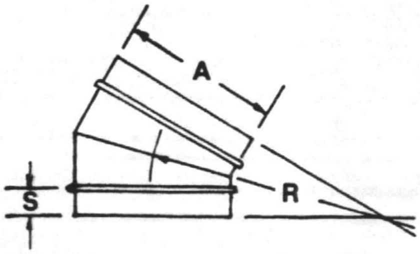


A = 3" THRU 60"

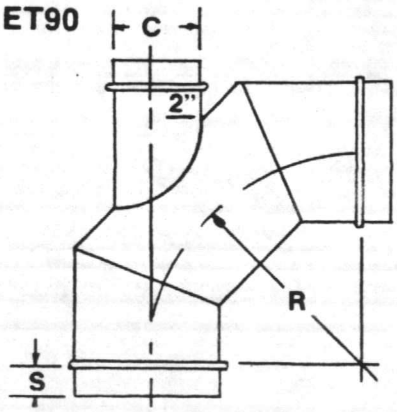
E60



E30

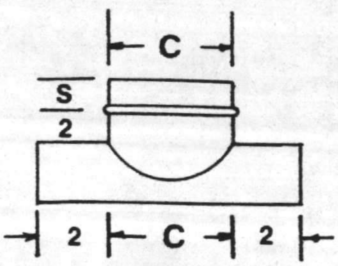


ET90



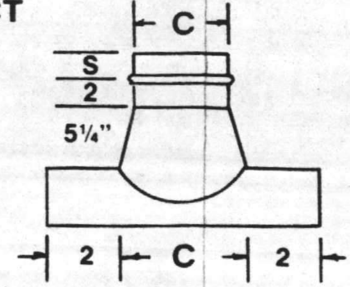
FITTINGS

ST



SADDLE STRAIGHT TEE

SCT



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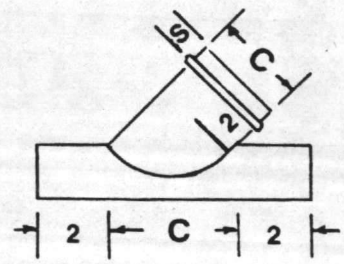
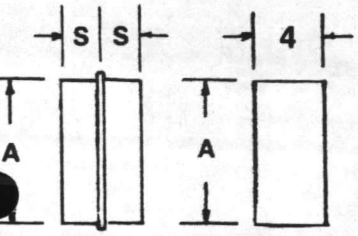
SL



SADDLE LATERAL TEE

PP FF

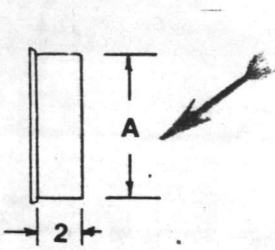


PIPE TO PIPE

FITTING TO FITTING

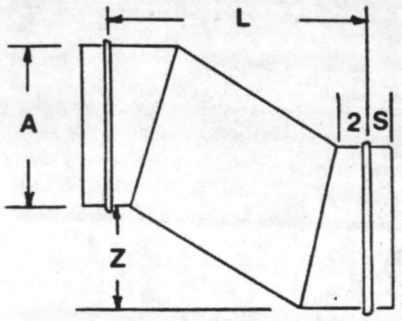
EC - FOR FITTING

EP - FOR PIPE



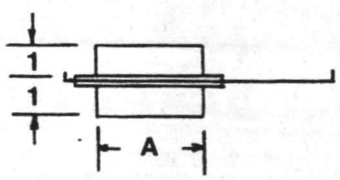
END CAP

OFF



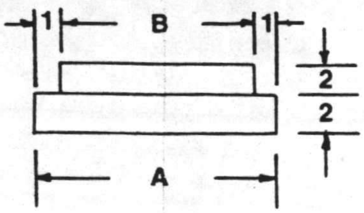
OFFSET

BG



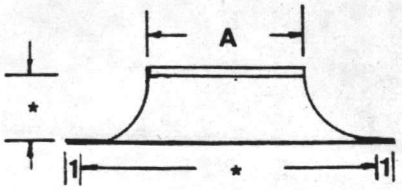
BLASTGATE

SD



STEP DOWN

B1



*CONSULT FACTORY

BELLMOUTH

AD

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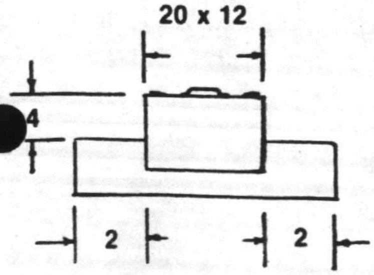
12 x 12
20 x 12



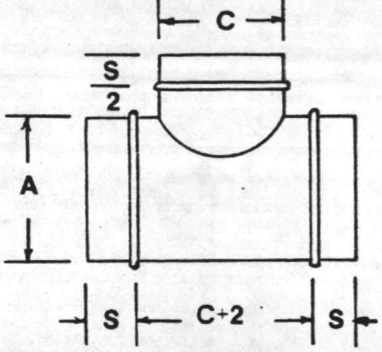
DUCT SEALER

WE ALSO OFFER

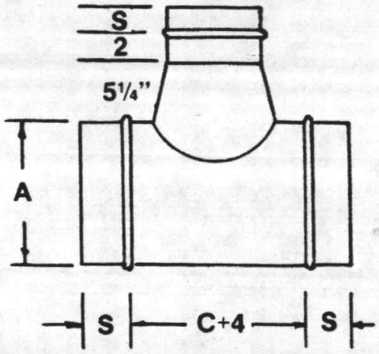
- Double wall insulated pipe and fittings
- Detailed assembly drawings
- Angle rings for bracing and hangers
- Fast accurate computerized bid information

STANDARD

T1



CT1



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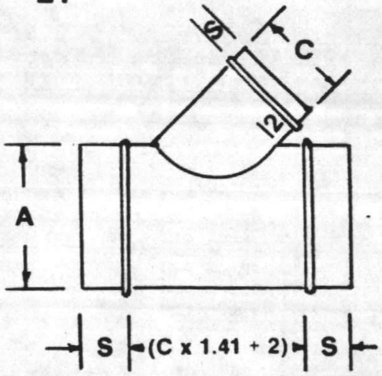

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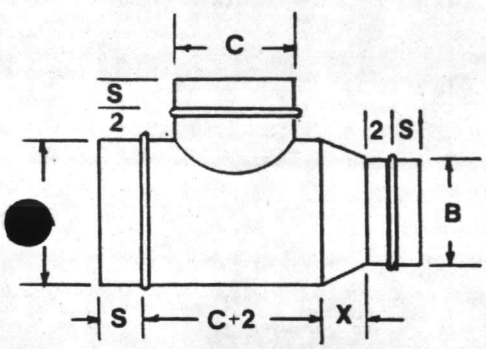

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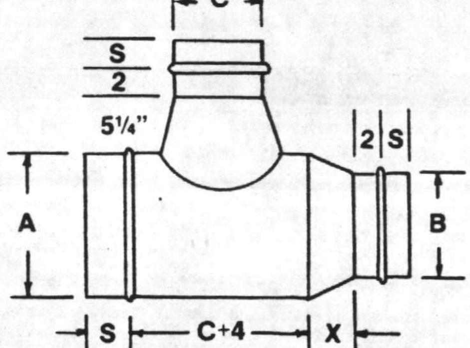

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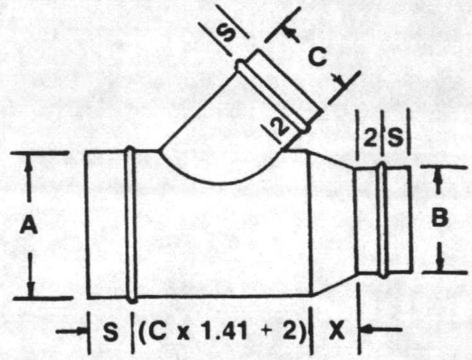

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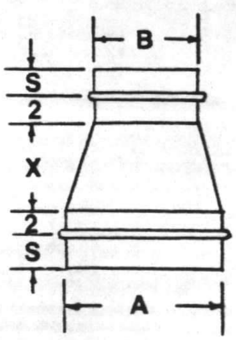

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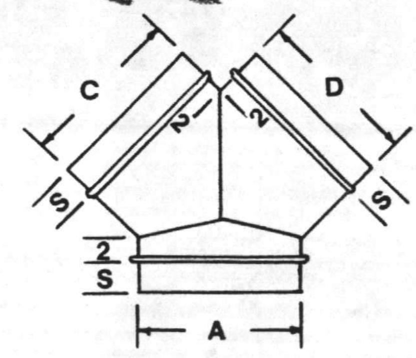
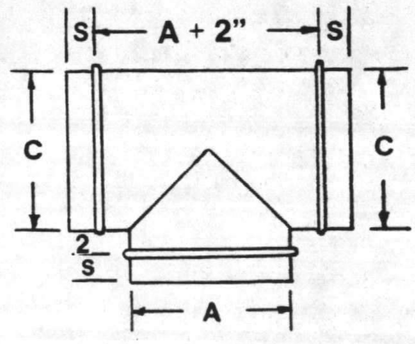
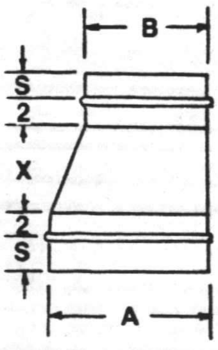


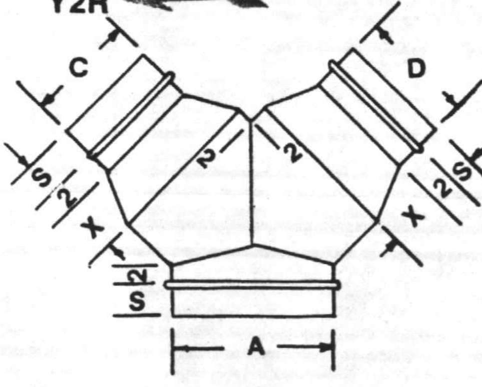
BT



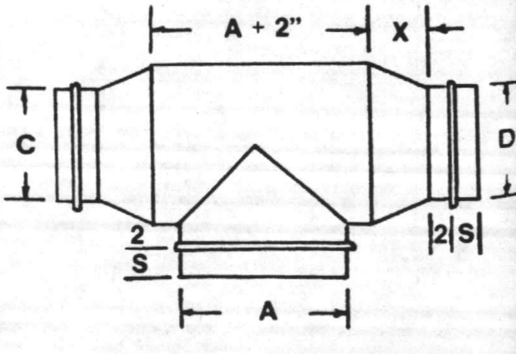
ER1



Y2R



BTR



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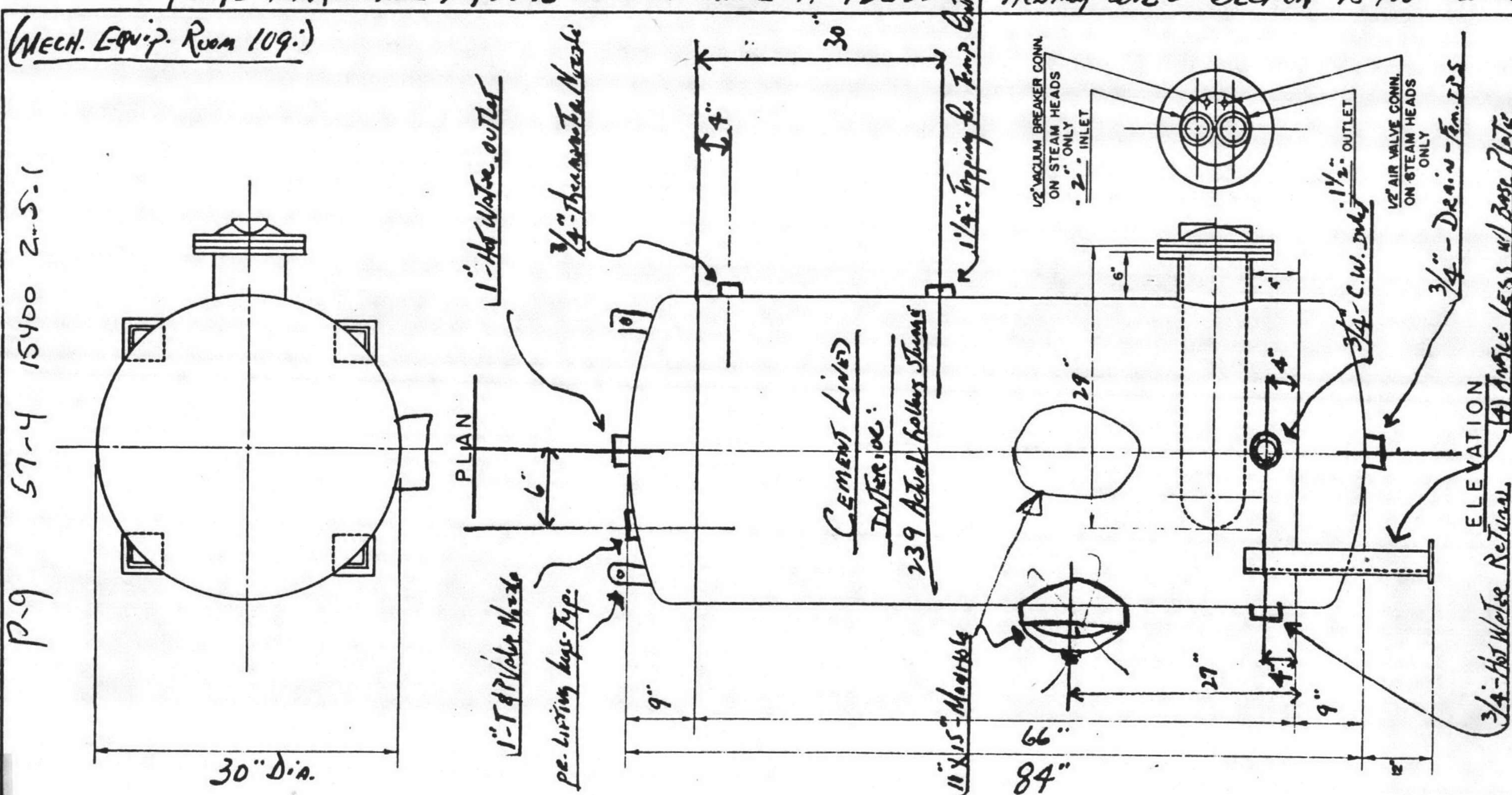
VERTICAL HEATER P-9- TANK- MIL-T-12295 - WITH MIL-H-12322 Heating Coil - SECTION 15400- Plumbing

(MECH. EQUIP. ROOM 109.)



1. NUMBER REQUIRED (1) ONE
2. DESIGN PRESSURE 125 LBS. P.S.I. TEST PRESSURE 187.5 LBS. P.S.I.
3. CONSTRUCTION ASME STAMPED, SECTION VIII :-
4. MATERIAL FINEST QUALITY BLACK CARBON STEEL PLATE - W/ ELLIPTICAL HEADS
5. PAINT STEEL TANK EXTERIOR ONE COAT METAL PRIMER RED CHROMATE PRIMER
6. INTERIOR LINING CEMENT LINED - UP TO 5/8" THICK - APPLIED AFTER SSPC-SP-3 CLEANING.
7. WEIGHT EACH 961 LBS. EACH.

1. ELEMENT U-58-7.4 [3/4 O.D. #18 BWG] SEAMLESS COPPER TUBES
2. HEATING SURFACE 7.4 SQ. FT. HEATING CAPACITY 306 G.P.H.
3. TEMPERATURE RANGE 40 °F TO 140 °F
4. HEATING MEDIUM 5 LBS.

Copper Silicone Tube sheet & Parts-
PR. Lifting Lugs-

REV: Nozzles - Fem. IPS - Copper Silicone REV: REV:

ENGINEER - DEPT. of NAVY - NORFOLK, VA.

RECO RICHMOND ENGINEERING CO.
Richmond, Virginia

VERTICAL STORAGE HEATER

CUSTOMER (SNEEDEN, INC.) NOLAND CO.-KINSTON, NC. P.O. NO. 2601-E-85167
JOB COMBAT VEHICLE MAINTENANCE SHOP - MCB- CAMP LEJEUNE, N. C.
REPRESENTATIVE DOZIER & LEN SALES CO. CITY CHARLOTTE, N.C.

JOB NO. ____ DRAWN BY CHJ, Jr. - DRAWING NO
DATE NOV. 3, 1986 APP'D BY ____

C-59-399

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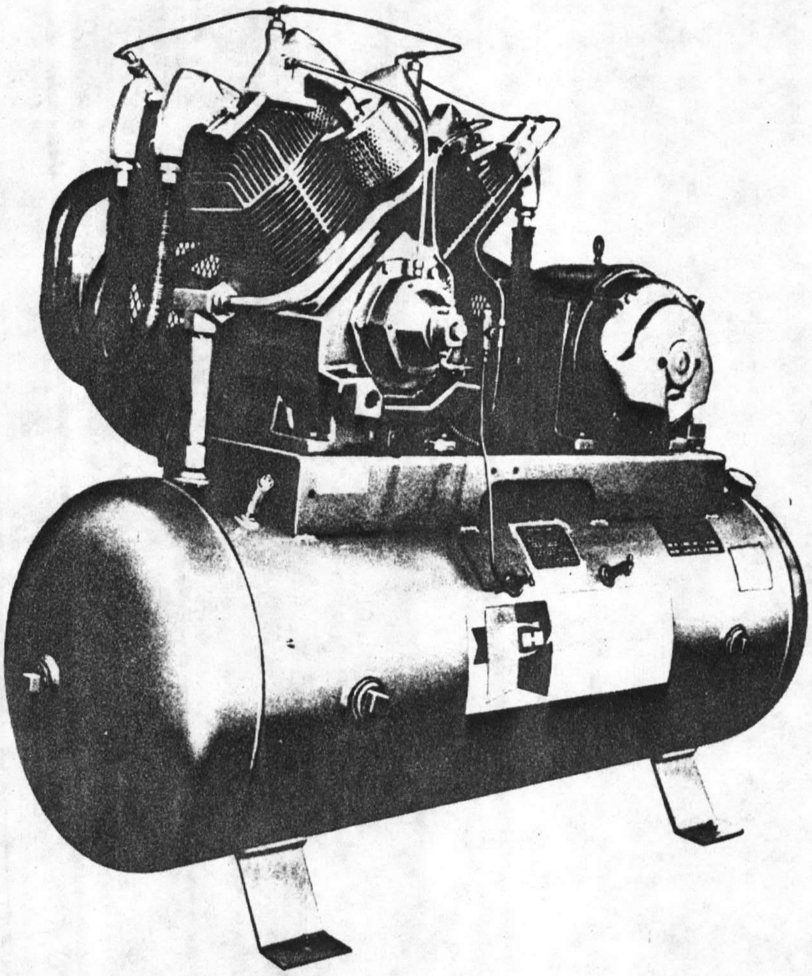
CHAMPION OWNERS GUIDE

TWO STAGE/FOUR CYLINDER AIR COMPRESSORS



TYPE AND MODEL NUMBERS ELECTRIC DRIVEN WITH MODEL R-70 PUMP

HORIZONTAL UNITS

Model HR20-12
Model HR20-25
Model HR25-12
Model HR25-25

BASE MOUNTED UNITS

Model BR-20
Model BR-25

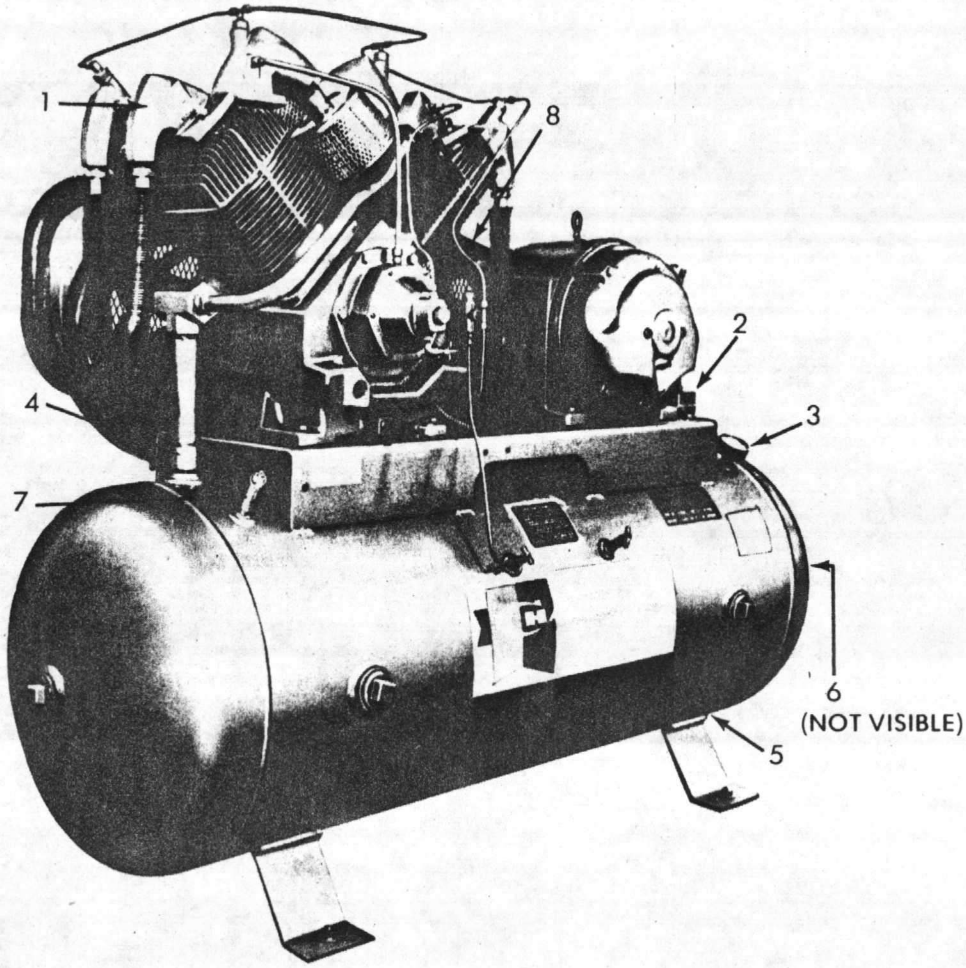
CHAMPION PNEUMATIC MACHINERY CO., INC.

1301 N. Euclid Ave. • Princeton, Illinois 61356 • (815) 875-3321 • TWX 9106424191 • Cable: "CHAMP PNE PCTN"
Manufacturing Plants in Princeton, Illinois • Belzoni, Mississippi • Medford, Oregon

COMPLETE NATION-WIDE ORGANIZATION OF CHAMPION REPRESENTATIVES AT YOUR SERVICE
AN EQUAL OPPORTUNITY EMPLOYER

Form No. 1071-3060-Rev. 876

SPECIFICATIONS



COMMON TO ALL MODELS EXCEPT BASEMOUNTED

1 Compressor Pump R-70
4 Pressure Switch P-3172A
5 Pressure Gauge M-1119
6 Check Valve P-3590A
7 Drain Cock M-521
9 Globe Valve M-1525
10 Safety Valve Z-207-200
11 V-Belt B-100

MODEL	MOTOR H.P.	TANK	MOTOR PULLEY
HR-20-12	20	P-3665D	M-1645
HR-20-25	20	P-2654D	M-1645
HR-25-12	25	P-3665D	P-3594A
HR-25-25	25	P-3564D	P-3594A
BR-20	20	P-3538C Baseplate	M-1645
BR-25	25	P-3538C Baseplate	P-3594B

TROUBLE SHOOTING CHECK LIST

SERVICE PROBLEM

A	Motor or Engine will not Start
B	Motor or Engine is Noisy or Overheats
C	Motor or Engine Stops
D	Compressor Runs Hot
E	Compressor Pumps Too Slowly
F	Compressor Won't Shut Off
G	Noisy Check Valve
H	Excessive Belt Wear
I	Abnormal Pressure Fluctuation
J	Air Escapes From Unloaden Muffler When Running
K	Air Escapes From Unloader Muffler When Stopped
L	Interstage Safety Valve Pops Off Continously
M	Compressor Cycles (runs) too Often
N	Starter Kicks Out

POSSIBLE CAUSE OF PROBLEM

			N	M	L	K	J	I	H	G	F	E	D	C	B	A	
E	1	Check Main Switch and Fuses												•		•	1
E	2	Check Magnetic Starter Heater Coils												•		•	2
E	3	Reset Magnetic Starter												•		•	3
E	4	Check Points in Pressure Switch									•			•		•	4
E	5	Check Diaphragm in Pressure Switch		•							•			•		•	5
E	6	Check for Low Voltage	•											•	•		6
E	7	Lubricate Motor													•		7
	8	Drain Water From Air Receiver		•													8
	9	Clean Aftercooler; Cylinder and Intercooler												•			9
	10	Check "V" Belts for Proper Tension							•			•	•		•		10
	11	Check for Proper Flywheel Rotation											•				11
	12	Check Compressor Pump Valves			•							•	•		•		12
	13	Check Pipe Lines for Leaks		•				•			•	•					13
	14	Check Adjustment of Unloader Valve		•				•			•						14
	15	Check Unloader Valve For Leaks		•				•			•	•					15
	16	Centrifugal Unloader Valve is Leaking		•			•	•			•	•					16
	17	Check Valve is Leaking		•		•											17
	18	Check Valve is Worn								•							18
	19	Check Valve or Line to Tank is Plugged			•			•									19
	20	Align Belts							•								20
	21	Clean Intake Muffler										•	•				21
	22	Check Crankcase Oil Level											•	•	•		22
	23	Clean Air Cleaner											•				23
G	24	No Fuel In Tank or Shut-off Valve Closed												•		•	24
G	25	Water, Dirt in Gasoline												•		•	25
G	26	Faulty Ignition Cable or Spark Plug												•		•	26
G	27	Spark Timing Wrong												•	•	•	27
G	28	Carburetor Incorrectly Adjusted													•	•	28
G	29	Remove Carbon From Engine												•	•	•	29
			N	M	L	K	J	I	H	G	F	E	D	C	B	A	

E = Electric Motor Driven Unit (Items 1-23)
G = Gasoline Engine Driven Units (Items 8-29)

FOR EXPLANATION SEE REVERSE SIDE

EXPLANATION OF CHECK LIST

1. & 2. Check all fuses and switches on lines to motor to be sure it is receiving power. Check for broken wire.

3. A magnetic starter embodies a reset button which may be used to place the motor back in service after some unusual power conditions.

4. & 5. A pressure switch uses a diaphragm to open and close a set of points. Points may become pitted or dirty thru use. Clean by "touching" up with sandpaper or replace. See instructions in pressure switch cover.

6. Low voltage is prime cause of motor trouble. Ask your power company to test for low voltage.

7. Most electric motors are of the sealed bearing type. Check motor manufacturer's recommendation.

8. Water in the form of vapor is compressed along with incoming air and condenses in tank. Tank must be drained periodically so that full storage capacity of tank may be used. To drain, open pet cock on end of horizontal tank or on side of vertical tank. This is unnecessary if compressor is equipped with automatic tank drain.

9. The fins on the cylinder and tubing should be free of dirt which acts as an insulation. This is easily done by periodically blowing them clean or thru the use of a wire bristle brush.

10. "V" belts must be tight enough to transmit the necessary power to the compressor. If too tight they will overload the engine. If, by pushing down on one belt, its top lines up with the bottom of the belt next to it the tension is correct. Should it be necessary to change the tension, slide the engine in slots provided in tank baseplate to desired position.

11. The fan blade flywheel must rotate in the direction shown by the arrows.

12. Compressor valves may become fouled by carbon or other foreign matter. To service, remove manifold and extract valve. Replace if badly carboned or worn.

13. All air lines from compressor to tank and from tank to air operated devices should be tight. A soap solution will show bubbles when put on a leaky joint. At 175 PSI a 1/32" hole will allow almost 3 cubic feet per minute to escape.

14. The unloader valve has one adjustment which controls cutout pressure. Unload pressure is regulated by piston rod nut tension.

15. Check unloader valve for loose connections.

16. The centrifugal unloader valve may become fouled by foreign matter. To clean, unscrew hex cap on end of unloader, remove spring and ball. To remove ball rock flywheel. Clean and replace. Should ball not be seating properly in body it may be tapped lightly to form a better seat in soft brass body.

17. & 18. Before servicing check valve be sure pressure in tank is ZERO. Remove check valve cap and extract plunger. Disc at bottom of plunger should be clean and free from scratches. It may be lapped in on fine sandpaper or merely turned over to other side or replaced.

19. Badly worn compressors which are pumping oil may deposit carbon within after-cooler tube and check valve, restricting flow of air and possibly plugging these parts completely. These parts should be cleaned or replaced.

20. Engine pulley and flywheel must be in line to prevent wear on sides of belts. If misaligned, move pulley in or out by loosening set screw on key and tapping pulley in appropriate direction.

21. Intake muffler should be cleaned periodically to allow unrestricted flow of entering air. To service muffler, remove from manifold by loosening set screw on side of manifold, disassemble muffler by removing bolt passing from end to end, soak in solvent, clean, dry thoroughly and replace in manifold.

22. Cool running and long life can be assured by careful attention to crankcase oil. Check fequently and change as indicated on compressor data sheet.

23. Intake muffler should be cleaned periodically to allow unrestricted flow of entering air. To service muffler, remove from manifold by loosening set screw on side of manifold, disassemble muffler by removing bolt passing from end to end, soak in solvent, clean, dry thoroughly, and read instructions on filter.

24. Self-Explanatory.

25. Dirt or gum will hold float needle in carburetor open. This condition would be indicated if fuel drips from carburetor when engine is idle. Tapping the float chamber lightly should remedy this difficulty.

26. Ignition cable may be disconnected, broken or oil soaked. Spark plug may be wet, dirty or have broken insulator. Spark plug point gap may be wrong.

27. Refer engine section Contact point adjustments.

28. Refer to engine section Carburetor adjustments.

29. Refer engine section cylinder head combustion chamber clean out.

..2 Procedures:

a. Cleaning and flushing

1.2.1.3 Test Reports:

a. Air compressors
b. Air receivers
c. Pressure tests
d. Leak tightness tests

1.2.1.4 Operation and Maintenance Manuals:

a. Compressors
b. Air dryers

1.2.1.5 Posted Operating Instructions:

a. Compressors
b. Air dryers
c. Compressed air systems

1.2.1.6 Equipment Data: Submit the following data for all equipment listed for "Operation and Maintenance Manuals".

a. Name and address of authorized branch or service department.

b. Characteristic curves.

c. Following applicable data completely filled in:

Manufacturer and Model No. CHAMPION HHP 20-12

Operating Speed 655

Capacity 93 Displacement 78.2 Del. @175 lbs. (CFM)

Type of Bearings in Unit Timkin Roller/Automotive type insert

Type of Lubrication pressure lube by rotary vane pump

Type and Adjustment of Drive Belt, slotted motor base

Capacity of Tank 120 gallon

Electric Motor: Manufacturer, Frame and Type ______

Motor Speed 1725 RPM

Current Characteristics and HP of Motor 230/460 20 hp

Thermal Cut-out Switch: Manufacturer, Type and Model ______

Starter: Manufacturer: Type and Model ______

..2 Procedures:

a. Cleaning and flushing

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a. Name and address of authorized branch or service department.

b. Characteristic curves.

c. Following applicable data completely filled in:

Manufacturer and Model No. ZEKS 100-NCAA-100

Operating Speed N/A

Capacity 100 @35°F 125 @50°F (CFM)

Type of Bearings in Unit Sleeve bearings

Type of Lubrication Incapsulated

Type and Adjustment of Drive ______

Capacity of Tank ______

Electric Motor: Manufacturer, Frame and Type ______

Motor Speed ______ RPM

Current Characteristics and HP of Motor 1/2 hp

Thermal Cut-out Switch: Manufacturer, Type and Model ______

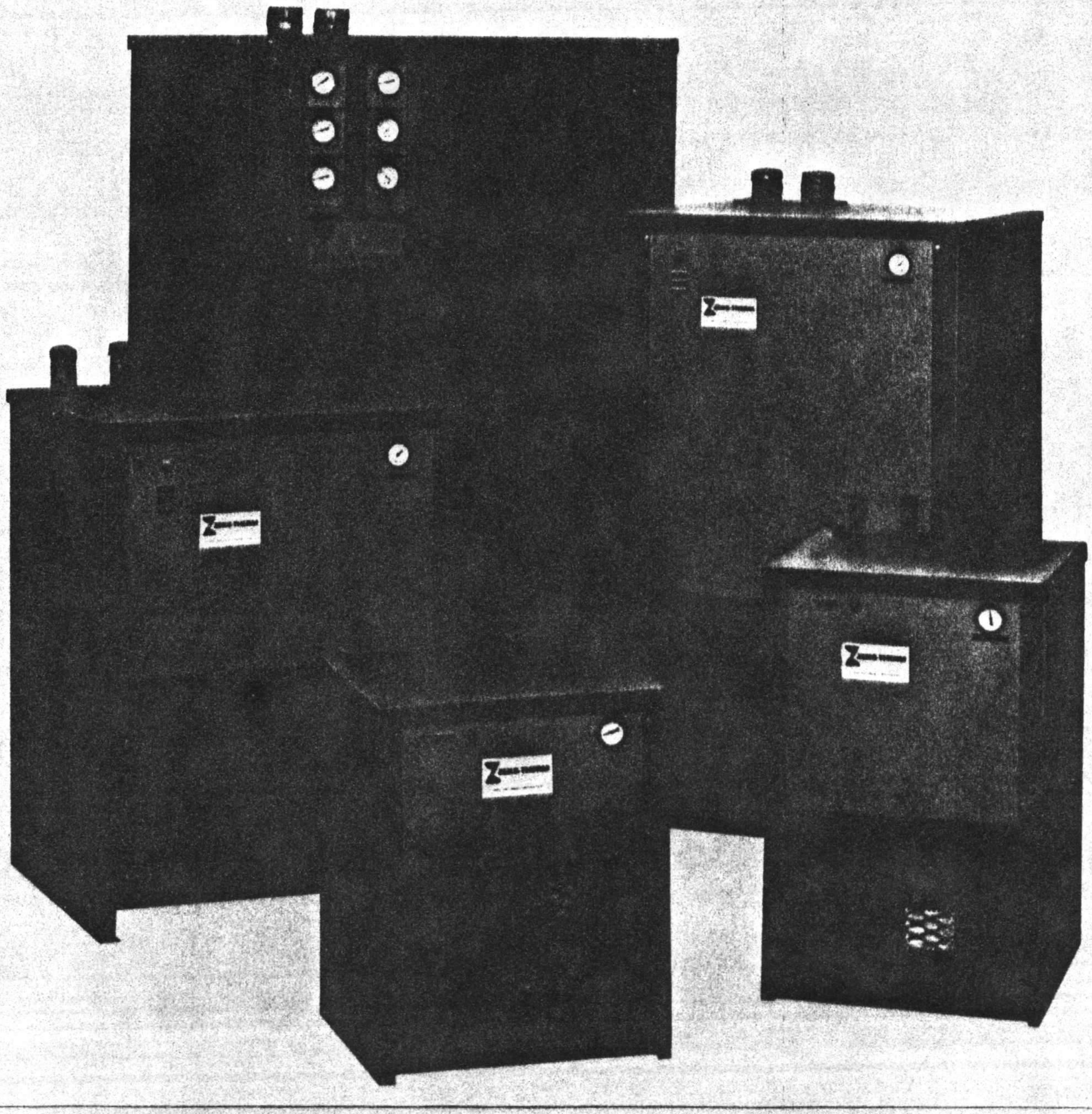
Starter: Manufacturer: Type and Model ______

15411 - 1, 2, 1, 3 B, 2, 2

ZEKS

NON-CYCLING REFRIGERATED AIR DRYERS

35-12,000 SCFM



ZEKS NCA SERIES

NON-CYCLING REFRIGERATED AIR DRYERS

PERFORMANCE SPECIFICATIONS

Model		35 NCA	50 NCA	75 NCA	100 NCA	150 NCA	200 NCA	250 NCA	300 NCA	400 NCA
Capacity	35°F	35	50	75	100	150	200	250	300	400
	50°F	44	63	94	125	188	250	313	375	500
Length	Inches	20	20	20	20	29	29	29	29	29
	cm	51	51	51	51	74	74	74	74	74
Depth	Inches	20	20	20	20	26	26	26	26	26
	cm	51	51	51	51	66	66	66	66	66
Height	Inches	25	25	31	31	39	39	53	53	53
	cm	64	64	79	79	99	99	135	135	135
Shipping Weight	Lbs	106	112	143	190	320	365	440	505	585
	Kg	48	51	65	86	145	166	200	230	266
Air Connections In-Out		1″ MPT	1″ MPT	1″ MPT	1″ MPT	2″ MPT	2″ MPT	2½″ MPT	2½″ MPT	2½″ MPT
Drain Connection		⅛″ FPT	⅛″ FPT	⅛″ FPT	⅛″ FPT	¼″ FPT	¼″ FPT	¼″ FPT	¼″ FPT	¼″ FPT
Refrigeration HP		⅕	¼	½	½	¾	1	1½	1½	2
** Max. Working Pressure PSIG		200	200	200	200	200	200	200	200	200
Full-Load Amps	115-1-60	4.9	5.8	9.3	9.3	12.3				
	230-1-60	3.1	3.1	5.0	5.0	6.5	10.4	13.0	14.8	18.1
	230-3-60					3.7	6.9	6.9	8.7	12.2
	440-3-60						4.1	4.1	5.0	6.3
	575-3-60									

** Maximum working pressure limited by rating of standard trap. Consult factory for higher working pressures.

STANDARD EQUIPMENT	AUTOMATIC CONDENSATE TRAP ON/OFF SWITCH POWER ON LIGHT REFRIGERANT ANALYZER GAUGE (SUCTION PRESSURE) AIR OUTLET PRESSURE GAUGE
OPTIONAL EQUIPMENT AND ACCESSORIES	HIGH TEMPERATURE LIGHT AIR INLET PRESSURE GAUGE AIR OUTLET TEMPERATURE GAUGE AMBIENT FILTERS WEATHERPROOF ENCLOSURE NEMA 4/NEMA 12 DUSTPROOF NEMA 7 CL.I, GROUD D, DIV. 2 EXPLOSION-PROOF REFRIGERANT DISCHARGE PRESSURE GAUGE TIMED DRAIN SOLENOID TERMINALS FOR REMOTE ALARM POWER INTERRUPTION LIGHT LOW AMBIENT PACKAGE AIR BYPASS W/PREFILTER AND AFTERFILTER NOT AVAILABLE — WATER COOLED CONDENSERS

Specifications, illustrative material and descriptions contained herein were as accurate as known at the time this publication was approved for printing. ZEKS Air Drier Corp. reserved the right to change specifications, discontinue models, equipment or design, without notice and without incurring obligation.

ZEKS-THERM® NON-CYCLING

AIR DRYER SELECTION PROCEDURE

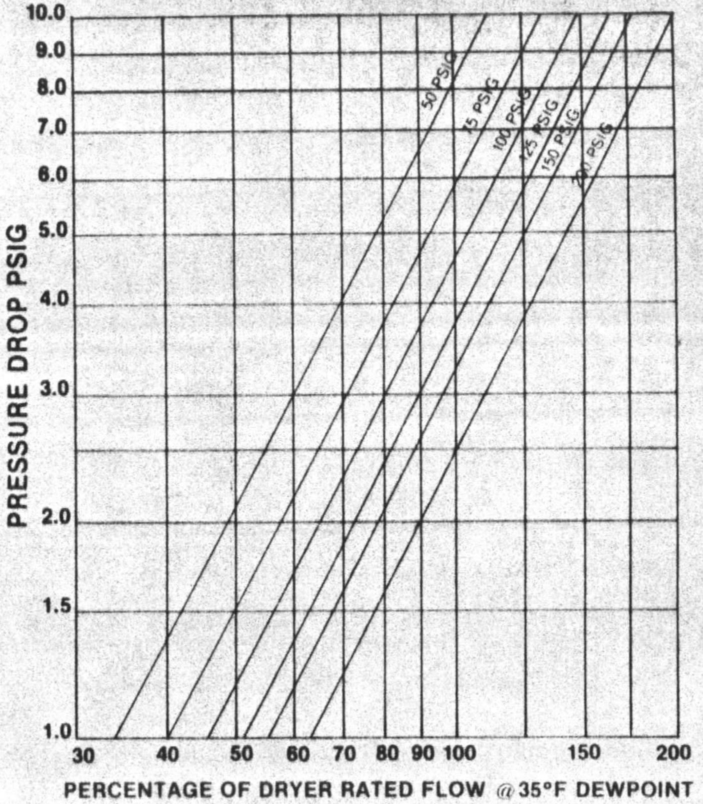
Dryer Capacities

All non-cycling refrigerated air dryer ratings are based in accordance with National Fluid Power Association (NFPA) recommended Standard NFPA/T3.27.2. This standard indicates that a dryer capacity be established on the basis of 100°F entering air temperature, 100°F ambient air temperature and 100 psig saturated inlet compressed air. At these stated conditions, a dryer must be capable of producing a dewpoint of 33°F-39°F, with a pressure drop of 5 psi or less. (Class H)

Capacity at varied conditions

All installations vary with climate, type of aftercooling, ventilation and maintenance. When conditions vary from standard, it is important to remember what effect conditions have on the amount of air flow any dryer can handle.

1. INLET TEMPERATURE
   When inlet temperature is decreased from 100°F, the capacity of the dryer increases.
2. AMBIENT TEMPERATURE
   When ambient temperature is decreased from 100°F, the capacity of the dryer increases.
3. INLET AIR PRESSURE
   When inlet pressure increases from 100 psig, the capacity of the dryer increases.
4. DEWPOINT REQUIREMENTS
   Zeks non-cycling dryers are rated nominally at 35°F. If your application does not necessarily require suppression to 35°F, it is possible that a smaller dryer could handle the requirement. In selecting a dryer for an indoor application, where temperature beyond the dryer does not go below 70°F, you can safely size a dryer requiring 50°F dewpoint. It should be noted however, that while the unit selected will provide dewpoint, pressure drop through the unit will increase. In such a situation, it is important to be aware of pressure loss. If not acceptable, resize the unit for 35°F dewpoint, thereby decreasing pressure drop.



IMPORTANT: Specific operating conditions affect the performance, thus the sizing, of any air dryer. Variations in YOUR parameters will vary the results of YOUR DRYER. Be Specific—Be Exact. Standard Sizing Conditions are: 100°F inlet air temperature, 100°F Ambient air temperature, and 100 PSIG inlet pressure.

Example: 350 SCFM
150 PSIG Inlet Air Pressure
110°F Inlet Air Temperature
90°F Ambient Air Temperature

CORRECTION FACTORS (Apply to YOUR air flow)

INLET AIR PRESSURE		INLET AIR TEMPERATURE		AMBIENT AIR TEMPERATURE	
PRESSURE PSIG	CORRECTION FACTOR	TEMPERATURE °F/°C	CORRECTION FACTOR	TEMPERATURE °F/°C	CORRECTION FACTOR
50	1.19	80 / 27	.66	80 / 27	.92
75	1.06	90 / 32	.82	90 / 32	.95
100	1.00	100 / 38	1.00	100 / 38	1.00
150	.95	110 / 43	1.21	110 / 43	1.07
275	.91	120 / 49	1.42	120 / 49	1.16

From the above chart select and apply three correction factors to YOUR known volume (350 SCFM)

1. 150 PSIG—.95 x known volume
2. 110° Inlet—1.21 x known volume
3. 90° Ambient—.95 x known volume

.95 x 1.21 x .95 x 350 SCFM = 382
Corrected SCFM

Now that you have applied the correction factors and have arrived at your CORRECTED VOLUME, you can select the proper ZEKS AIR DRYER for the performance YOU need.

For a 35° Pressure Dewpoint-Model 400
For a 50° Pressure Dewpoint-Model 300

ZEKS has a complete line of machines to specifically and economically fit your particular application requirements. Dust proof, explosion proof and other options available. Your ZEKS representative will be pleased to assist you in every way possible in selecting just the right air dryer to meet your needs.

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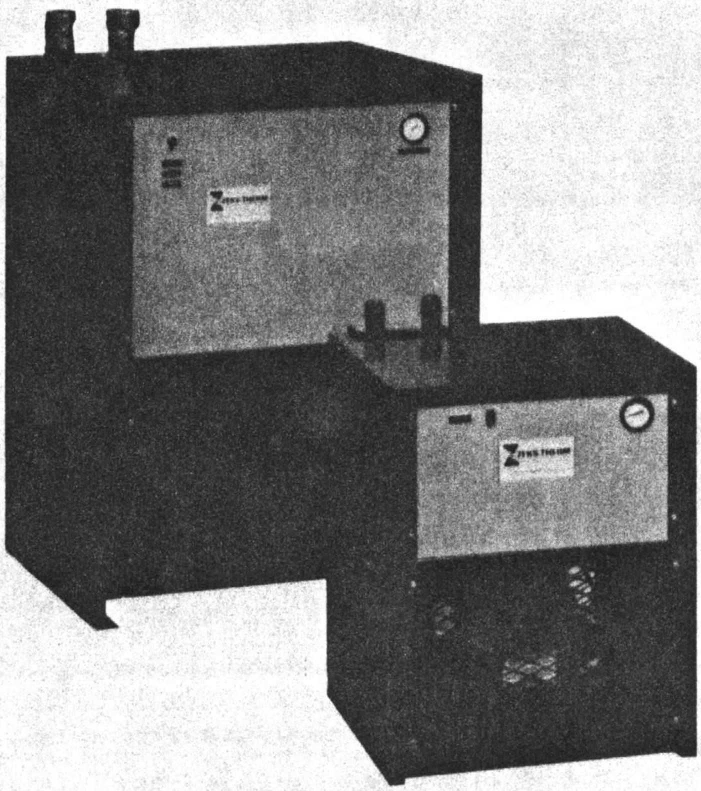
REFRIGERATED AIR DRYERS for compressed air systems

TECHNICAL MANUAL

MODELS 35NCA-400NCA



PERMEA™

A MONSANTO COMPANY

ZEKS AIR DRIER CORPORATION

Malvern Industrial Park, Box 396
Malvern, Pennsylvania 19355
(215) 647-1600—Telex 83-4832
800-345-1156
All States East of Mississippi River 800-424-3867

MODEL NUMBER DESIGNATION AND SPECIFICATIONS

EXAMPLE: MODEL 200, 230/208-1-60, AIR COOLED, WEATHERPROOF, INSTRUMENT PKG.

200	NCA	A	2	H	O
NOMINAL CAPACITY	MODEL TYPE	CONDENSER OPTION	VOLTAGE OPTION	CABINET OPTION	ACCESSORY OPTIONS

NOMINAL CAPACITY: 35, 50, 75, 100, 150, 200, 250, 300, 400

CONDENSER OPTION:
- A - Air Cooled
- W - Water Cooled**

VOLTAGE OPTION:
- 1-115-1-60
- 2-230/208-1-60
- 3-240/200-1-50
- 4-460-3-60
- 5-230/208-3-60
- 6-575-3-60

CABINET OPTION:
- E - NEMA 7 Explosionproof
- H - NEMA 4 Weatherproof Indoors/Outdoors
- R - NEMA 3 Weatherproof Outdoors
- D - NEMA 12 Dustproof/ (Industrial Use)

ACCESSORY OPTIONS: Consult Factory

MODEL	REFRIGERANT TYPE	REFRIGERANT CHARGE OZ.	VOLTAGE	ELECTRICAL COMPRESSOR RLA	ELECTRICAL COMPRESSOR LRA	ELECTRICAL FAN MOTOR RLA	ELECTRICAL FAN MOTOR LRA	WEIGHT LBS	WEIGHT KG	MAX.* WORKING PRES.PSIG
35NCAA1	R12	6	115-1-60;100-1-50	4.40	24.00	0.50	--	103	47	200
35NCAA2	R12	6	230/208-1-60;200-1-50	2.80	14.40	0.30	--	103	47	200
35NCAA3	R12	6	240/220-1-50	2.00	11.20	0.30	--	103	47	200
50NCAA1	R12	6	115-1-60;100-1-50	5.00	28.00	0.80	--	115	52	200
50NCAA2	R12	6	230/208-1-60;200-1-50	2.80	14.40	0.30	--	115	52	200
50NCAA3	R12	6	240/220-1-50	2.30	12.40	0.30	--	115	52	200
75NCAA1	R22	31	115-1-60;100-1-50	7.70	34.00	1.90	2.60	143	65	200
75NCAA2	R22	31	230/208-1-60;200-1-50	4.00	20.00	0.95	1.30	143	65	200
75NCAA3	R22	31	240/220-1-50	3.32	16.00	0.95	1.30	143	65	200
100NCAA1	R22	34	115-1-60;100-1-50	7.70	34.00	1.90	2.60	190	86	200
100NCAA2	R22	34	230/208-1-60;200-1-50	4.00	20.00	0.95	1.30	190	86	200
100NCAA3	R22	34	240/220-1-50	4.00	21.20	0.95	1.30	190	86	200
150NCAA1	R22	34	115-1-60;100-1-50	10.40	46.00	1.90	2.60	320	145	200
150NCAA2	R22	34	230/208-1-60;200-1-50	5.50	26.00	0.95	1.30	320	145	200
150NCAA3	R22	34	240/220-1-50	5.00	31.00	0.95	1.30	320	145	200
150NCAA5	R12	34	230/208-3-60;240/200-3-50	2.70	19.90	0.95	1.30	375	170	200
200NCAA2	R22	34	230/208-1-60;200-1-50	8.50	41.00	1.86	3.90	365	165	200
200NCAA3	R22	34	240/220-1-50	10.20	51.00	1.86	3.90	365	165	200
200NCAA4	R22	32	460-3-60;420/380-3-50	3.20	24.00	0.89	1.70	370	168	200
200NCAA5	R22	32	230/208-3-60;240/200-3-50	5.00	49.00	1.86	3.90	370	168	200
200NCAA6	R22	32	575-3-60 Transformed	3.20	24.00	0.89	1.70	370	168	200
250NCAA2	R22	61	230/208-1-60;200-1-50	11.10	56.00	1.86	3.90	445	202	200
250NCAA3	R22	61	240/220-1-50	10.50	52.50	1.86	3.90	445	202	200
250NCAA4	R22	61	460-3-60;420/380-3-50	3.20	24.00	0.89	1.70	453	205	200
250NCAA5	R22	61	230/208-3-60;240/200-3-50	5.00	49.00	1.86	3.90	453	205	200
250NCAA6	R22	61	575-3-60 Transformed	3.20	24.00	0.89	1.70	453	205	200
300NCAA2	R22	65	230/208-1-60;200-1-50	11.10	56.00	(2)1.86	(2)3.90	505	229	200
300NCAA3	R22	65	240/220-1-50	10.50	52.50	(2)1.86	(2)3.90	505	229	200
300NCAA4	R22	65	460-3-60;420/380-3-50	3.20	24.00	(2)0.89	(2)1.70	515	234	200
300NCAA5	R22	65	230/208-3-60;240/200-3-50	5.00	49.00	(2)1.86	(2)3.90	515	234	200
300NCAA6	R22	65	575-3-60 Transformed	3.20	24.00	(2)0.89	(2)1.70	515	234	200
400NCAA2	R22	68	230/208-1-60;200-1-50	14.40	71.00	(2)1.86	(2)3.90	585	265	200
400NCAA3	R22	68	240/220-1-50	15.50	68.80	(2)1.86	(2)3.90	585	265	200
400NCAA4	R22	68	460-3-60;420/380-3-50	4.50	27.00	(2)0.89	(2)1.70	585	265	200
400NCAA5	R22	68	230/208-3-60;240/200-3-50	8.50	65.00	(2)1.86	(2)3.90	585	265	200
400NCAA6	R22	68	575-3-60 Transformed	4.50	27.00	(2)0.89	(2)1.70	585	265	200

* Maximum Working Pressure limited by Trap - Consult factory for details.

** For watercooled machines, refrigerant charge will be different than aircooled - Refer to the machine nameplate for the correct charge.

TABLE I

GENERAL

The Zeks-Therm air dryer removes moisture, dirt, oil vapor, and other contaminants from the compressed air. This is accomplished by cooling the air with a refrigeration unit to below its dewpoint causing the moisture to condense. This dependable, highly efficient dryer can be easily installed in any pneumatic system in which dry air is required or desired. Refer to Principle of Operation for complete operating details.

INSTALLATION

Inspection - The unit should be inspected upon receipt for any signs of damage during transit. Any signs of damage should be reported immediately to the carrier.

Locating and Mounting - The dryer should not be located in an area where ambient temperature is likely to exceed 113°F(45°C) or be less than 50°F(10°C).

For locations where this maximum ambient temperature is exceeded for prolonged periods of time, a watercooled refrigeration unit must be furnished.

On installations with relative steady flow rate, the dryer is normally connected after the air receiver. But if loads fluctuate widely as in sand blasting, sufficient storate capacity downstream of the dryer should be available to prevent excessive airflow through the dryer.

The dryer may be mounted on any substantial floor that is free of excessive vibration.

The dryer must be sufficiently clear of walls and adjoining equipment so that the access panels may be easily removed, and also to provide a free circulation of air through the ventilating louvers and grills. Make sure that sufficient space is available on the condenser inlet and outlet side. A minimum of 12in.(300mm) should be allowed.

In floor mounting, make certain that the dryer is level before anchoring the unit to the floor. If necessary, insert shims under the mounting rails to level.

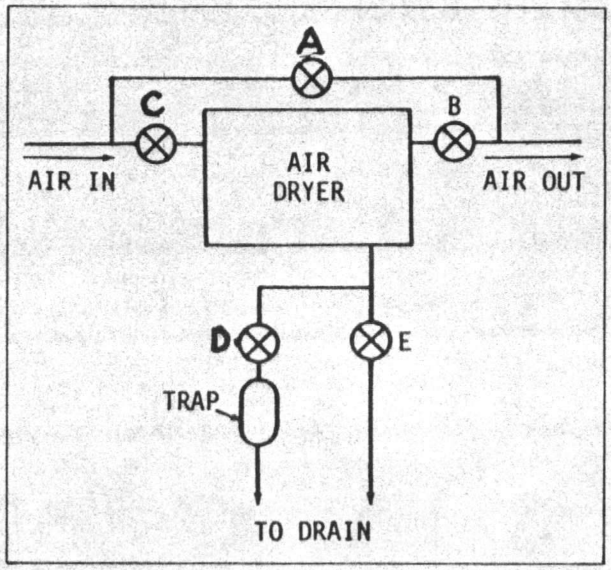


FIGURE 1. TYPICAL PIPING ARRANGEMENT

Electrical Connection - Connect wires located inside electrical junction box on dryer to power source. The nameplate on the dryer identifies the voltage requirements. A suitable fused disconnect switch in accordance with national and local code requirements is recommended. See Table 1 for full load amps requirement of unit.

Zeks-Therm air dryers are equipped with an on-off power switch. The dryer is designed to run continuously while the air system is being used. Dryer may be turned off during night time or weekend shutdown periods. This should be done with the on-off switch.

IMPORTANT: Maximum allowable voltage variation is +15% and -10% from rated voltage.

Piping - Install piping, fittings and accessory items as indicated in Figure 1. For bypass and isolating purposes, valves A,B, and C must be installed (not furnished). An automatic draintrap, preferably of the ball and float type, (std. 35 thru 400 must be installed in the drain line. For testing and isolating this trap for servicing purposes, valves D and E must be installed (not furnished).

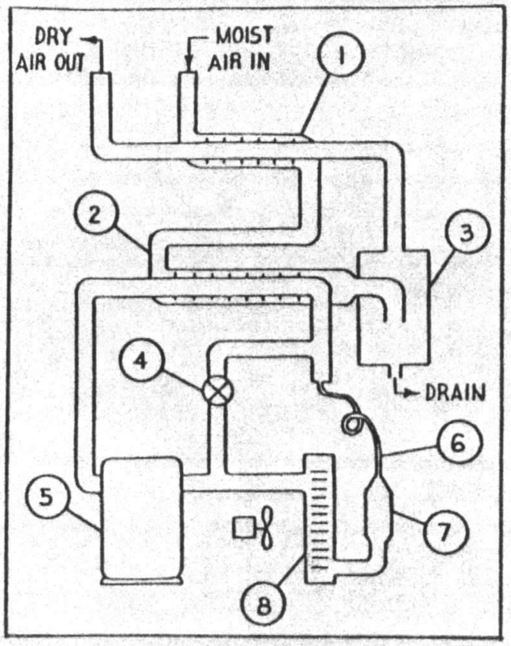
Valves - To operate dryer all valves shown in Figure 1 are to be closed except valves (B), (C), and (D). Valve (A) used for by pass purposes; Valve (E) is for test and drain purposes.

OPERATION (Refer to Figure 2)

Compressed Air System - Compressed air entering dryer goes first to the pre-cooler/reheater where it is cooled by the cool air leaving the separator. The air then goes into the evaporator where it is further cooled to the desired dewpoint by the freon in the refrigeration circuit. The air continues to the separator where the condensed moisture is separated from the air by centrifugal force and the condensate goes out the drain while dry compressed air goes to the precooler/reheater where it is reheated by the incoming hot moist air. The air then goes back into the compressed air system.

Cooling in the refrigeration circuit is accomplished by the continuous circulation and evaporation of a fixed supply of refrigerant, either R12 or R22. The hermetically sealed compressor delivers the gas thru the discharge tube under pressure to the condenser. Here the combined action of the fan and the finned tubes releases the heat to the air. When the gas loses heat it reverts to a liquid.

The flow of liquid refrigerant into the evaporator is controlled by the capillary tube. As the refrigerant enters the evaporator it is subject to much lower pressure due to the suction of the compressor. Therefore it will boil and evaporate picking up heat from the compressed air and lowering its temperature. The temperature of the refrigerant entering the evaporator is controlled by a by-pass valve. This valve meters the amount of hot gas which is allowed to bypass the condenser and mixes with the refrigerant, thus controlling the temperature of the freon entering the evaporator.



(1) PRECOOLER/REHEATER
(2) AIR CHILLER EVAPORATOR
(3) SEPARATOR
(4) HOT GAS BYPASS VALVE
(5) COMPRESSOR
(6) CAPILLARY TUBE
(7) FILTER/DEHYDRATOR
(8) CONDENSER (AIR OR WATER COOLED)

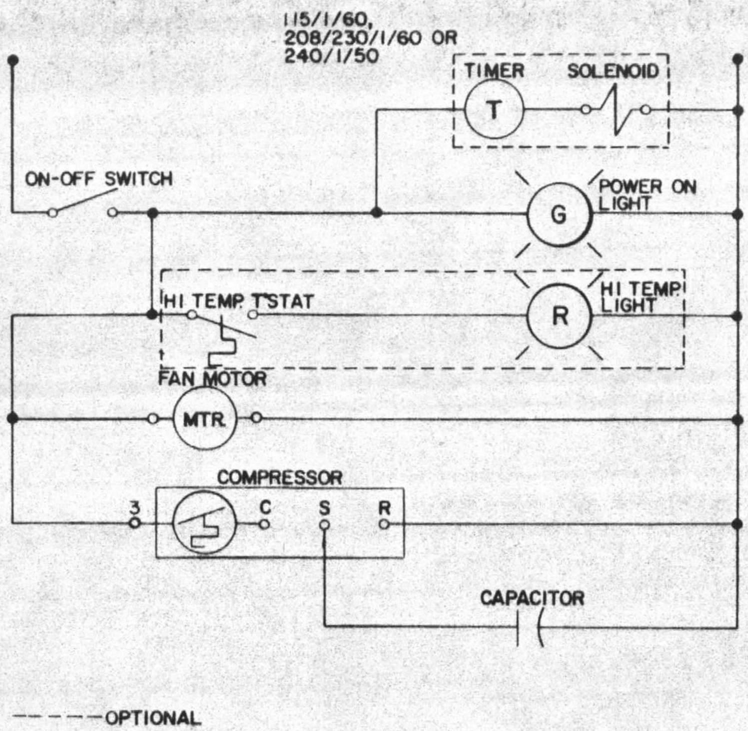
FIGURE 2 SCHEMATIC

ROUTINE INSPECTION AND MAINTENANCE

The Zeks-Therm refrigerated air dryer requires little maintenance. Fan motor bearings are prepacked and sealed. However it is recommended to inspect and service your dryer at regular intervals to obtain maximum benefit out of your dryer.

Lubrication - These dryers are constant running hermetically sealed condensing units. Units do not require any lubrication.

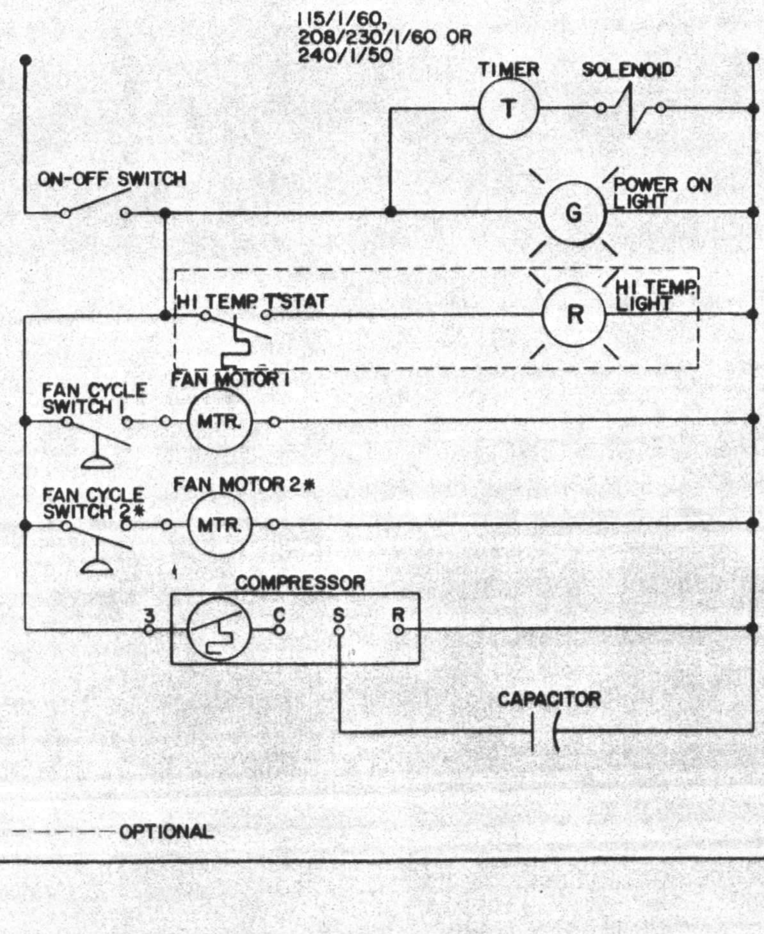
1. Inspect Refrigerant Condenser - For proper operation, it is essential that the condenser fins are free of dirt and dust. Regular cleaning is therefore required. If the dryer is located in an area where dust is excessive, a condenser ambient air filter should be fitted.
2. Blow Down and Test Condensate Drainage System - Refer to figure 1 - Open test valve (E) occasionally to test operation of the automatic drain trap. Should water blow through the test valve, the automatic trap is inoperative and should be inspected and cleaned. To service trap, isolate it from the system by closing valve (D). Recheck the operation of the drain trap with the test valve after several days of operation.



MODELS
35 NCAA1
35 NCAA2
35 NCAA3
50 NCAA1
50 NCAA2
50 NCAA3
75 NCAA1
75 NCAA2
75 NCAA3
100 NCAA1
100 NCAA2
100 NCAA3

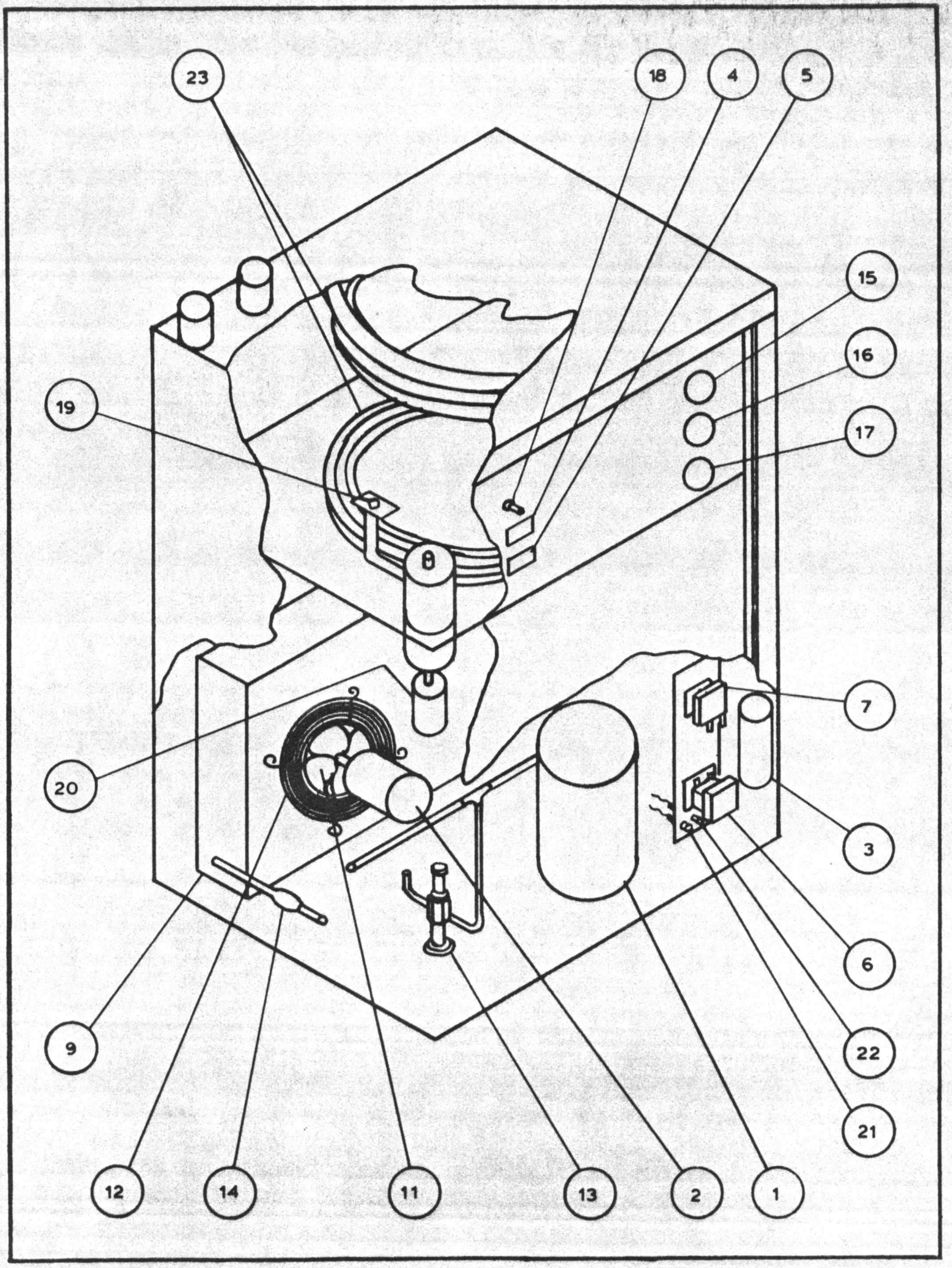
* NOTE - FAN CYCLE SWITCH USED ON MODELS 125, 150, 200 ONLY
NOTE 2 - NCA200 FAN MOTOR LEADS; RED WIRE 208V, WHITE WIRE COMMON, TAPE UNUSED WIRE

AIR COOLED MODELS



MODELS
150 NCAA1
150 NCAA2
150 NCAA3
200 NCAA2
200 NCAA3
250 NCAA2
250 NCAA3
300 NCAA2
300 NCAA3
400 NCAA2
400 NCAA3

* NOTE - MOTOR 2 AND FAN CYCLE SWITCH 2 USED ON MODELS 300 AND 400 ONLY



PARTS LIST ITEM NUMBERS

PARTS LIST NCA

ITEM	1	2	3	4	5	6	7
DESCRIPTION	COM-PRESSOR	FAN MOTOR	RUN CAP-ACITOR	POWER ON LIGHT	HI TEMP. LIGHT	CON-TACTOR	TRANS-FORMER
35NCAA1	600029	--	--	697299	697297	--	--
35NCAA2	697354	--	--	697302	697300	--	--
35NCAA3	697365	--	--	697302	697300	--	--
50NCAA1	600005	--	--	697299	697297	--	--
50NCAA2	697354	--	--	697302	697300	--	--
50NCAA3	697355	--	--	697302	697300	--	--
75NCAA1	697191	697304	697310	697299	697297	--	--
75NCAA2	697192	600083	697310	697302	697300	--	--
75NCAA3	697190	600083	697311	697302	697300	--	--
100NCAA1	697191	697304	697310	697299	697297	--	--
100NCAA2	697192	600083	697310	697302	697300	--	--
100NCAA3	697193	600083	697310	697302	697300	--	--
150NCAA1	697194	697304	697310	697299	697297	--	--
150NCAA2	697195	600083	697310	697302	697300	--	--
150NCAA3	697196	600083	697311	697302	697300	--	--
150NCAA5	697361	600083	--	697302	697300	697289	--

PARTS LIST NCA

ITEM	DESCRIPTION	35NCA	50NCA	75NCA	100NCA	150NCA
8	Water Valve	--	--	600561	600561	600561
9	Condenser (Air Cooled)	--	--	697172	697172	697168
10	Condenser (Water Cooled)	--	--	600554	600554	600555
11	Fan Blade	--	--	697186	697186	697186
12	Motor Mount	--	--	697223	697223	697223
13	Hot Gas Valve	600403	600403	697341	697341	600405 230-3-60 697341 A1,A2,A3
14	Dryer	698044	698044	698044	698044	698045
15	Suction Pressure Gauge	697358	697358	697306	697306	697306
16	Leaving Air Pressure Gauge	697285	697285	697285	697285	697285
17	Entering Air Temp. Gauge	697284	697284	697284	697284	697284
18	Switch	697303	697303	697303	697303	697303
19	Hi Temp. T'Stat	697277	697277	697277	697277	697277
20	Trap	697360	697360	697360	697360	600569
						697362 A1,A2,A3
21	Fan Cycle Switch #1	--	--	--	--	600097 230-30-60
22	Fan Cycle Switch #2	--	--	--	--	--
23	Exchanger	700908	700909	700910	700911	700912

TAB PLACEMENT HERE

DESCRIPTION:

8.

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New Bern, NC
1-888-622-4425
9/08

Honeywell

ENGINEERING DATA FOR

JOB NAME: COMBAT VEHICLE MAINT. SHOP

JOB NUMBER: 939-87610

ENGINEER: RICK MANALOTO

OPERATION AND MAINTENANCE

LP914A
V5011C
MP953D
L4029E
P658A
VP526A
LP920A
MP918B
RP418A
2SA2
AK3485E
HKN8210B
T651A/T451A
RHD9007
T675A
MP909E
RP920B
R4222D

HONEYWELL INC., 517 SOUTH SHARON AMITY ROAD, P.O. BOX 22087, CHARLOTTE, NORTH CAROLINA 28222, TELEPHONE 704/364-4770

15971-3.5

Honeywell

December 10, 1987

Sneeden, Inc.
301 Eastwood
Wilmington, N.C. 28403

Attention: James Sneeden

Subject: Checkout Procedure
Combat Vehicle Shop
Honeywell Job #939-87610

Dear Mr. Sneeden:

This will be the checkout procedure used. On all pneumatic controllers and thermostats the set point will be adjusted to the present temperature. The output pressure will be adjusted to 9 PSI, then the controller or thermostat will be set to specified set point and proper sequence of operation verified. At that time all interlocks will be checked.

All electric controls, switches, relays, etc. will be switched to verify specified sequence of operation.

1. All 4-10 MA transducers are factory calibrated. A 24 VDC power supply will be connected to the inputs and the current measured. This current will be compared to cal sheet to verify proper reading.

2. All start/stop relays will be energized to verify remote start/stop of fan coil units and pumps.

NOTE: See attached for sequence of operation. Mr. Ed Thornton will be performing tests.

Regards,

HONEYWELL INC.

Lee Stafford
Systems Engineer

LS:bl

cc: ECI
Ed Thornton, Honeywell

HONEYWELL INC., 517 SOUTH SHARON AMITY ROAD, P.O. BOX 220487, CHARLOTTE, NORTH CAROLINA 28222, TELEPHONE 704/364-4770

939-87610

SEQUENCE OF OPERATION - Combat Veh. Shop

Hot Water Temperature Control: On a rise in hot water temperature leaving the steam to hot water converter, the hot water thermostat will act to modulate the steam control valve towards its closed to the converter position. On a further rise in hot water temperature, the thermostat will act to shut the steam control valve completely. On a fall in water temperature, the hot water thermostat will act to open the steam control valve. On a further fall in water temperature, the thermostat will act to fully open the steam control valve. The leaving hot water temperature will be reset in accordance with the schedule shown on the drawings by the outside air temperature acting on the thermostat. A solenoid valve will be installed in the control circuit to prevent the steam control valve from opening unless the hot water pump is in operation.

Hot Water Pump Control: If the switch is in the auto position then the hot water pump will be started by the action of an outside air thermostat when the outside air temperature drops below 65 Deg. F. The signal will be fed through the automatic contact of a hand-off-automatic switch on the pump starter.

Air Handling Units No. 1, 2, and 3 System Control:

Air Handling Unit: The air handling unit will operate continuously unless stopped by the action of the 7-day time clock or firestat. The air handling unit may be started during non-programmed hours by use of the manual timed override switch.

Space Temperature Control: On a rise in space temperature, the space thermostat acts to close the 3-way valve at 63 Deg. F. On a further rise in space temperature and after a dead band range to 75 Deg. F., the thermostat acts to start the compressor. The condensing unit will be interlocked with the air handling unit so that the condenser unit can operate only when the air handling unit is in operation.

Night Setback Control: During the non-programmed hours and on a fall in space temperature below the set point (approximately 60 Deg. F.) the space setback thermostat (T-7) act to start the air handling unit and modulate the three way hot water control valve open.

Air Handling Unit No. 4 and 6 Controls:

Air Handling Unit: The air handling unit will be interlocked with the vehicle fume exhaust fan, located in its bay, to operate any time the exhaust fan is in operation. The outside air intake damper will be interlocked with the air handling unit fan to close when the fan is not in operation. Air handling unit #4 will also be interlocked with fan #1 to operate any time fan #1 is in operation.

Supply Air Temperature Control: The supply air temperature will be controlled by a supply air controller acting on the face and by-pass damper in the air handling unit. The temperature of the supply air is transmitted to the controller by a supply air temperature sensor located in the supply air ductwork. On a rise in supply air temperature above the set point (68 Deg. F) the supply air controller will act to modulate the face and by-pass damper to by-pass air around the hot water coil. On a further rise in supply air temperature the supply air controller will act to close the face and by-pass all the air around the hot water coil. The hot water will circulate through the coil any time the hot water pump is in operation.

Hot Water Unit Heater and Fin Tube Heater Control: The heater will be controlled by a wall mounted thermostat acting on the 3-way two position valve. On a rise in room temperature, the space thermostat will act to close the three way valve to the coil and by pass the hot water from the heater.

TEST PROCEDURE

Combat Vehicle Shop #939-87610

CONVERTOR:

Set thermostat (TE-3) to start hot water pump. E.P. Relay (EP-1) will energize. Receiver controller (RC-1) will assume control of valve (V-1). Raise set point of receiver controller (RC-1), valve (V-1) will open. Lower set point of receiver controller (RC-1), valve (V-1) will close. Check reset schedule to make sure control point equals what temperature at which it should be controlling.

AHU-1,2,3:

Set time clock (CK-1) to the on position. Make sure relays (R-1,2) energize. AHU-1,2,3 should start. Place time clock CK-1) to the off position, AHU-1,2,3 stop. Raise set point of night low limits (TN-1,2,3), respective air handling unit starts. Lower set point and unit will stop. Turn timed overide (TOS-1,2,3) on, respective air handling unit will start. Energize relays (EMR-1,2,3) with unit running, unit will shut down. Check firestate (FS-1) to make sure it shuts down its respective air handling unit. Raise thermostat (T-1) set point, check to see that valve (V-2) opens to flow thru the coil. Lower set point of thermostat (T-1), check to see that valve (V-2) opens to full coil bypass position. Lower set point more and P.E. switch (PE-1) will start condensing unit. When respective unit is started check to make sure outside damper (DM-3,4) open thru action of the EP relay (EP-3,4).

EF-1,2,3,4,5,7,8,9,10,11,12,13,15,16, AND 17:

Turn toggle switch on, check to make sure respective fan starts.

AHU-4,6:

Turn EF-4 and EF-9 on. Make sure AHU-4 and 6 start from respective interlock (AHU-4 with EF-4 and AHU-6 with EF-9). Check to make sure damper (DM-2) opens thru action of the EP relay (EP-2). Raise set point of thermostat (TC-1), dampers modulate open to the coil. Lower set point of thermostat (TC-1), dampers modulate to the full bypass position.

Test procedure for Combat Vehicle Shop continued:

EF-6 AND 14:

Lower set point of thermostat (TE-1), fan EF-6 will start. Raise set point, fan will stop. Check to make sure when time clock (CK-1) is turned on and off, fan EF-14 starts and stops.

UNIT HEATERS:

Raise set point of room thermostat (F-2,3), unit heater fan will start thru action of the PE switch (PE-2,3). Valve (V-3,4) will modulate open to flow thru the unit heater coil. Lower setpoint, valve will modulate to the bypass position and fan will stop.

FIN TUBE RADIATION:

Raise set point of thermostat (T-4), the valve (V-5) will modulate open to flow thru the radiation. Lower set point, valve will modulate to the by pass position.

Honeywell

Comfort Control Systems

MO953A-D AND MP953A-F PNEUMATIC VALVE ACTUATORS

Service Data

GENERAL

DESCRIPTION

The MO953 and MP953 are pneumatic valve actuators for V5011 and/or V5013 Valve Assemblies, and with adapters, control older steam and water valves. The MP953E and MP953F models have a new-style positive positioner (1982). There are four new-style positive positioner retrofit kits available for MP953A and B models (see ACCESSORIES in PARTS AND ACCESSORIES section).

APPLICATION

These pneumatically powered actuators operate the V5011 and V5013 Valve Assemblies, or certain other coil, line, and zone valve assemblies which proportionally control steam, or hot and cold liquids in HVAC systems.

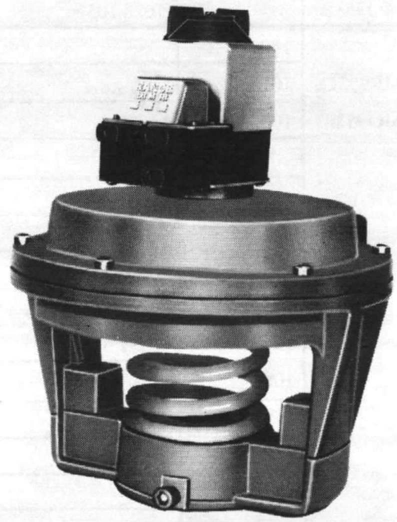
SPECIFICATIONS

MODELS:

- MP953A—Direct-acting with old-style positioner (Gradutrol Relay).
- MP953B—Reverse-acting with old-style positioner.
- MP953C—Direct-acting without positioner.
- MP953D—Reverse-acting without positioner.
- MP953E—Direct-acting with new-style positive positioner.
- MP953F—Reverse-acting with new-style positive positioner.

MAXIMUM SAFE AIR PRESSURE: 30 lb/in^2 (172 kPa).

Refer to Table I for other MO953/MP953 specifications.



MP953E R2620

MP953C R1878

Table I. MO953/MP953 Specifications.

Device	Active	Inactive (1982) MP953	Inactive (1982) MO953	Size in Inches (mm)	Travel in Inches (mm)	Maximum Temperature ⚠1 F (C)	Spring Range lb/in² (kPa)	Corrosion Resistant
MP953A		1087 1004 1210	A1	5 (127)	3/4 (19)	160 (71)		No
MO953A		1095 1012 1228	A2	5 (127)	3/4 (19)	250 (121)		No
		1103 1046	A6	5 (127)	3/4 (19)	250 (121)		Yes
		1079 1111	A9	5 (127)	1/2 (13)	160 (71)		No
			A5	5 (127)	3/4 (19)	160 (71)		No
		1145 1020 1244	A3	8 (203)	3/4 (19)	160 (71)		No
		1038 1152	A4	8 (203)	1-1/2 (38)	160 (71)	Adjustable	No
		1178 1053	A7	8 (203)	3/4 (19)	160 (71)		Yes
		1202 1186 1061 1269	A8	12 (330)	1/1-2 (38)	160 (71)		No
		1002 1036 1069	B6	7-1/8 (181)	3/4 (19)	160 (71)		No
MP953B		1010 1044	B7	7-1/8 (181)	1/2 (13)	160 (71)		Yes
MO953B		1028 1051	B8	7-1/8 (181)	3/4 (19)	160 (71)		Yes
	1000		C1XH	5 (127)	3/4 (19)	160 (71)	2-7 (14-48)	No
MP953C	1018		C1XK	5 (127)	3/4 (19)	160 (71)	8-12 (55-83)	No
MO953C	1026		C1XL	5 (127)	3/4 (19)	160 (71)	4-11 (28-76)	No
		1034	C2XH	5 (127)	3/4 (19)	250 (121)	2-7 (14-48)	No
		1042	C2XK	5 (127)	3/4 (19)	250 (121)	8-12 (55-83)	No
		1059	C2XL	5 (127)	3/4 (19)	250 (121)	4-11 (28-76)	No
		1505		5 (127)	3/4 (19)	250 (121)	4-11 (28-76)	Yes
	1067		C3XH	8 (203)	3/4 (19)	160 (71)	2-7 (14-48)	No
	1075		C3XK	8 (203)	3/4 (19)	160 (71)	8-12 (55-83)	No
	1083		C3XL	8 (203)	3/4 (19)	160 (71)	4-11 (28-76)	No
		1422		8 (203)	3/4 (19)	250 (121)	4-11-(28-76)	Yes
		1091	C4XH	8 (203)	1-1/2 (38)	160 (71)	2-7 (14-48)	No
		1109	C4XK	8 (203)	1-1/2 (38)	160 (71)	8-12 (55-83)	No
	1117		C4XL	8 (203)	1-1/2 (38)	160 (71)	4-11 (28-76)	No
	1547			8 (203)	1-1/2 (38)	160 (71)	3-15 (21-103)	Yes
		1141	C9XH	5 (127)	1/2 (13)	160 (71)	2-7 (14-48)	No
		1158	C9XK	5 (127)	1/2 (13)	160 (71)	8-12 (55-83)	No
		1166	C9XL	5 (127)	1/2 (13)	160 (71)	4-11 (28-76)	No
		1174	C5XH	5 (127)	3/4 (19)	160 (71)	2-7 (14-48)	Yes
		1182	C5XK	5 (127)	3/4 (19)	160 (71)	8-12 (55-83)	Yes
		1190	C5XL	5 (127)	3/4 (19)	160 (71)	4-11 (28-76)	Yes
		1208	C6XH	5 (127)	3/4 (19)	250 (121)	2-7 (14-48)	Yes
		1216	C6XK	5 (127)	3/4 (19)	250 (121)	8-12 (55-83)	Yes
		1224	C6XL	5 (127)	3/4 (19)	250 (121)	4-11 (28-76)	Yes
		1232	C7XH	8 (203)	3/4 (19)	160 (71)	2-7 (14-48)	Yes
		1240	C7XK	8 (203)	3/4 (19)	160 (71)	8-12 (55-83)	Yes
		1257	C7XL	8 (203)	3/4 (19)	160 (71)	4-11 (28-76)	Yes
		1414		8 (203)	3/4 (19)	250 (121)	4-11 (28-76)	No
	1471	1125	C8XH	13 (330)	1-1/2 (38)	160 (71)	2-7 (14-48)	No
	1489	1133	C8XL	13 (330)	1-1/2 (38)	160 (71)	4-11 (28-76)	No

Table I. MO953/MP953 Specifications. (Continued)

Device	Active	Inactive (1982) MP953	Inactive (1982) MO953	Size in Inches (mm)	Travel in Inches (mm)	Maximum Temperature ⚠1 F (C)	Spring Range lb/in^2 (kPa)	Corrosion Resistant
MP953D	1107	1008	D1	7-1/8 (181)	3/4 (19)	160 (71)	8-13 (55-90)	No
MO953D		1115 1016	D2	7-1/8 (181)	1/2 (13)	160 (71)	8-13 (55-90)	No
		1123 1024	D3	7-1/8 (181)	3/4 (19)	160 (71)	8-13 (55-90)	Yes
	1131	1073		7-1/8 (181)	3/4 (19)	160 (71)	4-11 (28-76)	No
		1081 1149		7-1/8 (181)	1/2 (13)	160 (71)	4-11 (28-76)	No
		1099 1156		7-1/8 (181)	3/4 (19)	160 (71)	4-11 (28-76)	Yes
	1172			7-1/8 (181)	3/4 (19)	160 (71)	3-7 (21-48)	No
	1198 ⚠2			7-1/8 (181)	3/4 (19)	160 (71)	4-11 (28-76)	No
	1206 ⚠2			7-1/8 (181)	3/4 (19)	160 (71)	8-13 (55-90)	No
	1214 ⚠2			7-1/8 (181)	3/4 (19)	160 (71)	3-7 (21-48)	No
	1222			7-1/8 (181)	3/4 (19)	250 (121)	4-11 (28-76)	No
MP953E	1301			5 (127)	3/4 (19)	160 (71)	3 (21)	No
	1319			5 (127)	3/4 (19)	160 (71)	5 (34)	No
	1327			5 (127)	3/4 (19)	160 (71)	10 (69)	No
	1277			8 (203)	1-1/2 (38)	160 (71)	3 (21)	No
	1285			8 (203)	1-1/2 (38)	160 (71)	5 (34)	No
	1293			8 (203)	1-1/2 (38)	160 (71)	10 (69)	No
	1368			8 (203)	3/4 (19)	160 (71)	3 (21)	No
	1376			8 (203)	3/4 (19)	160 (71)	5 (34)	No
	1384			8 (203)	3/4 (19)	160 (71)	10 (69)	No
	1392			13 (330)	1-1/2 (38)	160 (71)	3 (21)	No
	1400			13 (330)	1-1/2 (38)	160 (71)	5 (34)	No
	1418			13 (330)	1-1/2 (38)	160 (71)	10 (69)	No
MP953F	1119			7 (180)	3/4 (19)	160 (71)	10 (69)	No
	1101			7 (180)	3/4 (19)	160 (71)	5 (34)	No
	1093			7 (180)	3/4 (19)	160 (71)	3 (21)	No

⚠1 Diaphragm color varies with maximum temperature: Black (Neoprene)—160 F (71 C), Black with White Dot (Ethylene Propylene)—250 F (121 C).

⚠2 Sales Special.

OPERATION

In a direct-acting (N.O. valve) system, an increase in control air pressure forces the actuator diaphragm and cup assembly downward, forcing the valve stem down to proportionally close off the flow through the valve (Fig. 1).

In a reverse-acting (N.C. valve) system, an increase in control air pressure forces the actuator diaphragm and cup assembly upwards, forcing the valve stem up to proportionally increase the flow through the valve.

Actuators without the positive positioner have branch line pressure applied to the diaphragm. Operators with positive positioners may have up to full main air pressure applied to diaphragm to ensure the valve is positioned proportionally to the branch line pressure.

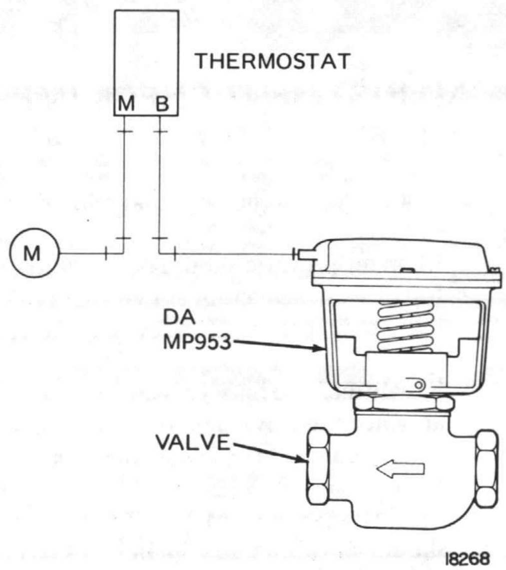


Fig. 1. Typical Direct-Acting MP953 Operation.

MAINTENANCE

EQUIPMENT NEEDED

— Commercial cleaning solvent or degreaser.
— Gage, 0 to 30 lb/in^2 (0 to 207 kPa).
— Wrench, Part No. 301572A, for MP953A and B.

VISUAL INSPECTION

Periodically make a visual check for leaks, loose fittings, etc.

CLEANING

Clean the actuator with a commercial cleaning solvent or degreaser.

WARNING

Careless handling of solvents can result in permanent damage to the respiratory system or to the skin. Avoid prolonged inhalation or contact with the skin.

OPERATIONAL CHECK

Vary the branch line pressure through the operational range of the actuator in both directions. The valve should open and close smoothly.

ADJUSTMENT CHECK (MP953A, B, E, F)

1. Install gages in the main and pilot air lines.

2. Main air pressure should be equal to or more than top of sequencing range: 13 lb/in^2 (90 kPa) is minimum main pressure for device to function.

3. Slowly increase pilot pressure and note the pressure at which the valve stem travel starts. This pressure should be within $\pm 3/4$ lb/in^2 (5 kPa) of the start point setting for the MP953A and MP953B. For the MP953E and MP953F models the pressure should be within ± 1 lb/in^2 (7 kPa) of the start point.

4. Continue increasing the pilot pressure until the valve stem travel is complete. This pressure should be the start point pressure plus the range setting.

5. If necessary make fine adjustments with the start point adjustment knob.

CAUTION

ON MP953A and MP953B models, loosen the cover locking screw before turning the start point adjustment knob.

ADJUSTMENTS

TO SET OPERATING RANGE, MP953A AND B

1. Using wrench, loosen the cover locking screw (Fig. 2).

2. Unscrew the start point adjustment knob and remove cover.

   a. For three lb/in^2 (21 kPa) range, back all range adjustment screws off to friction stop.
   b. For five lb/in^2 (34 kPa) range, back only the black range adjustment screws to stop and tighten the outer, plated screws.
   c. For ten lb/in^2 (69 kPa) range, tighten all range adjustment screws.

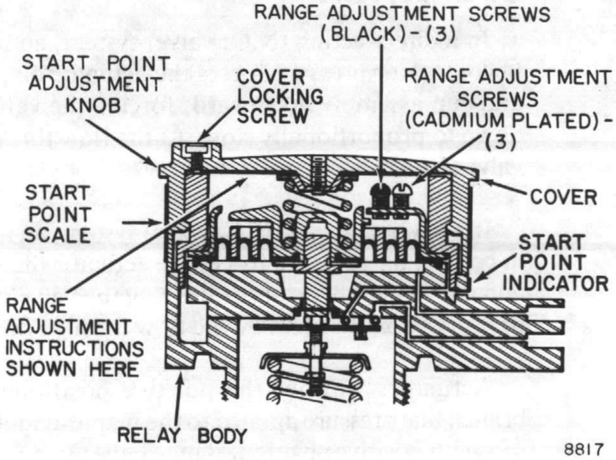


Fig. 2. Adjustment Points of MO953/MP953A and B Gradutrol Relay.

OPERATING RANGE, MP953E AND F

The operating range of the MP953E and MP953F models may be changed by replacing the feedback spring with one for the desired range (see REPAIR section).

START POINT ADJUSTMENT

MP953A AND B POSITIONER (GRADUTROL RELAY)

1. Tighten the cover by turning it until it bottoms on the relay body (Fig. 2).
2. Back off (one turn maximum) until the start point of the correct scale range lines up with the start point indicator near "B" marking.
3. Tighten the cover locking screw until it engages the relay body. Do not overtighten.

MP953E AND F POSITIVE POSITIONER (1982)

Set start point on positioner to valve in job drawings. Only the most critical applications or feedback spring changes will require fine tuning the start point. Each click of the start point knob will adjust the start point 1/4 lb/in^2 (1.7 kPa).

TROUBLESHOOTING

EQUIPMENT REQUIRED

Gage, 0 to 30 lb/in^2 (0 to 207 kPa).

SYMPTOMS AND CORRECTIVE ACTION

Table II lists possible equipment malfunctions and their corrective action. Refer to Figures 3, and 4 Troubleshooting Flowcharts for further troubleshooting.

Table II. Symptoms and Corrective Action.

Symptom	Corrective Action
MP953A, C, or E closes too slowly or MP953B, D, or F opens too slowly.	1. Replace positive positioner filters (see REPAIR section). 2. Replace restrictor if one exists. 3. Add capacity relay if controller capacity is too low for the application.

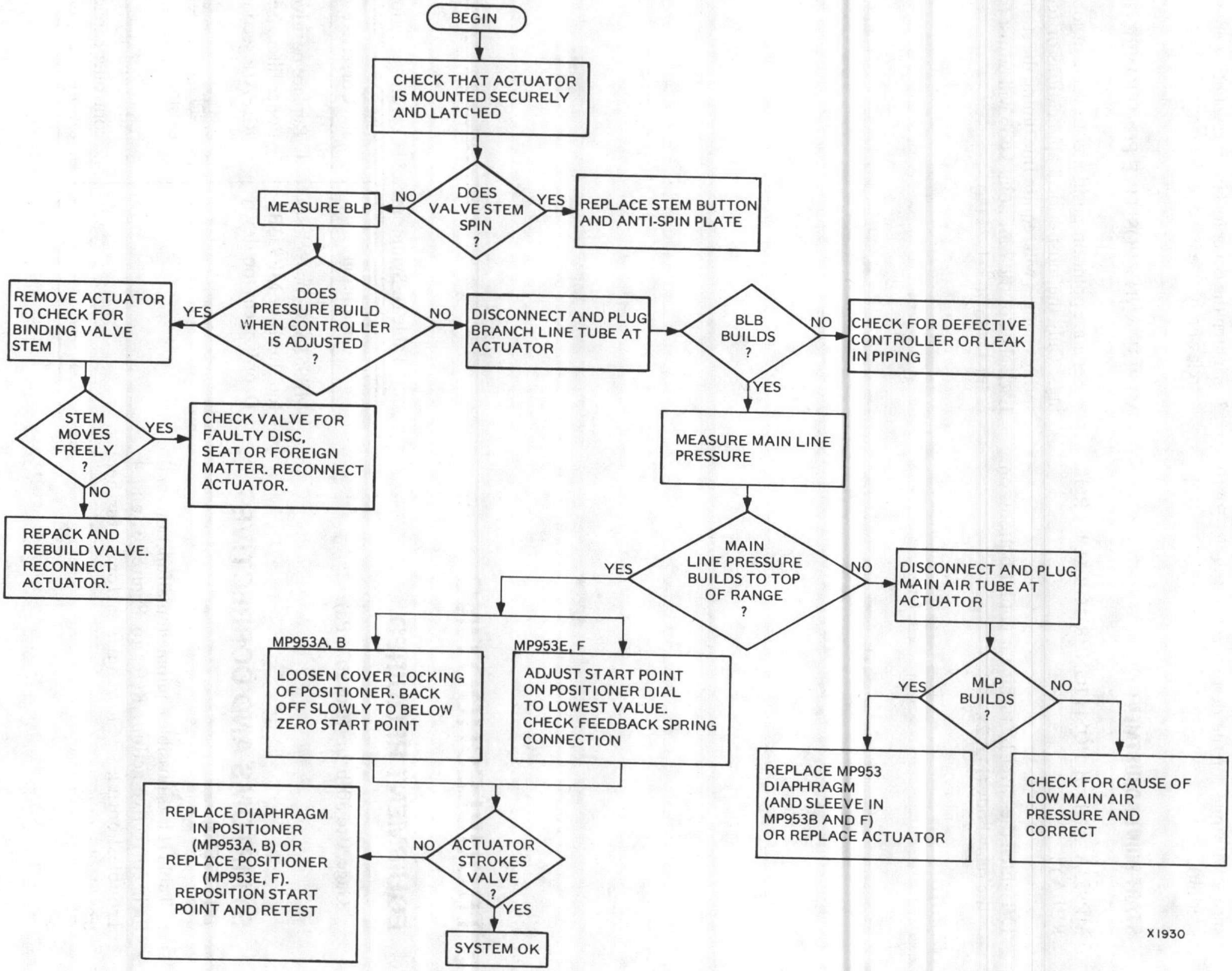


Fig. 3. Troubleshooting Flowchart, MP953A, B, E, F. With Positioner.

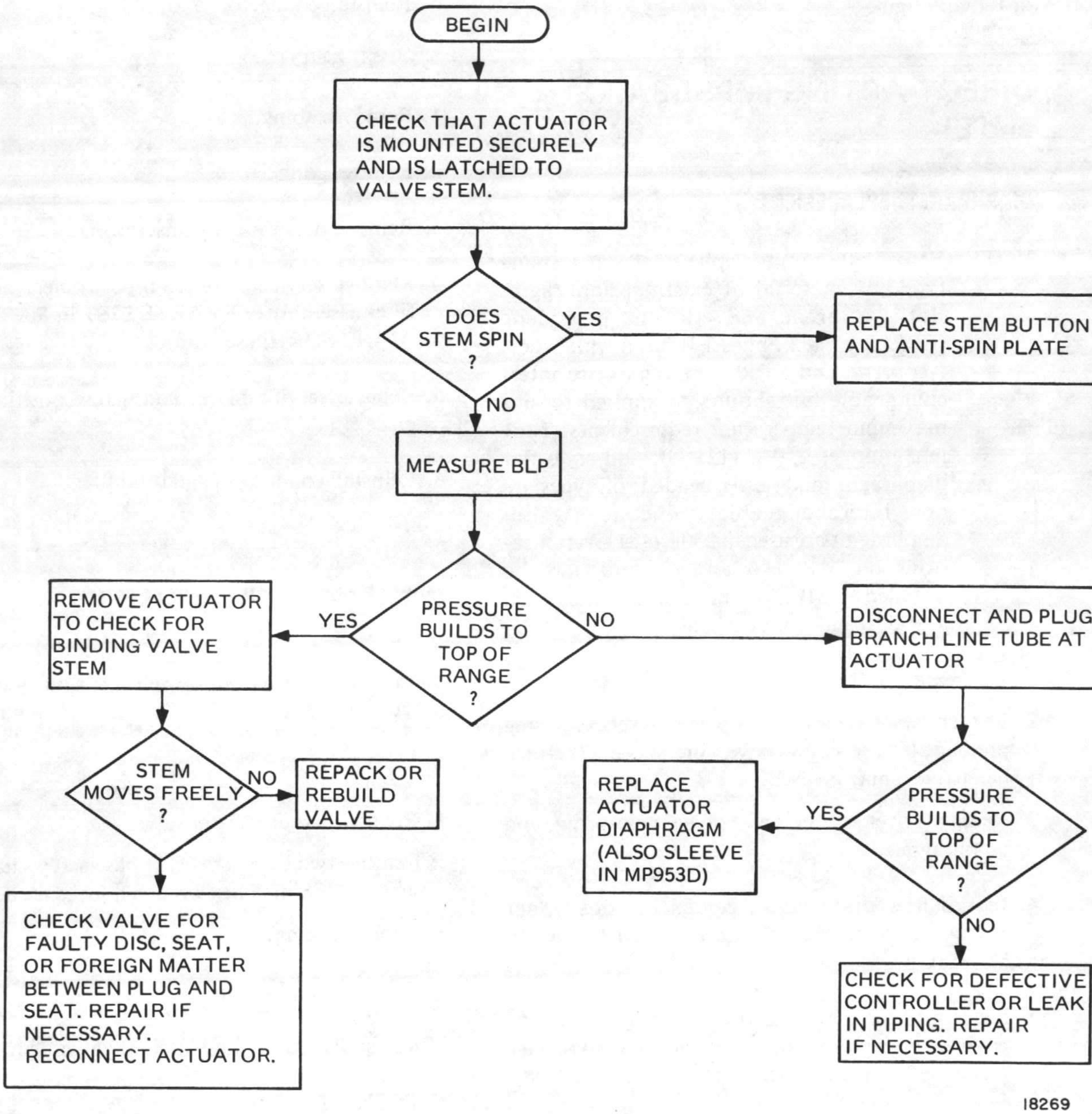


Fig. 4. Troubleshooting Flowchart, MP953C, D.

REPAIR

EQUIPMENT NEEDED

Pliobond glue, or equivalent, to replace MP953A or E diaphragm.

DIRECT-ACTING (MP953A, C, and E)

DIAPHRAGM REPLACEMENT

NOTE: Before attempting replacement, determine type and material of existing diaphragm. Both neoprene and ethylene propylene (EPR) are black, but EPR has a white spot. Neoprene and EPR diaphragms are interchangeable but should be applied to suit maximum temperature requirements. EPR maximum is 250 F (121 C). Old style flat diaphragms and newer beaded roll types are not interchangeable. Silicone (white) diaphragms are used in 250 F (121 C) applications on MP953A and C, and may be installed on MP953E models. EPR is used on MP953B and D models only.

1. Disconnect air lines.
2. Loosen two base screws to partially relieve spring preload. If base screws have Torx socket, 1/8-inch hex wrench may be used.
3. Remove cover screws, cover, feedback spring, and diaphragm.
4. Install new diaphragm, cementing positioner spring cup to center of diaphragm on MP953A and MP953E models.
5 Reassemble positioner feedback spring, cover, and screws. Use cap type allen head setscrews to replace socket head setscrews used on older models.

POSITIONER FILTER REPLACEMENT

MP953A AND B

1. Remove tubing.
2. Remove connectors.
3. Remove filters from relay ports with pointed tool such as an awl.
4. Install foam filters, taking care not to fold or bunch together.
5. Reinstall connectors and tubing.

MP953E AND F

1. Remove tubing.
2. Remove connectors.
3. Remove positioner by unscrewing.
4. Remove service plate from positioner and replace filter assembly (see PARTS LIST in PARTS AND ACCESSORIES section).
5. Replace service plate, and screw positioner into place.
6. Reinstall connectors and tubing.

MP953C MAIN SPRING REPLACEMENT

Springs with different ranges are interchangeable on the same size actuators. Select spring by operating range and stem travel. See Table IV and Figure 12.

5- AND 8-INCH

1. Remove actuator from valve.
2. Remove two base screws. If base screws have Torx sockets, 1/8-inch hex wrench may be used.
3. Replace spring.
4. Reinstall two base setscrews.
5. Reinstall actuator and latch of valve stem.

13-INCH

1. Remove actuator from valve.
2. Loosen two base setscrews.
3. Remove cover, diaphragm, cup and stem retainer.
4. Replace spring.
5. Reinstall stem retainer, cup, diaphragm, cover, and screws.

POSITIONER REPLACEMENT (Old-Style Gradutrol Relay)

1. Disconnect air lines.

2. Unscrew positioner from actuator cover, taking care not to lose feedback spring (Fig. 5).

3. Screw new positioner in place, being sure new "O" ring is properly seated in positioner groove. Reuse old feedback spring as this is not included in 313695J assembly.

4. Tighten only enough to seat "O" ring.

5. Adjust positioner for range and start point (see MAINTENANCE section).

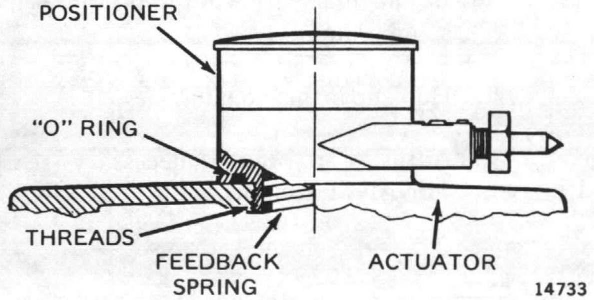


Fig. 5. Old-Style MP953A and B Positioner (Gradutrol Relay).

POSITIONER REPLACEMENT (New-Style 1982)

There are new-style positive positioner retrofit kits available to fit the MP953 actuators. Refer to ACCESSORIES in PARTS AND ACCESSORIES section for kit part number.

1. Remove air lines from positioner assembly.

2. Unscrew and remove positioner assembly and feedback spring from actuator cover.

3. Install feedback spring for desired spring range (see ACCESSORIES in PARTS AND ACCESSORIES section) from positioner retrofit kit into value and to positioner.

4. Screw positioner into place, being sure new "O" ring is properly seated.

5. Hook up main and pilot lines.

6. Adjust start point if necessary (see MAINTENANCE section).

TO CHANGE FEEDBACK SPRING (New-Style Positioner 1982)

1. Remove air lines from positioner assembly.

2. Unscrew and remove positioner assembly.

3. Remove feedback spring by unhooking at both ends and replace with feedback spring for desired range (Fig. 15 or 16).

4. Replace positioner assembly, making sure "O" ring is properly seated.

5. Hook up main and pilot lines.

6. Adjust start point if necessary (see MAINTENANCE section).

REVERSE-ACTING (MP953B, D, and F)

DIAPHRAGM REPLACEMENT

NOTE: Replace both the diaphragm and sleeve (inner seal) when replacement of either is indicated. Use SERVICELINE Kit 14003124-001 for 160 F (71 C) maximum temperature diaphragm replacement. See PARTS LIST in PART AND ACCESSORIES section for high temperature diaphragms.

MP953B AND F

1. Disconnect air lines.

2. Remove cover screws, cover, feedback spring, nut, lockwasher, cup, and diaphragm (see Fig. 11 in PARTS AND ACCESSORIES section).

3. Replace diaphragm.

4. Reinstall cup, lockwasher and nut.

5. Tighten nut only enough to seal diaphragm.

6. Reinstall feedback spring, cover, and screws.

7. Reconnect air lines.

MP953D

1 Disconnect air lines.

2. Remove cover screws, cover and diaphragm.

3. Replace diaphragm.

4. Replace cover and screws.

5. Reconnect air lines.

SLEEVE (Inner Seal) REPLACEMENT

1. Remove diaphragm as in DIAPHRAGM REPLACEMENT.

2. Remove cup, screws, ring, and sleeve (Fig. 11 and 13).

3. Replace sleeve.

4. Reinstall ring, screws, cup, and diaphragm.

MAIN SPRING REPLACEMENT

MP953B AND D

Select spring by operating range and valve stem travel. Springs are interchangeable if operating range and valve stem travel are the same. See Table V and Figures 11 and 13.

MP953F

All MP953F models use spring Part No. 312203-017.

1. Remove diaphragm and sleeve.
2. Remove two base screws and base. If base screws have Torx socket, 1/8-inch hex wrench may be used.
3. Replace main spring.
4. Reinstall base, two screws, sleeve, and diaphragm.
5. Finish as in DIAPHRAGM REPLACEMENT for your specific model.

POSITIONER REPLACEMENT

OLD-STYLE (Gradutrol Relay)

1. Remove air lines and screws from positioner assembly.

2. Remove and replace positioner assembly, being sure bias and feedback springs (Fig. 6) are properly seated.

3. Adjust positioner for proper range and start point (see MAINTENANCE section).

NEW-STYLE POSITIVE POSITIONER (1982)

There is a new positive positioner retrofit kit available for reverse-acting MP953 actuators (see ACCESSORIES in PARTS AND ACCESSORIES section).

1. Remove air lines and screws from positioner reversing bracket.

2. Remove positioner assembly.

3. Install bias spring and feedback spring (for desired spring range) from positioner retrofit kit into valve and to positioner.

4. Install new positioner and bracket assembly onto top of valve.

5. Install tubing from positioner branch port to actuator input.

6. Hook up main and pilot lines.

7. Adjust start point if necessary (see MAINTENANCE section).

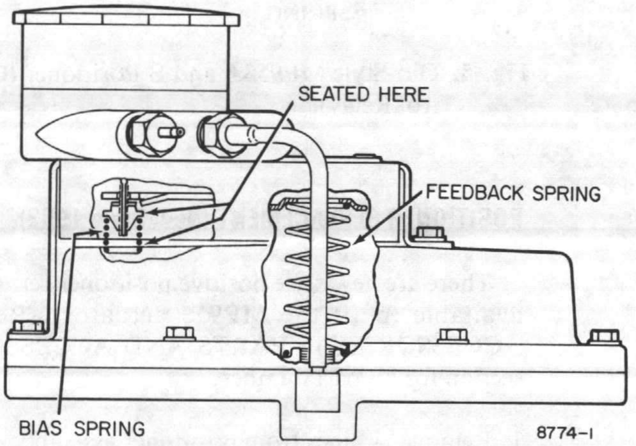


Fig. 6. MP953B Bias Spring and Feedback Spring Position.

TO CHANGE FEEDBACK SPRING (New-Style Positioner 1982)

1. Remove air lines and screws from positioner reversing bracket.

2. Remove positioner assembly.

3. Remove bias spring and feedback spring by unhooking at both ends.

4. Hook up new feedback spring for desired spring range (Fig. 14) and bias spring.

5. Replace positioner and bracket assembly onto top of valve.

6. Install tubing from positioner branch port to actuator input.

7. Hook up main and pilot lines.

8. Adjust start point if necessary (see MAINTENANCE section).

TO PREVENT SPINNING STEMS

Spinning stems may be prevented by locking the stem to the actuator. The 13-inch MP953 does this but the 5- and 8-inch actuators do not. Antispin capability may be field added to the 5- and 8-inch direct-acting actuators by the following procedure.

1. Disconnect air lines.

2. Loosen two base screws to partially relieve spring preload. If base screws have Torx socket, 1/8-inch hex wrench may be used.

3. Remove cover screws, cover, feedback spring, diaphragm, cup spring, retainer, and plate. Replace with Plate, Part No. 311975A.

4. Reassembly actuator.

For 1/2 to 3 inch V5011A and 1/2 to 2 inch V5013A screwed body valves, antispin capability may be added by replacing Stem Button Part No. 310503, with Stem Button Part No. 312495.

5. Remove actuator from valve.

6. Remove Stem Button 310503 and replace with Stem Button 312495.

7. Reassemble actuator to valve.

8. Connect air lines.

OLD STYLE GRADUTROL RELAY ASSEMBLIES

Refer to Figures 7, 8, and 9 and Table III.

Table III. Parts Included in Relay Assembly 313695 Models.

Assembly Parts	B	C	D	E	F	G	J
Basic Relay (lb/in^2 only)	X	X	X	X	X		
Basic Relay (lb/in^2/metric)						X	X
312602 "O" Ring	X	X	X		X		X
315178 Cup	X	X	X	X	X	X	X
313696 Spring	X						
313814 Spring		X			X		
313815 Spring			X				
311750 Diaphragm		X					
312505 Diaphragm					X		

NOTE: The A model is obsolete. It was basic relay plus "O" Ring and Cup. The H Model was the same as the E model except with gray paint. When replacing B, C, D, F, or H models use J model plus needed parts. Replace E model with G model.

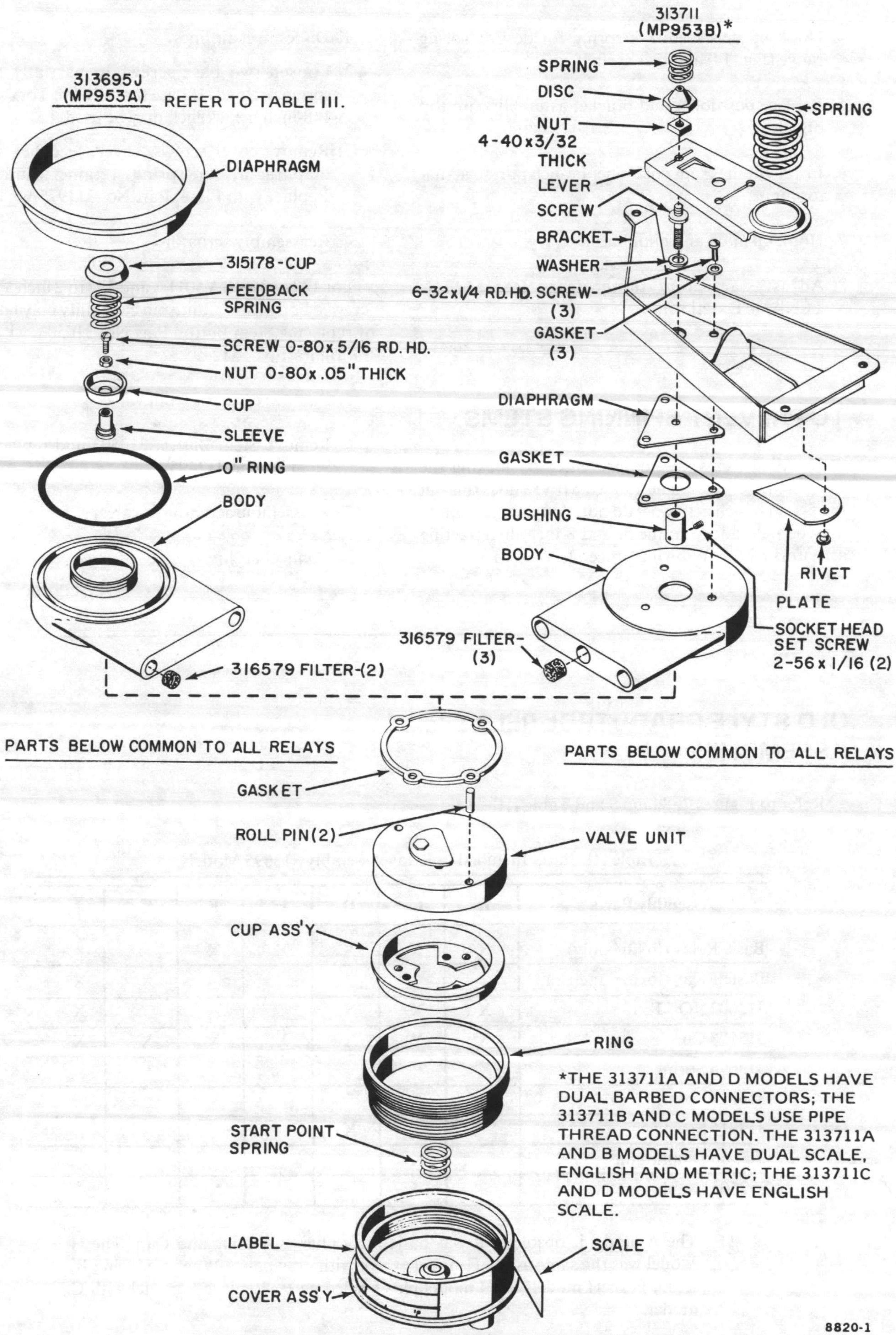


Fig. 7. Relay Assemblies Exploded View.

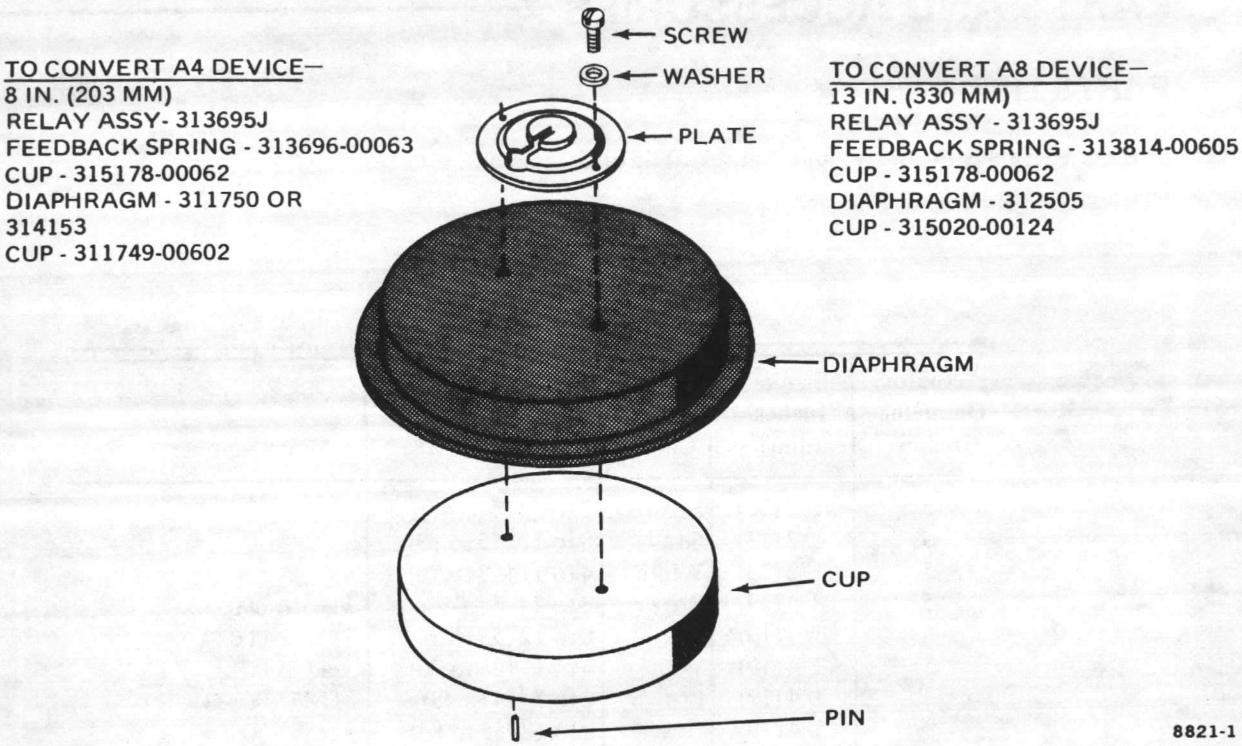


Fig. 8. MO953 Conversion.

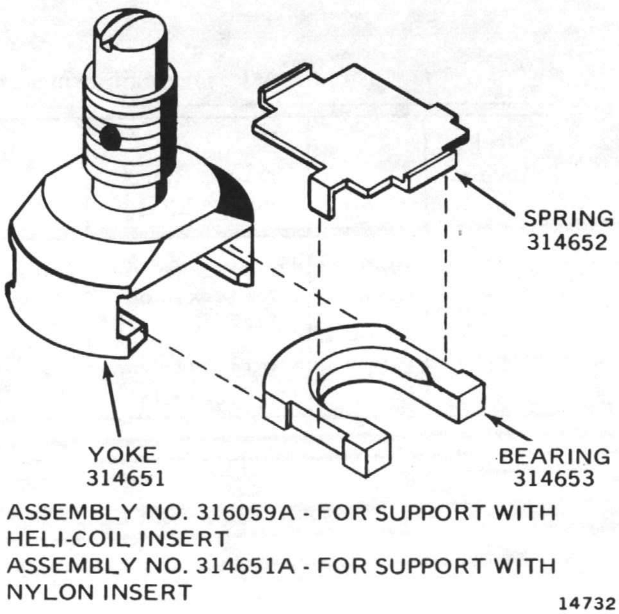


Fig. 9. Yoke Assembly.

PARTS AND ACCESSORIES

PARTS LIST

Refer to Tables IV and V, and Figures 10 through 13.

Table IV. MP953C Mainsprings.

Actuator Diameter (Inches)	Stroke Inches (mm)	Color	Pressure Range lb/in^2 (kPa)	Part Number
5	1/2 (13)	Brown	2 to 7 (14 to 48)	
5	1/2 (13)	Gray	8 to 12 (55 to 83)	
5	1/2 (13)	White	4 to 11 (28 to 76)	
5	3/4 (19)	Brown	2 to 7 (14 to 48)	311616-00033
5	3/4 (19)	Gray	8 to 12 (55 to 83)	311618-00034
5	3/4 (19)	White	4 to 11 (28 to 76)	311393-00123 △1
8	3/4 (19)	Brown	2 to 7 (14 to 48)	311852-00033
8	3/4 (19)	Gray	8 to 12 (55 to 83)	311855-00034
8	3/4 (19)	White	4 to 11 (28 to 76)	311854-00123 △1
8	1-1/2 (38)	White	4 to 11 (28 to 76)	313477-00123
8	1-1/2 (38)	Green	3 to 15 (21 to 103)	14002934-001
13	1-1/2 (38)	Brown	2 to 7 (14 to 48)	312469-00033
13	1-1/2 (38)	White	4 to 11 (28 to 76)	312471-00123 △1

△1 Used on MP953A and E models.

Table V. MP953D Mainsprings.

Stroke Inches (mm)	Color	Pressure Range lb/in^2 (kPa)	Part Number
1/2 (13)	White	4 to 11 (28 to 76)	314314-00123
1/2 (13)	Black	8 to 13 (55 to 90)	312792-00017
3/4 (19)	White	4 to 11 (28 to 76)	314313-00123
3/4 (19)	Black	8 to 13 (55 to 90)	312203-00017 △1
3/4 (19)	Silver	3 to 7 (21 to 48)	314963-00605

△1 Used on MP953B and F models.

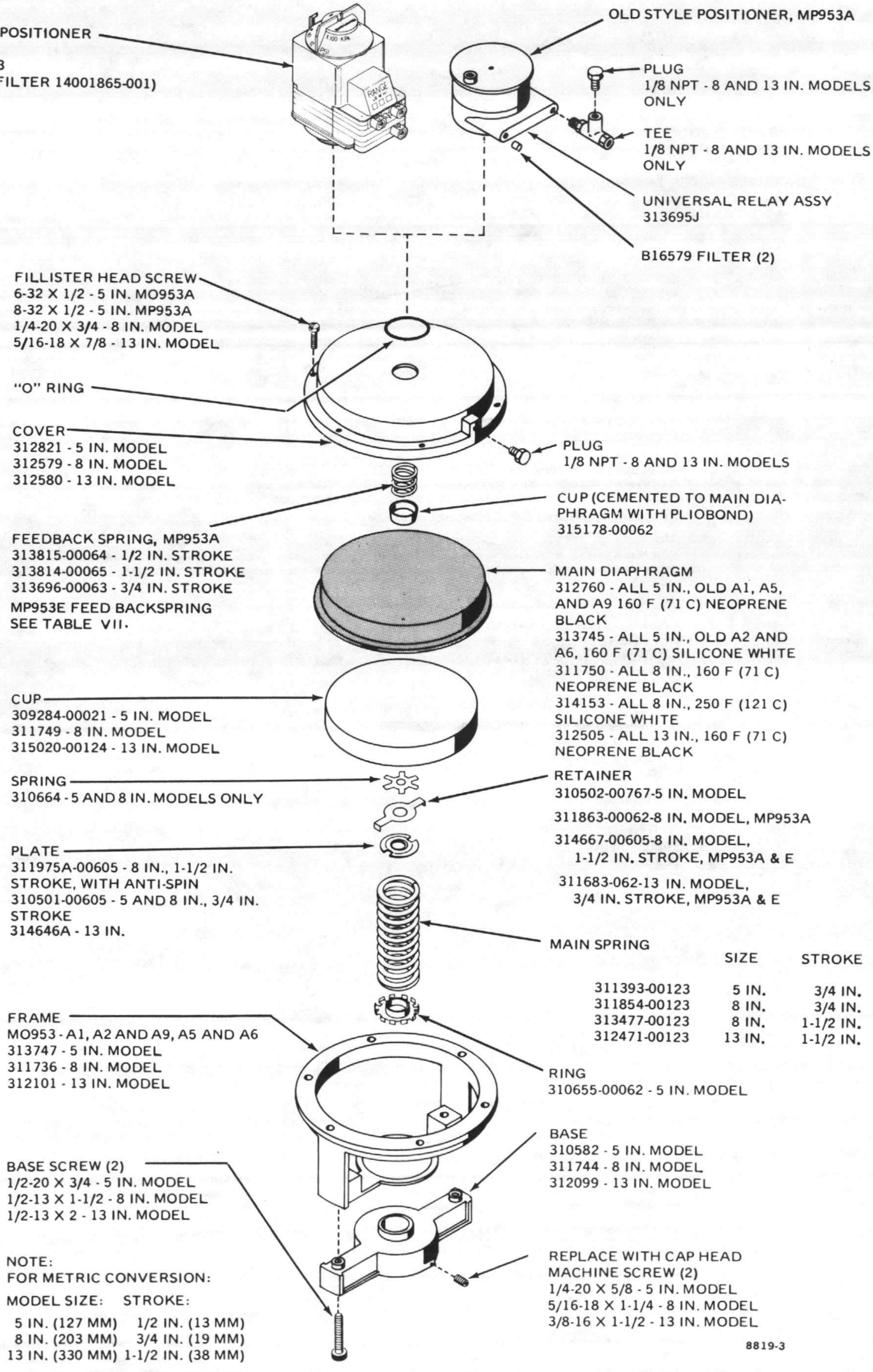


Fig. 10. MO/MP953A and E Exploded View.

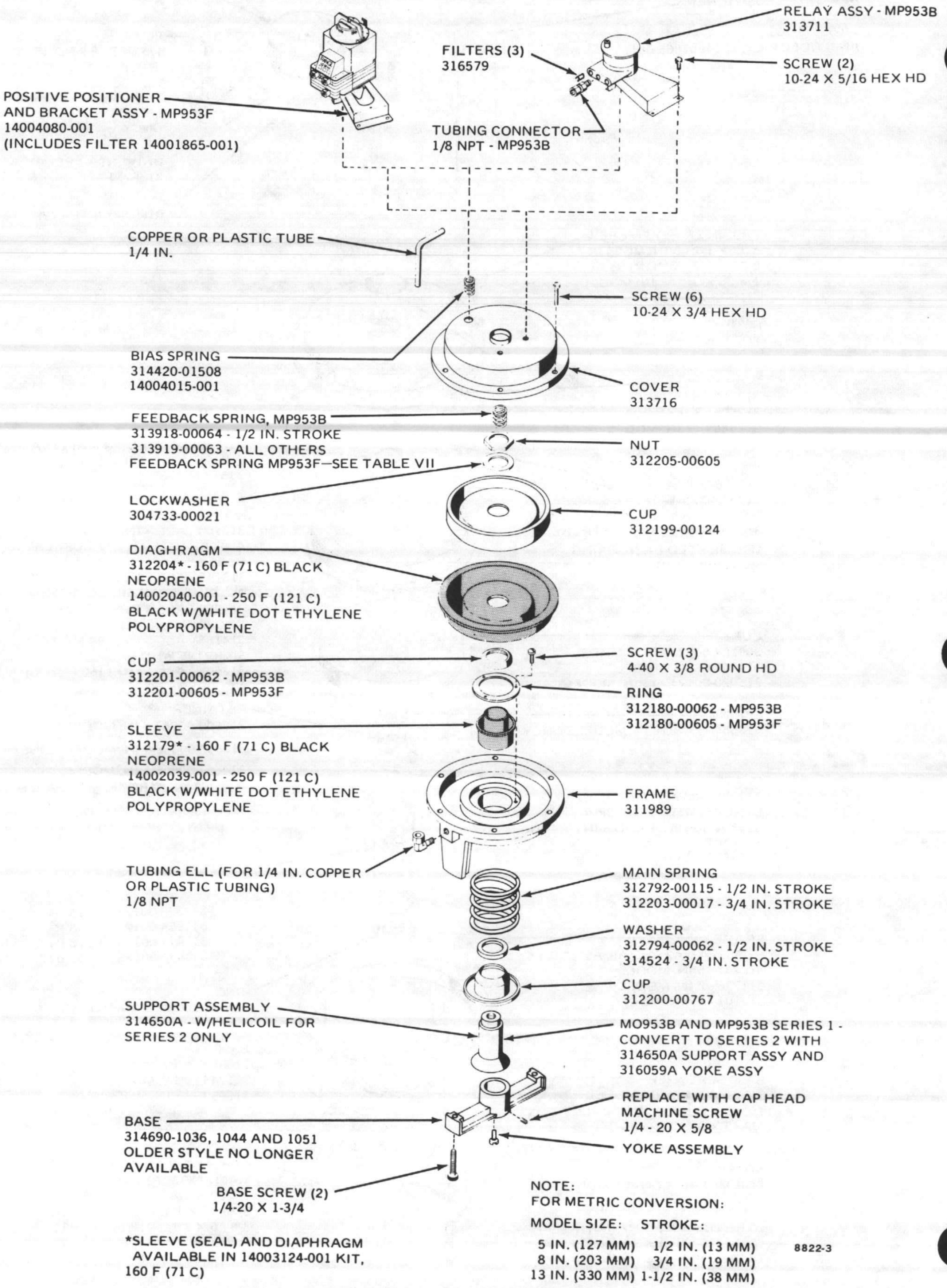


Fig. 11. MO/MP953B and F Exploded View.

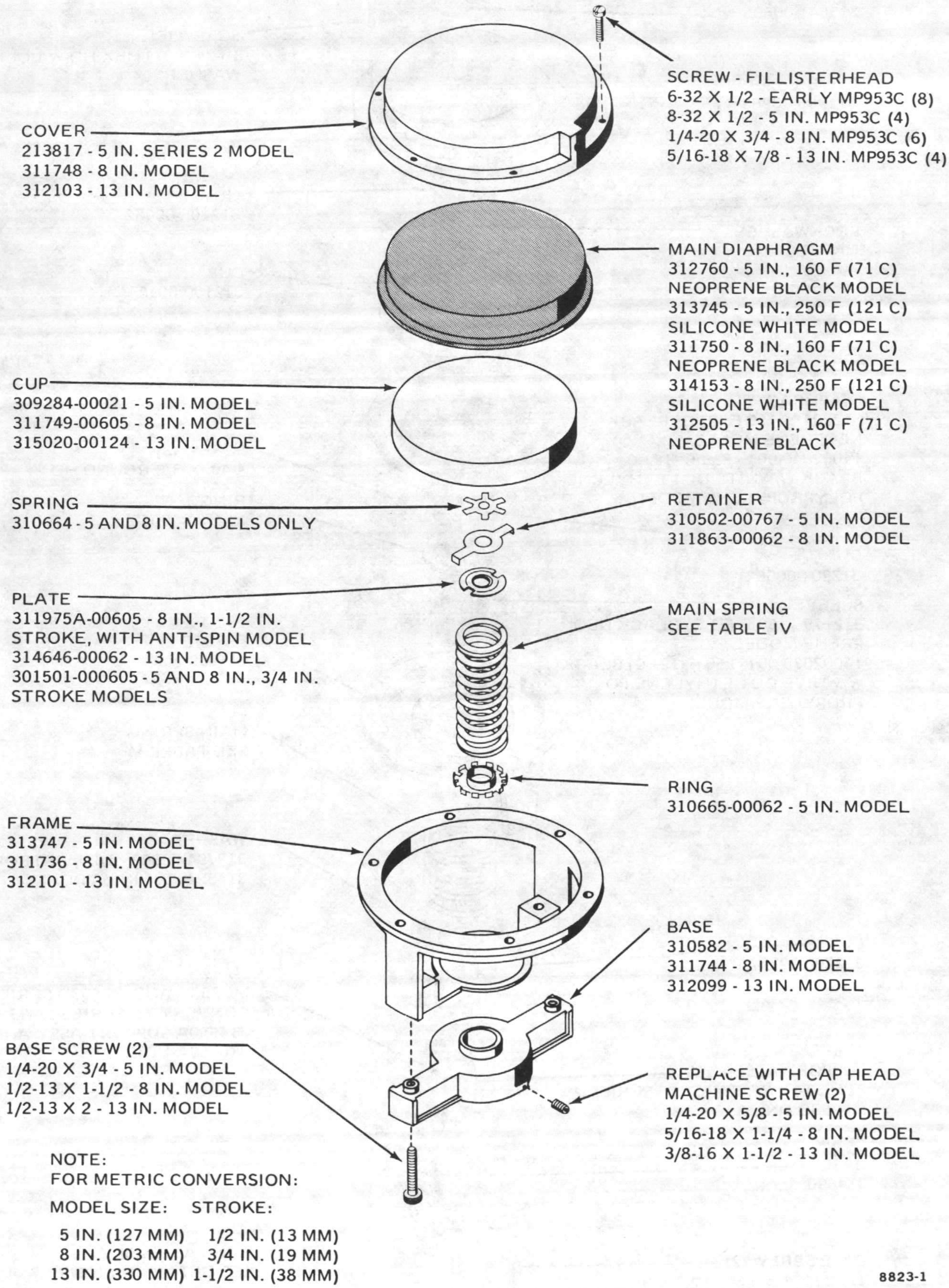


Fig. 12. MO/MP953C Exploded View.

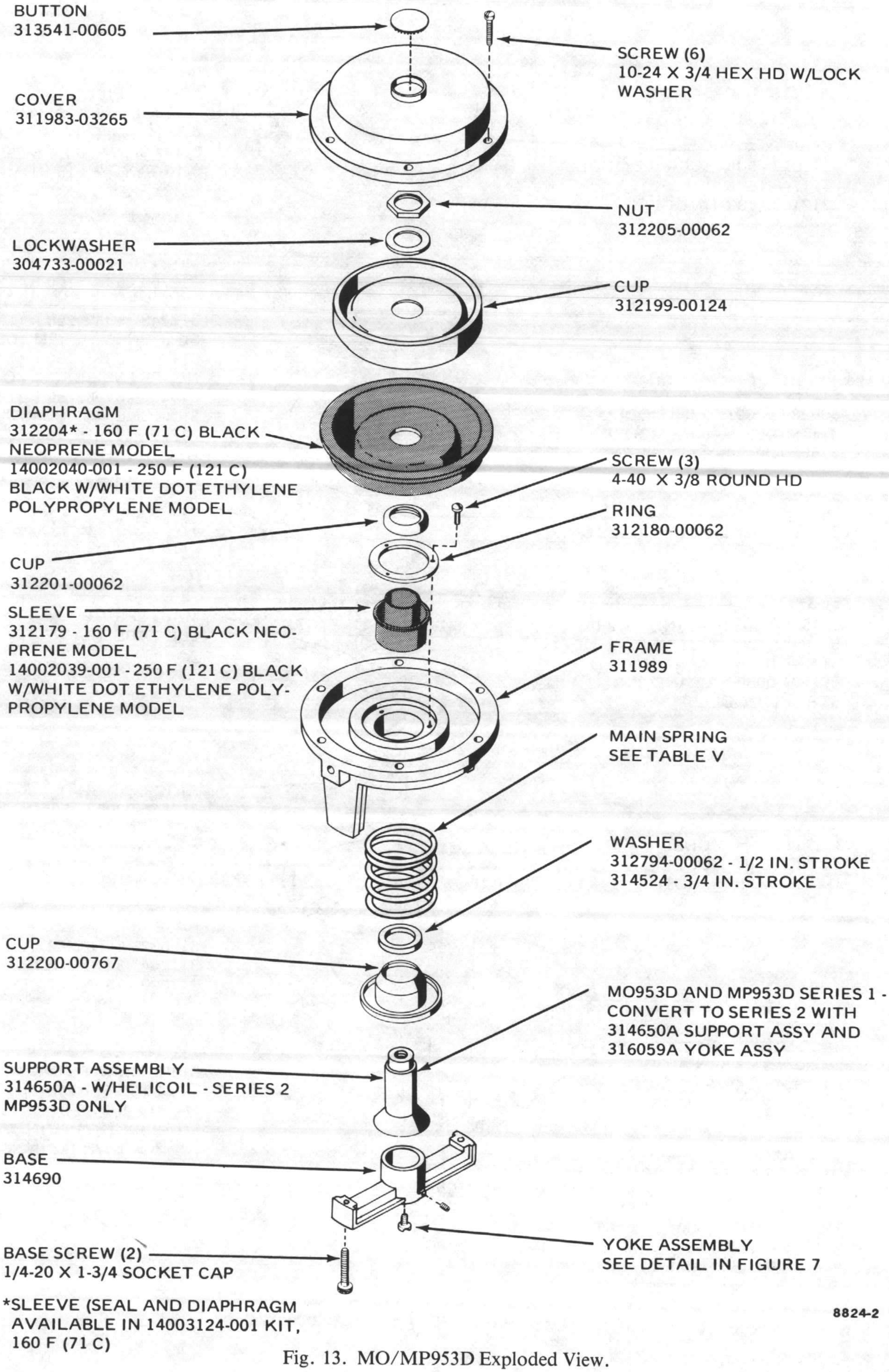


Fig. 13. MO/MP953D Exploded View.

ACCESSORIES

Refer to Tables VI and VII and Figures 14 through 17 for MP953 accessories.

Table VI. MP953 Positive Positioner Retrofit Kits.

Part No.	Description
14004138-001	For reverse-acting valve actuators (Fig. 14).
14004139-001	For 8-inch, 3/4-inch stroke valve actuators (Fig. 16).
14004140-001	For 8- and 13-inch, 1-1/2 inch stroke valve actuators (Fig. 15).
14004214-001	For 5-inch, 3/4-inch stroke valve actuators (Fig. 16).

Table VII. MP953 Feedback Spring Kits Includes 3, 5, and 10 lb/in^2 (21, 34, and 69 kPa) Range Springs.

Part No.	Description
14004213-001	For reverse-acting valve actuators (includes bias).
14004212-001	For 1-1/2 inch (38 mm) stroke D.A. valves.
14004211-001	For 3/4-inch (19 mm) stroke D.A. valves.

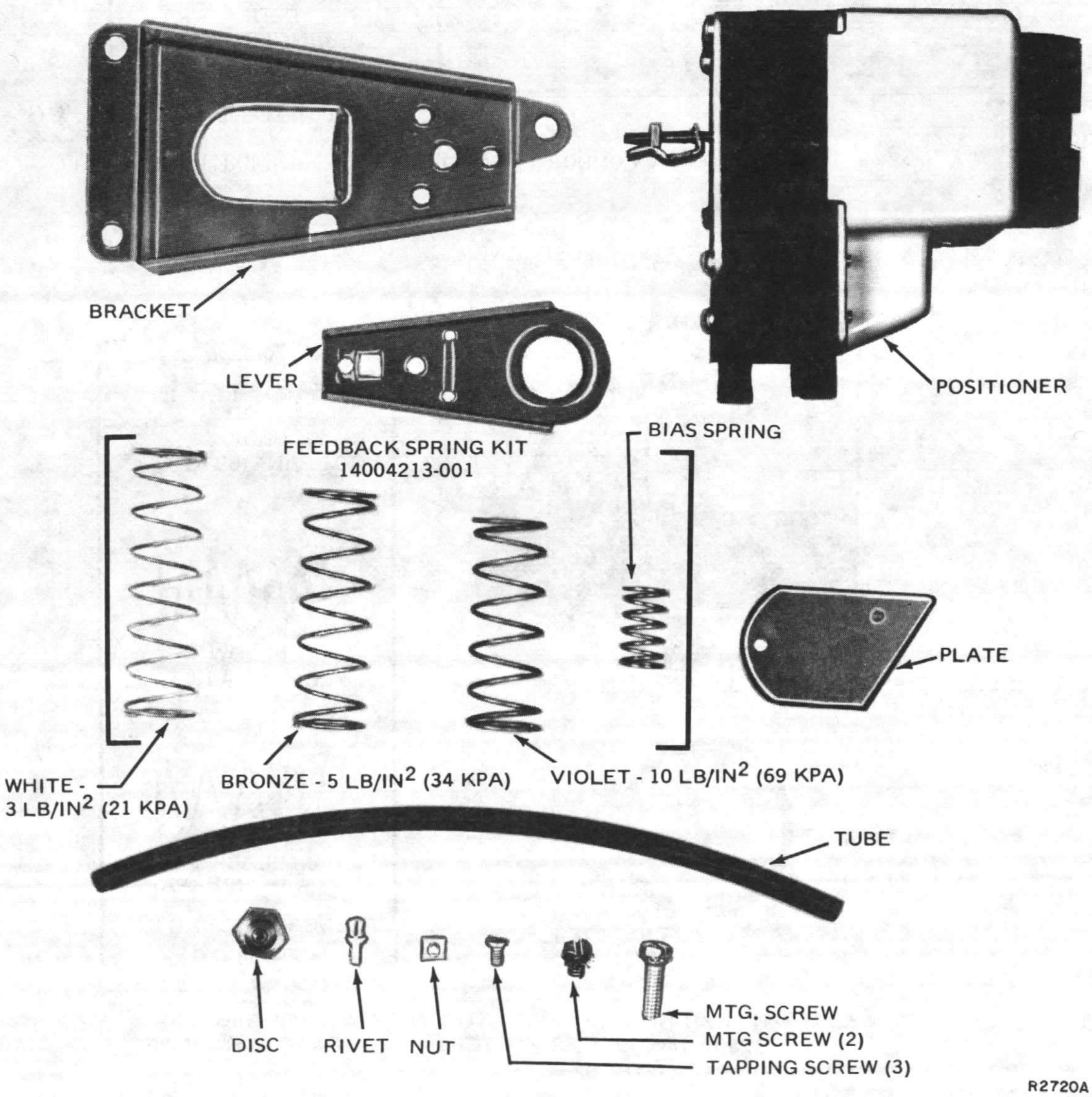


Fig. 14. Positive Positioner Retrofit Kit, Part No. 14004138-001.

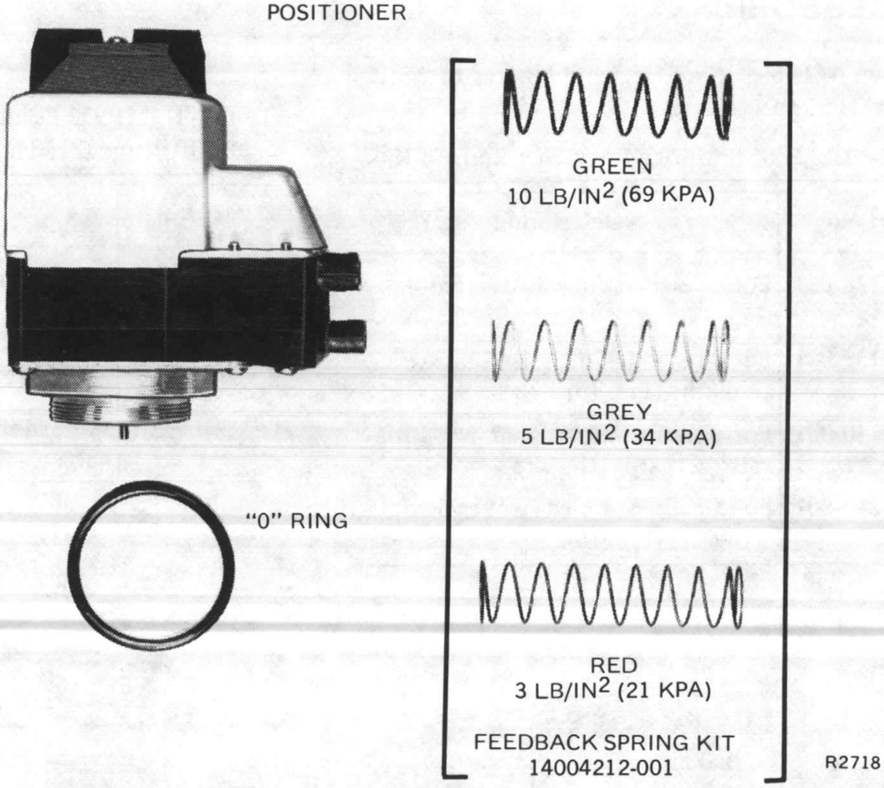
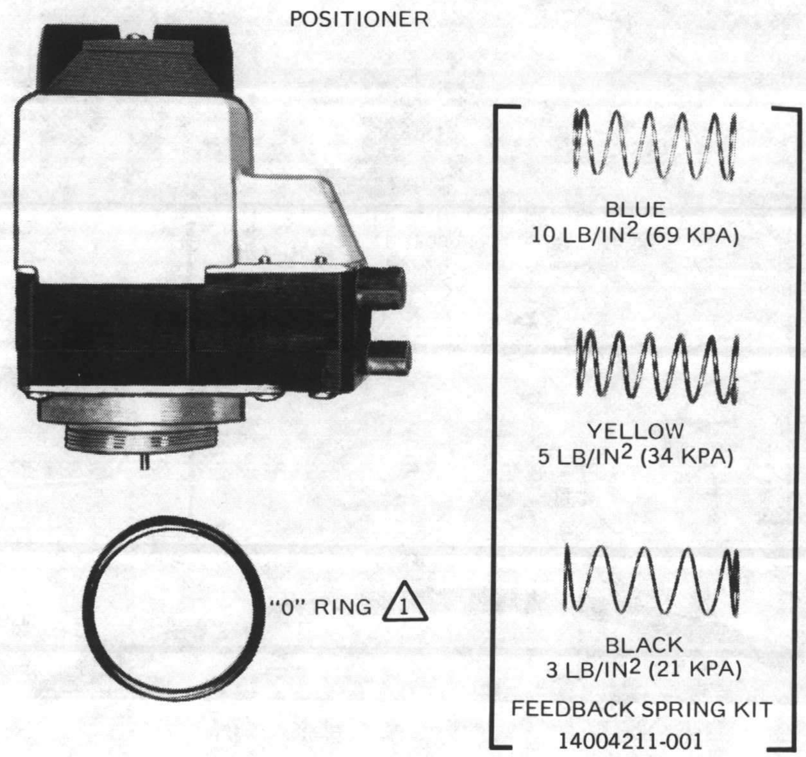


Fig. 15. Positive Positioner Retrofit Kit, Part No. 14004140-001.



1 14004139-001 KIT FOR 8 IN. ACTUATORS HAVE "0" RING PART NO. 312601. 14004214-001 KIT FOR 5 IN. ACTUATORS HAVE "0" RING PART NO. 312602.

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Fig. 16. Positive Positioner Retrofit Kits, Part No. 14004139-001 and14004214-001.

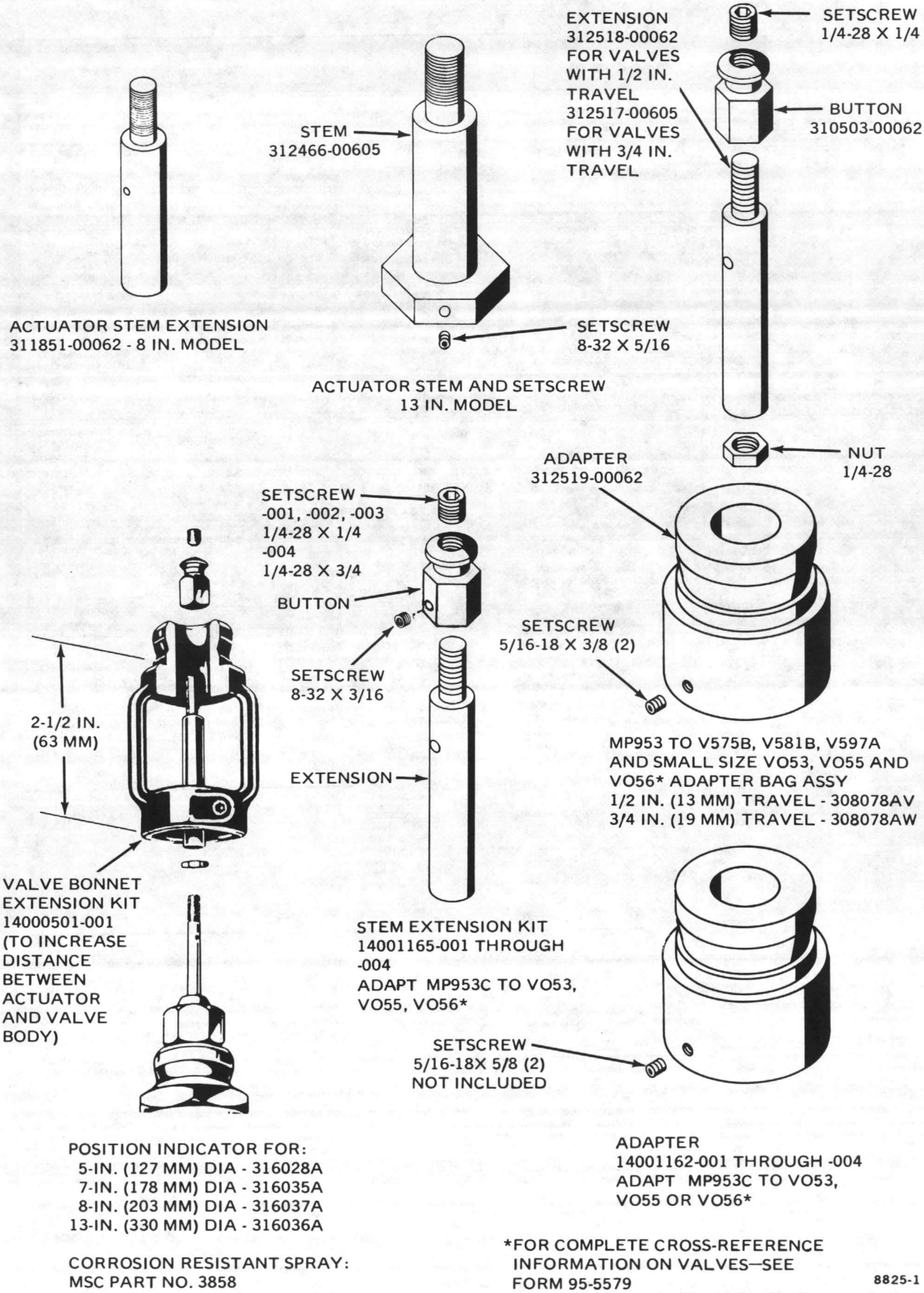

Fig. 17. MP953 Accessories.

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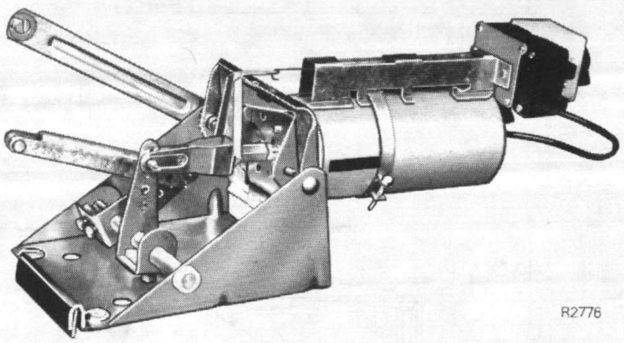
Comfort Control Systems

MP909E & H DAMPER OPERATORS

Installation Instructions

BEFORE INSTALLING, NOTE



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The MP909E and H Pneumatic Damper Operators are used for proportional control of dampers, variable-volume terminal units, and mixing boxes. This piston-type operator is rolling diaphragm operated; it can be mounted in any position and can be installed either externally or internally. The MP909H includes a positive positioner.

Tools needed:

7/16 inch box end wrench
1/8 inch Allen wrench

NOTE: For internally mounted normally open applications on dampers with 12-inch B dimensions, consult factory.

NOTE: On MP909H ensure positioner feedback spring is not binding on positioner support.

INSTALLATION SPECIFICATIONS

EXTERNAL MOUNT SHAFT DIAMETER: 1/2 inch (13mm).

AMBIENT TEMPERATURE RANGE:
MP909E: -29 to 160 F (-34 to 70 C).
MP909H: -20 to 160 F (-29 to 70 C).

MAXIMUM SAFE AIR PRESSURE:
MP909E: 29 psi (200 kPa).
MP909H: 25 psi (172 kPa).

AIR CONNECTION:
MP909E: Combination 5/32-inch (4mm) and 1/4-inch (6mm) push-on barb.
MP909H:
5/32-inch (4mm) push-on barb (pilot).
1/4-inch (6mm) push-on barb (main).

INSTALLATION

EXTERNAL MOUNTING

1. For external mounting dimensions, see Figure 1.

2. Check faceplate position (Fig. 2). Adjust faceplate position if necessary.

3. Move damper to normal position (position with 0 psi applied to operator).

4. Determine whether the damper driveshaft rotates clockwise or counterclockwise from the normal position.

5. Locate proper shaft hole (Fig. 3) over damper shaft.

6. Use mount as a template and mark the four mounting screw locations.

7. Drill or punch four 3/16-inch (4.7mm) mounting holes, and mount operator using four No. 14 x 1-inch slotted hexhead sheetmetal screws and washers provided in bag assembly.

8. For 3.1-inch stroke operators used with n.o. dampers, or all 4-inch stroke operators, go to step 10.

9. For 3.1-inch stroke operators used with n.c. operators, lengthen pushrod by turning out (unscrewing) pushrod four turns to 1-5/8 inch (41mm) dimension shown in Figure 3.

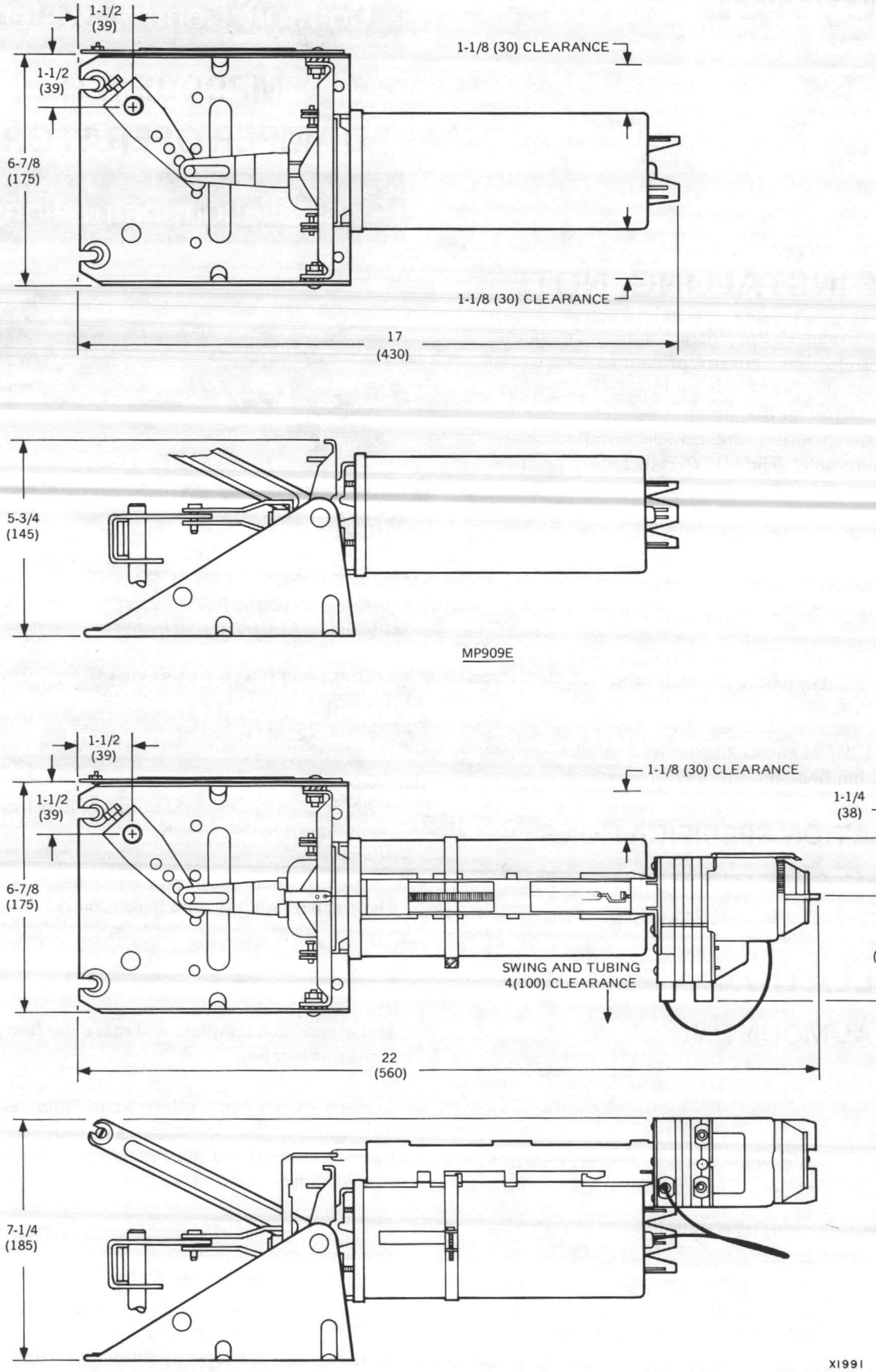


Fig. 1. External Mounting Dimensions in Inches (Millimeters).

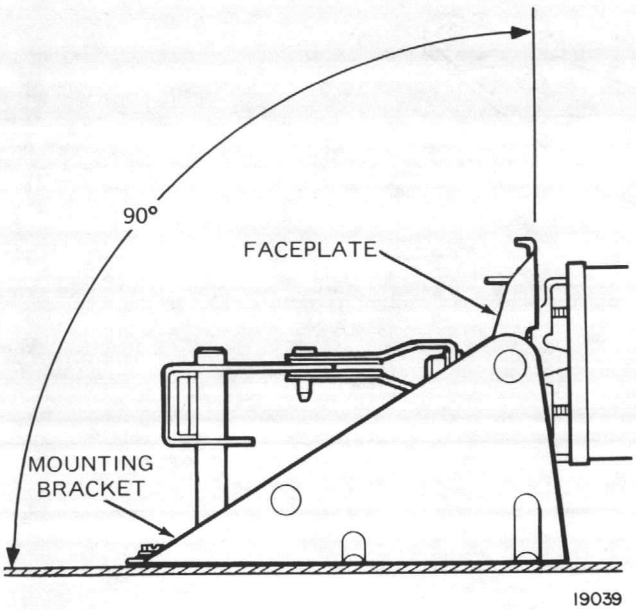


Fig. 2. External Mounting Faceplate Positioning.

10. To provide close-off force, use a squeeze bulb and stroke the operator:

    a. For normally open dampers: Fully extend operator shaft then retract 1/2-inch (13mm) for 4-inch stroke operators, or 1/8-inch (3mm) for 3.1-inch stroke operators.
    b. For normally closed dampers: Extend operator shaft 1/2-inch (13mm) for 4-inch stroke operators, or 1/8-inch (3mm) for 3.1-inch stroke operators.

11. Secure Crankarm to Damper Shaft.

CAUTION

See Figure 4 for proper tightening of crankarm bolts.

12. Go to PIPING section.

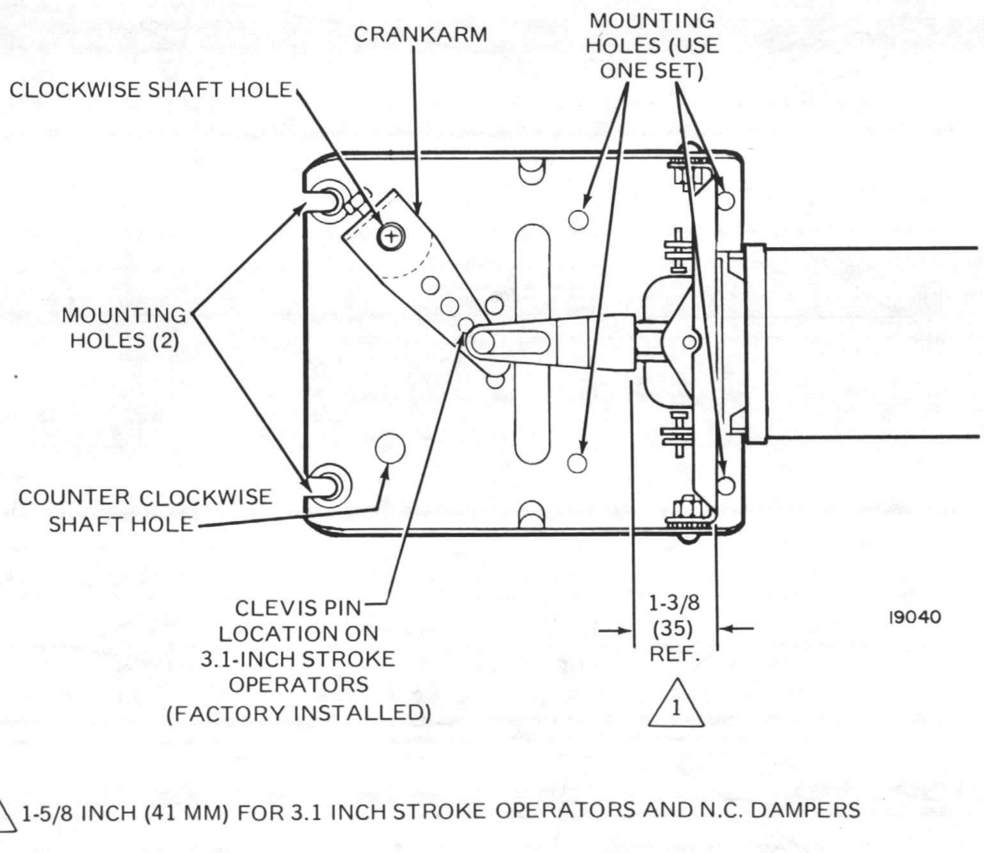


Fig. 3. External Installation.

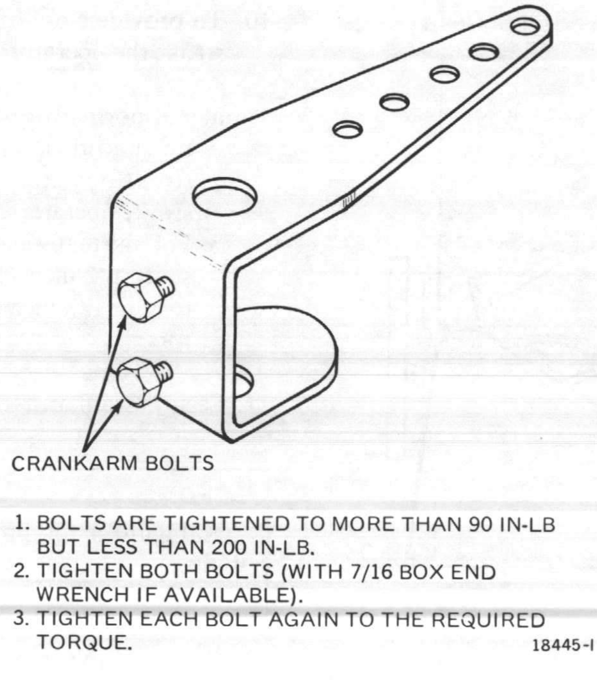


Fig. 4. Crankarm Bolt Tightening.

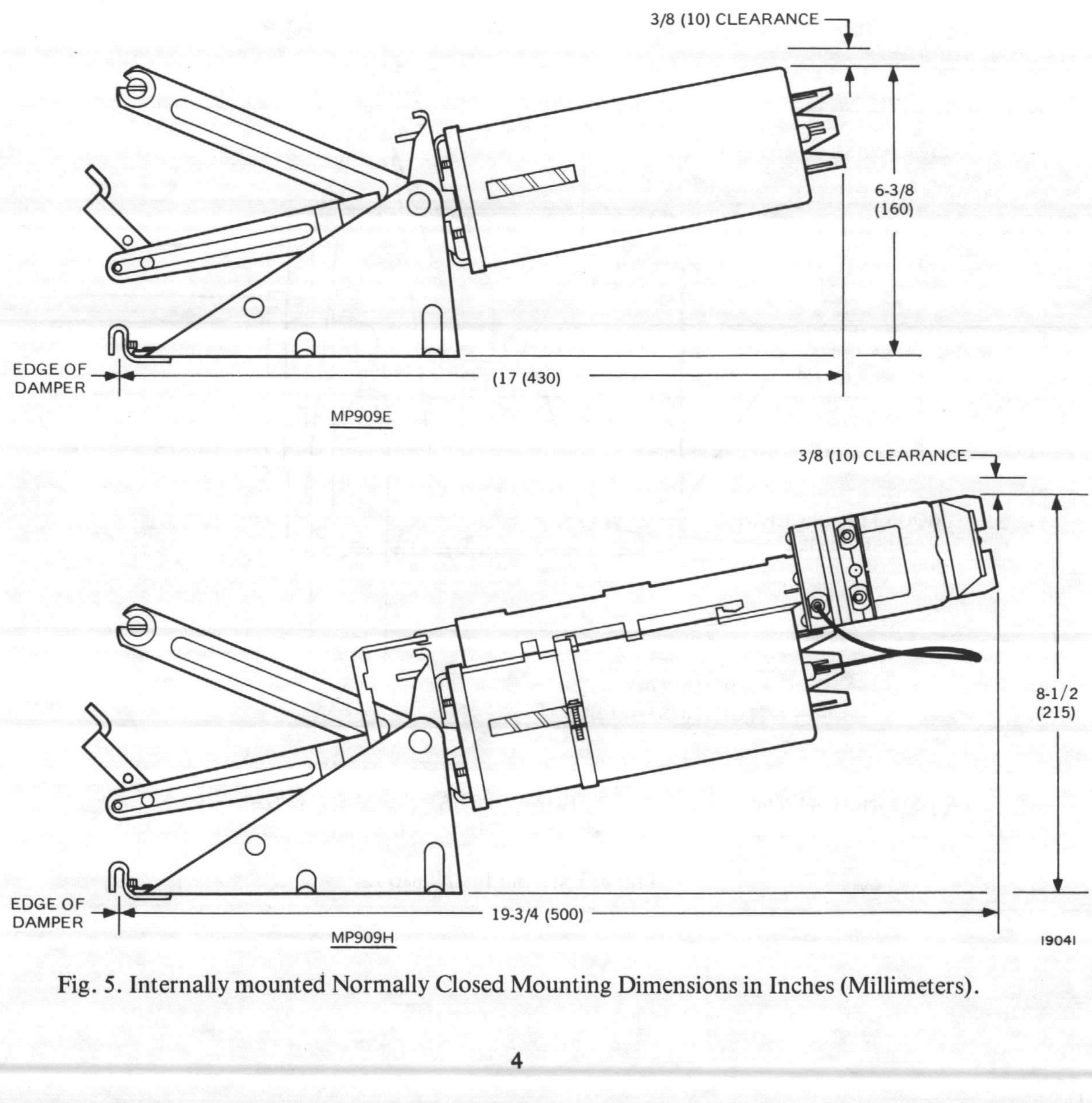


Fig. 5. Internally mounted Normally Closed Mounting Dimensions in Inches (Millimeters).

INTERNAL MOUNTING

NORMALLY CLOSED

1. For internal mounting normally closed dimensions, see Figure 5.

2. Check faceplate position (Fig. 6). Adjust faceplate position if necessary.

3. Use a 1/8-inch Allen wrench to loosen mounting set screws on damper mounting clamp (Fig. 6) one turn. Remove and discard shipping stop.

4. Locate factory installed drive ear on damper. (Mounted per Damper Ordering Instructions.) Operators must be mounted only in this (these) positions.

5. Remove mounting screw from damper end of truss link. Loosen screw between base and truss link. Remove clevis pin from operator pushrod.

6. Set operator in place by hooking operator mounting clamp over bottom edge of damper frame.

7. For 3.1-inch stroke operators when 81-degree damper rotation is acceptable, or all 4-inch stroke operators, insert clevis pin in drive ear hole marked P and the pushrod hole nearest the operator.

8. For 3.1-inch stroke operators when 90-degree rotation is required:

   a. Loosen locknut.
   b. Remove crankarm, pushrod, and coupler as a unit.
   c. Remove and discard locknut.
   d. Reinstall crankarm, pushrod, and coupler to 1-1/8 inch (28.5mm) dimension shown in Figure 7.
   e. Insert clevis pin in drive ear hole marked E and pushrod hole furthest from operator.

9. Connect truss link to damper and tighten both truss link screws.

10. Tighten damper mounting setscrews.

11. Go to PIPING section.

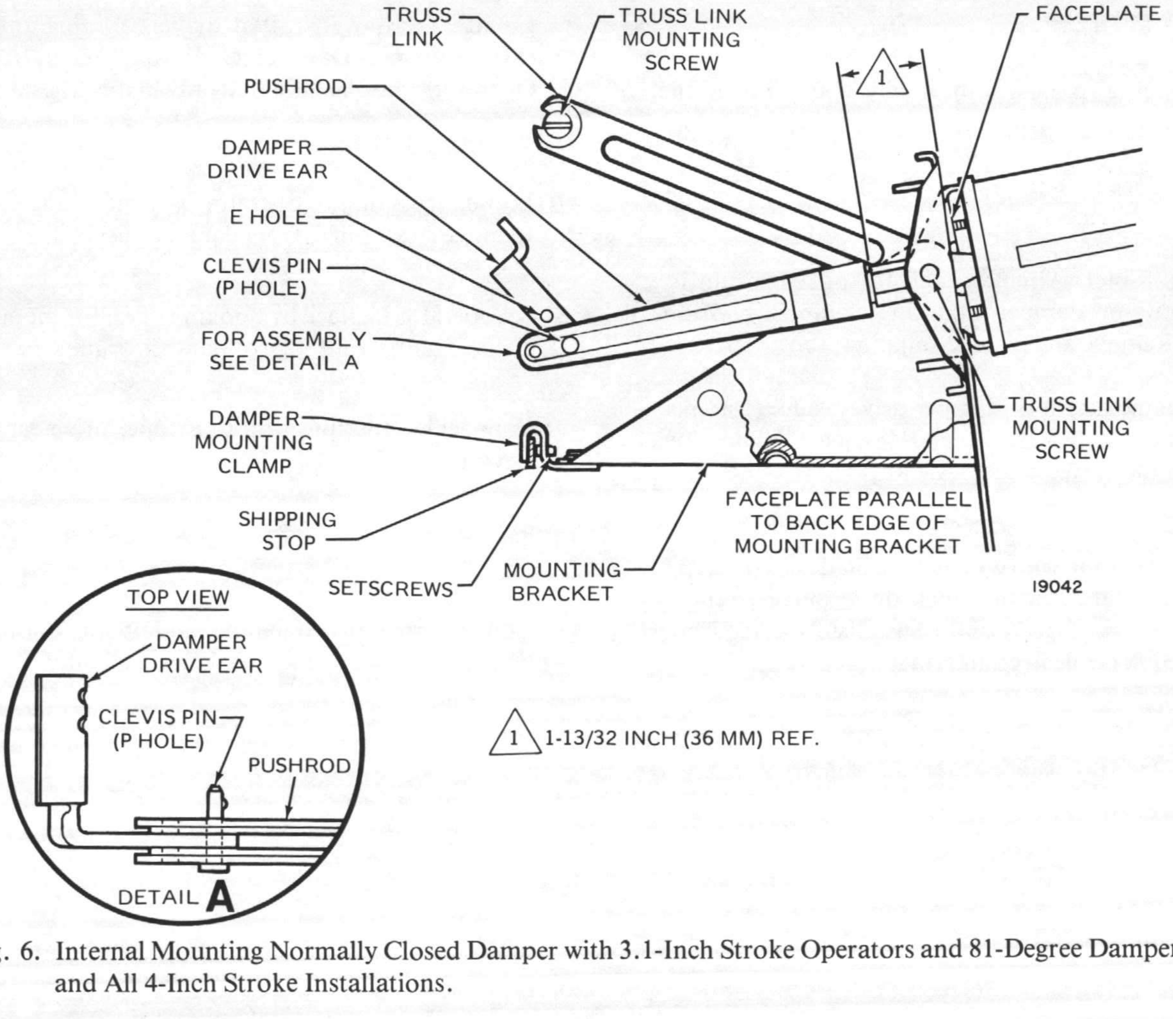


Fig. 6. Internal Mounting Normally Closed Damper with 3.1-Inch Stroke Operators and 81-Degree Damper Rotation, and All 4-Inch Stroke Installations.

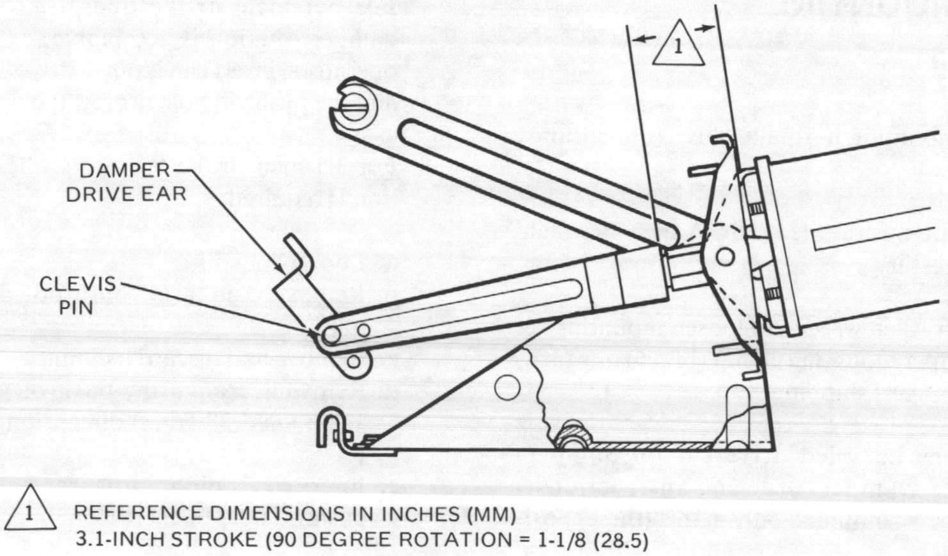
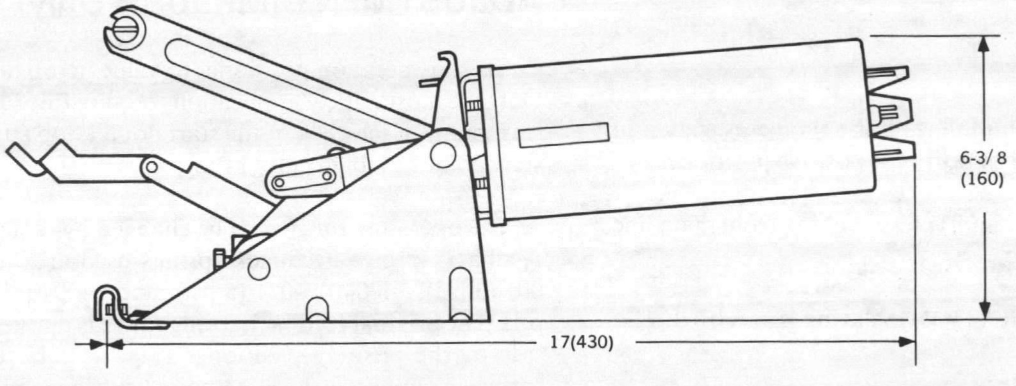


Fig. 7. Internal Mounting Normally Closed Damper with 3.1-Inch Stroke and 90-Degree Damper Rotation Installation.

NORMALLY OPEN

1. For internal mounting normally open dimensions, see Figure 8.
2. Check faceplate position (Fig. 6). Adjust faceplate position if necessary.
3. Use 1/8-inch Allen wrench to loosen mounting setscrews on damper mounting clamp (Fig. 6) one turn. Remove and discard shipping stop.
4. Determine height of damper drive blade. (Dampers with 10, 12, 18, 26, 34, and 48-inch B dimensions have 8-inch drive blades. All others have 6-inch drive blades.)
5. For installation with 6-inch drive blades, go to step 6. For installation with 8-inch drive blades, remove clevis pin A (Fig. 9) and reinstall in pushrod hole marked 8. (Hole in crankarm marked 90.)
6. Locate factory installed drive ear on damper. (Mounted per Damper Ordering Instructions.) Operators must be mounted only in this (these) positions.
7. Loosen truss link to operator base mounting screw. Remove clevis pin C from damper pushrod.
8. Set operator in place by hooking operator mounting clamp over bottom edge of damper frame.
9. Connect damper pushrod to damper drive ear with clevis pin.
10. Tighten damper mounting set screws.
11. Connect truss link to damper and tighten both truss link screws. Truss link must be bent slightly.



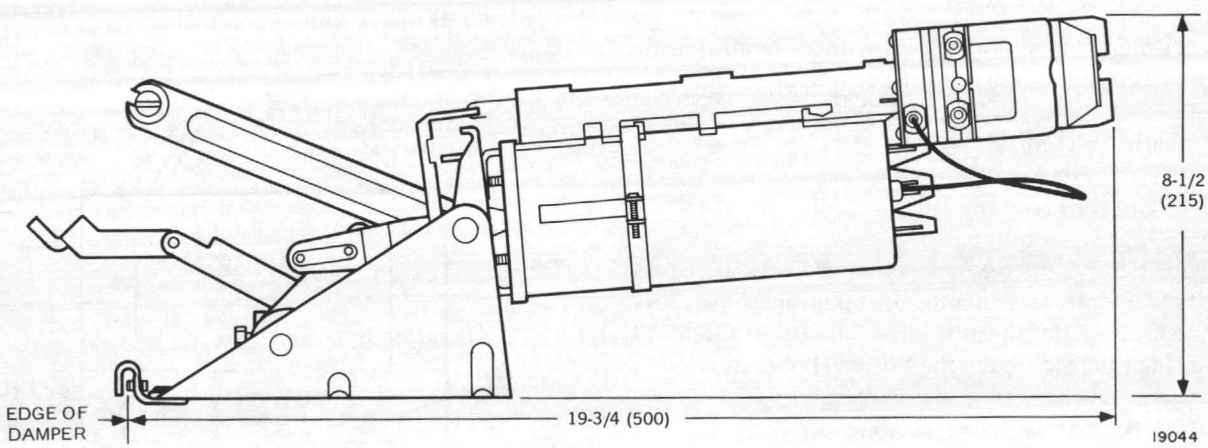


Fig. 8. Internal Mounting Normally Open Dimensions in Inches (Millimeters).

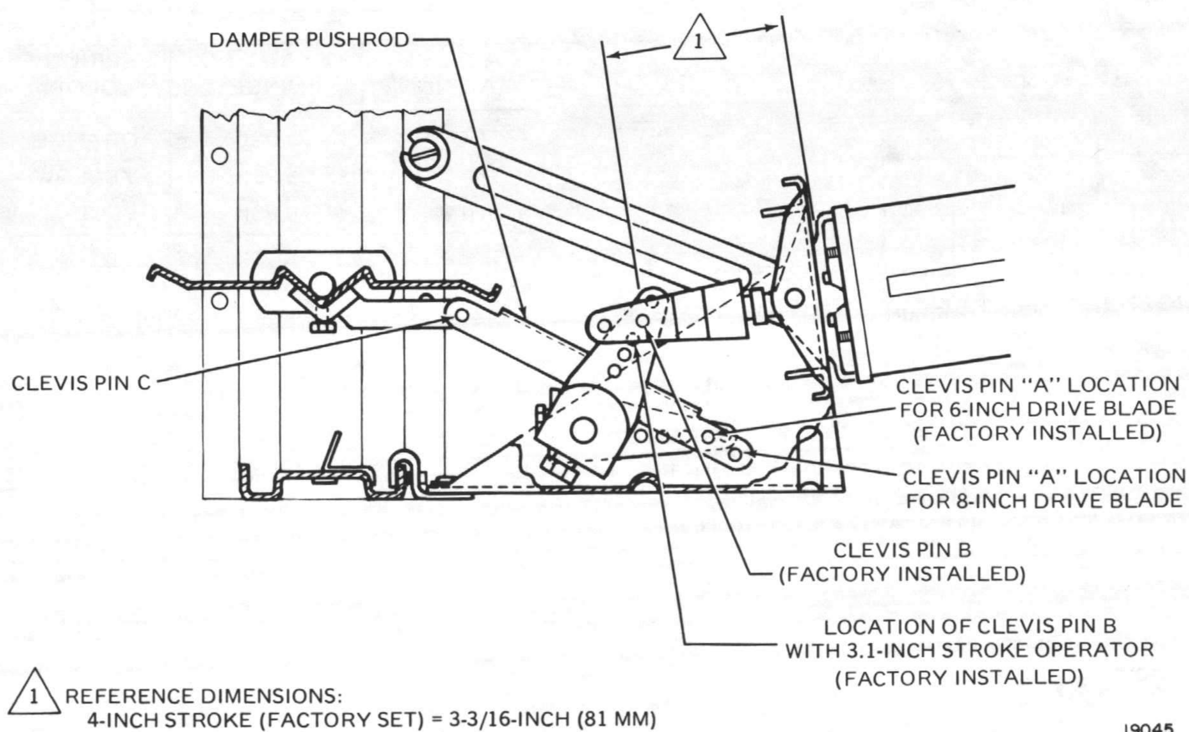


Fig. 9. Internal Mounting Normally Open Installation.

PIPING

MP909H

1. Push on 5/32-inch (4mm) plastic tubing as shown in job drawings to pilot port P of positive positioner.

2. Push on 1/4-inch (6mm) plastic tubing from main line to main port M.

3. See SLAVE OPERATION if slaving is specified.

4. Go to ADJUSTMENT section.

MP909E

1. Push on 5/32-inch (4mm) or 1/4-inch (6mm) plastic tubing as shown in job drawings to operator inlet port.

2. Installation is complete.

SLAVE OPERATION (See Fig. 10)

Slaving damper operators together provides increased capacity to operate large damper installations. Operators used in slave operation must have 5 to 10 psi (35 to 70 kPa) spring range to match the MP909H operator.

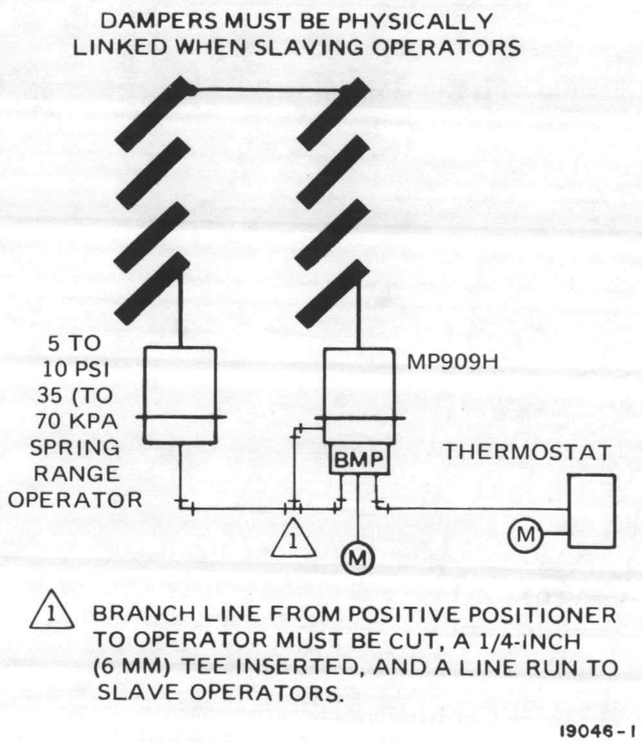


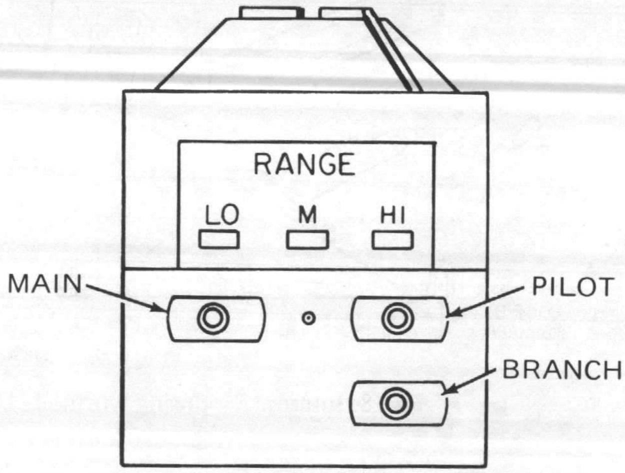
Fig. 10. MP909E Slaved to MP909H for Large Installations.

ADJUSTMENT (MP909H Only)

Set start point on positioner to value in job drawings. Only the most critical applications require fine tuning the start point. Each click of the start point knob adjusts the start point 1/4 lb/in^2 (1.7 kPa).

The operating range may be changed by replacing the feedback spring. Feedback springs used are 14004012-001 (3 psi), 14004013-001 (5 psi), and 14004014-001 (10 psi). The original feedback spring range is marked on the side of the positive positioner (Fig. 11). If feedback spring is changed, check setpoint with gage and compressed air.

MP909H installation is complete.



FACTORY MARKING	OPERATING RANGE	SPRING COLOR
LO	3 PSI	ORANGE
M	5 PSI	YELLOW
HI	10 PSI	BLUE

17011-2

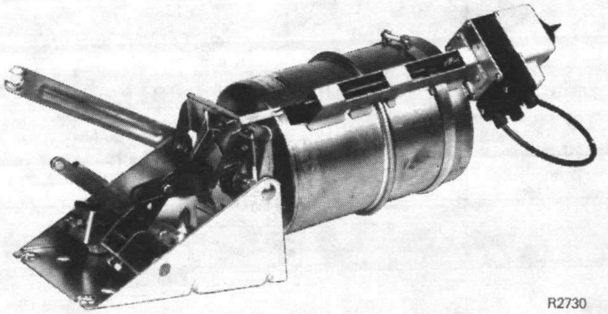
Fig. 11. Original Feedback Spring Marking.

Honeywell

Comfort Control Systems

MP918A & B PNEUMATIC DAMPER OPERATORS

Service Data



GENERAL

DESCRIPTION

The MP918A & B are rolling diaphragm, piston-type pneumatic damper operators. The MP918A is equipped with a positive positioner.

The MP918 operators are functional replacements for the MP904 Pneumatic Damper Operators, and for the MP909C Pneumatic Damper Operator where room allows. The MP918 is a larger operator than the MP909C.

APPLICATION

The pneumatic damper operators perform proportional control of variable-volume terminal units, mixing boxes, and medium- to large-size dampers in HVAC systems. They may be mounted in any position and installed either outside or within the ductwork. Figure 1 shows an MP918A used with a direct-acting controller to control dampers in sequence. Figure 2 shows the MP918B slaved to an MP918A for large damper installations.

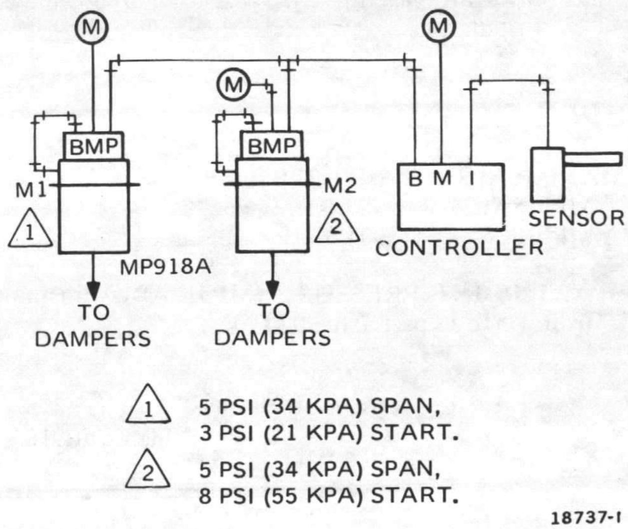


Fig. 1. MP918A Used with Direct-Acting Controller to Control Dampers in Sequence.

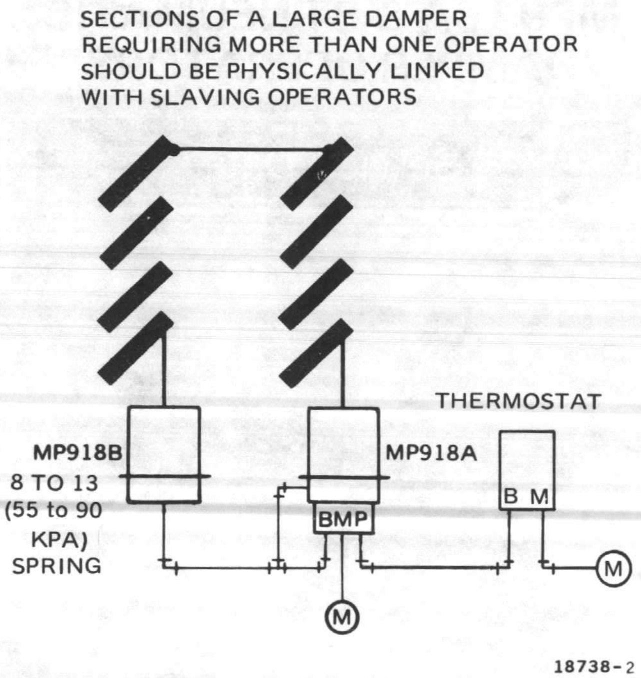


Fig. 2. MP918B Slaved to MP918A for Large Damper Installations.

SPECIFICATIONS

MAXIMUM SAFE AIR PRESSURE:
MP918A: 25 psi (172 kPa).
MP918B: 29 psi (200 kPa).

START POINT PRESSURE (MP918A): Adjustable from 1.5 to 13 psi (10 to 90 kPa).

OPERATING RANGE (MP918A): 3, 5, or 10 psi (21, 34, or 69 kPa), depending on feedback spring used.

AMBIENT TEMPERATURE RANGE:
MP918A: -20 to + 158 F (-29 to + 70 C).
MP918B: -40 to + 158 F (-40 to + 70 C).

SPRING RANGE:
MP918A: 8 to 13 psi (55 to 90 kPa).
MP918B: 3 to 7, 3 to 13, 5 to 10, or 8 to 13 psi (21 to 48, 21 to 90, 34 to 69, or 55 to 90 kPa).

AIR CONNECTIONS:
MP918A: 5/32-inch (4 mm) push-on barb (pilot), 1/4-inch (6 mm) push-on barb (main).
MP918B: 1/4-inch (6 mm) push-on barb.

DAMPER RATING: Refer to Tables I and II for maximum MP918 damper rating. Damper ratings for Honeywell Moduflow dampers are calculated by totaling the "B" dimension (Fig. 3) of all damper sections controlled by the operator.
EXAMPLE:
Damper Type: D640.
Duct Dimensions: 108 inches (A) by 36 inches (B).
Operator: MP918B.
Operating Range: 3 to 13 psi (21 to 90 kPa).
Type of Operation: Modulating Service.
Branch Pressure: 18 psi (124 kPa).

The 108-inch "A" dimension requires three damper sections. Multiply three times 36 (total "B" dimension) to get 108 inches. Table II shows one MP918B will operate up to 123 inches of "B" dimension. Therefore, one MP918B operator is sufficient for this example.

Table I. MP918A Maximum Damper Rating for "B" Dimension in Inches.

Damper Model No.	Modulating Service		2-Position Service	
	18 psi (124 kPa)	20 psi (138 kPa)	18 psi (124 kPa)	20 psi (138 kPa)
D640, D641	205	287	205	287
D642, D643 D644, D645	169	236	169	236

Table II. MP918B Maximum Damper Rating for "B" Dimension in Inches.

Damper Model No.	Spring Range in psi (kPa)	Modulating Service 13 psi (90 kPa)	Modulating Service 18 psi (124 kPa)	2-Position Service 18 psi (124 kPa)
D640, D641	3 to 7 (21 to 48)	123	123	123
	3 to 13 (21 to 90)	N/A	123	123
	5 to 10 (34 to 69)	123	123	205
	8 to 13 (55 to 90)	N/A	123	205
D642, D643, D644, D645	3 to 7 (21 to 48)	101	101	101
	3 to 13 (21 to 90)	N/A	101	101
	5 to 10 (34 to 69)	101	101	169
	8 to 13 (55 to 90)	N/A	101	169

N/A = Not Applicable.

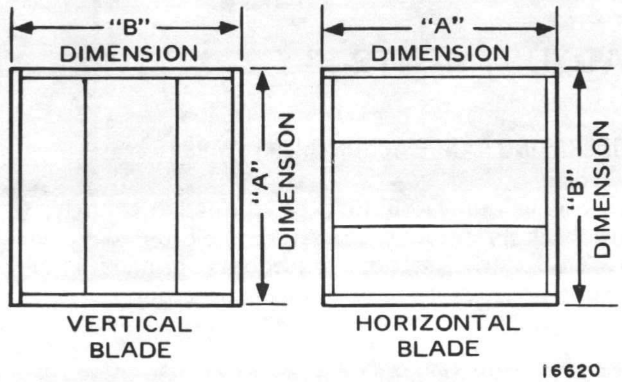


Fig. 3. Honeywell Moduflow Damper Dimensions.

OPERATION

When using the MP918A with a direct-acting controller to control dampers in sequence (Fig. 1), an increase in temperature at the sensor causes an increase in branch line pressure to damper operators M1 and M2. Damper operator M1 strokes completely before M2 starts operating. Full main air pressure is available to the operators at all times, providing positive damper positions correspond to controller branch line pressure for all load conditions.

When slaving an MP918B and an MP918A together (Fig. 2), increased capacity is provided to operate large damper installations. The MP918A receives a pilot signal from the thermostat which applies appropriate branch line pressure to the operators to position the dampers proportionately. The MP918B damper operators must have an 8 to 13 psi (55 to 90 kPa) spring to match the 8 to 13 psi spring in the MP918A.

MAINTENANCE

EQUIPMENT REQUIRED

Air pressure gage, 0 to 30 psi (0 to 270 kPa).

CLEANING

Brush off any accumulation of dust and dirt, and visually check condition of air piping and connections, and linkages.

OPERATIONAL CHECK

MP918A

1. If none exists, install a gage in controller branch line.
2. Set start point on positive positioner dial to lowest value.
3. Reduce branch line pressure to zero by adjusting setpoint of controller. Observe dampers to be sure they are in their normal position and that normally closed dampers are completely closed.
4. Increase the branch line pressure to full main pressure slowly and observe the damper, checking for smooth operation through the complete stroke and for proper final position.
5. If dampers are being operated in sequence, determine the branch line pressure where the damper is supposed to start moving and adjust the branch line pressure just above that point. The first damper should just start to move. Increase the pressure to the point where the operator should finish its stroke or the point the next damper in sequence should begin to operate, whichever comes first. Continue increasing pressure until all dampers in sequence are at maximum position. Check for smooth operation and proper final position.
6. Check all dampers in the system in this manner. Start and finish points of the operating range should be within 1 psi (7 kPa) of the settings. Adjust positive positioner start point if necessary.
7. Return the setpoint adjustments of the controller and/or positioning switch to the proper settings.

MP918B

1. If none exists, install a gage in controller (or positioner, for slaved or sequenced installations) branch line.
2. Adjust controller (positioner) setpoint to produce a branch line pressure slightly higher than the lowest point of the operating range of the MP918B. The damper should just start to move.
3. Increase the branch line pressure through the high point of the operating range, observing the damper for smooth operation and proper final position.
4. Return the setpoint of the controller (positioner) to desired setting.

ADJUSTMENTS

OPERATING RANGE ADJUSTMENT - MP918A

The operating range may be adjusted by changing the feedback spring. Refer to PARTS LIST in PARTS AND ACCESSORIES section for feedback spring kit number and REPAIR section for changing procedure.

START POINT CALIBRATION - MP918A

Special application may require fine tuning the start point. Each click of the start point knob dial will adjust the start point 1/4 psi (1.7 kPa). Set start point knob dial to 7 psi (48 kPa). With 18 psi (124 kPa) MLP and 8 psi (55 kPa) pilot pressure, adjust calibration screw on top of positioner knob to obtain a 3/4-inch (19 mm) stroke.

STROKE ADJUSTMENT - MP918B

Start stroke position may be adjusted by using 3/8-16 UNC nuts on the operator shaft for up to 1/2-inch (13 mm) start adjustment. Adjusting the operator stroke changes both start and range.

TROUBLESHOOTING

Refer to Figures 4 and 5 for troubleshooting.

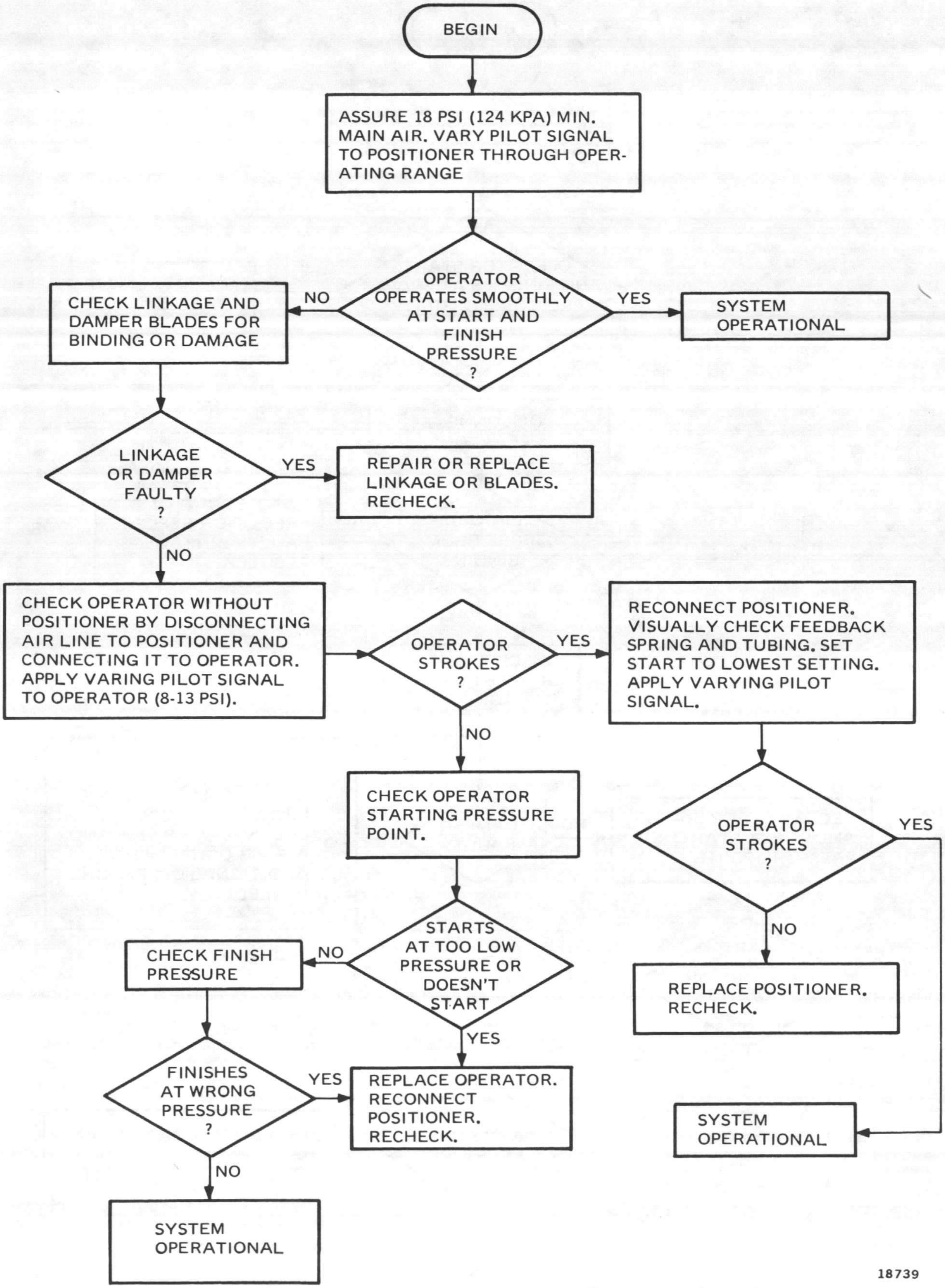


Fig. 4. MP918A Troubleshooting Flowchart.

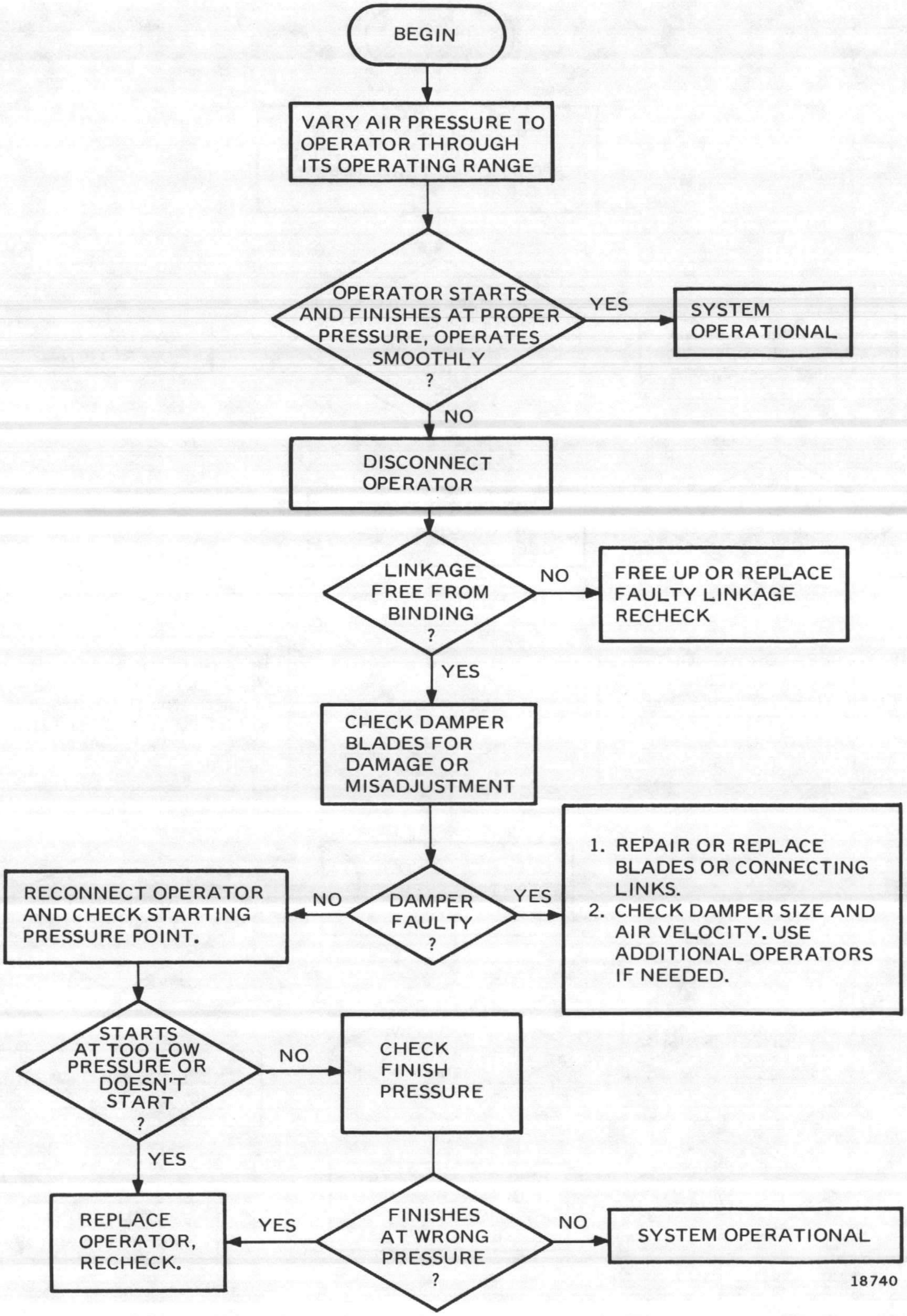


Fig. 5. MP918B Troubleshooting Flowchart.

REPAIR

The only repair available for the MP918 sealed operator is replacement of the positive positioner and bracket assembly, operator bracket assemblies, hardware, and feedback springs. There is a feedback spring kit available including a spring for each range. Refer to PARTS LIST in the PARTS AND ACCESSORIES section for feedback spring kit part number.

POSITIVE POSITIONER REPLACEMENT

1. Cut air lines to main, pilot, and branch (Fig. 6). Plug or cap main during replacement procedure.
2. Remove feedback spring by unhooking at both ends.
3. Remove positioner by unscrewing positioner bracket. Replace with new positioner, screwing positioner bracket securely.
4. Hook up feedback spring.
5. Reconnect pilot, branch, and main lines, using coupling where needed.
6. Recalibrate start point.

FEEDBACK SPRING REPLACEMENT

1. Cut air lines to main, pilot, and branch. Plug or cap main during replacement procedure.
2. Remove feedback spring by unhooking at both ends.
3. Hook up new feedback spring for desired range.
4. Reconnect pilot, branch, and main lines, using coupling where needed.
5. Recalibrate start point.

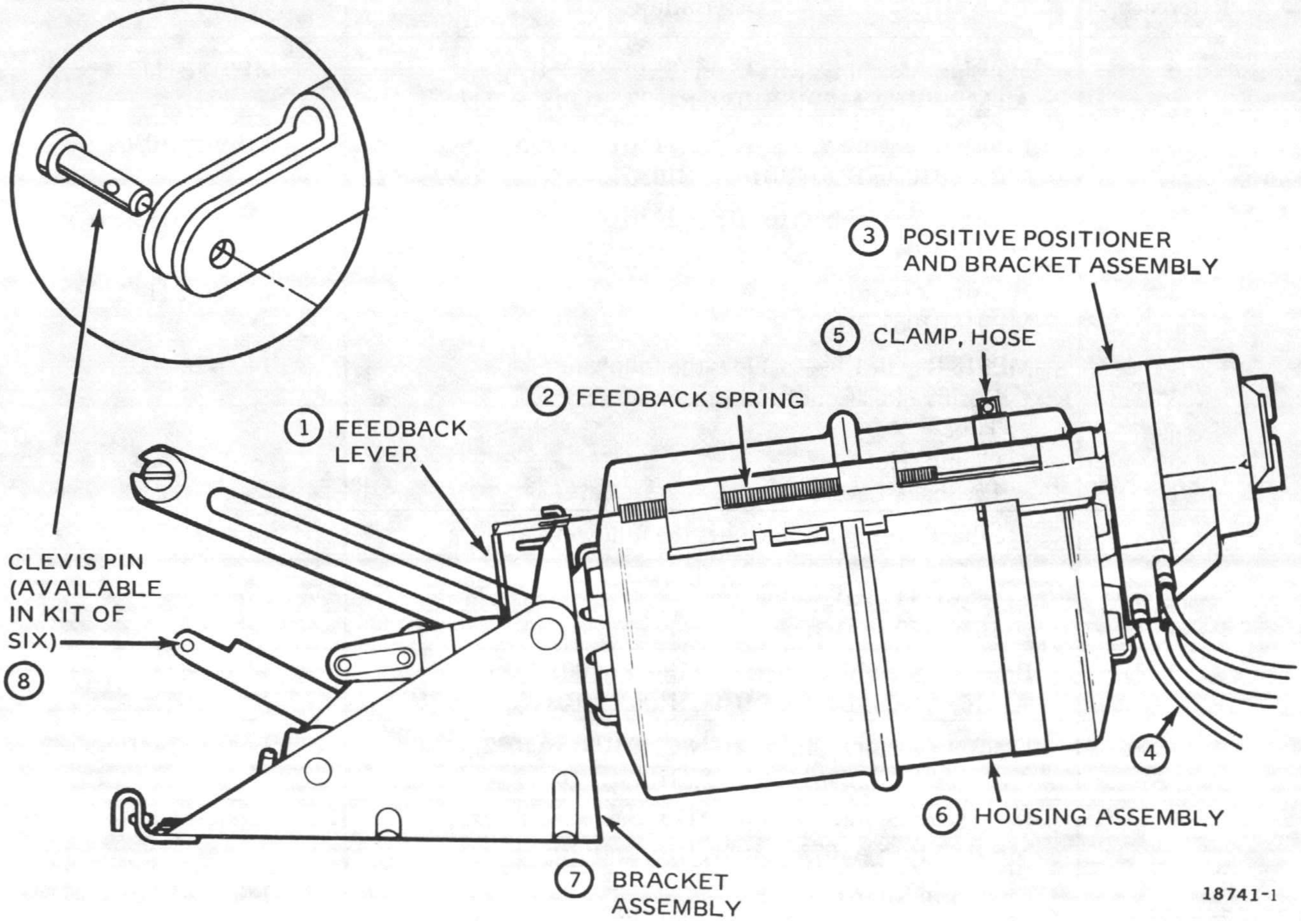


Fig. 6. MP918A Showing Repair Parts.

PARTS AND ACCESSORIES

PARTS LIST

Refer to Figure 6 in REPAIR section and Table III for available repair parts.

ACCESSORIES

Damper jackshaft kits are available for multisection damper installation. The following kits must be ordered separately:

— End Kit (one for each application) 15753693-001.
— Modular Kit (one for each vertical bank) 15753692-001.
— Operator Kit (one for each operator) 15753694-001.
NOTE: Order Linkage Assembly 14004236-001 with the Operator Kit.

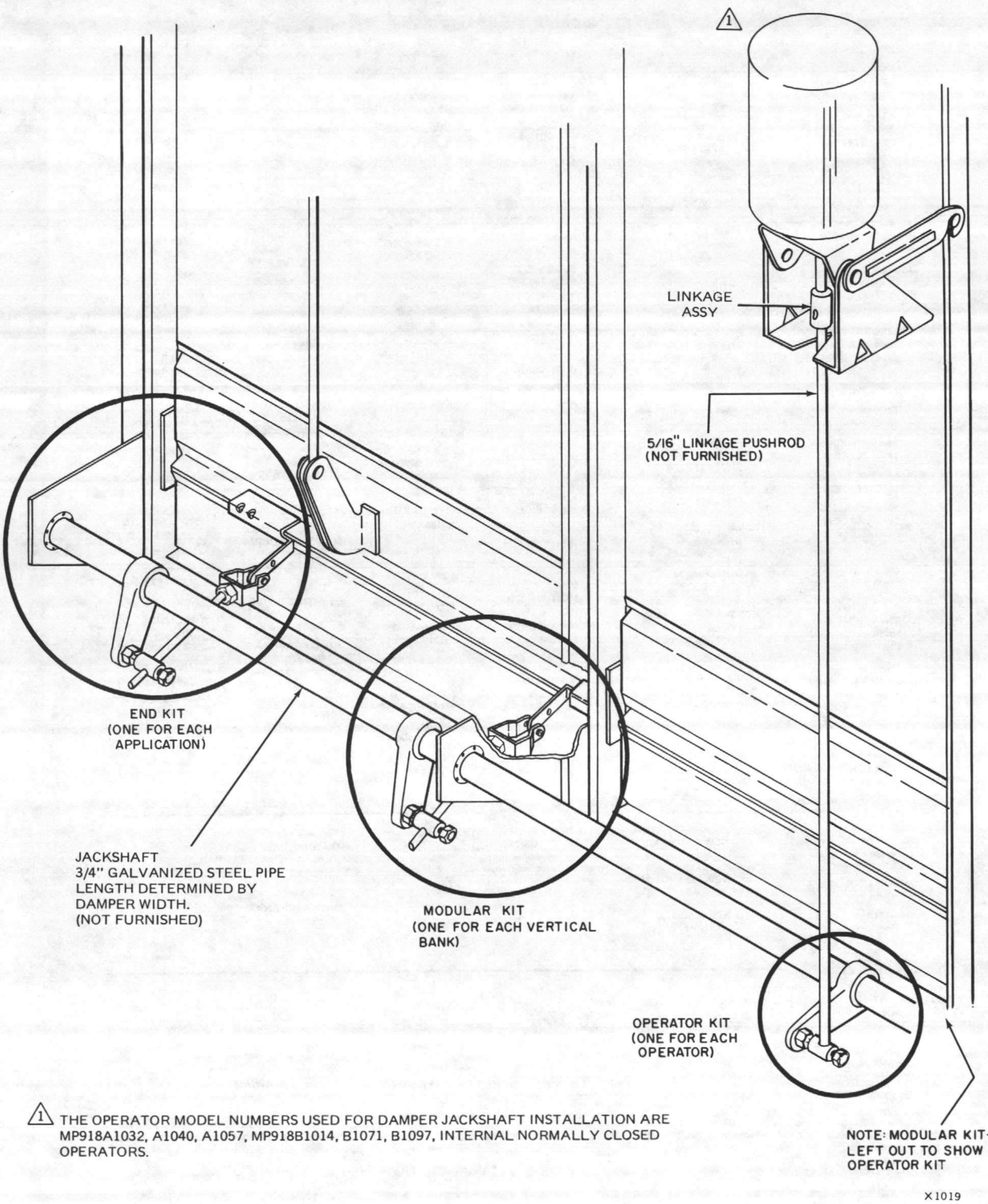
Drive blades of adjacent damper sections should not be joined through their axles, but should be independently driven from the jackshaft.

The jackshaft should be located at the bottom, or lower section of two-section damper installations. On installations which are three or more sections high, the shaft should be located near the middle.

Refer to Figure 7 for a typical jackshaft installation.

Table III. MP918 Parts List

Figure Reference	Description	Part No.
6	Housing Assembly, 8 to 13 psi (55 to 90 kPa): All MP918As, MP918B1089, B1097, B1105, B1113	MP918B1113
6	Housing Assembly, 3 to 13 psi (21 to 90 kPa): MP918B1006, B1014, B1022, B1030	MP918B1030
6	Housing Assembly, 5 to 10 psi (34 to 69 kPa): MP918B1048	MP918B1139
6	Housing Assembly, 3 to 7 psi (21 to 34 kPa): MP918B1063, B1071	MP918B1147
	MP918 Repair Kit—includes the following:	14004264-001
3	Positive Positioner and Bracket Assembly	
4	Tube	
5	Clamp, Hose	
1	Feedback Lever	
2	Feedback Spring Kit, includes the following springs: 3 psi (21 kPa), orange; 5 psi (34 kPa), yellow; 10 psi (69 kPa), blue	14004210-001
7	Bracket Assembly, External: MP918A1008, A1016, A1024, B1006, B1048, B1063, B1089	14004062-001
7	Bracket Assembly, Internal, N.C.: MP918A1032, A1040, A1057, B1014, B1071, B1097	14004062-002
7	Bracket Assembly, Internal, N.O. (reversing linkage): MP918A1065 A1073, A1081, B1022, B1105	14004062-003
8	Clevis Pin Kit (6 pins)	14004241-001



⚠1 THE OPERATOR MODEL NUMBERS USED FOR DAMPER JACKSHAFT INSTALLATION ARE MP918A1032, A1040, A1057, MP918B1014, B1071, B1097, INTERNAL NORMALLY CLOSED OPERATORS.

Fig. 7. Typical Damper Jackshaft Installation.

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Temperature Controls

P658A, B & C

PNEUMATIC-ELECTRIC SWITCH

Service Data

GENERAL

The following includes the information required to service and/or repair the P658 Pneumatic-Electric Switch. A repair Parts List is included to assist in ordering selected parts for field repair. Only those items which include an identifying part number are stocked for ordering purposes.

No special tools are required to service or repair these devices.

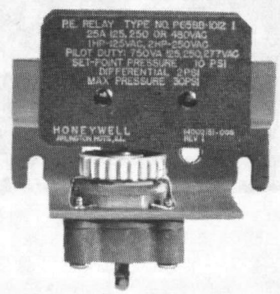
Operating ambient temperature is +40 to 140F (4.5 to 60C).

The switch in the P658A and B models is rated as follows:

25 amps at 125, 250 or 480v A.C.
1 Hp at 125v A.C.
2 Hp at 250v A.C.
Pilot duty–750VA at 125, 250, or 277v A.C.

The switch used in the P658C model is for special service and is rated at 5 ma @ 5 volts.

P658A



P658B & C

APPLICATION

The P658 converts a pneumatic signal from a controller or other pneumatic device to a two-position electric switch action. This switching action is used to provide on/off control of fans, pumps, electric heaters, etc. found in mechanical systems.

The SPDT switch action can also be used to energize alarm systems, provide interlock functions or other pneumatic to electric interface operations.

The P658C contains SPDT gold switching contacts for use in dry circuit switching and with DELTA 2000 applications.

OPERATION (See Fig. 1)

On a drop in input pressure below setpoint, the SPDT switch transfers from R-W to R-B.

Reverse switching (break R-B and make R-W) occurs on a pressure rise above the setpoint plus differential (2 psi [13.8 kPa]).

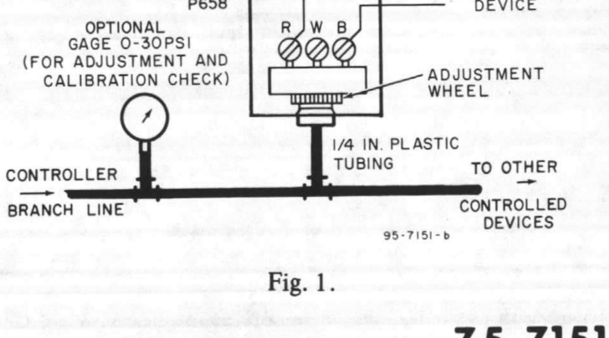


Fig. 1.

TROUBLE SHOOTING

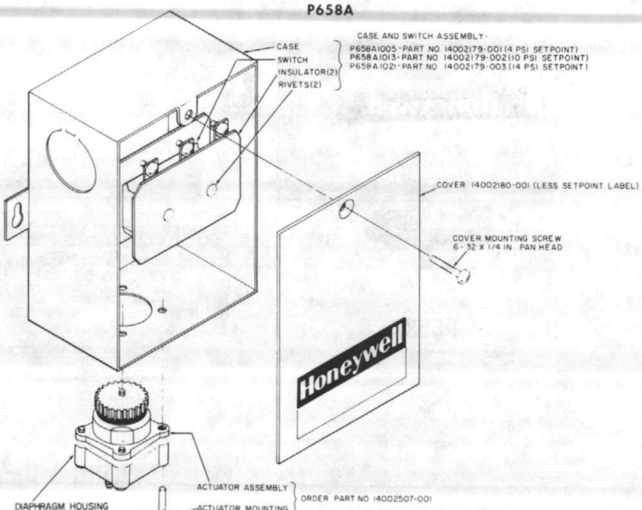
Inspect the P658 to determine that the setpoint (factory set and marked on coverplate) is correct for the application.

Increasing or decreasing the branch line pressure above or below the setpoint of the P658 should cause the switch to cycle the load. See General section for switch rating. Determine that the load connected to the switch is within the limits of the switch. Overloading will destroy or shorten the life of the switch. If the switch is found to be defective, refer to the Repair section for replacement.

To adjust the setpoint, if required, turn the adjustment wheel (Fig. 1) clockwise (as viewed from the top looking down) to increase the setpoint; to decrease setpoint, rotate counterclockwise. One full turn of the wheel will change the setpoint 9 psig (62 kPa).

REPAIR

PARTS LIST



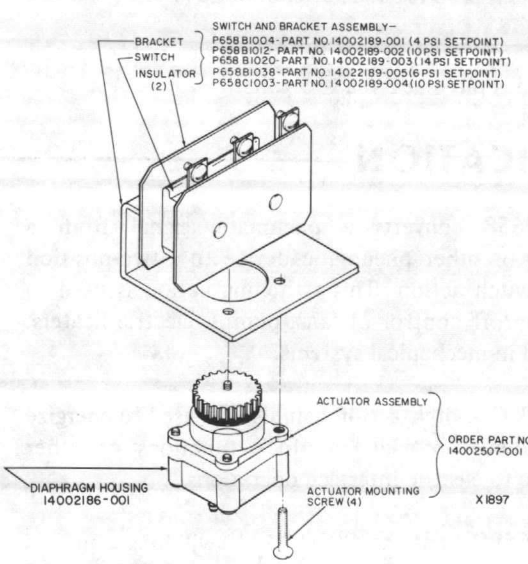


Fig. 2.

Honeywell

Comfort Control Systems

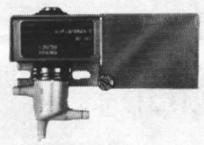
RP418A-C, RP818A, B ELECTRIC-PNEUMATIC RELAYS

Service Data

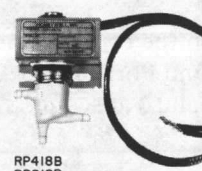
GENERAL

The RP418 and RP818 Electric-Pneumatic Relays are electrically operated pneumatic switches.

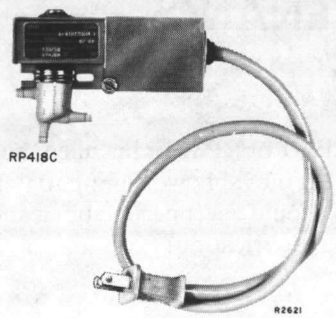
These relays are manufactured by the Skinner Division of Honeywell and are designed for either wall or panel mounting. They can be mounted in any position without affecting the operation of the device. These relays are a direct replacement for the RP417 and RP817 Electric-Pneumatic Relays.



RP418A, RP818A R2624



RP418B RP818B R2622



RP418C R2621

APPLICATION

The RP418 and RP818 Relays are used for interlock between an electrical and a pneumatic control system. They can also be used as stop and bleed relays or as diverting or selector relays. They function as three-way normally open or normally closed air valves, or a three-way diverting control, depending upon the piping hookup. If applied as shown in Figure 1, when the fan is turned on, the coil is energized, passing supply air through Ports 1 and 3 to the damper operator. With the fan off, the supply Port 1 is blocked. Ports 2 and 3 are connected, bleeding the air from the damper operator to atmosphere.

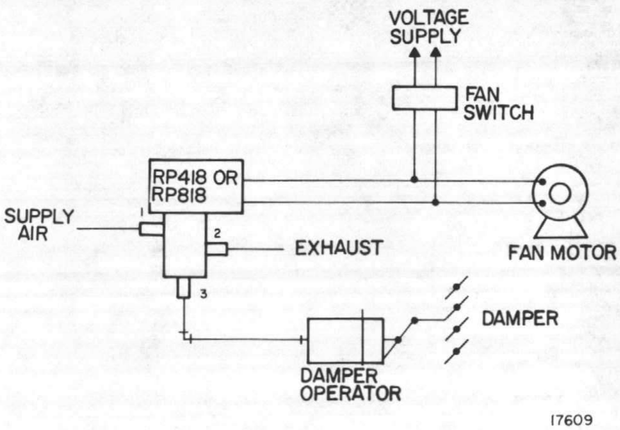


Fig. 1. Typical Piping Hookup of the RP418 or RP818 Relays.

SPECIFICATIONS

MODELS: Refer to Table 1 for model feature variations.

Table 1. RP418, RP818 Model Variation.

Model Number	Line Voltage	Low Voltage	Wall Mount	Panel Mount	Device Mount	Splice Box	Open Coil	Cord & Plug
RP418A	X		X		X	X		
RP418B	X			X			X	
RP418C	X		X		X	X		X
RP818A		X	X		X	X		
RP818B		X		X			X	

Form No. 85-0065
Commercial Bldg. Group
MLF TAB: II. C. 5.

AIR CAPACITY: At 20 lb/in^2 (138 kPa) supply with 1 lb/in^2 (7 kPa) drop: 0.42 standard ft^3/min (0.20 ℓ/s).

PRESSURE RATING: 50 lb/in^2 (345 kPa) maximum.

AMBIENT TEMPERATURE RATING: 0 to 100F (-18 to 38C).

NOTE: For rating up to 120F (49C) refer to Installation Instructions 95-6046.

POWER CONSUMPTION: 4.0 Watts, nominal.

AVAILABLE VOLTAGE/FREQUENCY: See Table 2.

Table 2. Available Voltage/Frequency.

Model	Complete O.S. No.	Voltage/ Frequency
RP418A	1107	110/120, 50/60
	1057	120/50
	1099	220/240, 50/60
	1040	240/50
	1081	208/60
	1115	575/50
	1073	277/60
	1024	277/50
	1065	440/480, 50/60
	1032	480/50
	1016	100/50
	1008	200/208, 50
RP418B	1071	110/120, 50/60
	1030	120/50
	1063	220/240, 50/60
	1022	240/50
	1055	208/60
	1014	208/50
	1048	440/480, 50/60
	1006	480/50
	1089	575/60
RP418C	1004	110/120, 50/60
RP818A	1012	24/50
	1004	24/60
RP818B	1010	24/50
	1002	24/60

OPERATION

When the coil is deenergized, Ports 2 and 3 are connected and Port 1 is blocked. When the coil is energized, Ports 1 and 3 are connected and Port 2 is blocked.

MAINTENANCE

GENERAL

Once the RP418 or RP818 is installed, no maintenance is necessary. All movable working parts are internal to the device and should never need to be cleaned. This relay does not require lubrication.

OPERATIONAL CHECK

Energize the electrical circuit to the relay. Determine whether the switch operates by analyzing airflow to the system parameters.

TROUBLESHOOTING

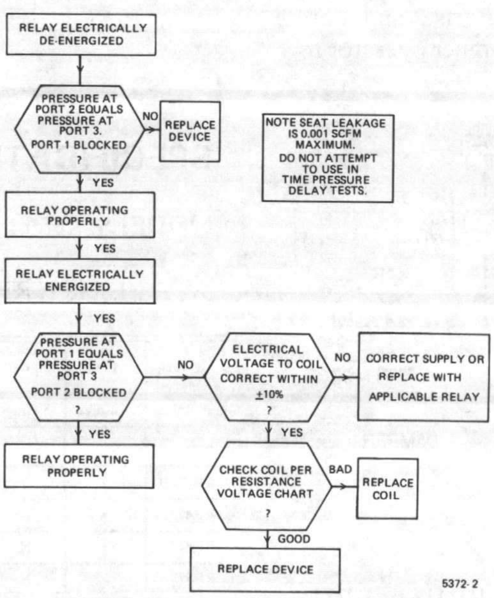


Fig. 2. Troubleshooting Flow Chart.

REPAIR

Coil replacement, the only field repair recommended for the RP418 and RP818 Relays, is described in the following procedures.

WARNING

To protect the eyes and face, and prevent loss of the garter spring while removing it, shield top of relay.

CAUTION

Before attempting any repair, be sure to disconnect electrical power and shut off the air supply to the relay.

1. Using a small screwdriver, pry loose the garter spring positioned at the top of the relay (Fig. 3).
2. Slide the valve body free from the rest of the relay.
3. On RP418C models, disconnect cord and plug.
4. Pull the coil electrical leads (splice box models) through the grommet in the box.
5. Remove the defective coil and replace with new coil in reverse order, aligning the holes so the valve body can slide into place.
6. Reconnect wires of cord and plug (RP418C), by stripping leads and either crimping or using a wire nut.
7. After the new coil has been aligned and assembled to the valve body, reinstall the garter spring over the bushing. Power and air supply can be restored to the relay. Check operation.

PARTS AND ACCESSORIES

PARTS LIST

Refer to Figure 3 and Table 3.

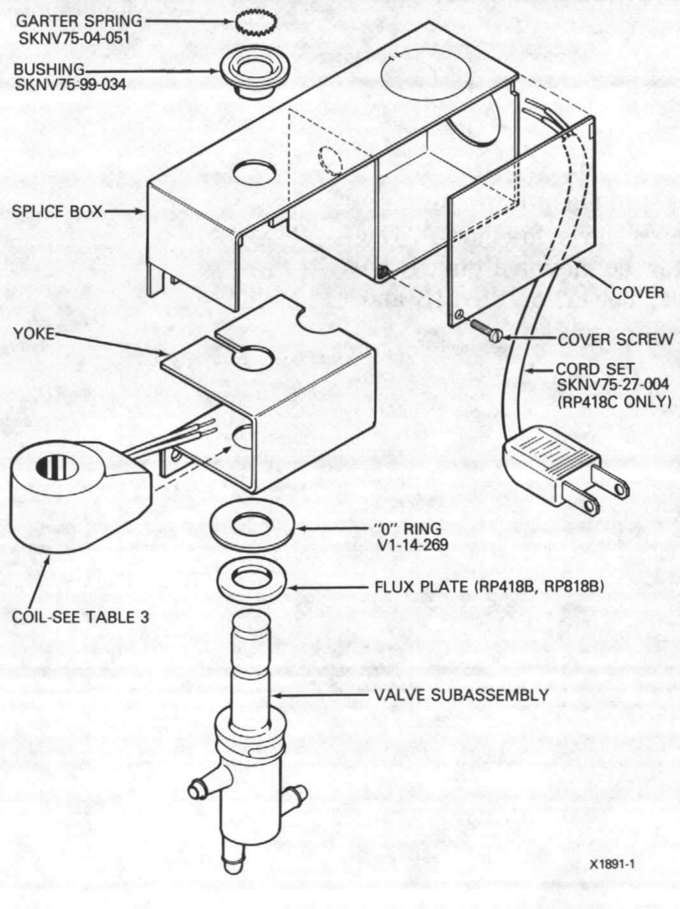


Fig. 3. RP418, RP818 Exploded View.

Table 3. Replacement Coils.

Part No. (1)	Voltage/ Frequency
SKNC75-1904	120/60, 110/50
C75-1905	120/50
SKNC75-1908	240/60, 220/50
C75-1909	240/50
SKNC75-1906	208/60
C75-1907	208/50, 200/50
SKNC75-1910	277/60
C75-1911	277/50
SKNC75-1912	480/60, 440/50
C75-1913	580/50
C75-1903	100/50
C75-1902	25/50
SKNC75-1901	24/60
C75-1914	575/60

(1) All 50-Hz coils without an SKN prefix must be ordered from Skinner Valve Division, 95 Edgewood Ave., New Britain, CT 06051

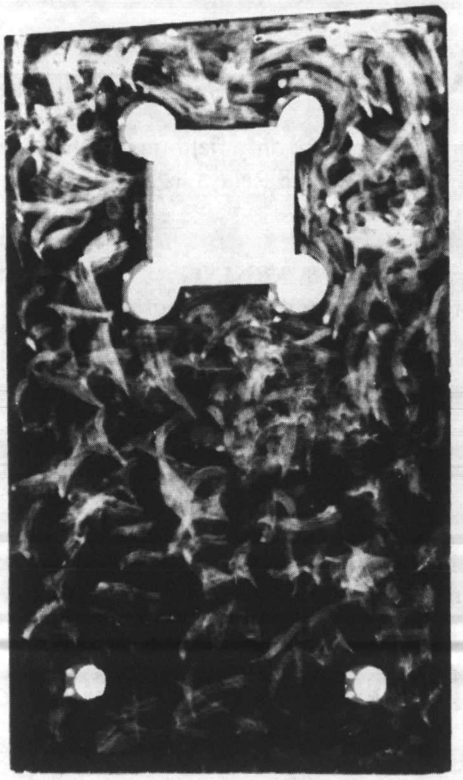


Fig. 4. Mounting Bracket 14003637-001 (Contained in Mounting Kit 14003638-001).

ACCESSORIES

Optional Mounting Kit 14003638-001 contains 14003637-001 Mounting Bracket shown in Figure 4. The RP418 and RP818 Relays can be mounted directly to MP516A Operators, VP519C Valves, or PP901B and PP902B Pressure Regulators using this kit.

HONEYWELL

MAINTENANCE AND REPAIR

T451A,B & T651A LINE VOLTAGE THERMOSTATS

INTRODUCTION

These instructions cover disassembly, maintenance, and repair procedures for the T451 and T651 Thermostats. A complete parts list and exploded view drawing are included. Parts and assemblies are designated by numbers for easy reference. For ordering information see the note following the parts list.

NOTE: Prices may be obtained from our local branch office. Prices and availability are subject to change without notice.

MAINTENANCE

WARNING: Remove the power source from the thermostats before removing the cover; failure to do so could result in serious electrical shock.

Turn off the power to the thermostat and remove the cover. Blow or brush away any accumulated dust or dirt and inspect the device for external or internal damage. Observe the contacts. If they are oxidized, clean them by manually closing the contacts upon a piece of hard finish cardboard (similar to a postcard) and drawing the cardboard from between the contacts, repeating the operation several times to ensure a good clean surface.

CALIBRATION

Turn the adjustment screw (Fig. 3, item 1) clockwise until snug. Place the cover, containing the thermometer, as close to the mounted thermostat as possible. Allow about ten minutes for the temperature of the thermostat to stabilize with the temperature of the thermometer in the cover. Set the lever (Fig. 1, item 23) on the mark of the scale (Fig. 1, item 14) which corresponds to the reading of the cover thermometer.

Turn the adjustment screw (Fig. 3, item 1) counter-clockwise slowly until the contacts make.

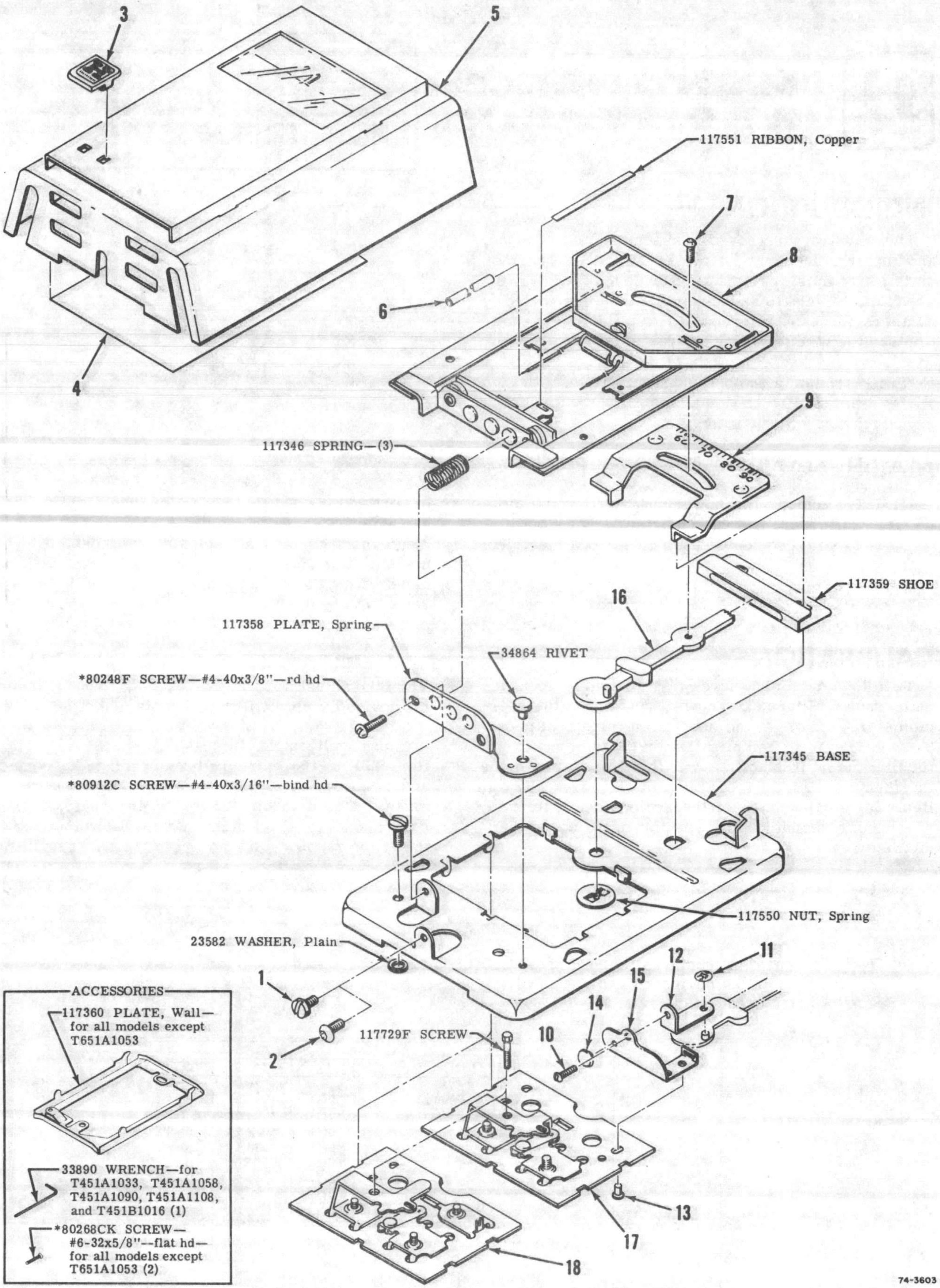
Check calibration by pushing the lever (Fig. 1, item 23) to the extreme left (opening the contacts) and returning it slowly to the right until the contacts make. Check the indication on the scale, it should correspond to the reading on the thermometer. If the two readings do not correspond, recalibrate.

PARTS LIST

Parts List for Fig. 1

NOTE: The four digit numbers listed in the MODELS column indicate the complete Ordering Specification number of the device. Example: T451B1008. The number in parentheses indicates the quantity of parts used in the device.

			MODELS		
KEY	PART NO.	DESCRIPTION	T451A	T451B	T651A
1	80916D	* SCREW—#4-40x1/4"—bind hd	1009(1) 1017(1) 1025(1) 1041(1) 1066(1) 1074(1) 1082(1)	1008(1) 1024(1) 1032(1) 1040(1)	1004(1) 1012(1) 1020(1) 1038(1) 1046(1) 1061(1)
2	80993B	SCREW	1033(1) 1058(1) 1090(1) 1108(1)	1016(1)	
3	114014B	MONOGRAM	(1)	(1)	1004(1) 1012(1) 1020(1) 1038(1) 1046(1)
3	114014C	MONOGRAM			1079(1)



*Standard hardware item which should be obtained locally when possible.

Fig. 1 - T451A, B and T651A Line Voltage Thermostat.

KEY	PART NO.	DESCRIPTION	MODELS T451A	T451B	T651A
4	117379	INSERT	(1)		
4	121043	INSERT		1008(1) 1016(1) 1024(1)	
4	117380	INSERT		1032(1) 1040(1)	
4	117381	INSERT			1004(1) 1012(1) 1020(1) 1061(1) 1079(1)
5	117361A	COVER ASSEMBLY—(See Fig. 2)	1025(1) 1033(1) 1041(1) 1058(1) 1066(1)	1008(1) 1024(1) 1032(1)	1004(1) 1020(1) 1046(1) 1079(1)
5	117361B	COVER ASSEMBLY—(See Fig. 2)	1009(1)	1016(1)	1012(1)
5	117361C	COVER ASSEMBLY—(See Fig. 2)	1017(1)	1040(1)	1038(1)
5	117361D	COVER ASSEMBLY—(See Fig. 2)	1074(1) 1082(1) 1090(1) 1108(1)		
5	117361G	COVER ASSEMBLY—(See Fig. 2)			1061(1)
6	113231E	TUBING		(2)	(2)
7	80993D	SCREW	1033(1) 1058(1) 1090(1) 1108(1)	1016(1)	
8	117343A	** BIMETAL ASSEMBLY—(See Fig. 3)	(1)		
8	117343B	** BIMETAL ASSEMBLY—(See Fig. 3)		1008(1) 1016(1) 1024(1)	
8	117343C	** BIMETAL ASSEMBLY—(See Fig. 3)			1004(1) 1012(1) 1020(1) 1053(1) 1061(1) 1079(1)
8	117343D	** BIMETAL ASSEMBLY—(See Fig. 3)			1038(1) 1046(1)
8	117343E	** BIMETAL ASSEMBLY—(See Fig. 3)		1032(1) 1040(1)	
9	117352A	SCALEPLATE	1025(1) 1033(1) 1066(1)	1008(1) 1016(1) 1024(1) 1032(1)	1004(1) 1012(1) 1020(1) 1046(1) 1061(1) 1079(1)
9	117352B	SCALEPLATE	1009(1) 1074(1) 1108(1)		
9	117352C	SCALEPLATE	1041(1) 1058(1)		
9	117352D	SCALEPLATE	1017(1)	1040(1)	1038(1)
9	117352E	SCALEPLATE	1082(1)		
9	117352F	SCALEPLATE	1090(1)		
10	80989F	SCREW	1041(1) 1058(1) 1090(1)		

KEY	PART NO.	DESCRIPTION	MODELS T451A	T451B	T651A
11	117974	NUT, Spring	1041(1) 1058(1) 1090(1)		
12	117972	CONNECTOR	1041(1) 1058(1) 1090(1)		
13	7056	RIVET	1041(2) 1058(2) 1090(2)		
14	30297	CONTACT	1041(1) 1058(1) 1090(1)		
15	117971	BLADE	1041(1) 1058(1) 1090(1)		
16	117350	LEVER	1009(1) 1017(1) 1025(1) 1041(1) 1066(1) 1074(1) 1082(1)	1008(1) 1024(1) 1032(1) 1040(1)	(1)
16	117351	LEVER	1033(1) 1058(1) 1090(1) 1108(1)	1016(1)	
17	117973B	TERMINAL BOARD ASSEMBLY— (See Fig. 4)	1041(1) 1058(1) 1090(1)		
18	117356B	TERMINAL BOARD ASSEMBLY— (See Fig. 5)	1009(1) 1017(1) 1025(1) 1033(1) 1066(1) 1074(1) 1082(1) 1108(1)		
18	117356C	TERMINAL BOARD ASSEMBLY— (See Fig. 5)		(1)	
18	117356D	TERMINAL BOARD ASSEMBLY— (See Fig. 5)			(1)

*Standard hardware item which should be obtained locally when possible.

**Because the component parts of this assembly are welded together, it is recommended that a complete replacement assembly be ordered.

NOTE: Please order by Part No. and Description. Also, give the complete Order Specification number of the Line Voltage Thermostat. The number is stamped on the bimetal assembly. In some cases it may be necessary to return the entire device to our factory for complete repair and reconditioning. Order from Honeywell, Golden Valley Plant, 1885 Douglas Drive North, Minneapolis 22, Minnesota (In Canada: Honeywell Controls Limited, Vanderhoof Avenue, Leaside, Toronto 17, Ontario). Prices may be obtained from our local branch.

Parts List for Fig. 2

KEY	PART NO.	DESCRIPTION	MODELS T451A	T451B	T651A
1	119175	SCREEN	1017(1) 1025(1) 1033(1) 1041(1) 1058(1) 1066(1) 1074(1) 1082(1) 1090(1) 1108(1)	1008(1) 1024(1) 1032(1) 1040(1)	1004(1) 1020(1) 1038(1) 1046(1) 1079(1)
1	123508A	SCREEN			1061(1)
2	119176	SCREEN	1009(1)	1016(1)	1012(1)
3	117362A	THERMOMETER COVER	1025(1) 1033(1) 1041(1) 1058(1) 1066(1)	1008(1) 1024(1) 1032(1)	1004(1) 1020(1) 1046(1)
3	117362B	THERMOMETER COVER	1017(1)	1040(1)	1038(1)
3	117362C	THERMOMETER COVER	1074(1) 1090(1) 1108(1)		
3	117362D	THERMOMETER COVER	1082(1)		
3	119716A	THERMOMETER COVER			1079(1)
4	111487E	ELEMENT ASSEMBLY	1017(1) 1025(1) 1033(1) 1041(1) 1058(1) 1066(1) 1074(1) 1082(1) 1090(1) 1108(1)	1008(1) 1024(1) 1032(1) 1040(1)	1004(1) 1020(1) 1038(1) 1046(1) 1079(1)
5	117719	POST	1017(1) 1025(1) 1033(1) 1041(1) 1058(1) 1066(1) 1074(1) 1082(1) 1090(1) 1108(1)	1008(1) 1024(1) 1032(1) 1040(1)	1004(1) 1020(1) 1038(1) 1046(1) 1079(1)
6	117361	COVER	(1)	(1)	1004(1) 1012(1) 1020(1) 1038(1) 1046(1) 1061(1) 1079(1)

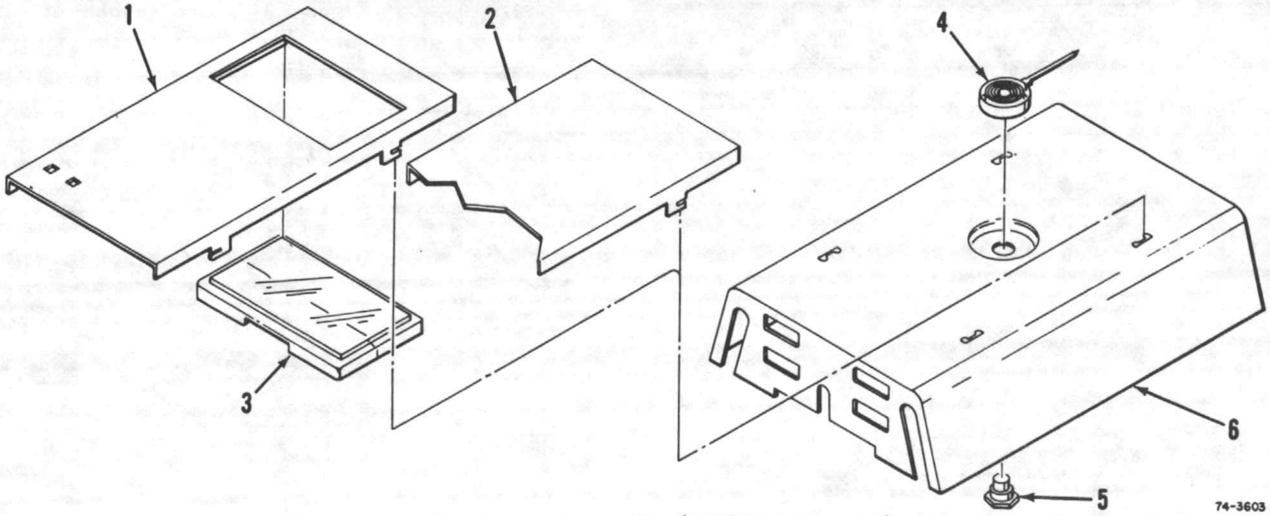


Fig. 2 - Cover Assembly (117361A-D and G).

Parts List for Fig. 3

KEY	PART NO.	DESCRIPTION	MODELS T451A	T451B	T651A
1	121723	SCREW	(1)	(1)	(1)
2	2112EHD	HEATER		1008(1) 1016(1) 1024(1)	1004(1) 1012(1) 1020(1) 1053(1) 1061(1) 1079(1)
2	2112BJE	HEATER		1032(1) 1040(1)	1038(1) 1046(1)

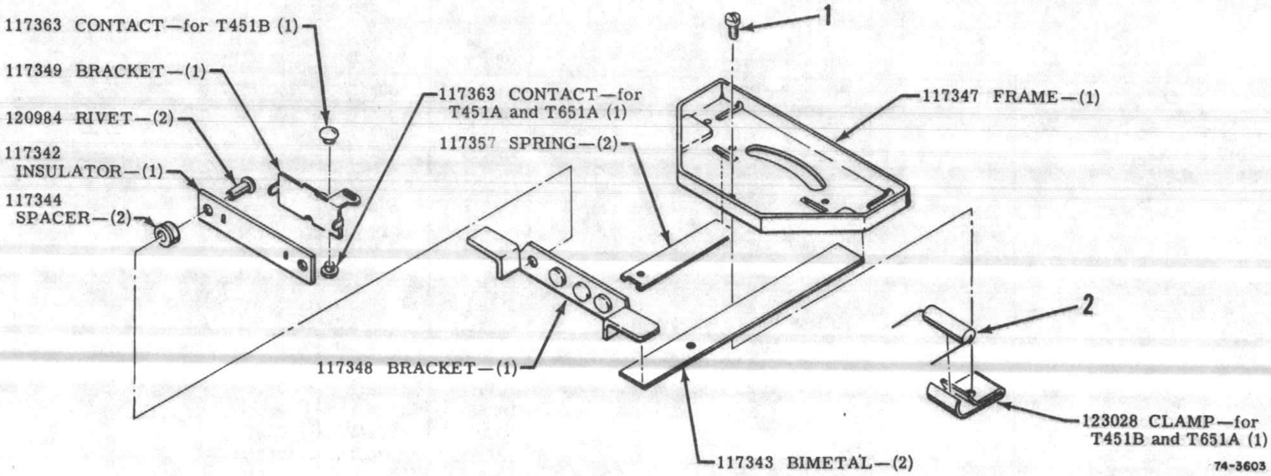
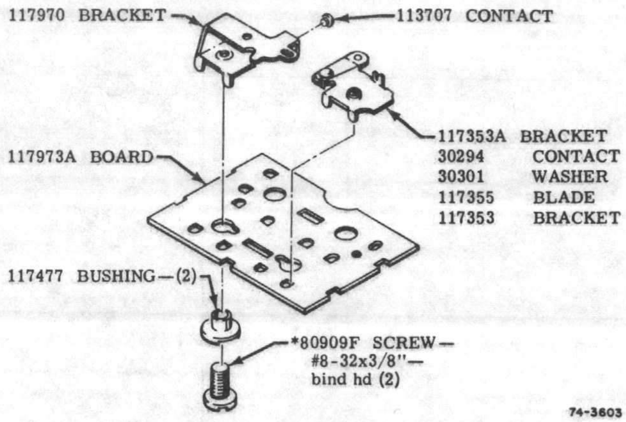


Fig. 3 - Bimetal Assembly (117343A-E).

Mechanical devices must be serviced periodically if they are expected to give continued satisfactory performance, and controls are not an exception. How accurate and how trouble-free your control system will be in the years to come depends largely on the maintenance given it. For best results, all devices in your system should be serviced at one time.

Time and trouble can be saved by arranging with Honeywell for a maintenance agreement which will guarantee expert, economical care, and insure maximum life and efficiency from your system.



*Standard hardware item which should be obtained locally when possible.

Fig. 4 - Terminal Board Assembly (117973B).

Parts List for Fig. 5

KEY	PART NO.	DESCRIPTION	MODELS T451A	T451B	T651A
1	80909F	* SCREW—#8-32x3/8"—bind hd	(2)	(2)	(3)
2	117477	BUSHING	(2)	(2)	(3)
3	117354	BRACKET, Upper	(1)		
3	117354A 30294 30301 117355 117353	BRACKET, Upper CONTACT—(1) WASHER—(1) BLADE—(1) BRACKET—(1)		(1)	(1)
4	117353	BRACKET, Lower		(1)	
4	117353A 30294 30301 117355 117353	BRACKET, Lower CONTACT—(1) WASHER—(1) BLADE—(1) BRACKET—(1)	(1)		(1)
5	117365	TERMINAL			(1)
6	117356A	BOARD, Terminal	(1)	(1)	(1)

*Standard hardware item which should be obtained locally when possible.

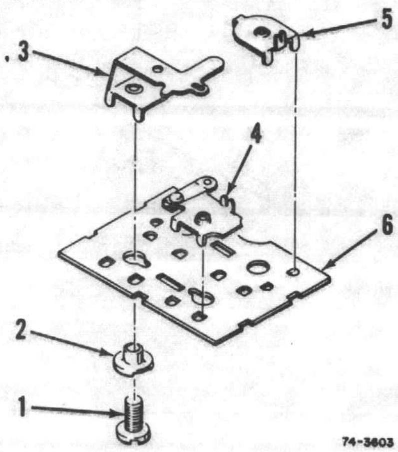


Fig. 5—Terminal Board Assembly (117356B-D).

Honeywell

Comfort Control Systems

TP970 SERIES PNEUMATIC THERMOSTATS

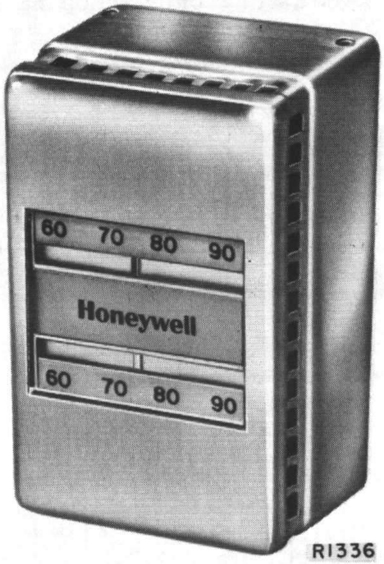
Service Data

GENERAL

DESCRIPTION

The TP970 Series Pneumatic Thermostats are one-, two-, or three-pipe proportioning thermostats with bimetal elements. They are suitable for controlling dampers and/or valves in HVAC systems.

All models of the series are covered in this sheet for servicing and repairing. Exploded view drawings are furnished with a listing of all available repair parts and assemblies.



R1336

APPLICATION

TP970A-D

The TP970 is a single-temperature, pilot-bleed, two-pipe thermostat. The TP970A model is used for heating (DA), the TP970B for cooling (RA), and the TP970C and D models for heating/cooling. There are TP970A and B models with Limited Control Range (LCR), for energy conservation. The TP970C and D models have a wide throttling range capability, allowing an adjustable Zero Energy Band (ZEB) between heating and cooling operations.

TP971A-E

The TP971A, B, D, & E are two-temperature, pilot-bleed, two-pipe thermostats for DAY/NITE operation, with automatic switchover from mainline pressure. The TP971C is a three-pipe thermostat for unit ventilator Day/Nite application.

TP972A

The TP972A is a single-temperature, pilot-bleed, two-pipe thermostat with Summer/Winter cycles and automatic switchover from mainline pressure. One model, TP972A1143, is designed specifically for replacing Johnson summer/winter thermostats (SPECIFICATIONS section).

TP973A AND B

The TP973 is a one- or two-pipe bleed type thermostat for heating or cooling applications.

Form No. 75-7134
Commercial Bldg. Group
MLF TAB: II. C. 2. a.

TP974A

The TP974A is a pneumatic space temperature sensor for either one- or two-pipe application. It is suitable for remote temperature indication or as the sensor for a receiver controller.

TP978A-D

The TP978 is a dual element bleed type thermostat used in dual one-pipe applications, suitable for use with variable volume systems. These thermostats may be used to control separate heating and cooling actuators in sequence, with a Zero Energy Band (ZEB) for energy conservation. The heating setpoint is limited to 73F (23C) maximum, and the cooling setpoint is limited to 77F (25C) minimum. Heating and cooling are both available in direct and reverse acting configuration.

TP979A-E

The TP979 contains two Summer-Winter/Day-Nite thermostats. They are one- or two-temperature, two-pipe thermostats for independent proportioning control of heating and cooling.

SPECIFICATIONS

MAXIMUM SAFE AIR PRESSURE: 25 psi (172 kPa).

MAXIMUM SAFE TEMPERATURE: 150F (66C).

Refer to Table 1 for additional specifications.

Table 1. TP970 Series Specifications.

Model No.	Description	Action	Setpoint	Supply Air Pressure psi (kPa)	Degrees Throttling Range	Special Features
TP970A1004	Single Temp., 2-Pipe, Pilot Bleed	DA Heating	60-90F	18 (124)	Adjustable 2-10F (1-5C)	
TP9701012			40-70F			
TP970A1020			15-30C			
TP970A1038			60-90F			Universal Modernization Kit
TP970A1053						Honeywell Stat Modernization Kit
TP970A1061			60-90F Controls at 72F Max.			Limited Control Range (LCR)
TP970A1087						LCR Universal Modernization Kit
TP970A1095			40-70F			Universal Modernization Kit
TP970B1002		RA Cooling	60-90F			
TP970B1010			15-30C			
TP970B1028			60-90F			Universal Modernization Kit
TP970B1036						Honeywell Stat Modernization Kit
TP970B1044			60-90F Controls at 78F Min.			Limited Control Range (LCR)
TP970C1000		DA Heating	60-90F		Adjustable 5-25F (2.8-14C)	Zero Energy Band (ZEB)
TP970C1018						Universal ZEB Modernization Kit
TP970D1008		RA Cooling				Zero Energy Band (ZEB)
TP970D1016						Universal ZEB Modernization Kit

Table 1. TP970 Series Specifications. (Continued)

Model No.	Description	Action	Setpoint	Supply Air Pressure psi (kPa)	Degrees Throttling Range	Special Features
TP971A1003	2-Temp, 2-Pipe, Pilot-Bleed	DA Day/Nite	60-90F 50-75F	13 or 18 (90 or 124)	Adjustable 2-10F (1-5C)	
TP971A1011			15-30C 12-24C			
TP971A1029			60-90F 50-75C	16 or 21 (110 or 145)		
TP971A1037				13 or 18, 16 or 21 (90 or 124, 110 or 145)		Universal Modernization Kit
TP971A1045						Honeywell Stat Modernization Kit
TP971A1052			15-30C 12-24C	16 or 21 (110 or 145)		
TP971A1078			60-90F 50-75F	13 or 18 (90 or 124)	Adjustable 5-25F (2.5-15C) Day, 2-10F (1-5C) Nite	
TP971B1001		RA Day/Nite			Adjustable 2-10F (1-5C)	
TP971B1019				16 or 21 (110 or 145)		
TP971B1027			15-30C 10-24C	13 or 18 (90 or 124)		
TP971C1009	2-Temp, 3-Pipe, Pilot Bleed	DA Day/Nite	60-90F 50-75F			
TP971C1017			15-30C 12-24C			Special for Unit Vent Application
TP971C1025			60-90F 50-75F	16 or 21 (110 or 145)		Special for Unit Vent Application
TP971D1007	2-Temp, 2-Pipe, Pilot Bleed		60-90F 75-100F	13 or 18 (90 or 124)		Night Setup
TP971E1004		RA Day/Nite				
TP972A1002	Single Temp., 2-Pipe, 2 Elements, Auto. Changeover, Summer/Winter	DA Winter RA Summer	60-90F	13 (S) or 18 (W) (90 or 124)		
TP972A1010			15-30C			
TP972A1028			60-90F			Universal Modernization Kit
TP972A1036			60-90F (S) 50-75F (W)			Energy Conservation Separate Setpoints
TP972A1044						Honeywell Stat Modernization Kit
TP972A1051			78-90F (S) 60-72F (W)		Separately Adjustable 2-10F (1-5C)	Limited Control Range (LCR)
TP972A1077			75-90F (S) 50-75F (W)			Setpoint Stop at 75F Minimum
TP972A1085				16 (S) or 21 (W) (110 or 145)		Setpoint Stop at 75F Minimum
TP972A1093		DA Winter DA Summer	78-90F (S) 60-72F (W)	13 (S) or 18 (W) (90 or 124)		Limited Control Range (LCR)
TP972A1101		DA Winter RA Summer				Universal LCR Modernization Kit
TP972A1119		RA Winter DA Summer	78-90F (S) 55-65F (W)	25 (S) or 20 (W) (172 or 138)		Limited Control Range (LCR)
TP972A1127		DA Winter DA Summer		13 (S) or 18 (W) (90 or 124)		Universal LCR Modernization Kit
TP972A1143		DA Winter RA Summer	60-90F	14 (W) or 19 (S) (97 or 131)		Specifically for replacing Johnson S/W Thermostats
TP972A1150			15-30C (S) 12-24C (W)	13 (S) or 18 (W) (90 or 124)		Energy Conservation Separate Setpoints
TP972A1168		DA Winter DA Summer	60-90F (S) 50-75F (W)	16 (S) or 21 (W) (110 or 145)		
TP972A1176		RA Winter DA Summer		20 (S) or 25 (W) (138 or 172)		
TP973A1068	1- or 2-Pipe Bleed Type	DA	60-90F	18 (124)	Adjustable 2-10F (1-5C)	Universal Modernization Kit
TP973A1076						
TP973A1084			15-30C			
TP973A1092			60-90F			Honeywell Stat Modernization Kit
TP973B1066		RA				
TP973B1074			15-30C			

Table 1. TP970 Series Specifications. (Continued)

Model No.	Description	Action	Setpoint	Supply Air Pressure psi (kPa)	Degrees Throttling Range	Special Features
TP974A1000	1- or 2-Pipe Sensor Bleed Type	DA	50-100F (10-38C) Range	18 (124, 3-15 (21-103) output	----	Sensor for use with RP908 Controller
TP978A1006	Dual Element, Dual Pipe, Bleed Type Heating/Cooling	DA Heating DA Cooling	60-73F Heating, 77-90F Cooling	18 (124)	2-10F (1-5C)	ZEB Energy Conservation, Setpoint Stop 73 (Htg) 77 (Clg)
TP978B1004		RA Heating DA Cooling				
TP978C1002		DA Heating RA Cooling				
TP978D1000		RA Heating RA Cooling				
TP979A1005	Dual Pneumatic Thermostat	DA Heating DA Cooling	60-90F		Adjustable 2-10F (1-5C)	
TP979B1003		RA Heating RA Cooling				
TP979C1001		DA Heating or Cooling RA Heating or Cooling				
P979D1009		DA Heating DA Cooling		13 (90) Day 18 (124) Nite		Day/Nite Setback (H) 50-75F, Setup (C) 75-100F
TP979E1006		DA Heating RA Cooling				

OPERATION

TP970A AND B

When using the TP970A (Fig. 1) in a heating application with a normally open valve, a fall in temperature lowers branch line pressure to the valve providing proportional valve action matching the existing load requirements. For cooling application, using a TP970B, a rise in temperature lowers branch line pressure. The energy conservation models limit control temperature to a maximum (heating) or minimum (cooling) of 72F (24C).

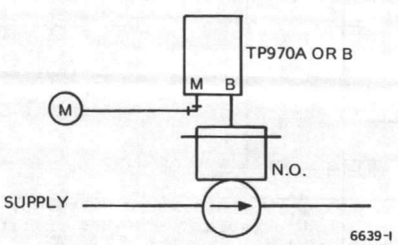


Fig. 1. TP970A and B Typical Operation.

TP970C AND D

The TP970C and D with wide throttling range (Fig. 2 and 3) allows use of heating and cooling valve assemblies with either selected spring ranges (Fig. 4), or ratio relays (Fig. 5) to achieve a Zero Energy Band range.

A variety of Zero Energy Band ranges, heating control points, and cooling control points are obtained by selecting thermostat setpoint, throttling range, and spring range or ratio relays.

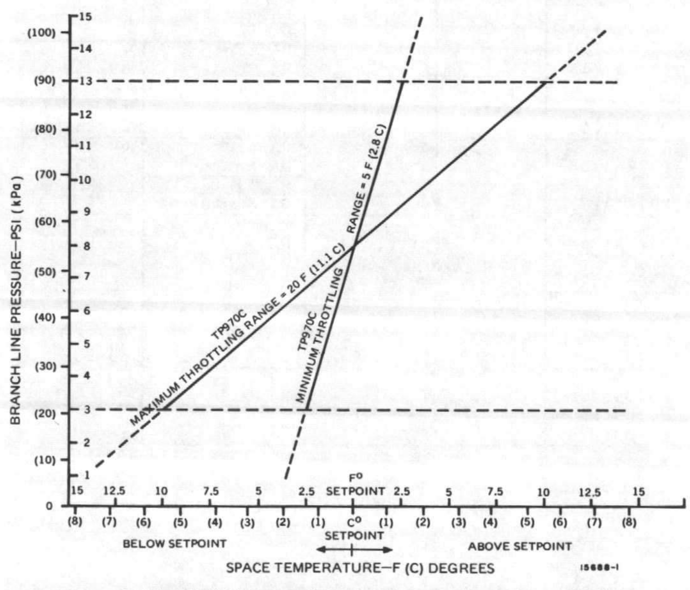


Fig. 2. TP970C Space Temperature vs Branch Line Pressure.

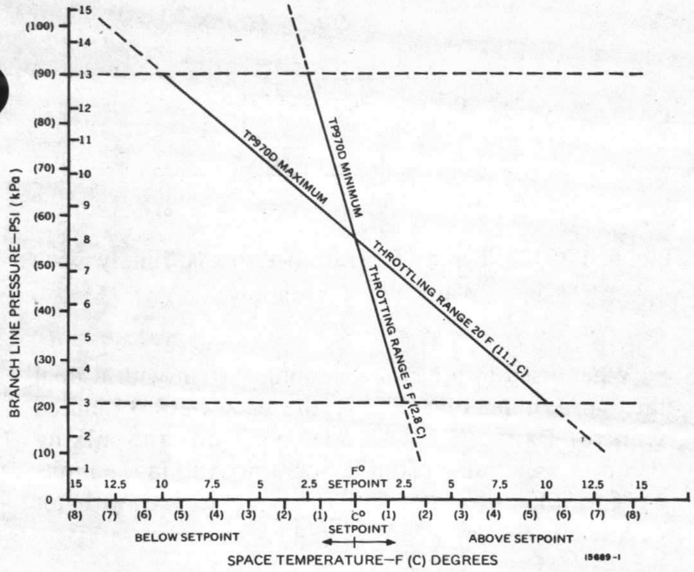


Fig. 3. TP970D Space Temperature vs Branch Line Pressure.

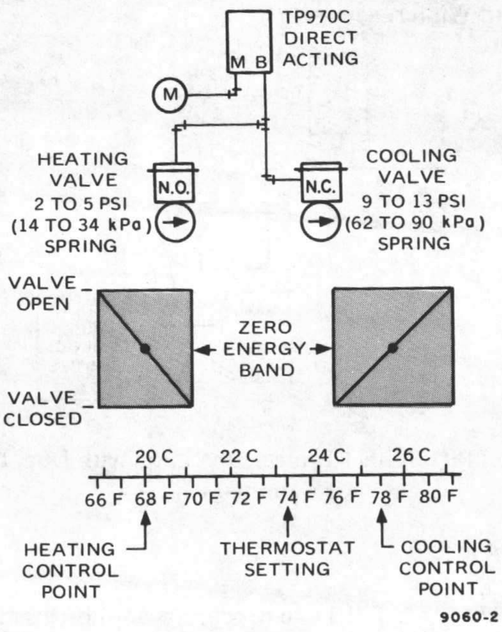


Fig. 4. Typical TP970C Operation Using Selected Spring Range Valve Operators.

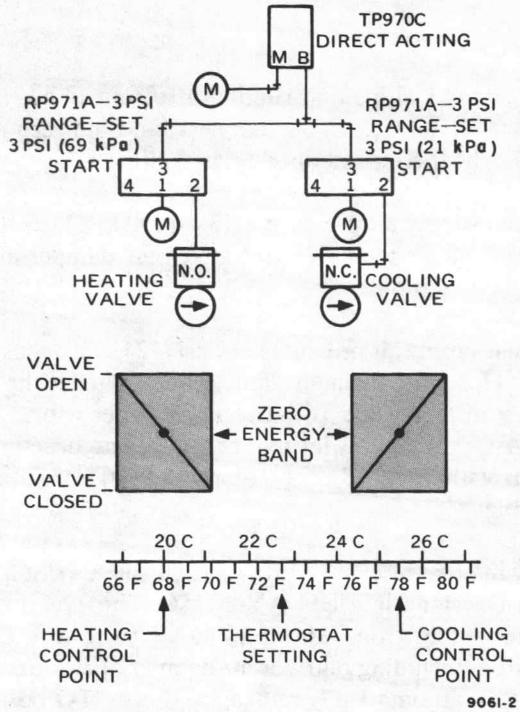


Fig. 5. Typical TP970C Operation Using Ratio Relays.

TP971A, B, D & E

The thermostat provides a branch line pressure that is proportional to the ambient temperature. When used in a heating application with a normally open valve (Fig. 6), a fall in room temperature lowers the branch line pressure to the valve, providing a proportional action matching the existing load requirement. When the supply air pressure is 13 psi (90 kPa), the thermostat controls at the normal DAY setting. When the supply air is switched to 18 psi (124 kPa), the thermostat controls at the reduced NITE setting. Models with 16 or 21 psi (110 or 145 kPa) pressure are available. The TP971D is the same as TP971A except with wide throttling range like TP970C. The TP971E is the same as TP971A except with wide throttling range like TP970B.

The manual reset lever protrudes from the cover through a slot marked DAY-AUTO. This lever may be manually reset from AUTO to DAY to restore DAY operation. The reset lever automatically returns to the AUTO position when the system air reaches DAY pressure.

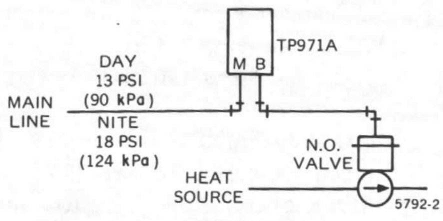


Fig. 6. TP971A Typical Operation.

TP971C

When used with a unit ventilator to control a heating valve, fresh and return air dampers, and blower motor (Fig. 7), the thermostat operates as follows:

When supply air pressure is 13 psi (90 kPa), the thermostat controls the valve and mixed-air damper at the normal day setpoint.

When supply air pressure is 18 psi (124 kPa), the thermostat closes the fresh air damper and switches the blower from constant to automatic operation. The thermostat then cycles the unit at reduced night setpoint. Models with 16 or 18 psi (110 or 145 kPa) pressure are available.

The manual reset lever protrudes through a slot in the cover. The slot is labeled DAY-AUTO. The lever may be manually reset from AUTO to DAY to restore DAY operation, including outdoor air damper operation. The reset lever automatically returns to the AUTO position when the system air reaches DAY pressure.

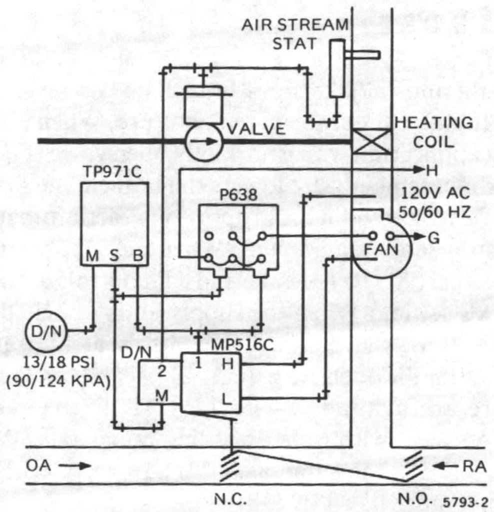


Fig. 7. TP971C Typical Operation.

TP972A

The thermostat is reverse acting (Summer) and direct acting (Winter). A rise in temperature at the thermostat with main air pressure at 30 psi (90 kPa), lowers branch line pressure, opening the valve to control the temperature with chilled water. A fall in temperature at the thermostat, with main air pressure at 18 psi (124 kPa), lowers branch line pressure, opening the valve to control the temperature with hot water (Fig. 8).

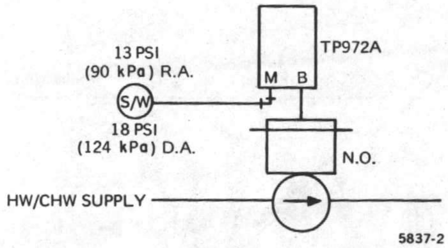


Fig. 8. TP972A Typical Operation with a Normally Open Water Valve Assembly.

When used in a heating/cooling system with a dual duct air terminal unit (Fig. 9), the TP972A1093 Limited Control Range (LCR) model positions the mixing dampers, maintaing room temperature within the limits of 75 to 90F (24 to 32C) or 60 to 75F (16 to 24C) with hot or cold air.

Models are available that limit the Summer setpoint to a minimum of 75 or 78F, the Winter setpoint to a maximum of 72 or 75F. They work with 16/21, 25/20, 19/14, or 20/25 psi changeover and are direct acting both Summer and Winter.

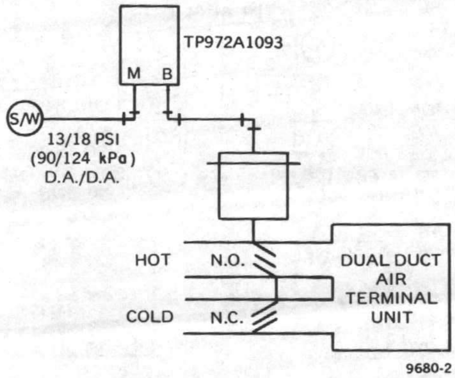


Fig. 9. TP972A1093 Typical Operation with Dual Duct Air Terminal Unit.

TP973A AND B

TP973A—A fall in temperature at the thermostat lowers branch line pressure, providing proportional control of existing load requirements for heating (Fig. 10).

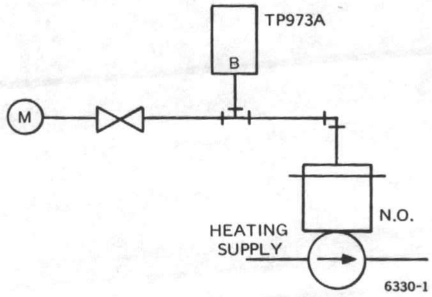


Fig. 10. TP973A Typical Operation, One-Pipe Using External Restriction.

TP973B—A rise in temperature at the thermostat lowers branch line pressure, providing proportional control of existing load requirements for cooling.

TP974A

The TP974A Sensor (Fig. 11) provides a pneumatic output signal of 3 to 15 psi (21 to 103 kPa) in direct relation to the sensed temperature, allowing direct and remote readout of the temperature. An RP908 Controller is used with the TP974A to convert the output into a usable signal to operate a pneumatic valve, damper, or other equipment.

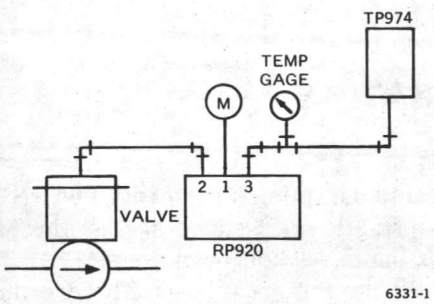


Fig. 11. TP974 Sensor Typical Operation.

TP978A-D

NOTE: To vary the Zero Energy Band (ZEB) between heating and cooling operation, adjust the setpoints on the TP978.

A fall in temperature, within the cooling range at the TP978A, decreases the branch line pressure of the cooling element. Thus, proportionally closing the normally open cooling valve (Fig. 12), maintaining the temperature set on the high range portion of the thermostat.

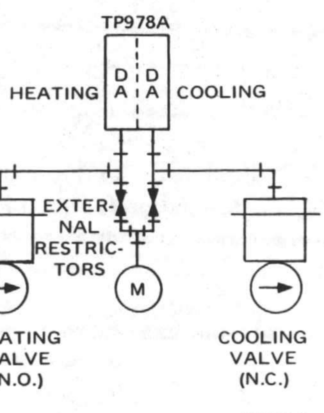


Fig. 12. TP978A Typical Operation.

A continued fall in temperature, into the heating range at the thermostat, lowers the branch line pressure of the heating element. Thus, proportionally opening the normally closed heating valve, maintaining the temperature set on the low range portion of the thermostat.

TP979A-E

The TP979 provides independent control of heating and cooling with dual thermostats and separate setpoints and branch lines. This enables Zero Energy Band operation without selected actuator springs or ratio relays (Fig. 13).

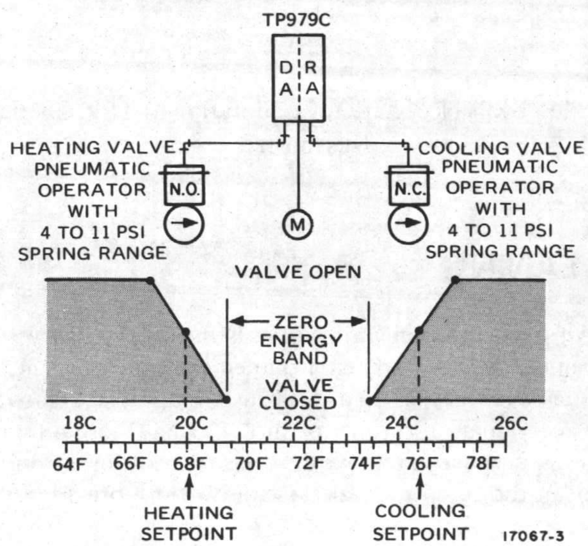


Fig. 13. TP979 Typical Operation.

The TP979D and E models provide automatic night setback of setpoint for heating and setup for cooling. Figure 14 shows potential energy savings with night setback operation.

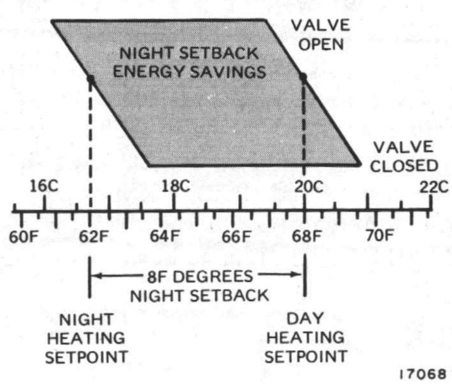


Fig. 14. Night Setback Operation, TP979.

MAINTENANCE

EQUIPMENT REQUIRED (Fig. 15)

1. Gage 305965, 0 to 30 psi (0 to 207 kPa).
2. Gage Adaptor, 315161A, with plug-in fittings.
3. Thermostat Calibration Tool 735.

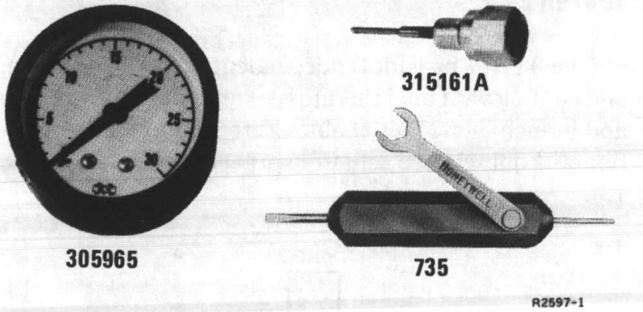


Fig. 15. Tools Necessary for Calibration of TP970 Series Thermostats.

CLEANING

An occasional cleaning or dusting is necessary in extremely dirty or dusty environments. Remove the thermostat cover and, using a soft brush or air hose, remove any accumulation of dust or dirt. DO NOT use a high pressure air hose to remove dust. Use the soft brush only to clean the flapper nozzle assembly. No lubrication is necessary.

CALIBRATION CHECK

NOTES:
1. Calibration of the TP974 is not recommended.
2. To check calibration or to recalibrate the Limited Control Range (LCR) thermostats, the space temperature must be 78F (26C) or above for cooling applications, and 72 or 68F (22 or 20C) or below for heating applications, depending on model. TP972A1119 and TP972A1127 are 68F (20C). The setpoint limitation is nonadjustable.
3. To check calibration or to recalibrate the TP978 Zero Energy Band (ZEB) thermostats, measure actual room temperature with a test thermometer. The 75F (24C) limit is nonadjustable.

DIRECT ACTING ELEMENTS

1. Turn the setpoint down five degrees below room temperature. The branch line pressure at the thermostat should build up within 30 seconds.
2. Turn the setpoint indicator up slowly. The thermostat should begin to bleed off audibly between 1 and 3F (1/2 and 1-1/2C) below room temperature.

REVERSE ACTING ELEMENTS

1. Turn the setpoint up five degrees above room temperature. The branch line pressure at the thermostat should build up within 30 seconds.
2. Turn the setpoint indicator down slowly. The thermostat should begin to bleed off audibly between 1 and 3F (1/2 and 1-1/2C) above room temperature.

CALIBRATION

NOTES:
1. The antihum spring (Fig. 16) must be free. Be sure the spring is not wedged against the throttling plate, but merely touches it.
2. The thermostats are very sensitive and should not be heated by excessive handling during calibration.

FOR ALL THERMOSTATS

1. Start with the main air pressure at the recommended setting.
2. Remove the thermostat cover.
3. Install a 0 to 30 psi (0 to 207 kPa) gage with the gage adaptor (Fig. 15) into the gage port (except TP978).
4. Set the temperature setpoint pointer at the indicated temperature.
5. The remaining steps are given for each specific model of thermostat. Follow the steps shown for the thermostat being calibrated.

TP970A AND B

1. Turn the calibration screw (Fig. 16) until the gage reads 0 psi (0 kPa).
2. Turn the calibration screw in the opposite direction until the gage reads 8 ± 1 psi (55 ± 7 kPa).
3. The thermostat is now in calibration and the setpoint and thermometer should be within one degree of each other.
4. Remove the gage and gage adaptor and replace the cover.
5. Set the thermostat at the desired setting.

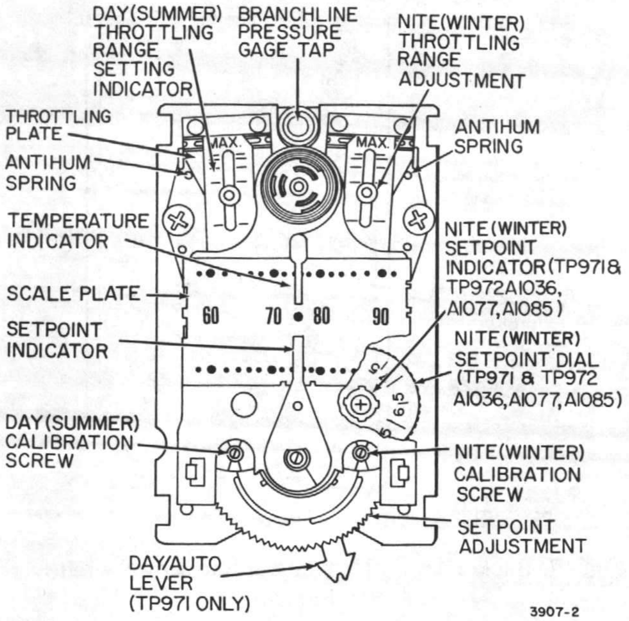


Fig. 16. Thermostat Front View, Cover Off, Showing Controls and Indicators.

TP970C AND D

1. Set throttling range to value specified on the job drawing.
2. Check mechanical throttling range by moving setpoint lever to determine the difference in setpoint indication when branch line pressure reads 3 psi (21 kPa) and 13 psi (90 kPa). It may be necessary to turn calibration screw to obtain this measurement.
3. Reset throttling range to within ±2F (±1C) degrees of specified throttling range for accurate control. If either throttling range adjustment or calibration screw are moved, recalibration is necessary.
4. Refer to TP970A and B, Step 1, for balance of TP970C and D calibration.

TP971

1. With 13 psi (90 kPa) main air pressure, turn the DAY (left) calibration screw (Fig. 16) until the gage reads 0 psi (0 kPa).
2. Turn the calibration screw in the opposite direction until the gage reads 8 ±1 psi (55 ±7 kPa).
3. With 18 psi (124 kPa) main air pressure, rotate the night setpoint dial until the setting agrees with the indicated temperature.
4. Repeat Steps 1 and 2 using the NITE (right) calibration screw (Fig. 16). The thermostat is now in calibration.
5. Remove the gage and replace cover.

TP972

1. With 13 psi (90 kPa) main air pressure, turn the SUMMER (left) calibration screw (Fig. 16) until the gage reads 0 psi (0 kPa).
2. Turn the calibration screw in the opposite direction until the gage reads 8 ±1 psi (55 ±7 kPa).
3. With 18 psi (124 kPa) main air pressure, repeat Steps 1 and 2, using the WINTER (right calibration screw (Fig. 16). The thermostat is now in calibration.
4. Remove the gage and replace the cover.

TP973

If the thermostat is not properly calibrated, and the remainder of the system is operating properly, turn the calibration screw until the thermostat performs as in Step 2 under CALIBRATION CHECK paragraph.

TP974

Field calibration not recommended.

TP978

Same as TP973 for each element.

TP979

TP979A-C—Same as TP970A and B.
TP979D & E—Same as TP971.

SWITCHOVER CALIBRATION

TP971

1. Make certain that main line pressure is set to low (13 psi) pressure requirement.
2. Set setpoint of stat 5 degrees below actual temperature.
3. BLP gage should read 0 psi for RA stat or 13 psi for DA stat. If it does not, turn switchover adjustment screw (Fig. 17) clockwise until it does.
4. Now, back out the adjustment screw, turning counterclockwise until the pressure begins to increase for RA stat or decrease for DA stat. This then indicates switchover. Allow the gage to go to full line pressure for RA stat or 0 psi for DA stat.
5. Look for the switchover point by turning the adjustment screw counterclockwise, allowing pressure to decrease to 0 psi for RA stat or increase to full main line pressure for DA stat. Now turn the adjustment screw an additional 1/8 to 1/4 turn clockwise. This places the switchover in calibration and allows for normal supply line fluctuations.

TP972 (Cooling, RA; Heating, DA)

1. Make certain that main line pressure is set to low (13 psi) pressure requirement.
2. Set setpoint of stat 5 degrees below actual temperature.
3. BLP gage should read 0 psi. If it does not, turn switchover adjustment screw (Fig. 17) clockwise until it does.
4. Now, back out the adjustment screw, turning counterclockwise until the pressure begins to increase. This indicates switchover. Allow the gage to go to full main line pressure.
5. Look for the switchover point by turning the adjustment screw clockwise, allowing pressure to decrease to 0 psi (switchover point). Now turn the adjustment screw an additional 1/8 to 1/4 turn clockwise. This places the switchover in calibration and allows for normal supply line fluctuations.

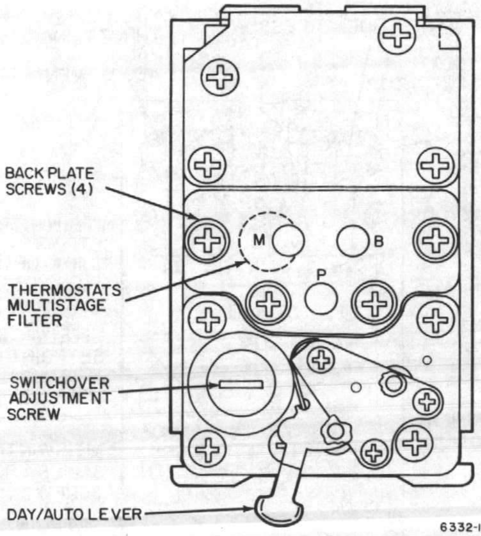


Fig. 17. Back View of Thermostat Showing Switchover Mechanism.

REPAIR

THERMOMETER REPLACEMENT

1. Insert the blade of a small screwdriver under the bimetal (4, Fig. 18) and pry up. Older style thermostats have a locking ring. Inserting the blade between the ring and white nylon bushing, pry the ring from the thermometer bimetal mounting post.
2. Remove the bimetal and bushing by lifting the top of the plate to which the scaleplate is attached, near the hex of the bimetal mounting post.

CAUTION

Use extreme care when handling the new bimetal as it may be easily distored.

3. Press the new bimetal and bushing onto the thermometer post using a 1/4-inch (6 mm) nut driver over the bobbin. Allow the bimetal to cool down to the ambient temperature after handling. Slowly rotate the bushing until the thermometer pointer is aligned with the existing ambient temperature on the scaleplate.

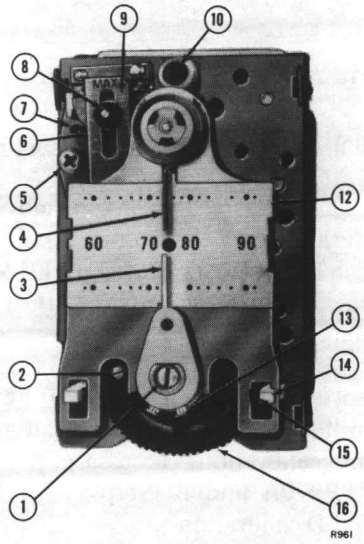


Fig. 18. Internal View of Thermostat.

SETPOINT KNOB REPLACEMENT

NOTE: Dual temperature thermostats require removal of one of the bimetal elements.

1. Remove the setpoint indicating pointer (3, Fig. 18) by prying it off the indicator post with a small screwdriver.
2. Remove the thermometer bimetal (4) by lifting the plate to which the scaleplate is attached, at the hex of the bimetal mounting post.
3. Bend the scaleplate locking tabs (15) up and compress the scaleplate mounting posts (14) together with the thumb and forefinger to free the scaleplate from the holding notches in the post.
4. Remove and replace setpoint knob (16), using caution not to damage or distort the bimetal sensing element(s). On models with DAY-NITE temperature setpoint wheel, located under the right sensing element, refer to NOZZLE, FLAPPER, AND BIMETAL ASSEMBLY REPLACEMENT paragraph for

removal of the bimetal and DAY-NITE scale prior to removing the setpoint knob.

5. Reassemble in reverse order and recalibrate if required. It is not necessary to reengage the scaleplate locking tabs (15) in the holding notches of the scaleplate mounting posts, as they are primarily for shipping purposes.

NOZZLE, FLAPPER, AND BIMETAL ASSEMBLY REPLACEMENT

1. Remove cover.
2. Remove the thermometer bimetal, temperature indicator, and scaleplate as previously described, if applicable.
3. Unscrew center holding screw (TP978) or thermometer mounting post using thermostat tool 735 (Fig. 15).
4. Remove the Phillips screw and the defective assembly (Fig. 19).
5. Replace with new assembly being sure the rubber O-ring, if used, is properly aligned around the nozzle opening in the recess on the bottom of the aluminum block.
6. Reassemble thermostat, being sure that the antihum spring (7, Fig. 18) is properly positioned. Position the spring so it just touches the flapper. Be certain the base of the spring (larger end) is seated properly in the recess of the spring mounting hole.
7. Calibrate thermostat.

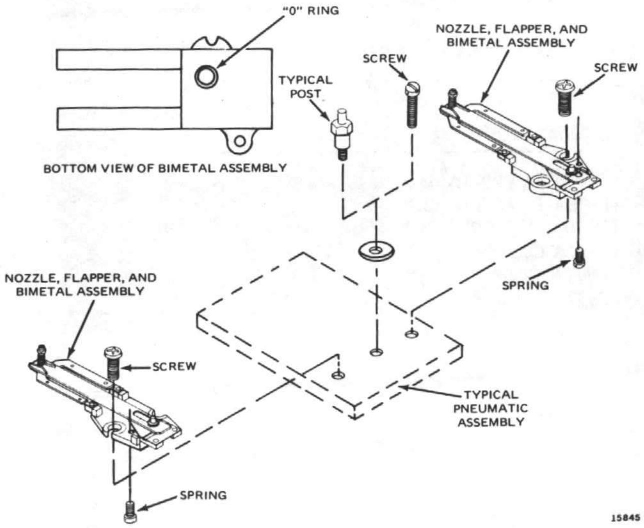


Fig. 19. Nozzle, Flapper, Bimetal Assembly Replacement.

RESTRICTOR BLOCK AND FILTER REPLACEMENT

CAUTION

When replacing these parts, use extreme caution to prevent dirt, dust, or chips from entering various chambers and openings of the thermostat.

1. Remove the four Phillips head screws which fasten the restrictor block and filter (Fig. 20) to the back of the thermostat.
2. Carefully lift off the first section of the "sandwich".
3. Remove the flat rubber gasket and immediately below it will be the filter and the block which contains the restrictor.
4. Replace the restrictor block and filter. First, align the gasket over the appropriate holes in the thermostat. Insert the filter into the gasket until it bottoms, then position restrictor block.
5. Replace screws and tighten.

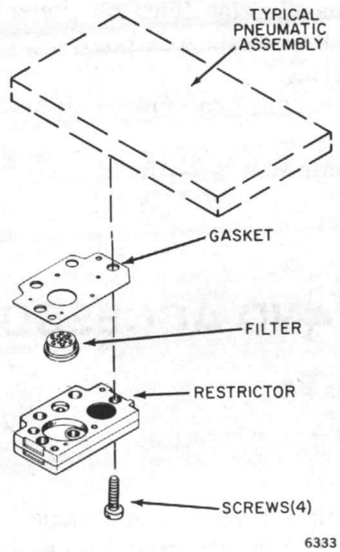


Fig. 20. Restrictor Block and Filter Replacement.

DAY/AUTO LEVER ASSEMBLY REPLACEMENT

1. Remove the three Phillips head screws which fasten the lever mechanism to the back of the thermostat (Fig. 21).

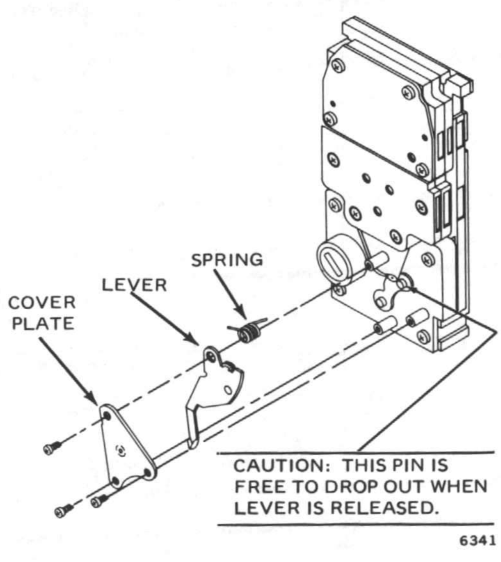


Fig. 21. Day/Auto Lever Assembly Replacement.

2. LIft of the cover plate, and remove the lever (with attached seal).
3. Lift the spring from the post.
4. Install replacement parts in reverse order. Replace and tighten screws.

SWITCHOVER ADJUSTMENT SPRING REPLACEMENT

1. Using screwdriver, carefully remove screw and switchover adjustment spring (Fig. 22). Refer to PARTS LIST in PARTS AND ACCESSORIES section for available springs.
2. Replace spring, then carefully position and replace screw.
3. Calibrate thermostat.

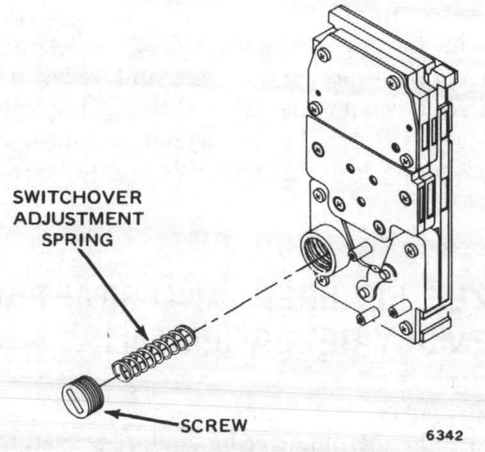


Fig. 22. Switchover Adjustment Spring Replacement.

PARTS AND ACCESSORIES

PARTS LIST

TP970-TP974

Refer to Figures 23 and 24, and Table 2 for TP970-TP974 Thermostat repair parts and assemblies.

Table 2. TP970-TP974 Thermostat Repair Parts and Assemblies.

Key No.	Part No.	Description
1	14002370-001	Scaleplate Bag Assembly (60 to 90F)—TP970A-D, TP973A, B.
	14002370-002	Scaleplate Bag Assembly (60 to 70F)—TP970A-D, TP973A, B.
	14002370-003	Scaleplate Bag Assembly (15 to 30C)—TP970A-D, TP973A, B.
	14002370-004	Scaleplate Bag Assembly (60 to 90F)—TP971A-C, TP972.
	14002370-005	Scaleplate Bag Assembly (15 to 30C)—TP971A-C, TP972.
	14002370-006	Scaleplate Bag Assembly (78 to 90F)—TP972.
1A	—	Pointer
1B	—	Bobbin
1C	—	Bimetal Element
1D	—	Scaleplate
1E	—	Thermostat Mounting Post (2).
2	—	Retainer Ring (Fig. 23).
2	—	Washer (Fig. 24).
3	—	Scaleplate—TP974.
4	—	Post, Thermostat Assembly—TP974.
5	—	Bushing—TP973.
6	14002062-001	Setpoint Cam Assembly—TP970A1004, A1012, A1020, A1038, A1046, A1053, A1095; TP970C: TP972A1143; TP973A1001, A1019, A1127.
	14002062-002	Setpoint Cam Assembly—TP970B1002, B1010, B1028, B1036; TP970D; TP972A1002, A1010, A1028, A1044; TP973B1009, B1017, B1025, B1108.
	14002062-003	Setpoint Cam Assembly—TP971A, C, D; TP972A1168, A1176.
	14002062-004	Setpoint Cam Assembly—TP971B, E; TP972A1036, A1077, A1085, A1150, A1184.
6	14002062-005	Setpoint Cam Assembly—TP970B1044; TP972A1051, A1101.
	14002062-006	Setpoint Cam Assembly—TP970A1061, A1087.
	14002062-007	Setpoint Cam Assembly—TP970A1093, A1127.
	14002062-008	TP972A1119.
	14002010-001	Setpoint Cam—TP973A1035, A1043, A1050, A1068, A1076, A1084, A1092, A1100.
	14002010-002	Setpoint Cam—TP973B1033, B1041, B1058, B1066, B1074, B1090.

Table 2. TP970-TP974 Thermostat Repair Parts and Assemblies. (Continued)

Key No.	Part No.	Description
7	—	Screw, No. 4-3/16 ph hd.
8	14002369-001	Nozzle, Flapper, Bimetal Assembly—TP970A; TP973A.
	14002369-002	Nozzle, Flapper, Bimetal Assembly (left)—TP971A, C; TP972A1093, A1127, A1143.
	14002369-003	Nozzle, Flapper, Bimetal Assembly (left)—TP971B; TP972A.
	14002369-004	Nozzle, Flapper, Bimetal Assembly—TP970B; TP973B.
	14002369-005	Nozzle, Flapper, Bimetal Assembly—TP974A.
	14002369-006	Nozzle, Flapper, Bimetal Assembly—TP970C.
	14002369-007	Nozzle, Flapper, Bimetal Assembly—TP970D.
	14002371-001	Nozzle, Flapper, Bimetal Assembly (right)—TP972A.
	14002371-002	Nozzle, Flapper, Bimetal Assembly (right)—TP971A, C.
	14002371-003	Nozzle, Flapper, Bimetal Assembly (right)—TP971B.
9	—	Spring.
10	—	Pneumatic Assembly—includes 10A through 10F below.
10A	—	Tab and Screw—TP974.
10B	14001960-001	Gasket, Restrictor block.
10C	14001865-001	Filter.
10D	14002374-001	Restrictor Block Assembly (0.005 restrictor)—TP970A, B; TP971A, B, D, E; TP972A; TP973A, B.
	14002374-002	Restrictor Block Assembly (0.005 restrictor)—TP970C, D; TP971C.
	14002374-003	Restrictor Block Assembly (0.007 restrictor)—TP974.
10E	14002373-001	Switchover Spring, gold—16 to 21 psi (110 to 145 kPa).
	14002373-002	Switchover Spring, silver—13 to 18 psi (90 to 124 kPa).
10F	14002372-001	DAY/AUTO Lever Assembly.
11	—	Screw, No. 4-40 x 5/8 ph hd.
12	14002636-001	Boxed Wall Plate Assembly (includes mounting screws), with setscrews 14003454-001 (2).

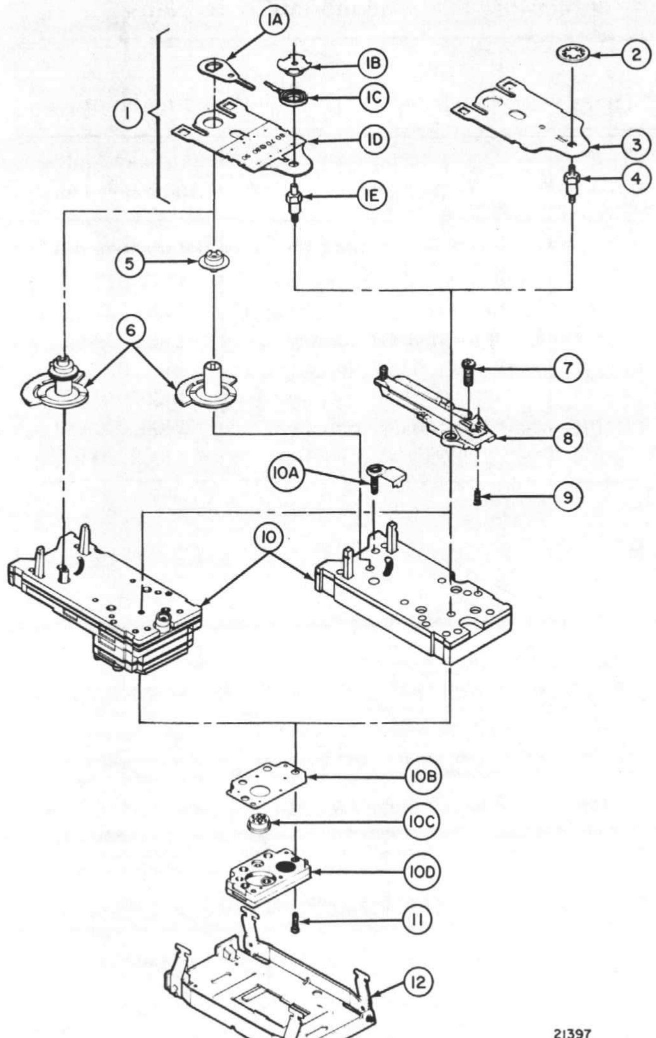


Fig. 23. Single Element Thermostat Exploded View Showing Repair Parts and Assemblies.

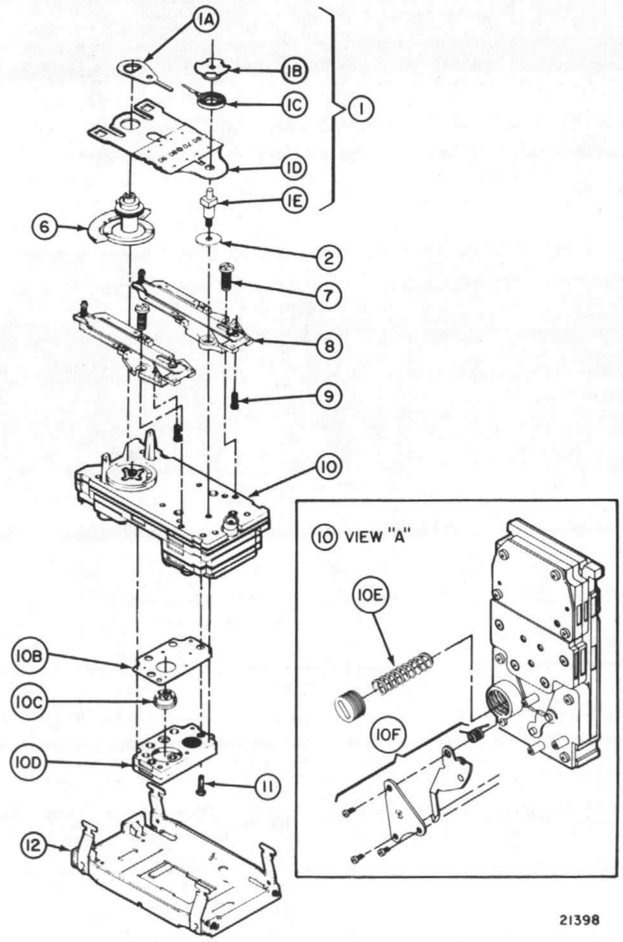


Fig. 24. Dual Element Thermostat Exploded View Showing Repair Parts and Assemblies.

TP978

Refer to Figure 25 and Table 3 for TP978 Thermostat repair parts and assemblies.

Table 3. TP978 Thermostat Repair Parts and Assemblies.

Key No.	Part No.	Description
1	—	Screw, No. 4 x 3/16 ph hd (2).
2	—	Washer.
3	14002387-004	Nozzle, Flapper, Bimetal Assembly (DA, left)—TP978A, C.
	14002387-005	Nozzle, Flapper, Bimetal Assembly (RA, left)—TP978B, D.
	14002387-006	Nozzle, Flapper, Bimetal Assembly (DA, right)—TP978A, B.
	14002387-007	Nozzle, Flapper, Bimetal Assembly (RA, right)—TP978C, D.
4	14003855-001	Base and Cam Assembly—TP978B.
	14003855-002	Base and Cam Assembly—TP978A.
	14003855-003	Base and Cam Assembly—TP978C.
	14003855-004	Base and Cam Assembly—TP978D.
5	14002095-001	Mounting Plate Assembly.

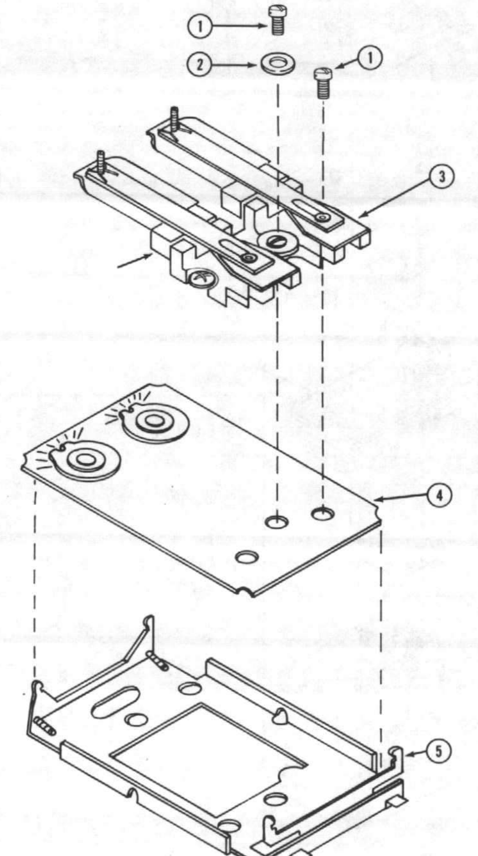


Fig. 25. TP978 Exploded View.

TP979

Refer to Figure 26 and Tables 4 and 5 for TP979A-E Thermostat repair parts and assemblies.

Table 4. TP979A-E Thermostat Repair Parts and Assemblies.

Key No.	Part No.	Description
1	14004057-001	Mounting Plate Assembly.
2	14004058-001	Manifold Assembly.
3	See Table 5.	Thermostats.
4	14004056-001	Thermostat Cover w/setpoint and temperature display.
	14004056-003	Thermostat Cover w/setpoint display.
	14004056-005	Thermostat Cover w/temperature display.
	14004056-007	Thermostat Cover w/Honeywell logo only.
	14004056-008	Thermostat Cover, blank.

Table 5. Replacement Thermostat Ordering Numbers.

O.S. Number	Replacement Ordering Number	Sticker Number (Reference Only)
TP979A	TP970A1004, requires 2	14002029-001
TP979B	TP970B1002, requires 2	14002029-002
TP979C	TP970A1004, requires 1 and TP970B1002, requires 1	14002029-001 14002029-002
TP979D	TP970B1003, requires 1 and TP971D1007, requires 1	14002030-001 14002030-003
TP979E	TP970B1003, requires 1 and TP971E1004, requires 1	14002030-001 14002030-002

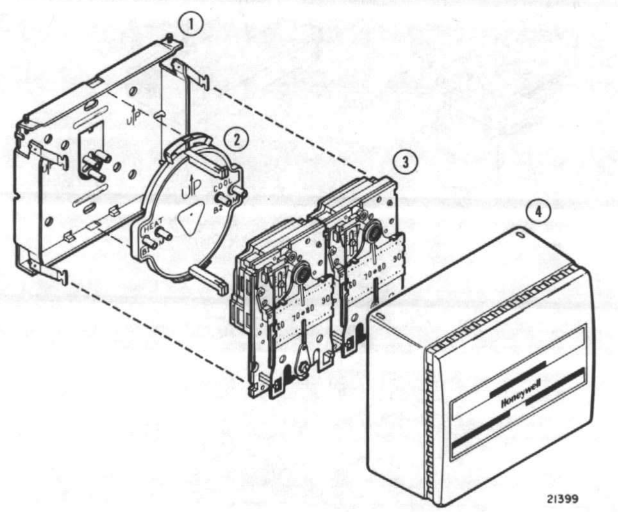


Fig. 26. TP979 Exploded View.

ACCESSORIES

Refer to Installation Instructions 95-7134 for illustrations of further information on the following pneumatic fittings.

1. Airheads:
   One-pipe black (main port plugged), 14000742-001.
   Two-pipe red, 14000742-002.
   Shallow one-pipe black (main port plugged), 14000686-001.
   Shallow two-pipe red, 14000686-002.
   Three-pipe white, 14001527-001.
   Tubing, 6-inch
   — Black, 3121700.
   — Red, 311902.
   — White, 312688.
   Internal Tubing Spring, 311699.
2. Wall Boxes.
   Shallow:
   Box alone, 14001614-001.
   One-pipe, 8-foot (2.5 m) copper tubing assembly, 14001615-001.
   Two-pipe, 8-foot (2.5 m) copper tubing assembly, 14001615-002.
   One-pipe, 8-foot (2.5 m), 5/32-inch plastic tubing assembly, 14001616-001.
   Two-pipe, 8 foot (2.5 m), 5/32-inch plastic tubing assembly, 14001616-002.
   Deep:
   Box alone, 14001355-001.
   Two-pipe, 8-foot (2.5 m), 5/32-inch plastic tubing assembly, 14001492-001.
   Deep Wall Box Mounting Bracket, 14001354-001.
   Aspirating Wall Box with 8-foot (2.5 m) 5/32-inch plastic tubing, 14002424-002.
   Cover for Aspirating Wall Box, AK3970.
3. Wall Plates:
   Black, 14002136-002.
   Beige, 14002136-003.
   Bag Assembly, 14001905-001.
   Mounting Plate Assembly, 14002053-001.
   Wall Plate Adaptor, 14003192-001.
4. Mounting Rings:
   Flush, 14001608-001.
   Surface, 14001608-002.
   Standoff Plaster Ring, 14000885-001.
5. Modernization Fittings:
   Universal
   — One- and Two-Pipe, 14002573-001.
   — Three-Pipe, 14002573-002.
   Serviceline Kit
   — 14003192-001.
6. Branch Line Gage Tap Plug, 14002172-001.
7. Electrical Box Adaptor Plate, 14001496-001.
8. Thermostat Heavy Duty Guard, 14002430-001.
9. Set Point Knob Retainer Kit, 14004300-001. It is used to prevent setpoint knob breakage on TP970 and TP973 thermostats with metal covers. Kit contains two socket-head screws, an Allen key, two round spacers, and a bar. The bar fits across the bottom of thermostat to shield setpoint knob.

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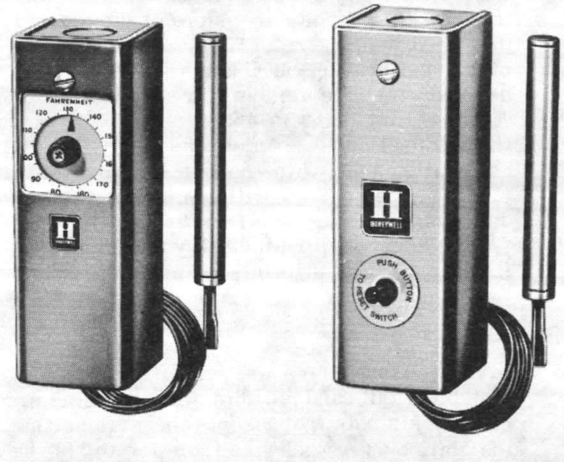
MAINTENANCE AND REPAIR

T675A, B; T678A, B and T478A TEMPERATURE CONTROLLERS

INTRODUCTION

The following instructions are for maintenance, repair and parts replacement of the T675A, T678A, T675B, T678B, and the T478A Temperature Controllers. Standard tools may be used to disassemble and reassemble these controllers. A calibration wrench, Honeywell part number 801534, is required for field calibration. Table 1 of this form lists the recommended cleaning solvent and lubricant. An exploded view drawing and parts list are included to facilitate repair. All parts are designated by part number and description. For ordering information, see note on page 11.

NOTE: Obtain prices form our local branch office. Prices and availability are subject to change without notice.



T675A T675B

MAINTENANCE

PERIODIC MAINTENANCE: Inspection, Cleaning, and Lubrication.

CAUTION: Be sure to disconnect power source from the controller before removing cover to work on internal components.

1. Inspect the controller for external and internal damage.
2. Brush or blow away all dust and dirt. If parts appear damaged, remove controller and disassemble.
3. Clean disassembled parts in the solvent listed in Table 1. Order replacement parts from the parts list on this sheet.
4. When reassembling the controller, coat all screw threads lightly with the lubricant listed in Table 1.

Table 1

TOOL OR MATERIAL	APPLICATION
Inhibited 1, 1, 1-Trichloroethane such as Chlorothene or Vythene.	Obtain locally—Remove caked grease and dirt which cannot be removed easily. Caution: Do not allow any solvent to get into the snap switches.
Lubricant — Multi-Purpose Grease (Honeywell part number 802771—4 oz. Tube).	Obtain from Honeywell branch office—lubricate screw threads to prevent rust and corrosion.
Calibration Wrench—Honeywell part number 801534.	Obtain from Honeywell branch office—calibrate dial setting to bulb temperature — (see CALIBRATION).

CAUTION: Use special care when using solvents. Avoid prolonged inhalation and/or contact with the skin. Careless handling can result in permanent damage to the respiratory system and skin tissue.

OPERATION CHECK:
A quick operational check can be performed by raising or lowering the setpoint through the temperature, including the differential, of the medium controlled. This should cause the controlled equipment to operate.

CALIBRATION

All controllers are carefully tested and calibrated at the factory under conditions that are accurately controlled. If the controller is not operating at a temperature corresponding to the scale setting and differential setting, check to see that the bulb is in a position to sense the average temperature of the medium controlled. If the temperature of the controlled medium is changing rapidly the differential will appear wider than its setting.

For calibration, an accurate temperature reading of the controlled medium must be taken. This can be done by placing an accurate thermometer along side the bulb of the controller, or by referring to a thermometer that has been installed as part of the system. If the bulb of the controller is installed in an inaccessible area, or if the controlled medium is unstable, it should be removed and placed in a controlled bath for accurate calibration.

T675A:
These controllers are to be calibrated so that the dial setting is the point at which the R-W switch contacts make on a temperature rise. Measure the temperature at the bulb. Rotate the dial counterclock-

wise from the top of the scale, to simulate a temperature rise, until the R-W switch contacts make. Note the dial reading.

Calibrate the dial as follows:

1. Assume that the setpoint on the dial is 70 degrees, but while moving the dial the controlled equipment comes on at 50 degrees—this means the controller is off calibration by 20 degrees. You must increase the calibration by 20 degrees.

2. Slip the fingers of the calibration wrench (part number 801534) into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note this point by observing the temperature indication on the dial. Assume this point is 45 degrees. You want to raise the calibration by 20 degrees; turn the dial and the calibration nut, with the wrench, to a dial indication of 65 degrees. This will raise the calibration by 20 degrees.

3. Repeat step 1 to check your adjustment. If you find the setpoint still off, repeat step 2.

T678A:

These controllers are calibrated so that the adjustable (left hand switch) makes on a temperature rise. This point represents the dial setting. Rotate the dial counterclockwise from the top of the scale, to simulate a temperature rise, until the left hand switch makes. Note the dial reading. Continue rotating dial until the right hand switch makes. The difference between the two readings indicates the switch differential. The adjustable switch must make at a lower reading than the right hand switch. Adjust the differential if necessary, by turning the adjustment screw (visible through the lower left hand corner of the frame). Changing the differential setting may change the calibration.

Measure the temperature at the bulb. Rotate the dial counterclockwise, from the top of the scale to simulate a temperature rise, until the contacts of the left hand switch make. Note the reading.

Calibrate the dial as follows:

1. Assume that the setpoint on the dial is 70 degrees, but while moving the dial the controlled equipment comes on at 50 degrees—this means the controller is off calibration by 20 degrees. You must increase the calibration by 20 degrees.

2. Slip the fingers of the calibration wrench (part number 801534) into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note this point by observing the temperature indication on the dial. Assume this point is 45 degrees. You want to raise the calibration by 20 degrees; turn the dial and the calibration nut, with the wrench, to a dial indication of 65 degrees. This will raise the calibration by 20 degrees.

3. Repeat step 1 to check your adjustment. If you find the setpoint still off, repeat step 2.

T675B:

These controllers are calibrated so that the dial setting is the point at which the switch contacts break on a temperature fall. Measure the temperature at the bulb. Rotate the dial clockwise from the bottom of the scale to simulate a temperature fall until the switch contacts break. Note the dial reading.

Calibrate the dial as follows:

1. Assume that the setpoint on the dial is 70 degrees, but while moving the dial the controlled equipment comes on at 50 degrees—this means the controller is off calibration by 20 degrees. You must increase the calibration by 20 degrees.

2. Slip the fingers of the calibration wrench (part number 801534) into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note this point by observing the temperature indication on the dial. Assume this point is 45 degrees. You want to raise the calibration by 20 degrees; turn the dial and the calibration nut, with the wrench, to a dial indication of 65 degrees. This will raise the calibration by 20 degrees.

3. To check the calibration, reset the switch by pushing the reset button. Rotate the dial until the switch breaks. Note the reading and compare with the temperature at the bulb. Readjust the dial, if necessary, until the bulb temperature and the dial reading correspond.

T478A:

These controllers are calibrated so that the adjustable (left hand switch) breaks on a temperature fall. This point represents the dial setting. Rotate the dial clockwise from the bottom of the scale, to simulate a temperature fall, until the left hand switch breaks. Note the dial reading. Continue rotating the dial until the right hand switch breaks. The difference between the two readings indicates the switch differential. The adjustable switch must break at a higher reading than the right hand switch.

Adjust the differential, if necessary, by turning the adjustment screw (visible through the rear of the frame). Changing the differential setting may change the calibration.

Measure the temperature at the bulb. Rotate the dial clockwise, from the bottom of the scale, to simulate a temperature fall, until the contacts of the left hand switch break. Note the reading.

Calibrate the dial as follows:

1. Assume that the setpoint on the dial is 70 degrees, but while moving the dial the controlled equipment comes on at 50 degrees—this means the controller is off calibration by 20 degrees. You must increase the calibration by 20 degrees.

2. Slip the fingers of the calibration wrench (part number 801534) into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note this point by observing the temperature indication on the dial. Assume this point is 45 degrees. You want to raise the calibration by 20 degrees; turn the dial and the calibration nut, with the wrench, to a dial indication of 65 degrees. This will raise the calibration by 20 degrees.

3. Repeat step 1 to check your adjustment. If you find the setpoint still off, repeat step 2.

T678B:

The T678B is carefully calibrated at the time of manufacture and will maintain adjustment for years of normal service. Poor control can be the result of many factors, and field re-calibration is not recommended. To verify calibration, compare temperature setting with an accurate thermometer.

TO CHECK CALIBRATION

1. Determine the outdoor-air temperature as accurately as possible at the location of the outdoor bulb. Subtract this temperature from 70 F (the calibration reference point of the T678B) to find the DIFFERENCE TEMPERATURE.

2. Multiply the DIFFERENCE TEMPERATURE by the RESET FACTOR (see table below) to find the amount of shift, or "reset", in the control point.

Reset Ratio	Reset-ratio Factor
1 to 1	1.0
1 to 1 1/2	1.5
1 1/2 to 1	0.667

3. Determine the temperature of the heating medium at the indoor bulb and subtract the amount of the control point reset (Step 2) to find the THEORETICAL SETPOINT.

4. Adjust the actual setpoint (on the scale of the T678B) to the THEORETICAL SETPOINT.

NOTE—Check the outdoor-air and heating medium temperatures to make certain that they have not changed from the readings used to make the above computations. Calibration check must be carried out with reasonable speed.

On models of the T678B having an adjustable differential between stages, the right hand switch will break R to B as the temperature rises to the THEORETICAL SETPOINT (cooling application). On a temperature fall, the SETPOINT shifts. Models of the T678B, with a fixed interstage differential, break R to W (make R to B) of the left hand switch on a temperature fall to the THEORETICAL SETPOINT.

5. TO CALIBRATE:

a. Find the difference between the actual operating point and the THEORETICAL SETPOINT by turning the dial of the controller with a screwdriver while observing the controlled equipment. For example, assume that the THEORETICAL SETPOINT is 70 degrees, but while moving the dial the controlled equipment comes on at 50 degrees—this means the control is off calibration by 20 degrees. You must increase the calibration by 20 degrees.

b. Slip the fingers of the calibration wrench (part number 801534) into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note this point by observing the temperature indication on the dial. Assume this point is 45 degrees. You want to raise the calibration by 20 degrees; turn both the dial and the calibration nut, with the wrench, to a dial indication of 65 degrees. This will raise the calibration by 20 degrees.

c. To check your adjustment, repeat step a. If you find the THEORETICAL SETPOINT and the actual setpoint still off, repeat step b.

PARTS LIST

NOTE: Four digit numbers listed in MODELS column indicate complete Ordering Specification Number. EXAMPLE: T675A1003. Number in parentheses indicates quantity of parts used.

PARTS LIST FOR FIG. 1

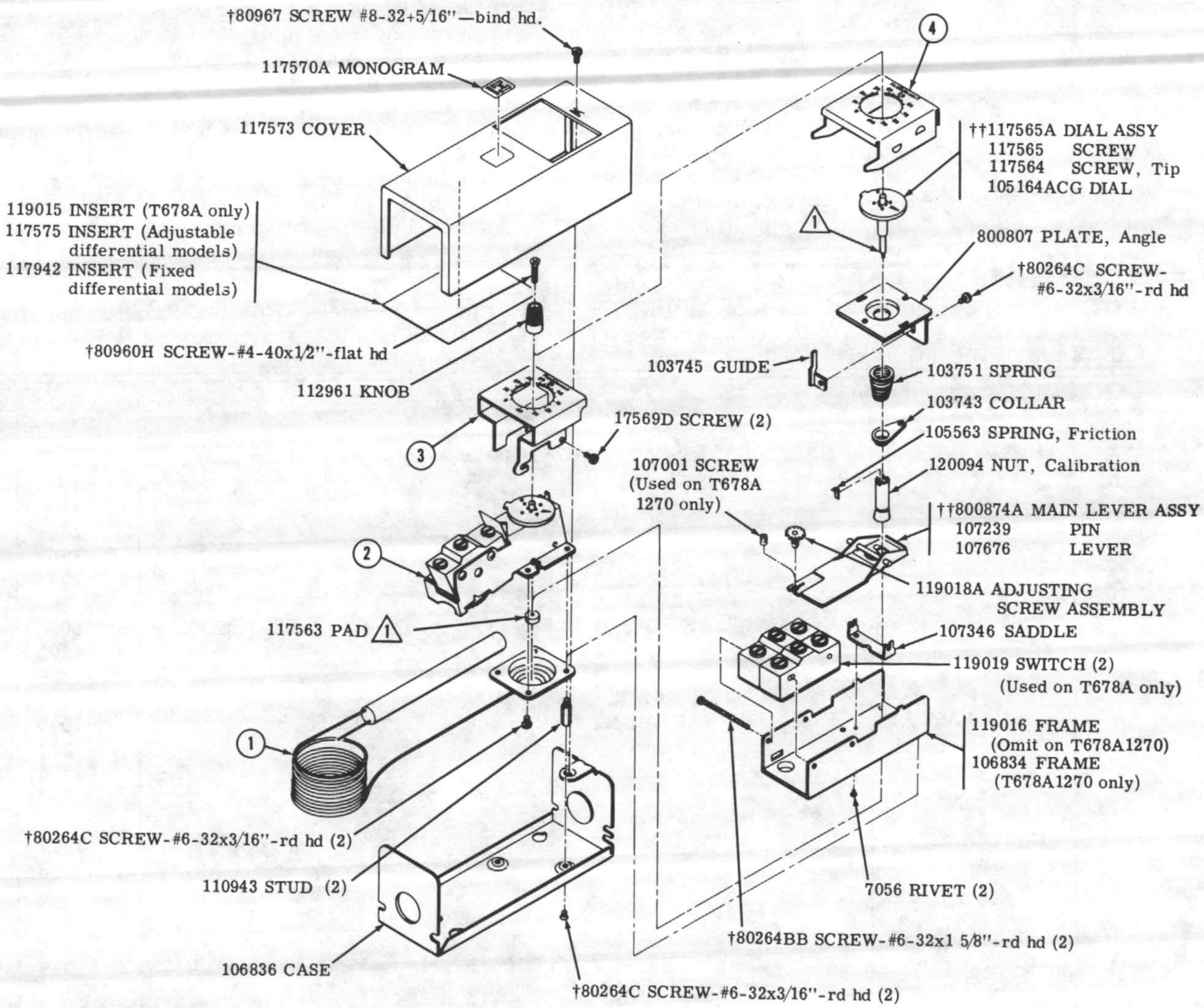
KEY	PART NO.	DESCRIPTION	MODEL T675A	MODEL T678A
1	108109AACA	ELEMENT ASSEMBLY (0 to 100°F, -15 to 35°C, 5' copper)	1003 1011 1169 1284 1508 1516	1007 1155 1437
1	108109AACB	ELEMENT ASSEMBLY (80 to 180°F, 30 to 80°C, 5' copper)	1052 1201 1326	1049 1197
1	108109AACC	ELEMENT ASSEMBLY (160 to 260°F, 75 to 125°C, 5' copper)	1094 1243 1334 1532	1080 1239
1	108109AECF	ELEMENT ASSEMBLY (55 to 175°F, 15 to 75°C, 5' copper)	1417 1458 1466 1540	1353 1395 1445
1	108109ACCA	ELEMENT ASSEMBLY (0 to 100°F, -15 to 35°C, 20' copper)	1029 1136 1177 1292	1015 1163
1	108109ACCB	ELEMENT ASSEMBLY (80 to 180°F, 30 to 80°C, 20' copper)	1060 1219	1056 1205
1	108109ACCC	ELEMENT ASSEMBLY (160 to 260°F, 75 to 125°C, 20' copper)	1102 1250	1098 1247

Parts list for Fig. 1 continued on page 4.

PARTS LIST FOR FIG. 1 CONTINUED

KEY	PART NO.	DESCRIPTION	MODEL T675A	MODEL T678A
1	108109AGCF	ELEMENT ASSEMBLY (55 to 175°F, 15 to 75°C, 20' copper)	1425 1474 1524	1361 1403
1	108109ACLA	ELEMENT ASSEMBLY (0 to 100°F, -15 to 35°C, 20' stainless steel)	1045 1151 1193 1318	1031 1189
1	108109ACLB	ELEMENT ASSEMBLY (80 to 180°F, 30 to 80°C, 20' stainless steel)	1086 1235	1072 1221
1	108109ACLC	ELEMENT ASSEMBLY (160 to 260°F, 75 to 125°C, 20' stainless steel)	1128 1276	1114 1262

Parts list for Fig. 1 continued on page 5.



1 Coat the screw to pad and pad to diaphram surfaces with 802771 GREASE, Multipurpose.

†Standard parts (screws, washers, electrical components, etc.) should be obtained locally when possible. Component values are subject to change without notice. Always use exact replacement parts when making repairs.
††Because the component parts of this assembly are staked or require a special assembly process, it is recommended that a complete replacement assembly be ordered.

NOTE: For information on seperable wells, pressure fittings, and bulb holders see Data Sheet 90-0559.

75-5193

Fig. 1—T675A and T678A Temperature Controllers.

PARTS LIST FOR FIG. 1 CONTINUED

KEY	PART NO.	DESCRIPTION	MODEL T675A	MODEL T678A
1	108109AGLF	ELEMENT ASSEMBLY (55 to 175°F, 15 to 75°C, 20' stain-	1441	1387
		less steel)	1490	1429
1	108109AALA	ELEMENT ASSEMBLY (0 to 100°F, -15 to 35°C, 5' stainless steel)		1270
1	108109ACMA	ELEMENT ASSEMBLY (0 to 100°F, -15 to 35°C, 20' monel)	1037	1023
			1144	1171
			1185	
			1300	
1	108109ACMB	ELEMENT ASSEMBLY (80 to 180°F, 30 to 80°C, 20' monel)	1078	1064
			1227	1213
1	108109ACMC	ELEMENT ASSEMBLY (160 to 260°F, 75 to 125°C, 20'	1110	1106
		monel)	1268	1254
1	108109AGMF	ELEMENT ASSEMBLY (55 to 175°F, 15 to 75°C, 20' monel)	1433	1379
			1482	1411
2	800806A	††FRAME ASSEMBLY	1011	
	80264AF	†SCREW-#6-32x1"-rd hd (2)	1136	
	117565A	††SCREW ASSEMBLY	1144	
	105563	SPRING, Friction (As needed)	1151	
	117937	NUT	1284	
	801032	SPRING	1292	
	110560	BARRIER	1300	
	111175	SWITCH	1318	
	27544	NUT, Hex (2)	1326	
	800806	FRAME	1334	
	801033	LEVER, Reverse	1458	
	125612	PIN	1516	
	117568	PLATE	1524	
	110556	COLLAR		
2	800806B	††FRAME ASSEMBLY	1003	
	117572	SWITCH	1029	
	117565A	††SCREW ASSEMBLY	1037	
	117937	NUT	1045	
	800806	FRAME	1052	
	80264AF	†SCREW-#6-32x1"rd hd (2)	1060	
	105563	SPRING, Friction (As needed)	1078	
	801032	SPRING	1086	
	110560	BARRIER	1094	
	27544	NUT, Hex (2)	1102	
	801033	LEVER, Reverse	1110	
	125612	PIN	1128	
	117568	PLATE	1508	
	110556	COLLAR	1532	
2	800806C	††FRAME ASSEMBLY	1169	
	801702	SWITCH	1177	
	117565A	††SCREW ASSEMBLY	1185	
	117937	NUT	1193	
	800806	FRAME	1201	
	80264AF	†SCREW-#6-32x1"-rd hd (2)	1219	
	105563	SPRING, Friction (As needed)	1227	
	801032	SPRING	1235	
	110560	BARRIER	1243	
	27544	NUT, Hex (2)	1250	
	801033	LEVER, Reverse	1268	
	125612	PIN	1276	
	117568	PLATE		
	110556	COLLAR		

Parts list for Fig. 1 continued on page 6.

PARTS LIST FOR FIG. 1 CONTINUED

KEY	PART NO.	DESCRIPTION	MODEL T675A	MODEL T678A
2	800806D	††FRAME ASSEMBLY	1417	
	802593	SWITCH	1425	
	117565A	††SCREW ASSEMBLY	1433	
	117937	NUT	1441	
	800806	FRAME	1540	
	80264AF	†SCREW-#6-32x1"-rd hd (2)		
	105563	SPRING, Friction (As needed)		
	801032	SPRING		
	110560	BARRIER		
	27544	NUT, Hex (2)		
	801033	LEVER, Reverse		
	125612	PIN		
	117568	PLATE		
	110556	COLLAR		
2	800806E	††FRAME ASSEMBLY	1466	
	802594	SWITCH	1474	
	117565A	††SCREW ASSEMBLY	1482	
	117937	NUT	1490	
	800806	FRAME		
	80264AF	†SCREW-#6-32x1"-rd hd (2)		
	105563	SPRING, Friction (As needed)		
	801033	LEVER, Reverse		
	125612	PIN		
	117568	PLATE		
	27544(2)	NUT, Hex		
	110556	COLLAR		
	801032	SPRING		
	110560	BARRIER		
3	109070A	SCALEPLATE (0 to 100°F)	1003	
			1011	
			1029	
			1037	
			1045	
			1136	
			1144	
			1151	
			1508	
			1516	
3	109070B	SCALEPLATE (80 to 180°F)	1052	
			1060	
			1078	
			1086	
			1326	
3	109070C	SCALEPLATE (160 to 260°F)	1094	
			1102	
			1110	
			1128	
			1334	
			1532	
3	109070D	SCALEPLATE (15 to 35°C)	1169	
			1177	
			1185	
			1193	
			1284	
			1292	
			1300	
			1318	
3	109070E	SCALEPLATE (30 to 80°C)	1201	
			1219	
			1227	
			1235	

Parts list for Fig. 1 continued on page 7.

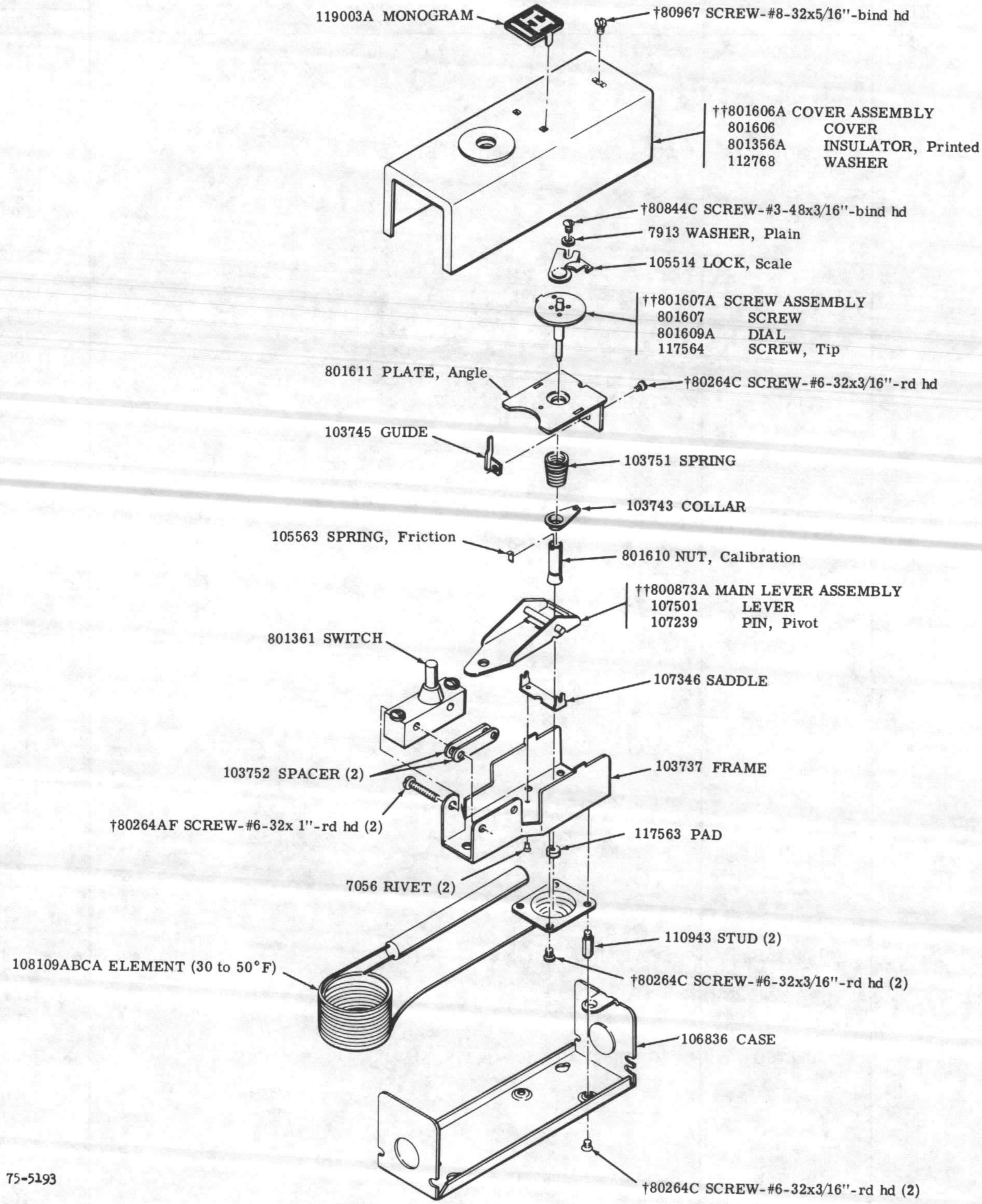
PARTS LIST FOR FIG. 1 CONTINUED

KEY	PART NO.	DESCRIPTION	MODEL	
			T675A	T678A
3	109070F	SCALEPLATE (-75 to 125°C)	1243	
			1250	
			1268	
			1276	
3	109070H	SCALEPLATE (55 to 175°F)	1417	
			1425	
			1433	
			1441	
			1458	
			1540	
3	109070J	SCALEPLATE (15 to 75°C)	1466	
			1474	
			1482	
			1490	
4	109076A	SCALEPLATE (0 to 100°F)		1007
				1015
				1023
				1031
				1270
				1437
4	109076B	SCALEPLATE (80 to 180°F)		1049
				1056
				1064
				1072
4	109076C	SCALEPLATE (160 to 260°F)	1080	
			1098	
			1106	
			1114	
4	109076D	SCALEPLATE (-15 to 35°C)	1155	
			1163	
			1171	
			1189	
4	109076E	SCALEPLATE (30 to 80°C)	1197	
			1205	
			1213	
			1221	
4	109076F	SCALEPLATE (75 to 125°C)	1239	
			1247	
			1254	
			1262	
4	109076G	SCALEPLATE (55 to 175°F)	1353	
			1361	
			1379	
			1387	
			1445	
4	109076H	SCALEPLATE (15 to 75°C)	1395	
			1403	
			1411	
			1429	
		ACCESSORIES		
	107324A	BULB HOLDER	1508	
	4074BR	ENVELOPE ASSEMBLY	1532	
	80703	SCREW-Sheet metal	1540	
	105900	CLAMP, 'T' plate		All Models

NOTE: For information on separable wells, pressure fittings, and bulb holders see Data Sheet 90-0559.

†Standard parts (screws, washers, electrical components, etc.) should be obtained locally when possible. Component values are subject to change without notice. Always use exact replacement parts when making repairs.

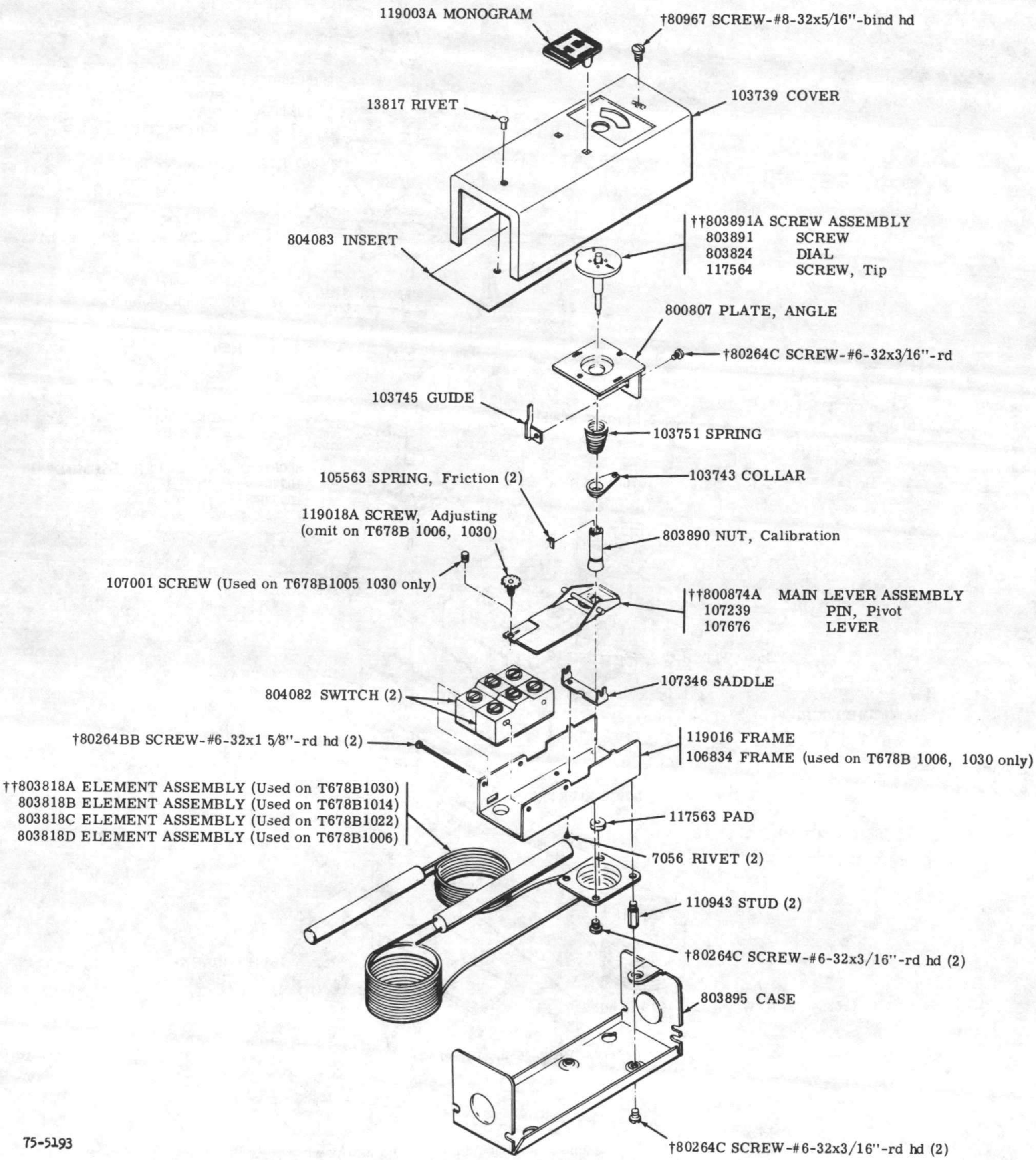
††Because the component parts of this assembly are staked or require a special assembly process, it is recommended that a complete replacement assembly be ordered.



†Standard parts (screws, washers, electrical components, etc.) should be obtained locally when possible. Component values are subject to change without notice. Always use exact replacement parts when making repairs.
††Because the component parts of this assembly are staked or require a special assembly process, it is recommended that a complete replacement assembly be ordered.

NOTE: For information on separable wells, pressure fittings, and bulb holders see Data Sheet 90-0559.

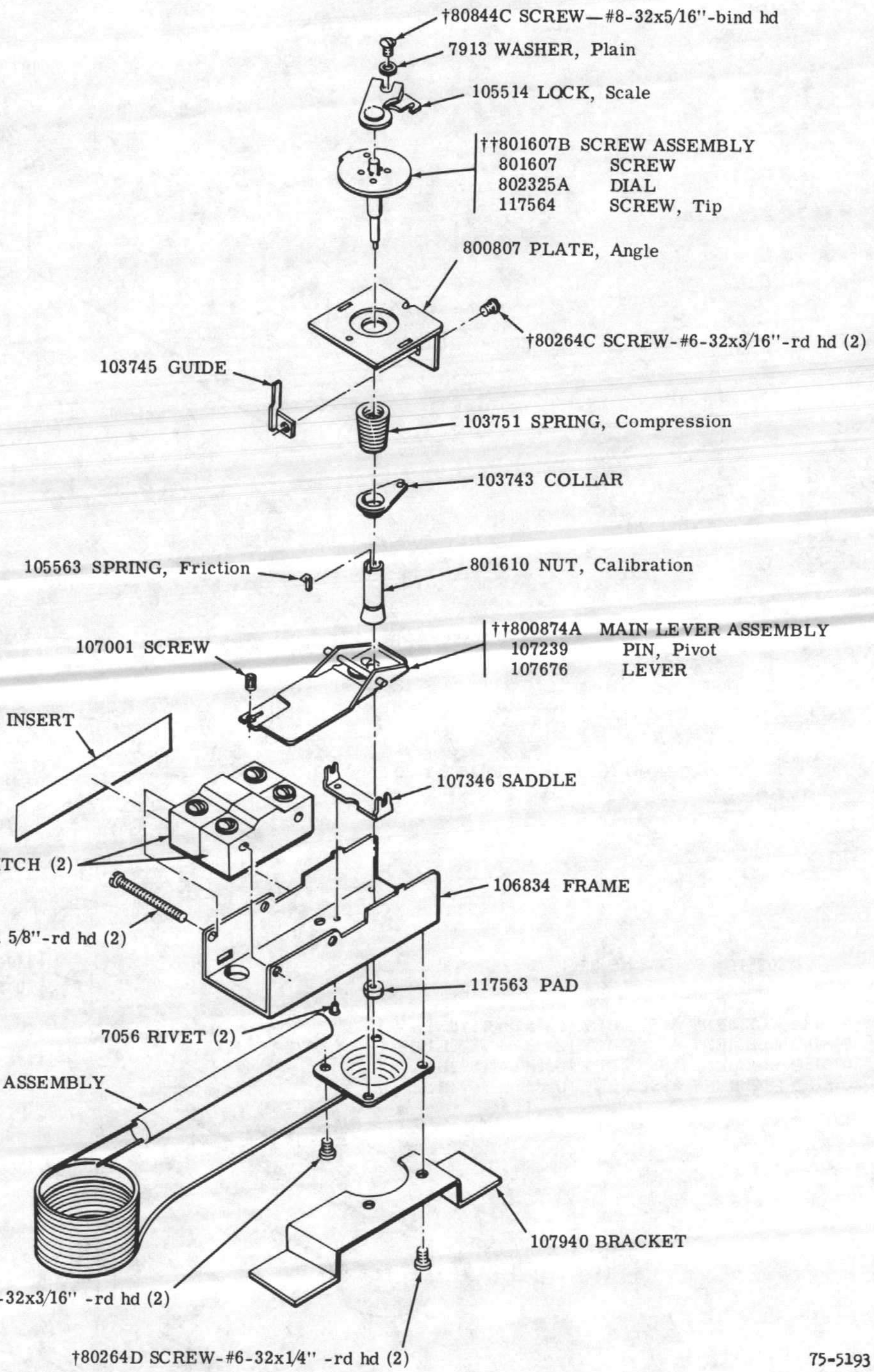
Fig. 2—T675B Temperature Controller.



†Standard parts (screws, washers, electrical components, etc.) should be obtained locally when possible. Component values are subject to change without notice. Always use exact replacement parts when making repairs.
††Because the component parts of this assembly are staked or require a special assembly process, it is recommended that a complete replacement assembly be ordered.

NOTE: For information on separable wells, pressure fittings, and bulb holders see Data Sheet 90-0559.

Fig. 3—T678B Temperature Controller.



†Standard parts (screws, washers, electrical components, etc.) should be obtained locally when possible. Component values are subject to change without notice. Always use exact replacement parts when making repairs.
††Because the component parts of this assembly are staked or require a special assembly process, it is recommended that a complete replacement assembly be ordered.

NOTE: For information on separable wells, pressure fittings, and bulb holders see Data Sheet 90-0559.

Fig. 4—T478A Temperature Controller.

ORDERING INFORMATION:

Please order by Part No. and Description. Also, give complete Order Specification number of the temperature controller. The number is stamped on case. If may be necessary to return the entire device to our factory for complete repair and reconditioning. In the U.S., orders should be mailed to Honeywell Inc., 1885 Douglas Drive, Minneapolis, Minnesota 55422. Direct all inquiries on orders to this same address. (In Canada, direct all orders and inquiries to Honeywell Controls Limited, Vanderhoof Avenue, Leaside, Toronto 17, Ontario.) For prices or further information, contact your nearest Honeywell Branch Office.

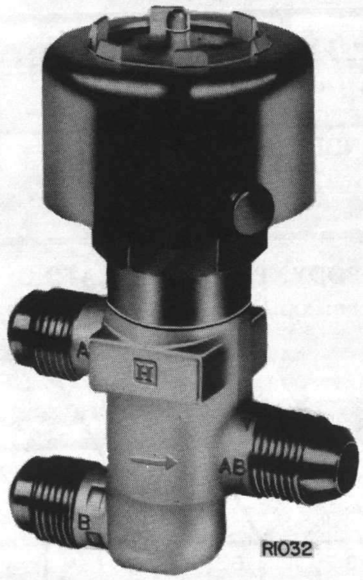
Mechanical devices must be serviced periodically if they are expected to give continued satisfactory performance, and controls are not an exception. How accurate and how troublefree your control system will be in the years to come depends largely on the maintenance given it. For best results, all devices in your system should be serviced at one time.

Time and trouble can be saved by arranging with Honeywell for a maintenance agreement which will guarantee expert, economical care, and insure maximum life and efficiency from your system.

Honeywell

Service Data

VP526A THREE-WAY HIGH PRESSURE WATER VALVE



GENERAL

The VP526A is a three-way mixing valve with an integral pneumatic operator used in unit air conditioners or fan coil units having hot and/or chilled water coils.

Three design modifications have been made to this valve, each designated by a Series number (the dash number) following the basic model number.

The production dates of these modifications are as follows:

Series No.	Mfg. Date
Series 1	Up to 1971
Series 2	1971 thru 1976
Series 3	1976 to present

APPLICATION

The VP526 is installed in the return piping of a unit containing a water coil in a coil bypass arrangement (see Fig. 1). It is controlled by a pneumatic room or unit thermostat to vary the temperature of the air discharged from the unit according to the temperature sensed by the controlling thermostat. Models having 2 to 5 psi (15 to 35 kPa) or 8 to 13 psi (55 to 75 kPa) operating ranges are used in systems where the VP526 is sequenced with another valve or separate control functions.

OPERATION

Minimum control air from the temperature controller closes Port A and opens Port B providing full flow through the coil and Ports B to AB.

As the air pressure is increased into the operating range of the valve, the valve plug moves away from Port A resulting in reduced flow through the coil. Maximum control air pressure closes Port B and opens Ports A to AB, bypassing the flow around the coil.

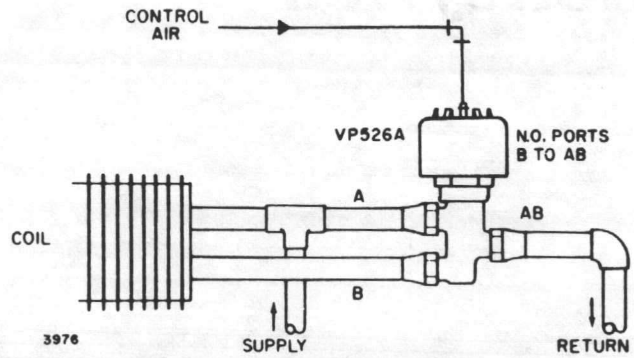


Fig. 1. Typical Operation Diagram.

SPECIFICATIONS

VALVE SIZES: 3/8 in. (for 1/2 in. OD tube) and 1/2 in. (for 5/8 in. OD tube).

CAPACITY INDEX (Cv):
3/8 in. valve: 1.0 or 1.6 Cv.
1/2 in. valve: 1.6 or 2.5 Cv.

NOMINAL BODY PRESSURE RATING: 250 psi (1720 kPa) maximum.

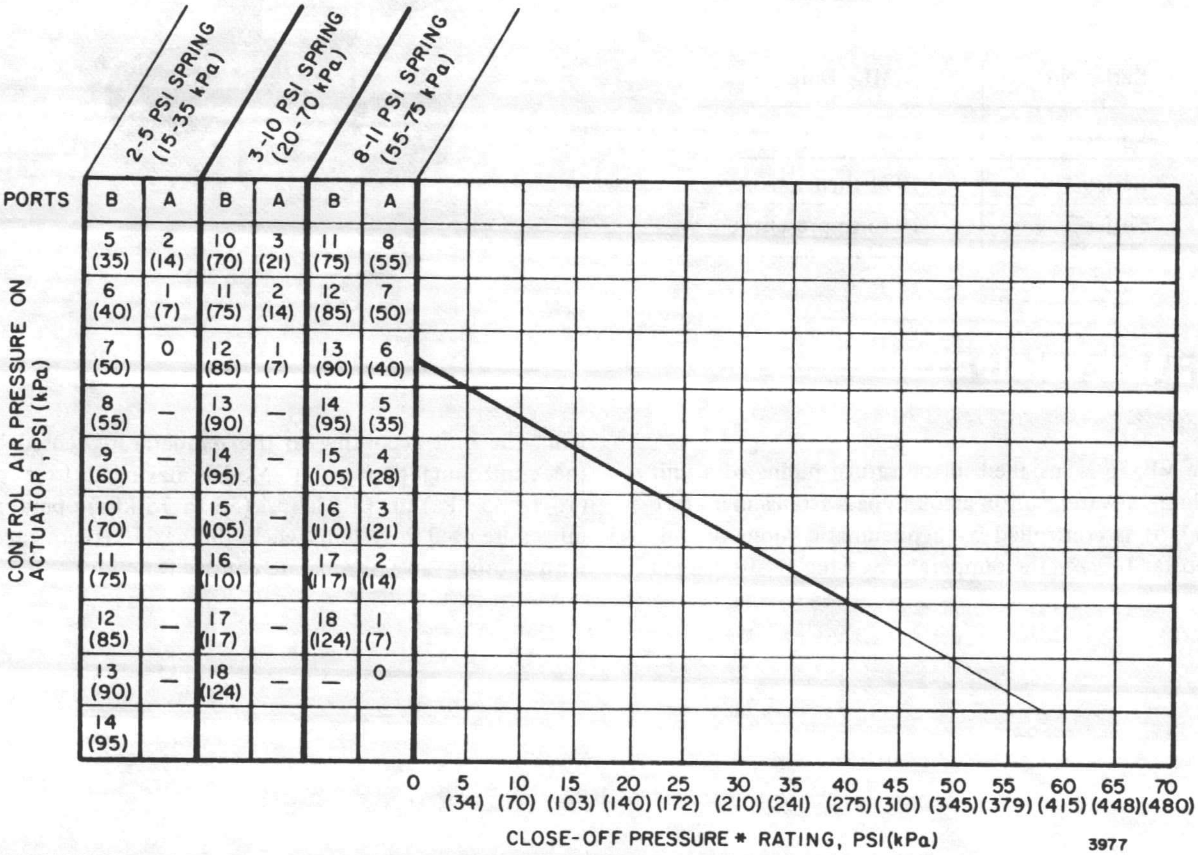
CONTROLLED MEDIUM TEMPERATURE: 35 to 250 F (2 to 121 C).

CLOSE-OFF RATINGS: Refer to Figure 2.

OPERATING RANGES: Refer to Figure 2.

MAXIMUM SAFE AIR PRESSURE: 30 psi (205 kPa).

MAXIMUM DIAPHRAGM TEMPERATURE: 230 F (110 C).



	2-5 PSI SPRING (15-35 kPa)		3-10 PSI SPRING (20-70 kPa)		8-11 PSI SPRING (55-75 kPa)	
PORTS	B	A	B	A	B	A
	5 (35)	2 (14)	10 (70)	3 (21)	11 (75)	8 (55)
	6 (40)	1 (7)	11 (75)	2 (14)	12 (85)	7 (50)
	7 (50)	0	12 (85)	1 (7)	13 (90)	6 (40)
	8 (55)	—	13 (90)	—	14 (95)	5 (35)
	9 (60)	—	14 (95)	—	15 (105)	4 (28)
	10 (70)	—	15 (105)	—	16 (110)	3 (21)
	11 (75)	—	16 (110)	—	17 (117)	2 (14)
	12 (85)	—	17 (117)	—	18 (124)	1 (7)
	13 (90)	—	18 (124)	—	—	0
	14 (95)					

*DIFFERENTIAL PRESSURE BETWEEN SUPPLY AND RETURN LINES

Fig. 2. Close-Off Ratings at Various Actuator Pressure.

MAINTENANCE

CLEANING

Remove all dirt and grease accumulation from around the valve assembly. A recommended cleaning solvent is chlorothene or Vythene (containing trichloroethane, inhibited 1-1-1) available at most office supply stores.

> **CAUTION**
>
> Exercise special care when using solvents. Avoid prolonged inhalation and/or contact with skin. Careless handling can result in permanent damage to the respiratory system or skin tissue.

OPERATIONAL CHECK

Observe physical appearance of valve. Check for signs of leakage around the stem, bonnet, or at the connections. Determine proper operation by adjusting the thermostat setting above the present room temperature. On heating applications, the temperature at the coil and discharge air should increase as the flow increases through the coil.

Adjusting the setpoint below room temperature should close off the flow through the coil, decreasing the coil and discharge air temperature. The reverse can be expected on cooling applications.

The valve operation should occur within the rated operating spring range (±1 psi) of the valve.

TROUBLESHOOTING

If there is evidence of a sticking stem or if leakage around the stem is observed during the valve operation, the valve should be repacked.

If there is no flow through the valve, first consider:

1. Are system circulating pumps running?

2. Is piping air locked? Bleed as required.

3. Is the system thermostat functioning properly?

Measure, with a pressure gage, for changes in branch line pressure as the thermostat is adjusted. If the pressure does not change according to the adjustment, refer to the Service Data sheet applicable to the specific thermostat to find and correct the malfunctions.

If all associated equipment checks out OK, the valve is stuck in position and must be disassembled, cleaned and repacked.

If flow through valve is uncontrollable, consider:

1. Does branch line pressure change as the thermostat is adjusted? If not, disconnect tubing at top of actuator and check for a leaking diaphragm by attaching a gage and pressure bulb assembly to the actuator. Attempt to pump up the actuator to 13 psi (91 kPa). If the pressure cannot be maintained, a leaking diaphragm is indicated and it or the complete top assembly must be replaced.

2. If the pressure is maintained but drops when reconnected to the system piping, suspect an air leak at the fittings, in the piping, at the thermostat, etc.

3. If the air pressure changes measured at the operator are normal, but the uncontrolled flow persists, suspect a defective valve seat or plug or the possibility of some foreign object within the valve body preventing the plug from seating properly. The valve must then be disassembled.

4. If the throttling plug is found to be defective, or the upper seat damaged, replacement parts can be installed. If the lower valve seat is defective, the complete valve assembly must be replaced.

REPAIR

GENERAL

RECOMMENDED SPECIAL TOOLS

1. Pressure bulb and gage assembly includes:

   a. Pressure bulb, No 852.
   b. Tubing (11/32 OD x 5/32 ID), No. 853.
   c. "T" fitting (1/4 x 1/4 barb x 1/8 FPT), No. 1614B.
   d. Gage 0 to 30 psi No. 305909.

2. 1-1/4 in. thin open-end wrench (make sure this is the correct size for both bonnet assemblies), No. 638.

3. Thermostat key, No. 301572A to remove tamperproof cover mounting screw on older models.

4. Upper valve seat removal tool, No. 3833.

PACKING REPLACEMENT (Part No. 14003297-001) (See Figures 3 and 4)

1. Remove system air and water pressure. Disconnect air tubing from actuator.

2. Unscrew valve bonnet, using a flat open-end wrench, and remove top and insert assembly from valve body by removing retainer or screw from side of top and twisting counterclockwise. Lift off top assembly.

3. Remove cup and main spring by sliding cup to disengage stem from captive hole in cup.

4. Remove packing nut from Series 1 and 2 versions. On Series 3 models, the base and packing gland must be removed.

5. Thoroughly clean the packing nut and stem with the recommended cleaning solvent. Inspect stem for scoring or bent conditions. Replace if needed.

6. Reassemble all parts in reverse order of disassembly using fresh lubricant, new packing, spring and spacers.

7. Restore air and water pressure to system and make Operational Check.

DIAPHRAGM REPLACEMENT

A defective diaphragm is best repaired by replacing the complete top assembly as shown in the Parts List. The diaphragm only can be replaced in Series 1 and 2 models, however it is recommended that the entire top assembly be replaced with either the standard top assembly or the vandalism shield assembly which are interchangeable. To replace top assembly:

1. Disconnect air tubing at actuator fitting.

2. Remove top assembly retainer. Turn top counterclockwise and lift off.

3. Install replacement unit and connect tubing.

STEM, PLUG AND/OR UPPER SEAT REPLACEMENT (See Figure 5)

1. Remove system air and water pressure. Disconnect air tubing from actuator.

2. Remove actuator as previously outlined.

3. Remove upper valve seat with special seat removal tool, Part No. 3833. Inspect and replace if worn.

4. With the upper seat removed, lift out the stem and throttling plug assembly and check its condition and that of the lower valve seat.

5. Replace plug, if necessary, by removing the small "c" locking rings at the end of the stem. Remove the plain and tension washer from the stem and slide off the defective throttling plug.

NOTE: A small O-ring is located in the stem recess, concealed by the plug.

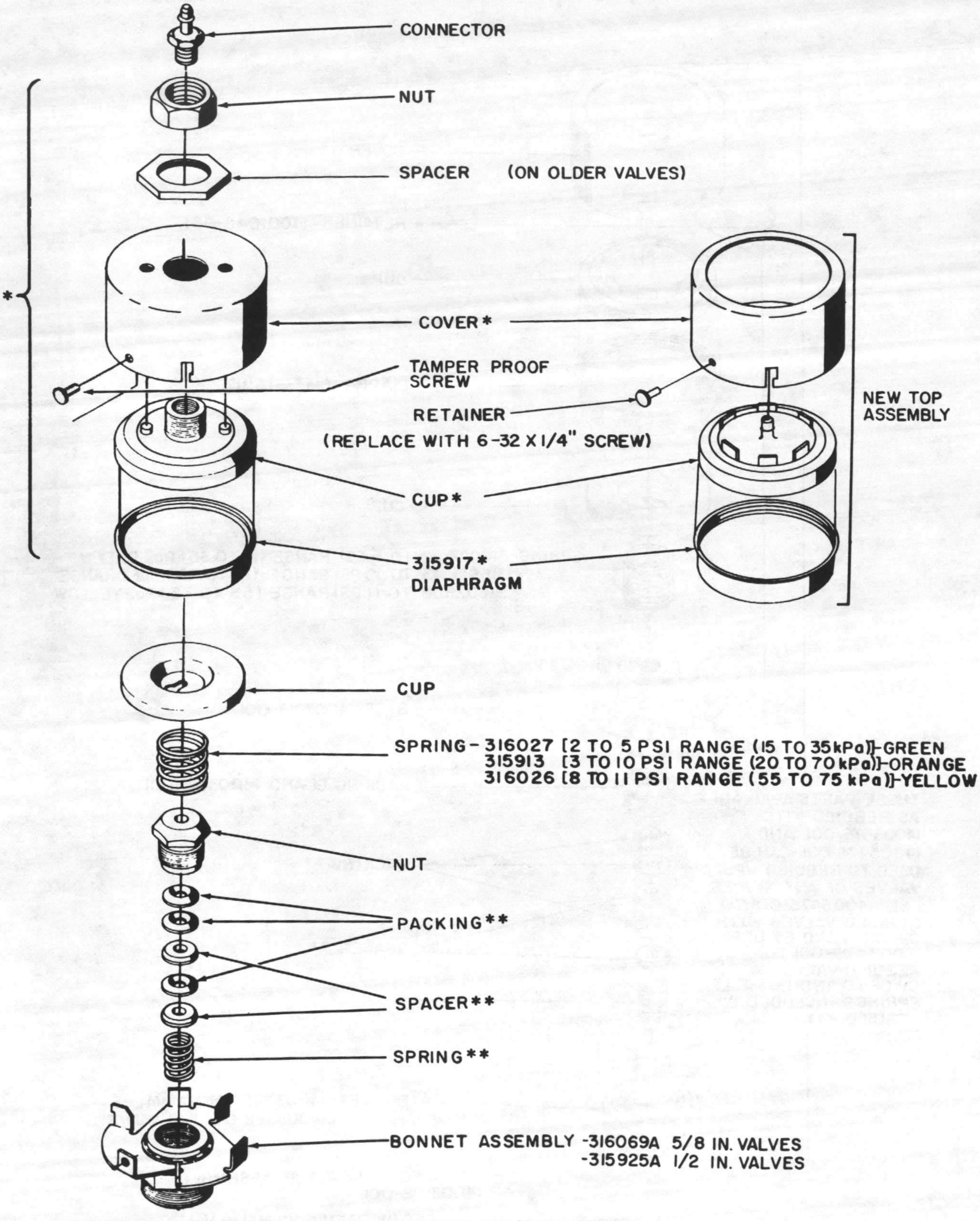
6. If the stem is being replaced, the washers and "c" ring referenced in step 5 must also be removed from above the throttling plug.

7. Whenever the plug or stem is replaced, a new O-ring as well as locking rings and washers must also be replaced.

8. When reassembling, the convex surface of the tension washer(s) must be in contact with the plug.

9. Complete reassembly of valve and repeat Operational Check.

PARTS LIST (Series 1 & 2- Metal Top Assembly)



*INCLUDED IN NEW TOP ASSEMBLY- 14003102-001 (CAN BE USED INTERCHANGEABLY WITH METAL CUP ACTUATOR ON SERIES 1 AND 2) THAT IS NOW AVAILABLE AS VANDALISM SHIELD ASSEMBLY 14003648-001. (SEE FIG. 5)

3978

** INCLUDED(WITH LUBRICANT) IN VALVE REPACK KIT NUMBER 14003297-001.

Fig. 3. Exploded View of Series 1 and 2 VP526A Valves with Metal Actuator Cup.

PARTS LIST (Series 3)

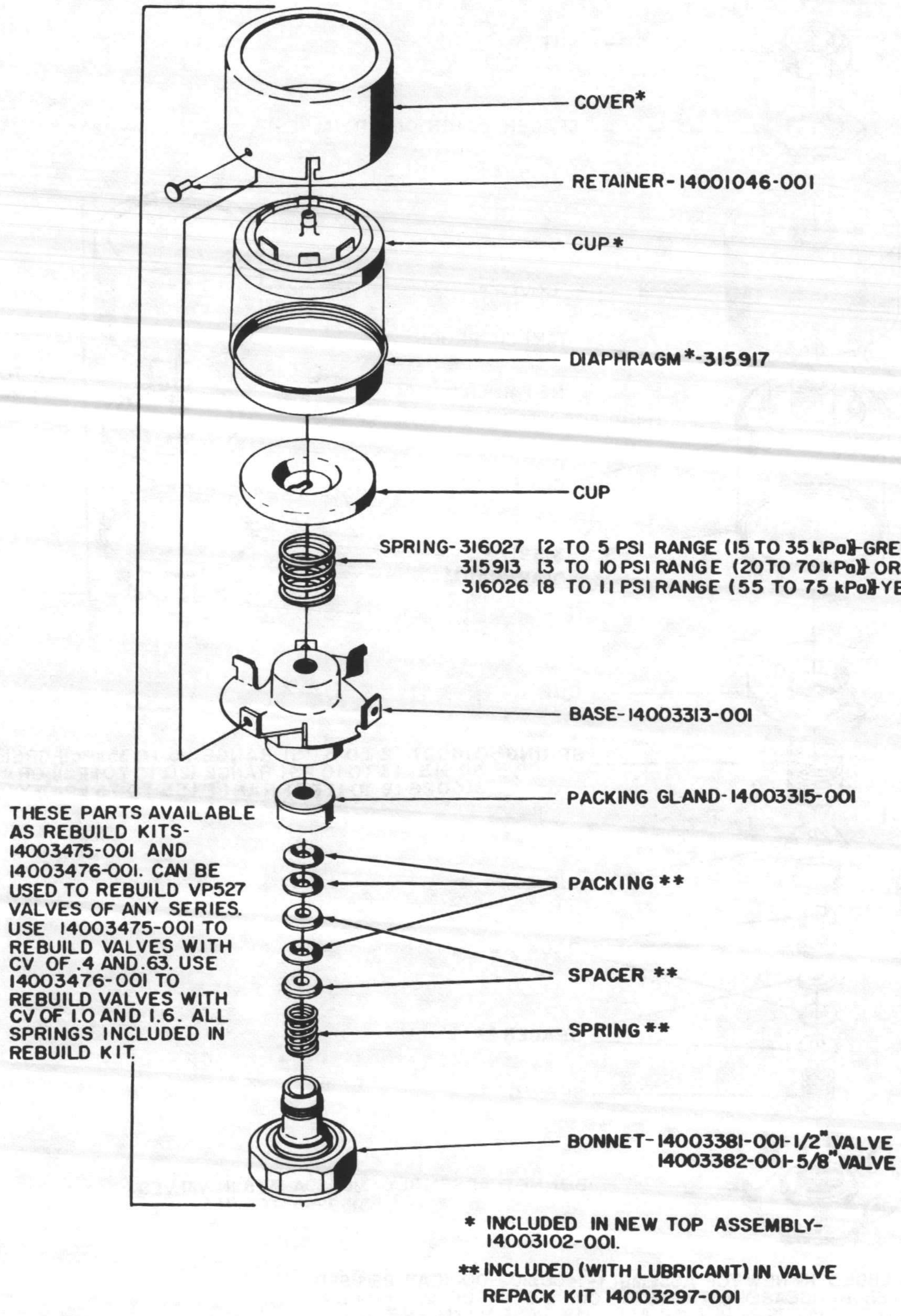


Fig. 4. Exploded View of Series 3 VP526A Valves.

PARTS LIST (All Series)

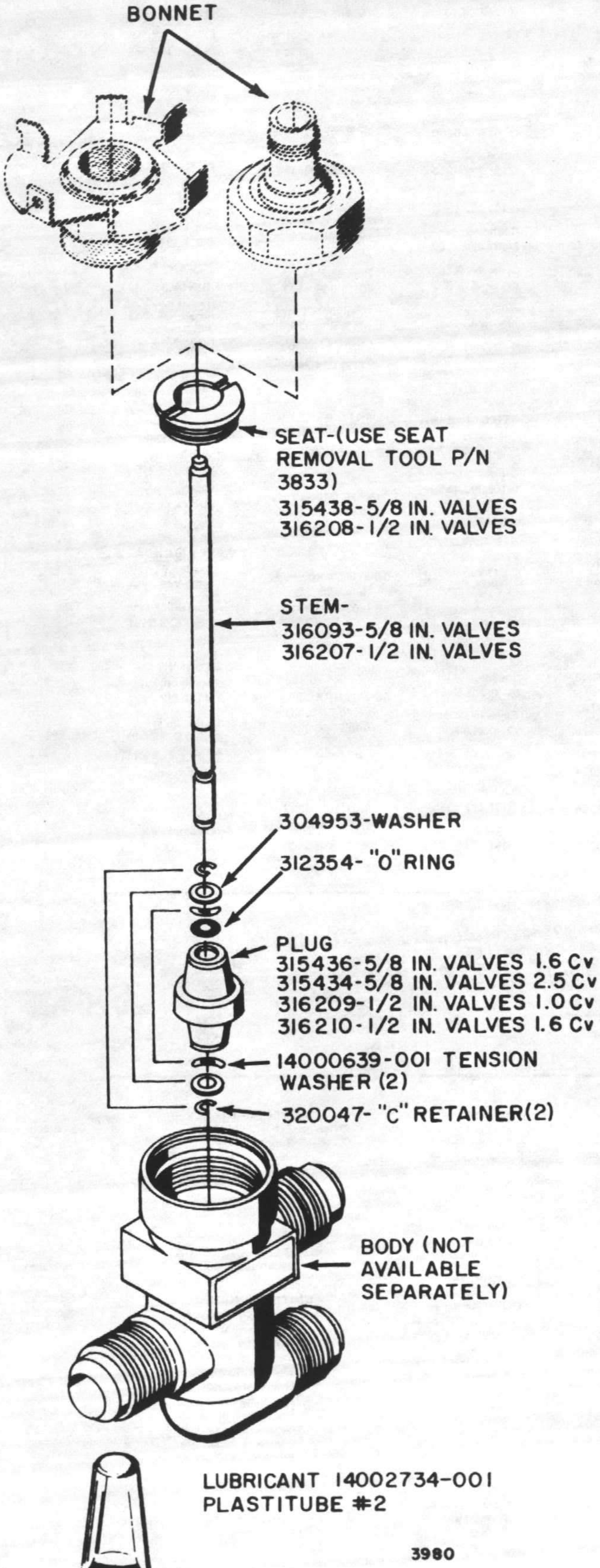
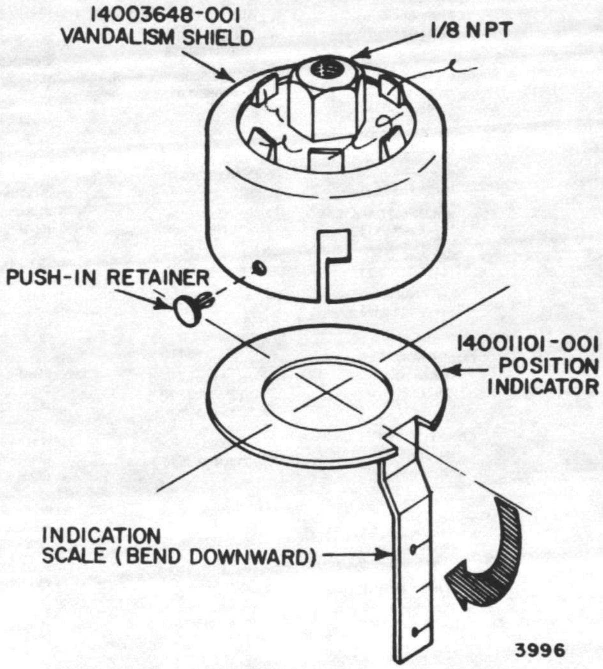


Fig. 5. Exploded View of Parts Common to All Series VP526A Valves.



MAY BE USED IN PLACE OF STANDARD 14003102-001 ACTUATOR ASSEMBLY WHEN 1/4" PLASTIC BARB CONNECTOR IS UNACCEPTABLE.

Fig. 6. Accessories for VP526A Valves.

ACCESSORIES:

Position Indicator - Part No. 14001101-001.

Vandalism Shield Assembly: Part No. 14003648-001. Consists of cover assembly with 1/8 in. NPT air connection and push-in retainer.

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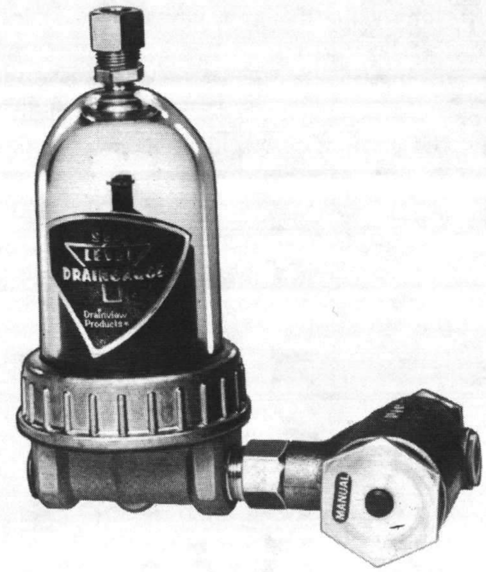
Honeywell

Comfort Control Systems

AK3470B&C CONDENSATE TRAPS AND AK3485D,E&F COMPRESSOR TANK DRAIN KITS

Installation Instructions



BEFORE INSTALLING, NOTE

The AK3470B and C Condensate Traps provide automatic compressor tank drainage. The AK3485D, E and F Compressor Tank Drain Kits contain the trap and all the necessary fittings for mounting on most Honeywell compressors (see Table 1).

If the installation requires both a dryer drain and a tank drain, use two separate traps.

Table 1. Condensate Traps and Kit Applications.

Drain Only	Drain and Fittings Kit	Tank Size in Gallons (Liters)			O.S. Suffix	Horse-Power
			Oil Lubricated			
		Oil-Less WP260	Single WP231	Dual WP241		
AK3470C	AK3485E	12 (45)			T	1/6
		20 (76)			A	1/4
			20 (76)	30 (114)	Y	1/3
		20 (76)	20 (76)	80 (303)	B	1/2
		30 (114)	30 (114)	80 (303)	C	3/4
AK3470B	AK3485D	30 (114)	30 (114)	80 (303)	D	1
		60 (227)	60 (227)	80 (303)	E	1-1/2
		------	60 (227)	80 (303)	F	2
		------	60 (227)	80 (303)	G	3
		------	80 (303)	------	H	5
	AK3485F	------	------	120 (454)	H	5
		------	120 (454)	200 (757)	J	7-1/2
		------	120 (454)	------	K	10
		------	120 (454)	------	L	15
		------	120 (454)	------	M	20

See Figures 1 through 3 for installation diagrams. Install the trap so the bowl is upright and the manual drain button is accessible.

If it is necessary to raise the compressor to allow for sufficient clearance, use cork and rubber blocks (CCM-3005) as shim material.

Make equalizing connections to the top of the trap as illustrated. NEVER connect to bottom of the filter bowl as the filter resistance may cause the air to bypass the filter.

NOTE: Always install the trap below the tank and on a horizontal plane.

INSTALLATION

After unpacking the trap, physically examine it for shipping damage. Invert the trap assembly several times to observe that the float moves up and down freely. If it binds or hangs up on the sides of the plastic bowl, remove the bowl and carefully straighten the float stem as required or replace.

NOTE: Use caution when replacing the bowl so as not to crossthread the bowl into its metal base.

Remove the two protective plastic pipe plugs from the unit.

NOTE: Do not twist the drain body by hand. Use a wrench on the hex adapter only. Turn the body only in the clockwise direction so as not to loosen the connector and cause an air leak. When making connections to the bowl, hold the compression fitting with a wrench to prevent damage to the threads in the top of the bowl.

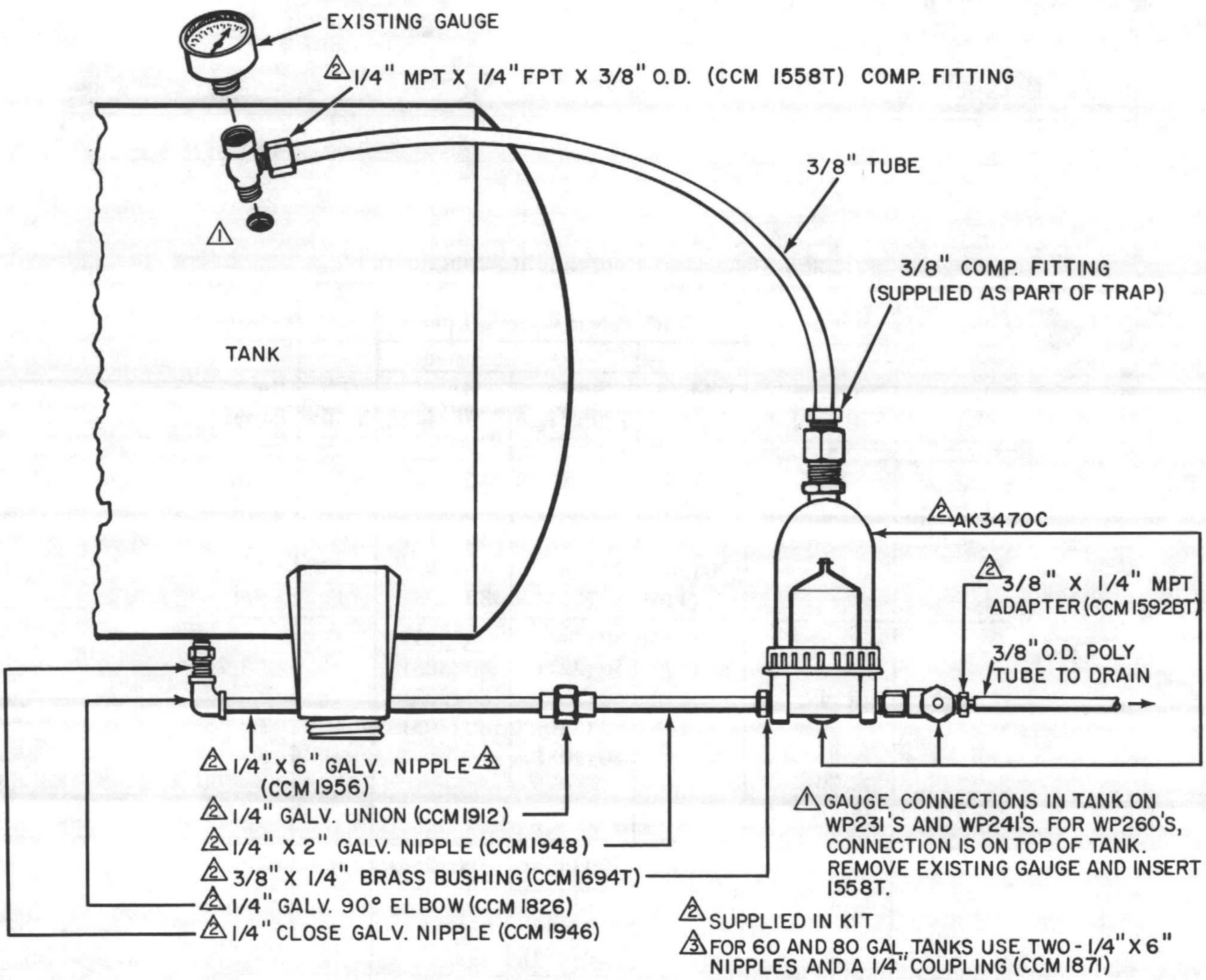


Fig. 1. AK3485E–for Compressors of 3/4 HP or Less.

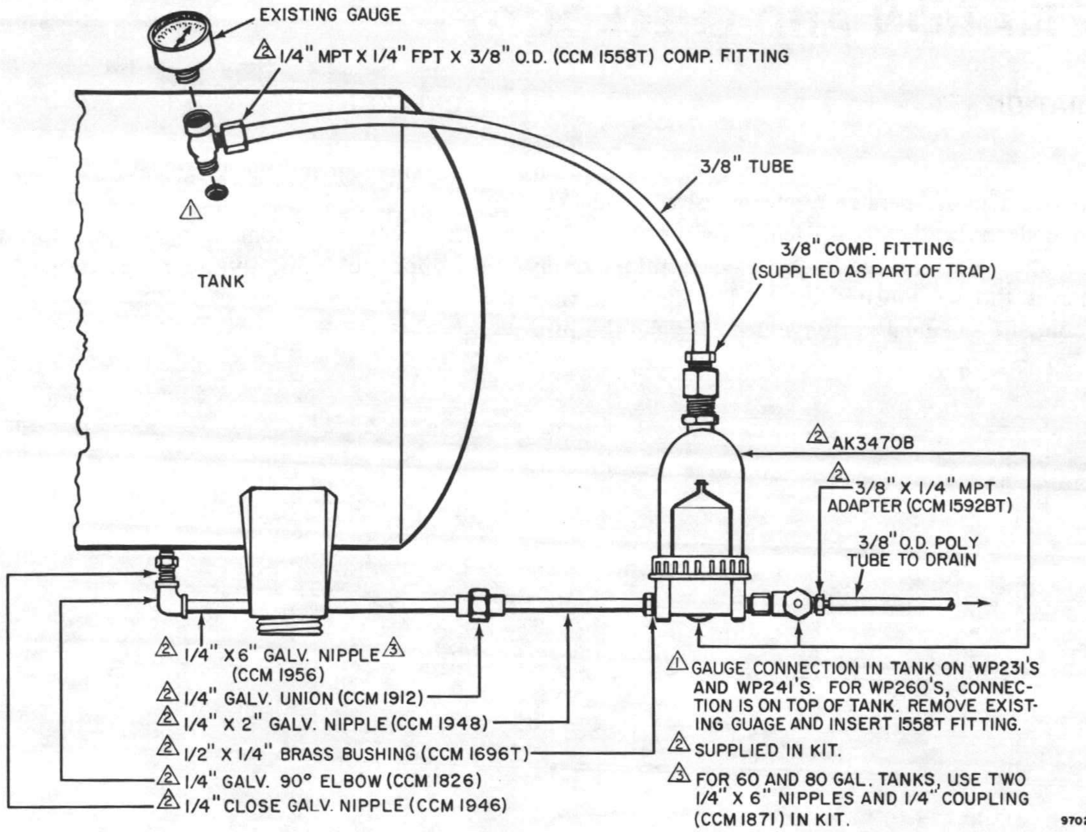


Fig. 2. AK3485D–for Compressors of 1 HP or More with Tanks No Larger Than 80 Gallons (303 Liters).

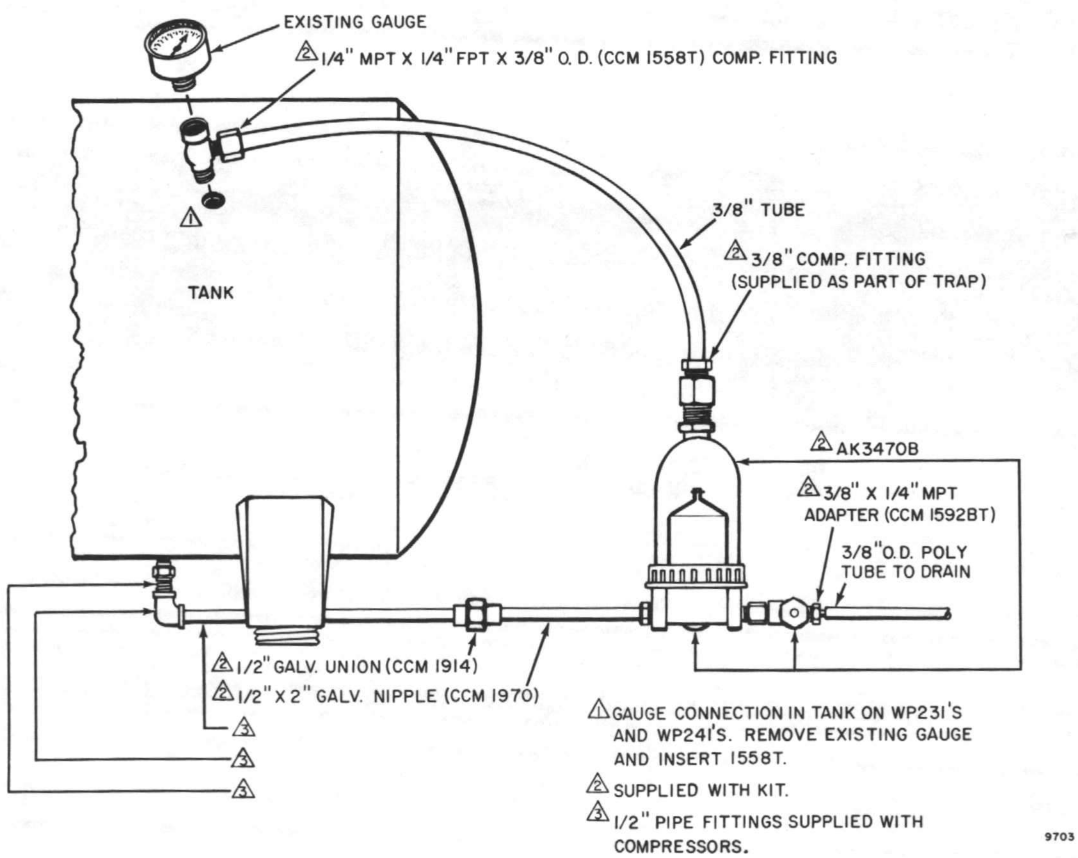


Fig. 3. AK3485F–for Compressors of 1 HP or More with Tank Sizes of 120 or 200 Gallons (454 or 757 Liters).

OPERATION AND CHECKOUT

OPERATION

The trap consists of two components; a float mechanism and a pilot operated discharge valve. Condensate liquid collects in the transparent bowl until the float rises to the predetermined level. The valve automatically discharges the accumulated liquid. The discharge valve also contains a manual button which overrides the automatic operation.

CHECKOUT

1. Apply air and check for leaks.

2. Check for automatic operation. Operating manually does not insure automatic operation.

Honeywell

Comfort Control Systems

LP914A & LP915A PNEUMATIC TEMPERATURE SENSORS

Service Data

GENERAL

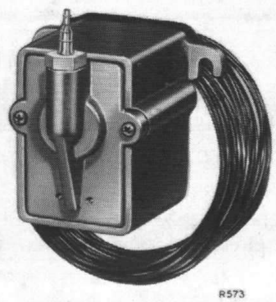
DESCRIPTION

The LP914A and LP915A Sensors are direct acting, proportional-type for use with a pneumatic receiver controller in HVAC systems to control valves and dampers.

The LP914A has a rod and tube insertion element for duct, well, or wall mounting.

The LP915A has a liquid-filled averaging element for duct mounting.

LP914



LP915

APPLICATION

LP914A

Figure 1 shows a typical application of duct-mounted LP914A.

LP915A

The liquid filled element of the LP915A is mounted in a duct with capillary clips to sense average air temperature in HVAC systems.

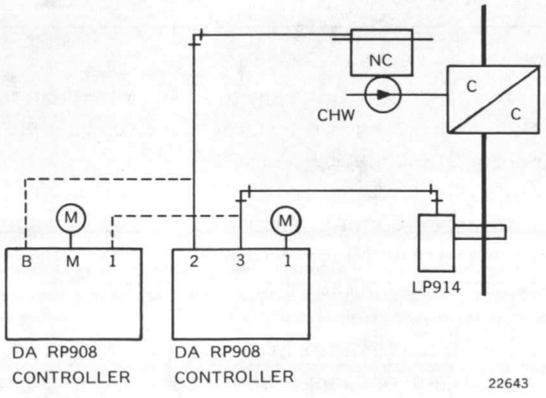


Fig. 1. LP914A Typical Duct-Mounted Application.

Table 1. Model No., Sensing Range, and Element Length.

Model No.	Sensing Range, F (C)	Element Length in. (mm)	Mounting
LP914A1003	-40 to 160 (-40 to 71)	15 (381)	duct
LP914A1011	-40 to 160 (-40 to 71)	12 (305)	wall
LP914A1029	40 to 240 (5 to 115)	15 (381)	well
LP914A1037	-40 to 160 (-40 to 71)	15 (381)	well
LP914A1045	-40 to 160 (-40 to 71)	6-1/2 (165)	duct
LP914A1052	40 to 240 (5 to 115)	6-1/2 (165)	well
LP914A1060	-40 to 160 (-40 to 71)	6-1/2 (165)	well
LP914A1110	-20 to 80 (-30 to 30)	15 (381)	well
LP914A1144	25 to 125 (-5 to 55)	15 (381)	duct
LP914A1243	-20 to 80 (-30 to +30)	15 (381)	duct
LP914A1250	-20 to 80 (-30 to +30)	12 (305)	wall
LP914A1268	40 to 240 (5 to 115)	15 (381)	duct
LP915A1044	0 to 200 (-18 to 93)	240 (6096)	duct
LP915A1051	0 to 200 (-18 to 93)	104 (2642)	duct
LP915A1077	30 to 130 (1 to 54)	240 (6096)	duct

SPECIFICATIONS

MODELS: See Table 1.

SENSING RANGE (Non-Adjustable): See Table 1.

MAXIMUM SAFE TEMPERATURE AT ELEMENT:
LP914A: 265F (129C).
LP915A: 225F (107C).

SUPPLY AIR PRESSURE: 18 psi (124 kPa).

MAXIMUM SAFE AIR PRESSURE: 25 psi (172 kPa).

PRESSURE OUTPUT: 3 to 15 psi (31 to 103 kPa).

AIR CONSUMPTION: 0.021 scfm (9.9 ml/s).

AIR CONNECTIONS: Push-on barb fitting for 5/32 and 1/4 in. (4 and 6 mm) O.D. tubing.

OPERATION

Operation is similar for both the LP914 and LP915. An increase in temperature at the sensing element (rod or capillary) causes a proportional increase in branchline pressure to the controller. For example, using the typical application shown in Figure 1, as branchline pressure from the controller to the n.c. valve increases, chilled water is circulated through the cooling coil. A decrease in temperature causes a decrease in branchline pressure proportionately and closes the valve.

MAINTENANCE

EQUIPMENT REQUIRED

Commercial cleaning solvent.

CLEANING

Remove any accumulated dust or dirt with a soft brush. A commercial cleaning solvent may be used if needed.

⚠WARNING⚠

Special care should be taken using solvents. Avoid prolonged inhalation and/or contact with skin. Careless handling can result in damage to the respiratory system and skin tissue.

OPERATIONAL CHECK

A quick operational check may be performed by raising the temperature at the sensing element. The output pressure should increase. Lower the temperature and the output pressure should decrease.

ADJUSTMENT AND CALIBRATION

The LP914 and LP915 are factory calibrated and require no adjustment.

CAUTION

1. Do not remove the cover of the sensor or tamper with sensor in any way.
2. Take care to prevent the sensor element from being dented or damaged.

TROUBLESHOOTING

Sensors are factory calibrated and cannot be recalibrated in the field.

If a sensor is applied to be read over a large range, such as outside air, then check the temperature(s) that is critical to the application.

1. Take accurate reading of temperature at sensing element.
2. Read sensor temperature at receiver gage. If difference in readings is unacceptable, adjust gage to read the same as the sensed temperature.
3. If not possible to adjust gage to the sensed temperature, place a known accurate receiver gage in the sensor branch line.
4. Change the temperature of the sensor element by heating or cooling, then allow sensor to slowly return to original temperature.
5. If sensor temperature as read at the gage is too high, replace the sensor.
6. If sensor temperature as read at the gage is too low, inspect and/or change sensor filters and the restriction that feeds the sensor. If the problem cannot be corrected, replace the sensor.

REPAIR

The only repair recommended for either the LP914 or LP915 is periodic replacement of the filters and screen for both the LP914 and LP915, and the gasket for the duct mounted LP915. This is shown in Figure 2 in the PARTS AND ACCESSORIES section. Device replacement is recommended for any operational problems or damage to the device.

REPLACEMENT OF FILTERS AND SCREEN

1. Shut off system air and remove barb fitting from sensor.
2. Remove and discard filters and screen. Replace with new parts.
3. Connect barb fitting and turn on system air.
4. Perform operational check.

REPLACEMENT OF GASKET (LP915)

1. Shut off system air and remove mounting screws (3) from LP915.
2. Remove gasket and replace with new part.
3. Turn on system air and perform operational check.

PARTS AND ACCESSORIES

PARTS LIST

Table 2. LP914A and LP915A Repair Parts List (Fig. 2).

Key	Part No.	Description
1	316429	Filter
2	309379	Screen
3	315602	Filter
4	315597	Gasket (LP915)
5		Screw, Slotted Hex-Head Drill Point. LP914 (2), LP915 (3)

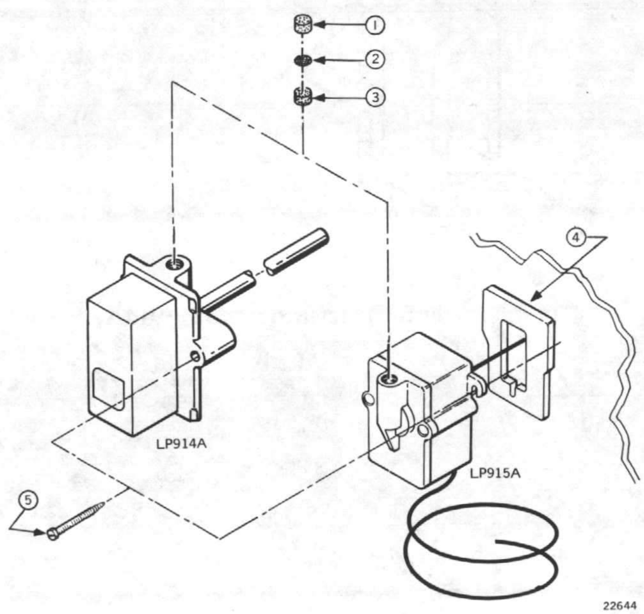


Fig. 2. LP914A and LP915A Replacement Parts (Table 1).

ACCESSORIES

1. Wells (LP914A):
   - Copper:
     - 315046A — 15-3/8 in. (385 mm) long.
     - 315046B — 7-3/8 in. (187 mm) long.
   - Stainless Steel:
     - 315904A — 15-5/16 in. (389 mm) long.
     - 315904B — 7-5/16 in. (186 mm) long.
2. Averaging Element Clip 314439 — LP915A (Fig. 3).
3. Gasket 315182 — duct-mounted LP914A (Fig. 4).
4. Outdoor Bulb Shield 311085-00107 — wall-mounted LP914A (Fig. 5).
5. Bracket 315114 — wall-mounted LP914A (Fig. 5).
6. Bracket 315115-00062 — well-mounted LP914A (Fig. 6).

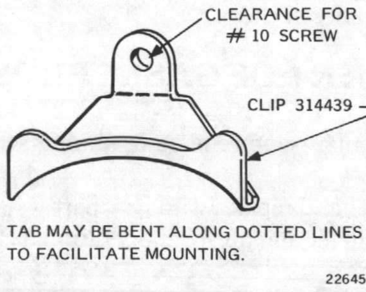


Fig. 3. Capillary Clip for Duct-Mounted LP915A.

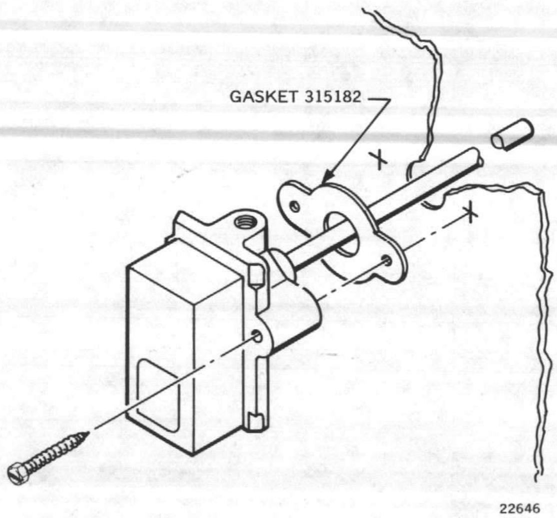


Fig. 4. Gasket for Duct-Mounted LP914A.

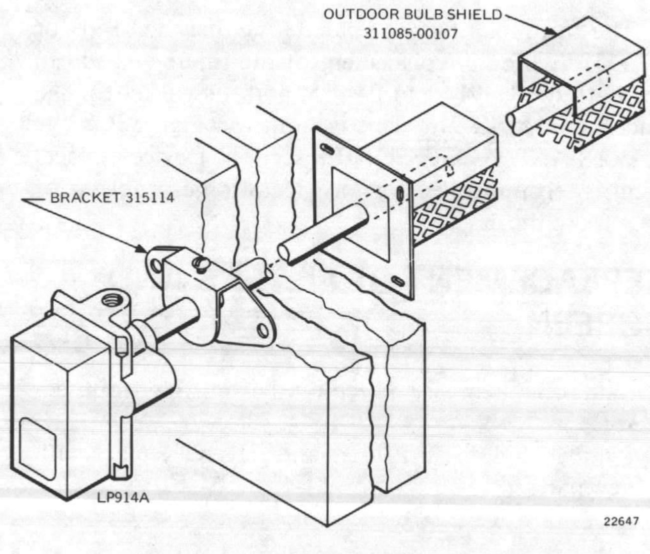


Fig. 5. Outdoor Bulb Shield and Bracket for Wall-Mounted LP914A.

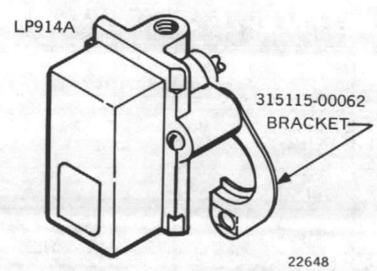


Fig. 6. Bracket for Well-Mounted LP914A.

Honeywell

Limit Controls

MODEL NUMBER L4029E, F

General

The L4029E and F Reset Limit Controls open a line or low voltage circuit if the air temperature reaches a critical level at controller location. The primary usage of the L4029 is as a fire thermostat in the ductwork of air conditioning and ventilating systems. It is also suitable for use with any warm air furnace to provide positive lockout of the burner in the event of fan failure.

Features

- If the circulated air reaches a temperature indicative of fire, the limit control shuts off the fan, preventing the fan from contributing to the spread of a fire.
- Internal snap-switch actuated by a bimetal strip inserted directly into the air stream responds rapidly to temperature changes.
- Requires manual reset.

Specifications

MODELS

L4029E: Manual Reset Limit Control with case and cover.

L4029F: Manual Reset Limit Control less case and cover.

CUTOUT SETTING (Fixed)

To break the circuit at 125, 135, 165, 200, or 240 F (52, 57, 73, 93, or 115 C).

ELECTRICAL RATINGS (in Amperes)

	30v AC	120v AC	240v AC
Full Load	2	10	5
Locked Rotor	--	60	30

0.25 amp full load at 0.25 to 12v DC.

SWITCH ACTION

Normally closed SPST, opens on temperature rise to setpoint. Switch must be manually reset to operate.

MAXIMUM AMBIENT TEMPERATURE

At switch: 190 F (88 C).

At bimetal: 350 F (176 C).

MANUAL RESET

Button through front cover. Must be pressed and released to remake switch after temperature falls approximately 25 degrees below the cutout point.

DIFFERENTIAL

Manual reset only, after approximately 25 F drop in temperature.

DIMENSIONS

See Figures 1 and 2.

ELEMENT INSERTION LENGTH

3 or 7 inches (76 or 178 millimeters)

MOUNTING MEANS

L4029E: Two screw holes are provided through back of case (see Fig. 1).

L4029F: Two screw notches are provided through the backplate (see Fig. 2).

Where there is no intake duct, the L4029E or F may be mounted on a suitable bracket so the air entering the fan is drawn across the element.

WIRING KNOCKOUTS (L4029E)

Bottom: for 1/2 inch conduit.

FINISH

Smooth gray.

UNDERWRITERS LABORATORIES, INC. LISTED

L4029E, File No. MP465 Guide No. MBPR.

UNDERWRITERS LABORATORIES, INC. COMPONENT RECOGNIZED

L4029F, File No. MP466 Guide No. MBPR.

WHEN ORDERING, SPECIFY

Model Number.
Element Length desired.
Cutout point desired.

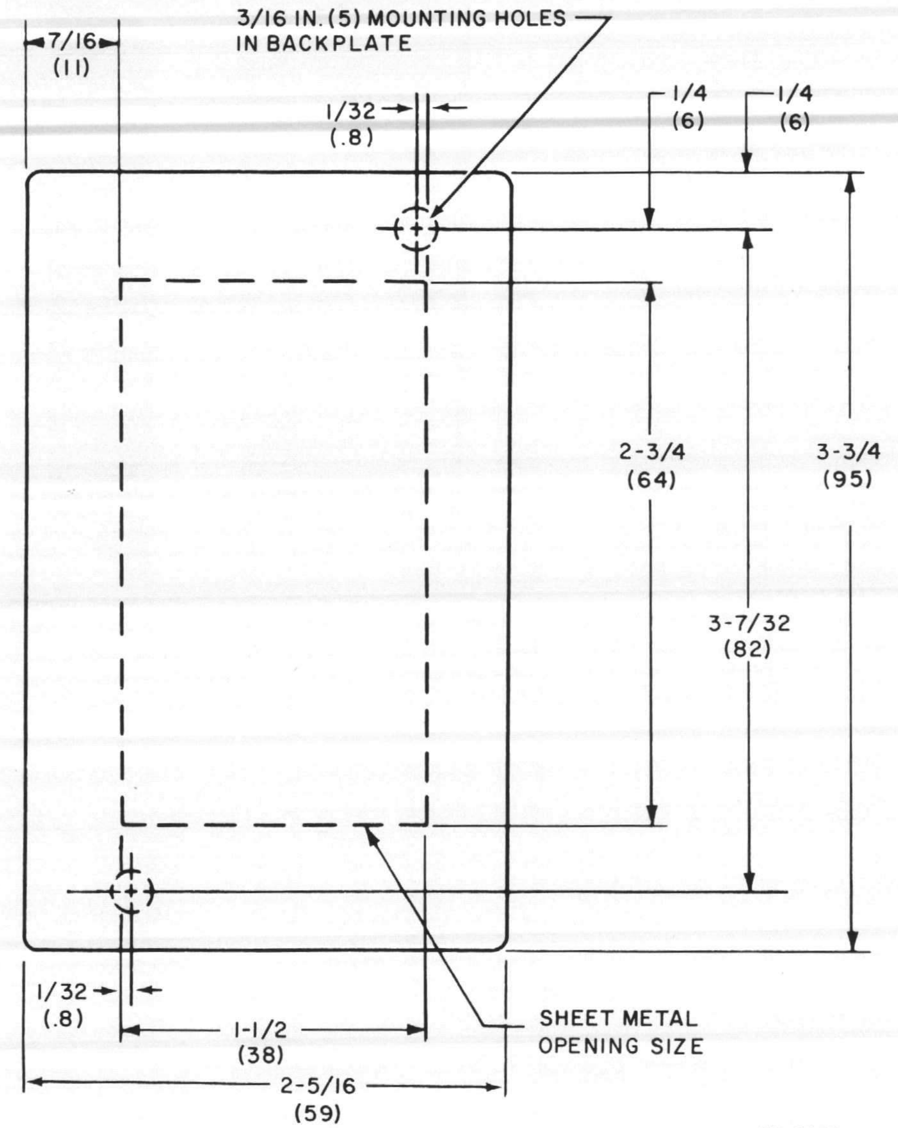


FIG. 1. L4029E DIMENSIONS IN INCHES (MILLIMETERS)

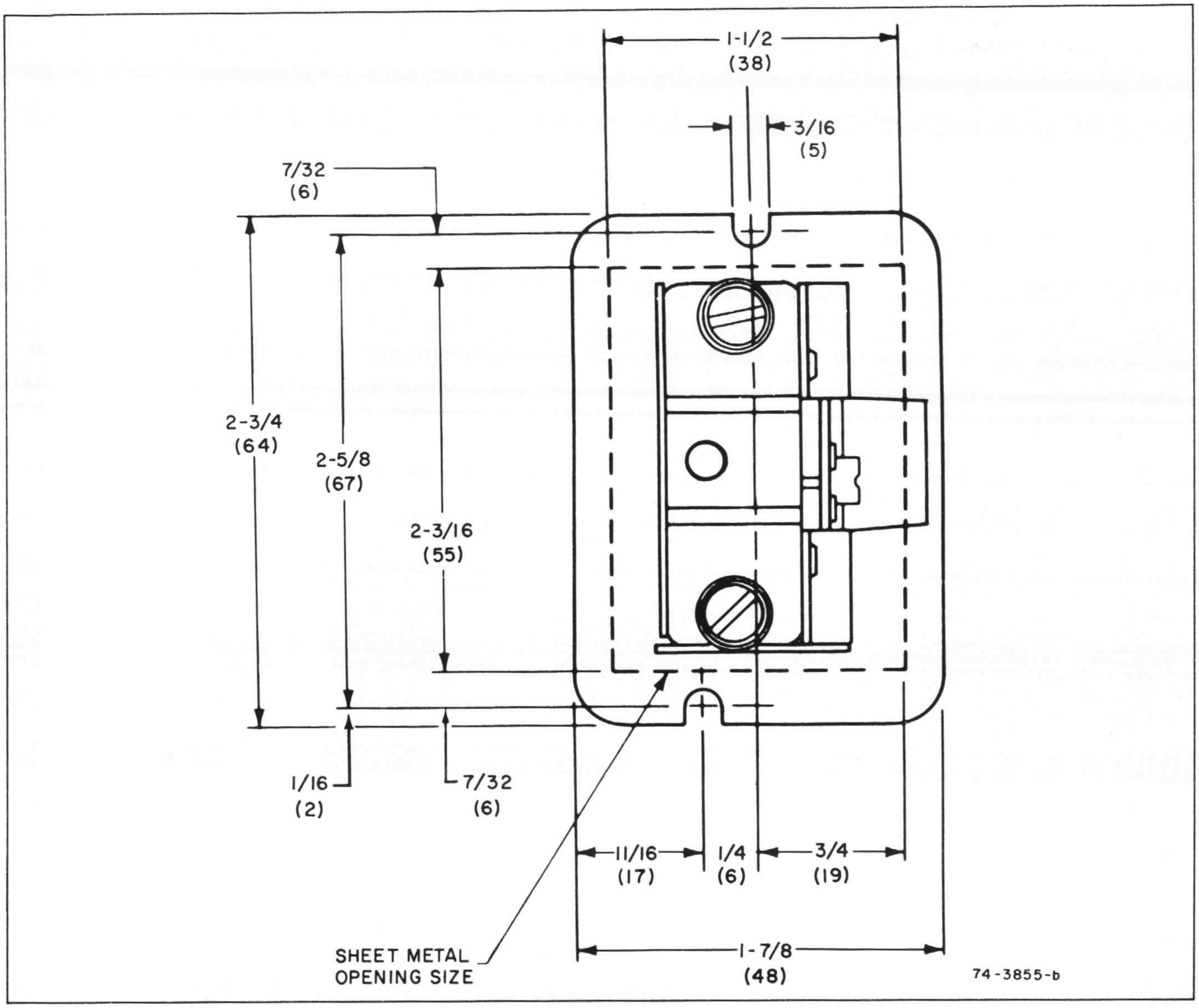


FIG. 2. L4029F DIMENSIONS IN INCHES (MILLIMETERS)

Typical Operation

Figure 3 shows the L4029E or F mounted in a ventilating or air conditioning system. The safety control is normally installed with element just upstream of fan, so the air is drawn across the element.

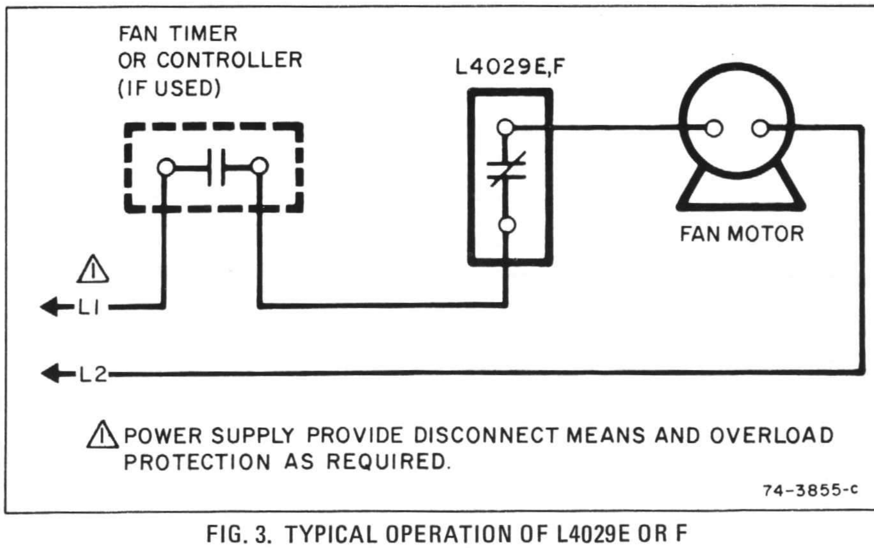


FIG. 3. TYPICAL OPERATION OF L4029E OR F

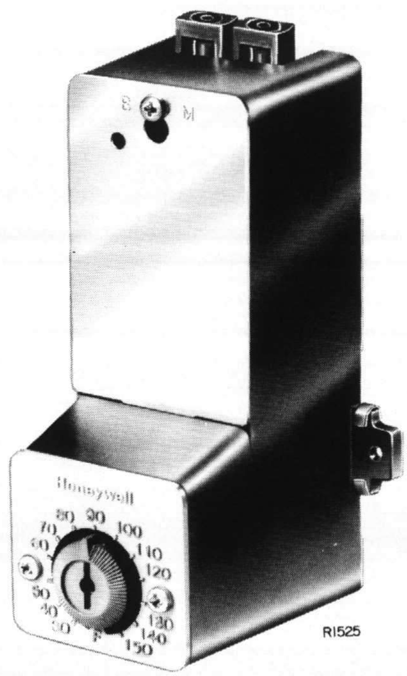
Honeywell

Remote Bulb Controller

MODEL NUMBER LP920A & B

General

The LP920 Remote Bulb Temperature Controller is a pneumatic single temperature controller with a high capacity valve and is available for direct or reverse action. It provides proportional control of pneumatic dampers and valves to regulate air or liquid temperature, sensed by an integral, liquid filled element. This remote temperature sensing element permits instrument location where it's easily accessible.



Features

- Fahrenheit or Celsius scales for all adjustments.
- Direct or reverse acting models.
- Adjustable setpoint and throttling ranges.
- Scales in bold type for high visibility.
- Replaceable filter cartridge.
- Single point or averaging elements.

Specifications

MODELS

☐LP920A: Direct Acting
☐LP920B: Reverse Acting

SETPOINT RANGE

35 to 150 F (1.7 to 66 C)

THROTTLING RANGE

5 to 25 F (3 to 15 C). Factory set at 10 F (6 C). Scale marked for 5, 10, 15, 20, 25 F (3, 6, 9, 12, 15 C).

MAXIMUM SAFE AIR PRESSURE

30 psi (210 kPa)

MAXIMUM SAFE TEMPERATURE

Element: 230 F (110 C)
Controller: 150 F (66 C)

MINIMUM OPERATING TEMPERATURE

Controller: 35 F (1.7 C)

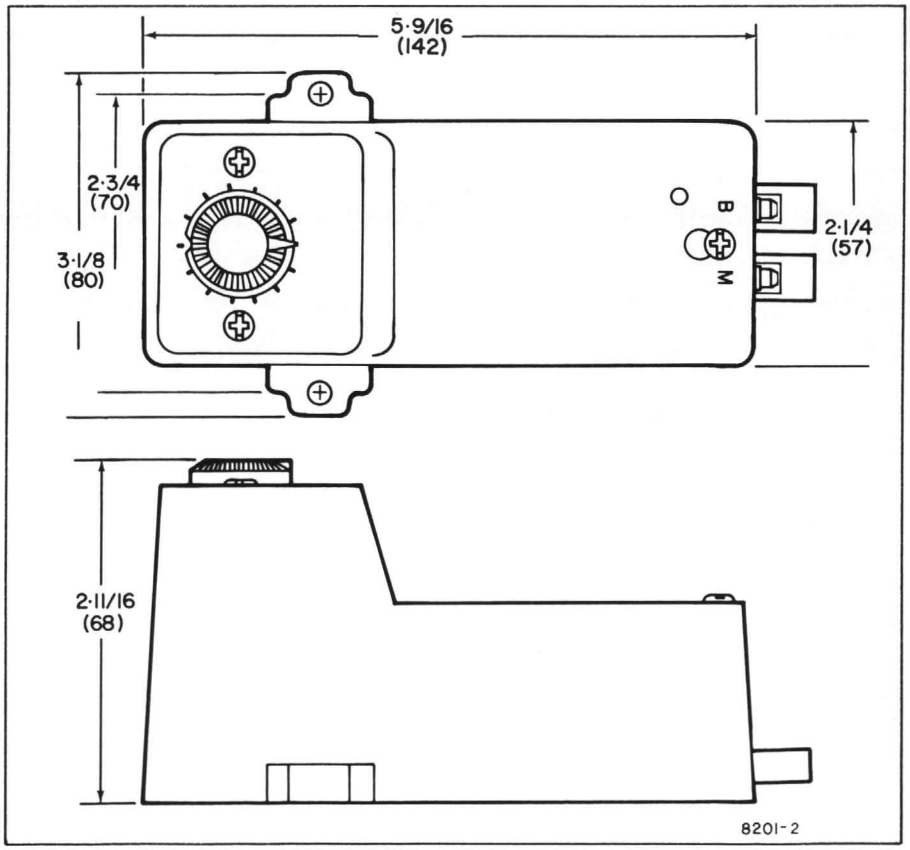


FIG. 1. LP920 DIMENSIONS IN INCHES (MILLIMETERS)

Rev. 5-79

Form Number 77-9873
Commercial Div.
MLF TAB: II. C. 2. b.

NOMINAL SUPPLY AIR PRESSURE
18 psi (125 kPa)

BRANCH LINE PRESSURE OUTPUT
3 to 13 psi (20 to 90 kPa)

AIR CONSUMPTION
.011 SCFM (.005 l/s)

ELEMENTS

- ☐ 8 ft (2.44 m) averaging capillary (Fig. 2a).
- ☐ 3 in. (76 mm) capillary with 5-1/4 in. x 3/8 in. (133 mm x 9.5 mm) dia bulb for well mounting (Fig. 2b).
- ☐ 10 in. (254 mm) capillary with 5-1/4 in. x 3/8 in. (133 mm x 9.5 mm) dia bulb for integral duct mounting (Fig. 2c).
- ☐ 5 ft (1.52 m) capillary with 5-1/4 in. x 3/8 in. (133 mm x 9.5 mm) dia bulb for remote bulb duct mounting (Fig. 2d).

DIMENSIONS
Refer to Figure 1.

AIR CONNECTIONS
Two barbs to fit 1/4 in. (6 mm) polyethylene tubing, marked for main and branch lines ("M" and "B").

FINISH AND MATERIAL
Aluminum with corrosion resistant anodized finish. Plastic knob and scaleplate.

ACCESSORIES
Wells: No. 315046B 7-3/8 in. (187 mm) copper, No. 315904B 7-5/16 in. (186 mm) stainless steel. Wells have 1/2 in. NPT pipe threads.

Duct Mounting Clip for Averaging Capillary: No. 314439.

WHEN ORDERING SPECIFY
Model Number Accessories.

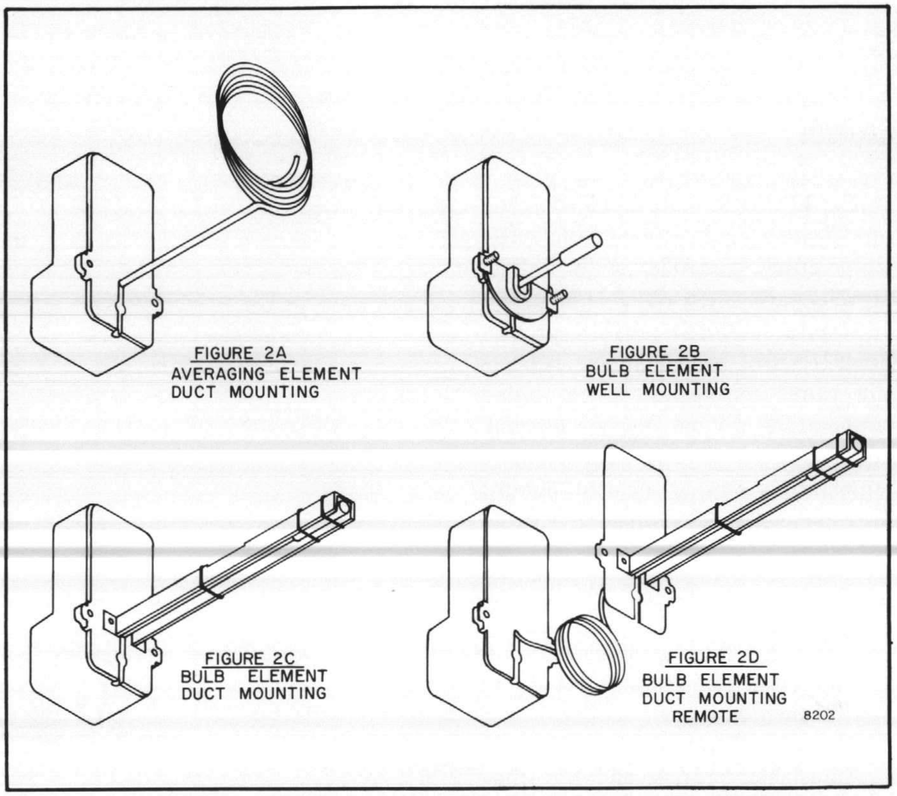


FIG. 2A-D. LP920 ELEMENTS AND MOUNTING HARDWARE

Honeywell

V5011A-E Single Seated Valves

R3300

GENERAL

V5011 single-seated, two-way, straight-through valves provide proportional control of steam, liquids, air, or other noncombustible gases in HVAC systems requiring tight shutoff. They are available in bronze bodies with screwed NPT end connections or cast iron bodies with flanged end connections.

FEATURES

- Direct or reverse acting
- Stainless steel stem with removable teflon or composition disc
- Self-adjusting, spring-loaded packing material to suit application
- Bronze, brass, or stainless steel plugs provide equal percentage or linear flow characteristics
- High pressure models available
- Stainless steel, metal-to-metal seating available in smaller valve sizes
- Suitable for pneumatic or electric/electronic (Modutrol motor or Versadrive) actuation with proper linkage
- Repacking kits available for field servicing

DESCRIPTION

V5011 single-seated, two-way, straight-through valves provide proportional control of steam, liquids, air, or other noncombustible gases in HVAC systems requiring tight shutoff.

SPECIFICATIONS

Models:
See Table 1

Flow Characteristics:
Equal Percentage or Linear. See Table 1 and Figure 1.

Dimensions:
See Table 2 and Figures 3 through 5

Close-off Ratings:
See Table 3 and Figure 10

Valve Pressure-Temperature Ratings:
See Figure 2

Stem Travel:
1/2- to 3-in. valves: 3/4-in. (19 mm)
4-, 5-, and 6-in. valves: 1-1/2 in. (38 mm)

Trim Materials:
Stem: Stainless Steel
Packing:
- Teflon cone for ANSI Class 125 flanged V5011A and ANSI Class 150 screwed V5011C valves
- Rubber or teflon/rubber for ANSI Class 150 screwed V5011A valves
- Teflon V-ring for ANSI Class 250 V5011D, E valves

Disc: Removable composition
Disc Holder:
- Screwed bodies—brass
- Flanged bodies—cast iron

Plug:
- Screwed bodies with composition disc—contoured brass
- Screwed bodies with metal-to-metal seating—contoured stainless steel
- Flanged bodies—V-ported, skirt guided bronze

Seat:
- Screwed bodies—brass (replaceable, screwed into body)
- Screwed bodies—metal-to-metal-stainless steel
- Flanged bodies—bronze (replaceable, screwed into body)

Body Materials:
Screwed end valves: Bronze
Flanged end valves: Cast iron

Valve Actuators:
V5011 valves require actuation provided by MP953s, Versadrives, or electric/electronic Modutrol motors as listed in Table 4. Refer to Figures 6 through 9 for actuator dimensions.

Accessories:
Actuator and linkage (refer to Valve/Actuator Selection, Table 4).

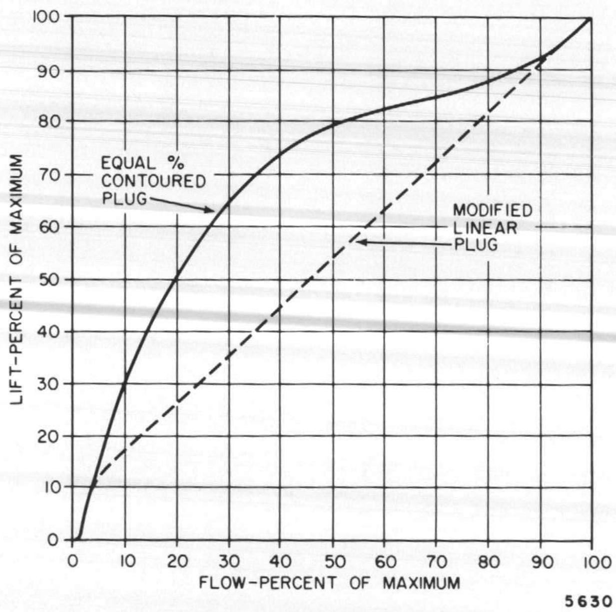
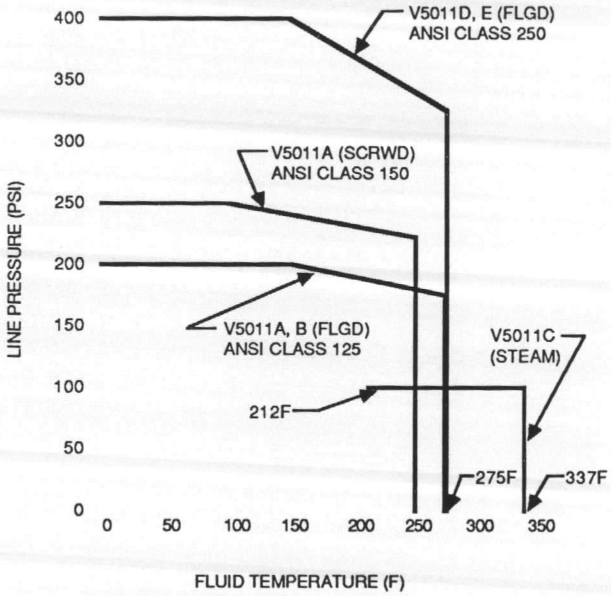


Fig. 1. Typical Flow Characteristics.



NOTES:
1. FOR HEATING FLUID TEMPERATURES, THE VALVE AND/OR PIPING SHOULD BE INSULATED TO PREVENT AMBIENT TEMPERATURES FROM EXCEEDING ACTUATOR RATINGS.
2. MAXIMUM TEMPERATURE DIFFERENTIAL IN ALTERNATE HOT-COLD WATER USE, 140F.

C204

Fig. 2. Valve Pressure-Temperature Ratings.

Table 1. Model Descriptions and Body Specifications.

√	Model and Plug Characteristic	Action ⚠1	End Connections	Body Size in Inches	Capacity Index (C_V) ⚠2	ANSI Body Class
	V5011A Equal Percentage V5011C Linear	Direct	Screwed NPT	1/2	0.4, 0.63, 1.0, 1.6, 2.5, 4.0	150
				3/4	6.3	
				1	10.0	
				1-1/4	16	
				1-1/2	25	
				2	40	
				2-1/2	63	
				3	100	
	V5011A Equal Percentage	Direct	Flanged	2-1/2 or 3	63; 2-1/2 in. 100; 3 in.	125
	V5011D Equal Percentage					250
	V5011A Equal Percentage	Direct	Flanged	4, 5, or 6	160; 4 in. 250; 5 in. 360; 6 in.	125
	V5011B Equal Percentage	Reverse				
	V5011D Equal Percentage	Direct				250
	V5011E Equal Percentage	Reverse				

⚠1 Direct: stem down to close.
Reverse: stem up to close.

⚠2 0.4 C_V available only on V5011C

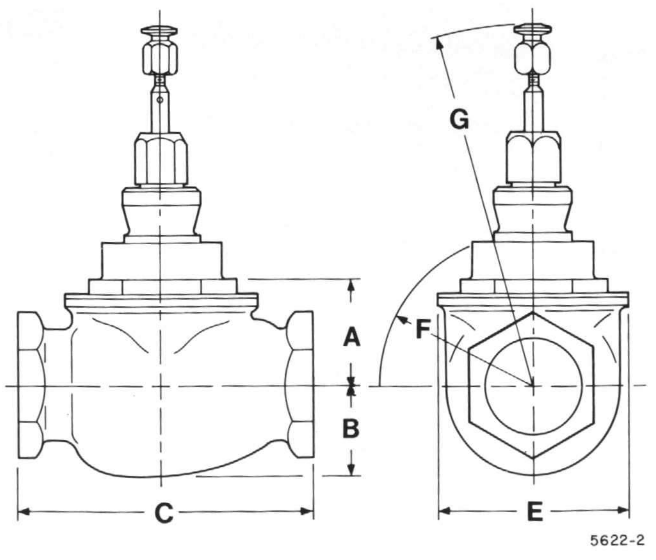


Fig. 3. V5011A and C Screwed, Direct Acting Body Dimensions.

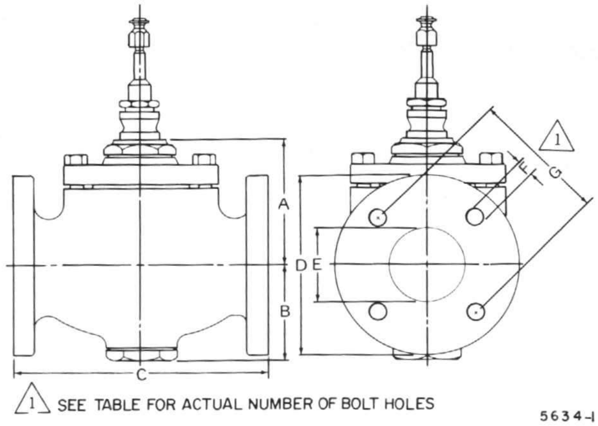


Fig. 4. V5011A and D Flanged Body Dimensions.

Table 2. V5011A-E Approximate Dimensions in Inches (Millimeters).

Model and Figure Reference	Valve Size (in.)	A	B	C	D	E	F	G	No. of Flange Bolt Holes
V5011A & C	1/2	2 (51)	1-3/4 (44)	3-3/8 (86)	—	1-13/16 (46)	1-5/8 (41)	5 (127)	—
Screwed,	3/4	1-7/8 (47)	1-3/4 (44)	3-1/2 (89)	—	1-13/16 (46)	1-5/8 (41)	5 (127)	—
Direct Body	1	2 (51)	1-5/8 (41)	4-3/8 (111)	—	1-15/16 (49)	1-3/4 (44)	5-1/8 (130)	—
(Fig. 3)	1-1/4	2-3/16 (56)	1-1/2 (38)	5 (126)	—	2-9/16 (65)	1-15/16 (49)	5-5/16 (135)	—
	1-1/2	3 (76)	1-3/8 (35)	5-3/4 (146)	—	3-9/16 (90)	2-11/16 (68)	5-7/16 (138)	—
	2	3-1/4 (83)	2 (51)	5-3/4 (146)	—	3-9/16 (90)	2-5/16 (58)	5-11/16 (144)	—
	2-1/2	2-13/16 (71)	2-3/8 (60)	7-1/2 (194)	—	4-3/8 (104)	3-1/16 (77)	5-15/16 (151)	—
	3	3-1/4 (83)	2-3/8 (60)	8-7/8 (226)	—	4-15/16 (125)	3-5/8 (92)	6-3/8 (162)	—
V5011A	2-1/2	4-13/16 (122)	4 (102)	9-1/2 (241)	7 (178)	2-1/2 (63)	3/4 (19)	5-1/2 (140)	4
Flanged,	3	5-3/8 (136)	4-5/8 (117)	11 (279)	7-1/2 (190)	3 (76)	3/4 (19)	6 (152)	4
Direct Body	4	7-9/16 (192)	5-3/16 (132)	13 (330)	9 (229)	4 (102)	3/4 (19)	7-1/2 (190)	8
(Fig. 4)	5	7 (178)	6-1/8 (155)	15 (381)	10 (254)	5 (127)	7/8 (22)	8-1/2 (215)	8
	6	8 (203)	7-1/16 (179)	16-1/2 (419)	11 (279)	6 (152)	7/8 (22)	9-1/2 (241)	8
V5011B	4	4-11/16 (119)	8-1/16 (205)	13 (330)	9 (229)	4 (102)	3/4 (19)	7-1/2 (190)	8
Flanged,	5	5-5/8 (143)	7-1/2 (190)	15 (381)	10 (254)	5 (127)	7/8 (22)	8-1/2 (215)	8
Reverse Body	6	6-9/16 (167)	8-1/2 (216)	16-1/2 (419)	11 (279)	6 (152)	7/8 (22)	9-1/2 (241)	8
(Fig. 5)									
V5011D	2-1/2	4-13/16 (122)	3-3/4 (95)	11-1/2 (292)	7-1/2 (178)	2-1/2 (63)	7/8 (22)	5-7/8 (149)	8
Flanged,	3	5-3/8 (136)	4-1/4 (108)	12-1/2 (317)	8-1/4 (209)	3 (76)	7/8 (22)	6-5/8 (168)	8
Direct Body	4	7-9/16 (192)	5 (127)	14-1/2 (368)	10 (254)	4 (102)	7/8 (22)	7-7/8 (200)	8
(Fig. 4)	5	7 (178)	5-1/2 (140)	16-3/4 (425)	11 (279)	5 (127)	7/8 (22)	9-1/4 (235)	8
	6	8 (203)	6-1/4 (159)	18-5/8 (473)	12-1/2 (318)	6 (152)	7/8 (22)	10-5/8 (270)	12
V5011E	4	4-3/4 (120)	7-5/16 (186)	14-1/2 (368)	10 (254)	4 (102)	7/8 (22)	7-7/8 (200)	8
Flanged,	5	5-3/4 (146)	6-3/4 (171)	16-3/4 (425)	11 (279)	5 (127)	7/8 (22)	9-1/4 (235)	8
Reverse Body	6	6-11/16 (170)	7-7/8 (200)	18-5/8 (473)	12-1/2 (318)	6 (152)	7/8 (22)	10-5/8 (270)	12
(Fig. 5)									

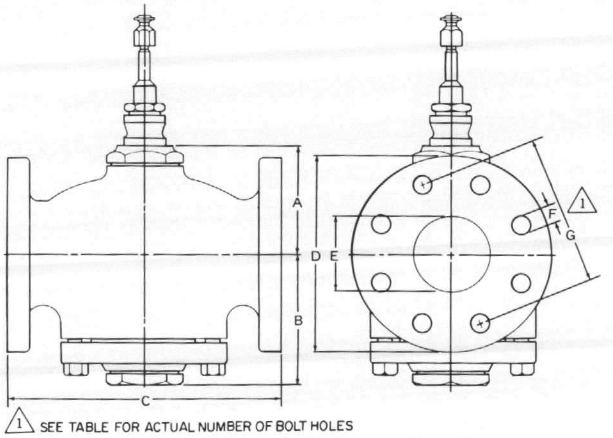


Fig. 5. V5011B and E Flanged Body Dimensions.

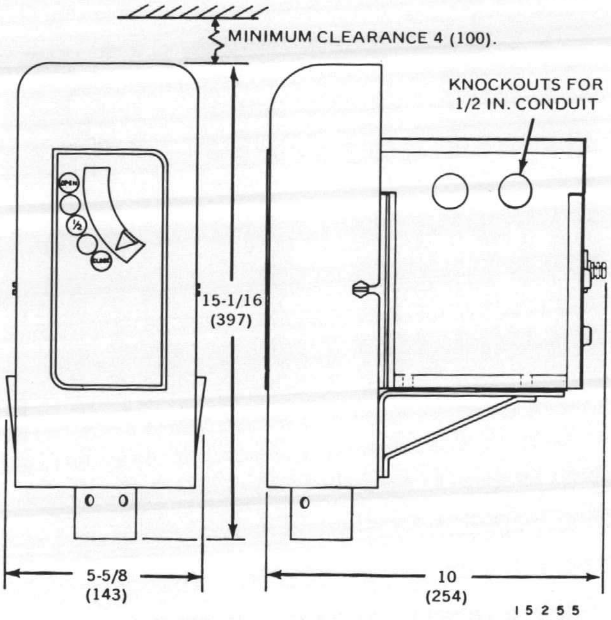
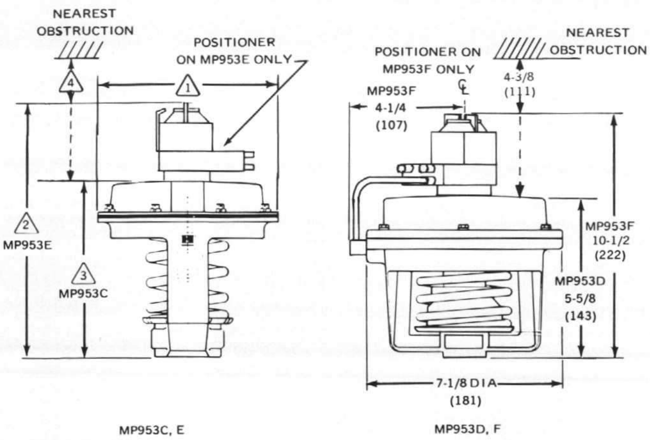


Fig. 6. Typical Electric/Electronic Actuator with Q601 Linkage Approximate Dimensions in Inches (Millimeters). M644 Shown.



OPERATOR SIZE NOMINAL DIA	△1	△2	△3	△4
5-INCH	5-1/8 (130)	9-1/4 (235)	4-5/8 (117)	4-3/8 (111)
8-INCH	8-1/4 (210)	11-1/8 (283)	6-1/2 (165)	5-3/8 (137)
13-INCH	13-1/2 (343)	18-1/8 (460)	10 (254)	7-11/16 (195)

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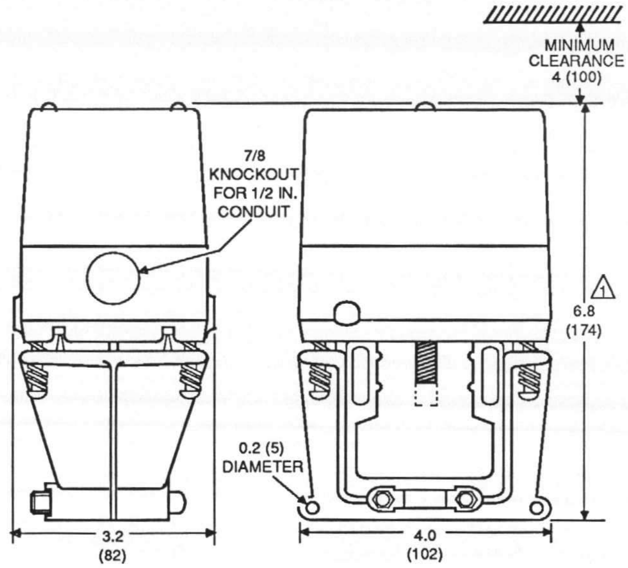
Fig. 7. MP953C-F Dimensions in Inches (Millimeters).



△1 DIMENSION IS FOR MLX84; MLX86 IS 7.8 (199) TO ALLOW FOR BATTERY.

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Fig. 9. Versadrive Actuator Dimensions in Inches (Millimeters).

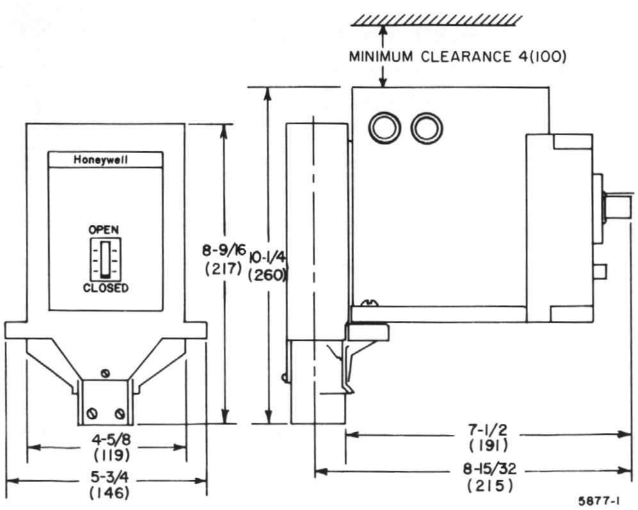


Fig. 8. Q618 Linkage with Modutrol Motor Approximate Dimensions in Inches (Millimeters). Motor shown is representative, other motors may vary in size.

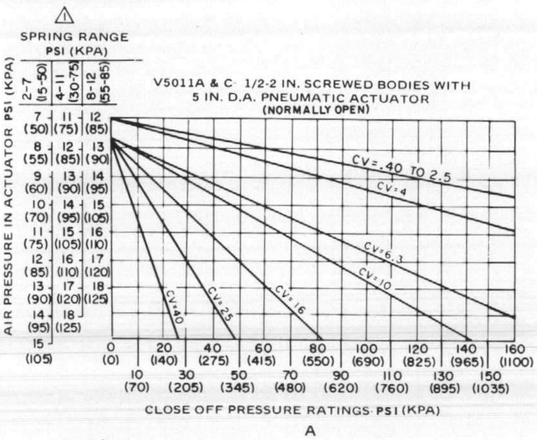
Table 3. Close-Off Ratings for V5011A-E Valves with Electric/Electronic Actuators.

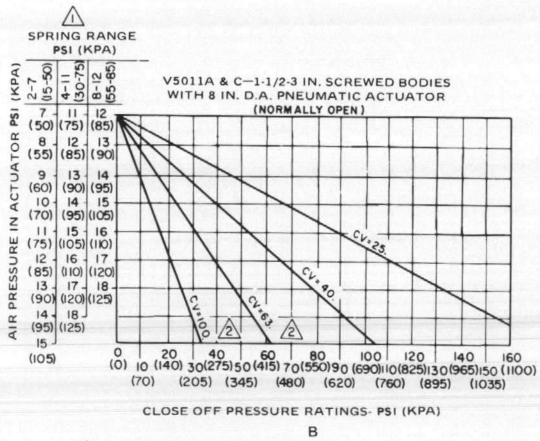
Model	Close-Off Ratings psi (kPa) Linkage Seal-Off Force 160 lb (711 N) △1	80 lb (356 N) △2	C_v	Size in Inches
V5011A&C Screwed Connections	150 (1034)	150 (1034)	0.40	1/2
			0.63	
			1.0	
			1.6	
			2.5	
			4.0	
	150 (1034)	122 (840)	16.3	3/4
	150 (1034)	106 (731)	10.0	1
	141 (970)	.60 (414)	16.0	1-1/4
	.91 (627)	.39 (269)	25.0	1-1/2
	.55 (379)	.22 (152)	40.0	2
	.32 (221)	.12 (83)	63.0	2-1/2
	.20 (138)	.8 (55)	100.0	3
V5011A&D Flanged	26 (179)	10 (69)	63.0	2-1/2
	20 (138)	.7 (48)	100.0	3
	10 (69) △3	—	160.0	4
	.6 (41) △3	—	250.0	5
	.4 (28) △3	—	360.0	6
V5011B&E Flanged	10 (69) △3	—	160.0	4
	.6 (41) △3	—	250.0	5
	.4 (28) △3	—	360.0	6

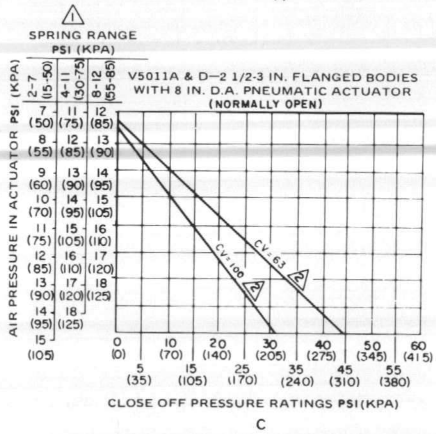
△1 160 lb—Q618A (160lb model); Q601E, J, K

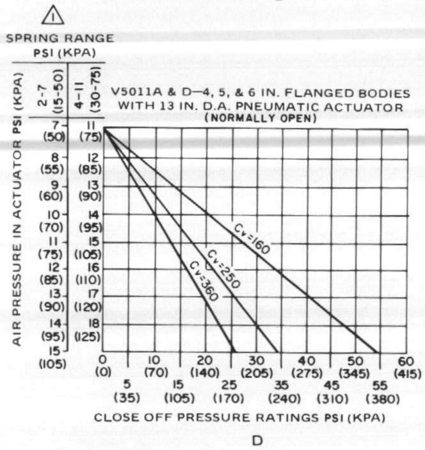
△2 .80 lb—Q618A (80lb model); Q610F, G, L, M; Versadrive

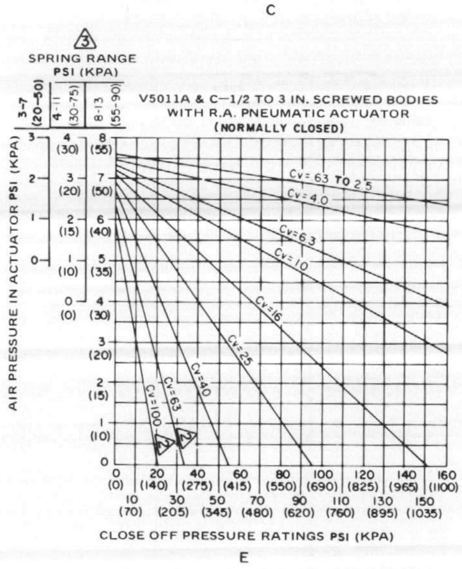
△3 160 lb—Q601E only

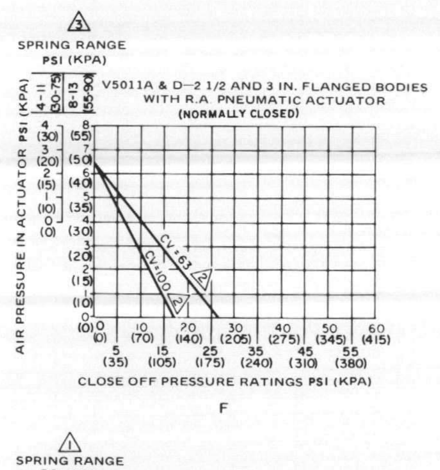


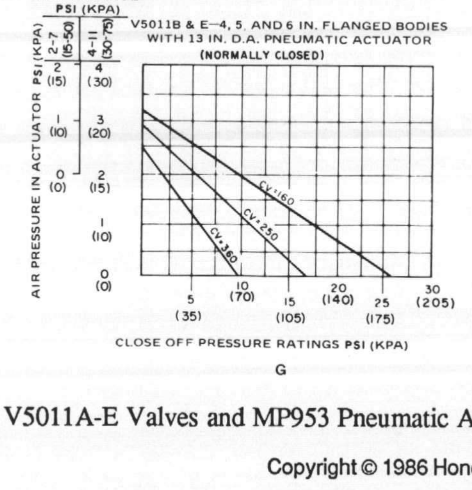












1. USE 4-11 PSI (30-75 KPA) RANGE FOR DETERMINING CLOSE OFF OF VALVES USED WITH MP953E.

2. DUE TO DIFFERENCES IN VALVE BODY CONSTRUCTION, SCREWED AND FLANGED PATTERNS HAVE DIFFERENT CLOSE-OFF RATINGS. THIS APPLIES TO 2-1/2 AND 3 IN. VALVE SIZES. SEE B, C, E, AND F.

3. USE 8-13 PSI (55-90 KPA) RANGE FOR DETERMINING CLOSE OFF OR VALVES USED WITH MP953F.

X1749-2

Fig. 10. Close-Off Pressures at Various Control Air Pressures for V5011A-E Valves and MP953 Pneumatic Actuators.

Table 4. Valve/Actuator Selection.

Model	Size in Inches	Cv	[1] Pneumatic Actuators	[2] Electric Actuators: Two-Position or Floating Non-Spring Return	[2] Electric Actuators: Two-Position Spring Return	[2] Electric Actuators: Proportional Non-Spring Return	[2] Electric Actuators: Proportional Spring Return	[2] Electronic Actuators: Proportional Non-Spring Return	[2] Electronic Actuators: Proportional Spring Return
V5011A	1/2	.63, 1.0, 1.6, 2.5, 4.0	A1, C1 A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	3/4	16.3							
	1	10							
	1-1/4	16							
	1-1/2	25							
	2	40	A1, C1						
	2-1/2	63							
	3	100	A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	2-1/2	63	A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	3	100	A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	4	160	A3, C3	F	*	K	*	*	*
	5	250	A3, C3	F	*	K	*	*	*
	6	360	A3, C3	F	*	K	*	*	*
V5011B	4	160	A3, C3	F	*	K	*	*	*
	5	250	A3, C3	F	*	K	*	*	*
	6	360	A3, C3	F	*	K	*	*	*
V5011C	1/2	.40, .63, 1.0, 1.6, 2.5, 4.0	A1, C1 A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	3/4	16.3							
	1	10							
	1-1/4	16							
	1-1/2	25							
	2	40	A1, C1						
	2-1/2	63							
	3	100	A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
V5011D	2-1/2	63	A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	3	100	A2, C2 B1, D1	E, F, or V	H or I	J, L, T, or W	M, N, or U	Q, R, or X	S
	4	160	A3, C3	F	*	K	*	*	*
	5	250	A3, C3	F	*	K	*	*	*
	6	360	A3, C3	F	*	K	*	*	*
V5011E	4	160	A3, C3	F	*	K	*	*	*
	5	250	A3, C3	F	*	K	*	*	*
	6	360	A3, C3	F	*	K	*	*	*

* Not recommended for tight close-off. Use pneumatic actuator.

[1] The MP953C-F are rolling type diaphragm actuators which provide proportional control of V5011 valves.

A1—MP953E D.A. 5 in. diameter with positioner.
A2—MP953E D.A. 8 in. diameter with positioner.
A3—MP953E D.A. 13 in. diameter with positioner.

B1—MP953F R.A. 7-1/8 in. diameter with positioner.

C1—MP953C D.A. 5 in. diameter without positioner.
C2—MP953C D.A. 8 in. diameter without positioner.
C3—MP953C D.A. 13 in. diameter without positioner.

D1—MP953D R.A. 7-1/8 in. diameter without positioner.

[2] Example Linkages:
Q601E1000—160 lb seal-off force.
Q618A1024—160 lb seal-off force.
Q618A1032—80 lb seal-off force.

Letter Designation	Use Motor Similar to:	With Linkage Similar to:
E	M644A	Q618A1024
F	M644C	Q601E1000
H	M845A	Q618A1032
I	M845E	Q618A1032
J	M944A	Q618A1024
K	M944C	Q601E1000
L	M934A	Q618A1032
M	M945A	Q618A1032
N	M945F	Q618A1032
Q	M734	Q618A1032
R	M744	Q618A1024
S	M745	Q618A1032
T	M954	Q618A1024
U	M955	Q618A1032
V	ML884 ML886	Linkage integral
W	ML984 ML986	Linkage integral
X	ML784 ML786	Linkage integral

Honeywell

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In Canada: Scarborough, Ontario MIP 2V9
Subsidiaries and Affiliates Around the World

Printed in USA

Rev. 9-86

Honeywell

Compressed Air Treatment Unit

MODEL NUMBER HKN8210

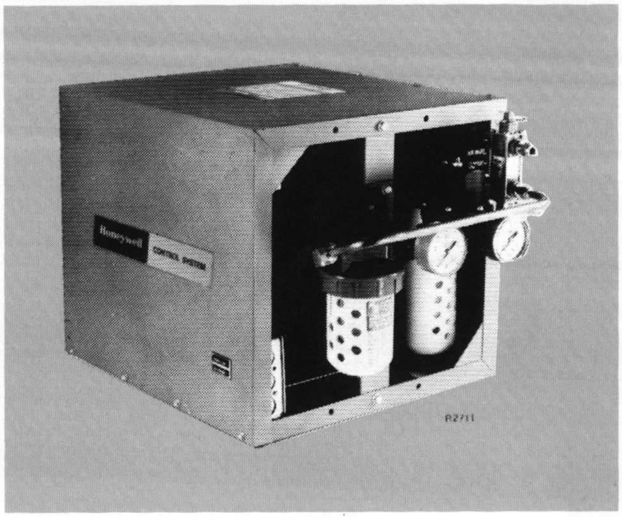
GENERAL

The HKN8210 Compressed Air Treatment Unit removes dirt, moisture, and oil from high-pressure compressed air, and reduces the main air pressure to meet control air system requirements.

The HKN8210B provides single-pressure supply.

The HKN8210C provides two-pressure supply.

All models include a refrigerated dryer, manual bypass valve, coalescing filter, regulator, operating status signal lights, and gages.



FEATURES

- Nonfouling, self-cleaning, smooth-surface heat exchangers for long service life.
- Noncycling hermetically sealed refrigeration unit.
- Refrigerant hot gas bypass valve for constant dew point control.
- Mechanical/coalescing type cleanable separator for complete moisture separation from the air.
- Operates efficiently from no flow to full flow.
- Three-micron replaceable filter with in-depth bed for long life (integral with separator).
- Automatic moisture drain.
- Power-on status light.
- High air temperature warning light.
- Wall mounting bracket assembly for easy installation.
- Six-foot power cord with grounded plug.
- One-piece dryer bypass valve for easy servicing.
- High efficiency coalescing type filter capable of removing oil aerosols and solid particles.
- Separator and filter bowl guards.
- Adjustable pressure regulator.
- Separately adjustable safety pressure and relief valve.
- Inlet and outlet pressure gages for pressure regulator.

SPECIFICATIONS

Air Capacity:
9.5 scfm maximum at 80 psig (552 kPa), and 100 F (38 C) inlet and 100 F (38 C) ambient.

Outlet Dew Point:
13 F (-11 C) at 20 psig (138 kPa) outlet (based on 80 psig [552 kPa] average inlet pressure and 37 F [3 C] dryer dew point setting).

Ambient Temperature:
120 F (49 C) maximum.

Inlet Pressure:
150 psig (1035 kPa) maximum; 60 psig (410 kPa) minimum.

Compressed Air Inlet Temperature:
120 F (49 C) maximum.

Electrical:
115V/60Hz/1ph, 1/6 hp, 0.25 kW power consumption.

Rev. 9-82

Form No. 77-9856
Commercial Bldg Group
MLF TAB: II. C. 9.

Shipping Weight:
66 lb.

Mounting:
Wall or floor mounted.

Filter Rating:
0.025 micron absolute; 99.999 + % efficiency.

Normal Remaining Oil Content:
0.1 ppm.

Dimensions:
See Figure 1.

Options:
1. Single- or two-pressure supply.
2. 220/240V/1ph, 50/60 Hz.
3. High altitude adjustment.
4. End screen(s).

When Ordering, Specify:
1. Model.
2. Options.

Compressed Airflow Schematic:
See Figure 2.

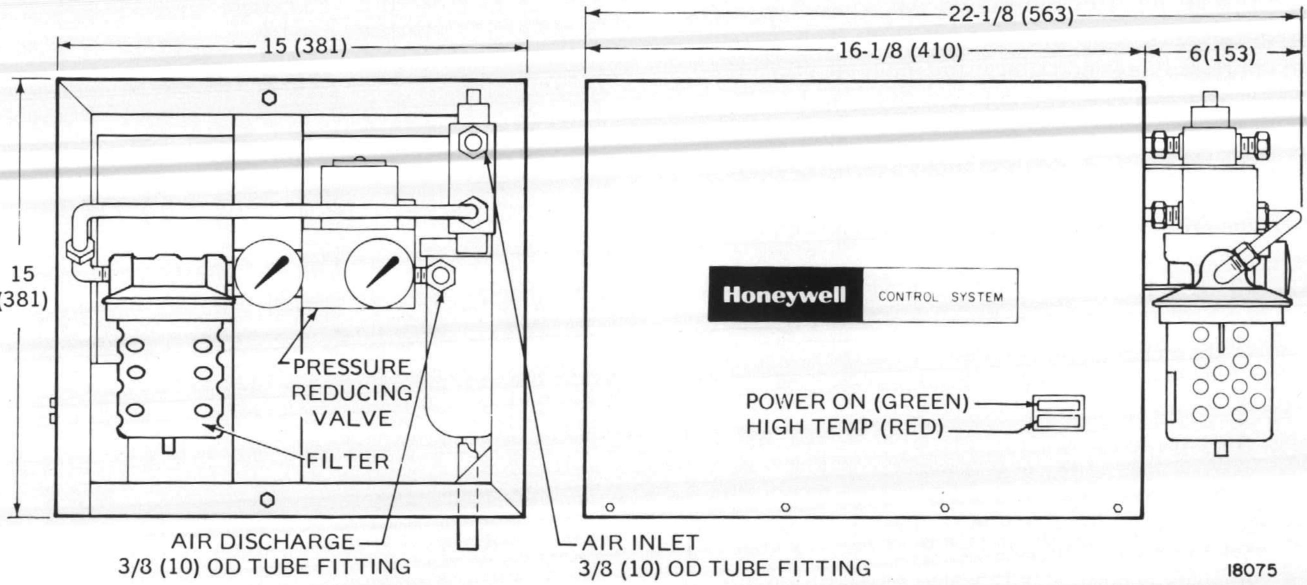


Fig. 1. HKN8210 Dimensions in Inches (Millimeters).

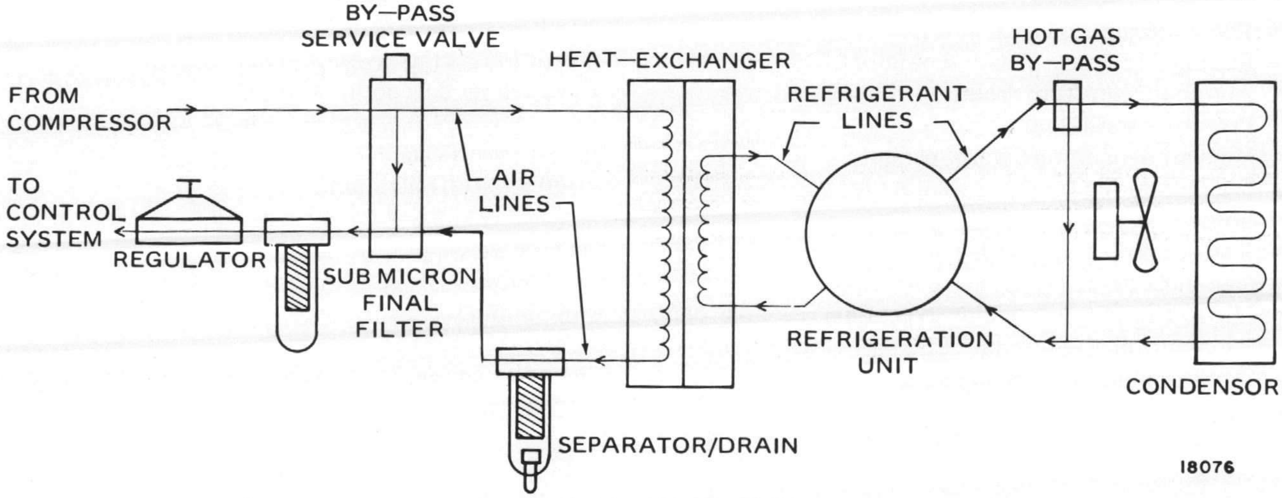


Fig. 2. Typical Operation.

TYPICAL OPERATION

The refrigerated air dryer removes moisture from compressed air by lowering the air temperature, which reduces the ability of the air to hold water. Water condensed from the air is removed by mechanical/coalescing action in the dryer separator, then discharged from the system by an automatic drain. Contaminants in the compressed air are partially removed by an in-depth type filter in the separator, then final filtered by the high efficiency coalescing filter. The coalescing filter also collects oil aerosols and removes the oil through a manual drain.

The pressure reducing valve reduces the clean, dry compressed air pressure to system needs. Used in two-pressure control systems (day-night or summer-winter), the pressure reducing valve furnishes either of two control pressures. Switchover from one pressure to the other is from an external two-position pneumatic or electric signal (not provided).

Honeywell

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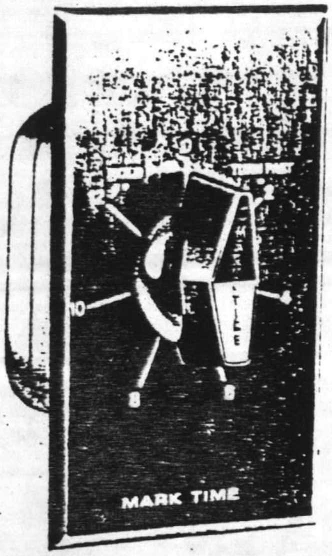
MARK-TIME

A COMPLETE LINE OF PORTABLE AND BUILT-IN TIME SWITCHES AND BELL TIMERS FOR HOME, INDUSTRY, AND OEM'S.

WALL BOX TIME SWITCHES



90000 Series-S.P.S.T.

The popular MARK-TIME 90000 Series automatically turns "OFF" ventilating fans, heaters, heat lamps, lights, and can operate as a thermostat bypass. Saves ENERGY, MONEY, and wear and tear of equipment. Adds convenience to installations in hotels, motels, hospitals, homes, schools, offices and industrial plants. As easy to install as a toggle switch. Individually packed with wood grain finish, metal calibrated switch plate, knob and mounting hardware.

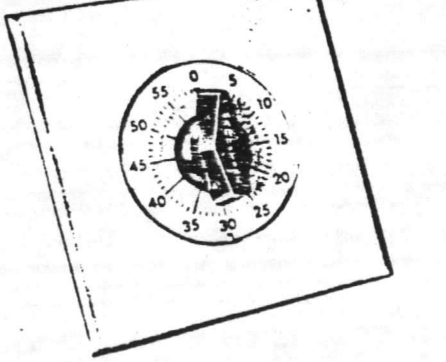
Hold Feature: Holds current "ON" without operation of timing mechanism; timing begins when knob is turned to a time period.

"OFF" type switch breaks circuit at end of time cycle.

"ON" type switch makes circuit at end of time cycle and is available on special order.

Cat. No.	Time Cycle	Gang Mounting Plates A	B	C	D	Notes
WITHOUT HOLD						
90004	0-5 min.	D14L	D14LB	D14LA	D517	Brushed Aluminum finished plates are also available to accommodate the time switch and (A) up to three Despard devices, (B) a toggle switch or (C) a duplex outlet. Adhesive backed MYLAR DIALS (D) are available to modify a standard gang switch plate.
90005	0-15 min.	D14J	D14JB	D14JA	D511	
90006	0-30 min.	D14G	D14GB	D14GA	D510	
90008	0-60 min.	D14N	D14NB	D14NA	D674	
90281	0-2 hrs.	—	D14QJ	D14QF	D2080	
90102	0-3 hrs.	—	D14QH	D14QE	D2081	
90240	0-4 hrs.	—	—	—	—	
90007	0-6 hrs.	—	D14QG	D14QD	D2060	
90001	0-12 hrs.	D14Q	D14QB	D14QA	D2044	
WITH HOLD						
90021	0-3 min.	—	D14EB	D14EA	D515	
90030	0-5 min.	—	—	—	—	
90032	0-30 min.	—	—	—	—	
90024	0-60 min.	D14C	D14CB	D14CA	D516	
90017	0-6 hrs.	—	—	—	—	
90015	0-12 hrs.	D14A	D14AB	D14AA	D499	

RATING: 20 Amps, 125V. AC., 1hp., 10 Amps, 250 V. AC., 1hp., 10 Amps, 277 V. AC., 7 Amps, 125V. AC. tungsten rating S.P.S.T., UL & CSA listed.



72000 AB
D.P.S.T.

74000 AB
S.P.D.T.

These series time switches are designed to be installed in double gang wall boxes 2½" deep. They make possible inexpensive, simple, manual time control of 240V. circuits controlling equipment such as air conditioners, heaters, and ventilating equipment.

Time switches are individually packed with brushed aluminum satin finish dials with black characters, knob, mounting hardware, and complete installation instructions.

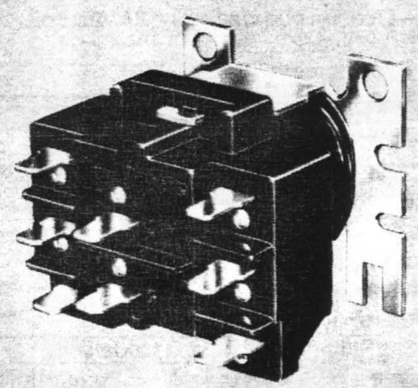
Catalog Number WITHOUT HOLD	WITH HOLD	Time Cycle
72000 AB — D.P.S.T.		
72130 AB	72131 AB	0-1 hr.
72132 AB	—	0-2 hrs.
72133 AB	—	0-4 hrs.
72134 AB	72135 AB	0-5 hrs.
72136 AB	72137 AB	0-12 hrs.
74000 AB — S.P.D.T.		
74112 AB	74113 AB	0-1 hr.
74114 AB	—	0-2 hrs.
74115 AB	—	0-4 hrs.
74116 AB	74117 AB	0-5 hrs.
74118 AB	74119 AB	0-12 hrs.

RATING: 28 Amps, 240V. AC., 1 hp., 120V. AC., 1 hp., 240V. AC., UL Listed
72000 AB Series—D.P.S.T.
74000 AB Series—S.P.D.T.

Honeywell

SWITCHING RELAYS

THE R4222, R8222, R4228 AND R8228 ARE GENERAL PURPOSE RELAYS FOR USE IN REFRIGERATION AND AIR CONDITIONING EQUIPMENT, APPLIANCES, VENDING MACHINES, AND OTHER APPLICATIONS REQUIRING GENERAL PURPOSE SWITCHING.



☐ R4222 and R8222 contacts are available for Powerpile (millivoltage), pilot duty, and power pole applications.

☐ R4228 and R8228 have power rated contacts only.

☐ R4222 and R4228 models have line voltage (120, 208/240, 277, or 480 Vac) coils. R8222 and R8228 models have low voltage (24 Vac) coils.

☐ Models available with a variety of switching configurations.

☐ Laminated magnet construction for high efficiency.

☐ Contacts rated for voltages up to 600 Vac.

☐ Molded terminal numbers and circuit diagram on top of relay provide easy identification for wiring and checking system operation.

☐ Relay constructed for high reliability.

☐ Quick-connect terminals are standard; double quick-connects available on coil terminals.

R4222; R8222; R4228; R8228

S.M.
REV. 4-85

Form Number 60-2056—4

SPECIFICATIONS

IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, THIS PRODUCT IS TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

TRADELINE MODELS

TRADELINE models are selected and packaged to provide ease of stocking, ease of handling and maximum replacement value. TRADELINE model specifications are the same as those of standard models except as noted below.

TRADELINE MODELS AVAILABLE:
R4222B,D,N,V Switching Relay—line voltage.
R8222B,D,N,V Switching Relay—low voltage.
R4228A,B,D Heavy-duty Relay—line voltage.
R8228A,B,D Heavy-duty Relay—low voltage.

TERMINALS: R4222, R8222, R4228D and R8228D have single quick-connects on poles, double quick-connects on coil terminals. R4228A,B and R8228A,B have double quick-connects on poles and double quick-connects on coil terminals.

SWITCHING CONFIGURATIONS: R4222 and R8222, see Table II. R4228 and R8228, see Table I.

ADDITIONAL FEATURES:
TRADELINE pack with cross reference label and special instruction sheet.

STANDARD MODELS

MODELS:
R4222—General purpose relay: 120, 208/240, 277, and 480 Vac coil.
R8222—General purpose relay: 24 Vac coil.
R4228—Heavy-duty general purpose relay: 120, 208/240, 277, and 480 Vac coil.
R8228—Heavy-duty general purpose relay: 24 Vac coil.

CONTACT RATINGS:
Power Pole (amperes per pole)—

R4222, R8222[c]	120 Vac	208 Vac	240 Vac	277 Vac	480 Vac
Inductive					
Full Load	12	6	6	6	3
Locked Rotor	60	35	35	35	18
Resistive					
A and C Models[b]	20.8	20.8	20.8	20.8	10
(equivalent resistive power)	(2.5 kW)	(4.3 kW)	(5.0 kW)	(5.7 kW)	(4.8 kW)
All Others[b]	15	15	15	15	10
Combined Ratings for A and C Models[a]					
Resistive	12.5	12.5	12.5	12.5	6.25
(equivalent resistive power)	(1.5 kW)	(2.6 kW)	(3.0 kW)	(3.4 kW)	(3.0 kW)
Inductive	+4.2 AFL 10.0 ALR	+4.2 AFL 10.0 ALR	+4.2 ALF 10.0 ALR	+4.2 AFL 10.0 ALR	+2.1 AFL +5.0 ALR
Horsepower	3/4 hp	3/4 hp	3/4 hp	3/4 hp	3/4 hp

[a]Combined ratings indicate that both a resistive and inductive load can be operated by each pole.
[b]Also rated 5 amp resistive at 600 volts. [c]Underwriters Laboratories Inc. and CSA approved for 50 cycle applications.

ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALER OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER, OR SPECIFY—

1. **Order number, include suffix letter and specify TRADELINE if desired.**
2. **Contact ratings.**
3. **Coil ratings.**
4. **Double quick-connects on coil terminals if desired.**
5. **Accessories.**

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 RESIDENTIAL DIVISION SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).**
2. **RESIDENTIAL DIVISION CUSTOMER SERVICE
HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
MINNEAPOLIS, MINNESOTA 55422-4386 (612) 542-7500**

IN CANADA—HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9. INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

Pilot Duty Poles for R4222 and R8222 Only:
Minimum—3 VA at 24, 120, and 480 Vac.
Maximum—25 VA at 24 Vac, 125 VA at 120, 240, and 480 Vac.
Resistive—3 A at 277 Vac (0.75 power factor).

Power Pole (amperes per pole)—
Powerpile (millivoltage) for R4222 and R8222 Only:
The normally open pilot duty contacts are rated for Powerpile (millivoltage) applications—0.25 A at 0.25 to 12 Vdc.

R4228A,B; R8228A,B	**120 Vac**	**208 Vac**	**240 Vac**	**277 Vac**	**480 Vac**
Inductive					
Full Load	16 18	18	18	12	5
Locked Rotor	96 72	72	72	72	30
Resistive[a]	25	25	25	25	15
(equivalent resistive power)	(3.0 kW)	(5.2 kW)	(6.0 kW)	(6.9 kW)	(7.2 kW)
Horsepower	1 hp	2 hp	2 hp	2 hp	1.5 hp
R4228C,D; R8228C,D	**120 Vac**	**208 Vac**	**240 Vac**	**277 Vac**	**480 Vac**
Inductive					
Full Load	5.5	5.5	5.5	5.5	3.0
Locked Rotor	15	15	15	15	8
Resistive[a]	25	25	25	25	12.5
(equivalent resistive power)	(3.0 kW)	(5.2 kW)	(6.0 kW)	(6.9 kW)	(6.0 kW)
Combined Ratings[b]					
Resistive	20.8	20.8	20.8	20.8	10.4
(equivalent resistive power)	(2.5 kW)	(4.3 kW)	(5.0 kW)	(5.6 kW)	(5.0 kW)
Inductive	+4.2 AFL 10.0 ALR	+4.2 AFL 10.0 ALR	+4.2 AFL 10.0 ALR	+4.2 AFL 10.0 ALR	+2.1 AFL 5.0 ALR
R4228E; R8228E	**120 Vac**	**208 Vac**	**240 Vac**	**277 Vac**	**480 Vac**
Inductive					
Full Load	16	—	18	5	5
Locked Rotor	96	—	72	30	30
Resistive[a]	25	—	25	25	15

[a] Also rated 10 A resistive at 600 V.

[b] Combined ratings indicate that both a resistive and an inductive load can be operated by each pole.

COIL RATINGS: All coils meet Underwriters Laboratories Inc. requirements for Class B coils. If coil voltages other than those listed below are desired, contact your local Honeywell representative for additional information.

COIL RATINGS		**24 V**	**120 V**	**208/240 V**	**277 V**	**480 V**
DC Resistive		9.5 ohms 9.25 ohms[b]	232 ohms	875 ohms	1385 ohms	3600 ohms
Pickup Voltage (maximum)[a]		18 V	96 V	176 V	220 V	384 V
Pickup Voltage (nominal)		16 ± 2 V	80 ± 10 V	150 ± 20 V	190 ± 30 V	330 ± 40 V
Inrush VA (maximum)		20 VA	20 VA	20 VA	20 VA	20 VA
Inrush VA (nominal)		17.0 VA 17.7 VA[b]	17.0 VA	13.5 VA/18.5 VA	17.8 VA	17 VA
Sealed VA (maximum)		10 VA	10 VA	10 VA	10 VA	10 VA
Sealed VA (nominal)		9 VA 9.5 VA[b]	9 VA	6.7 VA/9.2 VA	9.7 VA	9 VA
Sealed Amps (nominal)		0.375 A 0.400 A[b]	0.075 A	0.032 A/0.038 A	0.034 A	0.019 A
Sealed Wattage		5.0 W 5.3 W[b]	5.4 W	3.6 W/5 W	5.5 W	5.5 W
Admittance	(open)	0.029 0.031[b]	0.0012	0.0003	0.0002	0.00007
	(sealed)	0.016 0.016[b]	0.0006	0.00015	0.00012	0.00004

[a] Voltages listed are for the relay base mounted vertical. With the terminals pointing down, pickup voltage is increased by 12 percent.

[b] R8222D,G,J,N,R,T,V only.

NOTE: Pickup voltage varies with pole form. Specific models will have lower tolerance than shown above.

TERMINALS: Quick-connects are provided as shown:

MODEL	TERMINALS	NUMBER OF QUICK-CONNECTS	
		SINGLE	DOUBLE
R4222 & R8222	Coil	Std.	Opt.
	Load	Std.	—
R4228 & R8228E	Coil	—	Std.
R4228A,B & R8228A,B	Load	—	Std.
R4228C,D & R8228C,D	Load	Std.	—

MOUNTING: Use 2 screws (up to No. 10 size) through holes in the metal base. Base is designed for easy replacement of competitive relays.

AMBIENT TEMPERATURE RANGE: Minus 20 F [minus 29 C] to 155 F [68 C].

DIMENSIONS: See Fig. 1.

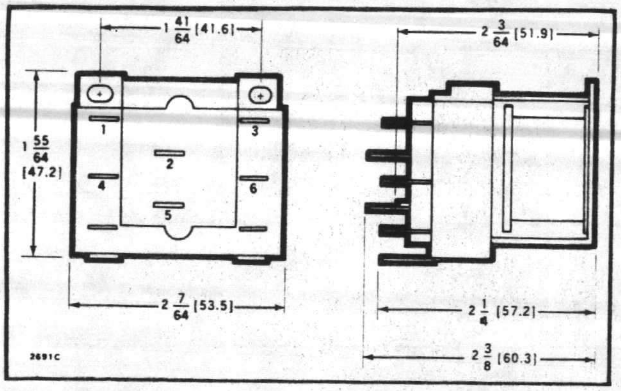


FIG. 1—RELAY DIMENSIONS IN in. [mm IN BRACKETS].

SWITCHING CONFIGURATIONS

The following tables give switching configurations, contact ratings, and terminal designations for the switching relays. For example, the R4222A is a spst switching relay with normally open power rated contacts. The R4222K is a spst relay with normally open contacts rated for pilot duty applications. Electrical connections to the A and K models would be made to terminals 1 and 3.

TABLE I—R4228, R8228

SWITCHING CONFIGURATION	TERMINALS	R4228 OR R8228 MODEL SUFFIX POWER RATED ONLY
SPST, N.O. (DOUBLE QUICK-CONNECTS)	1, 4 —| |— 3, 6	A
SPDT, (DOUBLE QUICK-CONNECTS)	1, 4 —| |— 3, 6 1, 4 —|/|— 2, 5	B
SPST, N.O.	1 —| |— 3	C
DPST, N.O.	1 —| |— 3 4 —| |— 6	D
SPST, N.C.	1 —|/|— 3	E

TABLE II—R4222, R8222

SWITCHING CONFIGURATION	TERMINALS	R4222 OR R8222 MODEL SUFFIX	
		POWER RATED	PILOT DUTY RATED
SPST, N.O.	1 —| |— 3	A	K
SPDT	1 —| |— 3 1 —|/|— 2	B	L
DPST, N.O.	1 —| |— 3 4 —| |— 6	C	M
DPDT	1 —| |— 3 1 —|/|— 2 4 —| |— 6 4 —|/|— 5	D	N
SPST, N.C.	1 —|/|— 2	E	P
DPST, 1-N.O. AND 1-N.C.	1 —| |— 3 4 —|/|— 5	F	Q
DPST, N.C.	1 —|/|— 2 4 —|/|— 5	G	R
SPDT AND SPST, N.O.	1 —| |— 3 1 —|/|— 2 4 —| |— 6	H	S
SPDT AND SPST, N.C.	1 —| |— 3 1 —|/|— 2 4 —|/|— 5	J	T
DPST N.O. (ONE POWER AND ONE PILOT DUTY)	1 —| |— 3 4 —| |— 6	†U	
DPDT (ONE POWER AND ONE PILOT DUTY)	1 —| |— 3 1 —|/|— 2 4 —| |— 6 4 —|/|— 5	†V	
SPDT AND SPST, N.O. (ONE POWER AND ONE PILOT DUTY)	1 —| |— 3 1 —|/|— 2 4 —| |— 6	†W	
SPDT AND SPST, N.O. (ONE POWER AND ONE PILOT DUTY)	1 —| |— 3 4 —| |— 6 4 —|/|— 5	†Y	
DPST, N.C.	1 —|/|— 2 4 —|/|— 5	†Z	

†Models with suffix letters U,V,W,Y and Z have power rated contacts on silver colored terminals and pilot duty rated contacts on brass colored terminals.

ACCESSORIES:

1. 129384A Case and Cover Assembly.

2. 4074BVJ Receptacle with 8 color-coded plug-in leadwires and retaining bail, for panel mounting applications; see Fig. 2.

3. Q633A1003—4 x 4 plate-mounted relay receptacle with metal relay cover and 8 color-coded plug-in leadwires.

NOTE:
   a. Use the receptacle in applications within the current carrying rating of the wire size and quick-connect terminal being used.
   b. The receptacle will accept relays with double quick-connect terminals.

4. 135959 Receptacle only. Leads and quick-connect terminals are not supplied with the receptacle.

NOTE: Not all standard quick-connect terminals will be adequately retained in this receptacle. It is recommended that a quick-connect terminal with 0.016 inch [0.406 mm] maximum material thickness be used (0.012 inch [0.305 mm] preferred). The maximum permissible dimension between the rolls is 0.115 inch [2.92 mm]. These requirements are met by AMP, Inc. Faston "250" series terminal No. 42100-1 quick-connects or equivalent.

5. 135887 Wire Bail only.

6. 137881A Adapters for converting 1/4 inch [6.4 mm] quick-connects to No. 6 screw terminals (bag of eight).

UNDERWRITERS LABORATORIES INC. COMPONENT RECOGNIZED:
   R4222 and R8222 models: A to H,J,U,V,W,Y,Z; File No. E59779; Guide No. NLDX2.
   R4222 and R8222 models: K,L,M,N,P,Q,R,S,T; File No. E49809; Guide No. NKCR2.
   R4228 and R8228 models: A,B,C,D,E; File No. E59779; Guide No. NLDX2.

CANADIAN STANDARDS ASSOCIATION COMPONENT CERTIFIED:
   R4222 and R8222: File No. LR35066; Guide No. 184-N-13.13.
   R4228 and R8228: File No. LR35066; Guide No. 184-N-13.13.

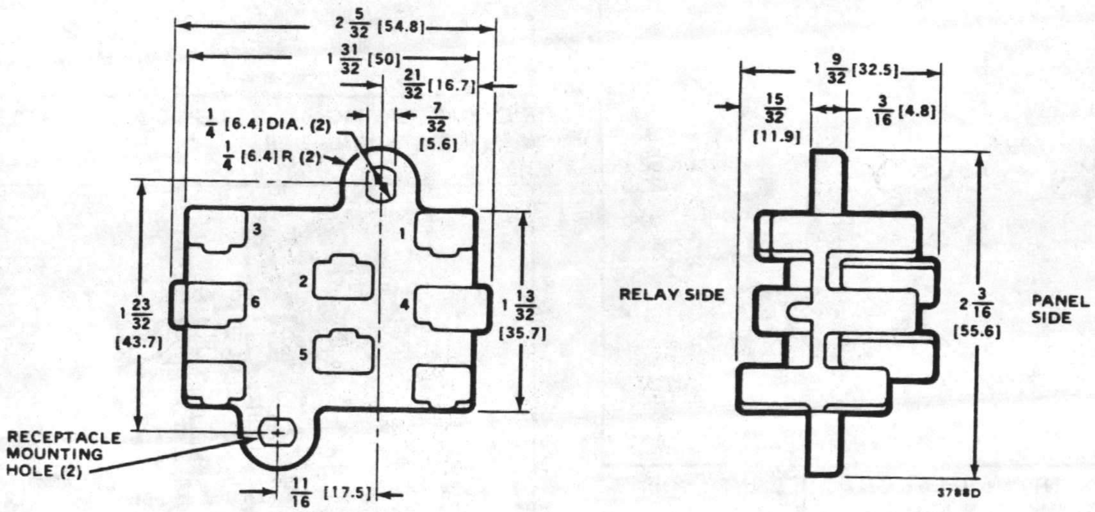


FIG. 2—DIMENSIONS OF WIRING RECEPTACLE.

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

Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.

LOCATION

Mount the relay on a flat, solid surface as close as possible to the equipment being controlled. *The relay may be mounted in any position except with the terminals pointed down.* Secure in place with two screws through holes or slots in the mounting base or as shown in Fig. 3 or 4. See Fig. 1 for mounting dimensions.

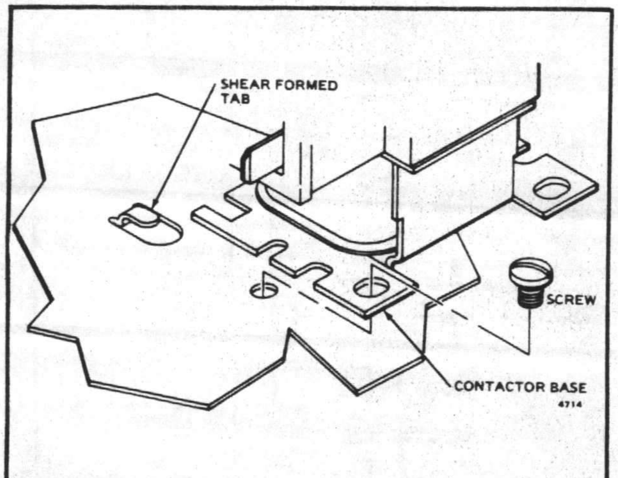


FIG. 3—MOUNTING RELAY ON PANEL WITH SHEAR-FORMED TAB AND ONE SCREW.

WIRING

Disconnect power supply before connecting wiring to avoid electrical shock or equipment damage.

All wiring must comply with local codes and ordinances. Crimp female quick-connects to the system wires and attach to the male quick-connect terminals of the relay. The relay has molded terminal numbers and circuit diagram for easy identification when wiring. Fig. 6 shows the location and circuits of all models.

Do not exceed contact and coil ratings when wiring into system.

Leadwires are provided with the 135959 Receptacle in 4074BVJ Bag Assembly for additional relay pole positions. Insert the required leadwires in the relay receptacle as follows.

Determine the leadwire colors required for the relay and application desired. Push the leadwire terminal into the receptacle plate from the side stamped with the numbers (Fig. 5). When inserting the leadwire, the tang on the quick-connect terminal must align with the small clearance slot in the terminal opening. Press the terminal in until it locks in place.

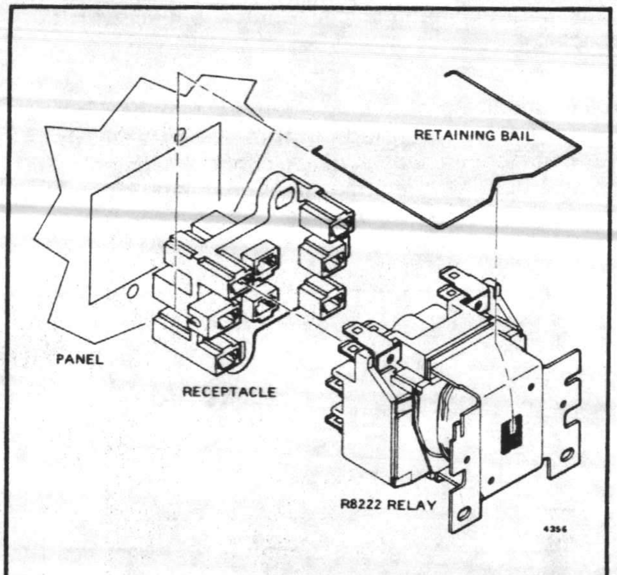


FIG. 4—RELAY MOUNTING USING RECEPTACLE AND RETAINING BAIL.

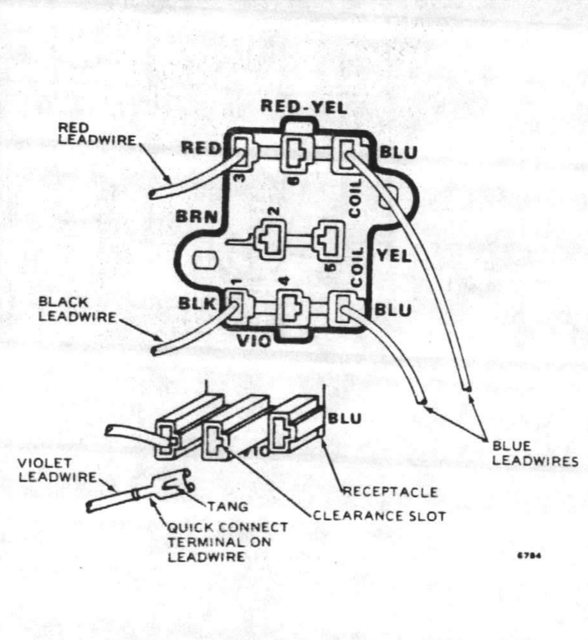


FIG. 5—BOTTOM OF 135959 RECEPTACLE SHOWING LEADWIRE INSTALLATION.

CHECKOUT

Operate the relay and controlled equipment to make sure that relay pulls in when the coil is energized and that controlled equipment operates as intended.

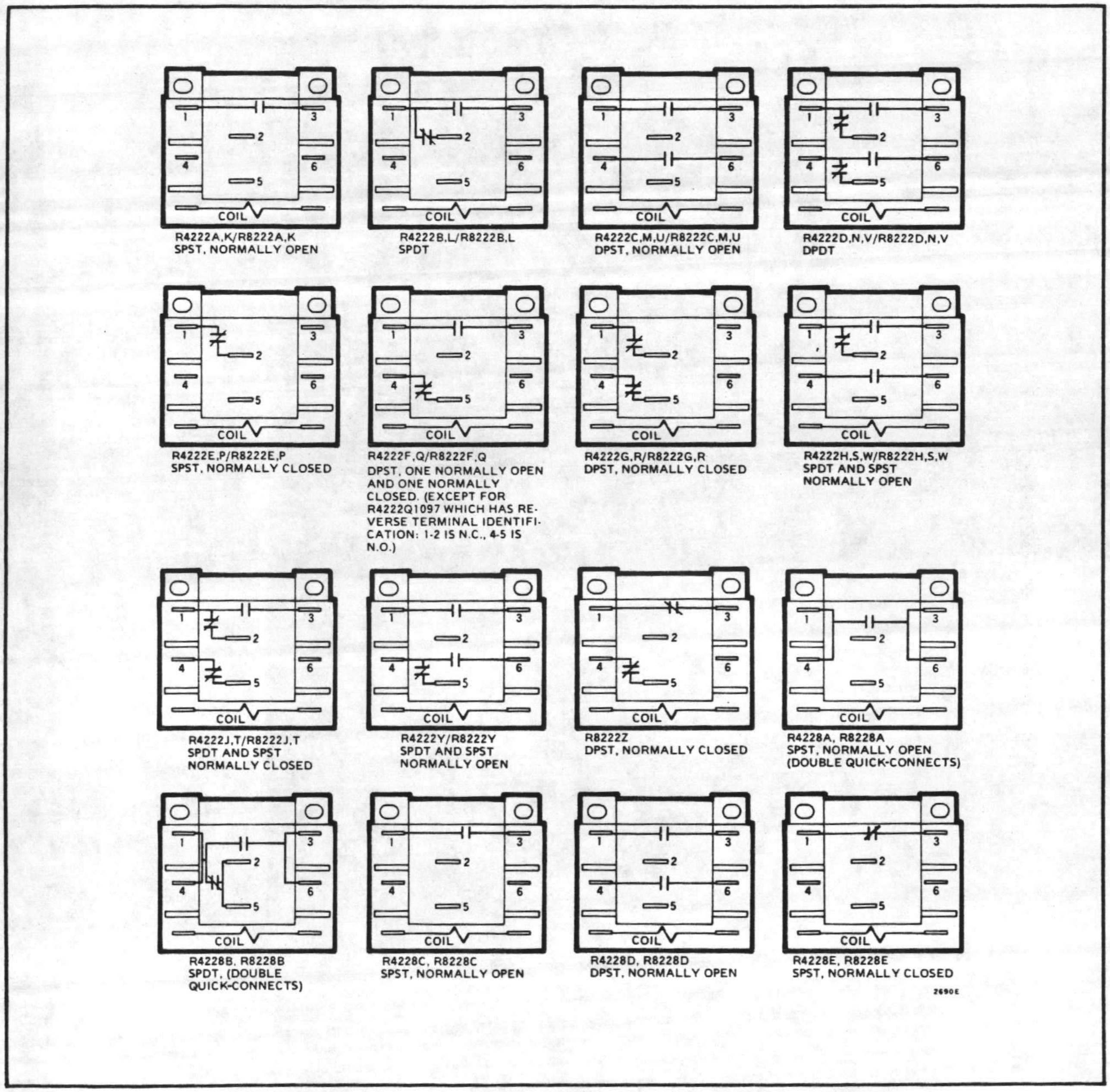
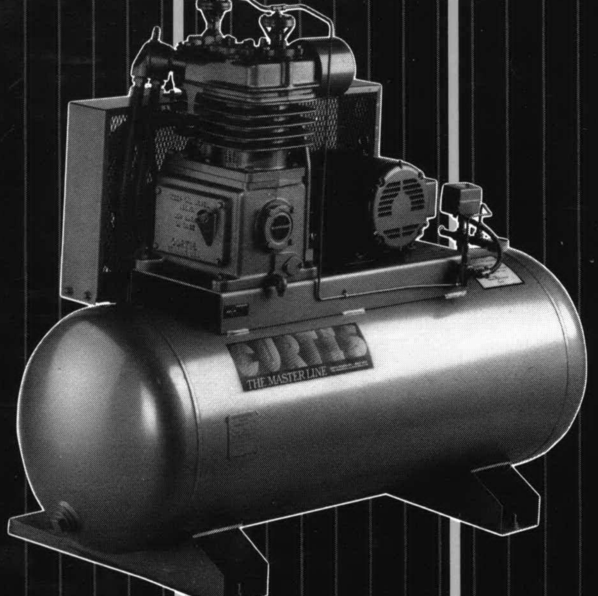


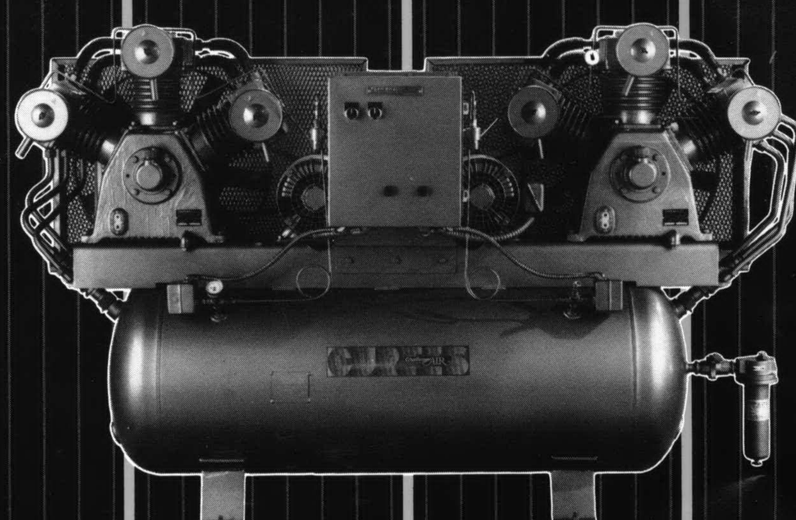
FIG. 6—R4222/R8222, R4228/R8228 CIRCUIT AND TERMINAL DESIGNATION.

CURTIS

The Symbol of Quality and Excellence since 1854

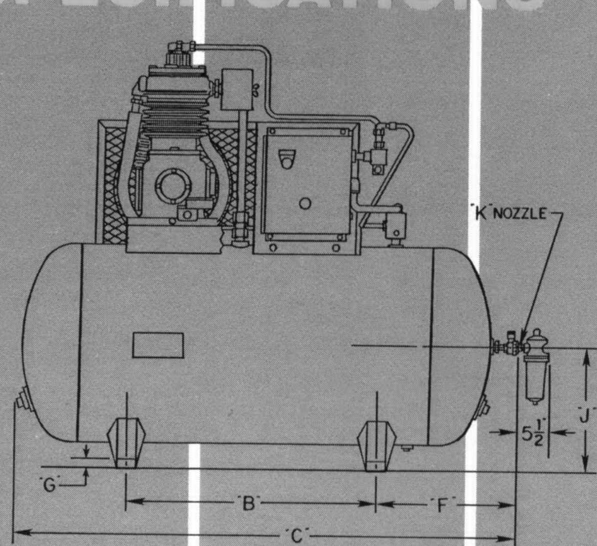
CLIMATE CONTROL COMPRESSORS





Providing Clean, Dry Air for Instrument Control Equipment

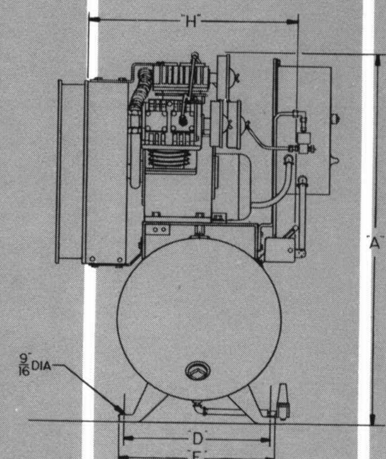
CURTIS SIMPLEX SPECIFICATIONS



Curtis Simplex Compressors

Standard Equipment

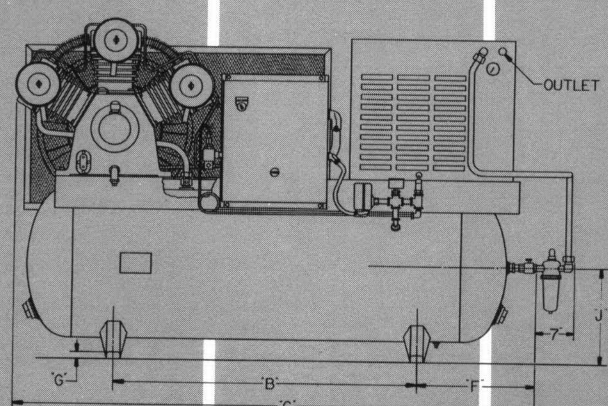
- Large Metal Intake Filter Silencer.
- ASME National Board Stamped Receiver.
- ASME Safety Relief Valve.
- Pressure Gage.
- Receiver Condensate Drain Valve.
- Discharge Line Check Valve.
- Receiver Shut-Off Valve.
- V-Belt Drive.
- NEMA Motors and Pressure Switches.
- OSHA Totally Enclosed Steel Belt Guard.
- Crankcase Lubrication Level Indicator.
- Pressure Switch Operated Automatic Start and Stop Control (Set 80-100 PSI).
- Specially Designed Piston Rings.



Optional Accessories

- Magnetic Motor Starters With Overload Protection and On/Off Switch.
- Discharge Air Coalescer Filters.
- Low Oil Level Shutdown.*
- Automatic Traps.
- Air-Cooled Aftercoolers.
- Dryers.

Above items can be factory mounted and wired.



*Contact factory for specific compressor availability.
Refer to Duplex Specifications for dimensions and available receiver sizes.
Refer to required HP listed under Simplex Specifications for RPM and CFM.

Specifications For SIMPLEX Compressors

MODEL	MOTOR H.P.	RPM	CFM AT 100 PSI	TANK SIZE INCHES	TANK SIZE GALS	DIMENSIONS A	B	C	D	E	F	G	H	J
1SA2	⅓	500	1.3	10x30	10	25⅞	16	30	10⅜	10	9⅞	½	16½	8⅜
2SA2	⅓	500	1.3	14x33	20	28⅝	18	33	12¼	14	10⅝	½	17½	9½
3SA2	⅓	500	1.3	16x41	30	33¾	23	41½	14¼	15⅞	11⅛	1⅛	18	10¼
3SB3	½	500	1.4	16x41	30	33¾	23	41½	14¼	15⅞	11⅛	1⅛	18¼	10¼
3SG4	¾	500	3.3	16x41	30	40¼	23	41⅝	14¼	15⅞	11⅛	1⅛	18⅜	10¼
6SG4	¾	500	3.3	20x50	60	45⅝	30	51⅝	15¾	17⅝	12⅝	1¼	21⅝	13⅝
3SG5	1	500	4.3	16x41	30	40¼	23	41⅝	14¼	15⅞	11⅛	1⅛	18⅞	10¼
6SG5	1	500	4.3	20x50	60	45⅝	30	51⅝	15¾	17⅝	12⅝	1¼	21⅝	13⅝
6SH6	1½	530	4.9	20x50	60	39⅜	30	51½	15¾	17⅝	12⅝	1¼	23½	13⅝
6SE6	1½	490	5.9	20x50	60	46⅛	30	51⅝	15¾	17⅝	12⅝	1¼	21⅝	13⅝
8SH6	1½	530	4.9	20x66	80	39⅜	38	66½	15¾	17⅝	16⅛	1¼	23½	13⅝
8SE6	1½	490	5.9	20x66	80	45⅝	38	66½	15¾	17⅝	16⅛	1¼	23½	13⅝
6SL6	1½	560	7.9	20x50	60	46⅞	30	51⅝	15¾	17⅝	12⅝	1¼	21⅝	13⅝
8SL6	1½	560	7.9	20x66	80	48⅞	38	66⅝	15¾	17⅝	16⅛	1¼	21⅝	13⅝
6SJ7	2	575	7.7	20x50	60	40 9⁄16	30	51½	15¾	17⅝	12⅝	1¼	25	13⅝
6SR7	2	400	10.2	20x50	60	46⅞	30	51⅝	15¾	17⅝	12⅝	1¼	21⅝	13⅝
8SJ7	2	575	7.7	20x66	80	40 9⁄16	38	66½	15¾	17⅝	16⅛	1¼	25	13⅝
8SR7	2	400	10.2	20x66	80	50⅝	38	66⅝	15¾	17⅝	16⅛	1¼	22¼	13⅝
6SN8	3	565	11.7	20x50	60	42⅞	30	51½	15¾	17⅝	12⅝	1¼	25	13⅝
6SP8	3	510	13.2	20x50	60	52⅝	30	51⅝	15¾	17⅝	12⅝	1¼	22½	13⅝
6SR8	3	565	14.2	20x50	60	46⅞	30	51⅝	15¾	17⅝	12⅝	1¼	21⅝	13⅝
8SN8	3	565	11.7	20x66	80	42⅞	38	66½	15¾	17⅝	16⅛	1¼	25	13⅝
8SP8	3	510	13.2	20x66	80	52⅝	38	66⅝	15¾	17⅝	16⅛	1¼	22¼	13⅝
8SR8	3	565	14.2	20x66	80	50⅝	38	66⅝	15¾	17⅝	16⅛	1¼	22¼	13⅝
8SS9	5	550	15.0	20x66	80	42⅞	38	66½	15¾	17⅝	16⅛	1¼	22¼	13⅝
8SV9	5	495	27.3	20x66	80	54¼	38	68	15¾	17⅝	17½	1¼	24⅝	13⅝
12SS9	5	550	17.3	24x70	120	47⅞	42	71½	22	24	18	¼	30	16
12SV9	5	495	27.3	24x70	120	59¼	42	73	22	24	18	¼	26⅝	16
20SS9	5	550	17.3	30x72	200	54⅛	45	75½	28	25	17	¼	25¼	18½
20SV9	5	495	27.3	30x72	200	56½	45	75½	28	25	17	¼	28	18½
8ST10	7½	595	24.5	20x66	80	45⅜	38	67	15¾	17⅝	17½	¼	24⅝	13⅝
8SY10	7½	595	38.6	20x66	80	54¼	38	68	15¾	17⅝	17½	1¼	24⅝	13⅝
12ST10	7½	595	24.5	24x70	120	50½	42	72	22	24	18	¼	32⅛	16
12SY10	7½	595	38.6	24x70	120	56⅝	42	73	22	24	18	¼	26⅝	16
20ST10	7½	595	24.5	30x72	200	57	45	76	28	25	17½	¼	29⅛	16
20SY10	7½	595	38.6	30x72	200	57	45	76	28	25	17½	¼	29⅛	16
12SW11	10	560	35.3	24x70	120	55⅞	42	72	22	24	18	¼	32¾	16
20SW11	10	560	35.3	30x72	200	62¼	45	76	28	25	17½	¼	32¾	18½
20SZ11	10	510	52.3	30x72	200	66⅞	45	76	28	25	18	¼	32¾	18½
20SZA12	15	680	69.0	30x72	200	66⅞	45	76	28	25	18	¼	32¾	18½
20SZB12	15	730	73.0	30x72	200	66⅞	45	76	28	25	18	¼	32¾	18½
20SZA13	20	795	80.0	30x72	200	66⅞	45	76	28	25	18	¼	32¾	18½
20SZB13	20	940	95.0	30x72	200	66⅞	45	76	28	25	18	¼	32⅜	18½

Specifications For DUPLEX Compressors

MODEL	MOTOR H.P. (2)	RPM	PKG. CFM AT 100 PSI	TANK SIZE		DIMENSIONS								
				INCHES	GALS	A	B	C	D	E	F	G	H	J
3DA2	⅓	500	2.6	16x41	30	36¾	23	41½	14¼	15⅞	11⅛	1⅛	23¼	10¼
3DB3	½	500	2.8	16x41	30	36¾	23	41½	14¼	15⅞	11⅛	1⅛	23¼	10¼
6DB3	½	500	2.8	20x50	60	36¾	23	51½	14¼	15⅞	11⅛	1⅛	23¼	10¼
8DB3	½	500	2.8	20x66	80	45	30	66½	14¼	17⅝	11⅛	1⅛	27¾	10¼
6DG4	¾	500	6.6	20x50	60	41¼	30	60½	15¾	17⅝	12⅝	1¼	22¾	13⅝
8DG4	¾	500	6.6	20x66	80	45⅞	30	66½	15¾	17⅝	12⅝	1¼	22¾	13⅝
6DG5	1	500	8.6	20x50	60	41¼	30	55	15¾	17⅝	12⅝	1¼	21⅝	13⅝
8DG5	1	500	8.6	20x66	80	41¼	30	55	15¾	17⅝	12⅝	1¼	21⅝	13⅝
6DH6	1½	530	9.8	20x50	60	39⅞	30	59½	15¾	17⅝	12⅝	1¼	28½	13⅝
8DH6	1½	530	9.8	20x66	80	39⅛	38	61¼	15¼	17⅝	16⅛	1¼	28½	13⅝
8DJ7	2	575	14.6	20x66	80	40 7/16	38	70¾	15¾	17⅝	16⅛	1¼	30	13⅝
8DR7	2	400	20.4	20x66	80	50⅝	30	68¾	15¾	17⅝	16⅛	1¼	22¼	13⅝
12DJ7	2	575	14.6	24x70	120	45	38	72	15¾	17⅝	16⅛	1¼	30	13⅝
12DR7	2	400	20.4	24x70	120	50⅝	38	74	15¾	17⅝	16⅛	1¼	25	13⅝
8DN8	3	565	23.4	20x66	80	42⅞	38	73	15¾	17⅝	16⅛	1¼	30	13⅝
8DP8	3	510	26.4	20x66	80	42⅞	38	73	15¾	17⅝	16⅛	1¼	30	13⅝
8DR8	3	565	28.4	20x66	80	46⅞	30	68¾	15¾	17⅝	16⅛	1¼	22¼	13⅝
12DN8	3	565	23.4	24x70	120	47⅛	38	74½	15¾	17⅝	16⅛	1¼	30	13⅝
12DP8	3	565	28.4	24x70	120	50⅝	30	74	15¾	17⅝	16⅛	1¼	22¼	13⅝
12DRA8	3	500	26.0	24x70	120	50⅝	30	74	15¾	17⅝	16⅛	1¼	22¼	13⅝
12DRB8	3	565	28.4	24x70	120	50⅝	30	74	15¾	17⅝	16⅛	1¼	22¼	13⅝
12DS9	5	550	34.6	24x70	120	47⅞	42	74½	22	24	18	¼	30	13⅝
12DV9	5	495	54.6	24x70	120	59¼	42	76½	22	24	18	¼	26⅝	13⅝
20DS9	5	550	34.6	30x72	200	64⅛	45	75½	28	25	17	¼	30¼	13⅝
20DV9	5	495	54.6	30x70	200	56½	45	76½	28	25	17	¼	28	13⅝
20DT10	7½	595	49.0	30x72	200	57	45	82	28	25	17½	¼	37⅛	16
20DY10	7½	595	77.2	30x72	200	57	45	78½	28	25	17½	¼	29⅛	16
12DW11	10	560	70.6	24x70	120	55⅛	42	87½	22	24	18	¼	37¾	16
20DW11	10	560	70.6	30x72	200	62¼	45	87½	28	25	18	¼	37¾	18½

CURTIS

CURTIS DUPLEX SPECIFICATIONS

- When Large Amounts of Air are Needed.
- Cyclical Operations for Greater Efficiency.
- Backup Power During Compressor Maintenance.

Curtis Duplex Compressors

Standard Equipment

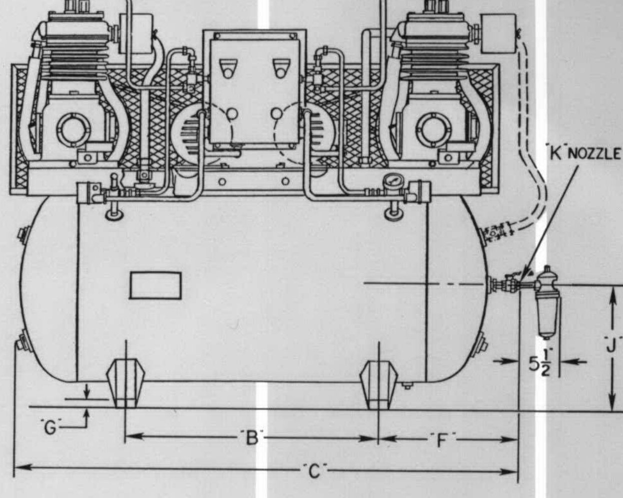
- Large Metal Intake Filter Silencer.
- ASME National Board Stamped Receiver.
- ASME Safety Relief Valve.
- Pressure Gage.
- Receiver Condensate Drain Valve.
- Discharge Line Check Valve.
- Receiver Shut-Off Valve.
- V-Belt Drive.
- NEMA Motors and Pressure Switches.
- OSHA Totally Enclosed Steel Belt Guard.
- Crankcase Lubrication Level Indicator.
- Pressure Switch Operated Automatic Start and Stop Control (Set 80-100 PSI).
- Specially Designed Piston Rings.

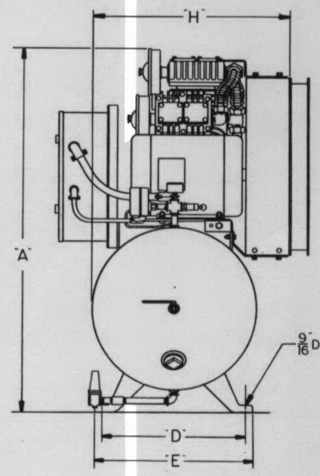
Optional Accessories

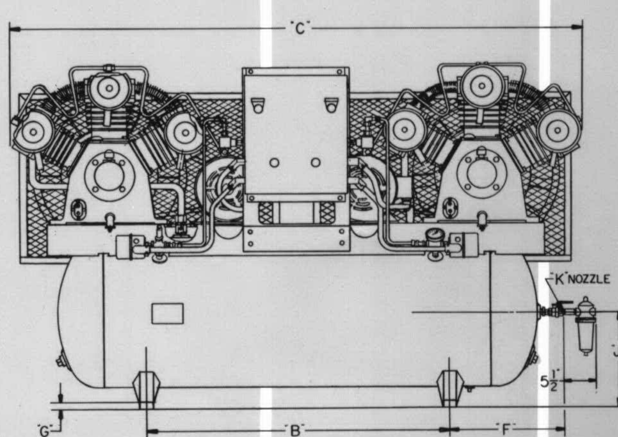
- Magnetic Motor Starters With Overload Protection and On/Off Switch.
- Discharge Air Coalescer Filters.
- Low Oil Level Shutdown.*
- Automatic Traps.
- Air-Cooled Aftercoolers.
- Dryers. (Remote Only on Duplex)
- Alternator Panels: Provides Equal Utilization of Compressors to Minimize Maintenance Downtime. Note: starters are mounted inside alternator panel.

* Contact factory for specific compressor availability.

Above items can be factory mounted and wired.







CURTIS

The Symbol of Quality and Excellence since 1854

CLIMATE CONTROL COMPRESSORS

PROVIDING CLEAN, DRY AIR FOR INSTRUMENT CONTROL EQUIPMENT

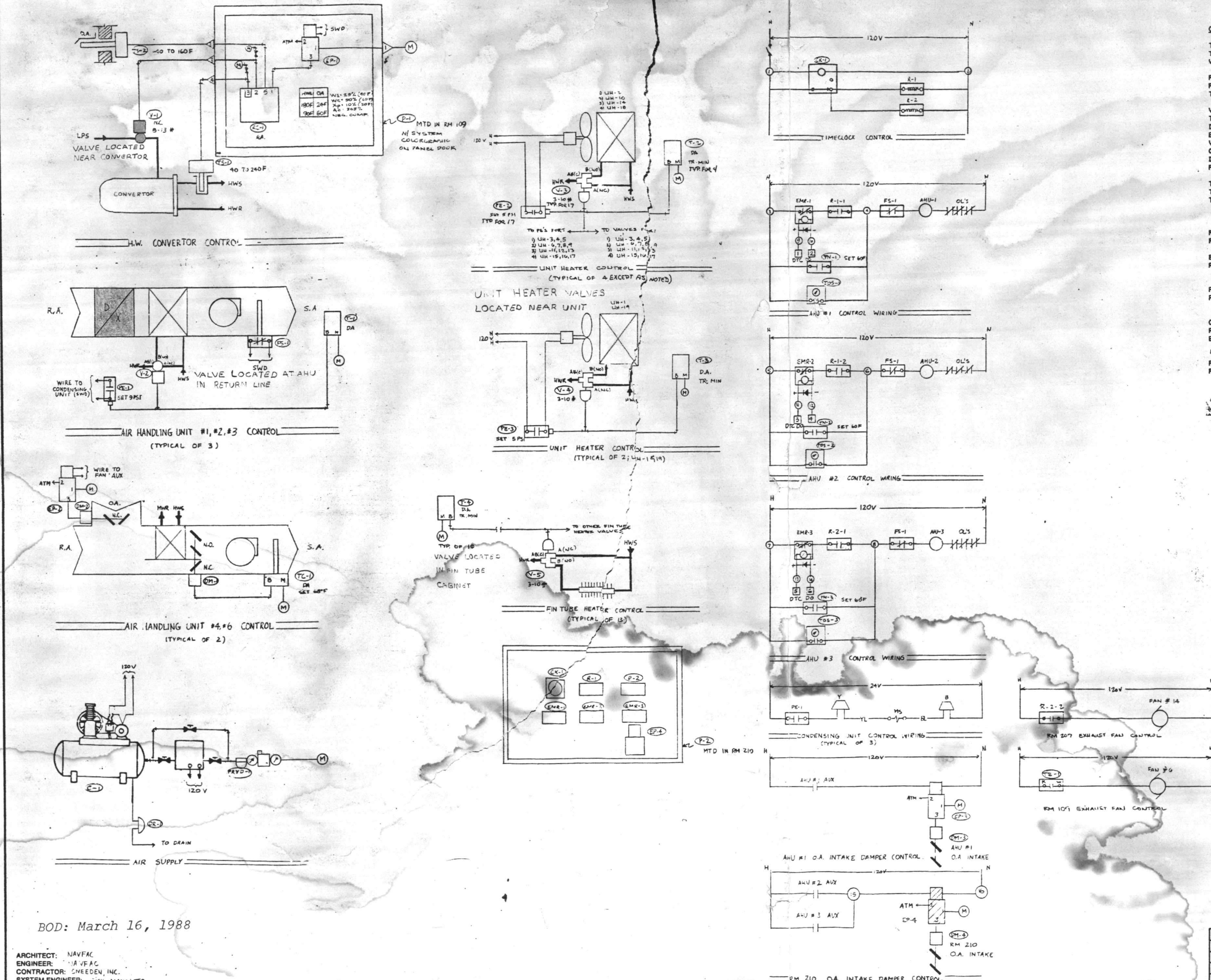
The Quality is Designed-In, Built-In, with Cast Iron Construction and Climate Control Dependability

Curtis' Climate Control Compressor Systems Can Solve Your Instrument Control Problems By Providing:

1. MAXIMUM ON-LINE CLIMATE CONTROL
   - Clean, Instrument Quality Air Due to Specially Designed Piston Rings.
   - Slow Compressor Speed.
   - Less than 24 Hour Service Response Time. (800) 325-0164.
2. UNLIMITED FACTORY PACKAGE FLEXIBILITY
   - Simplex Compressor Package.
   - Duplex Compressor Package.
   - Dryers.
   - Coalescer Filters.
   - Alternators.
   - Air-Cooled After Coolers.
   - Starters.
3. MINIMUM INSTALLATION AND OPERATING COSTS
   - Compact Packages to Fit Through Doorways and Minimize Floor Space.
   - Complete Factory Packaging Including Certified Drawings.
   - Minimum Maintenance Costs, Vibration, and Noise Due to Cast Iron Construction and Slow Speeds.
   - Best Consistent Delivery Time in the Industry.
   - High Heat Transfer–Specially Designed Cylinders Assure Smooth Valve and Piston Ring Operation for Long Life.

CURTIS-TOLEDO, INC.

1905 Kienlen Avenue • St. Louis, Missouri 63133 • (314) 383-1300 • Telex 44-7610 • Sales representatives in principal cities



BILL OF MATERIALS - Combat Veh. Shop

CODE	QTY	PART NUMBER	DESCRIPTION
TS-1	1	LP914A1053	Temp. Sensor 40 to 240 Deg. F.
TS-2	1	LP914A1011	Temp. Sensor -40 to 160 Deg. F.
V-1	1	V5011C1441	Steam Valve 2 1/2" NPT [illegible].0 CV
	1	MP953D1107	Valve Actuator 8-13 PSI
FS-1	3	L4029E1029	Firestat Man. Reset 200 Deg. F.
PE-1,2,3	22	P658A1013	PE Switch
T-1,2,3,4	19	TP970A1004	Room Thermostat 60-90 Deg. F.
	19	14002467-170	Plastic Blank Cover Beige
V-2	3	VP526A1027	3-Way Valve 5/8" Flare 1.6 CV 2-5 PSI
TC-1	2	LP920A1021	Temp. Controller -30 to 150 Deg. F.
DM-1,2	4	MP918B1006	Damper Operator 3 to 13 PSI
EP-2,3,	2	RP418A1107	EP Relay
V-3,4,5	32	VP526A1101	3-Way 5/8" Flare 1.6 CV 3-10 PSI
C-1	1	2SA2	Curtis Air Compressor 1/3 HP 120V
DR-1	1	AK3485E	Tank Drain Kit
PRVD-1	1	HKN8210B	Air Dryer with PRV and Filter Station
TN-1,2,3	3	T451A1132	Night Low Limit thermostat
TOS-1,2,3	3	RHD90007	Timed Override Switch 0 to 6 Hrs.
TE-3	1	T675A1508	Temp. Controller SPDT 0-100 Deg.
	1	34886A	Sun Shield
TE-1	1	T651A1209	ELEC RM T'STAT 52-94°F
DM-3,4	2	MP909E1018	DAMPER OPERATOR 3 TO 13 PSI
PANEL 1:			
P-1	1	A-8N84	Hoffman Enclosure 8 x 8 x 4
	1	A-8N8P	Hoffman Sub-panel 6 1/2" x 6 1/4"
EP-1	1	RP418B1071	EP Relay 120 V.
RC-1	1	RP920B1049	Rec. Controller Dual Input RA
PANEL 2:			
P-2	1	14505941-001	Half-Size Ring
	1	14505940-001	Half-Size Door
	1	14505584-002	Half-Size Sub-Panel
CK-1	1	14505526-008	7-Day Timeclock with Reserve
R-1,2	2	R4222D1013	DPDT Relay 120V
EMR-1,2,3	3	RR2P24VDC	DPDT Relay 24 VDC
EP-4	1	RP418B1071	EP RELAY 120V
PANEL 3:			
P-3	1	A-12N104	Hoffman Enclosure 12 x 10 x 4
	1	A-12N10P	Hoffman Sub-panel 10 1/4 x 8 1/4
SW-1,2	15	113701	SPDT TOGGLE SW 2-POS
	15	113575A	NAMEPLATE
	15	113578A	MTG. STRAP
	15	113591	ID TABS

BOD: March 16, 1988

ARCHITECT: NAVFAC
ENGINEER: NAVFAC
CONTRACTOR: SNEEDEN, INC.
SYSTEM ENGINEER: RICK MANALOTO
INSTALLATION SUPERVISOR:

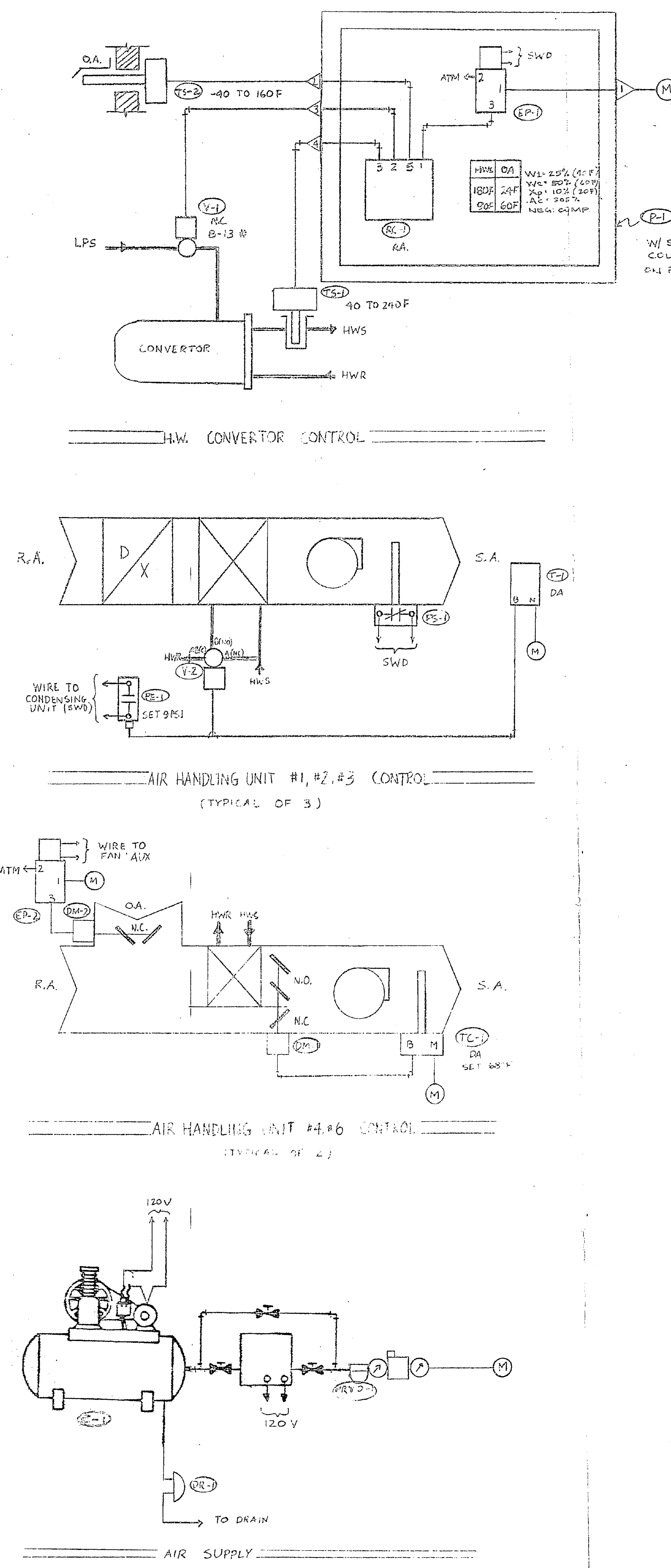
FC-270

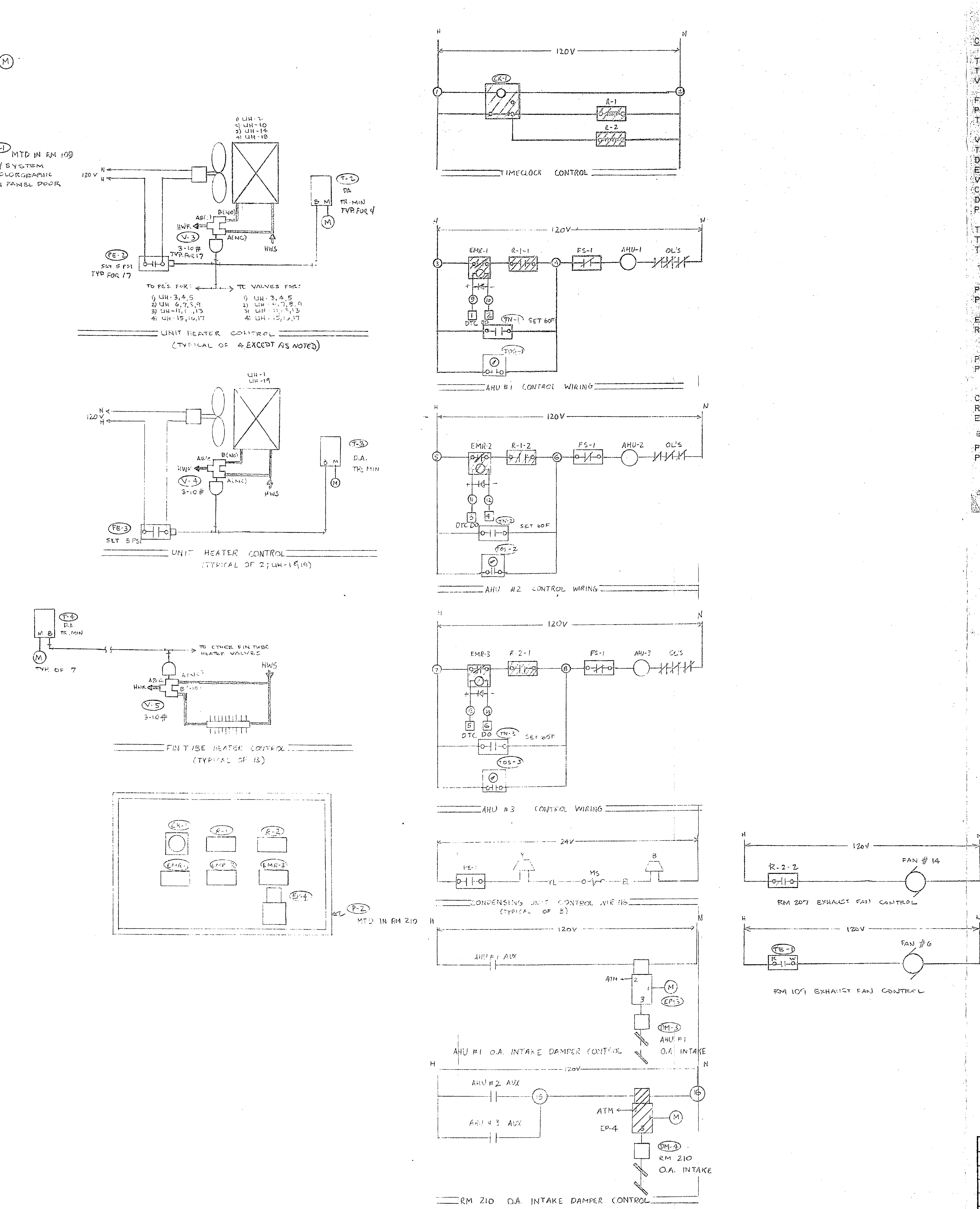
HONEYWELL, INC.
517 S. SHARON AMITY RD., CHARLOTTE, N.C.

COMBAT VEHICLE SHOP
CAMP LEJEUNE, N.C.

Rev.	Revisions	Date	Appd.
C			
B	AS BUILT	1/19/88	[illegible]
A	REV. T-4 QUANTITY	7-28-87	[illegible]

Supersedes: | Drawn By: MR/RM | Date 4-22-87
Superseded By: | Approved By: [illegible] | Sheet 1 Of 2
DRAWING NUMBER 959-87610-1XI | Rev. B





BILL OF MATERIALS – Combat Veh. Shop

CODE	QTY	PART NUMBER	DESCRIPTION
TS-1	1	LP914A1052	Temp. Sensor 40 to 240 Deg. F.
TS-2	1	LP914A1011	Temp. Sensor -40 to 160 Deg. F.
V-1	1	V5011C1441	Steam Valve 2 1/2" NPT 63.0 CV
	1	MP953D1107	Valve Actuator 8-13 PSI
FS-1	3	L4029E1029	Firestat Man. Reset 200 Deg. F.
PE-1, 3	22	P658A1013	PE Switch
T-1, 3, 4	16	TP970A1004	Room Thermostat 60-90 Deg. F.
	16	14002467-170	Plastic Blank Cover Beige
V-2	3	VP526A1027	3-Way Valve 5/8" Flare 1.6 CV 2-5 PSI
TC-1	2	LP920A1021	Temp. Controller -30 to 150 Deg. F.
DM-1,2	4	MP918B1006	Damper Operator 3 to 13 PSI
EP-2,3,		RP418A1107	EP Relay
V-3,4,5	32	VP526A1101	3-Way 5/8" Flare 1.6 CV 3-10 PSI
C-1	1	2SA2	Curtis Air Compressor 1/3 HP 120V
DR-1	1	AK3485E	Tank Drain Kit
PRVD-1	1	HKN8210B	Air Dryer with PRV and Filter Station
TN-1,2,3	3	T451A1132	Night Low Limit thermostat
TOS-1,2,3	3	RHD90007	Timed Override Switch 0 to 6 Hrs.
TE-3	1	T675A1508	Temp. Controller SPDT 0-100 Deg.
	1	34886A	Sun Shield
TE-1	1	[illegible]	ELEC RM TEMP [illegible]
DV-3,4	2	[illegible]	DAMPER OPERATOR 3 TO 13 PSI
PANEL 1:			
P-1	1	A-8N84	Hoffman Enclosure 8 x 8 x 4
	1	A-8N8P	Hoffman Sub-panel 6 1/2" x 6 1/4"
EP-1	1	RP418B1071	EP Relay 120 V.
RC-1	1	RP920B1049	Rec. Controller Dual Input RA
PANEL 2:			
P-2	1	14505941-001	Half-Size Ring
	1	14505940-001	Half-Size Door
	1	14505584-002	Half-Size Sub-Panel
CK-1	1	14505526-008	7-Day Timeclock with Reserve
R-1,2	2	R4222D1013	DPDT Relay 120V
EMR-1,2,3	3	RR2P24VDC	DPDT Relay 24 VDC
EP-4	1	RP418B1071	EP RELAY 120V
PANEL 3:			
P-3	1	A-12N104	Hoffman Enclosure 12 x 10 x 4
	1	A-12N10P	Hoffman Sub-panel 10 1/4 x 8 1/4
OA-1,2	15	113791	SPST TOGGLE SW 2-POS
	15	113575A	NAMEPLATE
	15	113578A	MTG. STRAP
	15	113591	ID TABS

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APR 27 1987

ARCHITECT: NAVFAC
ENGINEER: NAVFAC
CONTRACTOR: SNEEDEN, INC.
SYSTEM ENGINEER: RICK MANALOTO
INSTALLATION SUPERVISOR:

HONEYWELL, INC.
517 S. SHARON AMITY RD., CHARLOTTE, N.C.

COMBAT VEHICLE SHOP
CAMP LEJEUNE, N.C.

Revisions		Date	Appd.
C			
B			
A			

Supersedes | Drawn By: MR/RM | Date 4-22-87 | DRAWING NUMBER 939-87610-1XI | Rev.
Superseded By | Approved By: | Sheet 1 Of 2

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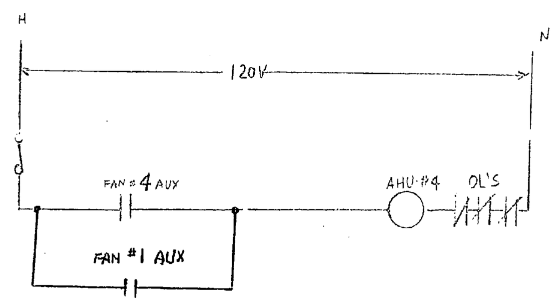
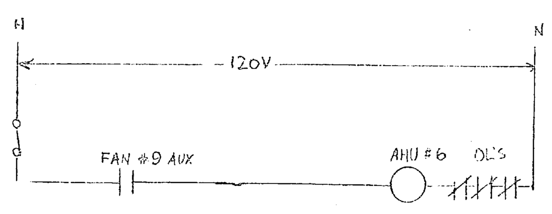
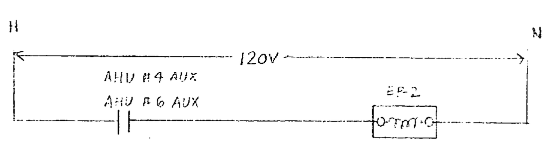


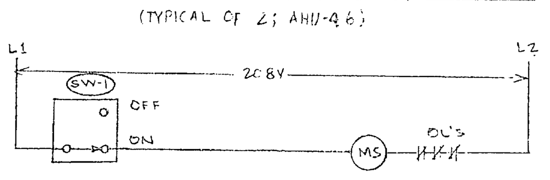
AHU NO. 4 FAN CONTROL WIRING



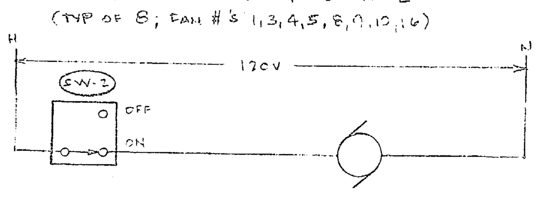
AHU NO. 6 FAN CONTROL WIRING



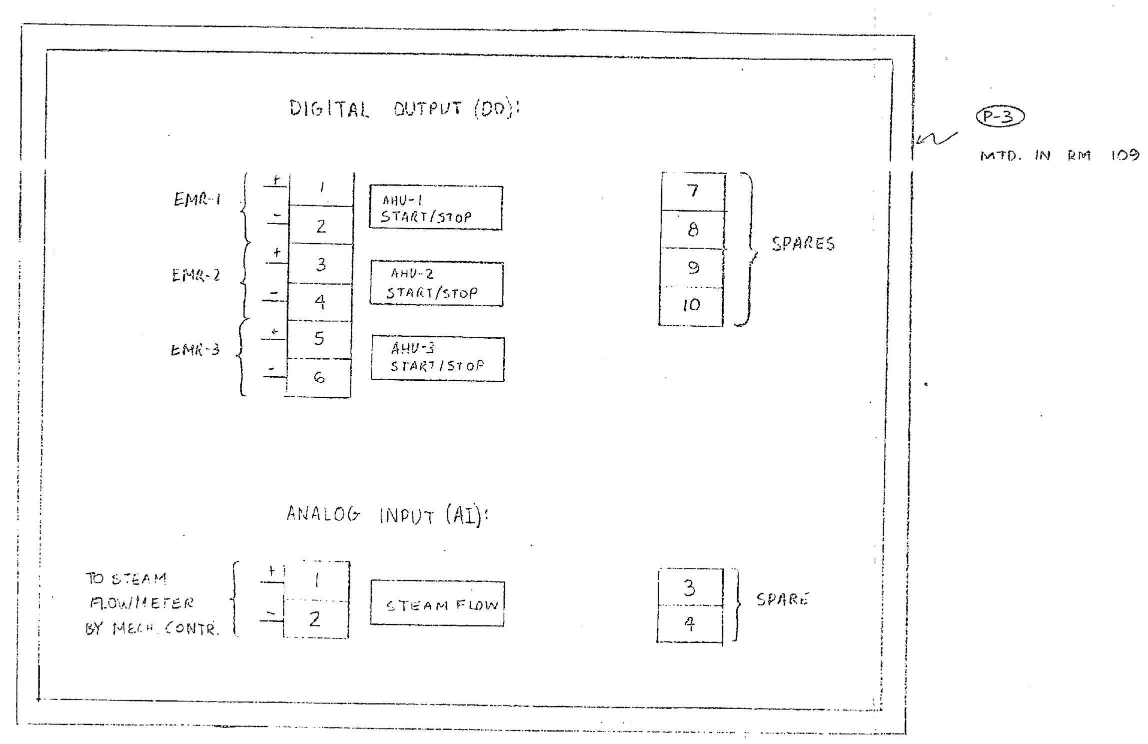
INTAKE DAMPER INTERLOCK
(TYPICAL OF 2; AHU-4,6)



EXHAUST FAN STARTER CONTROL
(TYP OF 8; FAN #'S 1,3,4,5,8,9,10,16)

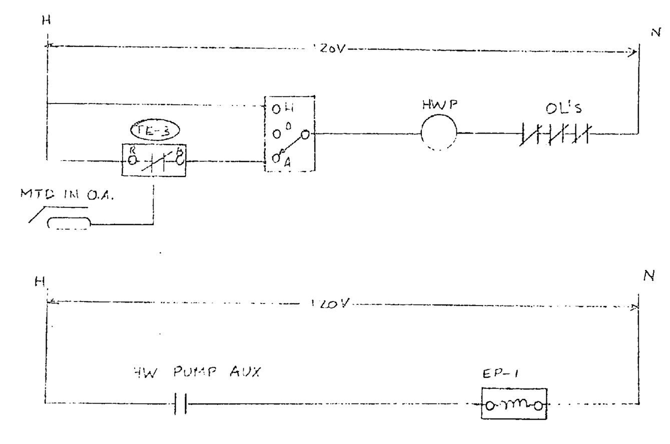


EXHAUST FAN CONTROL
(TYP OF 7; FAN #'S 2,11,12,13,15,7,17)



DTC LAYOUT

NOTES: TERMINAL BLOCK SPACE FOR 200% WILL BE PROVIDED TERMINAL BLOCKS FOR 150% WILL BE PROVIDED



HW PUMP CONTROL WIRING

SEQUENCE OF OPERATION - Combat Veh. Shop

Hot water Temperature Control: On a rise in hot water temperature leaving the steam to hot water converter, the hot water thermostat will act to modulate the steam control valve towards its closed to the converter position. On a further rise in hot water temperature, the thermostat will act to shut the steam control valve completely. On a fall in water temperature, the hot water thermostat will act to open the steam control valve. On a further fall in water temperature, the thermostat will act to fully open the steam control valve. The leaving hot water temperature will be reset in accordance with the schedule shown on the drawings by the outside air temperature acting on the thermostat. A solenoid valve will be installed in the control circuit to prevent the steam control valve from opening unless the hot water pump is in operation.

Hot Water Pump Control: If the switch is in the auto position then the hot water pump will be started by the action of an outside air thermostat when the outside air temperature drops below 65 Deg. F. The signal will be fed through the automatic contact of a hand-off-automatic switch on the pump starter.

Air Handling Units No. 1, 2, and 3 System Control:

Air Handling Unit: The air handling unit will operate continuously unless stopped by the action of the 7-day time clock or firestat. The air handling unit may be started during non-programmed hours by use of the manual timed override switch.

Space Temperature Control: On a rise in space temperature, the space thermostat acts to close the 3-way valve at 63 Deg. F. On a further rise in space temperature and after a dead band range to 75 Deg. F., the thermostat acts to start the compressor. The condensing unit will be interlocked with the air handling unit so that the condenser unit can operate only when the air handling unit is in operation.

Night Setback Control: During the non-programmed hours and on a fall in space temperature below the set point (approximately 60 Deg. F.) the space setback thermostat (T-7) act to start the air handling unit and modulate the three way hot water control valve open.

Air Handing Unit No. 4 and 6 Controls:

Air Handling Unit: The air handling unit will be interlocked with the vehicle fume exhaust fan, located in its bay, to operate any time the exhaust fan is in operation. The outside air intake damper will be interlocked with the air handling unit fan to close when the fan is not in operation. Air handling unit #4 will also be interlocked with fan #1 to operate any time fan #1 is in operation.

Supply Air Temperature Control: The supply air temperature will be controlled by a supply air controller acting on the face and by-pass damper in the air handling unit. The temperature of the supply air is transmitted to the controller by a supply air temperature sensor located in the supply air ductwork. On a rise in supply air temperature above the set point (68 Deg. F.) the supply air controller will act to modulate the face and by-pass damper to by-pass air around the hot water coil. On a further rise in supply air temperature the supply air controller will act to close the face and by-pass all the air around the hot water coil. The hot water will circulate through the coil any time the hot water pump is in operation.

Hot Water Unit Heater and Fin Tube Heater Control: The heater will be controlled by a wall mounted thermostat acting on the 3-way two position valve. On a rise in room temperature, the space thermostat will act to close the three way valve to the coil and by pass the hot water from the heater.

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B				COMBAT VEHICLE SHOP CAMP LEJEUNE, N.C.
A				
Revisions		Date	Appd.	

Supersedes	Drawn By: MR/RM	Date 4-22-87	DRAWING NUMBER 939-87610-2XI	Rev.
Superseded By	Approved By:	Sheet 2 Of 2		

81-3288-012 (Rev. 5/83)