FROM SNEEDEN, INC.
Mechanical Contractors

P. O. BOX 3548 • WILMINGTON, NORTH CAROLINA 28406-3548

RETURN REQUESTED - THIRD OR FOURTH CLASS

TO

OPERATION AND MAINTENANCE MANUAL
AIR CONDITIONING SYSTEM BLDG 1041
MARINE CORPS BASE, CAMP LEJEUNE, N.C.

26-5411
4152620

86-5411

4152620

SNEEDEN, INC.

Mechanical Contractor

MAINTENANCE AND OPERATION MANUAL

PROJECT:

AIR CONDITIONING SYSTEM BUILDING 1041
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA
CONTRACT No. N62470-86-B-5411

ENGINEER:

McKIM & CREED ENGINEERS, P.A.
243 N. FRONT STREET
WILMINGTON, NORTH CAROLINA

INSTALLING CONTRACTOR:

SNEEDEN, INC.
301 EASTWOOD ROAD
WILMINGTON, NORTH CAROLINA 28406

TAB PLACEMENT HERE

DESCRIPTION:

Table of contents

☐ Tab page did not contain hand written information

☑ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

TABLE OF CONTENT

TAB PLACEMENT HERE

DESCRIPTION:

SuB conTracTors

☐ Tab page did not contain hand written information

☑ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

SUBCONTRACTORS

	CONTRACTOR	TYPE OF WORK	TELEPHONE
1.	Blizzard Construction Co. P. O. Box 372 Beulaville, NC 28518	General Construction	(919) 298-4740
2.	Envirocon, Inc. P. O. Box 7349 Wilson, NC 27895-7349	Temperature Controls	(919) 291-4618
3.	Ellington Insulation Co., Inc. 2013 North Kerr Avenue Wilmington, NC 28405	Insulation Work	(919) 791-7223
4.	Watson Electrical Construction Co. P. O. Box 449 Wilmington, NC 28402	Electrical Work	(919) 762-1834

TAB PLACEMENT HERE

DESCRIPTION:

1

☐ Tab page did not contain hand written information

☑ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

(1)

TRANE

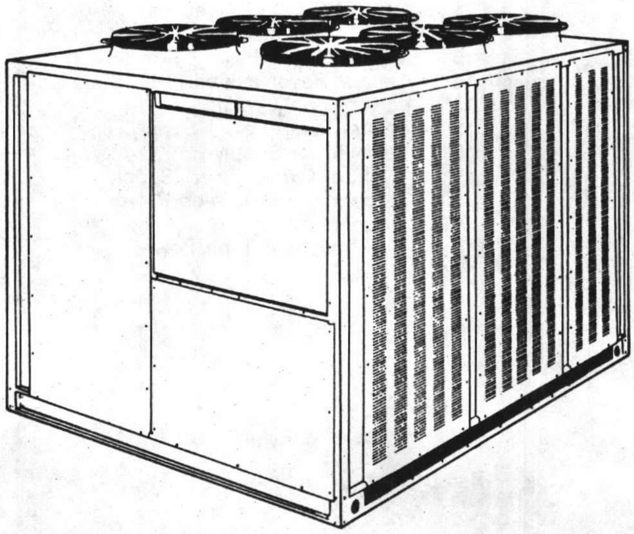
Use with Applicable
"Service Data" Sheets

Installation

CGAC-IN-4

Library	Service Literature
Product Section	Refrigeration
Product	Recip. Liquid Chillers - A/C Cold Gen.
Model	CGAC
Literature Type	Installation
Sequence	4
Date	January 1987
File No.	SV-RF-CG-CGAC-IN-4-187
Supersedes	

Model CGAC 20 thru 60 Ton Air-Cooled Cold Generators



Models

CGAC-C20K CGAC-C40K
CGAC-C25K CGAC-C50K
CGAC-C30K CGAC-C60K

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.

Table of Contents

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

Model Number Description

All standard Trane products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification codes used for CGAC units is provided on this page. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, components and options for any specific unit.

CG	A	C	-	C60	1	-	K	A	N	G	G	6	0	DFGPW
1,2	3	4		5,6,7	8		9	10	11	12	13	14	15	16,etc.

Digits 1,2
Unit Model
CG = Cold Generator

Digit 3
Unit Type
A = Air-Cooled Condensing

Digit 4
Development Sequence

Digits 5, 6, 7
Nominal Capacity
C20 = 20 Tons
C25 = 25 Tons
C30 = 30 Tons
C40 = 40 Tons
C50 = 50 Tons
C60 = 60 Tons

Digit 8
Electrical and Start Characteristics
1 = 460/60/3 PW
2 = 575/60/3 PW
3 = 230/60/3 PW
4 = 460/60/3 XL
6 = 200/60/3 PW
A = 380/50/3 PW
B = 415/50/3 PW
S = Special

Digit 9
Compressor I.D.
K = Model K Hermetic
S = Special

Digit 10
Design Sequence

Digit 11
Motors (Open Compressor Only)
N = None
S = Special

Digit 12
Evaporator
B = 20 Ton
C = 25 Ton
D = 30 Ton
E = 40 Ton
F = 50 Ton
G = 60 Ton
S = Special

Digit 13
Condenser
B = 20 Ton
C = 25 Ton
D = 30 Ton
E = 40 Ton
F = 50 Ton
G = 60 Ton
S = Special

Digit 14
Unloading Steps
2 = 2-Step (20-Ton Only)
3 = 3-Step (25 and 30-Ton)
4 = 4-Step (40 Ton Only)
6 = 6-Step (50 and 60-Ton)
S = Special

Digit 15
Approval Agency
0 = None
2 = UL
3 = CSA
S = Special

Digit 16, etc.
Miscellaneous
3 = Control Power Transformer
8 = Totally-Enclosed Fan Motors
D = Unit-Mounted Disconnect Switch
E = Unit Neoprene Isolators
F = Unit Spring Isolators
G = Pressure Gauges and Piping
H = Hot Gas Bypass
P = Periodic Pumpout
V = Copper Fins
W = Low Ambient Dampers
Y = No Evaporator Heat Tape (Export Only)
S = Special
X = Export

General Information

Literature Change History

CGAC-IN-4 (January 1986)

Original issue of manual, providing installation, pre-start and start-up information for model CGAC-C20K thru C60K air-cooled Cold Generator units of "A" design sequence.

CGAC "Service Data" Sheets

Use this installation manual in conjunction with the information provided in the applicable CGAC "Service Data" publications.

To insure proper CGAC installation and start-up, the design sequence of the unit (Refer to "Model Number Description") must agree with the design sequence printed on the front cover of the "Service Data" publication.

Installation Checklist

An "Installation Checklist" is provided at the end of the "Installation" section of this manual. Use the checklist to verify that all necessary installation procedures have been completed. <u>Do not use the checklist as a substitute for reading the detailed information contained in the manual</u>. Read the entire manual before beginning installation procedures.

Warnings and Cautions

"Warnings" and "Cautions" appear at appropriate points in this manual. Cautions indicate areas where special attention is required to prevent equipment or property damage. Warnings focus attention on the personal safety of installing and operating personnel. The instructions given in each warning that appears in this manual must be followed carefully.

Unit Description

Trane 20 thru 60-ton Model CGAC Air-Cooled Cold Generators are equipped with either one or two Trane Model K hermetic, reciprocating compressors. All units are dehydrated, leak tested, charged and tested for proper control operation before shipment. A low ambient lockout thermostat can be customer provided.

Standard control for these units is a microprocessor-based electronic controller that governs unit operation in response to chilled water temperature leaving the evaporator. Compressor unloaders are solenoid actuated and discharge pressure operated.

The number of capacity or unloading stages provided is:

```
CGAC-C20K ........ 2-Step Control.
CGAC-C25K, C30K... 3-Step Control.
CGAC-C40K ........ 4-Step Control.
CGAC-C50K, C60K... 6-Step Control.
```

The dual-compressor units (40, 50 and 60-Tons), feature two independent refrigerant circuits--one for each compressor.

Each refrigerant circuit is provided with an operating charge of refrigerant and refrigerant oil, a liquid line solenoid valve, filter drier, sight glass, thermostatic expansion valve and service valve.

Note: The compressor suction and discharge service valves are closed for shipment to isolate the refrigerant charge in the condenser.

The shell-and-tube type evaporator is manufactured in accordance with ASME standards. Each evaporator is fully insulated and equipped with a drain connection. A bulbwell for the unit temperature controller is located on the evaporator water outlet.

A bag containing the unit wiring diagrams, installation manual, and operation/maintenance manual is provided in the control panel. Be sure to read this literature <u>before</u> installing and operating the unit.

If pressure gauges are ordered for field-installation on the unit, they will be shipped in a separate carton along with a cloth bag containing connectors and gaskets.

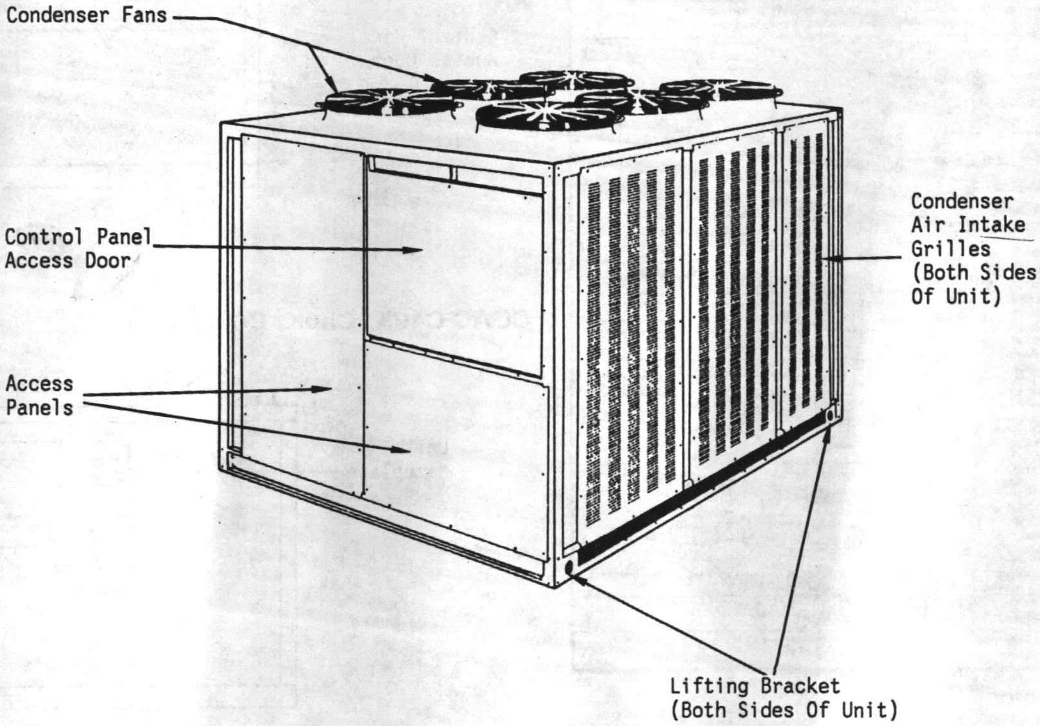
Figure 1 illustrates access panel locations and other CGAC exterior components.

Unit Inspection

When the unit is delivered, verify that the correct one has been shipped and that it is properly equipped by comparing the information that appears on the unit nameplate with ordering and submittal information. Refer to "Nameplates".

Inspect all exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a "unit damage" notation on the carrier's delivery receipt. Specify the extent and type of damage found, and notify the appropriate Trane sales office. <u>Do not proceed with installation of a damaged unit without sales office approval</u>.

Figure 1
Exterior Components of Typical CGAC Unit



Inspection Checklist

To protect against loss due to damage incurred in transit, complete the following checklist upon receipt of the unit:

[ ] Inspect individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.

[ ] Check the unit for concealed damage before it is stored and as soon as possible after delivery. Concealed damage must be reported within 15 days.

[ ] If concealed damage is discovered, stop unpacking the shipment. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.

[ ] Notify the carrier's terminal of damage immediately by phone and by mail. Request an immediate joint inspection of the damage by the carrier and the consignee.

[ ] Notify a Trane sales representative and arrange for repair. Do not repair the unit until damage is inspected by the carrier's representative.

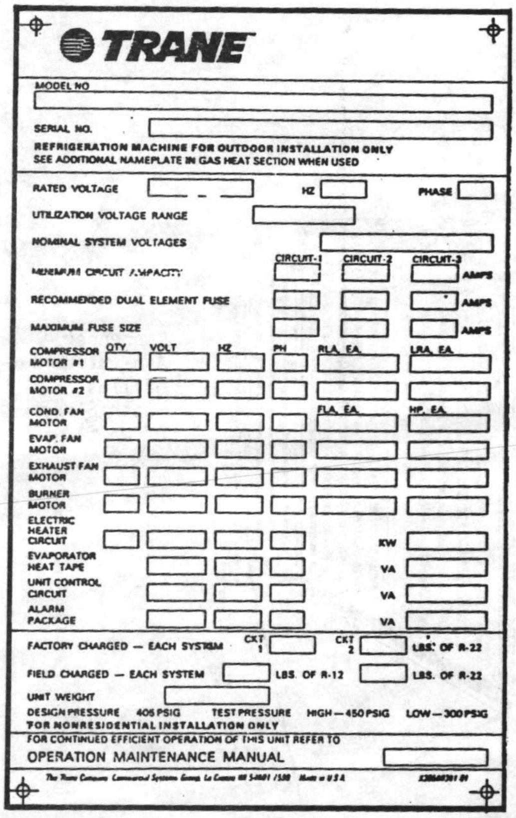
Nameplates

The nameplates on these machines provide valuable information pertaining to the identification of the unit and its components. Provide all pertinent nameplate data when ordering parts or literature, and when making other inquiries.

Unit Nameplate

The unit nameplate for 20 thru 60-ton CGAC units is mounted in the upper left corner of the control panel access door. See Figure 2. This nameplate (Figure 2) specifies control circuit power requirements and power requirements for the chiller heat tapes and optional alarm package. It also identifies the order number of the unit Operation/Maintenance manual. The owner should refer to this manual for information regarding the proper operation and maintenance of this equipment.

Figure 2
Typical CGAC Unit Nameplate and Nameplate Location



TRANE

MODEL NO

SERIAL NO.

REFRIGERATION MACHINE FOR OUTDOOR INSTALLATION ONLY
SEE ADDITIONAL NAMEPLATE IN GAS HEAT SECTION WHEN USED

RATED VOLTAGE | HZ | PHASE

UTILIZATION VOLTAGE RANGE

NOMINAL SYSTEM VOLTAGES

	QTY	VOLT	HZ	PH	CIRCUIT-1 / RLA. EA. / FLA. EA.	CIRCUIT-2	CIRCUIT-3 / LRA. EA. / HP. EA.	
MINIMUM CIRCUIT AMPACITY								AMPS
RECOMMENDED DUAL ELEMENT FUSE								AMPS
MAXIMUM FUSE SIZE								AMPS
COMPRESSOR MOTOR #1								
COMPRESSOR MOTOR #2								
COND. FAN MOTOR								
EVAP. FAN MOTOR								
EXHAUST FAN MOTOR								
BURNER MOTOR								
ELECTRIC HEATER CIRCUIT							KW	
EVAPORATOR HEAT TAPE							VA	
UNIT CONTROL CIRCUIT							VA	
ALARM PACKAGE							VA	

FACTORY CHARGED — EACH SYSTEM CKT 1 CKT 2 LBS. OF R-22

FIELD CHARGED — EACH SYSTEM LBS. OF R-12 LBS. OF R-22

UNIT WEIGHT

DESIGN PRESSURE 405 PSIG TEST PRESSURE HIGH — 450 PSIG LOW — 300 PSIG

FOR NONRESIDENTIAL INSTALLATION ONLY

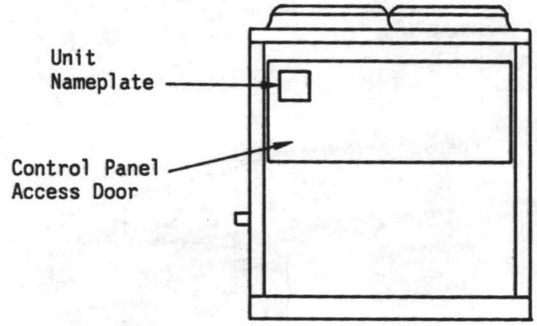
FOR CONTINUED EFFICIENT OPERATION OF THIS UNIT REFER TO

OPERATION MAINTENANCE MANUAL

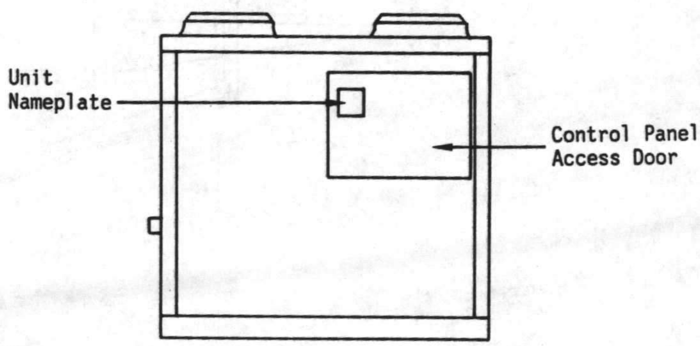
Typical Unit Nameplate

Art No.
RF/CG-2720

CGAC-C20K, C25K, C30K



CGAC-C40K, C50K, C60K



X39560391-01

Compressor Nameplate

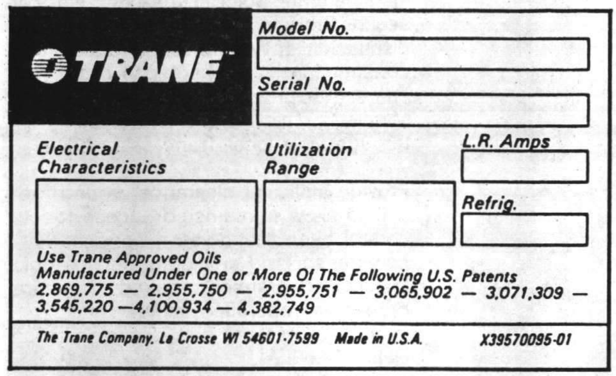
The Model K compressor nameplate shown in Figure 3, is mounted on the compressor lower housing.

Evaporator Nameplate

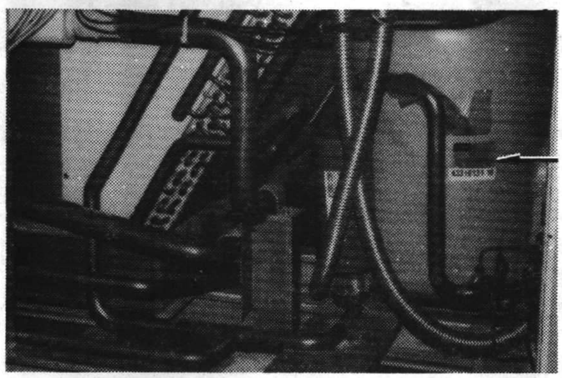
The evaporator nameplate is mounted on the top of the evaporator supply-end tube sheet. The word "nameplate" is applied to the insulation just above the nameplate (Figure 4); to view the nameplate, remove the tape over the area and spread the insulation.

Figure 3
Typical Model K Compressor Nameplate and Nameplate Location

Typical Compressor Nameplate



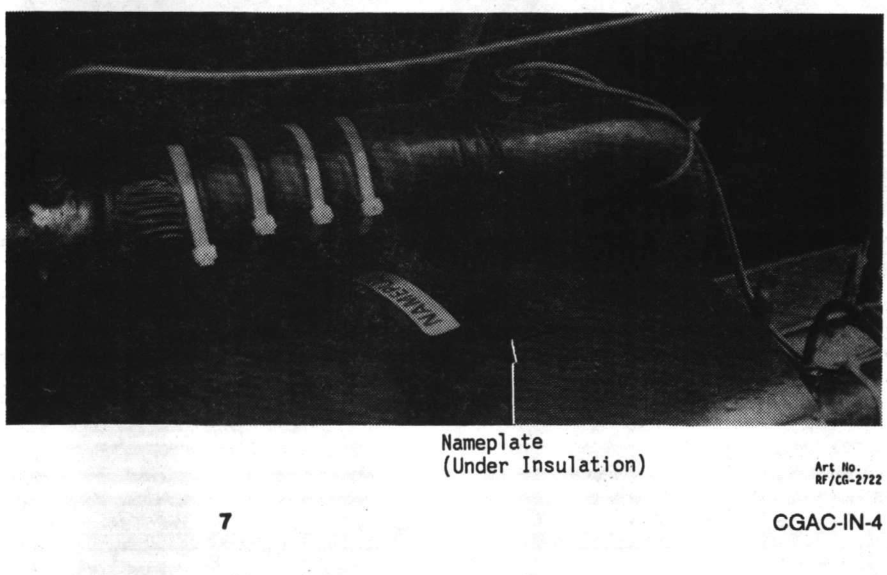
X39570095-01



Nameplate Location

Art No. RF/CG-2736

Figure 4
Evaporator Nameplate Location



Nameplate (Under Insulation)

Art No. RF/CG-2722

Installation

Complete the "Installation Checklist" during installation to verify completion of all recommended procedures before unit start-up.

Unit Dimensions, Clearances and Location

Refer to "Service Data" for unit dimensions. Provide a level mounting surface strong enough to support the unit's weight. Unit operating weights are provided in "Service Data". An isolated concrete foundation -- or footings at each loading point -- will minimize vibration and noise problems. Install anchor bolts in the concrete to secure the unit. For a detailed discussion of base and foundation construction, see Chapter VI of the Trane "Reciprocating Refrigeration Manual". This manual is available through your local Trane sales office.

Provide sufficient clearance around the unit to allow unrestricted access to control panel, evaporator, condenser, compressor and any other service points. Minimum clearances required to ensure proper unit operation, airflow, and service access are provided in "Service Data".

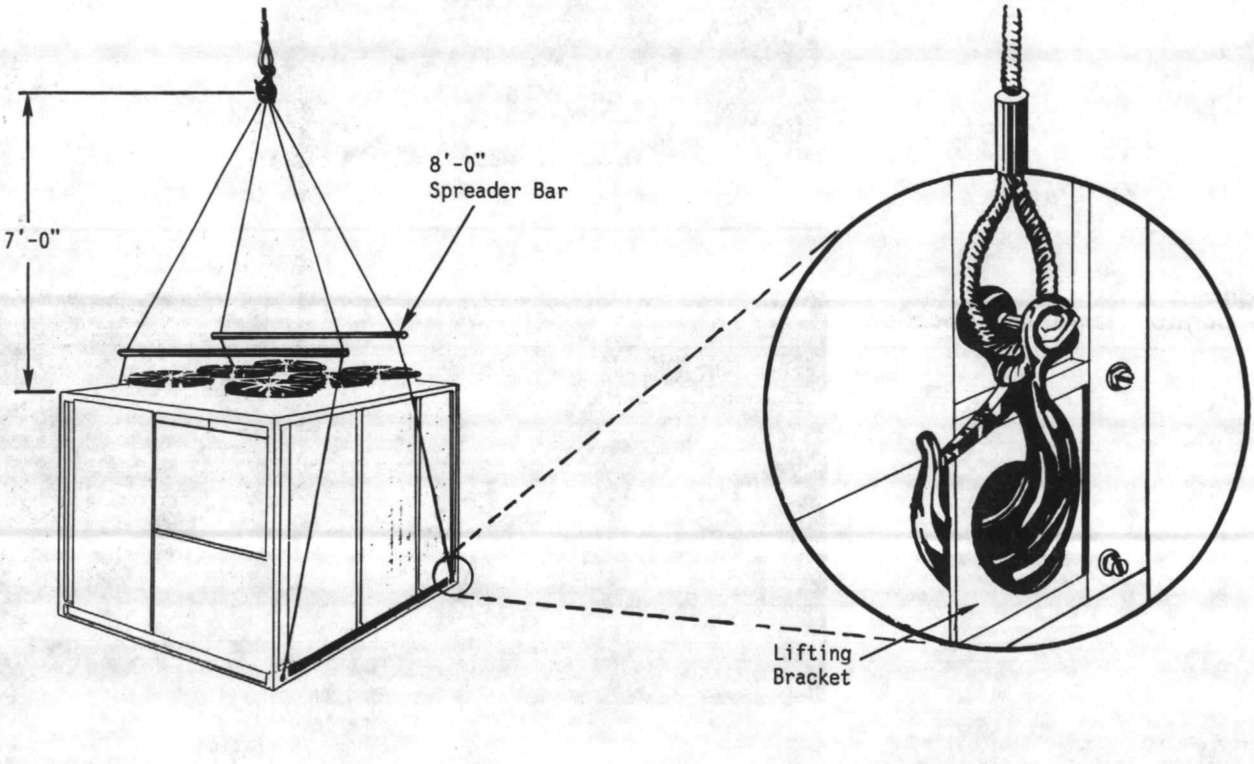
Note: If the unit is installed in a well, the depth of the well must not exceed the height of the unit.

Rigging

Lifting brackets are provided along the base rail on either side of the unit. Pass lifting cables through the brackets and install spreader bars between the cables above unit. A label on the unit base rail illustrates proper lifting procedure. See Figure 5. When rigged properly, the unit will balance at its center of gravity.

WARNING: To prevent injury, death or equipment damage, use cables strong enough to support unit weight. Test-lift unit to ensure proper balance and rigging.

Figure 5
CGAC Rigged for Lifting



Drainage

Locate a large-capacity drain near the unit for system drainage during shutdown or repair. A 3/4-inch NPT drain connection is provided at the leaving chilled water end of the chiller.

Unit Isolation

Mounting methods that will minimize sound and vibration problems are:

1. Mount the unit directly on an isolated concrete pad or on isolated concrete footings at each unit mounting point.

2. Install the optional neoprene or spring mounting isolators at each mounting location. Refer to "Neoprene Isolators" or "Spring Isolators".

Neoprene Isolators

Unit mounting locations and isolator selection information are provided in "Service Data". Proper isolator placement instructions are also placed the the control panel with other unit documentation. Isolators are identified by color and by the isolator part number.

Install neoprene isolators at each unit mounting point using the following procedure:

1. Secure the isolator to the mounting surface using the mounting holes in the base of the isolator (Figure 6). Do not fully tighten the isolator mounting bolts at this time.

2. Align the mounting holes in the base-rail of the unit with the holes in the top of the isolators and lower the unit.

3. Install mounting bolts through the unit base-rail into the threaded tap in the isolator and tighten securely. Maximum isolator deflection should be approximatley 1/4-inch.

4. Level the unit carefully. Refer to "Leveling the Unit".

Spring Isolators

Unit mounting locations and isolator selection information are provided in "Service Data". Proper isolator placement instructions are also placed the the control panel with other unit documentation. Isolators are identified by color and by the isolator part number.

Install neoprene isolators at each unit mounting point using the following procedure:

1. Bolt the isolators to the mounting surface using the mounting slots in the isolator base plate. Do not fully tighten the isolator mounting bolts at this time.

2. Set the unit on the isolators; the isolator positioning pins (Figure 6) must register in the unit mounting holes.

3. Clearance between upper and lower isolator housings should be 1/4 to 1/2 inch (Figure 6). A clearance of over 1/2 inch dictates that shims are required to level the unit (See "Leveling the Unit").

4. Make minor clearance adjustments by turning the isolator levelling bolt (Figure 6) clockwise to increase clearance and counterclockwise to decrease clearance.

5. If proper isolator clearance cannot be obtained by turning the levelling bolt, level the isolators themselves. A 1/4-inch variance in elevation is acceptable.

Leveling the Unit

Before snugging down the mounting bolts, level the unit carefully. Use the unit base rail as a reference. Level the unit to within 1/4 inch over its entire length. Use shims if adjustable isolators are not used.

Compressor Isolators

The Trane Model K hermetic compressor is fully operational as shipped. The compressor is mounted on neoprene grommet isolators that require no special pre-operational adjustments. The compressor receives a correct operational oil charge before shipment.

Caution: To prevent compressor damage, be certain that suction and discharge valves are open (backseated) before starting the unit.

Low Ambient Dampers

Operation

A set of dampers is used to extend operation of these units from the standard low limit operational temperature to a minimum of 0 F. The dampers modulate airflow across the condenser coils to maintain condensing pressure during low ambient operation.

Refrigerant-operated actuators control damper modulation for each refrigerant circuit in response to condensing pressure, closing the dampers when condensing pressure decreases due to a fall in ambient temperature. Damper operating setpoints are given in "Service Data".

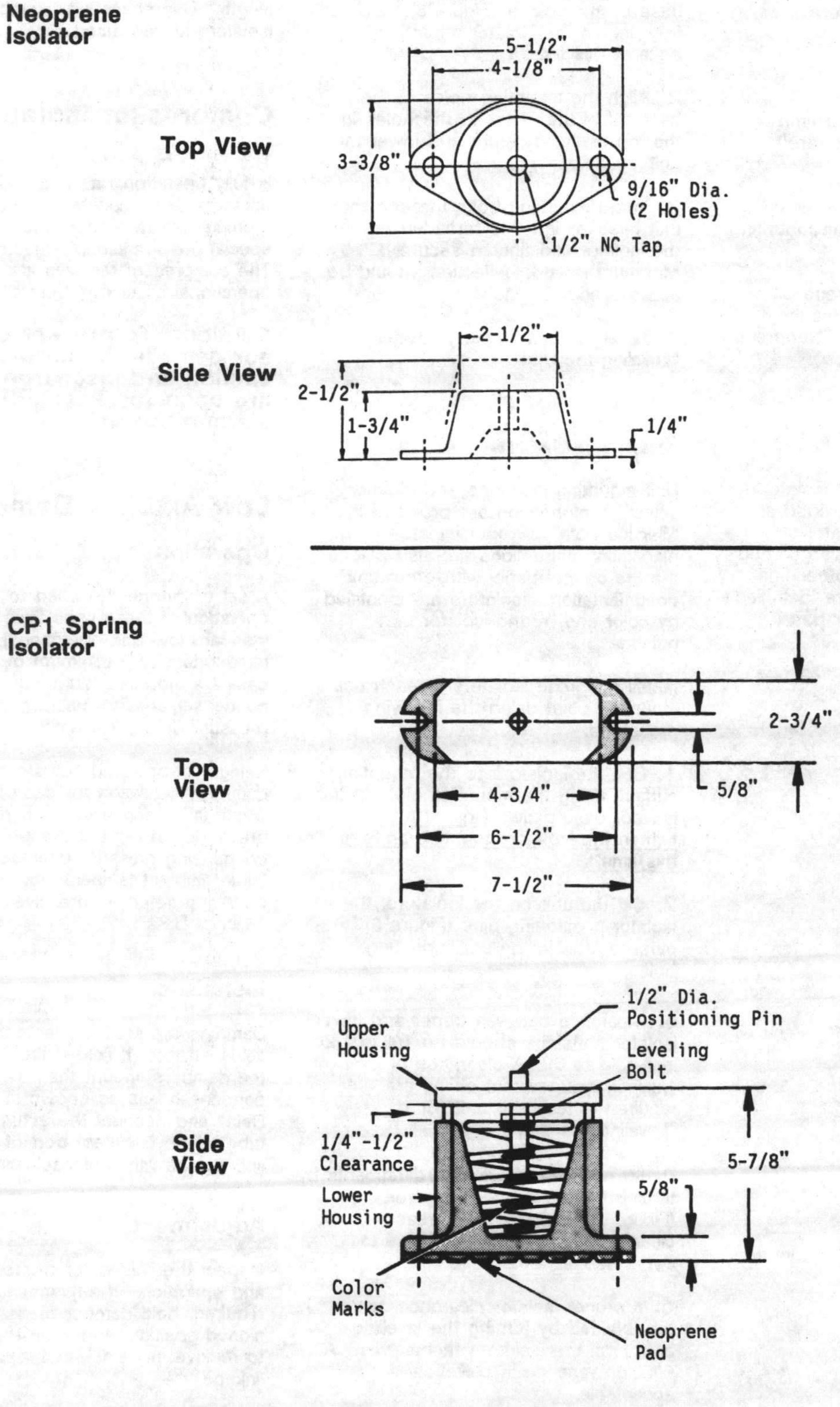
Installation

Dampers are available factory or field-installed. If field installing the dampers, mount them over the condenser fans as shown in "Service Data" and connect the actuator capillary tube to the backseat port of the liquid line service valve for each circuit.

Adjustment

Inspect the blades for proper alignment and operation. If adjustment is required, hold damper blades firmly in closed position, and slide the operator to remove any slack in the actuating linkage.

Figure 6
Typical CGAC Unit Mounting Isolators



Unit Water Piping

General Water Piping Recommendations

Thoroughly flush all system water piping before making final piping connections to the unit.

Caution: If using an acidic commercial flushing solution, construct a temporary bypass around the unit to prevent damage to internal components of the evaporator.

Caution: To avoid possible equipment damage, do not use untreated--or improperly treated--system water.

Use thread sealant or Teflon tape at all water connections to prevent leakage. To minimize heat gain and prevent condensation, insulate all piping.

Caution: Avoid overtightening to prevent damage to water connections; the use of Teflon tape makes overtightening more likely to occur.

The "Trane Reciprocating Refrigeration Manual" disusses proper piping practices and sizing methods. This manual is available through Trane sales offices.

Evaporator Water Piping

Connections. Types, sizes and locations of water inlet and outlet connections are provided in "Service Data".

Piping Components. Figure 7 shows typical evaporator water piping components. Components and layout will vary, depending upon the locations of the connections and water source. A vent is located on top of the evaporator at the return end. Provide additional vents at high points in the piping to bleed air from the chilled water system. Install pressure gauge(s) to monitor entering and leaving chilled water pressure.

Caution: To prevent evaporator damage, do not exceed 150 psig evaporator water pressure.

Provide shutoff valves in the pressure gauge line(s) to isolate them from the rest of the system when they are not in use. Use pipe unions to simplify disassembly for system service, and vibration eliminators to prevent vibration transmission through the water lines.

Install thermometers in the lines to monitor evaporator entering and leaving water temperatures, and a balancing cock in the leaving water line to establish a balanced water flow. Install shutoff valves in entering and leaving water lines to isolate the evaporator for service. Install a pipe strainer in the evaporator supply line.

Evaporator Drain. There is a 3/4-inch drain connection under the leaving chilled water end of the evaporator (Figure 8) that can be piped to a drain for emptying the evaporator during shutdown or service. Install a shutoff valve in the drain line. If drain is not piped, remove the drain plug from the plastic bag in the control panel and install it in the drain connection.

Evaporator Flow Switch. Use a flow sensing device (i.e., flow switch) to prevent or stop compressor operation if evaporator water flow drops drastically. Install it in the evaporator chilled water outlet piping as shown in Figure 7. See "Electrical Wiring" for the flow switch electrical interlock diagram; a procedure for measuring water pressure drop (along with a pressure drop chart) is provided in the "Prestart Procedures" section of this manual.

Freeze Protection

General Recommendations

Use the procedure described below to ensure that the chilled water system is adequately protected from freeze-up in those applications where the unit remains operational at subfreezing ambient temperatures.

1. Install chilled water piping heat tape along with a fused disconnect switch; refer to the instructions outlined under "Heat Tape". Ensure that all exposed piping is adequately protected.

Note: Heat tape is factory-installed on the unit evaporator and all internal water piping; this heat tape will protect these components from freeze-up at ambient temperatures down to -20 F.

2. Freeze-proof the chilled water system by adding a non-freezing, low-temperature, heat-transfer fluid to the chilled water system. This solution must provide protection against ice formation at the lowest expected ambient temperature.

Evaporator water capacities are provided in "Service Data". Follow the manufacturer's recommendations for the use and testing of the anti-freeze solution.

Note: Use of an ethylene glycol-type antifreeze reduces unit cooling capacity; this condition must be accounted for during total system design.

Figure 7
Recommended Piping Components for Typical Evaporator Installation

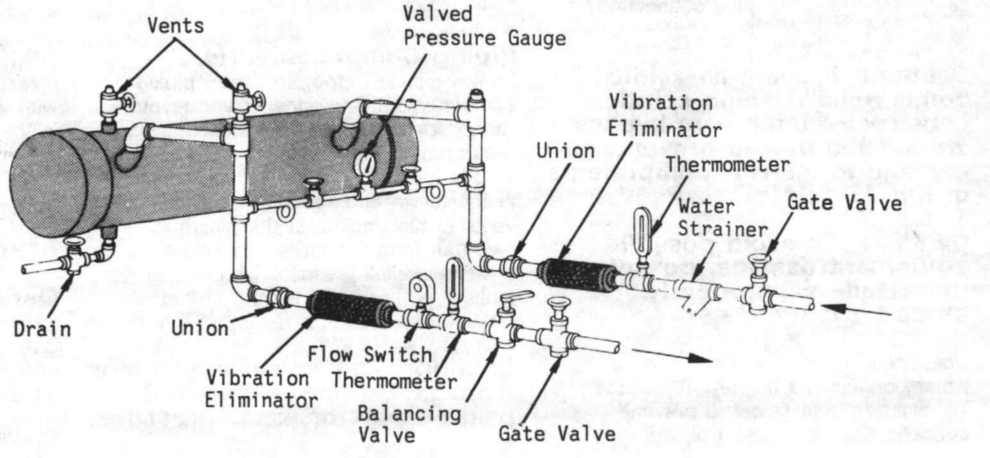
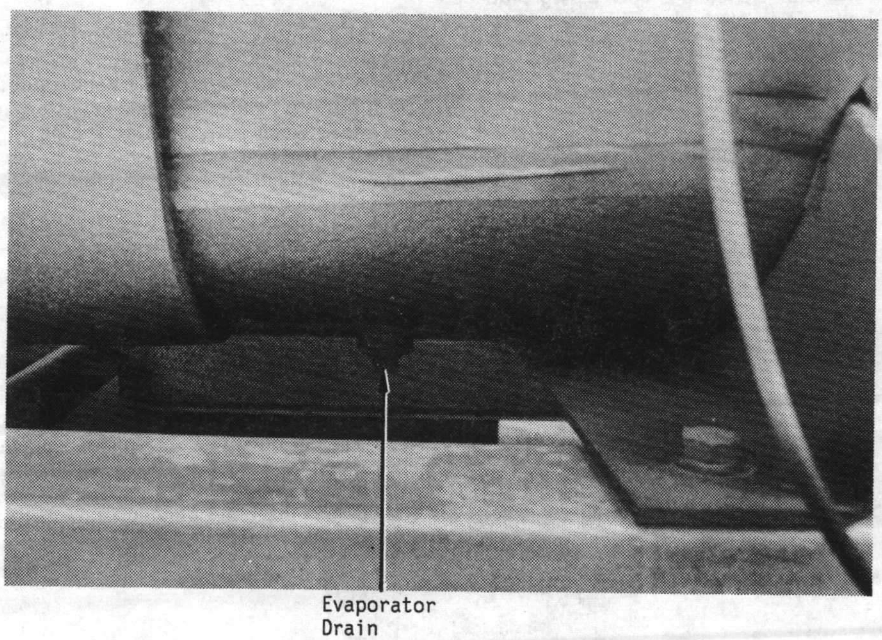


Figure 8
Evaporator Drain for Typical CGAC Units



Heat Tape Installaton

Install heat tape on all external water piping that may be exposed to freezing temperatures. Be sure to use heat tape that is recommended for low-temperature applications; it should be rated at 110/120 volts, thermostatically controlled, and dissipate 7 watts per linear foot.

Heat tape selection should be based on the lowest expected ambient temperature --including any wind chill factor. For heat tapes not automatically (i.e., thermostatically) controlled, install an accessory thermostat.

Refer to Tables 1 and 2 for typical heat tape characteristics.

To install the heat tape properly, follow the instructions provided by the heat tape manufacturer. If none are provided, use the recommendations outlined below:

1. Wrap the heat tape around the pipe or apply it straight along the pipe (Tables 1 and 2) as necessary to provide the required protection.

2. Use friction tape to secure the heat tape to the water pipe.

3. Place the thermostat tightly against -- and parallel to -- the water pipe; then tape it into place at both ends. Be sure to install the thermostat on the most exposed (i.e., coldest) portion of the pipe.

4. Wrap the pipe with weatherproof tape. On vertical pipe runs, start the wrap at the bottom and work up as shown in Figure 9. Be sure to overlap the tape so that it will shed moisture.

Note: If additional protection is required, insulate the pipe with fiberglass wrap before installing the outer wrap.

Caution: To prevent heat tape failure, frozen pipes, and other unit damage, do not install fiberglass insulation under outer pipe wrap if non-thermostatic heat tape is used.

If freezing is a potential problem, all exposed piping, pumps and other components must be protected with heat tape and insulation.

Figure 9
Typical Insulated Heat Tape Installation (Spiralled Application)

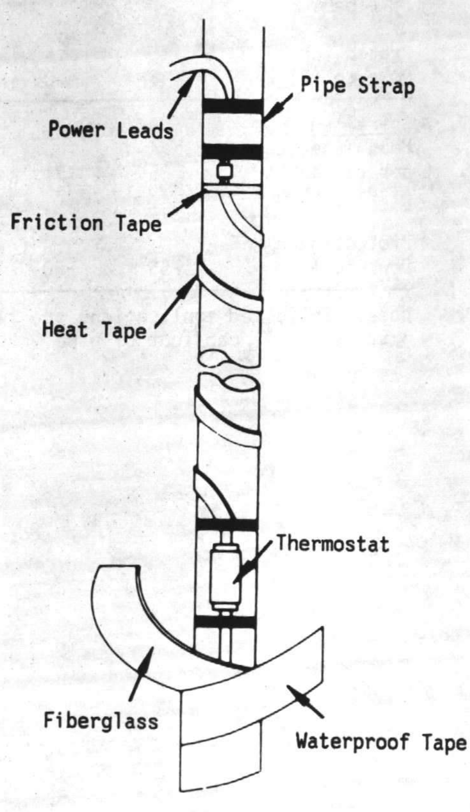


Table 1
Application of Non-Thermostatic Heat Tape w/Outer Wrap and No Insulation

Application Technique	Pipe Size				
	2"	2-1/2"	3"	4"	5"
Straight: Heat Tape Req. per Linear Ft. of Pipe	12"	12"	12"	12"	12"
Protection Down to (F)	6	11	15	20	22
Spiralled: Heat Tape Req. per Linear Ft. of Pipe	28"	31"	35"	47"	54"
Protection Down to (F)	-27	-23	-20	-17	-15

Note: Spiralled applications are twisted around pipe 3 turns per linear foot of pipe.

Table 2
Application of Non-Thermostatic Heat Tape w/Outer Wrap and Insulation

Application Technique	Pipe Size				
	2"	2-1/2"	3"	4"	5"
Straight: Heat Tape Req. per Linear Ft. of Pipe	12"	12"	12"	12"	12"
Protection Down to (F)	-6	0	3	12	16
Spiralled: Heat Tape Req. per Linear Ft. of Pipe	26"	31"	35"	47"	54"
Protection Down to (F)	-55	-50	-45	-40	-1

Note: Spiralled applications are twisted around pipe 3 turns per linear foot of pipe.

Electrical Wiring

General Recommendations

WARNING: To prevent injury or death, disconnect electrical power source before completing wiring connections to unit.

All wiring must comply with local and national electrical codes. The installer must provide properly sized system interconnecting and power supply wiring with with appropriate fused disconnect switches. Type and locations of disconnects must comply with all applicable codes.

Caution: Use only copper conductors for terminal connections to avoid corrosion or overheating.

Electrical connection locations, minimum circuit ampacities, recommended fuse sizes, and other unit electrical data is provided in "Service Data" and on the unit nameplate. Typical field wiring diagrams are shown in Figures 10 and 11.

Power Supply Wiring

Water Pump Power Supply. Provide supply power wiring with fused disconnect for the chilled water pump (Figures 10 and 11).

Unit Power Supply. Run appropriately sized power wiring through the line voltage access openings provided on the side of the unit and up through the openings in the bottom of the control panel. Connect it to the proper terminal block or unit-mounted disconnect. Refer to Figures 10 and 11. Install fused disconnects as required by local codes. Sizes and locations of electrical access openings are shown in "Service Data". Provide proper equipment ground to the ground connections in the control panel.

Note: For unit applications requiring supply power wiring conductors exceeding 500 MCM, run parallel conductors through the two line voltage electrical openings provided.

A non-fused, unit-mounted disconnect switch and the control power transformer are optional.

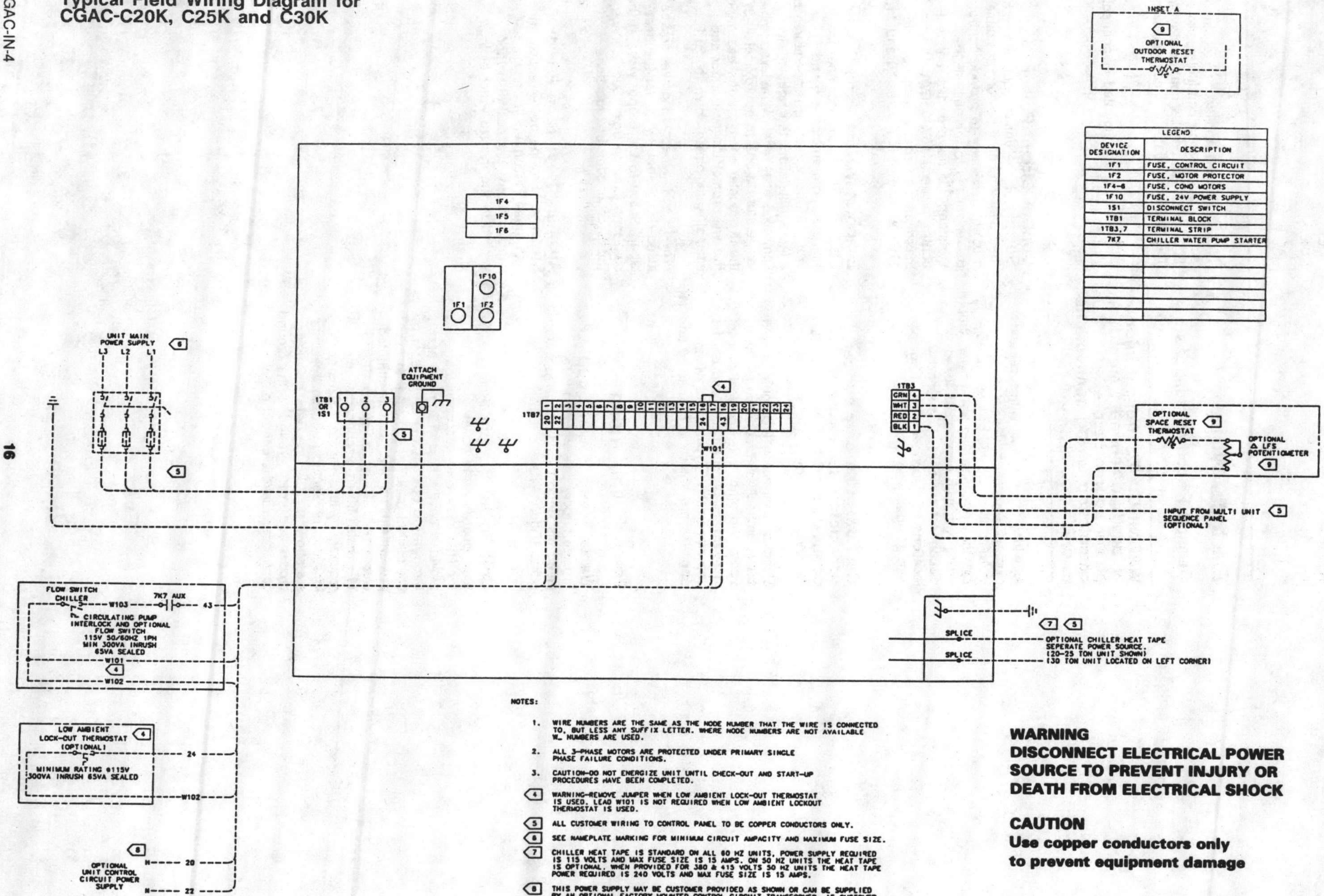
Control Circuit Power Supply. If the unit is equipped with the optional control power transformer it is not necessary to provide control power voltage to the unit. If the transformer is not provided, connect control power (115V, 750VA, 15 amp maximum fuse size) to terminal strip 1TB7 as shown in Figures 10 and 11.

Evaporator Heat Tape Power Supply. The evaporator shell is insulated from ambient air, and protected from freezing temperatures by a factory installed, thermostatically controlled heat tape. Whenever ambient temperature drops to approximately 37 F, the thermostat energizes the heat tape; this will protect the evaporator and internal water piping down to -20 F.

Provide an independent power source with fused disconnect switch for the heat tape. Splice to the proper wires in the heat tape junction box. See "Service Data" for junction box locations.

Auxiliary Heat Tape Power Supply. Provide power supply wiring with fused disconnect for any supplementary electrical heat tape applied to the system water piping.

Figure 10
Typical Field Wiring Diagram for CGAC-C20K, C25K and C30K



LEGEND	
DEVICE DESIGNATION	DESCRIPTION
1F1	FUSE, CONTROL CIRCUIT
1F2	FUSE, MOTOR PROTECTOR
1F4-6	FUSE, COND MOTORS
1F10	FUSE, 24V POWER SUPPLY
1S1	DISCONNECT SWITCH
1TB1	TERMINAL BLOCK
1TB3,7	TERMINAL STRIP
7K7	CHILLER WATER PUMP STARTER

NOTES:

1. WIRE NUMBERS ARE THE SAME AS THE NODE NUMBER THAT THE WIRE IS CONNECTED TO, BUT LESS ANY SUFFIX LETTER. WHERE NODE NUMBERS ARE NOT AVAILABLE W_ NUMBERS ARE USED.
2. ALL 3-PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
3. CAUTION-DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.

4 WARNING-REMOVE JUMPER WHEN LOW AMBIENT LOCK-OUT THERMOSTAT IS USED. LEAD W101 IS NOT REQUIRED WHEN LOW AMBIENT LOCKOUT THERMOSTAT IS USED.

5 ALL CUSTOMER WIRING TO CONTROL PANEL TO BE COPPER CONDUCTORS ONLY.

6 SEE NAMEPLATE MARKING FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM FUSE SIZE.

7 CHILLER HEAT TAPE IS STANDARD ON ALL 60 HZ UNITS, POWER SUPPLY REQUIRED IS 115 VOLTS AND MAX FUSE SIZE IS 15 AMPS. ON 50 HZ UNITS THE HEAT TAPE IS OPTIONAL. WHEN PROVIDED FOR 380 & 415 VOLTS 50 HZ UNITS THE HEAT TAPE POWER REQUIRED IS 240 VOLTS AND MAX FUSE SIZE IS 15 AMPS.

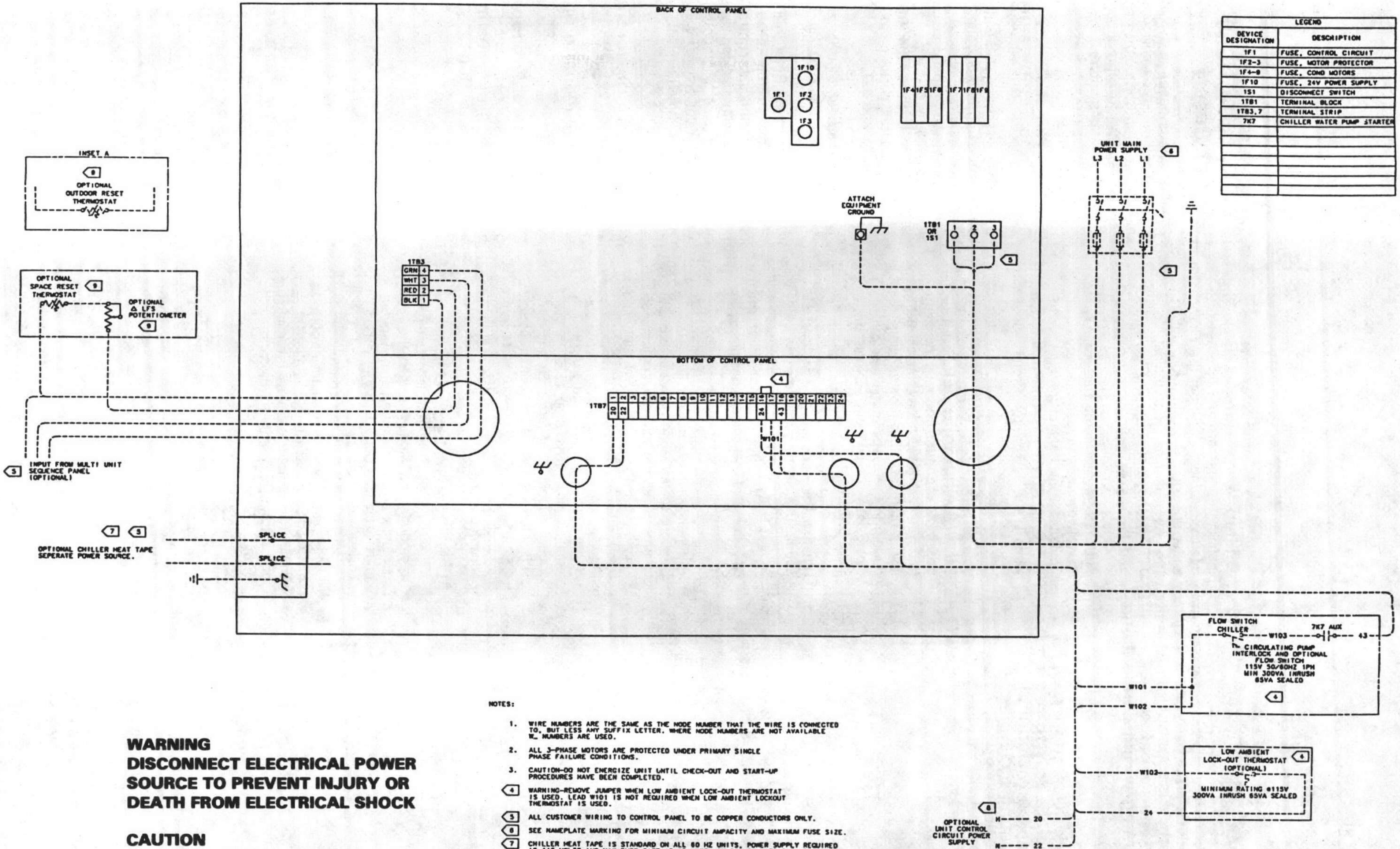
8 THIS POWER SUPPLY MAY BE CUSTOMER PROVIDED AS SHOWN OR CAN BE SUPPLIED BY AN OPTIONAL FACTORY MOUNTED CONTROL CIRCUIT TRANSFORMER. IF CUSTOMER PROVIDED THE POWER REQUIREMENTS ARE 115 VOLTS, 750 VA AND THE MAX FUSE SIZE IS 15 AMPS. IF THE OPTIONAL TRANSFORMER IS ORDERED THIS POWER SUPPLY AND LEADS 20 AND 22 ARE NOT REQUIRED.

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

2306-1929

Figure 11
Typical Field Wiring Diagram for CGAC-C40K, C50K and C60K



LEGEND	
DEVICE DESIGNATION	DESCRIPTION
1F1	FUSE, CONTROL CIRCUIT
1F2-3	FUSE, MOTOR PROTECTOR
1F4-9	FUSE, COND MOTORS
1F10	FUSE, 24V POWER SUPPLY
1S1	DISCONNECT SWITCH
1TB1	TERMINAL BLOCK
1TB3,7	TERMINAL STRIP
7K7	CHILLER WATER PUMP STARTER

NOTES:

1. WIRE NUMBERS ARE THE SAME AS THE NODE NUMBER THAT THE WIRE IS CONNECTED TO, BUT LESS ANY SUFFIX LETTER. WHERE NODE NUMBERS ARE NOT AVAILABLE W_ NUMBERS ARE USED.
2. ALL 3-PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
3. CAUTION-DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.

4 WARNING-REMOVE JUMPER WHEN LOW AMBIENT LOCK-OUT THERMOSTAT IS USED. LEAD W101 IS NOT REQUIRED WHEN LOW AMBIENT LOCKOUT THERMOSTAT IS USED.

5 ALL CUSTOMER WIRING TO CONTROL PANEL TO BE COPPER CONDUCTORS ONLY.

6 SEE NAMEPLATE MARKING FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM FUSE SIZE.

7 CHILLER HEAT TAPE IS STANDARD ON ALL 60 HZ UNITS. POWER SUPPLY REQUIRED IS 115 VOLTS AND MAX FUSE SIZE IS 15 AMPS. ON 50 HZ UNITS THE HEAT TAPE IS OPTIONAL. WHEN PROVIDED FOR 380 & 415 VOLTS 50 HZ UNITS THE HEAT TAPE POWER REQUIRED IS 240 VOLTS AND MAX FUSE SIZE IS 15 AMPS.

8 THIS POWER SUPPLY MAY BE CUSTOMER PROVIDED AS SHOWN OR CAN BE SUPPLIED BY AN OPTIONAL FACTORY MOUNTED CONTROL CIRCUIT TRANSFORMER. IF CUSTOMER PROVIDED THE POWER REQUIREMENTS ARE 115 VOLTS, 750 VA AND THE MAX FUSE SIZE IS 15 AMPS. IF THE OPTIONAL TRANSFORMER IS ORDERED THIS POWER SUPPLY AND LEADS 20 AND 22 ARE NOT REQUIRED.

9 △LFS RESET POTENTIOMETER USED WITH REMOTE SPACE SENSOR. FOR OUTDOOR RESET, REMOTE SPACE SENSOR AND △LFS RESET POTENTIOMETER IS NOT USED (SEE INSET A). THE NOTED OPTIONAL SPACE OR OUTDOOR RESET THERMOSTAT ARE NOT AVAILABLE IF THE MULTI UNIT SEQUENCE PANEL IS PROVIDED.

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

2306-1929

Interconnecting System Wiring

WARNING: To prevent injury or death, disconnect electrical power source before completing wiring connections to unit.

Caution: Use copper conductors only to prevent galvanic corrosion and overheating at terminal connections.

Chilled Water Pump (7B1). The installing contractor must provide interconnecting wiring from the chilled water pump (7B1) pushbutton station to the proper terminals on terminal block 1TB7 in the control panel (Figures 10 and 11).

The water pump motor starter (7K7) must have two normally-open auxiliary contacts: one contact in series with the pump START pushbutton, the other wired in the flow switch circuit. See Figures 10 and 11.

Flow Switch Interlock. To avoid possible evaporator freeze-up resulting from restricted water flow, install a flow switch (or other flow sensing device) in the evaporator water outlet piping; see "Unit Piping: Evaporator Flow Switch".

Whether field-supplied or a factory option, this sensing device must be adjusted to stop compressor operation if water flow to the evaporator drops below 50 percent of the system design full-flow rate.

The installer must provide interconnecting wiring between the unit control panel, the auxiliary contacts of the chilled water pump motor starter (7K7), and the flow sensing device in the evaporator water supply line. Connect the switch to the proper terminals of terminal strip 1TB7 in the control panel; see Figures 10 and 11. This interlock must allow compressor operation only if the chilled water pump is running and providing the minimum acceptable water flow rate.

Low Ambient Lockout Thermostat. The installer must provide interconnecting wiring between the customer-provided low ambient lockout thermostat (Figures 10 and 11), the chilled water flow switch and the proper terminals of 1TB7 in the control circuit panel. The thermostat should be adjusted to prevent unit operation at ambient temperatures below the minimum unit start-up temperatures given in "Service Data".

Installation of Optional Setpoint Reset

A factory control option is available that enables the leaving chilled water setpoint (i.e., from the unit) to be reset in response to either indoor zone or outdoor air temperature.

Indoor Zone Temperature

To reset unit leaving chilled water setpoint based on indoor zone temperature, a remote setpoint potentiometer and a space sensor (both factory-provided) must be field-connected to the proper terminal strip in the control circuit panel (Figures 10, 11 and 12).

The potentiometer and indoor zone sensor are connected in series to Terminals 1 and 2 of terminal strip 1TB3 in the control circuit panel. Refer to Figure 12. All wiring to and from these remote input devices to the unit control panel must be made with shielded, twisted-pair conductors; be sure to ground the shielding at the unit. See Table 3 for recommended conductor sizes.

WARNING: To prevent injury or death, disconnect electrical power source before completing wiring connections to unit.

Caution: Use only copper conductors to prevent galvanic corrosion and overheating at terminal connections.

Figure 12
Installation of Optional Setpoint Reset Sensors

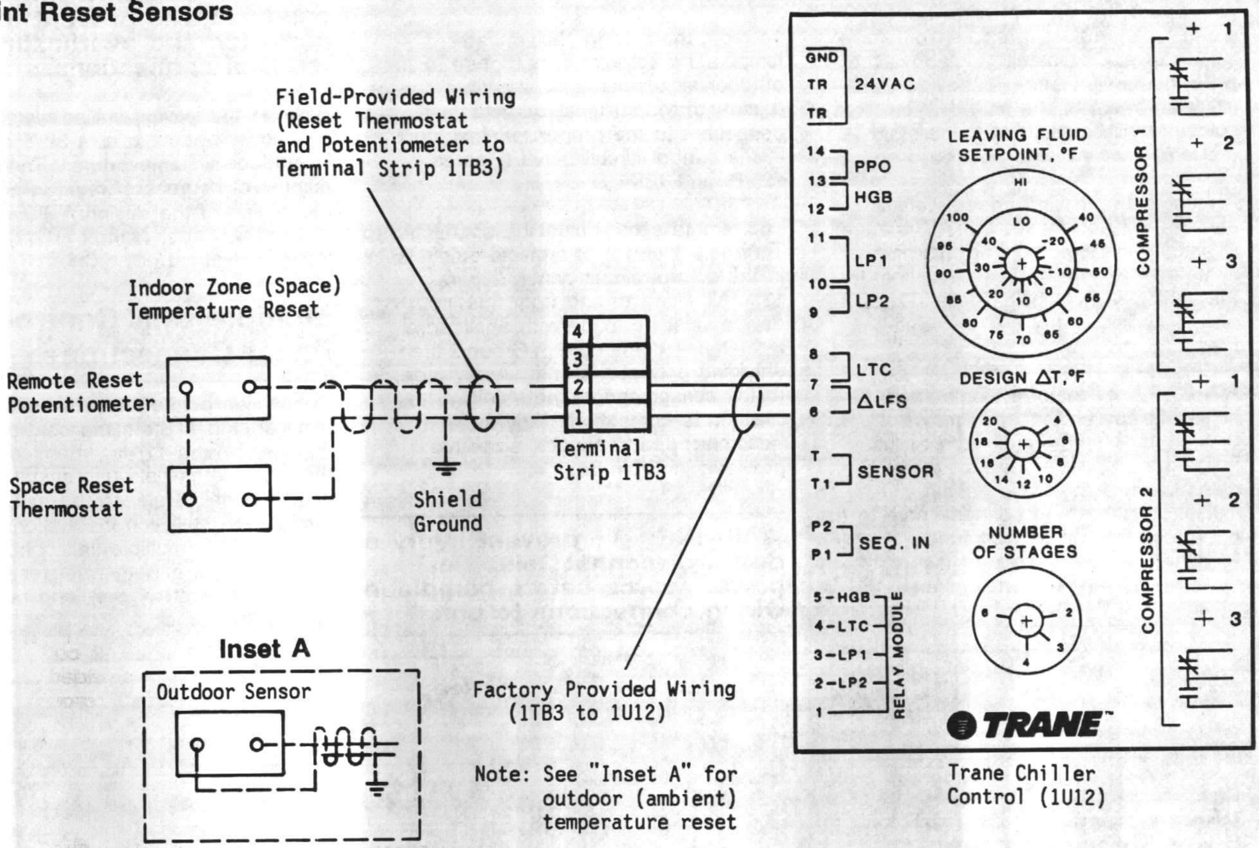


Table 3
Recommended Wire Sizes for Installation of Optional Setpoint Reset

Wire Gauge	Maximum Distance from Sensor to Unit	Maximum Total Wire Length
22 Awg	30 Feet	60 Feet
20 Awg	50 Feet	100 Feet
18 Awg	75 Feet	150 Feet
16 Awg	125 Feet	250 Feet
14 Awg	200 Feet	400 Feet

Once the indoor zone temperature input devices for the setpoint reset option are installed, adjust the potentiometer setting to approximately 2 F above the zone thermostat; this will provide maximum reset of the chilled water setpoint while continuing to maintain the temperature of the controlled space.

A reset in the leaving chilled water setpoint will occur over a 4.5 F change in space temperature. The maximum number of degrees of reset is equal to the setting of the design delta-T knob on the chiller control (1U12). See Figure 13.

Note: Placement of a single zone sensor in any one location may not provide an accurate indication of actual building load. To more accurately determine building load, install multiple sensors and connect them to the chiller control in a series-parallel wiring configuration; refer to Figure 14 for a typical wiring arrangement.

Outdoor Air Temperature

To reset the leaving chilled water temperature setpoint in response to the outdoor air temperature, a remote sensor (factory-provided) must be field connected to the proper terminal strip in the control circuit panel (Figures 10, 11 and 12).

The remote sensor must be connected to Terminals 1 and 2 of terminal strip 1TB3 in the control circuit panel. (Figure 12). All wiring to and from this input device must be made with shielded, twisted-pair conductors. Ground the shielding only at the unit. Apply tape to the sensor end of the shielding to prevent its contact with any surface. Recommended conductor sizes are provided in Table 3.

WARNING: To prevent injury or death, disconnect electrical power source before completing wiring connections to unit.

Caution: Use only copper conductors to prevent galvanic corrosion and overheating at terminal connections.

Reset in the leaving chilled water setpoint will occur over a 30 F change in outdoor air temperature. The maximum number of degrees of reset is equal to the setting of the design Δ T setpoint dial on the chiller control (1U12). Refer to Figure 13.

Multiple Unit Control Panel Connections

Connection points are provided at terminal strip 1TB3 in the control panel (Figures 10 and 11) for interface with the available multiple unit system control panel. Refer to the multiple unit panel installation instructions for details. If the multiple unit control panel is used, chilled water reset is provided at system level, and not at the unit control panel.

Figure 13
Reset of Leaving Chilled Water Setpoint vs. Input Resistance

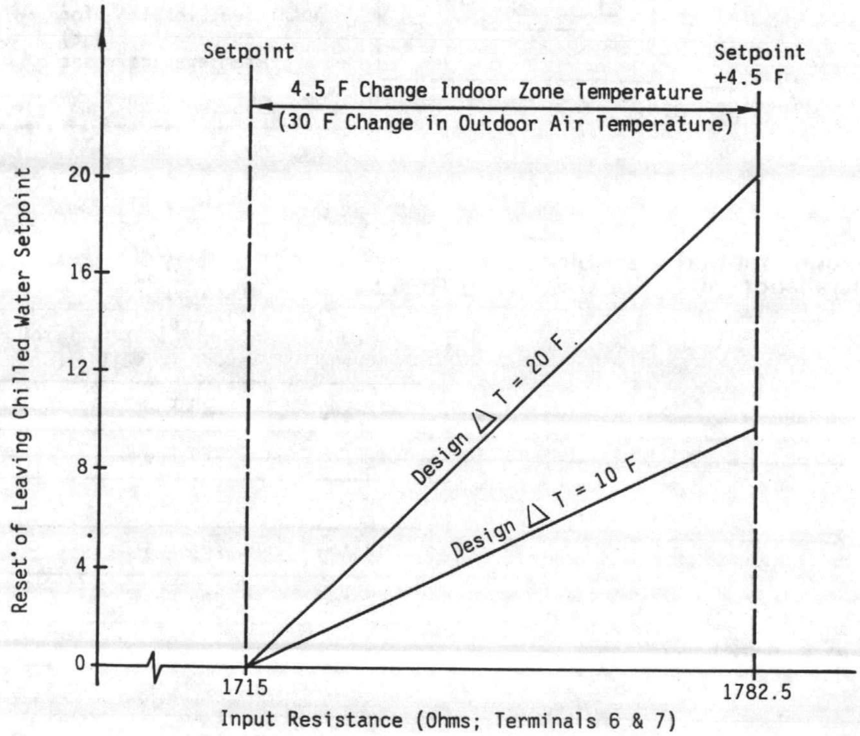
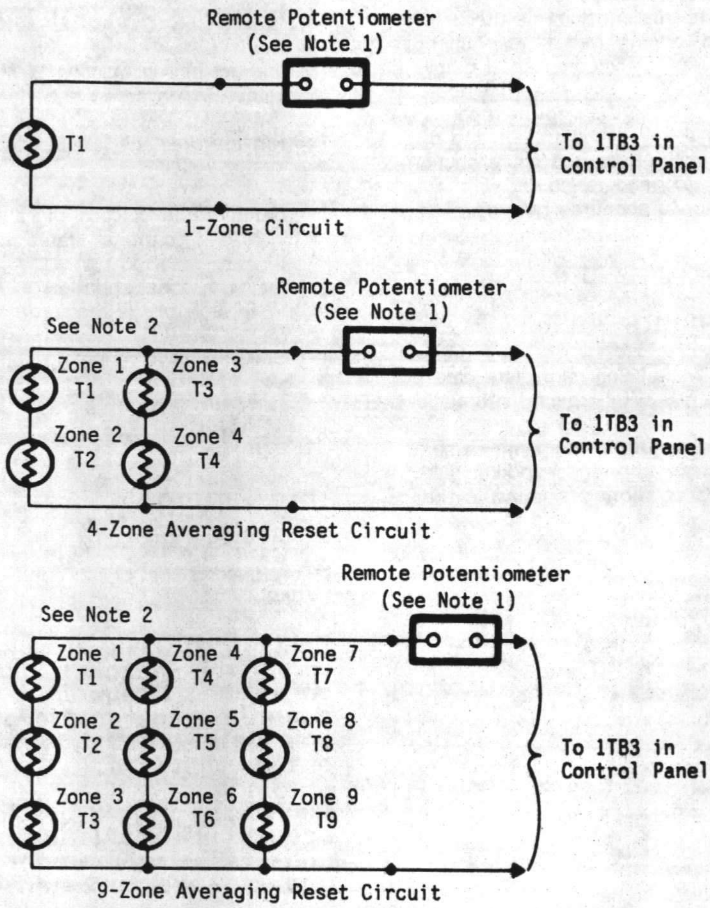


Figure 14
Setpoint Reset from Single or Multiple Indoor Zone Sensors



Notes:

1. Remote setpoint potentiometer required to permit adjustment of reset control point. (Use only with indoor zone sensors; do not use with outdoor air sensors.)

2. All thermostats wired in series-parallel configuration.

Installation Checklist

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

Receiving

[ ] Verify that unit nameplate data corresponds with ordering information.

[ ] Inspect unit for shipping damage and material shortage; report any damages or shortages found to the carrier.

Unit Location and Mounting

[ ] Inspect unit installation location for adequate service access clearances.

[ ] Provide drainage facilities for evaporator water.

[ ] Remove and discard any shipping materials (e.g., cartons, crates, etc.).

[ ] Install optional spring or neoprene isolators (if required).

[ ] Secure unit to mounting surface.

[ ] Level the unit.

Unit Piping

[ ] Flush all water piping to unit before making final piping connections to unit.

Caution: If using an acidic commercial flushing solution, construct a temporary bypass around the unit to prevent damage to internal components of the evaporator.

Caution: To avoid possible equipment damage, do not use untreated -- or improperly treated -- system water.

[ ] Make evaporator water connections.

[ ] Vent chilled water system at high points in system piping.

[ ] Install pressure gauges with shutoff valves, thermometers and shutoff valves on water inlet and outlet piping.

[ ] Install water strainer in evaporator supply line.

[ ] Install balancing valve and flow switch on water outlet piping.

[ ] Install evaporator drain plug, or install drain piping with shutoff valves.

[ ] Apply heat tape and insulation as necessary to protect all exposed piping from freeze-up.

Electrical Wiring

WARNING: To prevent injury or death, disconnect electrical power source before making final connections to unit.

Caution: Use only copper conductors for terminal connections to avoid corrosion or overheating.

Power Supply Wiring

[ ] Connect unit (compressor) power supply wiring with fused disconnect to terminal block (or unit-mounted disconnect) in control panel.

[ ] On units without optional control power transfomer, connect control power supply wiring with fused disconnect to terminal strip in control panel.

[ ] Connect power supply wiring for chilled water (evaporator) pump.

[ ] Connect power supply wiring with fused disconnect for factory evaporator heat tape.

[ ] Connect power supply wiring with fused disconnect, to any auxiliary heat tape installed on system water piping.

Interconnection Wiring

[ ] Install wiring to connect remote pushbutton station to chilled water (evaporator) pump motor starter.

[ ] Connect auxiliary contacts of chilled water pump starter to flow switch and unit control panel.

[ ] Install wiring to connect flow switch to unit control panel.

[ ] If unit is equipped with optional setpoint reset, install wiring between remote sensor (and potentiometer, if applicable) and the unit.

Pre-Start Procedures

Pre-Start Checklist

After the unit is installed, complete each step in the checklist that follows and check off each step as completed. When all are accomplished, the unit is ready to run.

[ ] Inspect all wiring connections. Connections should be clean and tight.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

Caution: To prevent overheating at connections and undervoltage conditions at the compressor motor, check tightness of all connections in the compressor power circuit.

[ ] Check compressor crankcase oil levels. Oil level with the compressor not running should be at the one-half to three-quarters point on the oil level sight glass. Refer to "Checking Operating Conditions" in the "Start-Up Procedure" section.

[ ] Open (backseat) the liquid line service valves and the compressor suction and discharge service valves (Figures 15 and 16).

Caution: To prevent compressor damage, be certain that all refrigerant valves are open before starting the unit.

[ ] Check voltage to the unit at the line power fused disconnect. Voltage must be within the voltage utilization range given in "Service Data" (also stamped on the unit nameplate). Voltage imbalance must not exceed 2 percent. Refer to "Unit Voltage".

WARNING: To prevent injury or death due to contact with rotating parts, open and lock all electrical disconnects.

[ ] Check condenser fans. Fan blades should rotate freely in fan orifices and should be mounted securely on the motor shafts.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

[ ] Check the sensing bulb in the bulbwell on the evaporator leaving water outlet (Figure 17). It must be installed securely in the bulbwell with heat transfer compound.

[ ] Energize the compressor crankcase heaters by closing the line power fused disconnect. The unit-mounted disconnect if used, must also be closed. The compressor service switches, on the operating panel should be in the Stand By position. The unit service switch should be in the Pump Down Or Reset position.

Caution: To prevent compressor damage, energize compressor crankcase heaters a minimum of eight hours before operating the unit.

[ ] Fill the chilled water system. Refer to "Service Data" for evaporator liquid capacities. Vent the system while filling it and remove the pipe plug from the vent located on the top of the evaporator (Figure 18). Replace the vent plug when the evaporator is filled.

Caution: To avoid possible equipment damage, do not use untreated -- or improperly treated -- system water.

[ ] Close the fused disconnect for the chilled water pump starter.

[ ] Start the chilled water pump by turning the chilled water pump On/Off switch at the pump remote pushbutton station to On. With water circulating through the chilled water system, inspect all piping connections for leakage. Make any necessary repairs.

[ ] With water circulating through the system, adjust water flow and check evaporator water pressure drop. Refer to "Water System".

[ ] Adjust the flow switch on the evaporator outlet piping for proper operation.

[ ] Stop the chilled water pump.

[ ] Open all fused disconnects.

Unit Voltage

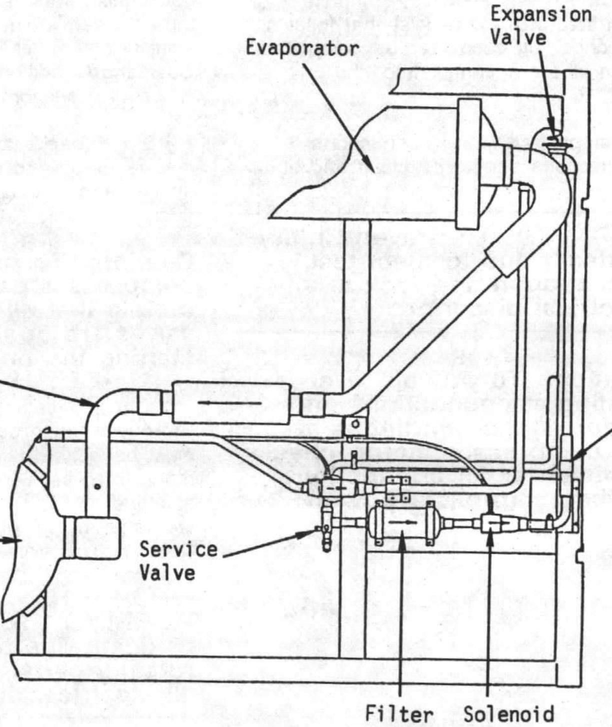
Electrical power to the unit must meet stringent requirements for the unit to operate properly. Total voltage supply and voltage imbalance between phases must be within the following tolerances.

Voltage Supply

Measure each leg of supply voltage at the line voltage disconnect switch. Readings must fall within voltage utilization range shown on the unit nameplate. If voltage of any leg does not fall within tolerance, notify the power company to correct this situation before operating the unit. Inadequate voltage to the unit will cause control components to malfunction and shorten the life of relay contacts and compressor motors.

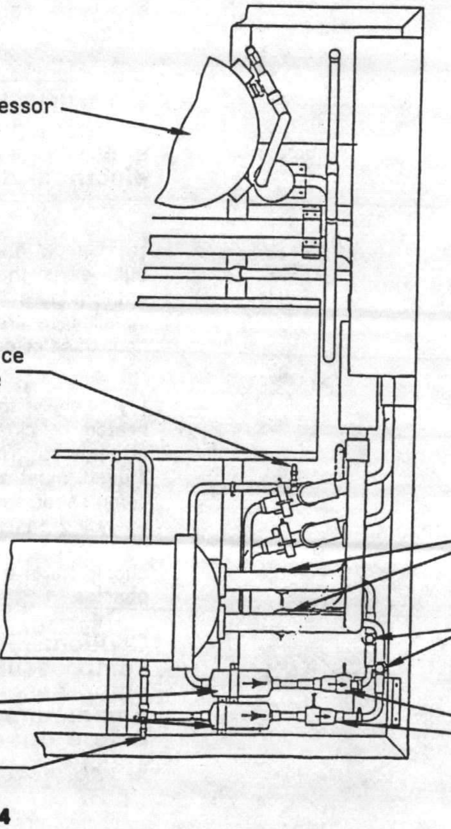
Figure 15
Typical Liquid Line Component Locations

CGAC-C30K



4401-0963C

CGAC-C60K



4401-0969C

Figure 16
Typical Compressor Service Valve and Locations (CGAC-C60K Shown)

Compressor Side View

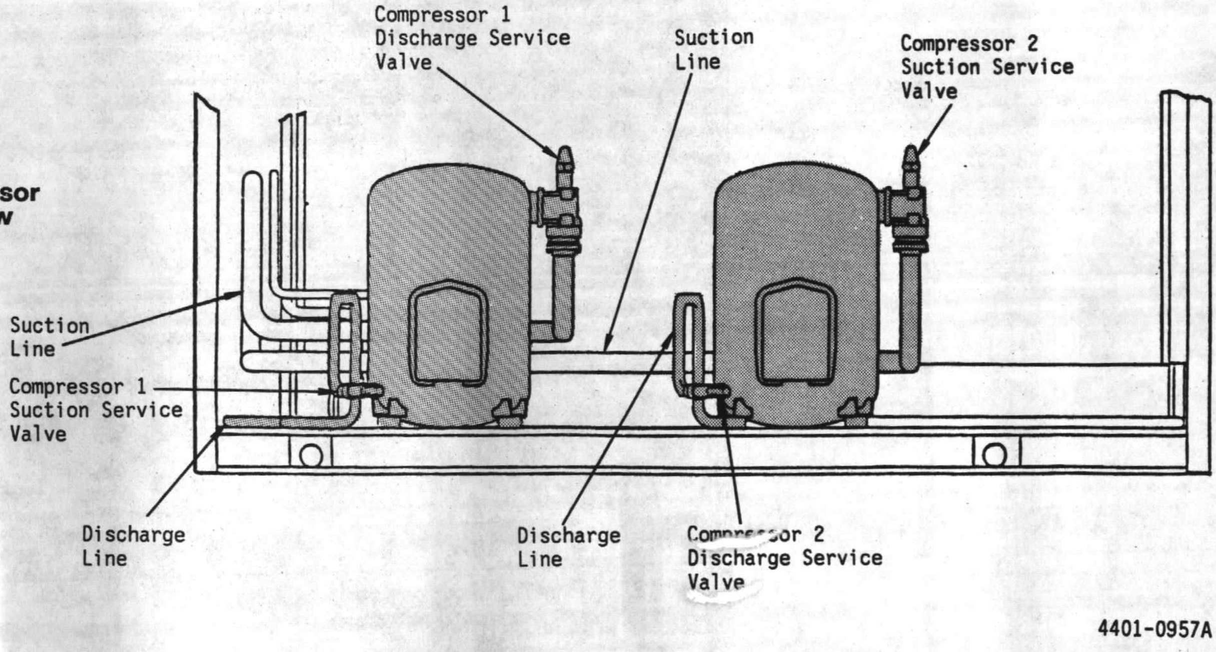


Figure 17
Chiller Control (1U12) Sensing Bulb Location on Evaporator Water Outlet

Evaporator Side View of Unit

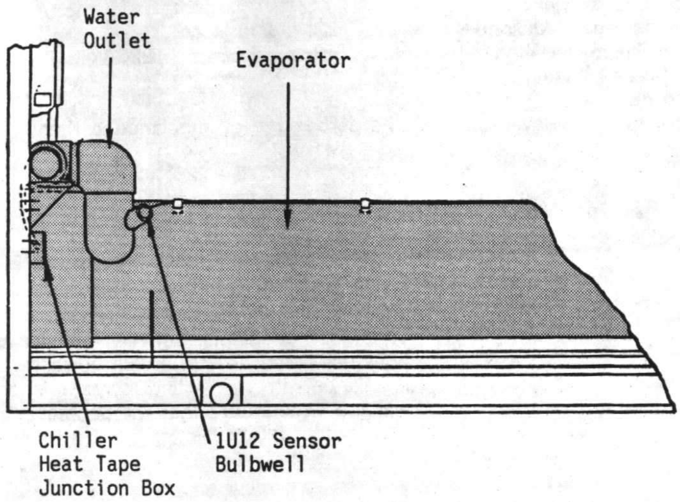
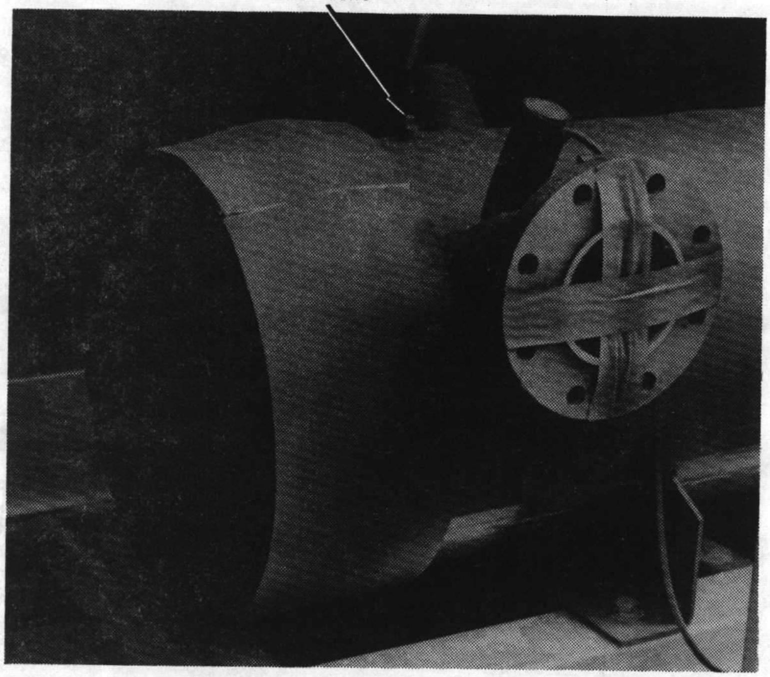


Figure 18
Air Vent Location on Typical Evaporator Shell



Art No.
RF-CG-2730

Voltage Imbalance

Excessive voltage imbalance between phases in a three-phase system will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2 percent. Voltage imbalance is defined as 100 times the maximum deviation of the three voltages (three phases) subtracted from the average (without regard to sign), divided by the average voltage.

Example:

If the three voltages measured at the line voltage fused disconnect are 221 volts, 230 volts and 227 volts, the average would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ volts.}$$

The percentage of imbalance is then:

$$\frac{100(226 - 221)}{226} = 2.2\%.$$

The 2.2 percent imbalance that exists in the example above exceeds maximum allowable imbalance by 0.2 percent. This much imbalance between phases can equal as much as 20 percent current imbalance with a resulting increase in winding temperature that will decrease compressor motor life.

Water System

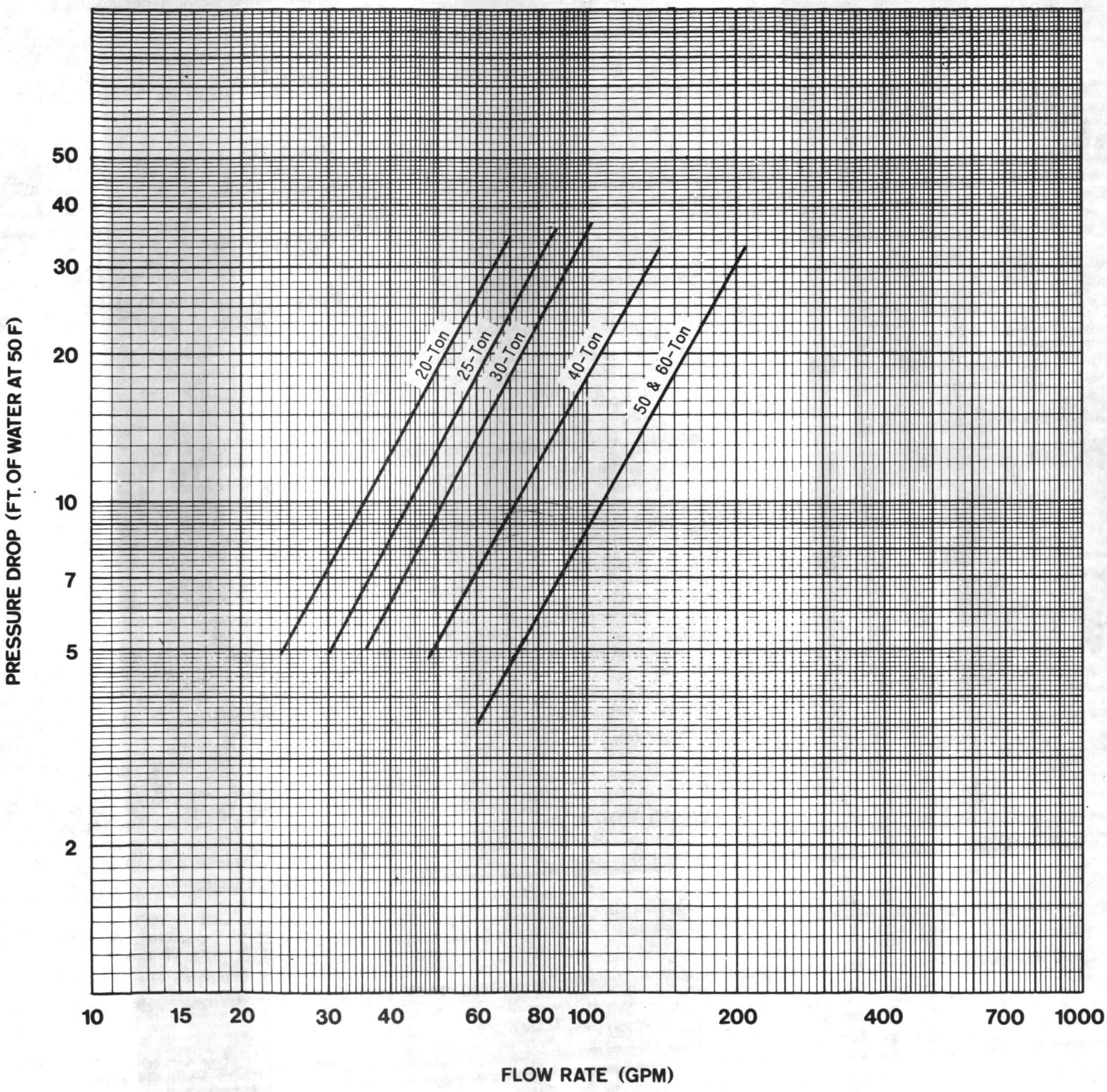
Water Flow Rates

Establish balanced water flow through the evaporator. Flow rates should fall between the minimum and maximum values given in "Service Data". Flow rates below minimum values will result in laminar flow, reducing heat transfer and causing either loss of TEV control or repeated nuisance low pressure cutouts. Excessively high water flow can cause damage to the tube supports and baffles in the evaporator.

Pressure Drop Measurement

Measure evaporator water pressure drop at the pressure gauge(s) on the system water piping. Pressure drop readings should approximate those shown by the pressure drop chart in Figure 19.

Figure 19
Evaporator Water Pressure Drop Chart for CGAC-C20K thru C60K Units



Refer to "Model Number Description" to determine evaporator designation for any unit.

Start-Up Procedure

Start-Up Checklist

To start the unit, complete each step of this checklist, in sequence. Check off each step as completed. Do not start the unit until all "Pre-Start Procedures" are complete. Typical unit operating controls are illustrated in Figures 24 and 25 on pages __ and __.

[ ] Turn the unit service switch on the operating panel to Pump Down Or Reset.

[ ] Turn the compressor service switches to the Operate position.

[ ] Adjust chiller control setpoints (1U12) for normal system operation. Refer to "Chiller Control Setup".

[ ] Close the evaporator water pump fused disconnect. Energize the pump by turning the pump On/Off switch at the remote pushbutton station to On. The chilled water (evaporator) circulating pump will run.

[ ] Check liquid line service valves and compressor suction and discharge service valves (Figures 15 and 16). These valves must be open (backseated) before starting the compressors.

Caution: To prevent compressor damage, be certain that all refrigerant valves are open before starting the unit.

[ ] Energize the compressor crankcase heaters if they aren't already energized by closing the line voltage disconnect. Also close the unit-mounted disconnect, if used.

Caution: To prevent compressor damage, energize compressor crankcase heaters a minimum of eight hours before operating the unit.

[ ] Energize evaporator heat tape by closing the fused disconnect switch provided by the installer.

[ ] Turn the unit service switch to On. If the chiller control calls for cooling and all safety interlocks are closed, the unit will start. The compressors load and unload in response to chilled water temperature leaving the evaporator as sensed by the sensing bulb on the evaporator water outlet.

Ambient temperature should be above the recommended minimum start-up temperatures given in "Service Data". Use the minimum start-up temperatures to establish proper setpoints for the customer-provided low ambient lockout thermostat, if used. Refer to the field wiring diagrams in Figures 10 and 11.

Checking Operating Conditions

Once the unit has been operating for about 30 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

[ ] Recheck evaporator water flow and pressure drop. These readings should be stable at proper levels. If pressure differential drops off, clean all evaporator water supply strainers.

[ ] Check suction pressure, discharge pressure and oil pressure at the gauges on the unit (Figure 20). If the unit is not equipped with gauges, install them on the gauge valves provided on the unit if so equipped. Use a refrigerant-tight thread seal such as teflon tape.

To read pressures, remove the cap from the shut-off valve and open (backseat) the valve (Figure 21). Read the operating pressure. Close (frontseat) the valve to isolate it from the system. Replace and retighten the cap.

Caution: To minimize gauge wear, close shut-off valves to isolate the gauges when pressure readings have been taken.

Note: If the unit is not equipped with pressure gauges, take operating pressures using a manifold gauge set at these points:

<u>Discharge pressures</u> - take at compressor discharge service valve backseat port (Figure 20). Normal discharge pressure is 250 to 360 psig. Refer to "Service Data" for more specific information.

<u>Suction pressures</u> - take at compressor suction service valve backseat port (Figure 20). Normal suction pressure is 55 to 70 psig. Refer to "Service Data" for more specific information.

[ ] Check compressor oil levels. At full load, oil level should be visible about one-half of the way up on the oil level sight glass on the compressor (Figure 22). If it is not, add or remove oil as required. Refer to "Service Data" for correct oil charges and recommended oils for these units.

[ ] Check and record compressor amperage draw. Compare the readings with the compressor electrical data provided in "Service Data" and on the unit nameplate.

[ ] Check the liquid line sight glasses (Figure 15). Refrigerant flow past the sight glasses should be clear. Bubbles in the liquid line indicate either low refrigerant charge or excessive pressure drop in the liquid line. Such a restriction can often be identified by a noticeable temperature differential on either side of the restricted area. Frost often forms on the outside of the liquid line at this point also. Refrigerant charges for CGAC units are provided in "Service Data".

Caution: The system may not be properly charged although the sight glass is clear. Also consider superheat, subcooling and operating pressures.

Figure 20
Location of Optional Operating Pressure Gauges (Typical Dual Compressor Unit)

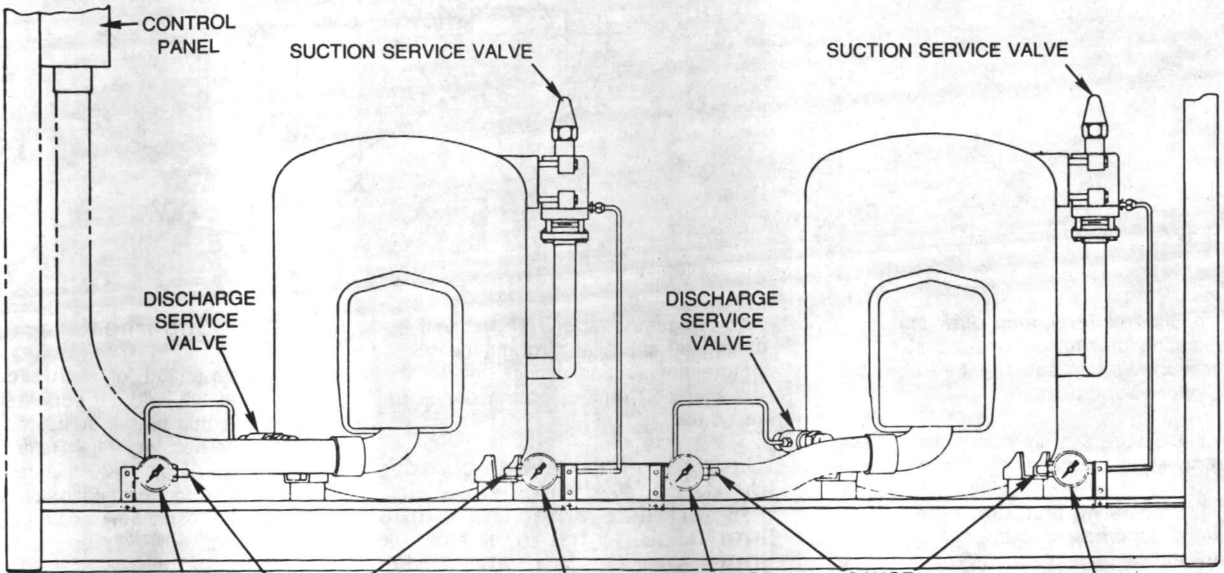
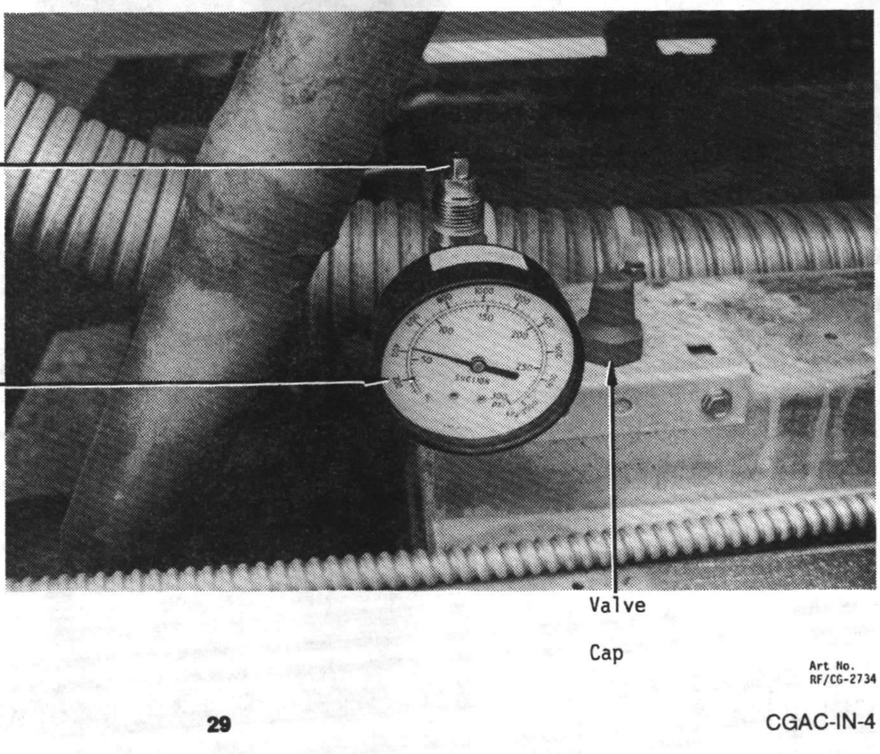
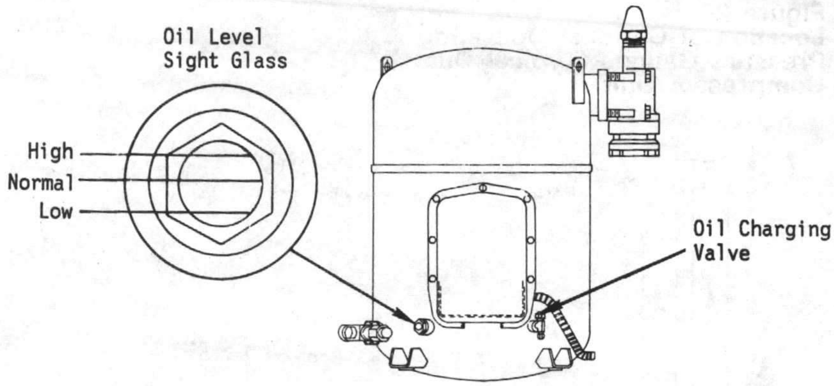


Figure 21
Typical Operating Pressure Gauge



Art No. RF/CG-2734

Figure 22
Model K Compressor Oil Level Sight Glass and Oil Charging Valve Locations



[ ] Once oil level, amp draw and operating pressures have stabilized, measure system superheat. Refer to "System Superheat".

[ ] Measure system subcooling. Refer to "System Subcooling".

[ ] If operating pressure, sight glass, superheat and subcooling readings indicate refrigerant shortage, gas-charge refrigerant into each circuit. Refrigerant shortage is indicated if operating pressures are low and subcooling is also low.

Caution: If suction and discharge pressures are low but subcooling is normal, no refrigerant shortage exists. Adding refrigerant, will result in overcharging.

Add refrigerant vapor with the unit running by charging through the compressor suction service valve backseat port until operating conditions are normal.

Caution: To prevent compressor damage, do not allow liquid refrigerant to enter the suction line. Liquid charge at the liquid line service valve only.

Caution: To prevent compressor damage and insure full cooling capacity, use refrigerants specified on the unit nameplate only.

[ ] If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line service valve. Do not discharge refrigerant into the atmosphere.

WARNING: To prevent injury due to frostbite, avoid skin contact with refrigerant.

[ ] If the unit is equipped with hot gas bypass, check regulating and solenoid valve for proper operation, Valve operating setpoints are provided in "Service Data".

[ ] If the unit is equipped with low ambient dampers, check for proper actuator and blade travel in relation to condensing pressure. Refer to "Service Data" for damper operating setpoints.

[ ] Once proper unit operation is confirmed, inspect for debris, misplaced tools, etc. Secure all exterior panels in place.

System Superheat

Normal superheat for each circuit is 12-15 F at full load. If superheat is not within this range, adjust expansion valve superheat setting. Refer to Figure 23. Allow 15-30 minutes between adjustments for the expansion valve to stabilize on each new setting.

System Subcooling

Normal subcooling for each circuit is 17 to 20 F at full load. If subcooling for either circuit is not in this range check superheat for the circuit and adjust, if required. If superheat is normal but subcooling is not, contact a qualified service technician.

Control Operation and Setup

Unit Operating Panel

CGAC unit operating switches and fuses are located on the switch panel inside the control panel (Figures 23 and 24).

Operating Switches

Unit Service Switch (1S41). Two-position toggle switch used for unit pumpdown or reset and to stop unit operation. Switch to On position to energize chiller control 1U12. If 1U12 calls for cooling and safety interlocks are complete, the compressor(s) will run. Switch to Pump Down Or Reset position to deenergize 1U12. If unit is operating, compressor(s) will go through pumpdown cycle, then stop.

Note: After turning 1S41 to On, allow a minimum of 4 minutes to elapse before turning the switch back to Pump Down or Reset, to allow the low ambient time delay function of the chiller control to elapse.

If the unit must be shutdown within 3 minutes of either compressor start, stop the compressor by turning the compressor service switch (1S5, 1S6) to Standby. This is necessary because, during this three-minute period, the low ambient delay function of the chiller control is energized (low pressure switches bypassed). Turning the unit off by switching the unit service switch (1S41) to Pump Down or Reset may allow a compressor to operate at excessively low pressure conditions.

Caution: To prevent possible damage to the evaporator or compressor, stop compressor using switch 1S5 or 1S6 if within 3 minutes of compressor start.

Compressor Service Switches (1S5, 1S6). Two-position toggle switches used to deactivate compressor control circuit for compressor service. On dual compressor units, this allows continued operation of the remaining compressor during service procedures. Turn to Operate for normal compressor operation. Turn to Stand-By to deactivate the compressor for service procedures. If the compressor is operating when switched to Stand By, it will not go through a pumpdown cycle.

Fuses

Control Circuit Fuse (1F1). 125V/10A fuse used to protect unit control circuit. Check if unit cuts out for unknown reasons.

Motor Protector Fuses (1F2, 1F3). 125V/6A fuses used to protect compressor control circuits.

Power Supply Fuse (1F10). 24V/3A fuse to protect low voltage control components (microprocessor 1U12, auxiliary relay module 1U13, etc.).

Evaporator Heater (4HR1)

The evaporator shell on all standard 60-cycle CGAC units is insulated from ambient air and protected by factory-installed, thermostatically controlled heat tapes for operation during low ambient conditions. The thermostats close to energize the heat tapes when evaporator shell temperature drops to approximately 37 F.

The installer must provide an independent 115V/60HZ/1PH power source with a fused disconnect switch to the proper terminal strip in the control panel.

Chilled Water (7B1) Pump and Interlocks

The chilled water pump is typically operated by a start/stop pushbutton (7S). If the chilled water pump overload (7K7-OL) is closed, the magnetic starter (7K7) is energized to run the chilled water pump when the pushbutton (7S) is pressed. Once the chilled water pump is running, the auxiliary contacts of the pump starter (7K7-Aux.) provide a holding circuit for the pump magnetic starter. A set of auxiliary contacts installed in series with the flow switch contacts establishes an interlock that keeps the unit from starting when the chilled water pump is not operating.

Figure 23
Unit Operating Panel for Typical CGAC Unit with Single Model K Compressor

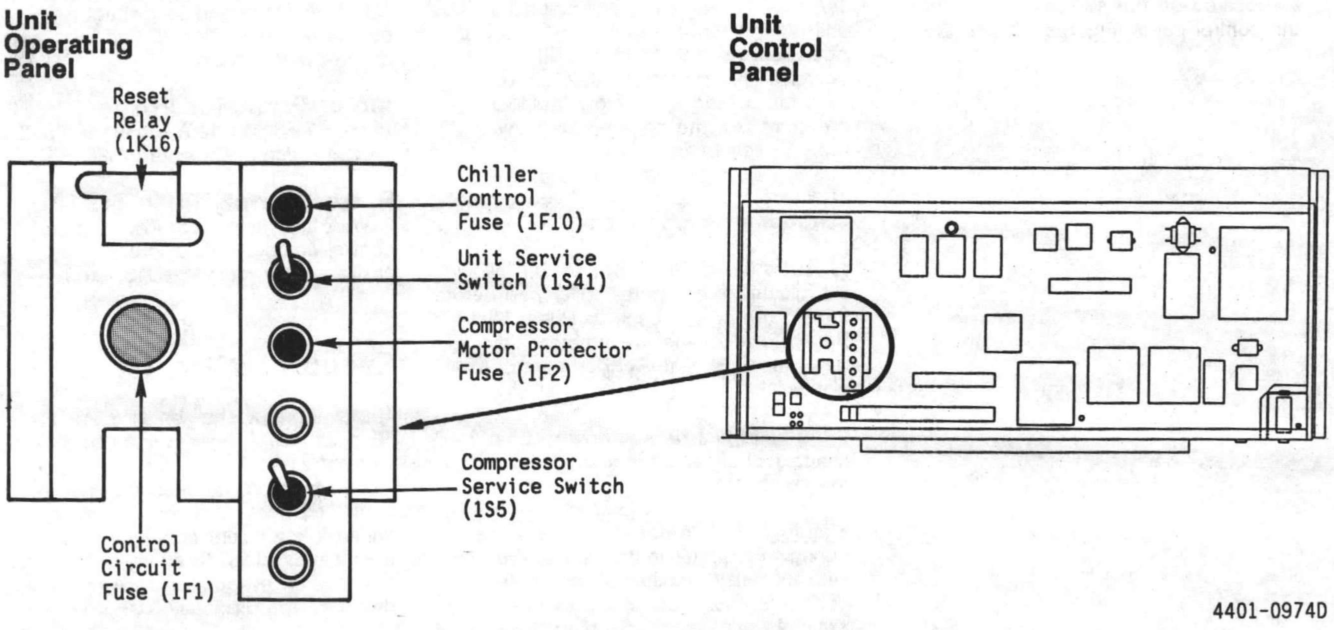
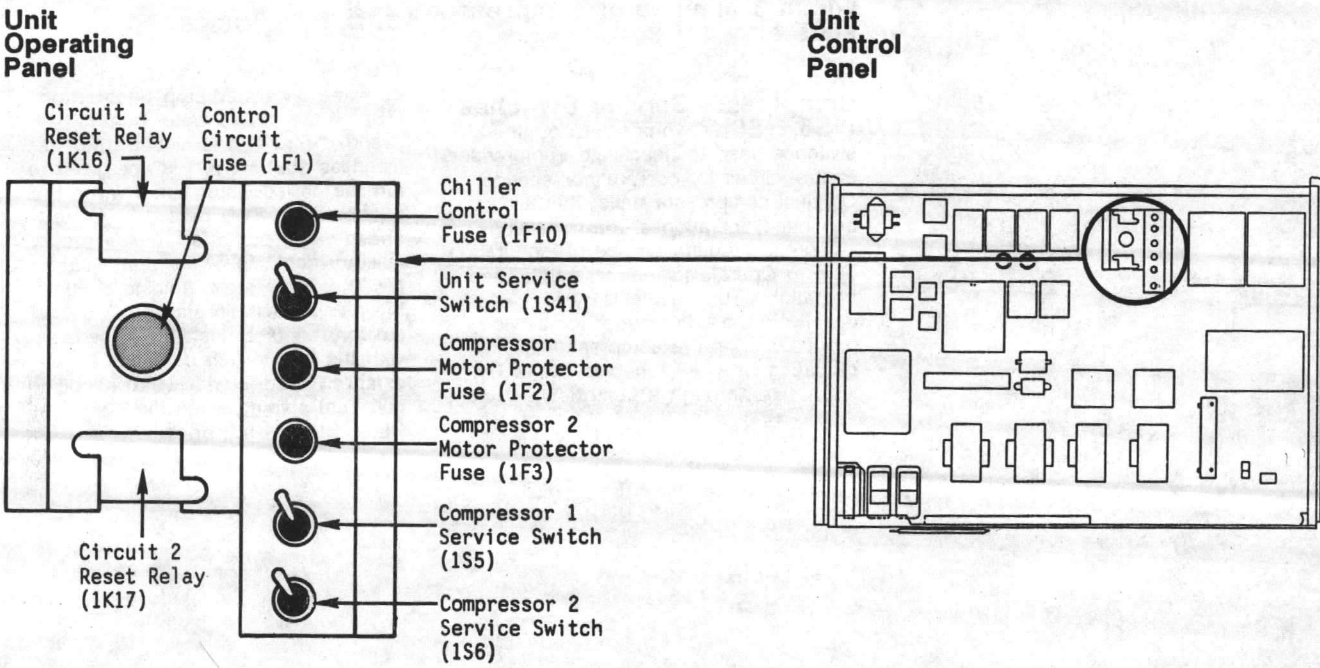


Figure 24
Unit Operating Panel for Typical CGAC Unit with Dual Model K Compressors



Electrical Control System

Controls for CGAC units are classified either as "operational controls" or "unit safety" controls. Figures 25 and 26 identify the locations of all unit control devices.

Refer to "Service Data" for control operating setpoints.

Safety Controls

Safety controls for CGAC units include the high pressure switches, compressor motor overloads and customer-provided flow switch. All, except the flow switch stop unit operation at the setpoints given in "Service Data" and require manual control circuit reset to continue unit operation.

To restart the compressor, correct the malfunction that caused the safety control to cut out and turn the unit service switch (1S41) to Pump Down Or Reset and back again to On. There will be a 4-5 minute time delay before compressor restart.

Caution: To prevent unit damage, do not reset the control circuit until the cause of the safety lockout is identified and corrected.

Operational Controls

Chiller Control and Auxiliary Relay Module (1U12, 1U13)

The solid-state, microprocessor-based chiller control (1U12) and auxiliary relay module (1U13) are used to maintain leaving chilled water temperature within a desired range. Multiple-stage capacity control of each unit is accomplished by loading and unloading each compressor.

The chiller control and auxiliary relay module, located in the control section of the unit control panel (Figures 25, 26 and 27), also provide the special operating and safety features described below:

- Evaporator Freeze Protection
- Compressor Anti-Recycle Protection
- Load Limiting
- Automatic Compressor Lead/Lag Sequencing
- Low Ambient Time Delay and Loss-of-Charge Protection
- Timed Periodic Pumpout (Optional)
- Timed Hot Gas Bypass (Optional)
- Setpoint Reset (Optional)

Refer to the unit operation and maintenance literature for a more detailed description of these features.

Chiller Control Setup

There are three setpoint adjustment dials on the face of the chiller control (Figure 27). They are: Leaving Fluid Setpoint, F; Design Δ T, F; and Number of Stages.

The <u>number of stages setpoint</u> is factory-set at the number of capacity control steps provided on the unit. It is not necessary to change this setting for normal unit operation.

The design Δ T setpoint and the leaving fluid setpoint are factory-set at ARI rating conditions. It may be necessary to reset either or both of these setpoints to satisfy job requirements.

Set the <u>design Δ T setpoint</u> (Figure 28) at the desired chilled water temperature drop through the evaporator. This setpoint is adjustable from 4 F to 20 F in two-degree F increments.

The <u>leaving fluid setpoint</u> dial (Figure 27) has two calibration scales. The inside scale is used for low temperature applications. The range of this scale is minus 20 F to plus 40 F in five-degree F increments. The outer scale is used in all normal comfort cooling applications where there is no requirement for glycol or an unusually low leaving chilled water temperature. The range of this scale is plus 40 F to plus 100 F in five-degree F increments. Set this dial for the desired leaving chilled water temperature at the evaporator water outlet.

Chiller Control Operation

Each time chiller control (1U12) is energized, it will initiate a four-minute start mode. During this start delay, the "start mode" LED on the face of the chiller control will be energized (Figure 28). If leaving chilled water temperature (as sensed by the chiller control sensing bulb in the evaporator water outlet) is below the chiller control leaving fluid setpoint at the end of this four-minute timing period, the start mode LED will deenergize without starting the compressor.

When leaving chilled water temperature rises above the leaving fluid setpoint, the chiller control first-stage contacts close. This will provide power to the compressor 1 contactors. When the chiller control first stage contacts close, the number 1 LED for Compressor 1 will energize (Figure 28).

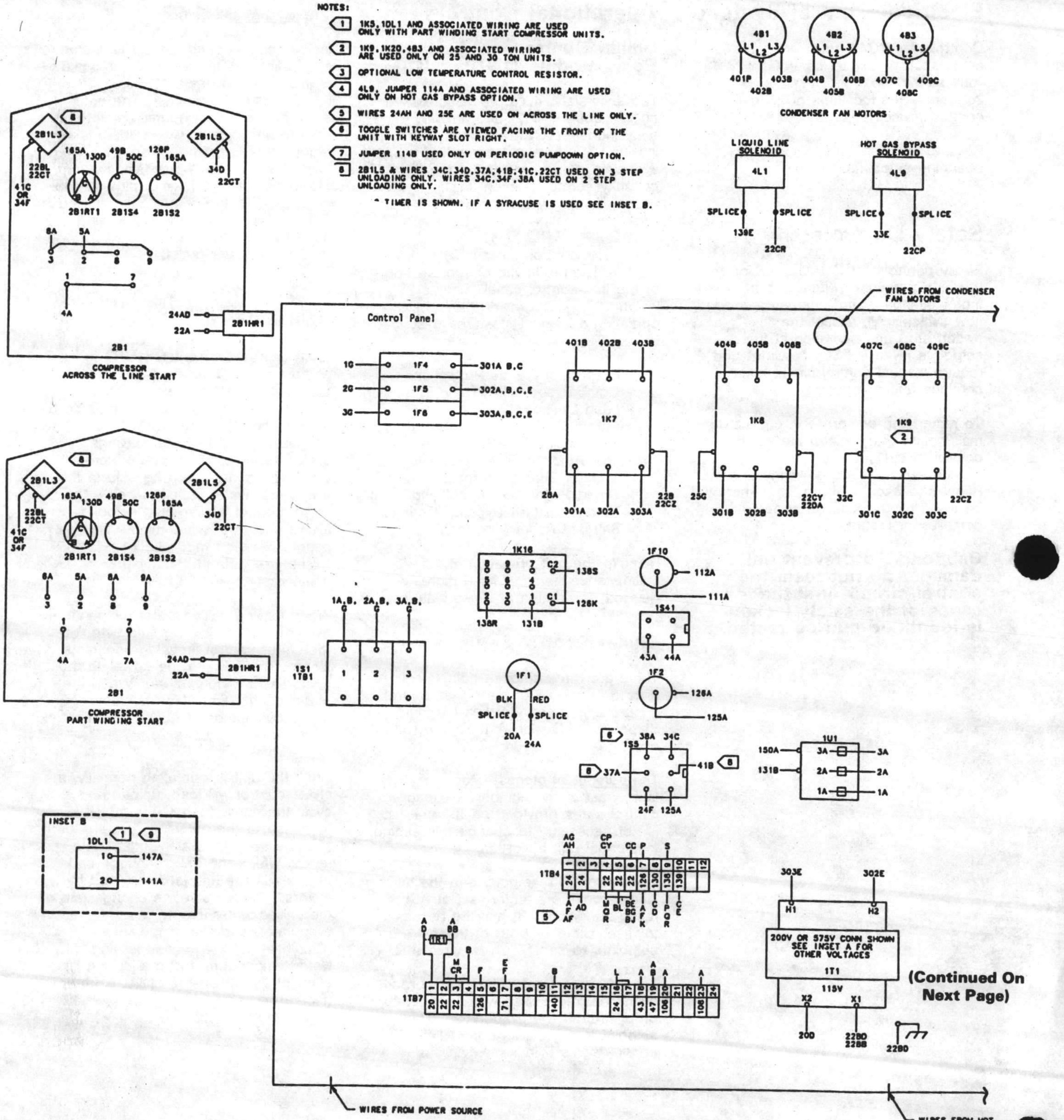
Once the unit is operating normally, the chiller control will load, unload and cycle the compressors on and off in response to the perceived cooling load at the evaporator water outlet. The rate at which the chiller control loads or unloads the unit is determined by two factors: the temperature change rate of the chilled water leaving the evaporator, and the temperature differential between actual leaving water temperature and the leaving fluid setpoint as set on the chiller control (Figure 27).

Figure 25
Typical Component Locations for CGAC-C20K, C25K and C30K Units

NOTES:

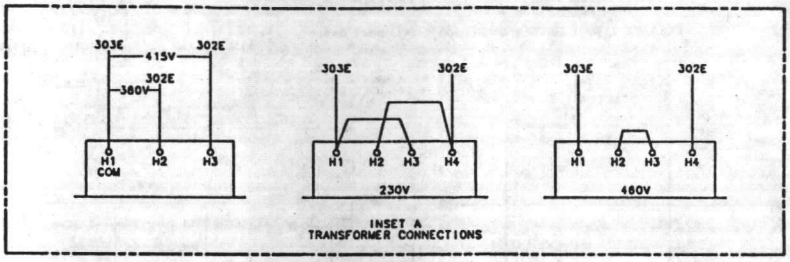
1. 1K5, 1DL1 AND ASSOCIATED WIRING ARE USED ONLY WITH PART WINDING START COMPRESSOR UNITS.
2. 1K9, 1K20, 4B3 AND ASSOCIATED WIRING ARE USED ONLY ON 25 AND 30 TON UNITS.
3. OPTIONAL LOW TEMPERATURE CONTROL RESISTOR.
4. 4L9, JUMPER 114A AND ASSOCIATED WIRING ARE USED ONLY ON HOT GAS BYPASS OPTION.
5. WIRES 24AH AND 25E ARE USED ON ACROSS THE LINE ONLY.
6. TOGGLE SWITCHES ARE VIEWED FACING THE FRONT OF THE UNIT WITH KEYWAY SLOT RIGHT.
7. JUMPER 114B USED ONLY ON PERIODIC PUMPDOWN OPTION.
8. 2B1L5 & WIRES 34C, 34D, 37A, 41B, 41C, 22CT USED ON 3 STEP UNLOADING ONLY. WIRES 34C, 34F, 38A USED ON 2 STEP UNLOADING ONLY.

* TIMER IS SHOWN. IF A SYRACUSE IS USED SEE INSET B.



(Continued On Next Page)

Component Legend (Outside Control Panel)	
2B1	Compressor 1
2B1HR1	Compressor 1 Crankcase Heater
2B1L3/2B1L5	Compressor 1 Unloader Solenoids
2B1RT1	Compressor 1 Winding Sensor
2B1S2	Ckt 1 High Pressure Switch
2B1S4	Ckt 1 Low Pressure Switch
4B1	Fan Motor 1 - Circuit 1
4B2	Fan Motor 2 - Circuit 1
4B3	Fan Motor 3 - Circuit 1
4L1	Ckt 1 Liquid Line Solenoid Valve
4L9	Ckt 1 Hot Gas Bypass Solenoid Valve
4RT1	Leaving Chilled Water Sensing Bulb

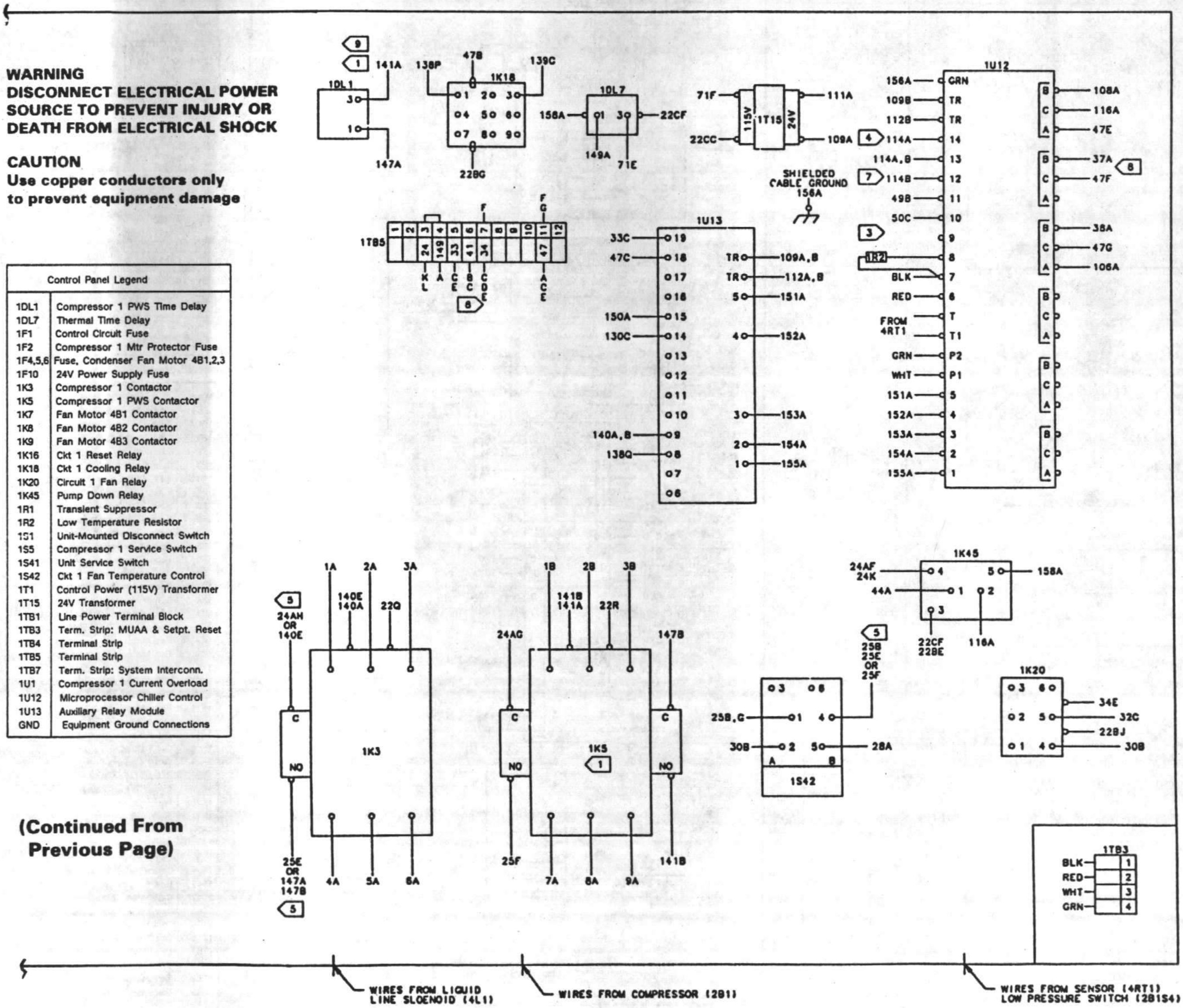


WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

Control Panel Legend	
1DL1	Compressor 1 PWS Time Delay
1DL7	Thermal Time Delay
1F1	Control Circuit Fuse
1F2	Compressor 1 Mtr Protector Fuse
1F4,5,6	Fuse, Condenser Fan Motor 4B1,2,3
1F10	24V Power Supply Fuse
1K3	Compressor 1 Contactor
1K5	Compressor 1 PWS Contactor
1K7	Fan Motor 4B1 Contactor
1K8	Fan Motor 4B2 Contactor
1K9	Fan Motor 4B3 Contactor
1K16	Ckt 1 Reset Relay
1K18	Ckt 1 Cooling Relay
1K20	Circuit 1 Fan Relay
1K45	Pump Down Relay
1R1	Transient Suppressor
1R2	Low Temperature Resistor
1S1	Unit-Mounted Disconnect Switch
1S5	Compressor 1 Service Switch
1S41	Unit Service Switch
1S42	Ckt 1 Fan Temperature Control
1T1	Control Power (115V) Transformer
1T15	24V Transformer
1TB1	Line Power Terminal Block
1TB3	Term. Strip: MUAA & Setpt. Reset
1TB4	Terminal Strip
1TB5	Terminal Strip
1TB7	Term. Strip: System Interconn.
1U1	Compressor 1 Current Overload
1U12	Microprocessor Chiller Control
1U13	Auxiliary Relay Module
GND	Equipment Ground Connections

(Continued From Previous Page)

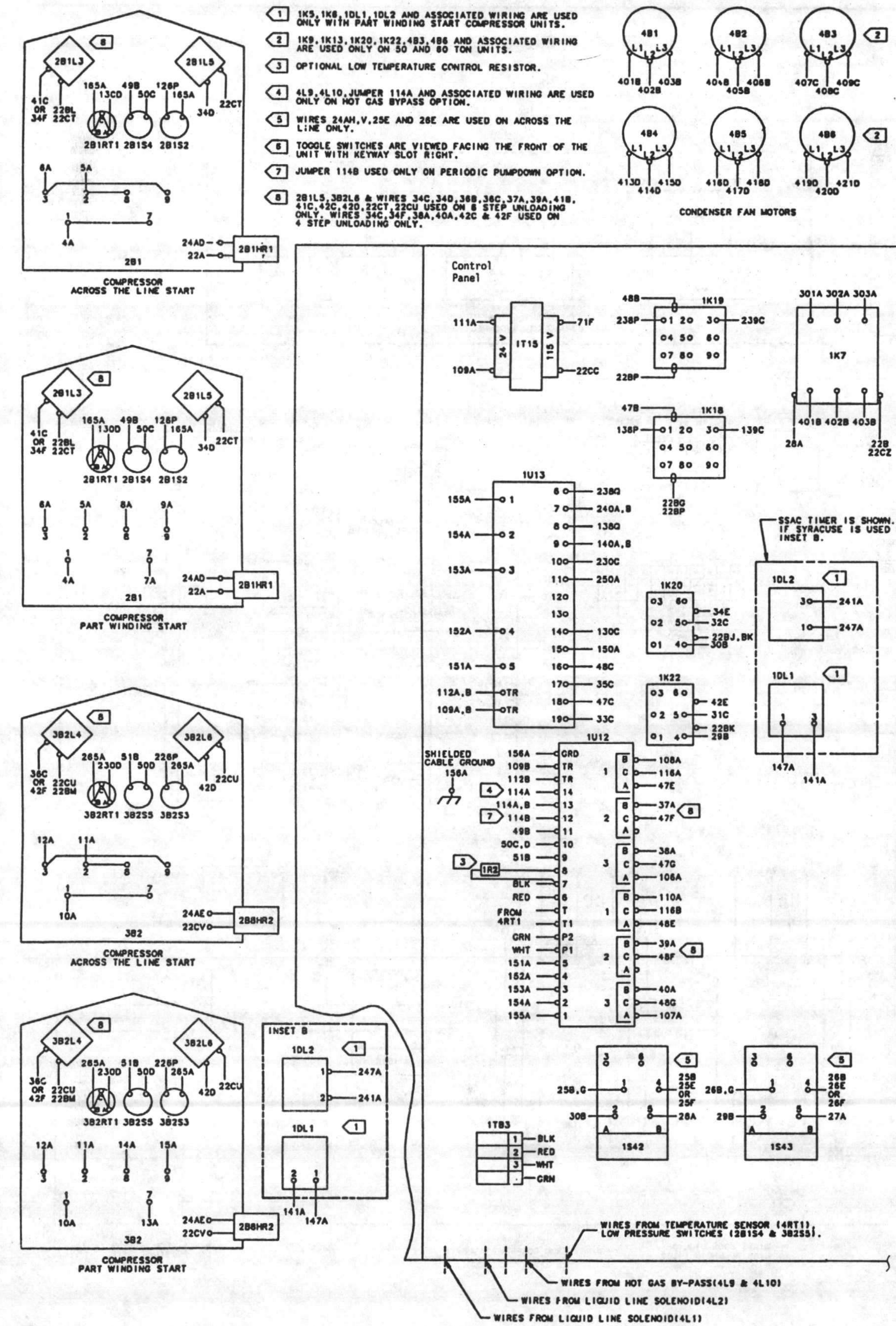


2306-2443B

Figure 26
Typical Component Locations for CGAC-C40K, C50K and C60K Units

NOTES:

1. 1K5, 1K6, 1DL1, 1DL2 AND ASSOCIATED WIRING ARE USED ONLY WITH PART WINDING START COMPRESSOR UNITS.
2. 1K9, 1K13, 1K20, 1K22, 4B3, 4B6 AND ASSOCIATED WIRING ARE USED ONLY ON 50 AND 60 TON UNITS.
3. OPTIONAL LOW TEMPERATURE CONTROL RESISTOR.
4. 4L9, 4L10, JUMPER 114A AND ASSOCIATED WIRING ARE USED ONLY ON HOT GAS BYPASS OPTION.
5. WIRES 24AH, V, 25E AND 26E ARE USED ON ACROSS THE LINE ONLY.
6. TOGGLE SWITCHES ARE VIEWED FACING THE FRONT OF THE UNIT WITH KEYWAY SLOT RIGHT.
7. JUMPER 114B USED ONLY ON PERIODIC PUMPDOWN OPTION.
8. 2B1L5, 3B2L6 & WIRES 34C, 34D, 36B, 36C, 37A, 39A, 41B, 41C, 42C, 42D, 22CT, 22CU USED ON 6 STEP UNLOADING ONLY. WIRES 34C, 34F, 38A, 40A, 42C & 42F USED ON 4 STEP UNLOADING ONLY.

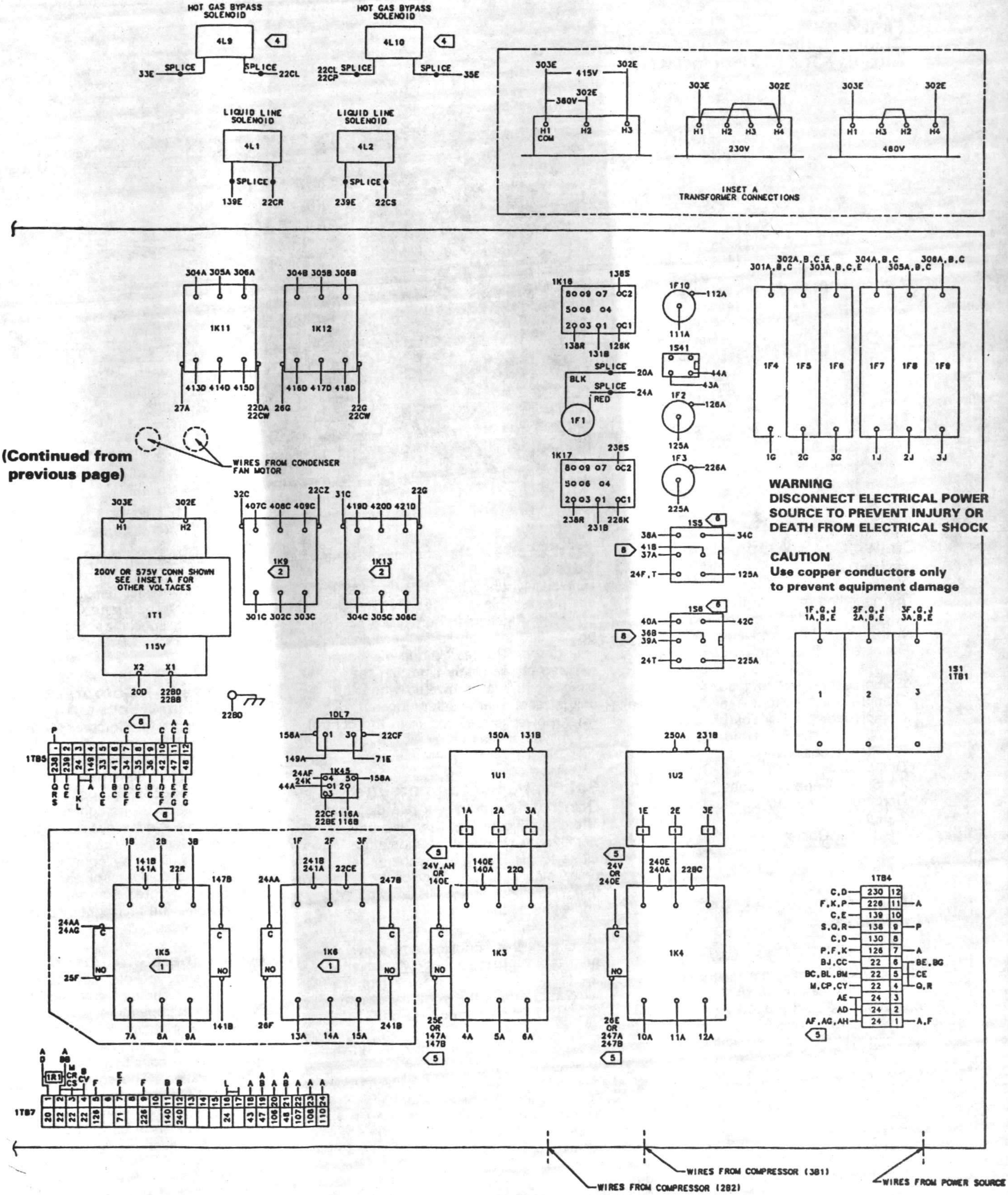


Component Legend (Outside Control Panel)	
2B1	Compressor 1
2B1HR1	Compressor 1 Crankcase Heater
2B1L3/2B1L5	Compressor 1 Unloader Solenoids
2B1RT1	Compressor 1 Winding Sensor
2B1S2	Compressor 1 High Pressure Switch
2B1S4	Compressor 1 Low Pressure Switch
3B2	Compressor 2
3B2HR2	Compressor 2 Crankcase Heater
3B2L4/3B2L6	Compressor 2 Unloader Solenoids
3B2RT1	Compressor 2 Winding Sensor
3B2S3	Compressor 2 High Pressure Switch
3B2S5	Compressor 2 Low Pressure Switch
4B1	Fan Motor 1 - Circuit 1
4B2	Fan Motor 2 - Circuit 1
4B3	Fan Motor 3 - Circuit 1
4B4	Fan Motor 4 - Circuit 2
4B5	Fan Motor 5 - Circuit 2
4B6	Fan Motor 6 - Circuit 2
4L1	Ckt 1 Liquid Line Solenoid Valve
4L2	Ckt 2 Liquid Line Solenoid Valve
4L9	Ckt 1 Hot Gas Bypass Solenoid Valve
4L10	Ckt 2 Hot Gas Bypass Solenoid Valve
4RT1	Leaving Chilled Water Sensing Bulb

(Continued on next page)

Control Panel Legend	
1DL1	Compressor 1 PWS Time Delay
1DL2	Compressor 2 PWS Time Delay
1DL7	Thermal Time Delay
1F1	Control Circuit Fuse
1F2	Compressor 1 Mtr Protector Fuse
1F3	Compressor 2 Mtr Protector Fuse
1F4,5,6	Fuse, Condenser Fan Motor 4B1,2,3
1F4	Fuse, Condenser Fan Motor 4B1
1F5	Fuse, Condenser Fan Motor 4B2
1F6	Fuse, Condenser Fan Motor 4B3
1F7	Fuse, Condenser Fan Motor 4B1
1F8	Fuse, Condenser Fan Motor 4B2
1F9	Fuse, Condenser Fan Motor 4B3
1F10	24V Power Supply Fuse
1K3	Compressor 1 Contactor
1K4	Compressor 2 Contactor
1K5	Compressor 1 PWS Contactor
1K6	Compressor 2 PWS Contactor
1K7	Fan Motor 4B1 Contactor
1K8	Fan Motor 4B2 Contactor
1K9	Fan Motor 4B3 Contactor
1K11	Fan Motor 4B4 Contactor
1K12	Fan Motor 4B5 Contactor
1K13	Fan Motor 4B6Contactor
1K16	Ckt 1 Reset Relay
1K17	Ckt 2 Reset Relay
1K18	Ckt 1 Cooling Relay
1K19	Ckt 2 Cooling Relay
1K20	Circuit 1 Fan Relay
1K22	Circuit 2 Fan Relay
1K45	Pump Down Relay
1R1	Transient Suppressor
1R2	Low Temperature Resistor
1S1	Unit-Mounted Disconnect Switch
1S5	Compressor 1 Service Switch
1S6	Compressor 2 Service Switch
1S41	Unit Service Switch
1S42	Ckt 1 Fan Temperature Control
1S43	Ckt 2 Fan Temperature Control
1T1	Control Power (115V) Transformer
1T15	24V Transformer
1TB1	Line Power Terminal Block
1TB3	Term. Strip: MUAA & Setpt. Reset
1TB4	Terminal Strip
1TB5	Terminal Strip
1TB7	Term. Strip: System Interconn.
1U1	Compressor 1 Current Overload
1U2	Compressor 2 Current Overload
1U12	Microprocessor Chiller Control
1U13	Auxiliary Relay Module
GND	Equipment Ground Connections

(Continued from previous page)

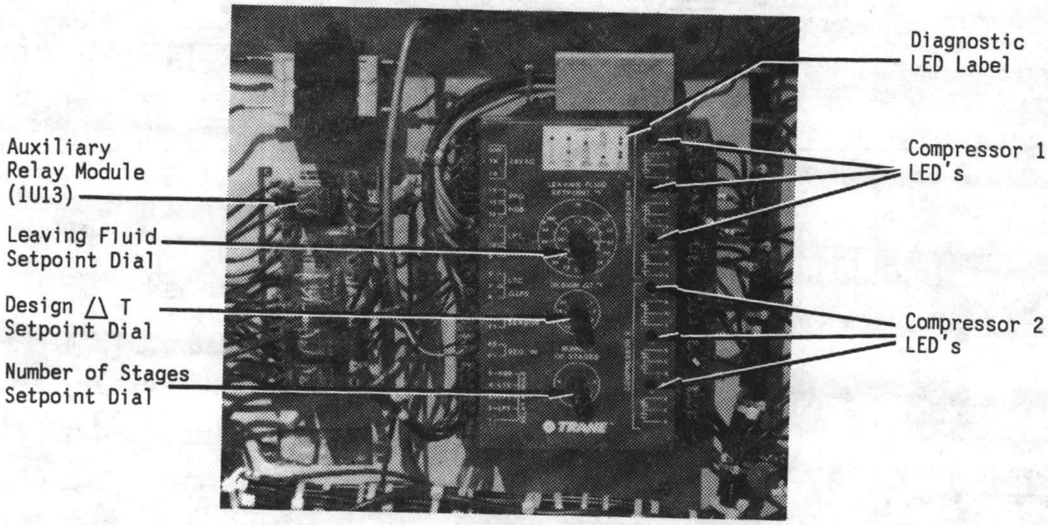


WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

2306-2439B

Figure 27
Chiller Control (1U12) Components and Auxiliary Relay Module (1U13)



Art No.
RF/CG-2727

Chiller Control Operating Indicators

The operating mode of the unit is indicated at all times by the red LED's on the face of the chiller control (Figure 28). Operating modes include:

Compressor 1 - Step 1 Loaded
Compressor 1 - Steps 1 and 2 Loaded
Compressor 1 - Full Load
Compressor 1 - Full Load, Compressor 2 - Step 1 Loaded
Compressor 1 - Full Load, Compressor 2 - Steps 1 and 2 Loaded
Compressor 1 - Full Load, Compressor 2 - Full Load
Load Limit Operation.

Chiller Control Diagnostic Indicators

The red LED's on the chiller control also display five different diagnostic states which can occur during operation. A label mounted on the front of the control above the leaving fluid setpoint dial (Figure 27) identifies the diagnostic conditions. These conditions, illustrated in Figure 28, include the following:

Start Mode
Setpoint/Low Temperature Control Overlap
Compressor 1 - Low Pressure Lockout
Compressor 2 - Low Pressure Lockout
Low Temperature Control Lockout.

Start Mode. The start mode diagnostic indicator (Figure 28) will light immediately when the chiller control is energized. This indicates that the control is functioning normally, proceeding through its four-minute start time delay. The start mode diagnostic will also energize any time that the chiller control is repowered when the unit is reset after a safety lockout, or when power is removed from the control for any other reason.

Setpoint/Low Temperature Control Overlap. If this diagnostic energizes (Figure 28), the minimum permitted leaving water temperature is too close to the low water temperature (freezestat) cutout setting for the unit. No unit operation is allowed under these conditions.

To correct this condition and allow normal unit operation, slowly adjust the leaving fluid setpoint to a higher temperature until the control setpoint overlap diagnostic lights go off.

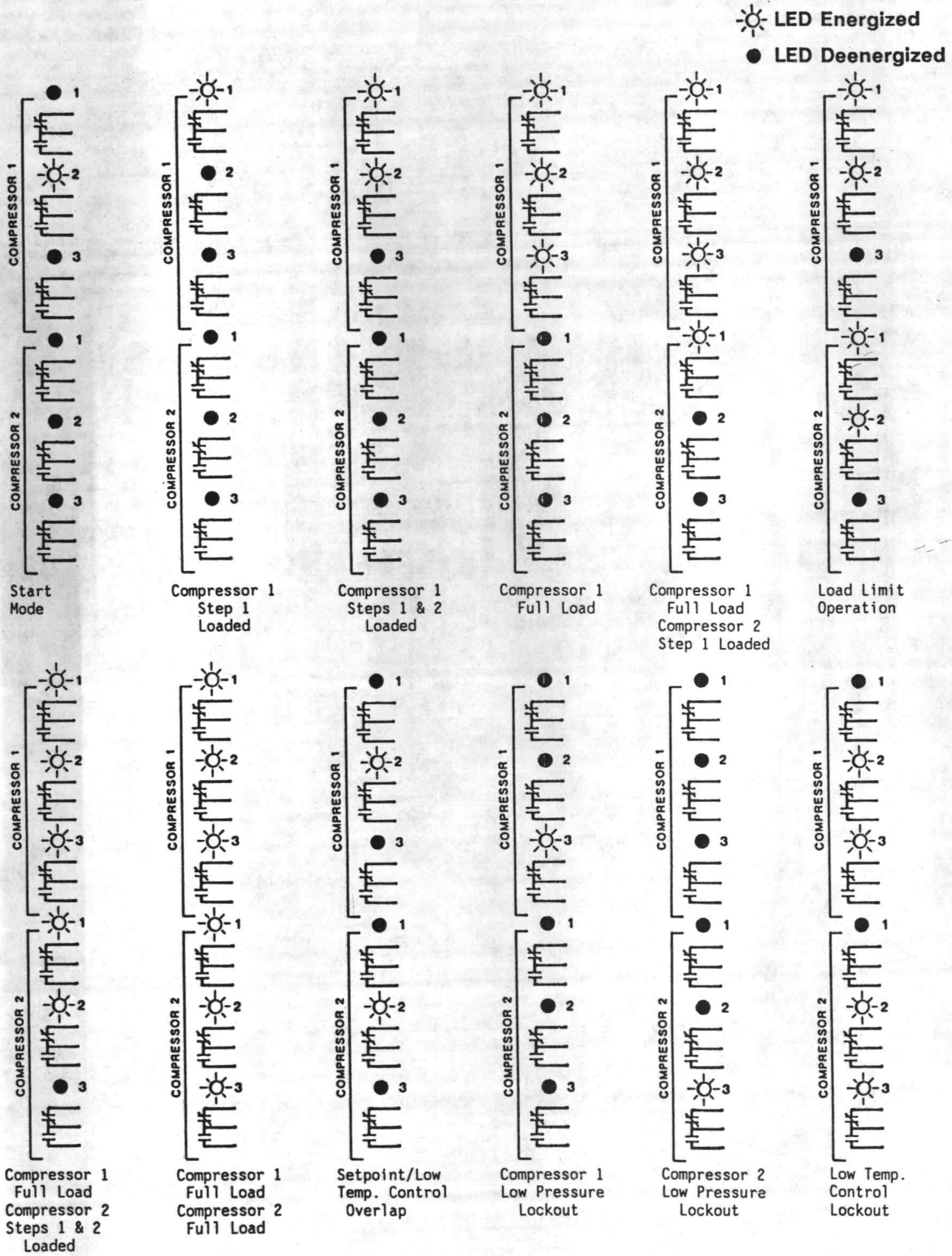
Note: Turn the setpoint dials on the chiller control slowly. Once the setpoints are established, allow the chiller control a minimum of 10-15 seconds to compute the value of the new setpoints and compare this to the low temperature cutout limit.

If the desired leaving fluid setpoint or design △ T setpoint cannot be selected due to the low water temperature limit (35 F), contact The Trane Company for information on special applications.

Compressor 1/Compressor 2 Low Pressure Lockout. The diagnostic lights for Compressor 1 or Compressor 2 low pressure lockout (Figure 28) will energize and lock out the compressor if either low pressure control (2B1S4, 3B2S5) opens during normal operation. This condition for one compressor does not affect the operation or loading of the remaining compressor which may continue to operate normally. The compressor and chiller control are prevented from further operation until the unit control circuit is manually reset.

Low Temperature Lockout. The low temperature lockout diagnostic (Figure 28) will energize any time leaving water temperature falls to the low water temperature limit for the unit. This diagnostic indicates that a potential freeze condition was detected during operation. The chiller control is locked out from further operation and the diagnostic will remain energized until the condition is corrected and the unit manually reset.

Figure 28
Chiller Control LED Operational Functions



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.

PRINTED BY PRODUCTION SERVICES — LA CROSSE RS /LW

TRANE

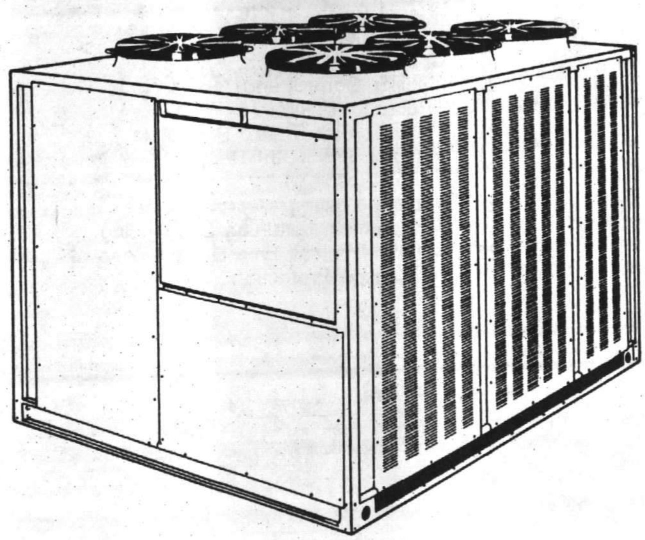
Use with Applicable "Service Data" Sheets

Operation Maintenance

CGAC-M-4A

Library	Service Literature
Product Section	Refrigeration
Product	Recip. Liquid Chillers - A/C Cold Gen.
Model	CGAC
Literature Type	Operation and Maintenance
Sequence	4A
Date	September 1987
File No.	SV-RF-CG-CGAC-M-4A-987
Supersedes	CGAC-M-4 Dated 187

Model CGAC 20 thru 60 Ton Air-Cooled Cold Generators



Models

CGAC-C20K CGAC-C40K
CGAC-C25K CGAC-C50K
CGAC-C30K CGAC-C60K

Table of Contents

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

Model Number Description

All standard Trane products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification codes used for CGAC units is provided on this page. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, components and options for any specific unit.

CG	A	C	-	C60	1	-	K	A	N	G	G	6	0	DFGPW
1,2	3	4		5,6,7	8		9	10	11	12	13	14	15	16,etc.

Digits 1,2
Unit Model
CG = Cold Generator

Digit 3
Unit Type
A = Air-Cooled Condensing

Digit 4
Development Sequence

Digits 5, 6, 7
Nominal Capacity
C20 = 20 Tons
C25 = 25 Tons
C30 = 30 Tons
C40 = 40 Tons
C50 = 50 Tons
C60 = 60 Tons

Digit 8
Electrical and Start Characteristics
1 = 460/60/3 PW
2 = 575/60/3 PW
3 = 230/60/3 PW
4 = 460/60/3 XL
6 = 200/60/3 PW
A = 380/50/3 PW
B = 415/50/3 PW
S = Special

Digit 9
Compressor I.D.
K = Model K Hermetic
S = Special

Digit 10
Design Sequence

Digit 11
Motors (Open Compressor Only)
N = None
S = Special

Digit 12
Evaporator
B = 20 Ton
C = 25 Ton
D = 30 Ton
E = 40 Ton
F = 50 Ton
G = 60 Ton
S = Special

Digit 13
Condenser
B = 20 Ton
C = 25 Ton
D = 30 Ton
E = 40 Ton
F = 50 Ton
G = 60 Ton
S = Special

Digit 14
Unloading Steps
2 = 2-Step (20-Ton Only)
3 = 3-Step (25 and 30-Ton)
4 = 4-Step (40 Ton Only)
6 = 6-Step (50 and 60-Ton)
S = Special

Digit 15
Approval Agency
0 = None
2 = UL
3 = CSA
S = Special

Digit 16, etc.
Miscellaneous
3 = Control Power Transformer
8 = Totally-Enclosed Fan Motors
D = Unit-Mounted Disconnect Switch
E = Unit Neoprene Isolators
F = Unit Spring Isolators
G = Pressure Gauges and Piping
H = Hot Gas Bypass
P = Periodic Pumpout
V = Copper Fins
W = Low Ambient Damper(s)
Y = No Evaporator Heat Tape (Export Only)
S = Special
X = Export

General Information

Literature Change History

CGAC-M-4 (January 1987)

Original issue of manual, providing operating, maintenance and trouble analysis information for model CGAC-C20K thru C60K air-cooled Cold Generator units of "A" design sequence.

CGAC-M-4A (September 1987)

Manual reissued to update electrical diagrams and revise "Chiller Control (1U12) Checkout Procedure". All units remain at "A" design sequence.

CGAC "Service Data" Sheets

Use this operation manual in conjunction with the information provided in the applicable CGAC "Service Data" publications.

To insure trouble-free operation and use of proper component information, the design sequence of the unit (Refer to "Model Number Description") must agree with the design sequence printed on the front cover of the "Service Data" publication.

Warnings and Cautions

"Warnings" and "Cautions" appear at appropriate points in this manual. Cautions indicate areas where special attention is required to prevent equipment or property damage. Warnings focus attention on the personal safety of service and operating personnel. The instructions given in each warning that appears in this manual must be followed carefully.

Unit Description

Trane 20 thru 60-ton Model CGAC Air-Cooled Cold Generators are equipped with either one or two Trane Model K hermetic, reciprocating compressors. All units are dehydrated, leak tested, charged and tested for proper control operation before shipment. A low ambient lockout thermostat can be customer provided.

Standard control for these units is a microprocessor-based electronic controller that governs unit operation in response to chilled water temperature leaving the evaporator. Compressor unloaders are solenoid actuated and discharge pressure operated.

The number of capacity or unloading stages provided is:

```
CGAC-C20K ........ 2-Step Control.
CGAC-C25K, C30K... 3-Step Control.
CGAC-C40K ........ 4-Step Control.
CGAC-C50K, C60K... 6-Step Control.
```

The dual-compressor units (40, 50 and 60-Tons), feature two independent refrigerant circuits–one for each compressor.

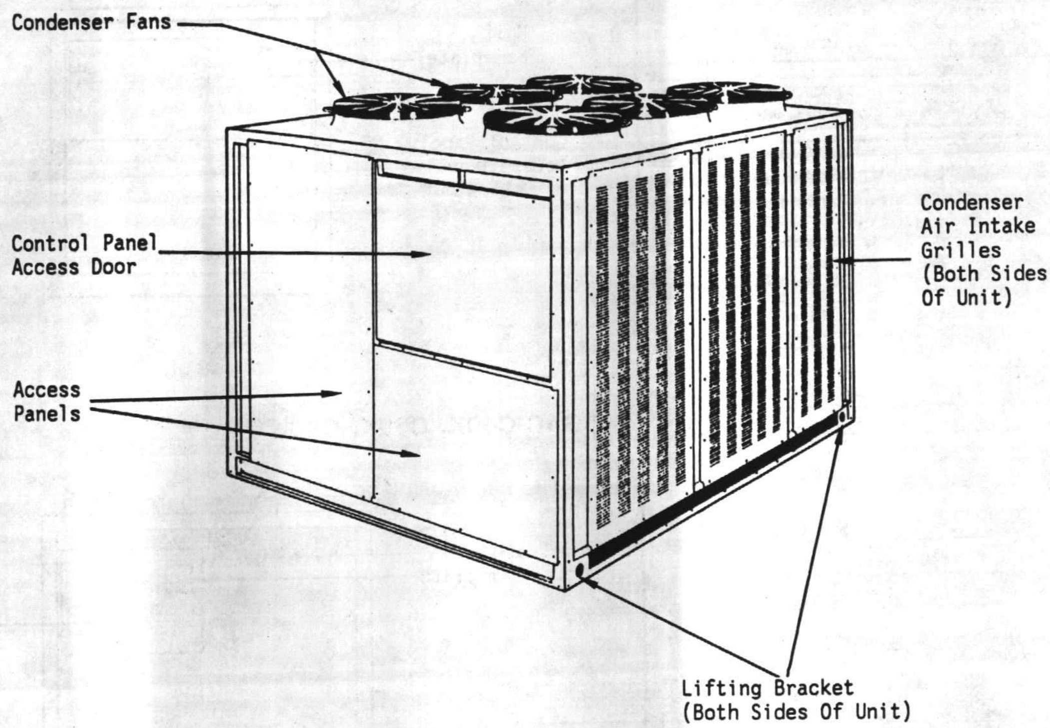
Each refrigerant circuit is provided with an operating charge of refrigerant and refrigerant oil, a liquid line solenoid valve, filter drier, sight glass, thermostatic expansion valve and service valve.

The shell-and-tube type evaporator is manufactured in accordance with ASME standards. Each evaporator is fully insulated and equipped with a drain connection. A bulbwell for the unit temperature controller is located on the evaporator water outlet.

A bag containing the unit wiring diagrams, installation manual, and operation/maintenance manual is provided in the control panel. Be sure to read this literature <u>before</u> operating the unit.

Figure 1 illustrates access panel locations and other CGAC exterior components.

Figure 1
Exterior Components of Typical CGAC Unit



Nameplates

The nameplates on these machines provide valuable information pertaining to the identification of the unit and its components. Provide all nameplate data when ordering parts or literature, and when making other inquiries.

Unit Nameplate

The CGAC unit nameplate is mounted in the upper left corner of the control circuit panel access door. See Figure 2. This nameplate (Figure 2) specifies control circuit power requirements and power requirements for the chiller heat tapes. It also identifies the order number of the unit Operation/Maintenance manual. Refer to this information if it becomes necessary to replace the operation and maintenance literature for this equipment.

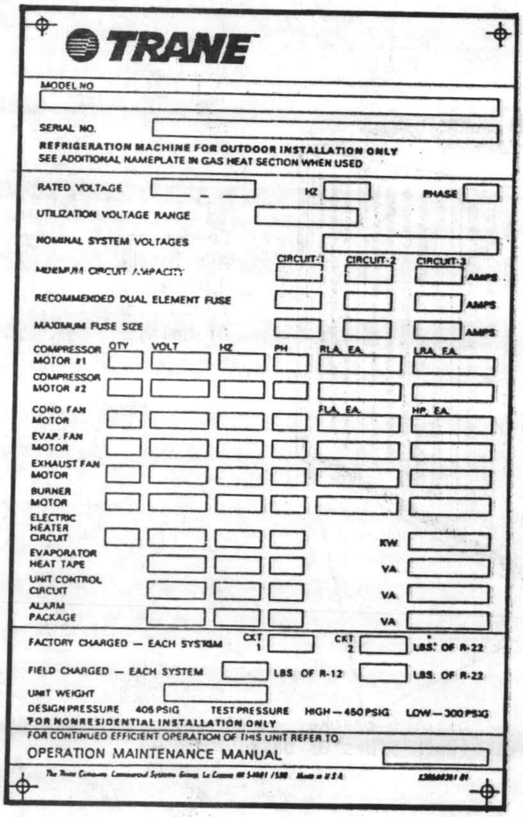
Compressor Nameplate

The Model K compressor nameplate is mounted on the compressor motor housing as shown in Figure 3.

Evaporator Nameplate

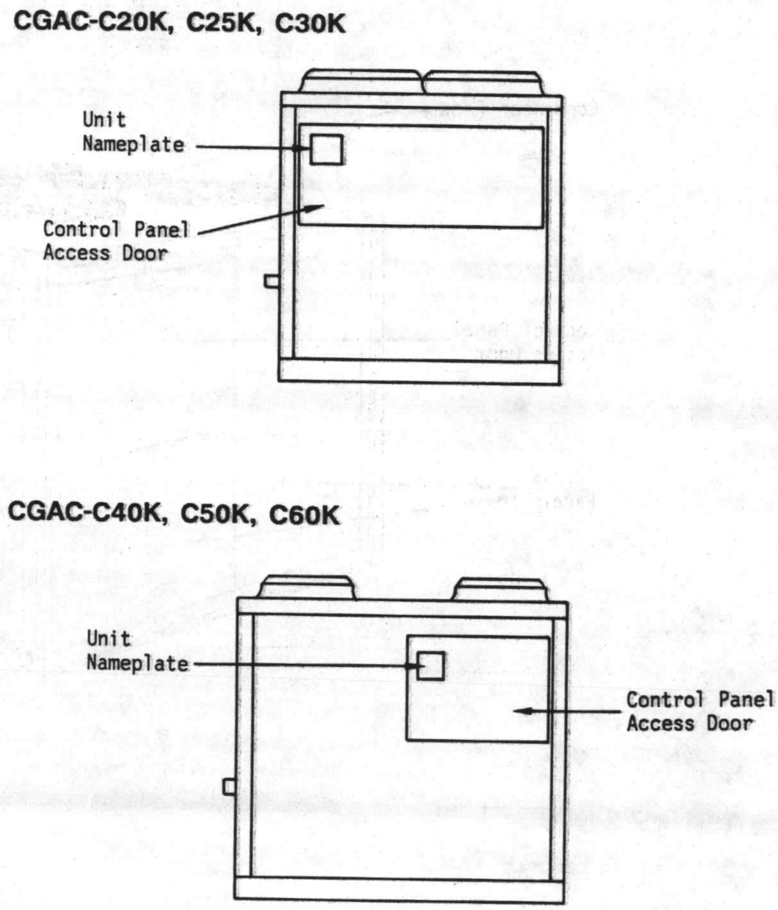
The evaporator nameplate is mounted on the top of the evaporator supply-end tube sheet. The word "nameplate" is applied to the insulation just above the nameplate (Figure 4); to view the nameplate, remove the tape over the area and spread the insulation.

Figure 2
Typical CGAC Unit Nameplate and Nameplate Location



Typical Unit Nameplate

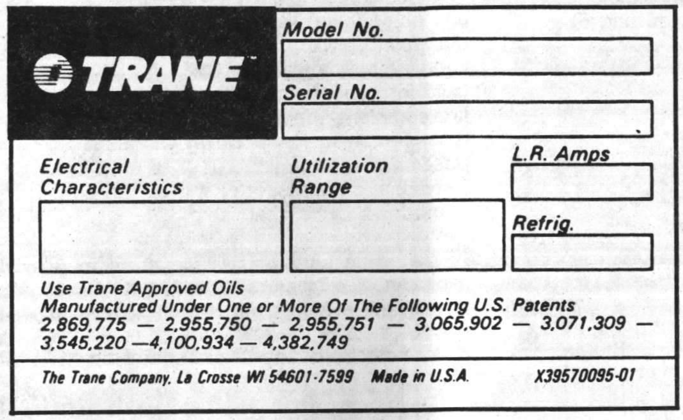
Art No.
RF/CG-2720



X39560391-01

Figure 3
Typical Model K Compressor Nameplate and Nameplate Location

Typical Compressor Nameplate


TRANE

Model No.

Serial No.

Electrical Characteristics

Utilization Range

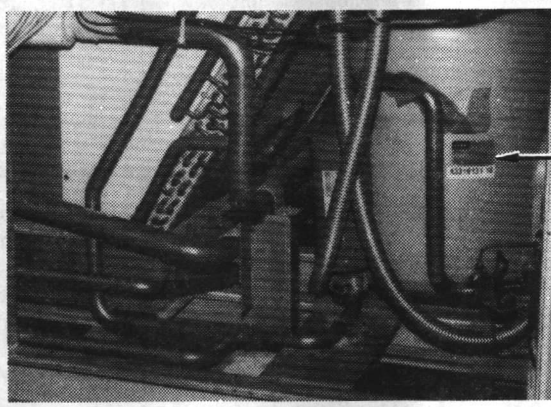
L.R. Amps

Refrig.

Use Trane Approved Oils
Manufactured Under One or More Of The Following U.S. Patents
2,869,775 — 2,955,750 — 2,955,751 — 3,065,902 — 3,071,309 — 3,545,220 —4,100,934 — 4,382,749

The Trane Company, La Crosse WI 54601-7599 Made in U.S.A. X39570095-01

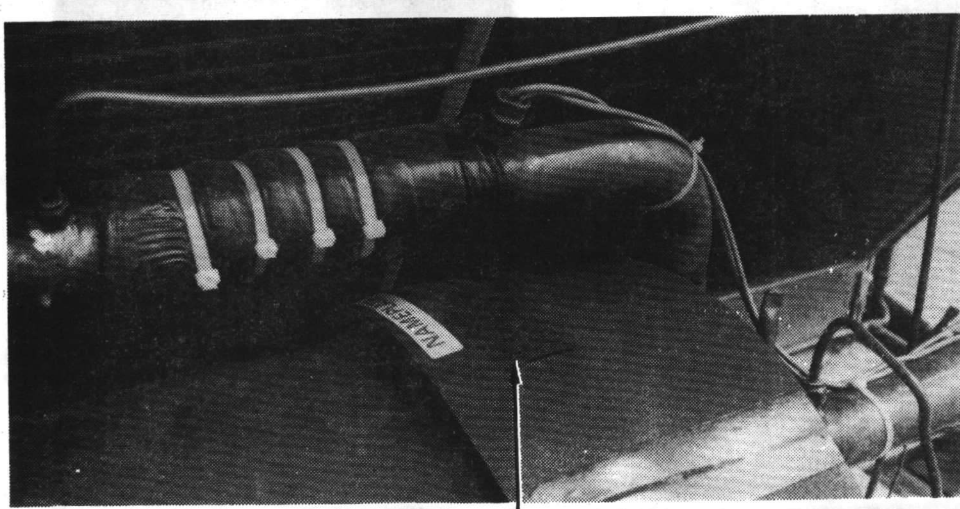
X39570095-01



Nameplate Location

Art No.
RF/CG-2736

Figure 4
Evaporator Nameplate Location



Nameplate
(Under Insulation)

Art No.
RF/CG-2722

Unit Operating Panel

CGAC unit operating switches and fuses are located on the switch panel inside the control panel (Figures 5 and 6).

Operating Switches

Unit Service Switch (1S41). Two-position toggle switch used for unit pumpdown or reset and to stop unit operation. Switch to On position to energize chiller control 1U12. If 1U12 calls for cooling and safety interlocks are complete, the compressor(s) will run. Switch to Pump Down Or Reset position to deenergize 1U12. If unit is operating, compressor(s) will go through pumpdown cycle, then stop.

Note: After turning 1S41 to On, allow a minimum of 4 minutes to elapse before turning the switch back to Pump Down or Reset, to allow the low ambient time delay function of the chiller control to elapse.

If the unit must be shutdown within 3 minutes of either compressor start, stop the compressor by turning the compressor service switch (1S5, 1S6) to Standby. This is necessary because, during this three-minute period, the low ambient delay function of the chiller control is energized (low pressure switches bypassed). Turning the unit off by switching the unit service switch (1S41) to Pump Down or Reset may allow a compressor to operate at excessively low pressure conditions.

Caution: To prevent possible damage to the evaporator or compressor, stop compressor using switch 1S5 or 1S6 if within 3 minutes of compressor start.

Compressor Service Switches (1S5, 1S6). Two-position toggle switches used to deactivate compressor control circuit for compressor service. On dual compressor units, this allows continued operation of the remaining compressor during service procedures. Turn to Operate for normal compressor operation. Turn to Stand-By to deactivate the compressor for service procedures. If the compressor is operating when switched to Stand By, it will not go through a pumpdown cycle.

Fuses

Control Circuit Fuse (1F1). 125V/10A fuse used to protect unit control circuit. Check if unit cuts out for unknown reasons.

Motor Protector Fuses (1F2, 1F3). 125V/6A fuses used to protect compressor control circuits.

Power Supply Fuse (1F10). 24V/3A fuse to protect low voltage control components (microprocessor 1U12, auxiliary relay module 1U13, etc.).

Evaporator Heater (4HR1)

The evaporator shell on all standard 60-cycle CGAC units is insulated from ambient air and protected by factory-installed, thermostatically controlled heat tapes for operation during low ambient conditions. The thermostats close to energize the heat tapes when evaporator shell temperature drops to approximately 37 F.

The installer must provide an independent 115V/60HZ/1PH power source with a fused disconnect switch to the proper terminal strip in the control panel.

Chilled Water (7B1) Pump and Interlocks

The chilled water pump is typically operated by a start/stop pushbutton (7S). If the chilled water pump overload (7K7-OL) is closed, the magnetic starter (7K7) is energized to run the chilled water pump when the pushbutton (7S) is pressed. Once the chilled water pump is running, the auxiliary contacts of the pump starter (7K7-Aux.) provide a holding circuit for the pump magnetic starter. A set of auxiliary contacts installed in series with the flow switch contacts establishes an interlock that keeps the unit from starting when the chilled water pump is not operating.

Figure 5
Unit Operating Panel for Typical CGAC Unit with Single Model K Compressor

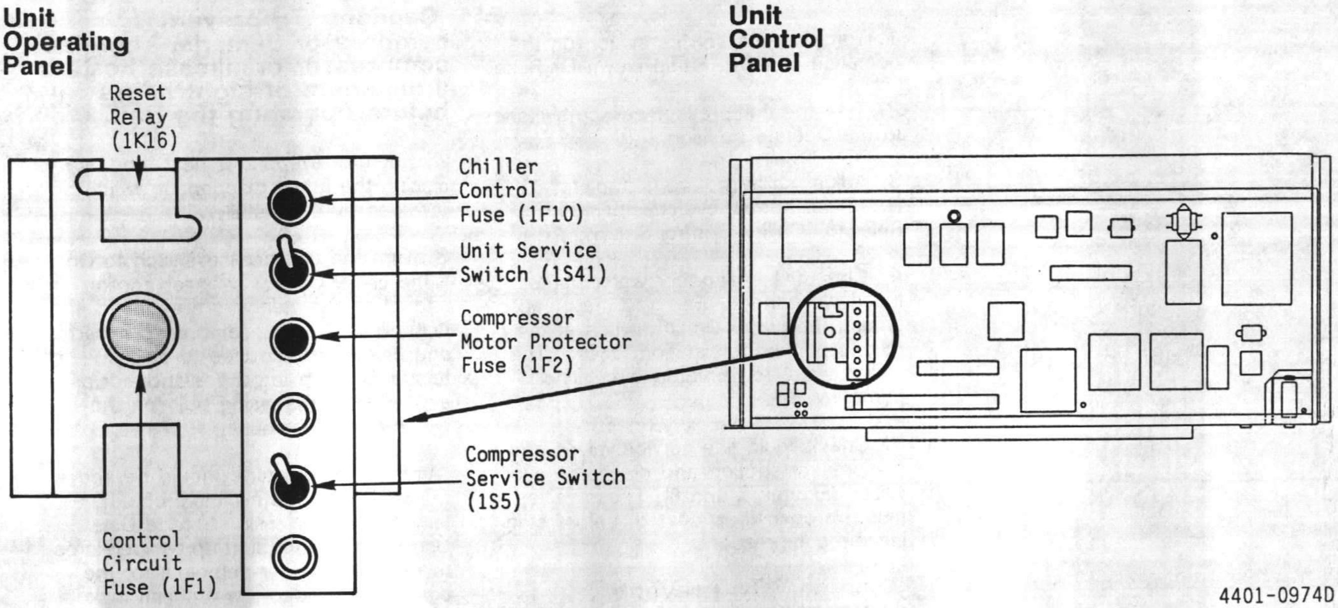
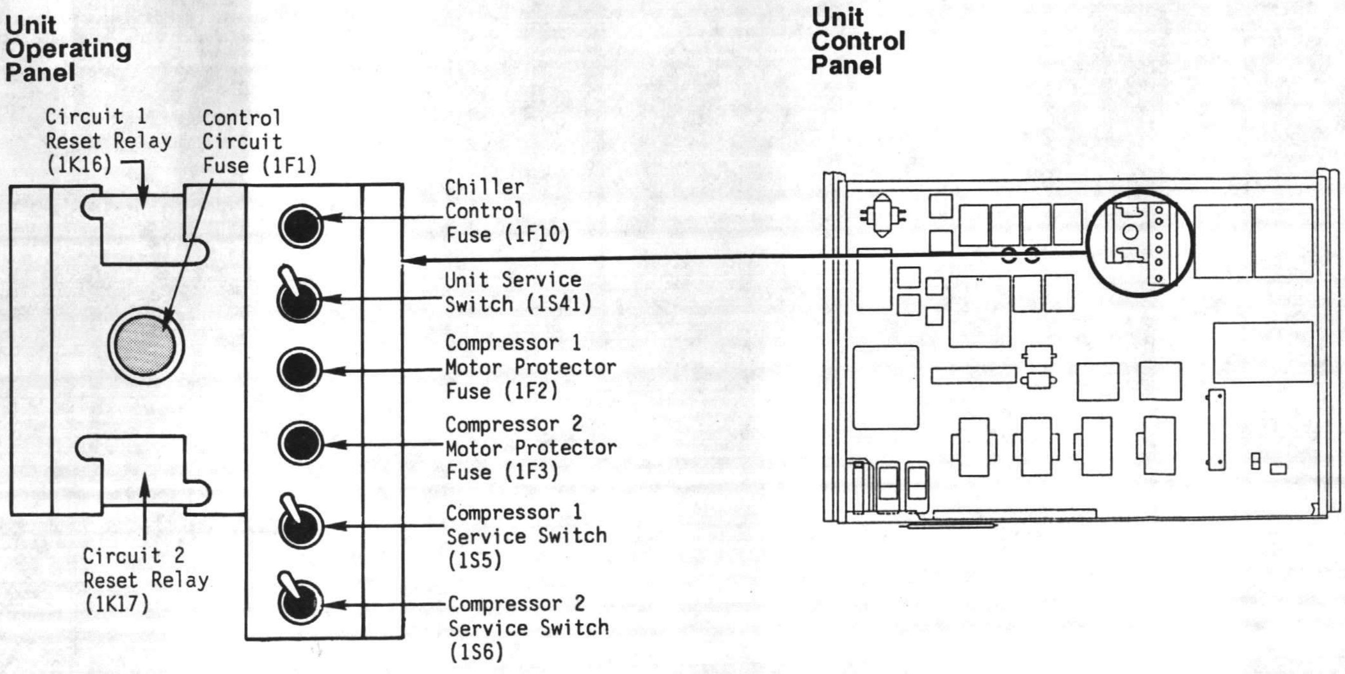


Figure 6
Unit Operating Panel for Typical CGAC Unit with Dual Model K Compressors



Start-Up Procedure

To start the unit, complete each step of this procedure, in sequence. Typical unit operating controls are illustrated in Figures 5 and 6.

1. Turn the unit service switch on the operating panel to Pump Down Or Reset.

2. Turn the compressor service switches to the Operate position.

3. Adjust chiller control setpoints (1U12) for normal system operation. Refer to "Chiller Control Setup".

4. Close the evaporator water pump fused disconnect. Energize the pump by turning the pump On/Off switch at the remote pushbutton station to On. The chilled water (evaporator) circulating pump will run.

5. Check liquid line service valves and compressor suction and discharge service valves (Figures 7 and 8). These valves must be open (backseated) before starting the compressors.

Caution: To prevent compressor damage, be certain that all refrigerant valves are open before starting the unit.

6. Energize the compressor crankcase heaters if they aren't already energized by closing the line voltage disconnect. Also close the unit-mounted disconnect, if used.

Caution: To prevent compressor damage, energize compressor crankcase heaters a minimum of eight hours before operating the unit.

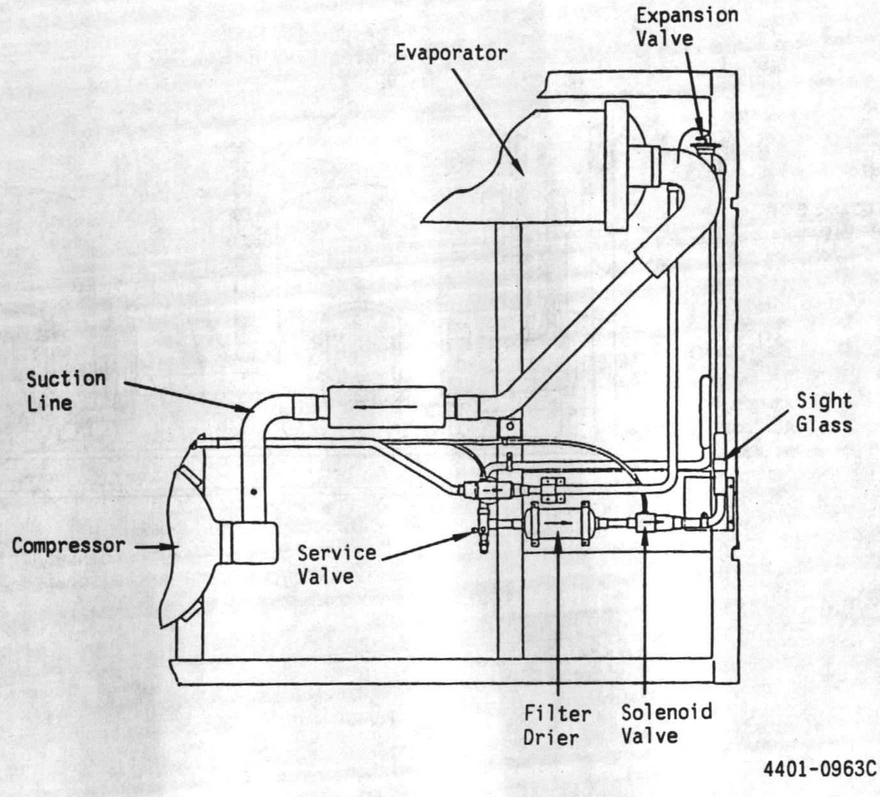
7. Energize evaporator heat tape by closing the fused disconnect switch provided by the installer.

8. Turn the unit service switch to On. If the chiller control calls for cooling and all safety interlocks are closed, the unit will start. The compressors load and unload in response to chilled water temperature leaving the evaporator as sensed by the sensing bulb on the evaporator water outlet.

Ambient temperature should be above the recommended minimum start-up temperatures given in "Service Data". Use the minimum start-up temperatures to establish proper setpoints for the customer-provided low ambient lockout thermostat, if used. Refer to the field wiring diagrams in Figures 9 and 10.

Figure 7
Typical Liquid Line Component Locations

CGAC-C30K



CGAC-C60K

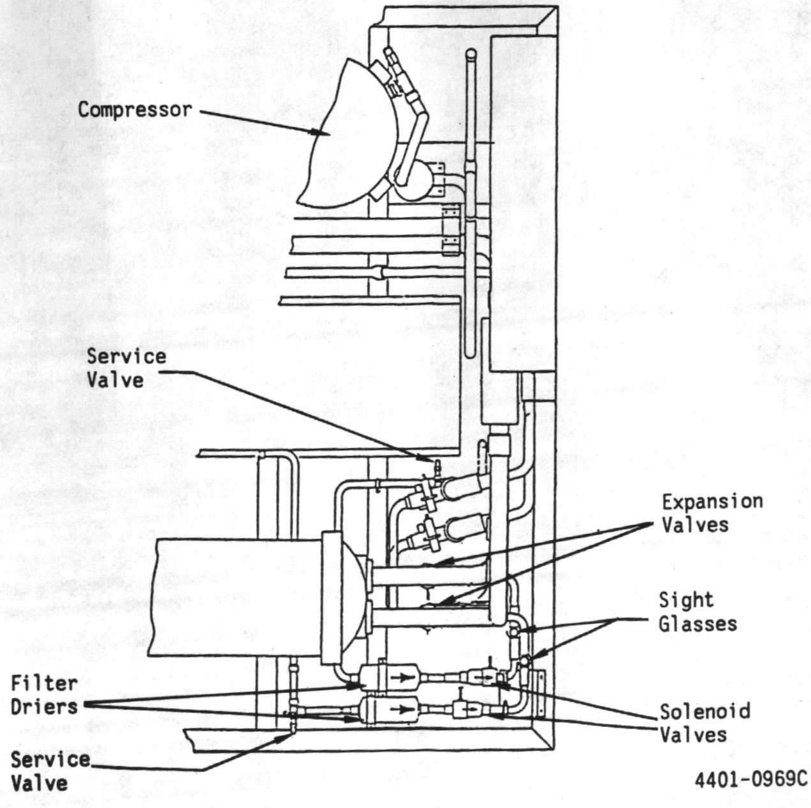


Figure 8
Typical Compressor Service Valve Locations (CGAC-C60K Shown)

Compressor Side View

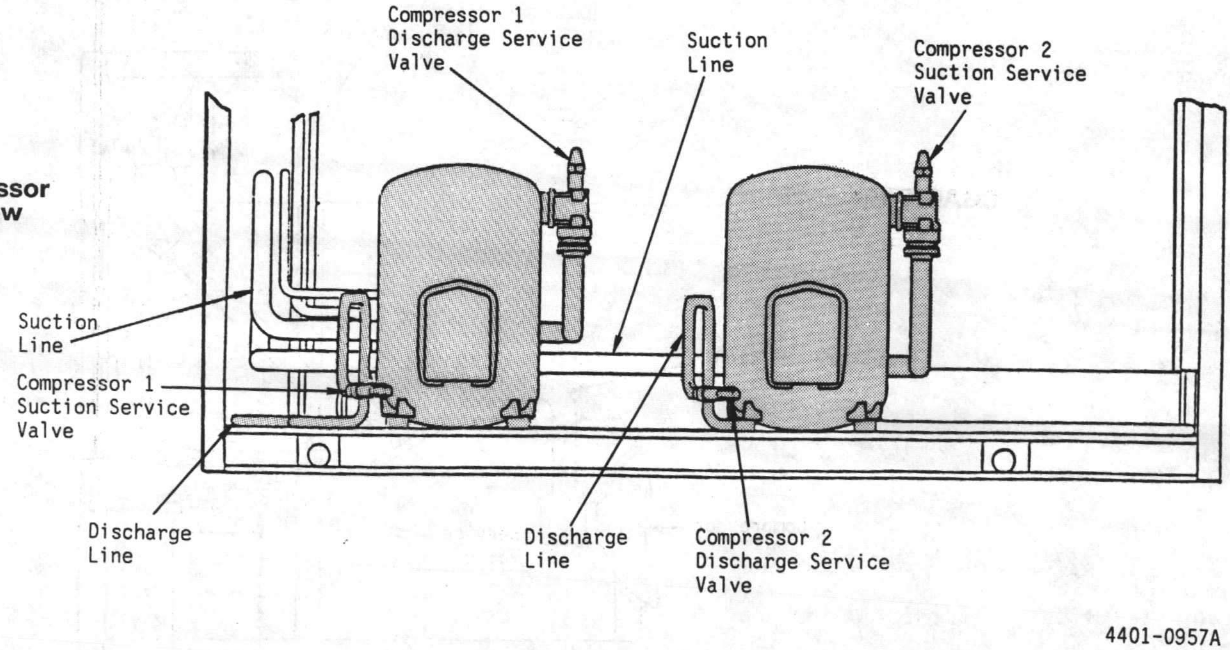
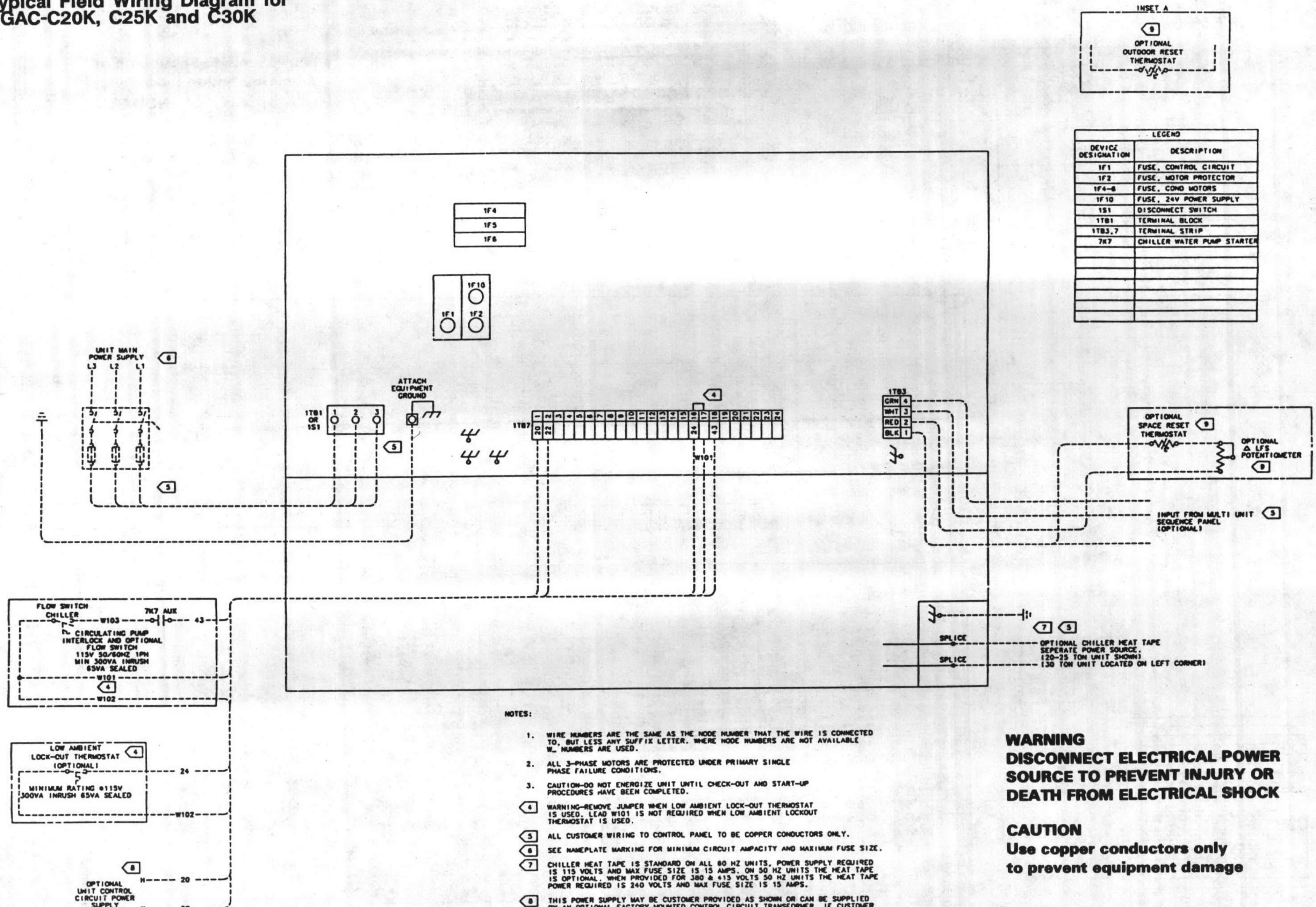


Figure 9
Typical Field Wiring Diagram for CGAC-C20K, C25K and C30K



LEGEND

DEVICE DESIGNATION	DESCRIPTION
1F1	FUSE, CONTROL CIRCUIT
1F2	FUSE, MOTOR PROTECTOR
1F4-6	FUSE, COND MOTORS
1F10	FUSE, 24V POWER SUPPLY
1S1	DISCONNECT SWITCH
1TB1	TERMINAL BLOCK
1TB3,7	TERMINAL STRIP
7K7	CHILLER WATER PUMP STARTER

NOTES:

1. WIRE NUMBERS ARE THE SAME AS THE NODE NUMBER THAT THE WIRE IS CONNECTED TO, BUT LESS ANY SUFFIX LETTER. WHERE NODE NUMBERS ARE NOT AVAILABLE W_ NUMBERS ARE USED.
2. ALL 3-PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
3. CAUTION-DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.

4 WARNING-REMOVE JUMPER WHEN LOW AMBIENT LOCK-OUT THERMOSTAT IS USED. LEAD W101 IS NOT REQUIRED WHEN LOW AMBIENT LOCKOUT THERMOSTAT IS USED.

5 ALL CUSTOMER WIRING TO CONTROL PANEL TO BE COPPER CONDUCTORS ONLY.

6 SEE NAMEPLATE MARKING FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM FUSE SIZE.

7 CHILLER HEAT TAPE IS STANDARD ON ALL 60 HZ UNITS. POWER SUPPLY REQUIRED IS 115 VOLTS AND MAX FUSE SIZE IS 15 AMPS. ON 50 HZ UNITS THE HEAT TAPE IS OPTIONAL. WHEN PROVIDED FOR 380 & 415 VOLTS 50 HZ UNITS THE HEAT TAPE POWER REQUIRED IS 240 VOLTS AND MAX FUSE SIZE IS 15 AMPS.

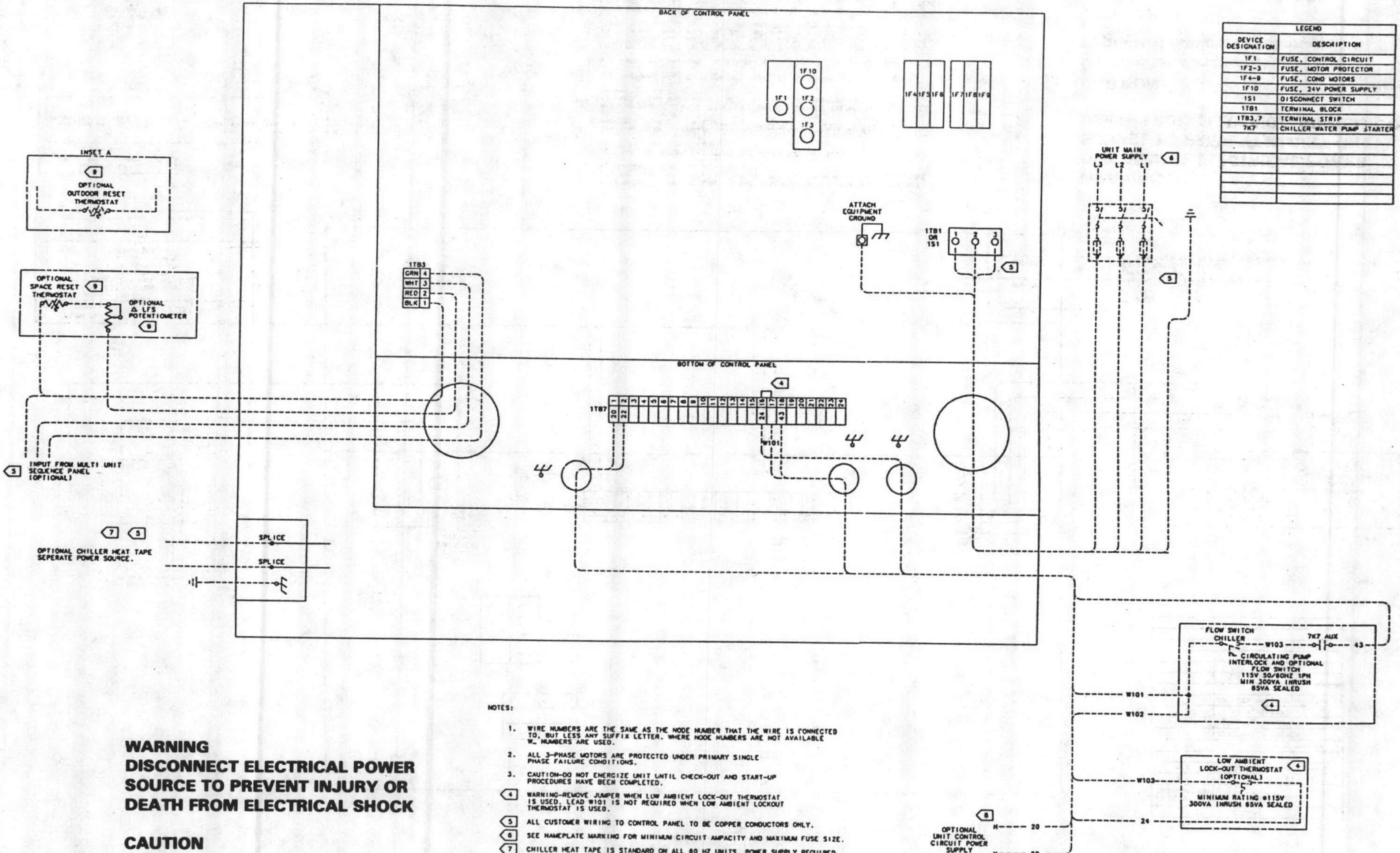
8 THIS POWER SUPPLY MAY BE CUSTOMER PROVIDED AS SHOWN OR CAN BE SUPPLIED BY AN OPTIONAL FACTORY MOUNTED CONTROL CIRCUIT TRANSFORMER. IF CUSTOMER PROVIDED THE POWER REQUIREMENTS ARE 115 VOLTS, 750 VA AND THE MAX FUSE SIZE IS 15 AMPS. IF THE OPTIONAL TRANSFORMER IS ORDERED THIS POWER SUPPLY AND LEADS 20 AND 22 ARE NOT REQUIRED.

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

2306-1929

Figure 10
Typical Field Wiring Diagram for CGAC-C40K, C50K and C60K



LEGEND	
DEVICE DESIGNATION	DESCRIPTION
1F1	FUSE, CONTROL CIRCUIT
1F2-3	FUSE, MOTOR PROTECTOR
1F4-9	FUSE, COND MOTORS
1F10	FUSE, 24V POWER SUPPLY
1S1	DISCONNECT SWITCH
1TB1	TERMINAL BLOCK
1TB3,7	TERMINAL STRIP
7K7	CHILLER WATER PUMP STARTER

NOTES:

1. WIRE NUMBERS ARE THE SAME AS THE NODE NUMBER THAT THE WIRE IS CONNECTED TO, BUT LESS ANY SUFFIX LETTER. WHERE NODE NUMBERS ARE NOT AVAILABLE W_ NUMBERS ARE USED.
2. ALL 3-PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
3. CAUTION-DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.
4. WARNING-REMOVE JUMPER WHEN LOW AMBIENT LOCK-OUT THERMOSTAT IS USED. LEAD W101 IS NOT REQUIRED WHEN LOW AMBIENT LOCKOUT THERMOSTAT IS USED.
5. ALL CUSTOMER WIRING TO CONTROL PANEL TO BE COPPER CONDUCTORS ONLY.
6. SEE NAMEPLATE MARKING FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM FUSE SIZE.
7. CHILLER HEAT TAPE IS STANDARD ON ALL 60 HZ UNITS. POWER SUPPLY REQUIRED IS 115 VOLTS AND MAX FUSE SIZE IS 15 AMPS. ON 50 HZ UNITS THE HEAT TAPE IS OPTIONAL. WHEN PROVIDED FOR 380 & 415 VOLTS 50 HZ UNITS THE HEAT TAPE POWER REQUIRED IS 240 VOLTS AND MAX FUSE SIZE IS 15 AMPS.
8. THIS POWER SUPPLY MAY BE CUSTOMER PROVIDED AS SHOWN OR CAN BE SUPPLIED BY AN OPTIONAL FACTORY MOUNTED CONTROL CIRCUIT TRANSFORMER. IF CUSTOMER PROVIDED THE POWER REQUIREMENTS ARE 115 VOLTS, 750 VA AND THE MAX FUSE SIZE IS 15 AMPS. IF THE OPTIONAL TRANSFORMER IS ORDERED THIS POWER SUPPLY AND LEADS 20 AND 22 ARE NOT REQUIRED.
9. △LFS RESET POTENTIOMETER USED WITH REMOTE SPACE SENSOR. FOR OUTDOOR RESET, REMOTE SPACE SENSOR AND △LFS RESET POTENTIOMETER IS NOT USED (SEE INSET A). THE NOTED OPTIONAL SPACE OR OUTDOOR RESET THERMOSTAT ARE NOT AVAILABLE IF THE MULTI UNIT SEQUENCE PANEL IS PROVIDED.

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

2306-1930

Checking Operating Conditions

Once the unit has been operating for about 30 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

[ ] Recheck evaporator water flow and pressure drop. These readings should be stable at proper levels. If pressure differential drops off, clean all evaporator water supply strainers.

[ ] Check suction and discharge pressure at the gauges on the unit (Figure 11). If the unit is not equipped with gauges, install them on the gauge valves provided on the unit if so equipped. Use a refrigerant-tight thread seal such as teflon tape.

To read pressures, remove the cap from the shut-off valve and open (backseat) the valve (Figure 12). Read the operating pressure. Close (frontseat) the valve to isolate it from the system. Replace and retighten the cap.

Caution: To minimize gauge wear, close shut-off valves to isolate the gauges when pressure readings have been taken.

Note: If the unit is not equipped with pressure gauges, take operating pressures using a manifold gauge set at these points:

Discharge pressures - take at compressor discharge service valve backseat port (Figure 11). Normal discharge pressure is 250 to 360 psig. Refer to "Service Data" for more specific information.

Suction pressures - take at compressor suction service valve backseat port (Figure 12). Normal suction pressure is 55 to 70 psig. Refer to "Service Data" for more specific information.

[ ] Check compressor oil levels. At full load, oil level should be visible about one-half of the way up on the oil level sight glass on the compressor (Figure 13). If it is not, add or remove oil as required. Refer to "Service Data" for correct oil charges and recommended oils for these units.

[ ] Check and record compressor amperage draw. Compare the readings with the compressor electrical data provided in "Service Data" and on the unit nameplate.

[ ] Check the liquid line sight glasses (Figure 7). Refrigerant flow past the sight glasses should be clear. Bubbles in the liquid line indicate either low refrigerant charge or excessive pressure drop in the liquid line. Such a restriction can often be identified by a noticeable temperature differential on either side of the restricted area. Frost often forms on the outside of the liquid line at this point also. Refrigerant charges for CGAC units are provided in "Service Data".

Caution: The system may not be properly charged although the sight glass is clear. Also consider superheat, subcooling and operating pressures.

[ ] Once oil level, amp draw and operating pressures have stabilized, measure system superheat. Refer to "System Superheat".

[ ] Measure system subcooling. Refer to "System Subcooling".

[ ] If operating pressure, sight glass, superheat and subcooling readings indicate refrigerant shortage, gas-charge refrigerant into each circuit. Refrigerant shortage is indicated if operating pressures are low and subcooling is also low.

Caution: If suction and discharge pressures are low but subcooling is normal, no refrigerant shortage exists. Adding refrigerant, will result in overcharging.

Add refrigerant vapor with the unit running by charging through the compressor suction service valve backseat port until operating conditions are normal.

Caution: To prevent compressor damage, do not allow liquid refrigerant to enter the suction line. Liquid charge at the liquid line service valve only.

Caution: To prevent compressor damage and insure full cooling capacity, use refrigerants specified on the unit nameplate only.

[ ] If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line service valve. Do not discharge refrigerant into the atmosphere.

WARNING: To prevent injury due to frostbite, avoid skin contact with refrigerant.

[ ] If the unit is equipped with hot gas bypass, check regulating and solenoid valve for proper operation, Valve operating setpoints are provided in "Service Data".

[ ] If the unit is equipped with low ambient dampers, check for proper actuator and blade travel in relation to condensing pressure. Refer to "Service Data" for damper operating setpoints.

[ ] Once proper unit operation is confirmed, inspect for debris, misplaced tools, etc. Secure all exterior panels in place.

System Superheat

Normal superheat for each circuit is 12-15 F at full load. If superheat is not within this range, adjust expansion valve superheat setting. Expansion valve locations are shown in Figure 7. Allow 15-30 minutes between adjustments for the expansion valve to stabilize on each new setting.

System Subcooling

Normal subcooling for each circuit is 17 to 20 F at full load. If subcooling for either circuit is not in this range check superheat for the circuit and adjust, if required. If superheat is normal but subcooling is not, contact a qualified service technician.

Figure 11
Location of Optional Operating Pressure Gauges (Typical Dual Compressor Unit)

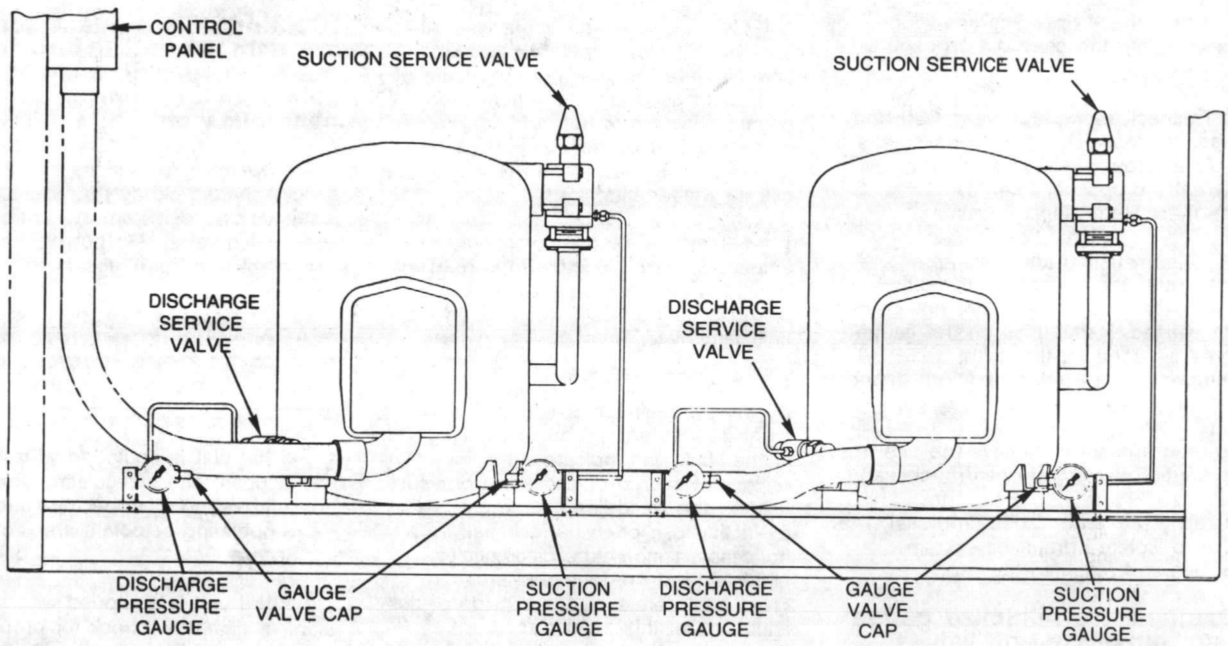
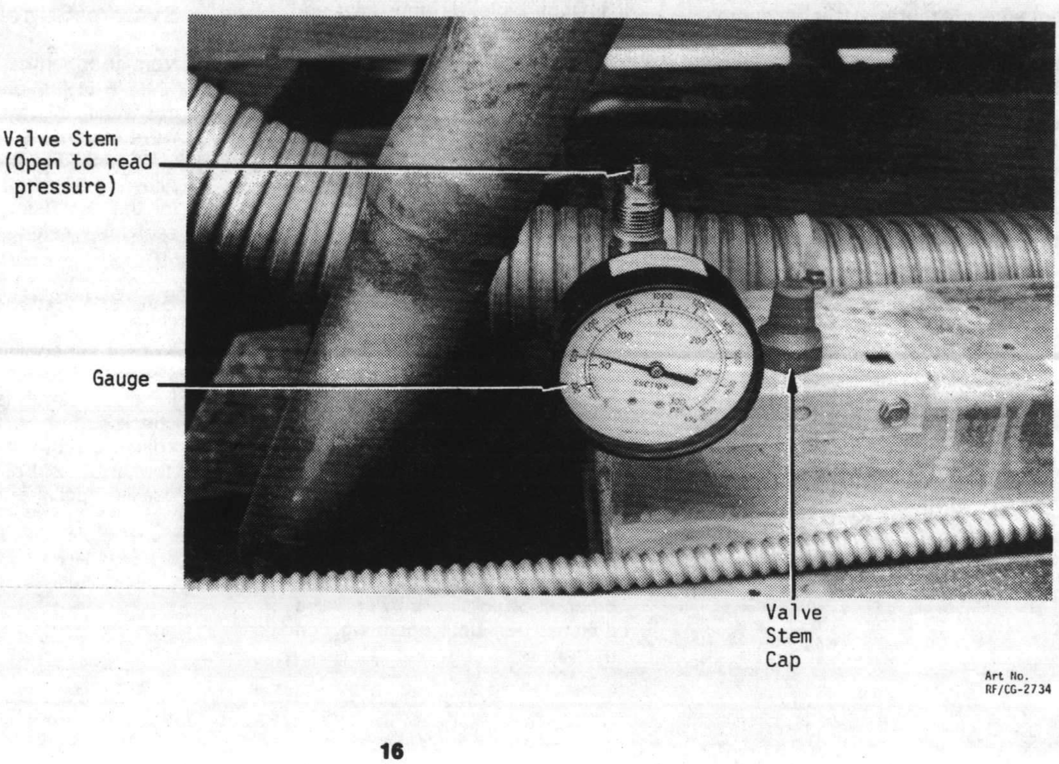
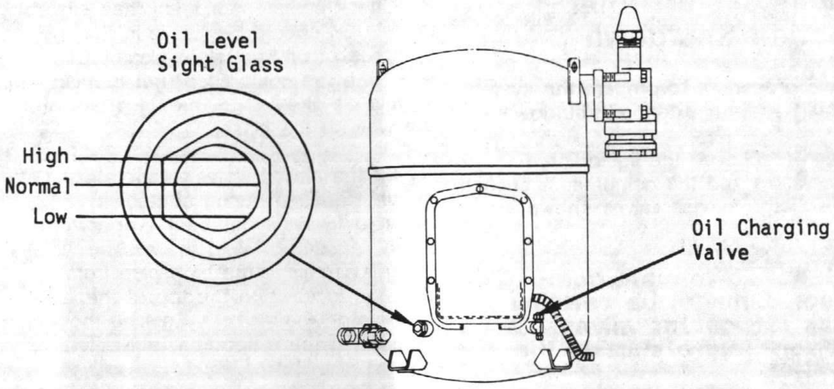


Figure 12
Typical Operating Pressure Gauge



Art No. RF/CG-2734

Figure 13
Model K Compressor Oil Level Sight Glass and Oil Charging Valve Locations



Temporary Shutdown and Restart

To shut the unit down for a short time, use the following procedure.

1. Turn the unit service switch (1S41) to Pump Down Or Reset. The compressor(s) continue to operate, pumping down the system and stopping as the low pressure switch(es) open to deenergize the compressor contactors. The condenser fans will deenergize at this time.

2. Leave the unit disconnect switch and the unit-mounted disconnect 1S1 (if used) closed to keep the compressor crankcase heater(s) energized.

WARNING: Do not use this procedure to shut unit down for service or repairs. To prevent injury or death due to electrical shock, service the unit only with electrical disconnects locked open.

3. Stop chilled water pump operation by turning the pump On/Off switch to Off.

To restart the unit after a temporary shutdown, restart the chilled water pump and turn the unit service switch (1S41) to On. The unit will operate normally provided the following conditions are met:

1. The chiller control (1U12) must call for cooling.

2. All system operating interlocks and safety circuits must be satisfied.

Extended Shutdown Procedure

If the system is taken out of operation for long periods of time for any reason (seasonal shutdown for example), use this procedure to prepare the system for shutdown.

1. Perform "Manual Pumpdown" procedure. Be certain to perform this procedure for both circuits.

2. Test condenser and high side piping for refrigerant leakage.

3. Open electrical disconnect switches for evaporator water pump. Lock the disconnect in open position.

Caution: Lock evaporator water pump disconnect open to prevent pump damage.

4. Close all evaporator water supply valves. Drain water from the evaporator. If unit will be exposed to sub-freezing low ambient conditions, flush evaporator with antifreeze solution or energize evaporator heaters by closing the fused disconnect provided by the installer.

Caution: To prevent freeze damage to evaporator internal components, protect with adequate strength antifreeze or be certain to energize the evaporator heater.

5. Open the unit main electrical disconnect and unit-mounted disconnect 1S1 (if used) and lock in open position.

Caution: Lock unit main disconnect open to prevent compressor damage due to accidental start-up while system is in "shutdown" condition.

System Restart After Extended Shutdown

Use this procedure to prepare the system for restart after an extended shutdown.

1. Open (backseat) the liquid line, service valves and the compressor suction and discharge service valves shown in Figure 11.

Caution: To prevent compressor damage, be certain that all refrigerant valves are open before starting the unit.

2. Close the unit main disconnect and the unit-mounted disconnect 1S1 (if used) to energize the compressor crankcase heater(s).

Caution: To prevent compressor damage, energize compressor crankcase heaters a minimum of eight hours before operating the unit.

3. Check compressor crankcase oil levels. Oil should be visible in the compressor oil level sight glass. Oil level with the compressor not running should be one-half to three-quarters of the way up the glass.

4. Fill the chilled water (evaporator) circuit if drained during shutdown. Refer to "Service Data" for evaporator liquid capacities. Vent the system while filling it. Remove the pipe plug from the vent located on the top of the evaporator (Figure 14). Replace the vent plug when the evaporator is filled.

Caution: To avoid possible equipment damage, do not use untreated -- or improperly treated -- system water.

5. Close the fused disconnect switch that provides power to the chilled water pump starter (7K7).

6. Start the chilled water pump by turning the chilled water pump On/Off switch (7S) at the pump remote pushbutton station to On. With water circulating through the chilled water system, inspect all piping connections for leakage. Make any necessary repairs.

7. With the circulating pump operating, adjust chilled water flow and check water pressure drop through the evaporator. Refer to "Water System".

8. Adjust the flow switch on the evaporator outlet piping for proper operation.

9. Stop the chilled water pump. Unit is now ready for normal operation. Refer to "Start-Up Procedure".

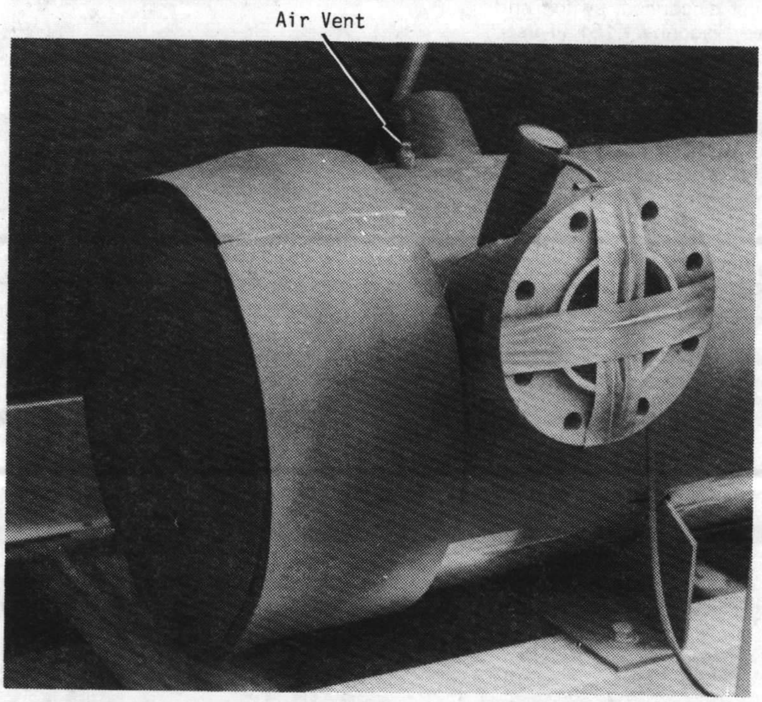
Unit Voltage

Electrical power to the unit must meet stringent requirements for the unit to operate properly. Total voltage supply and voltage imbalance between phases must be within the following tolerances.

Voltage Supply

Measure each leg of supply voltage at the line voltage disconnect switch. Readings must fall within voltage utilization range shown on the unit nameplate. If voltage of any leg does not fall within tolerance, notify the power company to correct this situation before operating the unit. Inadequate voltage to the unit will cause control components to malfunction and shorten the life of relay contacts and compressor motors.

Figure 14
Air Vent Location on Typical Evaporator Shell



Art No.
RF-CG-2730

Voltage Imbalance

Excessive voltage imbalance between phases in a three-phase system will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2 percent. Voltage imbalance is defined as 100 times the maximum deviation of the three voltages (three phases) subtracted from the average (without regard to sign), divided by the average voltage.

Example:
If the three voltages measured at the line voltage fused disconnect are 221 volts, 230 volts and 227 volts, the average would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ volts.}$$

The percentage of imbalance is then:

$$\frac{100(226 - 221)}{226} = 2.2\%.$$

The 2.2 percent imbalance that exists in the example above exceeds maximum allowable imbalance by 0.2 percent. This much imbalance between phases can equal as much as 20 percent current imbalance with a resulting increase in winding temperature that will decrease compressor motor life.

Water System

Water Flow Rates

Establish balanced water flow through the evaporator. Flow rates should fall between the minimum and maximum values given in "Service Data". Flow rates below minimum values will result in laminar flow, reducing heat transfer and causing either loss of TEV control or repeated nuisance low pressure cutouts. Excessively high water flow can cause damage to the tube supports and baffles in the evaporator.

Pressure Drop Measurement

Measure evaporator water pressure drop at the pressure gauge(s) on the system water piping. Pressure drop readings should approximate those shown by the pressure drop chart in Figure 15.

Manual Pumpdown for Service or Extended Shutdown

1. If the unit is running, turn the unit service switch (1S41) to Pump Down or Reset and allow the compressors to go through a normal system pumpdown. If the unit is not running, proceed to Step 2.

2. Open the unit main power disconnect switch and the unit-mounted disconnect 1S1 (if used) and adjust the chiller control (1U12) leaving fluid setpoint low enough to insure a call for cooling when the unit starts.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

3. Install a jumper across the terminals 10 to 11 (for circuit 1) and 10 to 9 (for circuit 2) of the chiller control (1U12). Install jumpers only for the circuit being pumped down.

4. Manually close the liquid line service valve for the circuit being pumped down. If both circuits are being pumped down, close both liquid line service valves (Figure 7).

5. Close the unit main power disconnect and the unit-mounted disconnect 1S1 (if used).

6. Turn the compressor service switches (1S5 and 1S6) to the Operate position.

7. Turn the unit service switch (1S41) to On. The designated lead compressor will start, followed by the lag compressor.

8. Carefully observe the suction pressure gauge for the circuit(s). When pressure drops to 2-3 psig, turn the compressor service switch (1S5 or 1S6)) for the circuit being pumped down to Standby and close (frontseat) the compressor suction and discharge service valves (Figure 7).

9. Turn the unit service switch (1S41) to Pump Down or Reset.

Note: If suction pressure rises, repeat steps 6 through 9 until pressure holds at 2-3 psig.

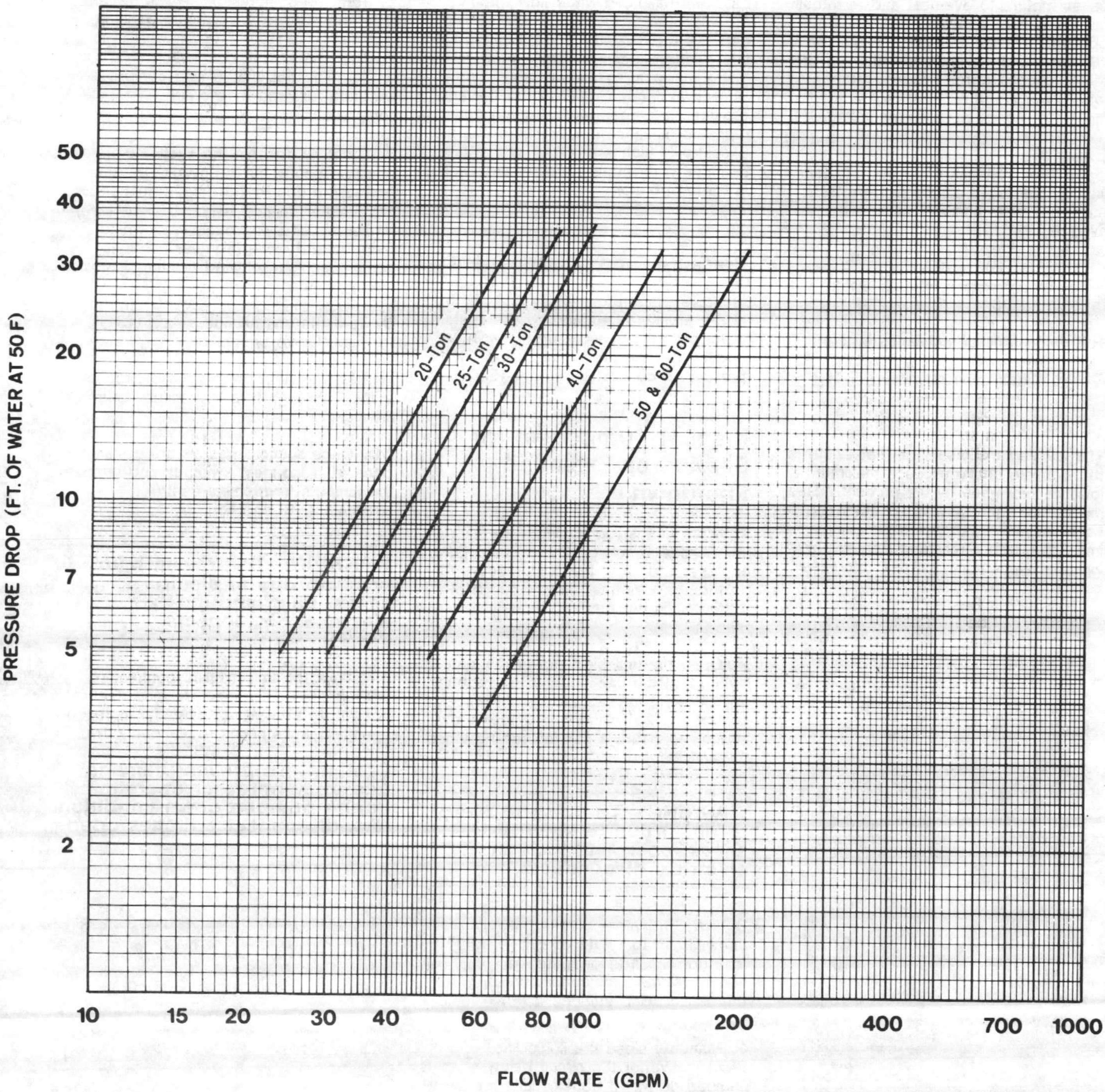
10. Once suction pressures are stable, open all disconnect switches and remove the jumpers from chiller control terminals 9, 10 and 11.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

11. Lock the unit main disconnect or unit-mounted disconnect in open (Off) position to prevent accidental compressor operation while circuit is pumped down.

Caution: To prevent damage due to compressor operation during pumped down condition, lock disconnect switches open.

Figure 15
Evaporator Water Pressure Drop Chart for CGAC-C20K thru C60K Units



Refer to "Model Number Description" to determine evaporator designation for any unit.

Electrical Control System

Controls for CGAC units are classified either as "operational controls" or "unit safety" controls. Figures 16 and 17 identify the locations of all unit control devices. Refer to "Service Data" for control operating setpoints.

Safety Controls

High Pressure Switches (2B1S2, 3B2S3)

The high pressure switches (2B1S2 and 3B2S3), located in the compressor terminal junction boxes (Figure 16 and 17), prevent compressor operation at high discharge pressures which can result from insufficient condenser air flow.

If discharge pressure increases to a point higher than the cut-out setting of the high pressure switch, the switch contacts open, stopping compressor operation. The contacts automatically reset once the system pressure falls below the cut-in setting of the control. If the contacts of the high pressure switch open, the reset relay is energized.

To restart the compressor, insure that the high pressure switch contacts have closed and reset the reset relay by turning the unit service switch (1S41) to Pump Down Or Reset and back again to On. There will be a 4-5 minute time delay before compressor restart.

Compressor Motor Overloads (1U1, 1U2)

The compressor motor overloads (1U1 and 1U2) are located in the unit control panel. These devices prevent compressor operation if compressor motor current draw exceeds the setting of the overloads. If compressor motor current draw exceeds the "must trip" setting of the overload, its normally closed contacts open, stopping compressor operation. If compressor motor overload contacts open, the reset relay is energized. To restart the compressor, reset the reset relay by turning the unit service switch (1S41) to Pump Down Or Reset and back again to On. There will be a 4-5 minute time delay before compressor restart.

The "must hold" and "must trip" setpoints of the overloads are set at the factory. A label showing these values is affixed to the face of the overload. These setpoints are given in "Service Data".

Reset Relays (1K16, 1K17)

The reset relays are located in the unit control panel as shown in Figures 16 and 17. They are used to prevent repeated compressor cycling if a high pressure switch ((2B1S2, 3B2S3), compressor motor overload (1U1, 1U2) or low water temperature protection contacts (1UK29) open. This is necessary since the high pressure switches, the compressor overloads and low water temperature contacts located in the compressor safety circuit, reclose automatically. If the contacts of one of these devices open during compressor operation, sufficient voltage is developed across the reset relay coil to open the relay contacts.

There is not enough voltage, however, for the rest of the unit control circuit. Compressor contactors (1K3, 1K4) and the liquid line solenoid valves (4L1, 4L2) are deenergized.

To restart the compressor, correct the malfunction that caused the safety contol to cut out and turn the unit service switch (1S41) to Pump Down Or Reset and back again to On. There will be a 4-5 minute time delay before compressor restart.

Caution: To prevent unit damage, do not reset the control circuit until the cause of the safety lockout is identified and corrected.

Chilled Water Flow Sensor

A flow sensor (flow switch or pressure differential switch) should be installed in the chilled water piping. The sensor, in conjunction with the chilled water pump motor starter interlock, prevents chiller operation if water flow through the evaporator is interrupted or becomes restricted. If a mechanical flow sensing device is used, it should be installed in the evaporator chilled water outlet piping.

Operational Controls

Chiller Control and Auxiliary Relay Module (1U12, 1U13)

The solid-state, microprocessor-based chiller control (1U12) and auxiliary relay module (1U13) are used to maintain leaving chilled water temperature within a desired range. Multiple-stage capacity control of each unit is accomplished by loading and unloading each compressor.

The chiller control and auxiliary relay module, located in the control panel (Figures 16 and 17), also provide the special operating and safety features described below:

Evaporator Freeze Protection. The low temperature cutout feature prevents the unit from operating if the leaving chilled solution temperature approaches its freezing point as sensed by 4RT1 located in the evaporator water outlet. This is accomplished through the 1UK29 contacts of the auxiliary relay module 1U13. The standard setpoint for low water temperature control cutout is 35 F. If a setpoint other than 35 F is required, contact The Trane Company.

Compressor Anti-Recycle Protection. The anti-recycle timing feature of the chiller control limits individual compressor starts to one start per compressor each five minutes. The timing period begins at compressor start-up. This feature also requires a minimum off-time of one minute. This timing period begins at compressor shut-down.

Load Limiting. Load-limiting prevents nuisance compressor tripouts by preventing full load operation of either compressor whenever excessive evaporator loading may cause the high pressure controls, (2B1S2, 3B2S3), compressor motor overloads (1U1, 1U2) or compressor winding temperature sensors (2B1RT1, 3B2RT1) to open.

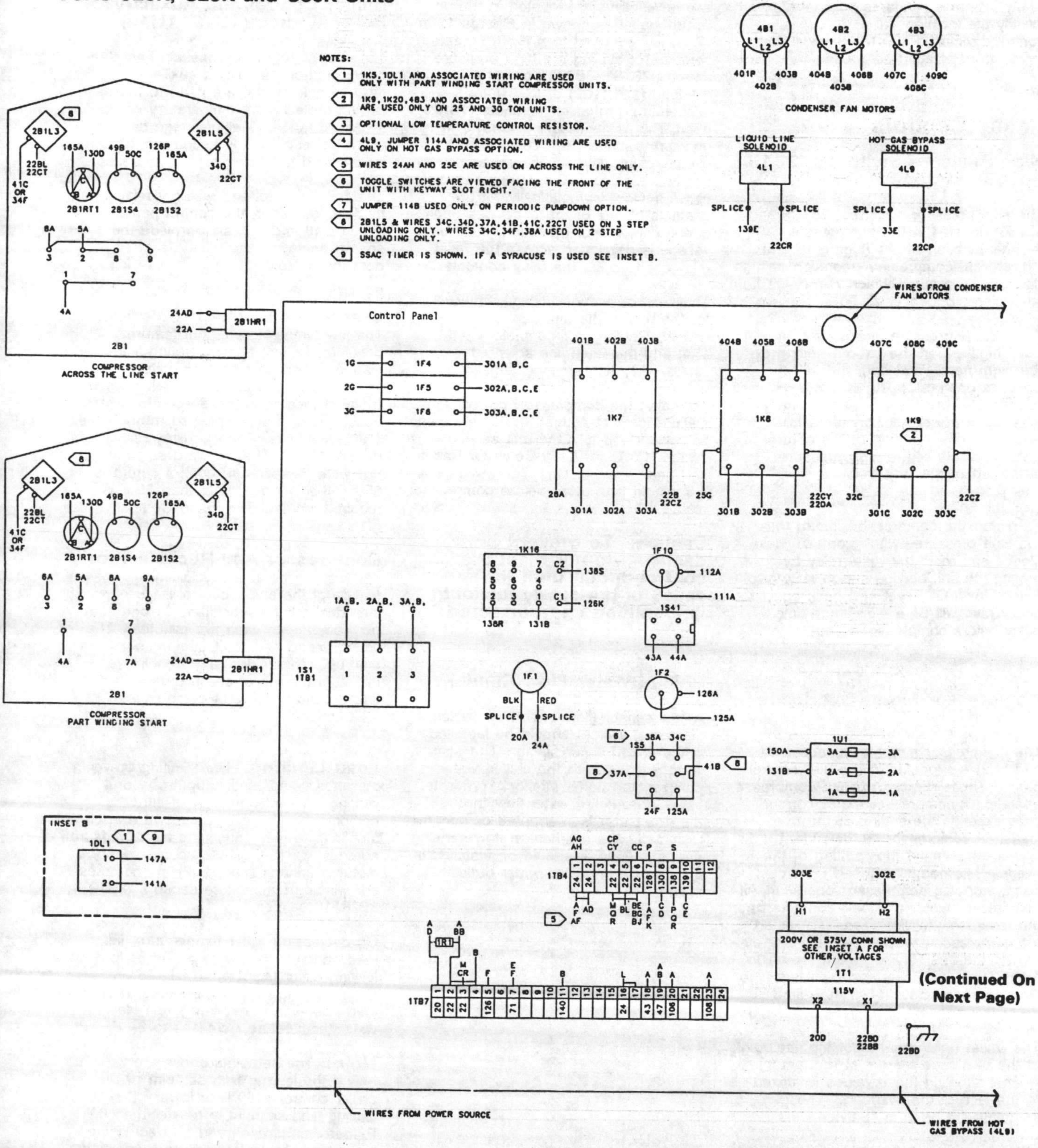
On decreasing water temperature, full load operation is not permitted until leaving water temperature falls to 56 F. On increasing water temperature, part load operation is required when leaving water temperature increases to 64 F.

Note: The setpoints above are valid only if the leaving fluid setpoint of the chiller control is 60 F or lower. If leaving fluid setpoint is greater than 60 F, load limit is energized on decreasing water temperature at 94 F and on rising leaving water temperature at 100 F.

Figure 16
Typical Component Locations for CGAC-C20K, C25K and C30K Units

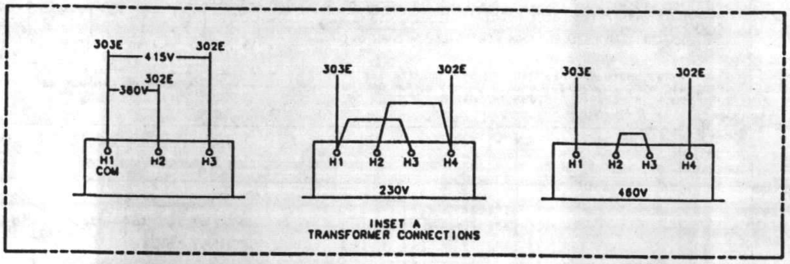
NOTES:

1. 1K5, 1DL1 AND ASSOCIATED WIRING ARE USED ONLY WITH PART WINDING START COMPRESSOR UNITS.
2. 1K9, 1K20, 4B3 AND ASSOCIATED WIRING ARE USED ONLY ON 25 AND 30 TON UNITS.
3. OPTIONAL LOW TEMPERATURE CONTROL RESISTOR.
4. 4L9, JUMPER 114A AND ASSOCIATED WIRING ARE USED ONLY ON HOT GAS BYPASS OPTION.
5. WIRES 24AH AND 25E ARE USED ON ACROSS THE LINE ONLY.
6. TOGGLE SWITCHES ARE VIEWED FACING THE FRONT OF THE UNIT WITH KEYWAY SLOT RIGHT.
7. JUMPER 114B USED ONLY ON PERIODIC PUMPDOWN OPTION.
8. 2B1L5 & WIRES 34C, 34D, 37A, 41B, 41C, 22CT USED ON 3 STEP UNLOADING ONLY. WIRES 34C, 34F, 38A USED ON 2 STEP UNLOADING ONLY.
9. SSAC TIMER IS SHOWN. IF A SYRACUSE IS USED SEE INSET B.



(Continued On Next Page)

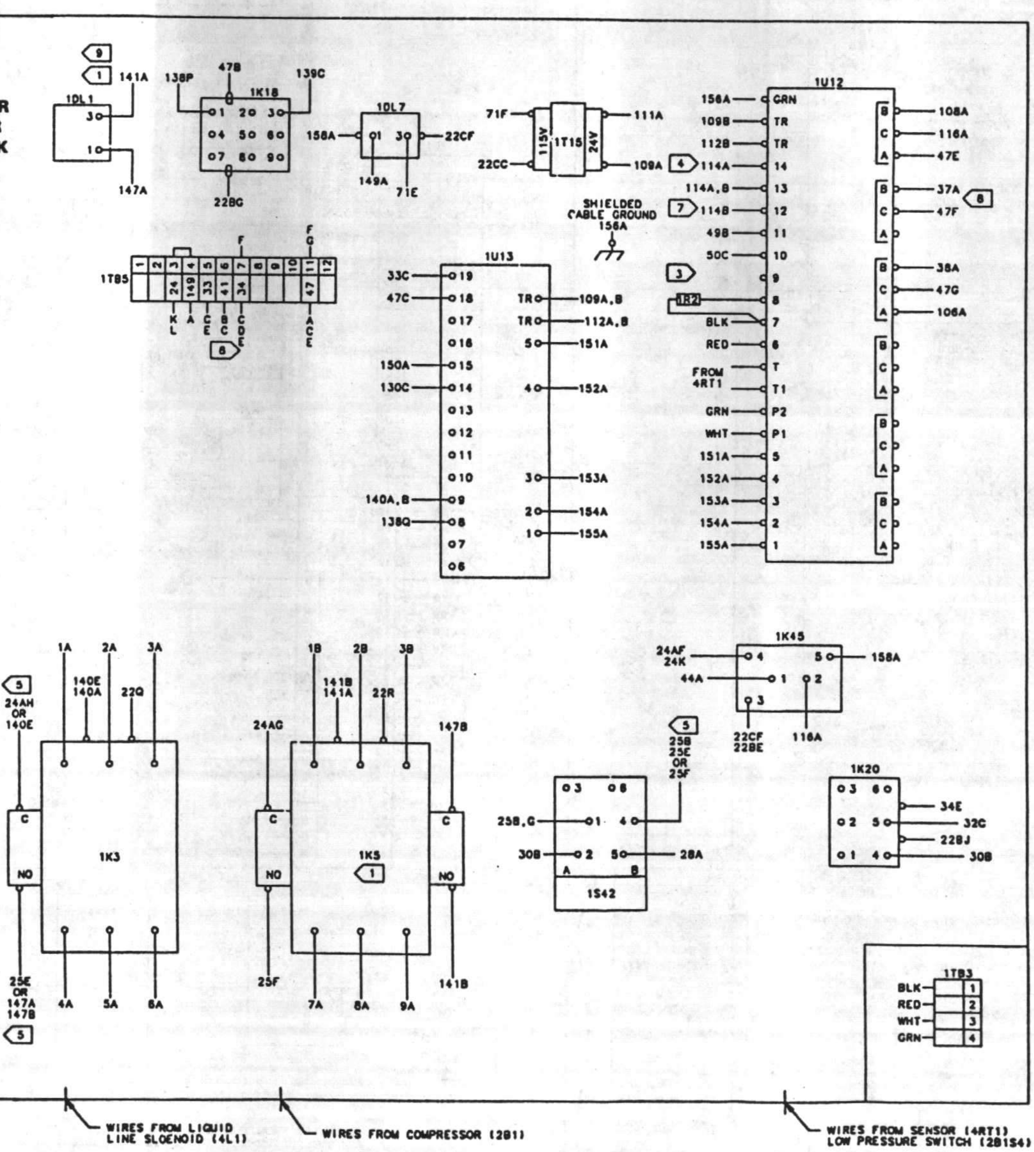
Component Legend (Outside Control Panel)	
2B1	Compressor 1
2B1HR1	Compressor 1 Crankcase Heater
2B1L3/2B1L5	Compressor 1 Unloader Solenoids
2B1RT1	Compressor 1 Winding Sensor
2B1S2	Ckt 1 High Pressure Switch
2B1S4	Ckt 1 Low Pressure Switch
4B1	Fan Motor 1 - Circuit 1
4B2	Fan Motor 2 - Circuit 1
4B3	Fan Motor 3 - Circuit 1
4L1	Ckt 1 Liquid Line Solenoid Valve
4L9	Ckt 1 Hot Gas Bypass Solenoid Valve
4RT1	Leaving Chilled Water Sensing Bulb



WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

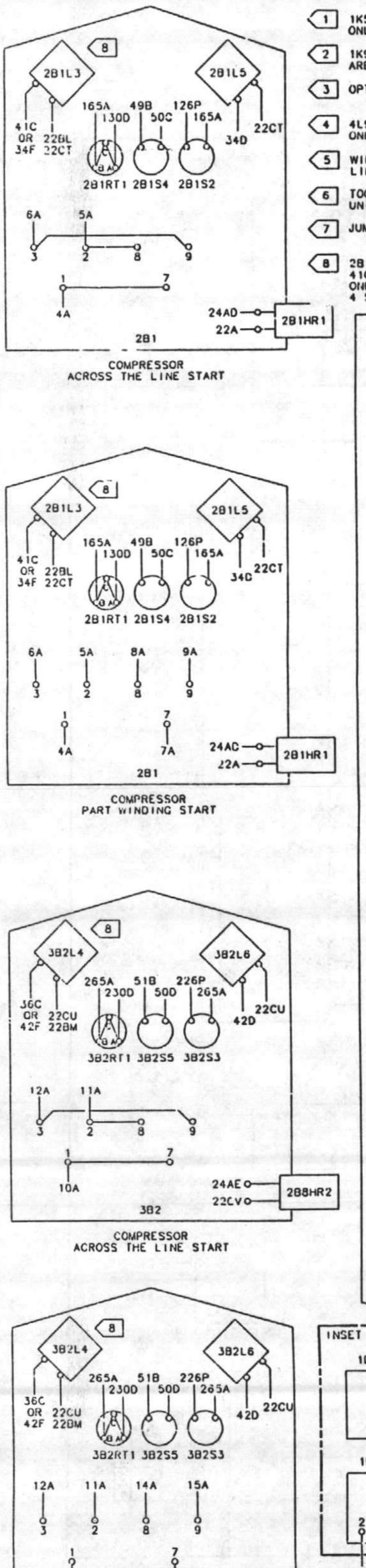
Control Panel Legend	
1DL1	Compressor 1 PWS Time Delay
1DL7	Thermal Time Delay
1F1	Control Circuit Fuse
1F2	Compressor 1 Mtr Protector Fuse
1F4,5,6	Fuse, Condenser Fan Motor 4B1,2,3
1F10	24V Power Supply Fuse
1K3	Compressor 1 Contactor
1K5	Compressor 1 PWS Contactor
1K7	Fan Motor 4B1 Contactor
1K8	Fan Motor 4B2 Contactor
1K9	Fan Motor 4B3 Contactor
1K16	Ckt 1 Reset Relay
1K18	Ckt 1 Cooling Relay
1K20	Circuit 1 Fan Relay
1K45	Pump Down Relay
1R1	Transient Suppressor
1R2	Low Temperature Resistor
1S1	Unit-Mounted Disconnect Switch
1S5	Compressor 1 Service Switch
1S41	Unit Service Switch
1S42	Ckt 1 Fan Temperature Control
1T1	Control Power (115V) Transformer
1T15	24V Transformer
1TB1	Line Power Terminal Block
1TB3	Term. Strip: MUAA & Setpt. Reset
1TB4	Terminal Strip
1TB5	Terminal Strip
1TB7	Term. Strip: System Interconn.
1U1	Compressor 1 Current Overload
1U12	Microprocessor Chiller Control
1U13	Auxiliary Relay Module
GND	Equipment Ground Connections



(Continued From Previous Page)

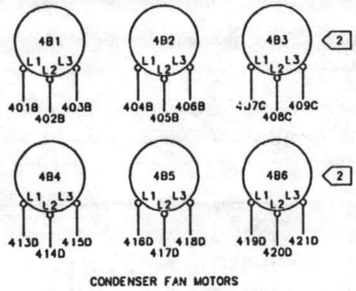
2306-2443B

Figure 17
Typical Component Locations for CGAC-C40K, C50K and C60K Units

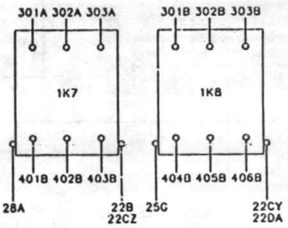


NOTES:

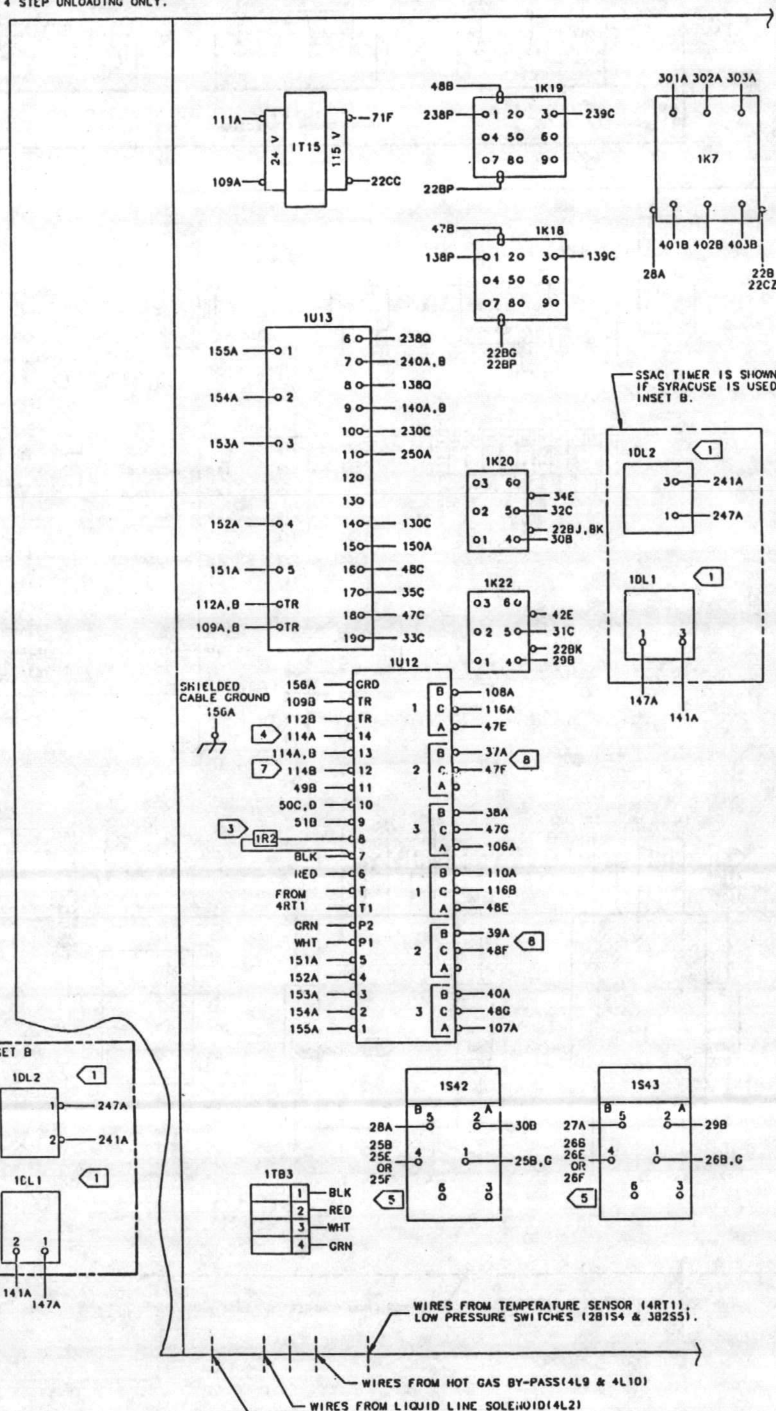
1. 1K5, 1K6, 1DL1, 1DL2 AND ASSOCIATED WIRING ARE USED ONLY WITH PART WINDING START COMPRESSOR UNITS.
2. 1K9, 1K13, 1K20, 1K22, 4B3, 4B6 AND ASSOCIATED WIRING ARE USED ONLY ON 50 AND 60 TON UNITS.
3. OPTIONAL LOW TEMPERATURE CONTROL RESISTOR.
4. 4L9, 4L10, JUMPER 114A AND ASSOCIATED WIRING ARE USED ONLY ON HOT GAS BYPASS OPTION.
5. WIRES 24AH, V, 25E AND 26E ARE USED ON ACROSS THE LINE ONLY.
6. TOGGLE SWITCHES ARE VIEWED FACING THE FRONT OF THE UNIT WITH KEYWAY SLOT RIGHT
7. JUMPER 114B USED ONLY ON PERIODIC PUMPDOWN OPTION.
8. 2B1L5, 3B2L6 & WIRES 34C, 34D, 36B, 36C, 37A, 39A, 41B, 41C, 42C, 42D, 22CT, 22CU USED ON 6 STEP UNLOADING ONLY. WIRES 34C, 34F, 38A, 40A, 42C & 42F USED ON 4 STEP UNLOADING ONLY.



Component Legend (Outside Control Panel)	
2B1	Compressor 1
2B1HR1	Compressor 1 Crankcase Heater
2B1L3/2B1L5	Compressor 1 Unloader Solenoids
2B1RT1	Compressor 1 Winding Sensor
2B1S2	Compressor 1 High Pressure Switch
2B1S4	Compressor 1 Low Pressure Switch
3B2	Compressor 2
3B2HR2	Compressor 2 Crankcase Heater
3B2L4/3B2L6	Compressor 2 Unloader Solenoids
3B2RT1	Compressor 2 Winding Sensor
3B2S3	Compressor 2 High Pressure Switch
3B2S5	Compressor 2 Low Pressure Switch
4B1	Fan Motor 1 - Circuit 1
4B2	Fan Motor 2 - Circuit 1
4B3	Fan Motor 3 - Circuit 1
4B4	Fan Motor 4 - Circuit 2
4B5	Fan Motor 5 - Circuit 2
4B6	Fan Motor 6 - Circuit 2
4L1	Ckt 1 Liquid Line Solenoid Valve
4L2	Ckt 2 Liquid Line Solenoid Valve
4L9	Ckt 1 Hot Gas Bypass Solenoid Valve
4L10	Ckt 2 Hot Gas Bypass Solenoid Valve
4RT1	Leaving Chilled Water Sensing Bulb

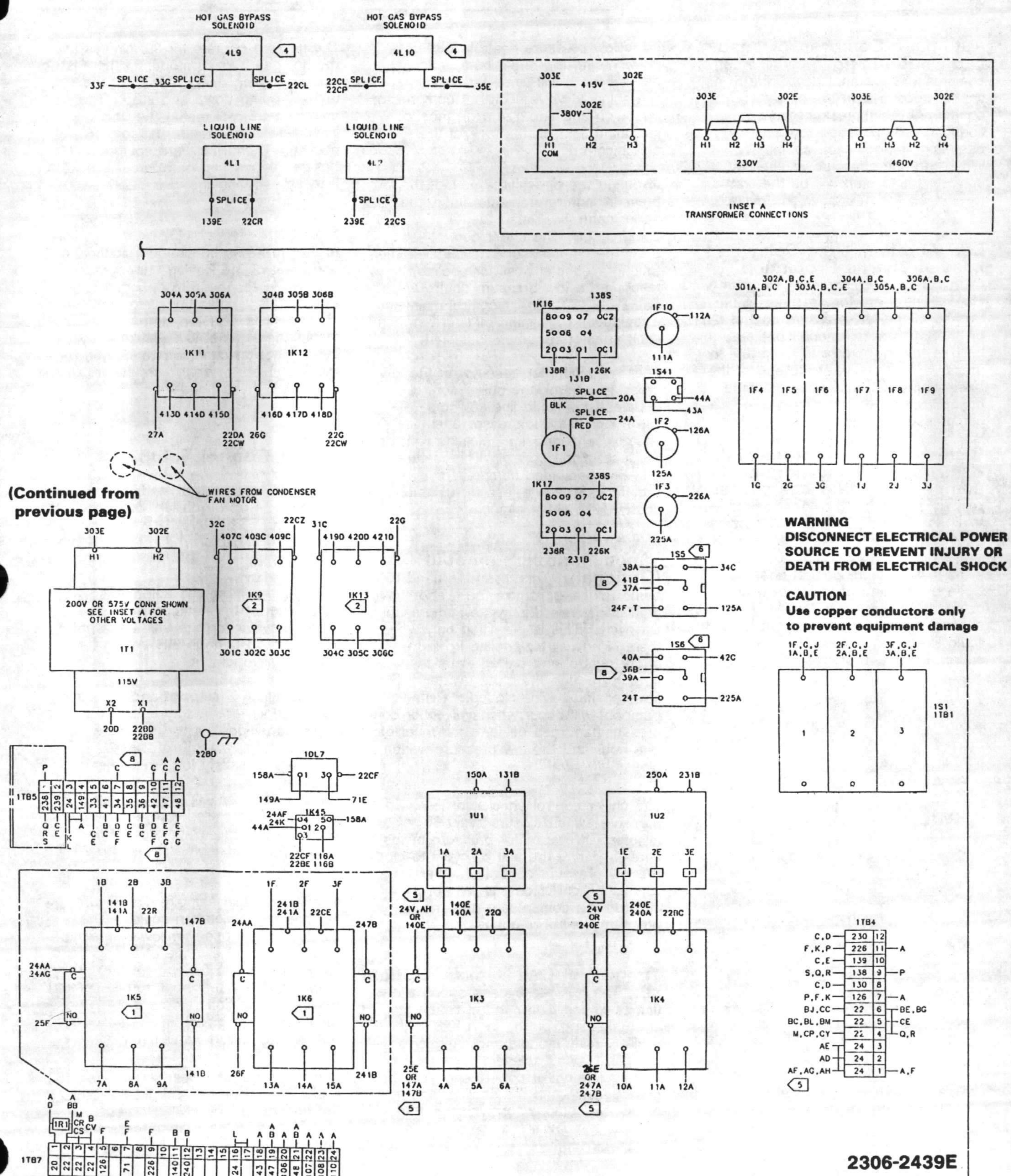


(Continued on next page)



Control Panel Legend	
1DL1	Compressor 1 PWS Time Delay
1DL2	Compressor 2 PWS Time Delay
1DL7	Thermal Time Delay
1F1	Control Circuit Fuse
1F2	Compressor 1 Mtr Protector Fuse
1F3	Compressor 2 Mtr Protector Fuse
1F4,5,6	Fuse, Condenser Fan Motor 4B1,2,3
1F4	Fuse, Condenser Fan Motor 4B1
1F5	Fuse, Condenser Fan Motor 4B2
1F6	Fuse, Condenser Fan Motor 4B3
1F7	Fuse, Condenser Fan Motor 4B1
1F8	Fuse, Condenser Fan Motor 4B2
1F9	Fuse, Condenser Fan Motor 4B3
1F10	24V Power Supply Fuse
1K3	Compressor 1 Contactor
1K4	Compressor 2 Contactor
1K5	Compressor 1 PWS Contactor
1K6	Compressor 2 PWS Contactor
1K7	Fan Motor 4B1 Contactor
1K8	Fan Motor 4B2 Contactor
1K9	Fan Motor 4B3 Contactor
1K11	Fan Motor 4B4 Contactor
1K12	Fan Motor 4B5 Contactor
1K13	Fan Motor 4B6Contactor
1K16	Ckt 1 Reset Relay
1K17	Ckt 2 Reset Relay
1K18	Ckt 1 Cooling Relay
1K19	Ckt 2 Cooling Relay
1K20	Circuit 1 Fan Relay
1K22	Circuit 2 Fan Relay
1K45	Pump Down Relay
1R1	Transient Suppressor
1R2	Low Temperature Resistor
1S1	Unit-Mounted Disconnect Switch
1S5	Compressor 1 Service Switch
1S6	Compressor 2 Service Switch
1S41	Unit Service Switch
1S42	Ckt 1 Fan Temperature Control
1S43	Ckt 2 Fan Temperature Control
1T1	Control Power (115V) Transformer
1T15	24V Transformer
1TB1	Line Power Terminal Block
1TB3	Term. Strip: MUAA & Setpt. Reset
1TB4	Terminal Strip
1TB5	Terminal Strip
1TB7	Term. Strip: System Interconn.
1U1	Compressor 1 Current Overload
1U2	Compressor 2 Current Overload
1U12	Microprocessor Chiller Control
1U13	Auxiliary Relay Module
GND	Equipment Ground Connections

(Continued from previous page)



WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage

2306-2439E

Automatic Compressor Lead-Lag Sequencing. Any time both compressors are shut down due to no call for cooling from the chiller control, the compressor lead/lag sequencing is reversed to equalize operating time for each compressor. When the unit shuts down, the first compressor to stop will be the first to start on the next operating cycle.

Low Ambient Time Delay and Loss-of-Charge Protection.
On a call for a compressor start, the chiller control provides a three-minute bypass of the low pressure control (2B1S4 or 3B2S5) to allow enough pressure to build in the evaporator to close the low pressure control. If, at the end of the three-minute delay, the low pressure control contacts have closed, the compressor will run.

Caution: To prevent possible damage to the evaporator or compressor, stop compressor using switch 1S5 or 1S6 if within 3 minutes of compressor start.

If the low pressure control does not close by the end of the three-minute delay, the chiller control will deenergize the compressor but keep the liquid line solenoid valve (4L1 or 4L2) energized (open) for one minute.

If the low pressure control does not close during the one-minute period, the chiller control will close the liquid line solenoid valve, lock out compressor operation and energize a diagnostic indicating light on the face of the chiller control.

If, during the one-minute period, the low pressure control contacts close, the chiller control will start the compressor. The chiller control will allow the compressor to cycle five times (during a constant call for cooling) in response to low pressure control operation. The chiller control maintains a ten-second minimum off-time between each attempted compressor start.

After five attempted restarts on the low pressure control, the chiller control will close the liquid line solenoid valve, lock out compressor operation and energize a diagnostic indicating light on the face of the control. This feature prevents continued compressor operation if there has been a loss of refrigerant charge from either circuit.

Timed Periodic Pumpout (Optional). This feature is used to pump refrigerant out of the evaporator at regular intervals during the compressor Off cycle. This is permitted only when there is no call for cooling from the chiller control and chilled water is flowing through the chiller (water flow-sensing device closed). Periodic pumpout will occur whenever either compressor has been off for a minimum of one hour and the low pressure switch closes.

The chiller control checks for low pressure switch closure every 60 minutes. If evaporator pressure builds enough during the unit off-cycle to close the low pressure control of either circuit, the chiller control will start and run the compressor until the low pressure control re-opens.

Timed Hot Gas Bypass (Optional). The hot gas bypass option allows unit operation below the minimum step of unit unloading, pulling in 1UK28 in the auxiliary relay module and energizing the hot gas bypass solenoid valve (4L9 or 4L10). The chiller control energizes hot gas bypass when the cooling load falls below the compressor minimum stage of unloading (1U12 first-stage contacts remain closed).

The unit will operate for 30 minutes in the hot gas bypass mode. If there is no call for cooling during this time, the unit will pump down and stop. The chiller control will restart the unit immediately on a return call for cooling. These units are equipped with hot gas bypass on both circuits to allow lead-lag sequencing.

Setpoint Reset (Optional). This feature provides continuous monitoring and reset of the leaving chilled water setpoint in response to changes in outdoor air temperature or to temperature changes in a selected zone. The magnitude of reset is determined by system design conditions and by how much ambient or zone temperature deviates from these conditions.

Chiller Control Setup

There are three setpoint adjustment dials on the face of the chiller control (Figure 18). They are: Leaving Fluid Setpoint, F; Design Δ T, F; and Number of Stages.

The number of stages setpoint is factory-set at the number of control steps provided on the unit. It is not necessary to change this setting for normal unit operation.

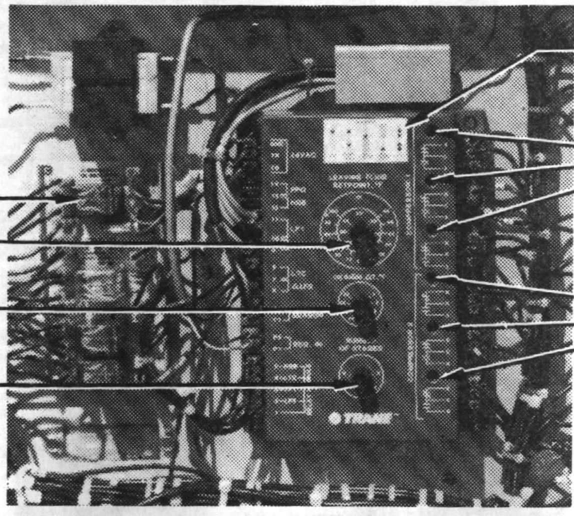
The design Δ T setpoint and the leaving fluid setpoint are factory set at ARI rating conditions. It may be necessary to reset either or both of these setpoints to satisfy job requirements.

Set the design Δ T setpoint (Figure 18) at the desired chilled water temperature drop through the evaporator. This setpoint is adjustable from 4 F to 20 F in 2 F increments.

The leaving fluid setpoint dial (Figure 18) has two calibration scales. The inside scale is used for low temperature applications. The range of this scale is -20 F to +40 F in 5 F increments. The outer scale is used in all normal comfort cooling applications where there is no requirement for glycol or an unusually low leaving chilled water temperature.

The range of this scale is +40 F to +100 F in 5 F increments. Set this dial for the desired leaving chilled water temperature at the evaporator water outlet.

Figure 18
Chiller Control (1U12) Components and Auxiliary Relay Module (1U13)



Art No. RF/CG-2727

Chiller Control Operation

Each time chiller control (1U12) is energized, it will initiate a four-minute start mode. During this start delay, the "start mode" LED on the face of the chiller control will be energized (Figure 19). If leaving chilled water temperature (as sensed by the chiller control sensing bulb in the evaporator water outlet) is below the chiller control leaving fluid setpoint at the end of this four-minute timing period, the start mode LED will deenergize without starting the compressor.

When leaving chilled water temperature rises above the leaving fluid setpoint, the chiller control first stage contacts close. This will provide power to the Compressor 1 contactors. When the chiller control first stage contacts close, the number 1 LED for Compressor 1 will energize (Figure 19).

Once the unit is operating normally, the chiller control will load, unload and cycle the compressors on and off in response to the perceived cooling load at the evaporator water outlet. The rate at which the chiller control loads or unloads the unit is determined by two factors: the temperature change rate of the chilled water leaving the evaporator, and the temperature differential between actual leaving water temperature and the leaving fluid setpoint as set on the chiller control (Figure 19).

Chiller Control Operating Indicators

The operating mode of the unit is indicated at all times by the red LED's on the face of the chiller control (Figure 19). Operating modes include:

Compressor 1 - Step 1 Loaded
Compressor 1 - Steps 1 and 2 Loaded
Compressor 1 - Full Load
Compressor 1 - Full Load, Compressor 2 - Step 1 Loaded
Compressor 1 - Full Load, Compressor 2 - Steps 1 and 2 Loaded
Compressor 1 - Full Load, Compressor 2 - Full Load
Load Limit Operation.

Chiller Control Diagnostic Indicators

The red LED's on the chiller control also display five different diagnostic states which can occur during operation. A label mounted on the front of the control above the leaving fluid setpoint dial (Figure 19) identifies the diagnostic conditions.

These conditions, illustrated in Figure 19, include the following:

Start Mode
Setpoint/Low Temperature Control Overlap
Compressor 1 - Low Pressure Lockout
Compressor 2 - Low Pressure Lockout
Low Temperature Control Lockout.

Start Mode. The start mode diagnostic indicator (Figure 19) will light immediately when the chiller control is energized. This indicates that the control is functioning normally, proceeding through its four-minute start time delay. The start mode diagnostic will also energize any time that the chiller control is repowered when the unit is reset after a safety lockout or that power is removed from the control for any other reason.

Setpoint/Low Temperature Control Overlap. If this diagnostic energizes (Figure 19), the minimum permitted leaving water temperature is too close to the low water temperature (freezestat) cutout setting for the unit. No unit operation is allowed under these conditions.

To correct this condition and allow normal unit operation, slowly adjust the leaving fluid setpoint to a higher temperature until the control setpoint overlap diagnostic lights go off.

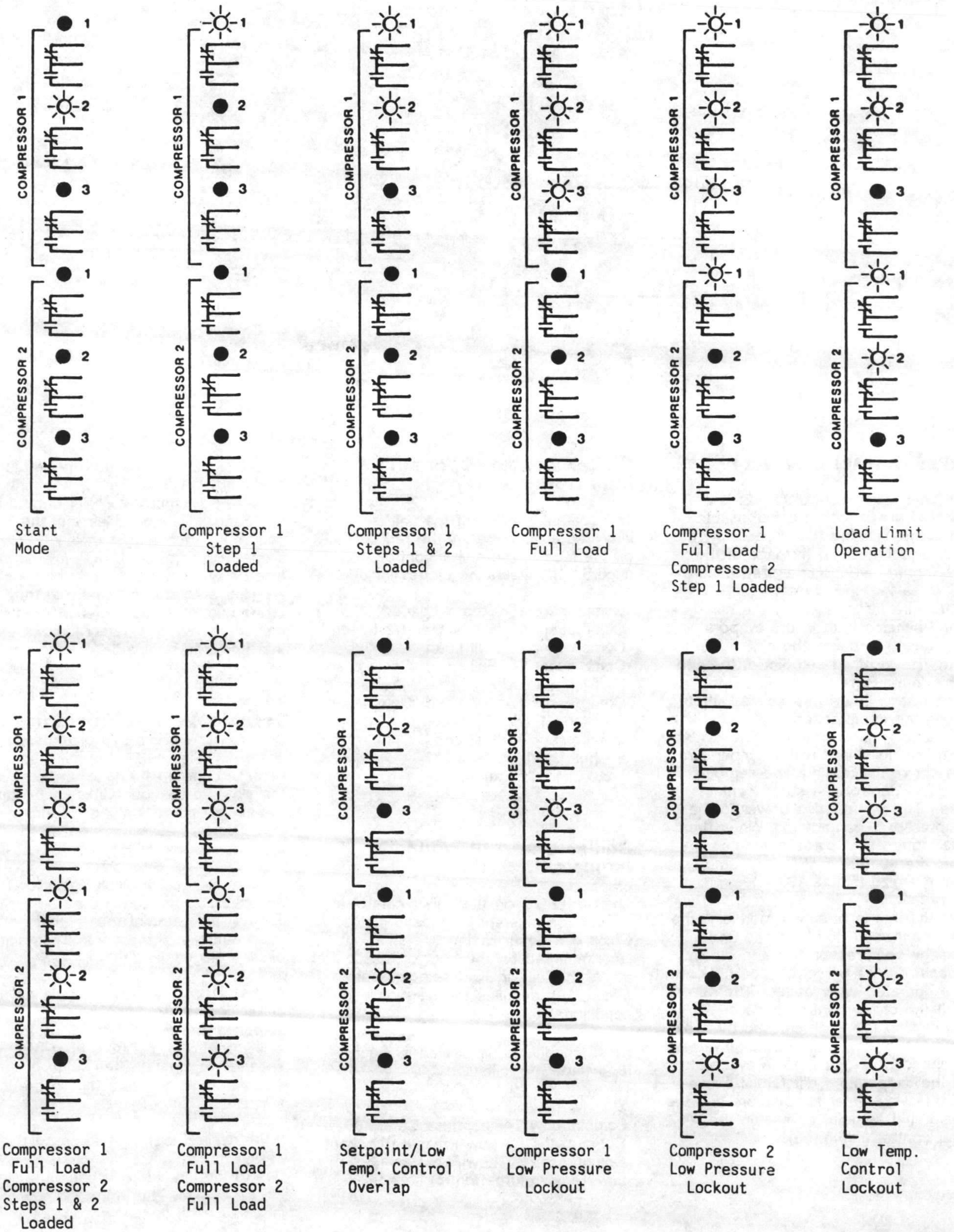
Note: Turn the setpoint dials on the chiller control slowly. Once the setpoints are established, allow the chiller control a minimum of 10-15 seconds to compute the value of the new setpoints and compare this to the low temperature cutout limit.

If the desired leaving fluid setpoint or design Δ T setpoint cannot be selected due to the low water temperature limit (35 F), contact The Trane Company for information on special applications.

Figure 19
Chiller Control LED Operational Functions

LED Energized

LED Deenergized



Low Temperature Lockout. The low temperature lockout diagnostic (Figure 19) will energize any time leaving water temperature falls to the low water temperature limit for the unit. This diagnostic indicates that a potential freeze condition was detected during operation. The chiller control is locked out from further operation and the diagnostic will remain energized until the condition is corrected and the unit manually reset. Refer to "Evaporator Freeze Protection".

Compressor 1/Compressor 2 Low Pressure Lockout. The diagnostic lights for Compressor 1 or Compressor 2 low pressure lockout (Figure 19) will energize and lock out the compressor if either low pressure control (2B1S4, 3B2S5) opens during normal operation. This condition for one compressor does not affect the operation or loading of the remaining compressor which may continue to operate normally.

The compressor and chiller control are prevented from further operation until the unit control circuit is manually reset. Refer to "Reset Relays" and "Low Ambient Time Delay and Loss of Charge Protection".

Part Winding Start Timers (1DL1, 1DL2)

The part winding start timer is used on each compressor that utilizes a part winding starter. When compressor contactor 1K3 or 1K4 closes, a set of 1K3 or 1K4 auxiliary contacts also close to energize the timer and provide a 0.5-second time delay before pulling in the second contactor. When the 0.5-second time delay has elapsed, contactors 1K5 or 1K6 are energized and held in through an auxiliary contact on the contactors.

Compressor Unloader Solenoid Valves

The compressor unloader solenoids for the model K compressor deenergize to load the compressor and energize to unload. Unloader solenoids for CGAC units with model K compressors are 2B1L3 and 2B1L5 for compressor 1 and 3B2L4 and 3B2L6 for compressor 2.

Low Pressure Switches (2B1S4, 3B2S5)

The low pressure switches (2B1S4 and 3B2S5) prevent compressor overheating due to extended periods of operation at extremely low suction pressures and are used to provide a pumpdown cycle and loss of charge protection for each compressor circuit. The normally closed contacts of the low pressure switches close on a rise in suction pressure and open on a drop in pressure at the setpoints given in "Service Data".

Hot Gas Bypass Regulating Valve

The hot gas bypass regulating valves (Figure 20) are adjustable modulating control valves located on a branch hot gas line off the compressor discharge line. The valves act as evaporator pressure regulators by opening on a decrease in suction pressure to maintain a desired minimum evaporating pressure regardless of a decrease in evaporator external loading. When evaporator (suction) pressures are above the valve's setpoints, they remain closed. As suction pressures fall below the valve's setpoints, the valves begin to open. If suction pressures continue to drop, the valves open proportionally to keep evaporating pressure up.

Valve Setpoint. Hot gas bypass valves are adjustable through a 0-80 psig range. They should be set to begin opening at 69 psig suction pressure. The valves should be full open at 61 psig. The hot gas bypass system should be set up to maintain a net Δ T across the evaporator of 0 F at minimum step of unloading (during hot gas bypass operation).

Condenser Fan Operation

Condenser fan locations are shown in "Service Data". Fan sequencing is as follows:

20-Ton Unit

Fan 2 starts with compressor start, stops when the compressor stops. Fan 1 starts when ambient temperature rises above 73 F, stops when ambient temperature falls to 65 F.

25 and 30-Ton Unit

Fan 2 starts with compressor start, stops when the compressor stops. Fan 1 starts when ambient temperature rises above 73 F, stops when ambient temperature falls to 65 F. Fan 3 starts with second stage call for cooling from the chiller control (1U12) when ambient temperature is above 53 F, stops when ambient temperature falls below 45 F.

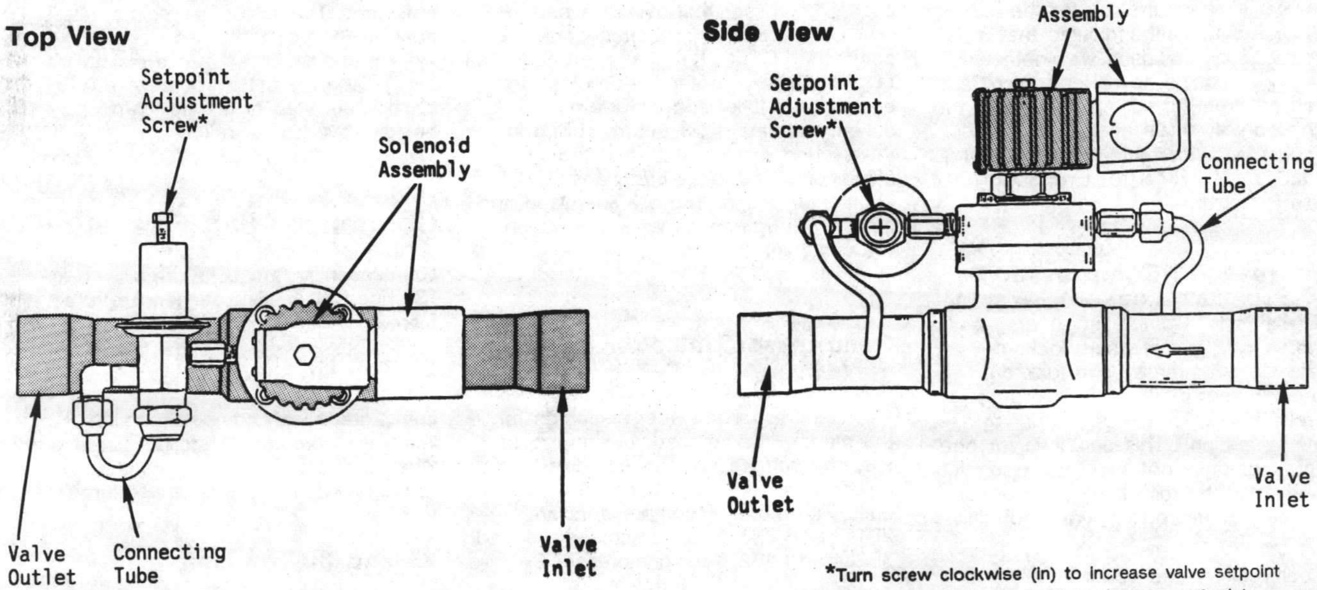
40-Ton Unit

Fan 2 starts and stops with compressor 1. Fan 5 starts and stops with compressor 2. Fan 1 starts when ambient temperature is above 73 F, stops when ambient temperature falls below 65 F. Fan 4 starts with compressor 2 when ambient temperature is above 73 F, stops when ambient temperature falls to 65 F.

50 and 60-Ton Unit

Fan 2 starts and stops with compressor 1. Fan 5 starts and stops with compressor 2. Fans 1 and 3 start with compressor 1 when ambient temperature rises to 73 F, stop when ambient temperature falls to 65 F. Fans 4 and 6 start with compressor 2 when ambient temperature reaches 53 F, stop when ambient falls to 45 F.

Figure 20
Typical Hot Gas Bypass Regulating Valve



*Turn screw clockwise (in) to increase valve setpoint and counterclockwise (out) to decrease setpoint.

Maintenance

Periodic Maintenance

Perform all maintenance procedures and inspections at the recommended intervals. This will prolong the life of the equipment and reduce the possiblity of costly equipment failures.

Use an "Operator's Log" such as the one at the back of this manual to record a weekly "operating conditions history" for this unit. The operating log for this unit can be a valuable diagnostic tool for service personnel. By noticing trends in the operating conditions, the operator can often foresee and prevent problem situations before they become serious.

If the unit does not operate properly during maintenance inspections, refer to "Trouble Analysis".

Weekly Maintenance

Once the unit has been operating for about 30 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

[ ] Check compressor oil levels. Oil should be visible in the sight glass when the compressor is running. Refer to "Checking Operating Conditions".

Operate the compressors at full load for a minimum of three to four hours when checking oil level, and check level every 30 minutes. If oil is not at proper level after this period, have a qualified service representative add or remove oil as required. Refer to "Service Data" for recommended refrigerant oils and correct oil charges for these units.

[ ] Check suction pressure and discharge pressure at the gauges on the unit. Refer to "Checking Operating Conditions".

[ ] Check the liquid line sight glasses. Refer to "Checking Operating Conditions". Refrigerant charges for CGAC units are provided in "Service Data".

[ ] If operating pressures and sight glass conditions seem to indicate refrigerant shortage, measure system superheat and system subcooling. Refer to "System Superheat" and "System Subcooling".

[ ] If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line service valve. Do not discharge refrigerant into the atmosphere.

WARNING: To prevent injury due to frostbite, avoid skin contact with refrigerant.

Monthly Maintenance

[ ] Perform all weekly maintenance procedures.

[ ] Measure and record system superheat. Refer to "System Superheat".

[ ] Measure and record system subcooling. Refer to "System Subcooling".

[ ] Manually rotate condenser fans to insure proper orifice clearance.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

Annual Maintenance

[ ] Perform all weekly and monthly maintenance procedures.

[ ] Have a qualified service technician check the setting and function of each control and inspect the condition of and replace compressor and control contactors if needed.

[ ] If chiller is not piped to drain facilities, make sure drain is clear to carry away system water.

[ ] Drain water from evaporator and associated piping systems. Inspect all piping components for leakage, damage, etc. Clean out any in-line water strainers.

[ ] Clean and repaint any corroded surface.

[ ] Check low ambient dampers for proper operation.

[ ] Clean condenser coils. Refer to "Coil Cleaning".

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

[ ] Inspect the expansion valve sensing bulbs for cleanliness. Clean if required. Sensing bulbs must make good contact with suction lines and be properly insulated.

[ ] Clean condenser fans. Check fan assemblies for proper orifice clearance and for motor shaft misalignment, abnormal end-play or vibration and noise.

WARNING: To prevent injury or death due to contact with rotating parts, open and lock all electrical disconnects.

Maintenance Procedures

This section describes specific maintenance procedures which must be performed as a part of the normal maintenance program for this unit. Be certain that electrical power to the unit is disconnected before performing these procedures.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

Coil Cleaning

Clean the refrigerant coil at least once each year (or more frequently if the unit is located in a "dirty" environment) to help main proper unit operating efficiency. Follow the detergent manufacturer's instructions as closely as possible to avoid potential damage to the coils.

To clean the refrigerant coil, a soft brush and sprayer (i.e., either garden pump-up type or high-pressure) must be used. In addition, a high-quality detergent is required; suggested brands include "SPREX A.C.", "OAKITE 161", "OAKITE 166", and "COILOX".

Note: If the detergent is strongly alkaline (i.e., has a pH value greater than 8.5) after mixing, an inhibitor must be added.

Chemically Cleaning the Evaporator

The chilled water system is a closed loop. It should not accumulate an appreciable amount of scale or sludge. If the chiller is fouled, first try to dislodge foreign material by backflushing the system several times. If this does not work, chemically clean the chiller.

Chemical cleaning is the most satisfactory method of cleaning scale from water vessels. With this treatment, scale is dissolved and flushed away by circulating a chemical solution around the tubes and headers.

CAUTION: Do not use an acidic type cleaning agent that will damage the steel, galvanized steel and copper internal evaporator components.

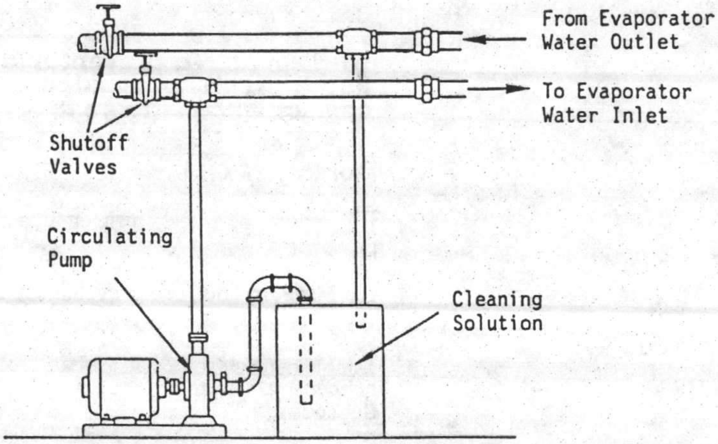
With this information, water treatment firms will be able to recommend a suitable chemical for this purpose. If water treatment is not available, consult a chemical supply house.

Figure 21 illustrates a typical chemical cleaning arrangement. All materials used in the chemical (external) circulating system, quantity of cleaning material, duration of cleaning and any safety precautions relative to the handling of the cleaning agent must be provided or approved by the supplier of the cleaning agent.

Water Treatment

The use of untreated or improperly treated water in these units may result in the formation of scale, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what treatment, if any, is required. The Trane Company assumes no responsibility for equipment failure that results from the use of untreated or improperly treated water.

Figure 21
Typical Circulating Arrangement for Chemical Cleaning of Evaporator



Trouble Analysis

Preliminary Trouble Inspection

If operational difficulties are encountered, be sure to perform these preliminary checks before referring to the troubleshooting charts:

[ ] Check the chiller control (1U12) to ensure that all setpoints are set correctly, and that it is getting control power.

[ ] Verify that the unit is receiving electrical supply power, and that the fuses in the fused disconnect switches are intact.

[ ] Check the evaporator for proper water supply and condenser for proper air flow. Check the flow switches for proper operation, and take pressure drop readings across the evaporator and Δ T readings across the condenser coils.

After completing the preliminary checks described above, be sure to inspect the unit for other obvious problems such as leaking water connections, broken or disconnected wires, etc. If everything appears to be in order, but the unit still fails to operate properly, refer to the following troubleshooting charts and contact a qualified service technician.

Troubleshooting Charts

The troubleshooting charts that follow are provided to serve as an aid for identifying malfunctions that may occur. Within each chart are three columns: (1) the Symptom column describes what the unit is doing; (2) the Probable Cause column identifies the most likely sources of the problem; and, (3) the Recommended Action column describes what should be done to correct the problem.

Note: The troubleshooting charts that follow are provided only to help identify the cause of an operating malfunction. If this happens, The Trane Company recommends that qualified service personnel be contacted to ensure proper diagnosis and repair procedures.

WARNING: To avoid injury or death due to electrical shock never open access panels to inspect or service the unit without first opening all disconnect switches.

Compressor Short Cycles

Symptom	Probable Cause	Recommended Action
Normal operation except too frequent starting and stopping.	Intermittent contact in electrical control circuit.	Repair or replace faulty control.
L.L. solenoid valve hisses when closed. High temperature differential on each side of valve.	Leaky liquid line solenoid valve.	Repair or replace solenoid valve.
Rapid cycling on low pressure control. Bubbles in liquid line sight glass.	Refrigerant shortage.	Repair refrigeant leak and recharge.
Compressor will not load or unload.	Inoperative compressor unloading system.	Repair or replace faulty control.

Compressor Runs Continuously

Symptom	Probable Cause	Recommended Action
Low temperature in conditioned area.	Chiller control malfunction or set incorrectly.	Reset or test and replace chiller control.
	"Welded" control contacts in motor starter circuit.	Replace contacts.
	Liquid line solenoid valve stuck open.	Repair or replace solenoid valve.
Compressor noisy. Discharge pressure too low. Suction pressure too high.	Leaky valves in compressor.	Repair or replace compressor.
Leaving chilled water temperature too high.	Excessive system load.	Reduce load. Reduce water flow if needed.
	Chiller control malfunction or set incorrectly.	Reset, or test and replace chiller control.

Compressor Fails to Start

Symptom	Probable Cause	Recommended Action
Chiller control (1U12) "Start Mode" LED energized.	Chiller control has not completed 4-minute "Start-Mode" time delay.	Allow 1U12 to complete "Start Mode" LED will deenergize after 4 minutes and unit will run.
Chiller control (1U12) "Setpoint/ Low Temp. Overlap" LED energized.	Minimum allowed leaving chilled water temperature too close to low temperature cutout (freezestat) setpoint.	Adjust "leaving fluid setpoint" of 1U12 to higher temperature.
Chiller control (1U12) "Low Temperature Lockout" LED energized.	Leaving chilled water temperature below low temperature control (freezestat) setpoint.	Allow leaving chilled water temperature to rise. Operate at higher "leaving fluid setpoint" or install proper "low temperature resistor".
Chiller control (1U12) "Low Pressure Lockout" LED energized.	Suction pressure too low due to refrigerant loss.	Check system charge. Repair leak and recharge.
	Suction pressure too low due to operation below minimum operating ambient.	Add low ambient damper kit.
	Suction pressure too low due to inoperative liquid line solenoid valve.	Repair or replace solenoid valve.
	Suction pressure too low due to inoperative low ambient damper(s).	Repair or replace low ambient damper components.
No current on line side of motor starter.	Power failure.	Check for blown line fuse or broken lead.
	Disconnect switch open.	If system is in working order, close disconnect.
Voltage present on line side of fuse. No voltage on motor side.	Fuse blown.	Replace fuse. Check load on compressor.
Improper voltage reading.	Low voltage.	Call power company.
Full voltage at motor terminals. Motor will not run.	Motor burned out.	Replace or repair compressor or motor.
Motor starter inoperative.	Motor starter contacts or holding coil burned out.	Repair or replace motor starter.
Motor starter holding coil not energized.	Open control circuit.	Locate control, determine cause and correct.
Compressor will not run.	Frozen compressor. Locked-up or internally damaged.	Repair or replace compressor.
High pressure switch open.	Discharge pressure too high.	Refer to "Discharge Pressure Too High".
Motor starter will not pull in.	Motor overload contacts open.	Determine cause and correct. Reset overload.
Flow switch contacts open.	Restricted or no water flow. Flow switch malfunction.	Restore water flow. Test flow switch and repair or replace.

Compressor Is Noisy

Symptom	Probable Cause	Recommended Action
Compressor knocks. Too frequent starting and stopping.	Internal compressor damage.	Repair or replace compressor.
Excessively cold suction line due to liquid floodback to compressor.	TEV set incorrectly.	Check and adjust superheat.
	TEV sensing bulb dirty, not properly insulated or loose on suction line.	Inspect sensing bulb. Clean, tighten or reinsulate as needed.
	TEV stuck open.	Clean, repair or replace TEV.

System Short of Capacity

Symptom	Probable Cause	Recommended Action
Superheat reading high. Suction pressure unstable.	Flash gas in liquid line.	Check refrigerant charge and add refrigerant if needed.
High temperature differential on either side of filter drier or solenoid valve.	Restricted drier core or solenoid valve orifice.	Replace drier or clean/replace solenoid valve.
Compressor short-cycling.	TEV sticking or partially blocked.	Repair or replace TEV.
Oil foaming in compressor. Leaving chilled water temperature too high or too low.	TEV adjusted incorrectly.	Check and adjust superheat.
Insufficient water pressure drop across evaporator.	Reduced water flow. Water supply problem or obstruction in water line.	Restore water supply or remove obstruction from water line.

Suction Pressure Too High

Symptom	Probable Cause	Recommended Action
Excessively cold suction line due to liquid floodback to compressor.	TEV overfeeding.	Check and adjust superheat. TEV sensing bulb must be clean, insulated, have good contact with suction line.
	TEV stuck open.	Clean, repair or replace TEV.
Compressor runs continuously.	Evaporator overloaded.	Refer to "Compressor Runs Continuously".
Compressor noisy. Leaving chilled water temp. too high or too low.	Compressor suction valves damaged.	Remove head, inspect valves and replace damaged valves.

Suction Pressure Too Low

Symptom	Probable Cause	Recommended Action
Bubbles in liquid line sight glass.	Refrigerant loss.	Check system charge. Repair leak and recharge.
High temperature differential on either side of filter drier or solenoid valve.	Restricted drier core or solenoid valve orifice.	Replace drier or clean/replace solenoid valve.
No refrigerant flow through TEV.	TEV power element charge lost.	Replace TEV.
Loss of system capacity.	TEV sticking or partially blocked.	Clean/repair or replace TEV.
Insufficient water pressure drop across evaporator.	Reduced water flow. Water supply problem or obstruction in water line.	Restore water supply or remove obstruction from water line.

Discharge Pressure Too High

Symptom	Probable Cause	Recommended Action
Excessively cold air leaving condenser. Insufficient Δ T through condenser. Good air flow.	Refrigerant overcharge.	Slowly remove refrigerant to obtain proper subcooling reading.
	Air or non-condensible gas in system.	Remove contaminant from the system.
Air leaving condenser too cold. Insufficient Δ T through condenser.	Condenser coil blocked.	Clean condenser coil.
Leaving chilled water temperature too hot.	Excessive system load.	Reduce load. Reduce water flow if needed.

Discharge Pressure Too Low

Symptom	Probable Cause	Recommended Action
Insufficient Δ T through condenser coil.	Low temperature condensing air.	Provide adequate head pressure controls.
Bubbles in liquid line sight glass.	Refrigerant loss.	Check system charge. Repair leak and recharge.
Suction pressure rise exceeds 5 psig/minute after system shutdown.	Damaged or leaking compressor discharge valves.	Remove head, inspect and replace damaged or worn valves.

Compressor Loses Oil

Symptom	Probable Cause	Recommended Action
Excessively cold suction line due to liquid floodback to the compressor.	TEV set incorrectly. Refrigerant carries oil out of compressor.	Check and adjust superheat.
	TEV sensing bulb dirty, not properly insulated or loose on suction line. Refrigerant carries oil out of compressor.	Inspect sensing bulb. Clean, tighten or replace as needed.
	TEV stuck open. Refrigerant carries oil out of compressor.	Clean, repair or replace TEV.
Oil level too low.	Insufficient oil charge.	Add oil to proper system charge.
Oil level gradually drops.	Plugged liquid line filter drier.	Replace filter drier or drier core.
Compressor stops and starts too often. Low oil level.	Compressor short-cycling.	Refer to "Compressor Short Cycles".
Oil evident on and around compressor.	Compressor crankcase fittings leak.	Repair leaks and recharge system with proper oil charge.
Oil leaves sight glass rapidly.	Defective unloader "O" rings.	Repair or replace compressor.

Chiller Control (1U12) Test Procedure

To determine whether or not the chiller control module (1U12; see Figures 16, 17 and 18) is functioning properly, obtain TOL-101 (which includes a diagnostic plug and necessary resistor) from Trane LaCrosse and perform the checkout procedure outlined below:

1. Deenergize the CGAC unit.

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

---

2. Disconnect wires 116A and 116B from terminal 2 of relay 1K45, all wires connected to the terminals on the left side of the chiller control (1U12) and all external connections to the auxiliary relay module (1U13) <u>except</u> for the 24 VAC supply power wires to each control, ground wire and the five wires which connect the chiller control and auxiliary relay module. See Figures 22 and 23 for electrical schematics of the wiring connected to these controls.

3. Insulate the exposed ends of all of the leads removed in Step 2; this is important since some of these leads will be "hot" when the panel is re-energized.

WARNING: Use care when measurements or adjustments must be made with the power on to prevent injury or death due to electrical shock.

---

4. Remove the red diagnostic port cover from the bottom of the chiller control module and insert the diagnostic plug from TOL-101.

5. Energize the unit control panel and observe the LED indicator lights; none of the LEDs should be illuminated at this time.

6. Measure the power supply voltage between the 24 VAC input terminals (i.e., Terminals TR and TR) on the chiller control module; the reading obtained should be 25 ± 5 VAC.

<u>If the power supply voltage does not fall within the acceptable range</u>, check for a defective fuse or 24 VAC transformer.

7. Measure the power supply voltage between Terminals TR and TR (i.e., the 24 VAC input terminals) on the auxiliary relay board; again, the reading obtained should be 25 ± 5 VAC.

<u>If the power supply voltage does not fall within the acceptable range</u>, check for a defective fuse or 24 VAC transformer.

8. At this time all output relays on the chiller control and the auxiliary relay module should be in their deenergized state; measure the resistance across all relay contact terminals to verify that this is true. (On the auxiliary relay board all contacts should be open except between terminals 12 and 13.)

<u>If any of the relay contacts are not in the correct state</u> the component on which that relay is mounted must be replaced.

Caution: Complete the following procedure in the sequence given. Any step completed out of sequence will require a restart of the entire test.

9. Turn the "Leaving Fluid Setpoint" knob on the chiller control (1U12) to the full counterclockwise position.

10. Momentarily short chiller control Terminals P1 to T1; the No. 1 LED of "Compressor 1" should light.

<u>If this does not occur</u>, remove and reinsert the diagnostic plug (TOL-101); then repeat Step 10. If the "Compressor 1, No. 1" LED still fails to energize, replace the chiller control (1U12).

11. Slowly rotate the "Leaving Fluid Setpoint" knob clockwise, pausing at least 10 seconds at each setting given below. As the dial is rotated up through the "Leaving Fluid Setpoint" temperature settings, the remaining LEDs will light at the following points (the "Compressor 1, No. 1" LED is already on; see Step 10):

Dial Setting	Energizes LED
46±2 F	Comp. 1 - No. 2
58±2 F	Comp. 1 - No. 3
70±2 F	Comp. 2 - No. 1
82±2 F	Comp. 2 - No. 2
94±2 F	Comp. 2 - No. 3

<u>If the LEDs fail to light as indicated above</u>, replace the chiller control (1U12).

12. Slowly rotate the "Leaving Fluid Setpoint" knob counterclockwise, pausing at each setting given in Step 11. Each LED will go off in turn, reversing the sequence in Step 11. The "Compressor 1, No. 1" LED <u>will not go out</u>, however, even when the dial is returned to full counterclockwise position.

13. Turn the "Design Δ T" knob to the full counterclockwise position.

14. Momentarily short chiller control Terminals P2 to T1; the No. 1 LED of "Compressor 1" should remain lit.

<u>If this does not occur</u>, replace the chiller control (1U12).

15. Slowly rotate the "Design Δ T" knob clockwise, pausing at least 10 seconds at each setting given below. As the dial is rotated up through the "Design Δ T" temperature settings, the remaining LEDs will light at the following points (the "Compressor 1, No. 1" LED is already on; see Step 14):

Dial Setting	Energizes LED
5.6±1 F	Comp. 1 - No. 2
8.8±1 F	Comp. 1 - No. 3
12.0±1 F	Comp. 2 - No. 1
15.2±1 F	Comp. 2 - No. 2
18.4±1 F	Comp. 2 - No. 3

<u>If the LEDs fail to light as indicated above</u>, replace the chiller control (1U12).

16. Slowly rotate the "Design Δ T" knob counterclockwise, pausing at each setting given in Step 15. Each LED will go off in turn, reversing the sequence in Step 15. The "Compressor 1, No. 1" LED <u>will not go out</u>, however, even when the dial is returned to full counterclockwise position.

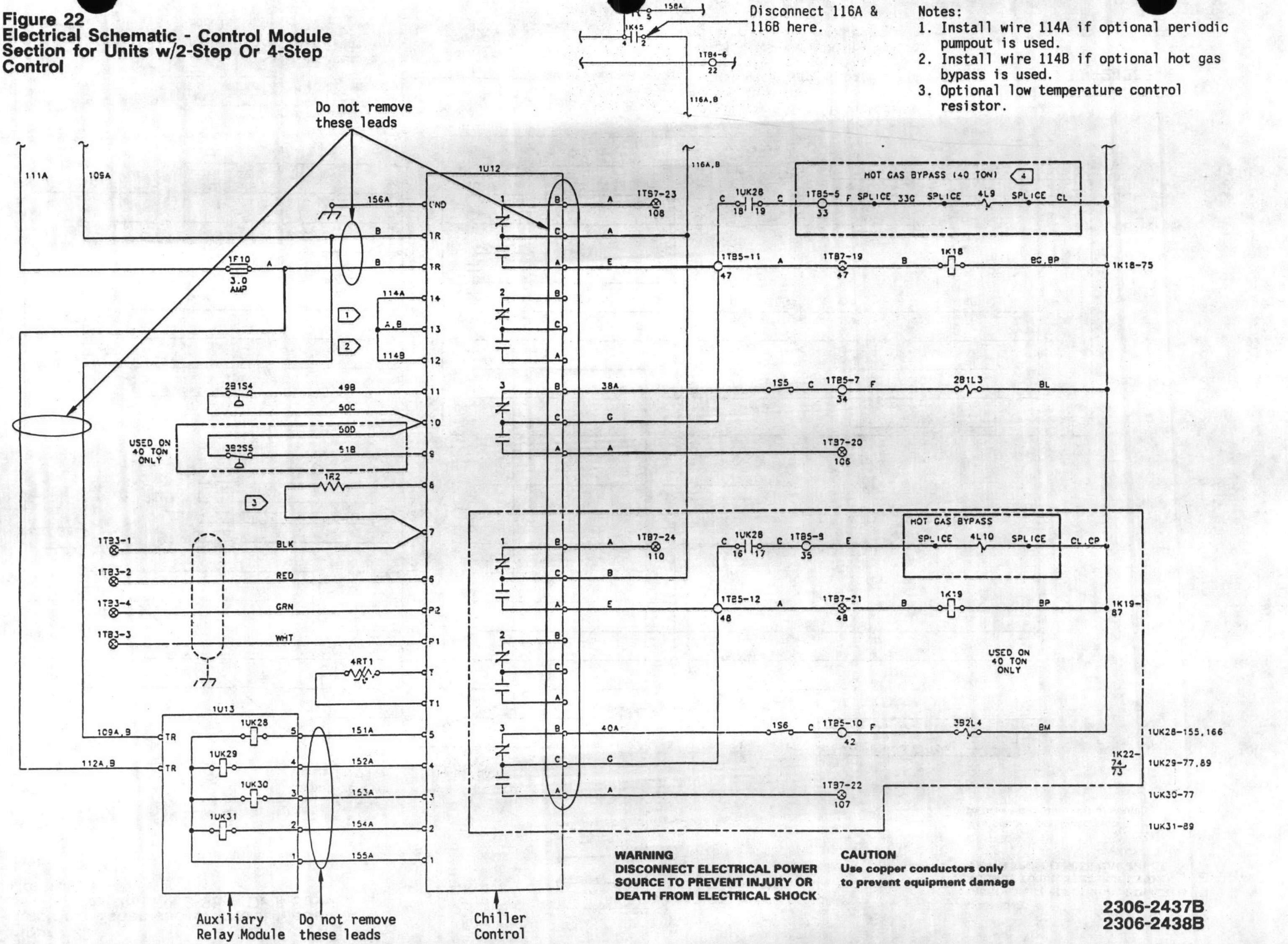
17. Turn the "Number of Stages" knob to the full counterclockwise position.

18. Momentarily short chiller control Terminals P1 to T1; the "Compressor 1, No. 1" LED remains lighted and the "Compressor 1, No. 2" LED should also light.

<u>If this does not occur</u>, replace the chiller control (1U12).

Figure 22
Electrical Schematic - Control Module Section for Units w/2-Step Or 4-Step Control

Notes:
1. Install wire 114A if optional periodic pumpout is used.
2. Install wire 114B if optional hot gas bypass is used.
3. Optional low temperature control resistor.



WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

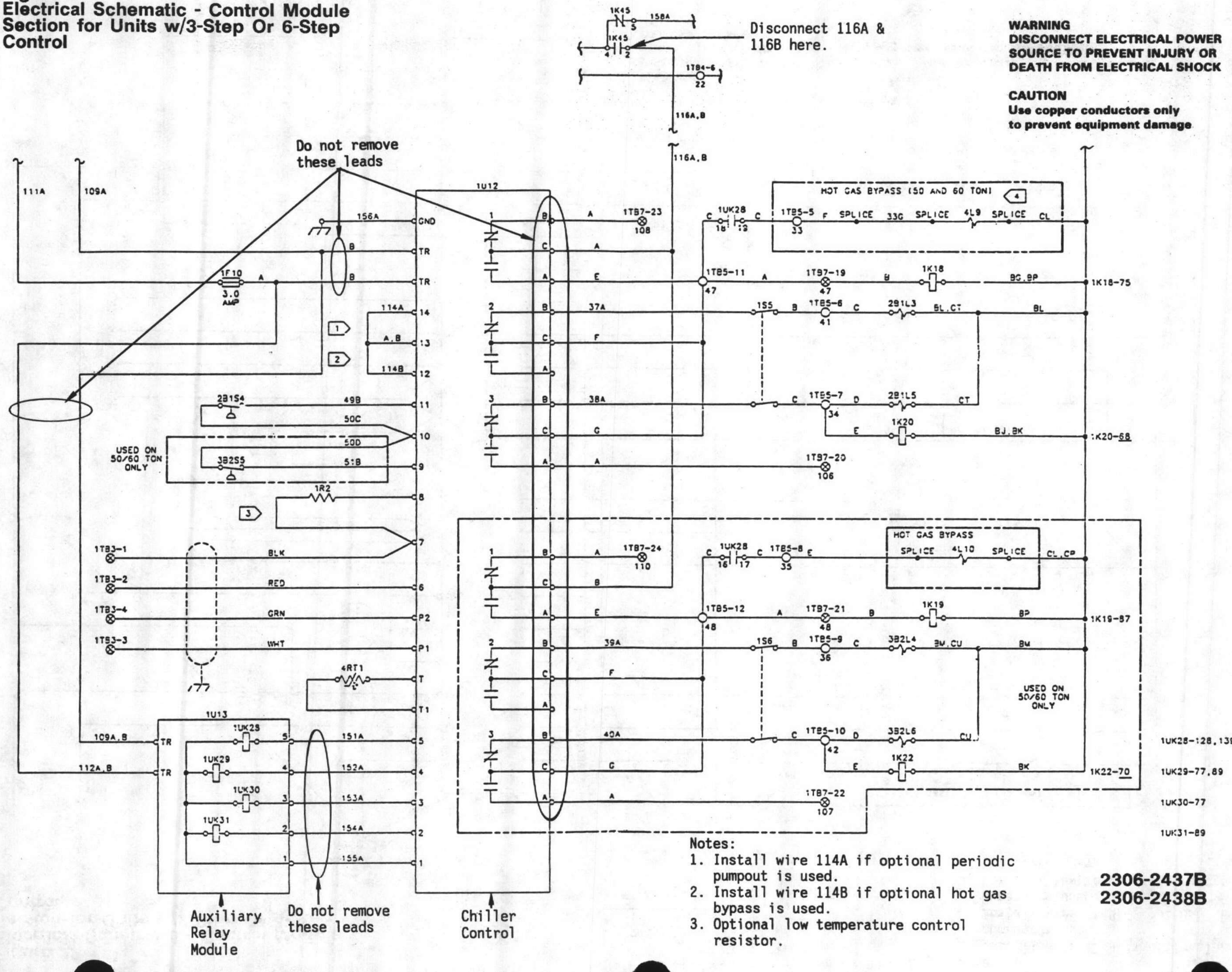
CAUTION
Use copper conductors only to prevent equipment damage

2306-2437B
2306-2438B

Figure 23
Electrical Schematic - Control Module Section for Units w/3-Step Or 6-Step Control

WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
Use copper conductors only to prevent equipment damage



Notes:
1. Install wire 114A if optional periodic pumpout is used.
2. Install wire 114B if optional hot gas bypass is used.
3. Optional low temperature control resistor.

2306-2437B
2306-2438B

19. Slowly rotate the "Number of Stages" knob clockwise, pausing at least 10 seconds at each setting given below. As the dial is rotated up through the "Number of Stages" settings, the remaining LEDs will light at the following points (the "Compressor 1, No. 1 and No. 2" LEDs are already on; see Step 18):

Dial Setting	Energizes LED
3	Comp. 1 - No. 3
4	Comp. 2 - No. 1
6	Comp. 2 - No. 2 & 3

If the LEDs fail to function in this manner, replace the chiller control (1U12).

20. Slowly rotate the "Number of Stages" knob counterclockwise, pausing at each setting given in Step 19. Each LED will go off in turn, reversing the sequence in Step 19. The "Compressor 1, No. 1 and No. 2" LEDs will not go out, however, even when the dial is returned to full counterclockwise position.

21. Momentarily short chiller control Terminals T to T1; the "Compressor 1, No. 1 LED" remains lighted, but the "Compressor 1, No. 2" LED should go out.

Measure voltage between terminals 1 and 4 on the chiller control. The reading should be 9 to 13 VDC.

If the LEDs do not function properly, or if the voltage reading is not within the specified range, replace the chiller control (1U12).

22. Momentarily short chiller control Terminals 6 to 7; the short must be held for 5 seconds. The No. 2 and 3 LEDs of "Compressor 2" should light, and the "Compressor 1, No. 1" LED should turn off.

If this does not occur, replace the chiller control (1U12).

23. Momentarily connect a resistor (rated between 100 and 1000 ohms supplied in TOL 101) across chiller control Terminals 7 and 8; maintain this connection for at least 5 seconds. All six of the main control LEDs should light.

All of the control relay contacts should switch; measure the resistance across the relay contact terminals to verify this has occured.

If this does not occur, replace the chiller control (1U12).

24. Momentarily short chiller control Terminals 9 to 10; the short must be held for 5 seconds. All except the No. 3 LED of "Compressor 2" should turn off at this time.

Measure voltage between terminals 1 and 2 on the chiller control. The reading should be 9 to 13 VDC.

If the LEDs do not function properly, or if the voltage reading is not within the specified range, replace the chiller control (1U12).

25. Momentarily short chiller control Terminals 10 to 11; the short must be held for 5 seconds. The No. 3 LED of "Compressor 1" should light and the No. 3 LED of "Compressor 2" should turn off at this time.

Measure voltage between terminals 1 and 3 on the chiller control. The reading should be 9 to 13 VDC.

If the LEDs do not function properly, or if the voltage reading is not within the specified range, replace the chiller control (1U12).

26. Momentarily short chiller control Terminals 12 to 13; the short must be held for 5 seconds. The No. 2 LEDs of both "Compressor 1" and "Compressor 2" should light and the No. 3 LED of "Compressor 1" should turn off at this time.

Measure voltage between terminals 1 and 5 on the chiller control. The reading should be 9 to 13 VDC.

If the LEDs do not function properly, or if the voltage reading is not within the specified range, replace the chiller control (1U12).

27. Momentarily short chiller control Terminals 13 to 14; the short must be held for 5 seconds. The No. 1 LED of "Compressor 2" should light and the No. 2 LEDs of both "Compressor 1" and "Compressor 2" should turn off.

If this does not occur, replace the chiller control (1U12).

All of the relays on the auxiliary relay module (1U13) should also pull in at this time; measure the resistance across the relay contact terminals to verify that this has occurred.

If the resistance measured across the relay terminals indicates that any of the relays have not pulled in, measure the DC voltage between Terminals 1 (Common) and 2 (LP2), Terminals 1 and 3 (LP1), Terminals 1 and 4 (LTC), and Terminals 1 and 5 (HGB) on the auxiliary relay module. Each of the readings obtained should be 9 to 13 VDC.

a. If any of the voltages measured is higher than 13 VDC, replace the chiller control (1U12).

b. If all of the voltages measured are lower than 13 VDC but one or more of the relays have not closed, replace the auxiliary relay module (1U13).

Test Procedure for Chiller Control Sensing Bulb (4RT1)

WARNING: To prevent injury or death due to electrical shock, open and lock all electrical disconnects.

Disconnect the leaving water sensor (4RT1) leads from Terminals T and T1 on the chiller control (1U12). See Figures 22 and 23.

To determine whether or not the sensor is functioning properly, measure the resistance across the sensor leads; then, compare the reading obtained with the resistance-to-temperature conversion chart provided below:

Temperature	Resistance
90 F	3516.2 Ohms
80 F	3498.2 Ohms
70 F	3450.0 Ohms
60 F	3401.8 Ohms
50 F	3353.4 Ohms
40 F	3304.8 Ohms
30 F	3256.3 Ohms
20 F	3207.5 Ohms
10 F	3159.7 Ohms
0 F	3109.7 Ohms

If the resistance measured across the sensor leads does not correspond to the actual leaving water temperature, replace the sensor.

OPERATOR'S MAINTENANCE LOG (1)

DATE	WEEKLY MAINTENANCE INSPECTION											
	COMPRESSOR(S)						SIGHT GLASS/MOISTURE INDICATOR				WATER TEMP. (°F)	
	COMPRESSOR 1			COMPRESSOR 2 (2)			SIGHT GLASS 1		SIGHT GLASS 2 (2)		EWT	LWT
	OIL LEVEL	SUCT.(3) PRESS.	DSCHG. PRESS.	OIL LEVEL	SUCT. PRESS.	DSCHG. PRESS.	REFRIG. CONDITION	MOISTURE LEVEL	REFRIG. CONDITION	MOISTURE LEVEL	(WATER ENT. EVAPORATOR)	(WATER LVG. EVAPORATOR)
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ OK ☐ LOW			☐ OK ☐ LOW			☐ OK ☐ BUBBLES	☐ DRY ☐ WET	☐ OK ☐ BUBBLES	☐ DRY ☐ WET		
	☐ LOW ☐ OK			☐ LOW ☐ OK			☐ BUBBLES ☐ OK	☐ WET ☐ DRY	☐ BUBBLES ☐ OK	☐ WET ☐ DRY		

1. Perform each inspection once per week with the unit operating.
2. Record operating pressures in psig. Available only if the unit is equipped with pressure gauges.

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.

PRINTED BY PRODUCTION SERVICES — LA CROSSE

RS/LW

TAB PLACEMENT HERE

DESCRIPTION:

2

☐ Tab page did not contain hand written information

☒ Tab page contained hand written information
*Scanned as next image

(2)

TRANE™

BTA-SF-29A

SERVICE FACTS

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.

Split System Condensing Unit

C - SPLIT COOLING

Library	Service Literature
Product Section	Unitary
Product	Split System
Model	BTA
Literature Type	Service Facts
Sequence	29A
Date	June 1987
File No.	SV-UN-S/S-BTA-SF-29A 6/87
Supersedes	BTA-SF-29A Dated 12/86

Model
BTA180F400AB

IMPORTANT - This document is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

SAFETY NOTICE

THIS INFORMATION IS INTENDED FOR USE BY INDIVIDUALS POSSESSING ADEQUATE BACKGROUNDS OF ELECTRICAL AND MECHANICAL EXPERIENCE. ANY ATTEMPT TO REPAIR A CENTRAL AIR CONDITIONING PRODUCT MAY RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE. THE MANUFACTURER OR SELLER CANNOT BE RESPONSIBLE FOR THE INTERPRETATION OF THIS INFORMATION, NOR CAN IT ASSUME ANY LIABILITY IN CONNECTION WITH ITS USE.

RECONNECT ALL GROUNDING DEVICES

ALL PARTS OF THIS PRODUCT CAPABLE OF CONDUCTING ELECTRICAL CURRENT ARE GROUNDED. IF GROUNDING WIRES, SCREWS, STRAPS, CLIPS, NUTS OR WASHERS USED TO COMPLETE A PATH TO GROUND ARE REMOVED FOR SERVICE, THEY MUST BE RETURNED TO THEIR ORIGINAL POSITION AND PROPERLY FASTENED.

DISCONNECT POWER BEFORE SERVICING

INDOOR THERMOSTAT

Thermostat	System Switch	Fan Switch	Cool Steps	Heat Steps
BAYSTAT010*	Auto	Auto	2	2
BAYSTAT011	Auto	N.A.	2	2
BAYSTAT012	Manual	Auto	2	1
BAYSTAT013	Manual	Auto	2	2
BAYSTAT015	Auto	Auto	2	None

*BAYRLAY001 must be used in conjunction with this thermostat.

Night Setback: BAYSTAT003

Coil Guard: BAYGARD004

Isolators: BAYISLT001
BAYISLT002

Low Ambient Damper: BAYLOAM001A

® AN INDEPENDENT LABORATORY UL TESTING FOR PUBLIC SAFETY

3rd Printing 1987

SERVICE PARTS

COMPONENT	QTY.	DESCRIPTION	DPG CAT. #	CSG PART #
Capacitors (C)	3	5.0 MFD, 440V	WW20X0108	CPT-119
Compressor (COMPR)	1	460/60/3, RLA 25.6/12.8, LRA 124/45, Bristol H2NG184GPE	WW77X0370	COM-2057
Crankcase Heater (CCH)	1	480V, 60 Hz, 100 Watts	WW08X0109	HTR-1200
Motor Protector (CMPM)	1	Power Supply 24 VAC-60 Hz, Control Rating 2.5 Amps, Reset time: 4 min. + 48 sec.	WW24X0200	CNT-890
Contactors (compressor) (CCF)	1	Type 3PST, Contacts: Ind. FLA 30, Res. Amps 40, LRA @ 240 = 180, LRA @ 480 = 150, Coil: 24V, Inrush V.A. 50, Sealed V.A. 6.0	WW30X0116	#CTR-522
Contactor (outdoor fan) (ODR)	1	Type 2PST, Contacts: Ind. FLA 10, Res. Amps 25, LRA @ 240 = 100, LRA @ 480 = 50, Coil: 24 V, Inrush V.A. 30, Sealed V.A. 7.5	WW24X0077	CTR-550
Motor Controller (CCT,CCS)	1	Type CS/CT, Contacts: Ind. FLA 30, Res. FLA 40, LRA @ 240 = 180, LRA @ 480 = 150, Coil: 24V, Inrush V.A. 50, Sealed V.A. 6, Aux. Switch (1) SPST N.O.	WW30X0121	CTR-493
Drier	2	Liquid Line w/Sweat Fittings, 16 c.u. in., ½" x ½"	WW22X0096	DHY-152
Fan	3	3 Blade, 20" Dia., ½" Dia. Bore, CW	WW73X0077	FAN-661
Fuse (control) (F7)	2	Dual Element, 3 Amps, 300V	WG23X0070	FUS-200
Condenser Motor (ODFM)	3	460V, 60 Hz., 1 Ph., Dripproof Shell, CCW, 1625 Rpm, ½ H.P., 1-speed, FLA 2.1, LRA 4.8, type PSC	WW94X0621	##MOT-2366
Relay (reset) (RR)	1	Type SPDT, Contact Rating: Pilot Duty, Coil Voltage: 24 V.A.C.	WW24X0171	RLY-657
Relay (CR)	1	Type SPDT, Contact Rating: Pilot Duty, Coil: Inrush V.A. 4, Sealed V.A. 3 @ 24 VAC	WG24X0190	RLY-880
Slinger	3	½" Dia. Bore	WW72X0048	SLG-31
Control Switch High Pressure (HPC)	1	Cut-out Pressure: Opens @ 425 ± 20 PSIG, Resets @ 325 ± 20 PSIG	WW26X0068	CNT-510
Control Switch Low Pressure (LPC)	1	Cut-out Pressure: Opens @ 20 ± 4 PSIG, resets @ 50 ± 5 PSIG	WW26X0095	CNT-542
Condenser Fan Limit Control (FLT)	1	Type SPST, Switch Opens @ 55 ± 3 F. Closes @ 65 ± 3 F, Rating @ 240 V = 10 Amps	WW28X238	CNT-959
Condenser Fan Limit Control (FLT)	1	Type SPST, Switch Opens @ 65 ± 3 F. Closes @ 75 ± 3 F, Rating @ 240 V = 10 Amps	WW28X0250	THT-500
Time Delay Relay (LATD)	1	Time Delay 240 Sec., Input Voltage 24V, Output Rating 1 Amp.	WW24X0116	RLY-858
Transformer T1)	1	Primary 460V, Secondary 24V, Class II, Rating 60 V.A., Primary 60 Hz.	WW32X0069	TRR-397
SERVICE REPLACEMENT PARTS				
Drier, Liquid	1	Liquid line w/sweat fittings, 16 Cu. In., ⅝" x ⅝"	WW22X150	DHY-154
Drier, Suction	1	Suction line w/sweat fittings, 100 Cu. In., 1⅝" x 1⅝"	WW22X0151	DHY-182

#Standardized Part. First time replacement requires Side Switch, SWT-528, includes Holding Coil, COL-3601.
##Standardized Part. First time replacement requires Capacitor, CPT-230.

NOTE:
CSG refers to the Commercial Systems Group and DPG refers to the Dealer Product Group of The Trane Company. The CSG and DPG part numbers shown side by side above are not necessarily interchangeable for applications other than documented in this bulletin. Both are approved for service of the product listed. Inventories to support your needs are available to you through both Trane divisions.

Normal Operating Pressures

To determine the proper head and suction pressure refer to Figure A.

1. Determine that the system CFM is the same as listed in Figure A.
2. Determine the evaporator entering air dry and wet bulb temperatures by using a sling psychrometer.
3. Determine the outdoor ambient at temperature entering the condensor.
4. Find the intersection of the outdoor ambient temperature and the evaporator DB and WB temperatures. From that point, go vertically to find the correct suction pressure and horizontally to find the correct head pressure.
5. Refer to the troubleshooting section of the Operation/Maintenance Guide for additional information if the head pressure is more than ±10 PSIG and the suction pressure is more than ±3 PSIG.

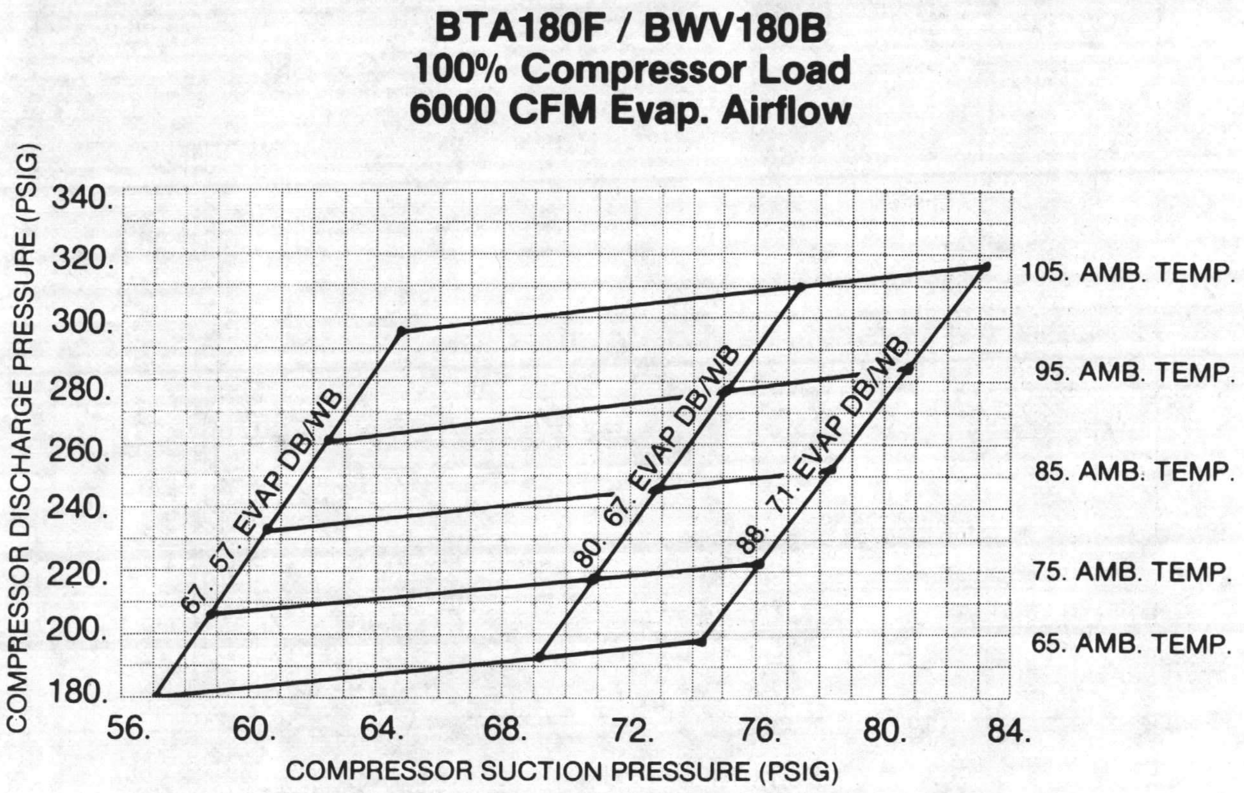
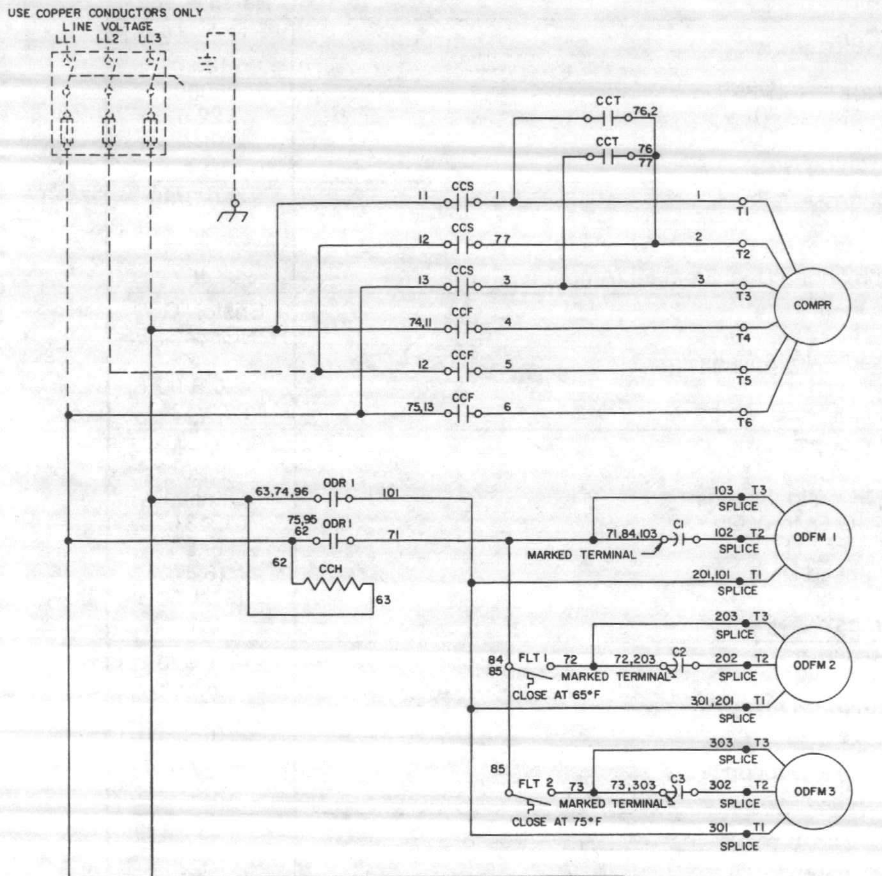


Figure A

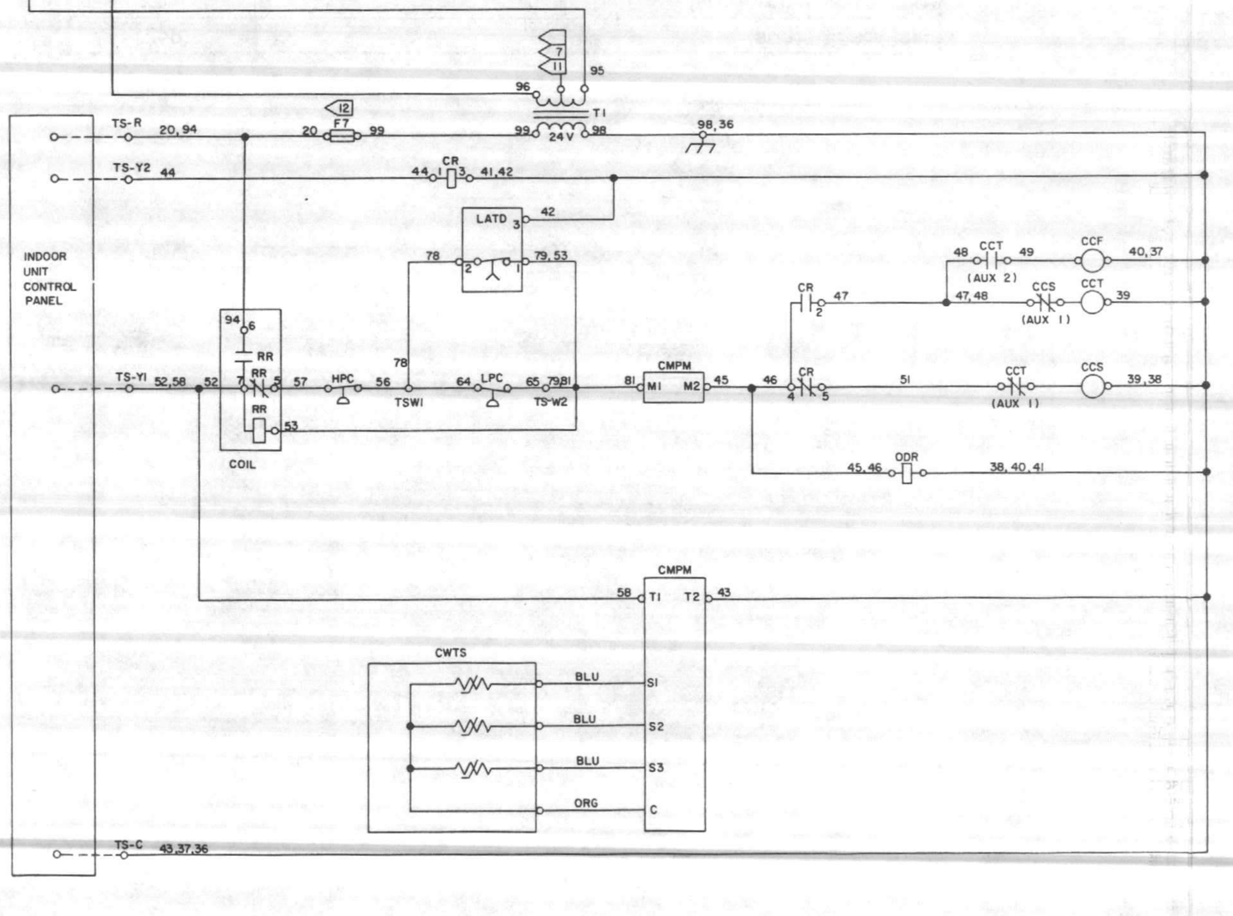
PRODUCT SPECIFICATIONS BTA180F

Outdoor Unit **Indoor Unit**	**Rated w/460**
Ratings Cooling MBH Indoor Airflow (CFM) Power Input (KW) EER Noise Rating No.	 185.0 6000 22.8 8.2 8.8
Power Conns. - V/Ph/Hz Min. Brch. Cir. Ampacity Br. Cir - Max. (Amps) Recommended Dual Element (Amps)	460/3/60 42 60 45
Compressor No. Used - No. Speeds Volts/Ph/Hz R.L. Amps. - L.R. Amps	Bristol "G"/ H2NG184GPEF 1/2 460/3/60 28.2/124
Outdoor Fan - Type No. Used/Dia. (In.) Type Drive/No. Speeds CFM @ O.O. in W.G. No. Motors - H.P. Motor Speed Rpm Volts/Ph/Hz F.L. Amps	Propeller 3/20 Direct/1 12131 3/.5 1625 460/1/60 2.1
Outdoor Coil - Type Rows/F.P.I. Face Area (Sq Ft) Tube Size	Plate Fin 3/13 26.0 3/8"
Refr. Line Size Suction Liquid	1.375 3/8"
Outdoor Unit Dimen. Crated	43 x 43 x 112
Shipping Weight (Lbs)	1022
Net Weight (Lbs)	842

BTA-SF-29A

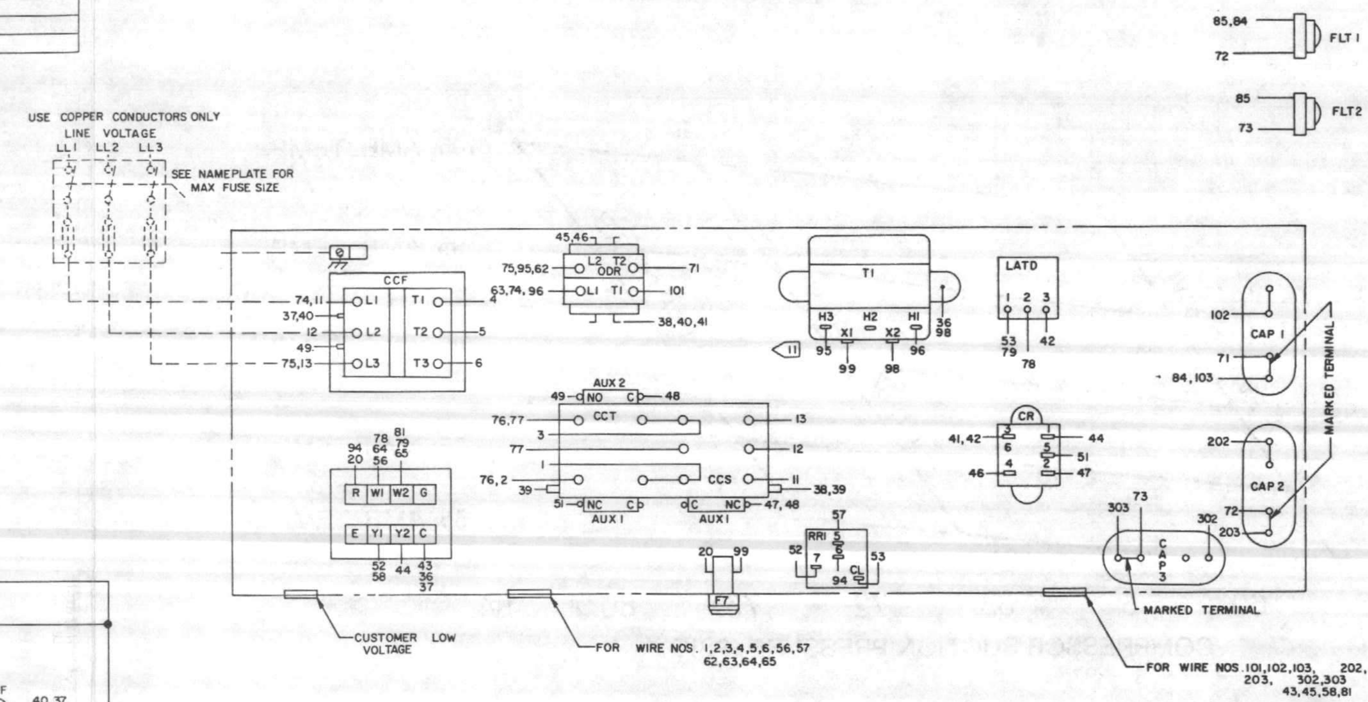


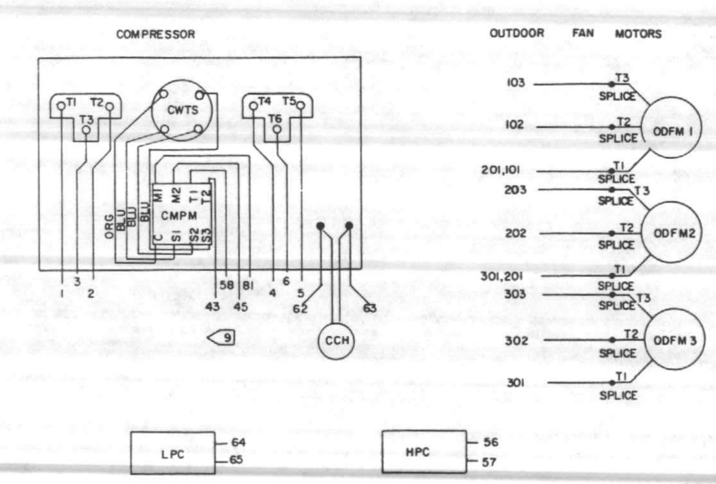
LEGEND	
DEVICE DESIGNATION	DESCRIPTION
C1,2,3	CAPACITOR
CCF	COMPRESSOR CONTACTOR FAST
CCH	CRANKCASE HEATER
CCS	COMPRESSOR CONTACTOR SLOW
CCT	COMPRESSOR CONTACTOR TIE
CMPM	COMP. MTR. PROTC. MODULE
COMPR	COMPRESSOR
CR	SECOND STAGE COOLING RELAY
CWTS	COMP. WINDING TEMP SENSOR
F7	CONTROL CIRCUIT FUSE
HPC	HIGH PRESSURE CIRCUIT
LATD	LOW AMBIENT TIME DELAY
LPC	LOW PRESSURE CIRCUIT
ODFM 1,2,3	OUTDOOR FAN MOTOR
ODR	OUTDOOR FAN RELAY
RR	RESET RELAY
T1	TRANSFORMER
TS	TERMINAL STRIP
FLT	FAN LIMIT T-STAT



NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25°C (77°F) AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURED. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITERY OR AVAILABLE SALES OPTIONS. NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF THE CONTACTS BY LINE NUMBER. AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT.
2. ALL WIRING AND DEVICES SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTICAL CODES.
3. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THIS UNIT, MUST BE REPLACED, REPLACE IT WITH APPLIANCE WIRING MATERIAL RATED AT 105°C OR EQUIVALENT.
4. THREE PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASING CONDITIONS AND HAVE INTERNAL OVERLOAD PROTECTION.
5. FOR REMAINDER OF CONTROL CIRCUITS, SEE ELECTRICAL DIAGRAM LOCATED ON INDOOR UNIT CONTROL PANEL.
6. RESET RELAY WILL RESET WHEN POWER IS INTERRUPTED
7. ALL 50 HZ UNITS ARE FACTORY WIRED FOR 415 VOLT APPLICATIONS. FOR 380 VOLT APPLICATIONS MOVE LEAD 95 FROM THE 415 VOLT TRANSFORMER TERMINAL (H3) TO THE 380 VOLT TERMINAL (H2).
8.
9. CMPM IS LOCATED IN THE COMPRESSOR JUNCTION BOX. TEXAS INSTRUMENT PN 15AA 11059. COMPRESSOR CONTACTOR CANNOT BE RE-ENERGIZED FOR 4 MINUTES AFTER WINDING TEMPERATURES HAVE RETURNED TO NORMAL FOLLOWING CUT-OUT ON EXCESSIVE TEMPERATURE, CURRENT OVERLOAD OR POWER INTERRUPTION TO TERMINAL "T1".
10. EVAPORATOR APPLICATION TEMPERATURE RANGE: 32 DEG F TO 53.5 DEG F.
11. WIRE 95 IS CONNECTED TO 600 VOLT TRANSFORMER TERMINAL (H3) ON 575 VOLT UNITS AND 480 VOLT TERMINAL (H2) ON 460 VOLT UNITS.
12. REPLACE ONLY WITH BUSSMAN GLQ OR GMQ 3AMP 300V FUSES.





2306-3565 Rev. C

BTA-SF-29A

Operation

Single Compressor, 2-Speed Operation

Sensing a need for cooling, the first stage cooling contacts of the thermostat will close. Assuming that no safety controls have tripped, this supplies power to the low speed compressor contactor coil (CCS) and outdoor fan relay coil (ODR). Safety controls in this circuit include the high pressure control (HPC), low pressure control (LPC), reset relay (RR), and compressor motor protection module (CMPM).

NOTE: *The compressor contactor cannot be re-energized on the BTA180F for four minutes after winding temperatures have returned to normal following cut-out on excessive temperature, current overload, or power interruption to Terminal T1 of the compressor motor protection module. This provides an anti-short cycle feature on the standard unit. The compressor cannot be re-energized for four minutes following termination of the cooling cycle. This is a standard option on the dual compressor units.*

Energizing the compressor contactor coil (CCS) closes the CCS contacts in the power circuit, and starts the compressor on low speed. Concurrently, outdoor fan relay coil (ODR) is energized. This starts the outdoor fan motor(s) by closing the ODR contacts in the power circuit. The total number of condenser fans which will operate is dependent upon the outdoor ambient and the resulting position of the FLT switches (See Figure 2).

As the cooling load increases, the second stage contacts of the thermostat will close. This supplies power to the control relay coil (CR), which opens one set of contacts and closes the other on this single-pole, double-throw relay. This, in turn, de-energizes the low speed compressor contactor coil (CCS) and supplies power to the "tie point" compressor contactor coil (CCT) through normally closed auxiliary contacts CCS located in the control circuit. Auxiliary control circuit contacts CCT then close, and power is supplied to the high speed compressor contactor coil (CCF). After the low speed compressor contactor contacts (CCS) in the power circuit open, both the "tie point" and high speed compressor contactor contacts (CCT and CCF) close and the compressor motor switches from low to high speed.

It should be noted that the dual compressor contactor is both mechanically and electrically interlocked in order to protect the compressor motor from having both low and high speed windings energized at the same time. Electrically, this is accomplished with a normally closed auxiliary side switch (CCS) on the "tying" compressor contactor coil (CCT), and a double-pole, double-throw auxiliary side switch (CCT) on both the high and low speed compressor contactor coils (CCF and CCS). See Figures 3 and 4 for further details on this electrical connection.

Normally, the compressor will start and operate on low speed before switching to high speed. However, the compressor can start on high speed if the difference between the thermostat setting and the space temperature is great enough. This will be the case in a "pull-down" situation where the unit has been disconnected from normal thermostat control for an extended period of time. It will also occur if the thermostat setting is lowered substantially while the system is off.

NOTE: *The compressor may not start in low speed when a differential pressure greater than 180 PSIG exists between the high and low side of the refrigerant circuit.*

BTA compressors include two-pole/four-pole motor hookup capability for two speed operation. The compressor operates at approximately 3500 RPM on high speed (two-pole), and at 1750 RPM on low speed (four-pole).

To achieve two speed operation, the motor windings are switched between a parallel connected (high speed) and series connected (low speed) motor winding through the use of low speed, high speed, and tie point contacts on the compressor contactor. This is shown in Figure 3 (high speed) and Figure 4 (low speed).

CAUTION: Extreme care must be taken when making wiring connections in the compressor terminal box. Incorrect hookup can result in immediate compressor failure when power is applied.

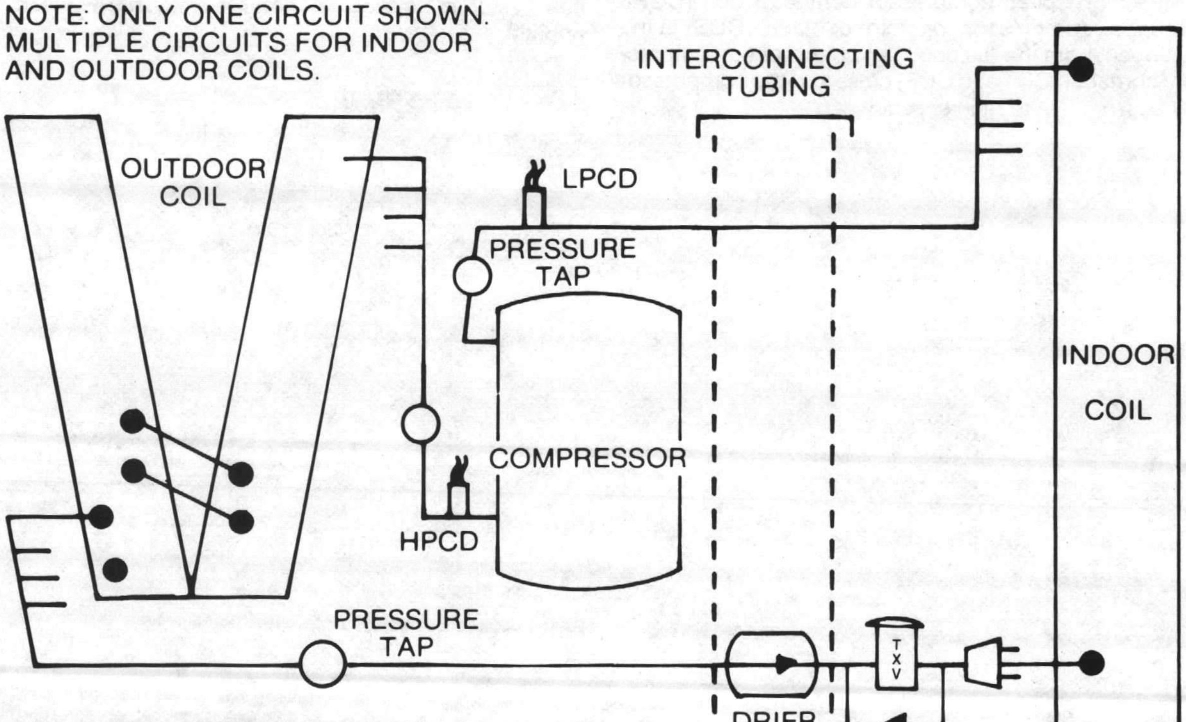
TROUBLESHOOTING CHART — WHAT TO CHECK

SYSTEM FAULTS	POWER SUPPLY	HIGH VOLTAGE WIRING	COMPR. IOL	RUN CAPACITOR	START CAPACITOR	START RELAY	CONTACTOR CONTACTS	LOW VOLTAGE WIRING	CONTROL TRANSFORMER	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMPRESSOR	REFRIGERANT UNDERCHARGE	REFRIGERANT OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	RESTRICTED O.D. AIRFLOW	O.D. AIR RECIRCULATION	TXV STUCK OPEN	SUPERHEAT	RESTRICTED I.D. AIRFLOW	REF. CIRCUIT RESTRICTIONS
REFRIGERANT CIRCUIT																							
Liquid Pressure Too High															P		S	P	S				S
Liquid Pressure Too Low													S	P						S	S		S
Suction Pressure Too High													S		P	P				S	P		
Suction Pressure Too Low														S							S	P	S
Liquid Refrig. Floodback TXV System																				S	S		
Liquid Refrig. Floodback Capillary Tube System															P			S	S		S	P	
I.D. Coil Frosting														P								P	S
Compressor Runs Inadequate or No Cooling													S	P		P	S				S	P	S
ELECTRICAL																							
Compressor & O.D. Fan Do Not Start	P	P						S	P	P	P												
Compressor Will Not Start But O.D. Fan Runs		P	S	P	P	P						S											
O.D. Fan Won't Start		P		P																			
Compressor Hums But Won't Start		P		P	P	P	S					S											
Compressor Cycles on IOL		P	S	P	P	P	S					P	S	P	S	S		S			S		S
I.D. Blower Won't Start	P	S						S	P		P												

P Primary Causes S Secondary Causes

REFRIGERANT CIRCUIT — BTA180F400A

NOTE: ONLY ONE CIRCUIT SHOWN.
MULTIPLE CIRCUITS FOR INDOOR
AND OUTDOOR COILS.



NOTE: TWO COMPRESSORS PER UNIT.
ONLY ONE SHOWN.

NOTE: ONLY ONE CIRCUIT SHOWN.

TRANE™

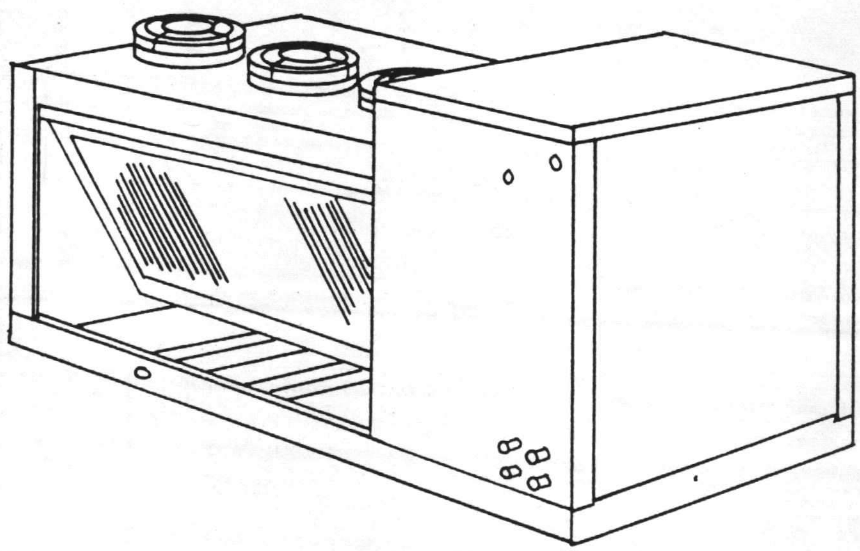
BTA-IN-5

INSTALLER'S GUIDE

Split System Condensing Units

Library	Service Literature
Product Section	Unitary
Product	Split System
Model	BTA
Literature Type	Installation
Sequence	5
Date	December 1986
File No.	SV-UN-S/S-BTA-IN-5 12/86
Supersedes	New

Models
BTA120D-AB
BTA150D-AB
BTA180D-AB
BTA180F-AB



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.

18-AC60D4

Table of Contents

Unit Model Number Description

Trane LCG products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of this multiple-character number is shown below. It will enable the owner or Service Engineer to define operation, components and applicable accessories for a specific unit.

LCG Unit Model Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12
B	T	A	1	2	0	D	3	0	0	A	A

Digit 1 — Always "B"

Digits 2, 3 — Product Type

TA = Split System Cooling, Outdoor Unit
WE = Split System Cooling or Heat Pump, Convertible Indoor Unit
WV = Split System Cooling or Heat Pump, Verticle Indoor Unit
WH = Split System Cooling or Heat Pump, Horizontal Indoor Unit

Digits 4, 5, 6 — Cooling Capacity (MBH)

090 = 90 MBH
120 = 120 MBH
180 = 180 MBH
240 = 240 MBH

Digit 7 — Major Design Sequence

Digit 8 — Electrical Characteristics

3 = 208-230/60/3
4 = 460/60/3
W = 575/60/3

Digits 9, 10 — Secondary Capacity and/or Factory Installed Options

00 = Not Used

Digit 11 — Minor Design Sequence

Digit 12 — Service Digit

General Information

Model BTA Condensing Units are designed for outdoor mounting with a vertical air discharge. They are usually installed on concrete slabs at ground level, but can also be used on a flat roof or a sloping roof with a properly built-up platform (making a level installation possible). Each unit is leak tested and evacuated at the factory, and shipped with a holding charge of Refrigerant-22. An access panel on the end of the unit provides access to the compressor section and access to the control box.

An Installation Checklist is provided at the end of this manual and should be completed after all installation procedures have been accomplished. This checklist should not be substituted for the detailed information given in appropriate sections of this manual.

Installation

Unit Installation

BTA unit dimensions, weights, and clearances are shown in Figures 1 through 3. Figure 4 illustrates various components of the split system condensing unit.

Receiving

When the unit is delivered to the jobsite, inspect all components for damage. Manually rotate the condenser fans to be sure they revolve freely. Report any damage or material shortage to the carrier and record this information on the bill of lading. File damage claims with the carrier, and notify the appropriate Trane sales office before installing a damaged unit. Any material shortages should also be reported directly to the Trane sales office.

Compare the electrical data on the unit nameplate with the ordering and shipping information to verify that the correct unit has been received.

Unit wiring diagrams and installation-operation-maintenance literature are shipped with the unit. Before unit start-up, read the provided literature to become familiar with the unit and its operation.

Location and Clearances

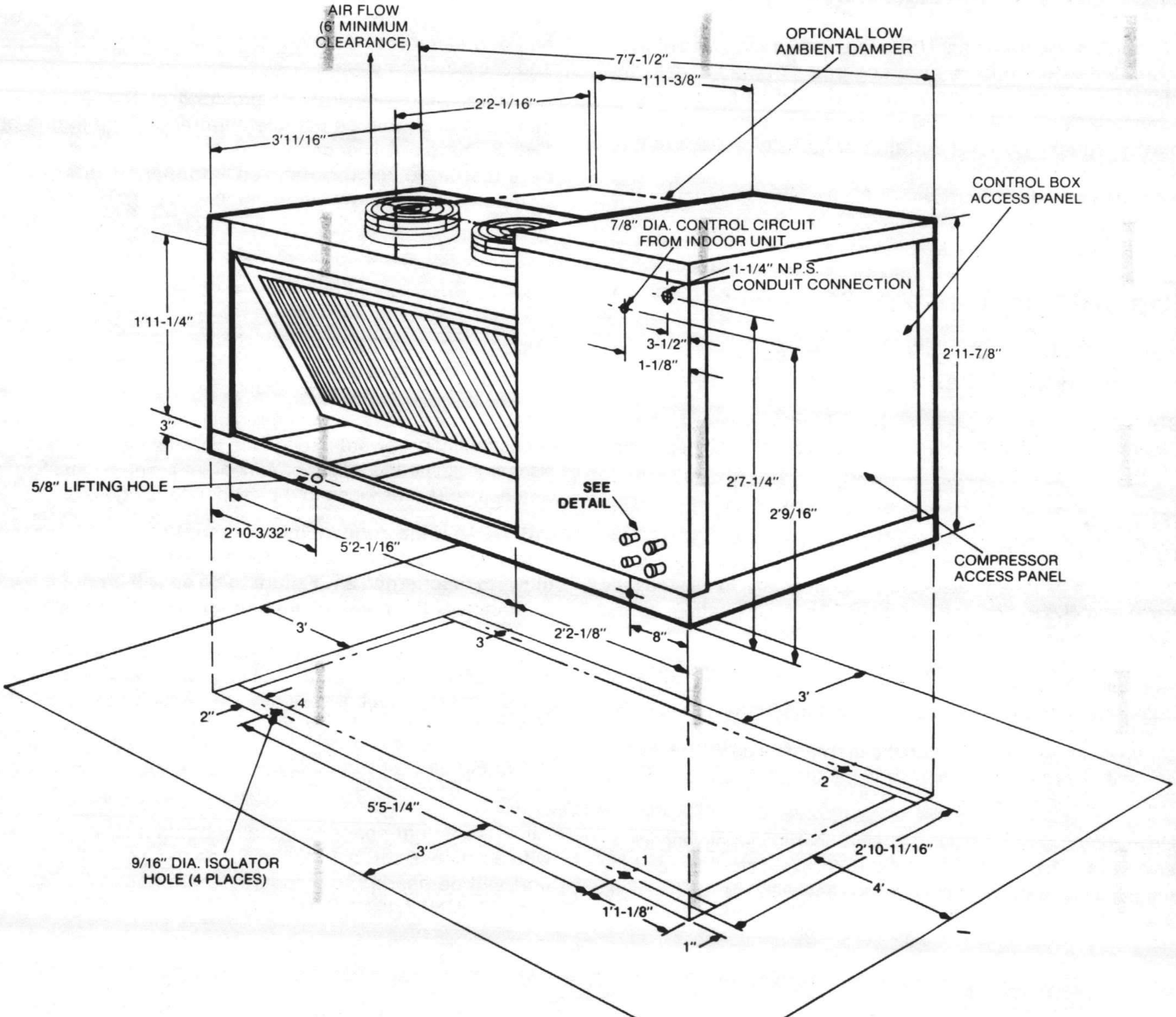
Select a location for the condensing unit where air will flow, without obstruction, upward through the coil and away from the fan discharge. Limit the length of refrigerant piping by locating the condensing unit as close to the evaporator as possible.

CAUTION: If the condensing unit must be placed under an overhang, take the necessary steps to avoid the recirculation of warm discharged air. Failure to do so will hinder the performance of the condensing unit and lead to unit damage.

Suggested air flow clearances and service clearances are given in Figures 1 through 3. If the unit is placed under an overhang, allow at least six feet of clearance above the unit to prevent recirculation of hot discharge air.

NOTE: *Four feet of service clearance must always be provided on the compressor end of the unit.*

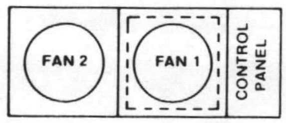
Allow sufficient space to install a liquid line shutoff valve with an access port next to the condensing unit. The access port will be needed to measure subcooling, as discussed in the MAINTENANCE manual.



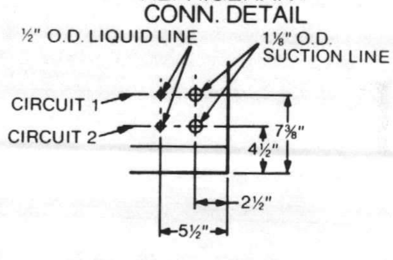
Weight Data

MODEL	NO. OF COMPS.	WEIGHT CONCENTRATED ON LEG (LBS) 1	2	3	4	SHIPPING WEIGHT (LBS)	OPERATING WEIGHT (LBS)
BTA120D	Two 5-Ton	226	228	124	100	830	678

DAMPER LOCATION



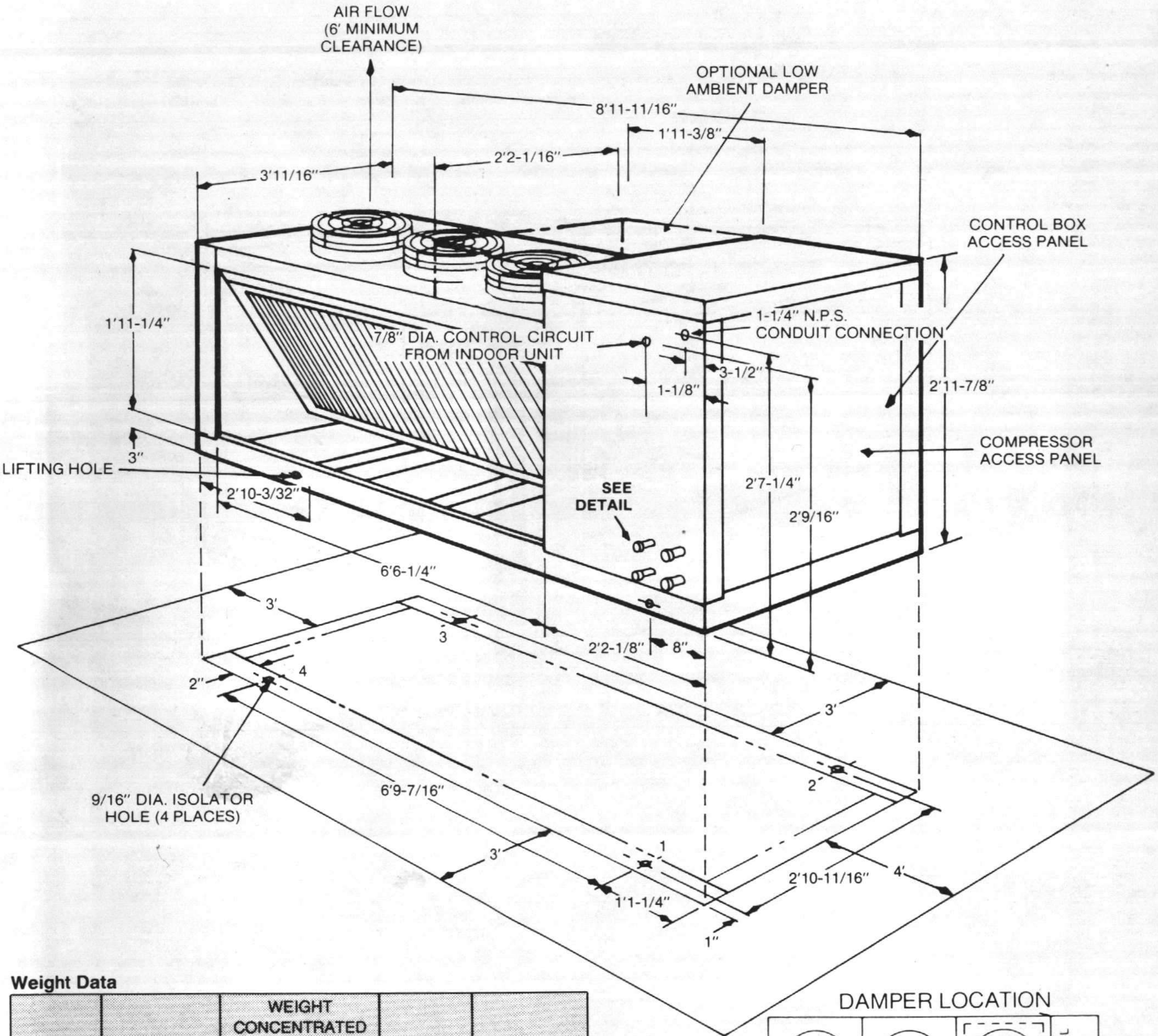
REFRIGERANT
CONN. DETAIL



Clearance Data

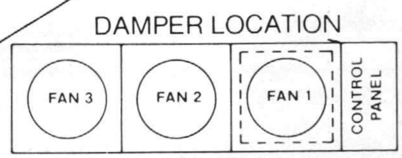
MODEL	SUGGESTED SERVICE CLEARANCE	SUGGESTED AIR FLOW CLEARANCES: SINGLE UNIT INSTALLATION	SIDE BY SIDE UNIT INSTALLATION	PIT INSTALLATION: MAX. PIT DEPTH	COIL CLEARANCE
BTA120D	4'-0"	3'-0"	6'-0"	3'-0"	6'-0"

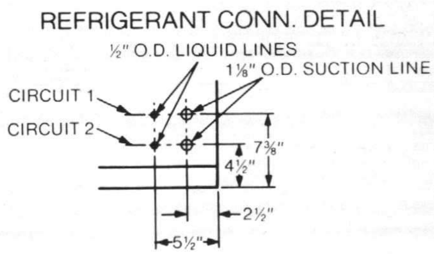
Figure 1 · Dimensions, Weights, and Clearances for BTA120D Units



Weight Data

MODEL	NO. OF COMPS.	WEIGHT CONCENTRATED ON LEG (LBS) 1	2	3	4	SHIPPING WEIGHT (LBS)	OPERATING WEIGHT (LBS)
BTA150D	Two 6.25-Ton	256	259	138	119	960	772
BTA180D	Two 7.50-Ton	270	272	158	140	1020	840

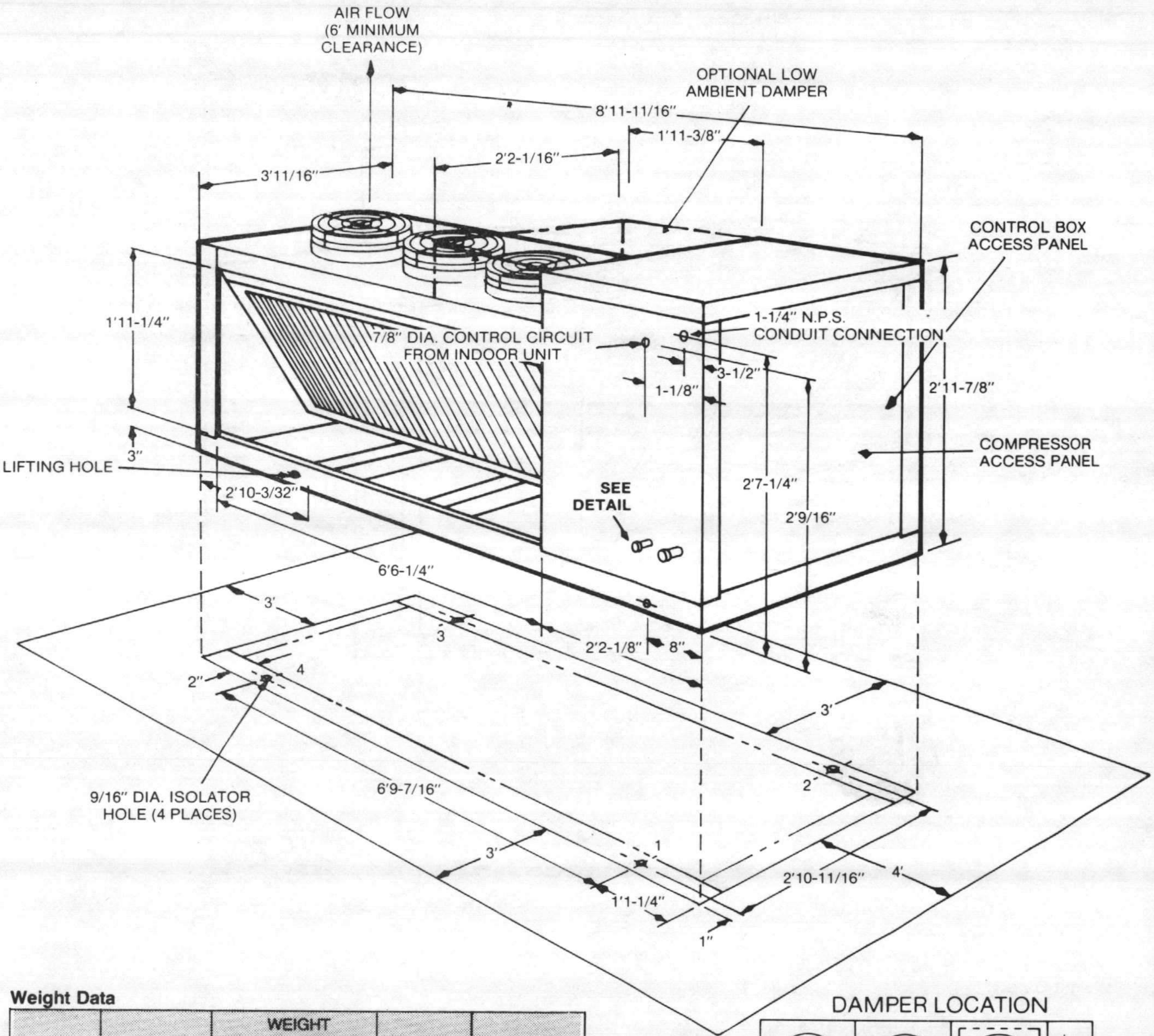




Clearance Data

MODEL	SUGGESTED SERVICE CLEARANCE	SUGGESTED AIR FLOW CLEARANCES: SINGLE UNIT INSTALLATION	SIDE BY SIDE UNIT INSTALLATION	PIT INSTALLATION: MAX. PIT DEPTH	COIL CLEARANCE
BTA150D	4'-0"	3'-0"	6'-0"	3'-0"	6'-0"
BTA180D	4'-0"	3'-0"	6'-0"	3'-0"	6'-0"

Figure 2 · Dimensions, Weights, and Clearances for BTA150D and 180D Units



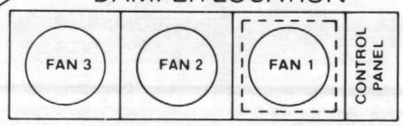
Weight Data

MODEL	NO. OF COMPS.	WEIGHT CONCENTRATED ON LEG (LBS) 1	2	3	4	SHIPPING WEIGHT (LBS)	OPERATING WEIGHT (LBS)
BTA180F	One 15-Ton	271	273	158	140	1022	842

Clearance Data

MODEL	SUGGESTED SERVICE CLEARANCE	SUGGESTED AIR FLOW CLEARANCES: SINGLE UNIT INSTALLATION	SIDE BY SIDE UNIT INSTALLATION	PIT INSTALLATION: MAX. PIT DEPTH	COIL CLEARANCE
BTA180F	4'-0"	3'-0"	6'-0"	3'-0"	6'-0"

DAMPER LOCATION



REFRIGERANT CONN. DETAIL

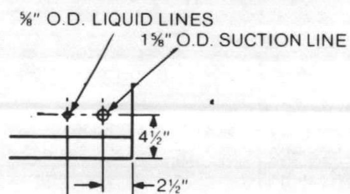


Figure 3 - Dimensions, Weights, and Clearances for BTA180F Units

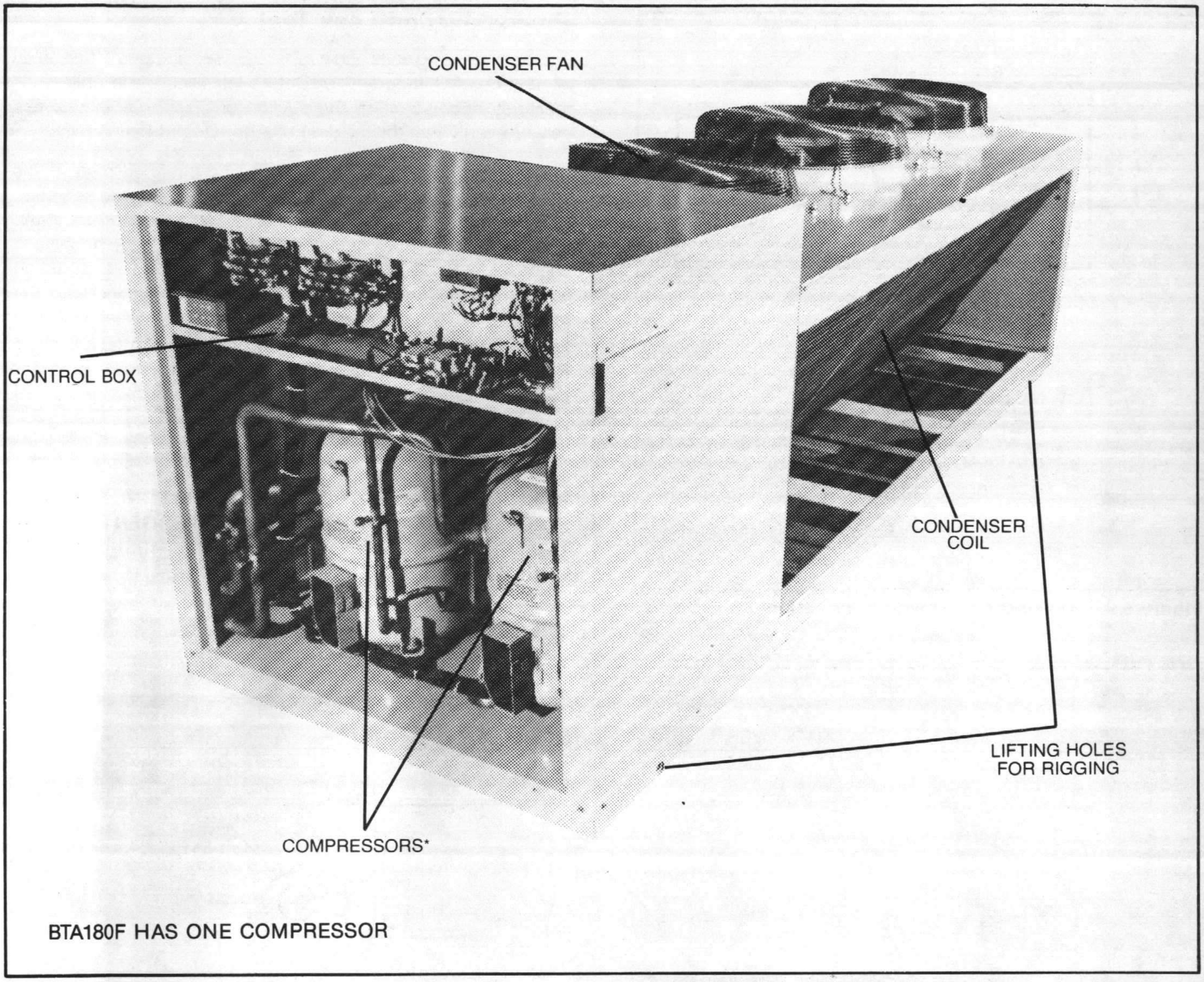


Figure 4 - BTA Component Identification

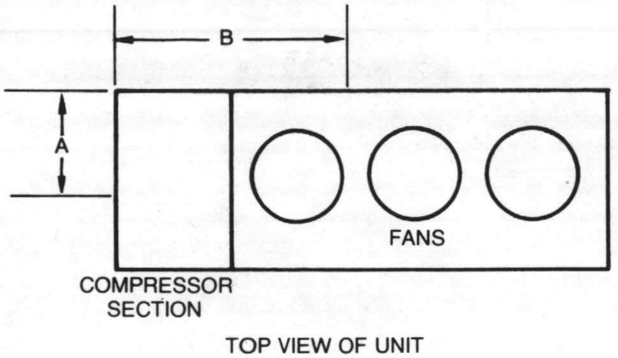
Foundation

If the unit is to be set on the ground, provide a four inch thick, level concrete slab for mounting. In rooftop applications, make sure the roof is strong enough to support the unit. Check with a roofing contractor for proper waterproofing installation practices to ensure that the roof does not develop leaks as a result of unit weight, vibration, and hot weather.

Rigging

Rig the unit using either belt or cable slings. The slings must be fastened to the unit at the four holes in the base rail of the unit, as shown in Figure 6. Use spreaders to protect the top of the unit when it is lifted. The point where the slings meet at the lifting hook must be at least six feet above the unit. Refer to Figure 5 for center of gravity information, and to Figure 6 for proper rigging procedures.

WARNING: TO PREVENT OVERSTRESSING THE BASE RAILS, THE UNIT SHOULD BE RIGGED AS SHOWN IN FIGURE 6 AND LIFTED AS SMOOTHLY AS POSSIBLE. FAILURE TO DO SO COULD RESULT IN SERIOUS PERSONAL INJURY AND DAMAGE TO THE UNIT.



MODEL	A	B
BTA120D	18.5"	33"
BTA150D	18.5"	39"
BTA180D	18.5"	41"
BTA180F	18"	40"

Figure 5 - Unit Center of Gravity Information

Pre-Installation Leak Test

Trane condensing units and evaporators are shipped with a holding charge of Refrigerant-22. Before installing these units, momentarily depress either the suction or discharge line access valve to verify that this holding charge has not been lost.

If no refrigerant escapes when depressing the access valve, the condensing unit should be leak tested to determine the source of refrigerant loss. Pressurize the unit to 100 psi with refrigerant, and use a halogen leak detector, halide torch, or soap bubbles to check for leaks. If a leak is found, release the test pressure and repair the leak. If no leak is found, use nitrogen to increase the test pressure to 150 psi and repeat the leak test. When repairing leaks, refer to "Brazing Procedures" in the MAINTENANCE PROCEDURES manual. Retest the unit to make sure the problem has been corrected.

NOTE: *It may be difficult to pressurize the unit to 100 psi with refrigerant if the ambient temperature is below 60 F.*

WARNING: DO NOT USE OXYGEN, ACETYLENE, OR AIR IN PLACE OF REFRIGERANT AND DRY NITROGEN FOR LEAK TESTING. A VIOLENT EXPLOSION WILL RESULT WHICH COULD CAUSE SERIOUS INJURY OR DEATH.

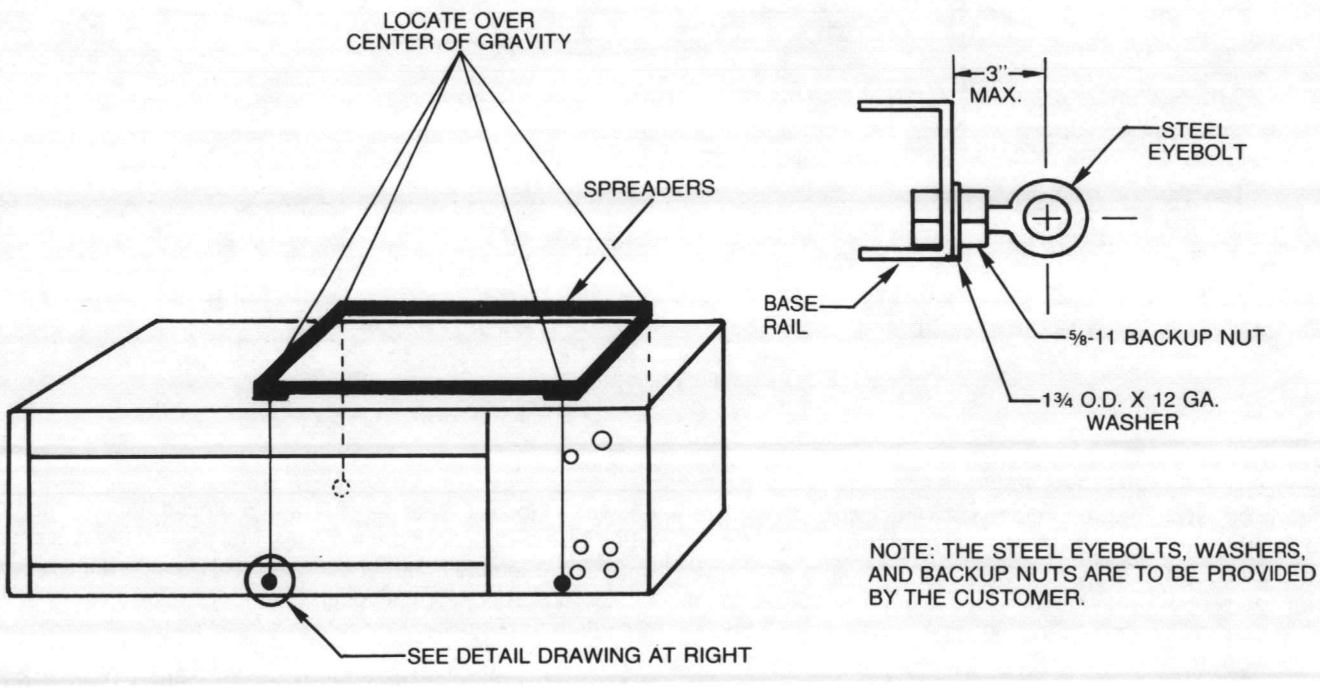


Figure 6 - Rigging the Unit

Refrigerant Piping

It is essential that refrigerant piping be properly sized and applied since these factors have a significant effect on system performance and reliability. On self-contained units, proper piping design is insured by the equipment manufacturer. However, split systems must operate with interconnecting lines which are selected and applied by the installer. If the interconnecting piping does not follow recommended guidelines, any system will be plagued by erratic performance, compressor failures, and other problems.

NOTE: *The piping should be sized and laid out according to the job plans and specifications. This should have been completed when components were selected for the system.*

Recommended Line Sizes

The interconnecting line sizes recommended by Trane are listed in Table 1. These tube sizes are within the velocity, pressure drop, and refrigerant charge limitations necessary for proper system operation. (The refrigerant charge limit is the maximum system charge recommended for a particular compressor, and is determined by the design of the compressor.) The line lengths in Table 1 are based on pressure drop and refrigerant charge limitations in the **liquid line**. Pressure drop limits assume that equivalent length equals two times the physical length. In most applications, this is a reasonable assumption. However, actual pressure drop must be calculated if one or more of the following situations exists:

1. LONG RISER: Installations with liquid line risers have an added pressure drop of 0.5 psi per foot of riser. If the riser is long, the system may require a larger diameter and/or shorter liquid line to ensure subcooling at the expansion valve.

2. EXCESSIVE BENDS, REDUCERS, VALVES: A larger than normal number of tube bends, reducers, and/or valves may increase equivalent length and pressure drop above the assumption of two times the physical length. Actual pressure drop should be calculated for these situations.

Trane recommends sizing the liquid line diameter as small as possible, while maintaining pressure drop within acceptable limits. This will minimize system charge and, therefore, have the general effect of increasing compressor life.

Trane recommends the use of Type L (medium wall) refrigerant tubing. Only refrigeration grade copper tubing should be used since it is available cleaned, dehydrated, and capped to avoid contamination prior to installation. Copper tubing used for plumbing usually has oil, grease, or other contaminants on the interior wall, and these can cause serious operating problems if not removed prior to installation. Tube size recommendations in this manual are based on Type L (medium wall) tubing.

Table 1 - Interconnecting Line Sizes

	LENGTH OF INTERCONNECTING LINES (FEET)							
CONDENSING	0-20		21-40		41-60		61-80	
UNIT	LINE SIZE — O.D. (INCHES)							
UNIT	LIQ.	SUCT.	LIQ.	SUCT.	LIQ.	SUCT.	LIQ.	SUCT.
BTA120D†	3/8	7/8	3/8	1-1/8	1/2	1-1/8	1/2	1-1/8
BTA150D†	3/8	7/8	3/8	1-1/8	1/2	1-1/8	1/2	1-3/8
BTA180D†	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-3/8
BTA180F	5/8	1-3/8	5/8	1-3/8	5/8	1-5/8		

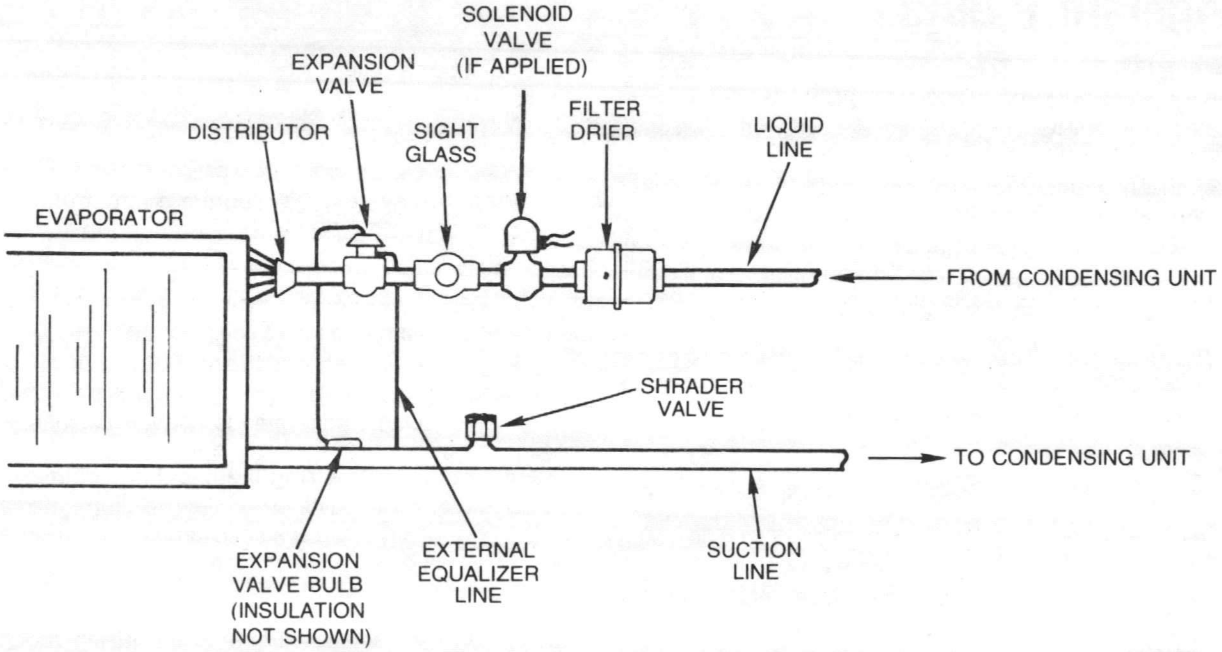
NOTES:
1. For line lengths and risers greater than maximum recommended in table, refer to the Trane Refrigeration Manual.
2. Use type L (medium wall) A.C.R. copper tubing.
†2 line sets required.

Refrigerant Piping Guidelines

A. Maximum recommended line lengths:
Maximum linear length .... 80 Ft.
(w/o accumulator)
Maximum suction line lift .... 60 Ft.
Maximum liquid line lift .... 60 Ft.

B. Maximum allowable pressure drops (R-22):
Suction line .... 3 psi
Liquid line .... 35 psi

Route refrigerant piping for minimum linear length, minimum number of bends and fittings (no reducers) and minimum amount of line exposed to outdoor ambients.



NOTE: INSTALL THE EXPANSION VALVE, SIGHT GLASS, SOLENOID VALVE, AND FILTER DRIER AS CLOSE TO THE EVAPORATOR AS POSSIBLE.

Figure 7 · Diagram of Refrigerant Piping Components in Liquid Line

Liquid Line Components

A properly sized liquid line filter drier must be installed upstream from the expansion valve. In addition, a moisture indicator/sight glass should be installed between the expansion valve and filter drier. Both of these components should be installed at the evaporator close to the expansion valve, as shown in Figure 7.

A shut-off valve (with access port) should be sized with the liquid line O.D. selected, 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.

Liquid line receivers are not recommended on 10 to 15 ton systems since they increase the refrigerant charge.

The following points should be considered when connecting the evaporator to the BTA180F condensing unit.

1. It is recommended that the full evaporator coil be used during low speed compressor operation because of efficiency considerations.
2. In some installations, insufficient moisture removal may result when the full evaporator coil is used with the compressor on low speed.
3. In instances where the importance of moisture removal overrides efficiency considerations, one-half of the evaporator coil capacity can be shut off when the compressor switches to low speed.
4. If solenoid valves are required, they should be installed between the filter drier and sightglass in order to shutoff one-half of the evaporator coil capacity. On units where the solenoid valves are factory installed, the sightglass can be installed between the unit and filter drier. However, all of these components should be installed close to the expansion valve, and no more than one-half of the coil capacity should be shut off.

Suction Line Components

Trane does not recommend the use of suction line accumulators on 10 to 15 ton single compressor units because accumulators of sufficient size and quality are not available.

Suction line filter driers are not recommended as standard components when installing BTA condensing units. They may be necessary on systems that have experienced a compressor burn-out (refer to Trane Service Bulletin No. HCOM-SB-45).

On 10 to 15 ton systens, a suction line shut-off valve installed in the interconnecting tubing has little value, and is not recommended due to pressure drop considerations. Increased suction line pressure drop has a significant effect on system capacity and efficiency.

Risers and Tube Routing

Liquid Line

Liquid line riser lengths are limited only by the additional pressure drop (0.5 psi/ft) which results from the liquid column. No limit exists on the length of liquid line drops, and no special line sloping considerations are necessary.

Normally it is not necessary or desirable to insulate liquid lines. In most applications, the ambient temperature is lower than the refrigerant temperature, and has the desirable effect of increasing subcooling at the expansion valve. However, liquid lines routed through extremely high ambient environments (such as a boiler room) may reduce subcooling below acceptable levels. To minimize this loss, liquid lines passing through extremely warm spaces should be insulated. Increasing the liquid line size only tends to aggravate this problem.

Suction Line

The suction line sizes recommended in Table 1 will result in sufficient refrigerant vapor velocity to ensure good oil entrainment. It is also important to utilize good tube routing practices in order to ensure proper oil return to the compressor.

It is recommended that horizontal suction lines be pitched toward the compressor.

Insulate the suction line with 1/2-inch thick, closed cell neoprene insulation such as armaflex or similar material.

Brazing and Leak Testing

For proper brazing techniques when installing refrigerant piping, refer to "Brazing Procedures" in the MAINTENANCE manual.

After completing the installation of all refrigerant piping, the system should be thoroughly checked for possible leaks. Refer to "Leak Testing" in the MAINTENANCE manual.

Electrical Wiring

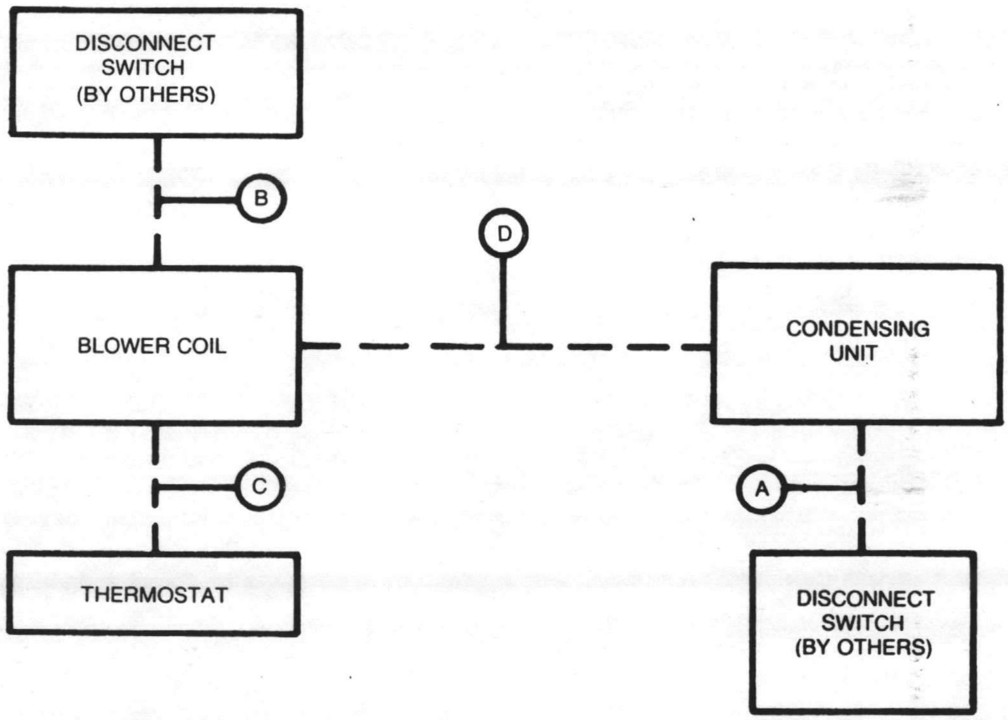
WARNING: OPEN THE ELECTRICAL POWER DISCONNECT SWITCH AND SECURE IN THAT POSITION BEFORE INSTALLING OR SERVICING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK.

Install all field wiring, including the unit electrical ground, in accordance with the National Electrical Code and applicable local codes. Figure 8 provides a block diagram of the electrical connections to be made by the customer or installing contractor.

NOTE: *When connecting wires at the terminal block, make sure that all lugs are tight. Also check the terminal block and compressor contactor lugs that were wired at the factory.*

The unit wiring diagram is pasted on the back of the control box cover. Refer to Figures 1 and 2 for the locations of holes provided for electrical conduit entry on the unit. The locations of the electrical panel components are shown on the unit wiring diagram.

Table 2 lists the electrical characteristics for BTA120D to BTA180D, BTA180F units.



FIELD WIRING WHEN USED WITH A BACA UNIT:

A — 3 power wires, line voltage

B — 3 power wires, line voltage

C — Cooling only thermostat: 4 wires, 24 volts

— One-stage electric heat: add 1 additional wire, 24 volts

— Two-stage electric heat: add 2 additional wires, 24 volts

D — 4 wires, 24 volts

NOTE: Wiring shown with dash lines is to be furnished and installed by the customer. All customer-supplied wiring must be copper only and must conform to NEC and local electrical codes. Codes may require line of sight between disconnect switch and unit.

Figure 8 · Electrical Connections by Customer

Table 2 - Electrical Characteristics for BTA120D to BTA180D, BTA180F Units

	Unit Characteristics					Compressor Motor				Condenser Fan Motor			
Model	7 Electrical Characteristics	Allowable Voltage	3.6 Min. Circuit Range	2.6 Max. Fuse Amp.	4.6 Recm'd Dual Element Fuse Size	No.	1 RLA (Ea)	1 LRA (Ea)	1.5 KW (Ea)	NO/ HP	1 FLA (Ea)	1 LRA (Ea)	1.5 KW (Ea)
BTA120D300	208-230/60/3	187-254	53	70	60	2	19.0	115	6.0	2/.75	5.0	11.0	0.77
BTA120D400	460/60/3	416-508	29	35	35	2	10.6	50	6.0	2/.75	2.7	5.5	0.77
BTA120DW00	575/60/3	520-536	23	30	25	2	8.5	45	6.0	2/.75	1.8	4.4	0.77
BTA150D300	208-230/60/3	187-254	65	80	80	2	23.6	142	7.3	3/.50	4.1	9.5	0.60
BTA150D400	460/60/3	416-508	30	40	35	2	10.7	71	7.3	3/.50	2.1	4.8	0.60
BTA150DW00	575/60/3	520-635	24	30	30	2	8.6	57	7.3	3/.50	1.6	3.8	0.60
BTA180D300	208-230/60/3	187-254	73	100	80	2	27.1	156	8.9	3/.50	4.1	9.5	0.62
BTA180D400	460/60/3	416-508	34	45	40	2	12.3	79	8.9	3/.50	2.1	4.8	0.62
BTA180DW00	575/60/3	520-635	27	35	30	2	9.9	63	8.9	3/.50	1.6	3.8	0.62
BTA180F300	208-230/60/3	187-254	83	125	100	1	56.4	248	17.8	3/.50	9.5	9.5	0.62
BTA180F400	460/60/3	416-508	42	60	50	1	28.2	124	17.8	3/.50	4.8	4.8	0.62
BTA180FW00	575/60/3	520-635	33	50	40	1	22.6	100	17.8	3/.50	3.8	3.8	0.62

NOTES:
1. Electrical information is for each individual motor.
2. Maximum fuse size permitted by N.E.C. 440-22 is 225% of one compressor motor RLA plus the total RLA of the remaining motors in the circuit.
3. Minimum circuit ampacity is 125% of the RLA of one compressor motor plus the total RLA of the remaining motors in the circuit.
4. Recommended dual element fuse size is 150% of the RLA of one compressor motor plus the total RLA of the remaining motors in the circuit.
5. KW values are taken at conditions of 45 F saturated suction temperature at the compressor and 95 F ambient.
6. Local codes may take precedence.
7. Allowable range at unit terminal block.
8. Data given at high speed.

CAUTION: Use only copper conductors for supply power power wiring. Do not use aluminum conductors. Unit terminals are not designed to accept other than copper conductors.

NOTE: *For 208 volt operation, reconnect the control power transformer as shown on the unit wiring diagram. Cap the unused transformer lead with a wire nut.*

Fuses

Refer to the unit wiring diagram pasted on the inside of the control box cover for condenser fan and control circuit fuse specifications.

Thermostat Installation

Recommended wire sizes and lengths for installing the unit thermostat are provided in Table 3. The total resistance of these low voltage wires must not exceed one ohm. Any resistance in excess of one ohm may cause the control circuit to malfunction.

When selecting a thermostat location, be sure to choose a site in a frequently occupied area with good air circulation at an average temperature. The thermostat should be positioned approximately five feet above the floor and **must be level.**

Avoid mounting the thermostat in areas subject to the following:
— drafts or "dead" spots behind doors or in corners;
— hot or cold air from ducts;
— radiant heat from the sun, or from appliances;
— concealed pipes and chimneys;
— unheated or uncooled surfaces behind the thermostat, such as outside walls;
— in an area where the thermostat will be affected by a unit in another zone.

CAUTION: If an energy management device, time clock, or other power consuming device is used, a separate power supply must be provided for that device. Do not use the unit control circuitry, or damage to the unit may result.

Table 3 - Recommended Thermostat Wire Size

WIRE SIZE	MAXIMUM WIRE LENGTH
22 Gauge	30 Ft.
20 Gauge	50 Ft.
18 Gauge	75 Ft.
16 Gauge	125 Ft.
14 Gauge	200 Ft.

Table 4 - Air Handler Motor Electrical Data

Unit Model Number	Unit Electrical Characteristics	No. of Motors	Hp (Ea.)	Speed (Rpm)	FLA		LRA	
					200/230V	460V	200/230V	460V
BWE090C100E	200-230/60/1	1	1	3450	6.3	—	45.0	—
BWE090C400E	200-230 & 460/60/3	1	1	1725	3.8	1.9	21.2	10.6
BWE120C100E	200-230/60/1	1	2	3450	11.5	—	61.0	—
BWE120C400E	200-230 & 460/60/3	1	1½	1725	5.0	2.5	37.4	18.7
BTE120C100E	200-230/60/1	1	2	3450	11.5	—	61.0	—
BTE120C400E	200-230 & 460/60/3	1	1½	1725	5.0	2.5	37.4	18.7

Table 5 - BWH and BWV Unit Electrical Data

Unit Model Number	Unit Characteristics		Indoor Fan Motor			
	Electrical Characteristics	Voltage Utilization Range	No. Req'd.	Hp (Ea.)	Speed (Rpm)	FLA
BWH180B300C BWV180B300C	200-230/60/3	180-254	1	3	1725	9.0
BWH180B400C BWV180B400C	460/60/3	414-506	1	3	1725	4.4
BWH240B300C BWV240B300C	200-230/60/3	180-254	1	5	1725	15.2
BWH240B400C BWV240B400C	460/60/3	415-506	1	5	1725	6.6

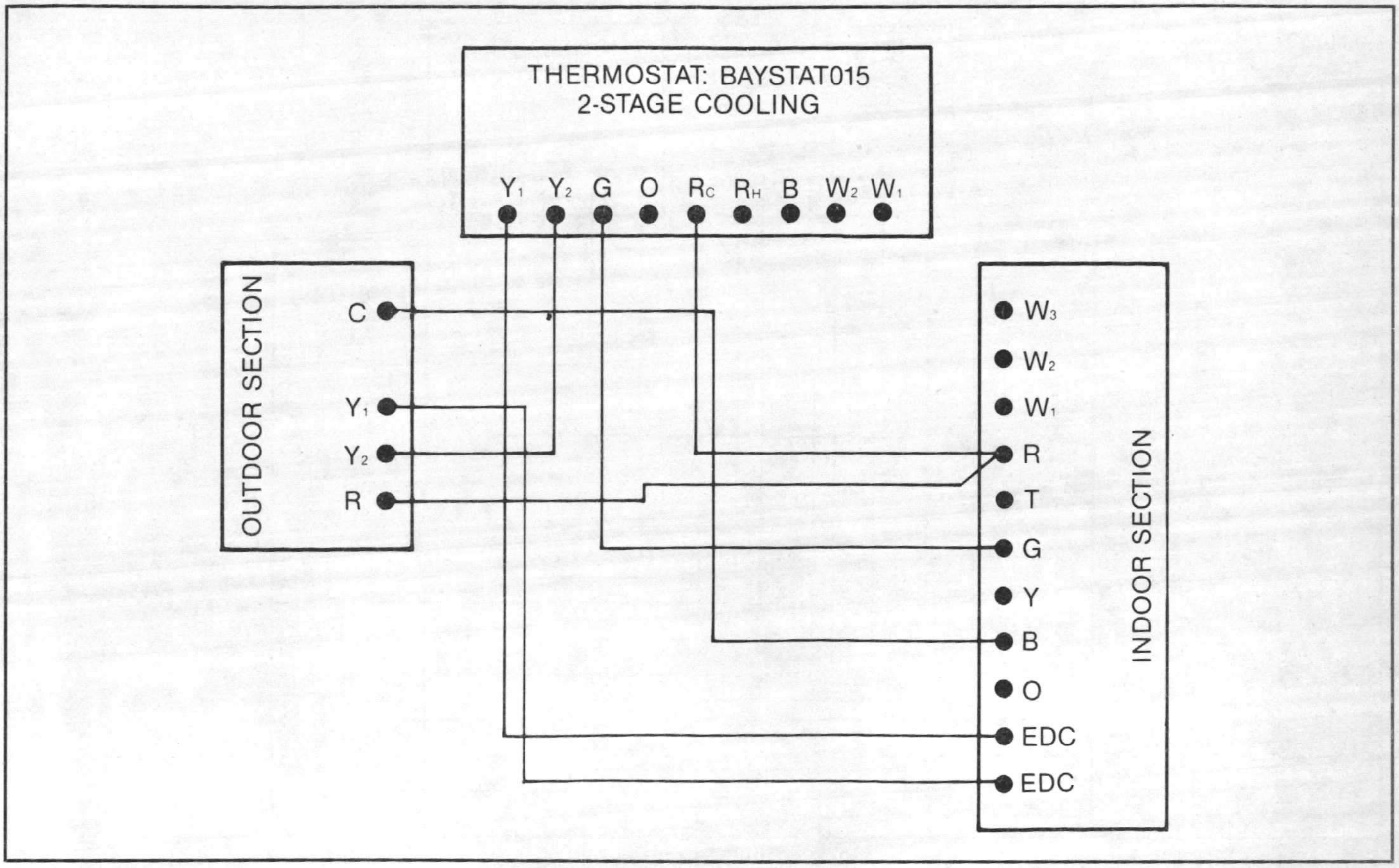


Figure 9 · Field Wiring for BTA120D with BTE120B Air Handler No Electric Heat

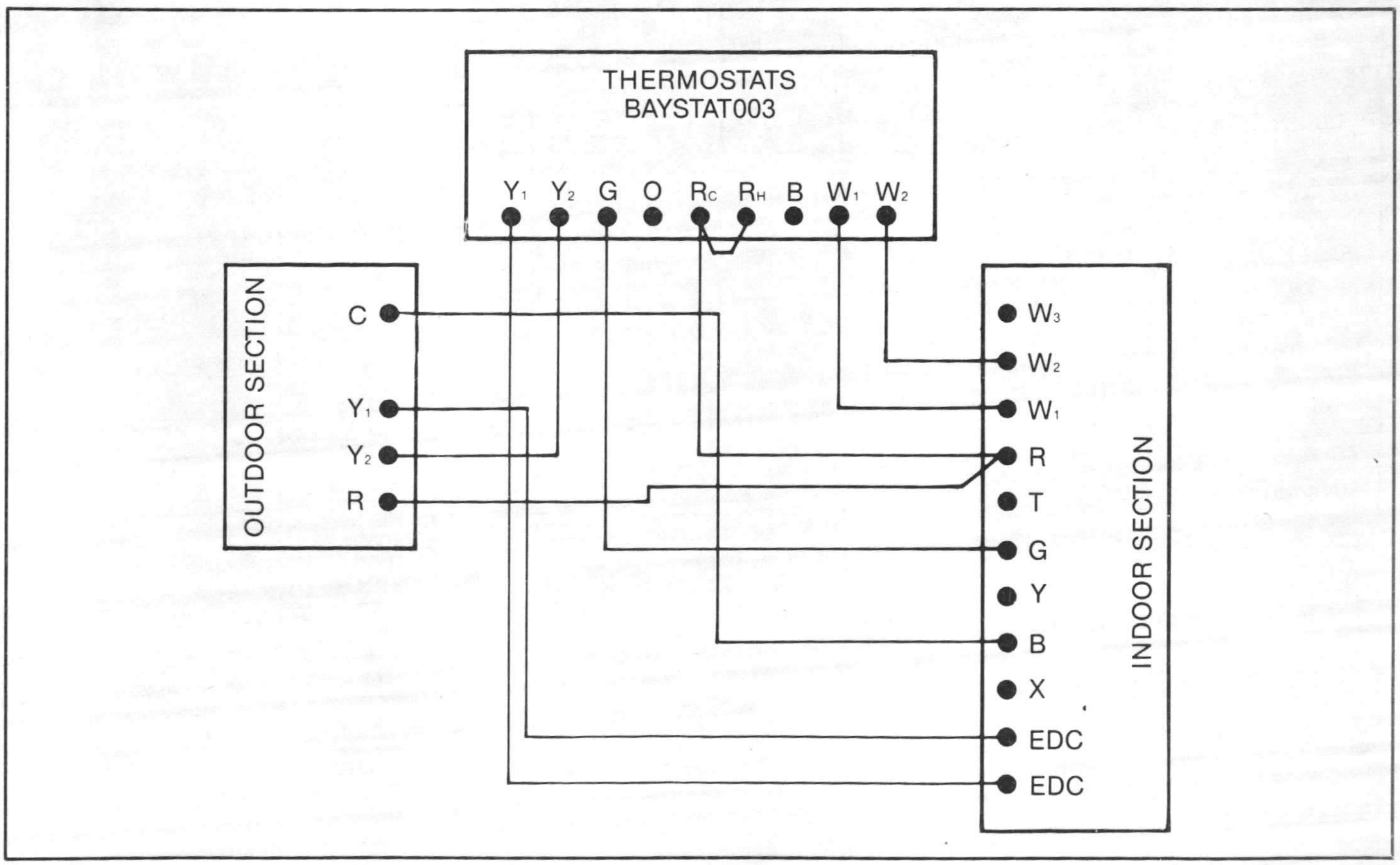


Figure 10 · Field Wiring for BTA120D with BTE120B Air Handler With Electric Heat

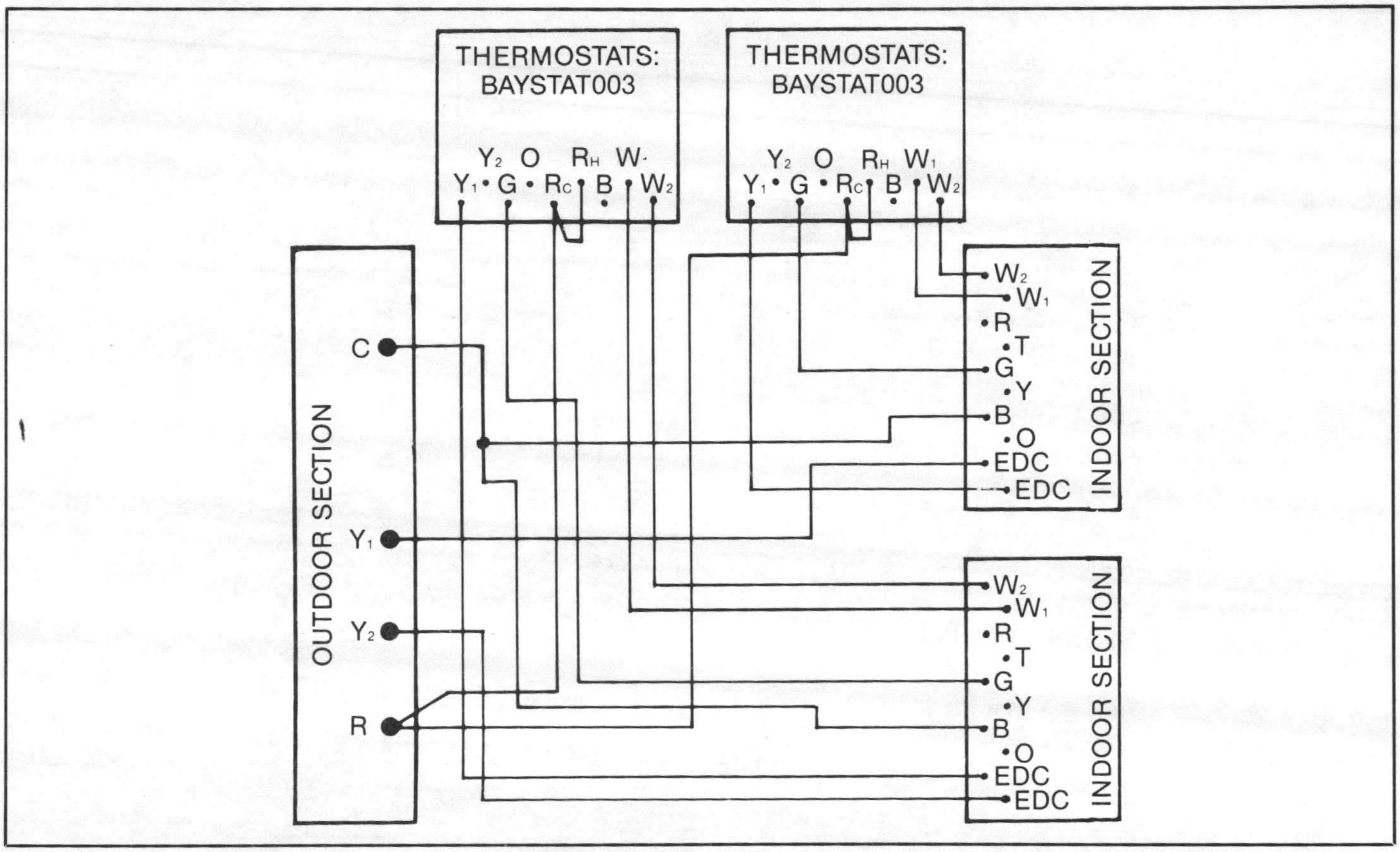


Figure 11 · Field Wiring for BTA150D and BTA180D With Two (2) BWE090C Air Handlers With Electric Heat

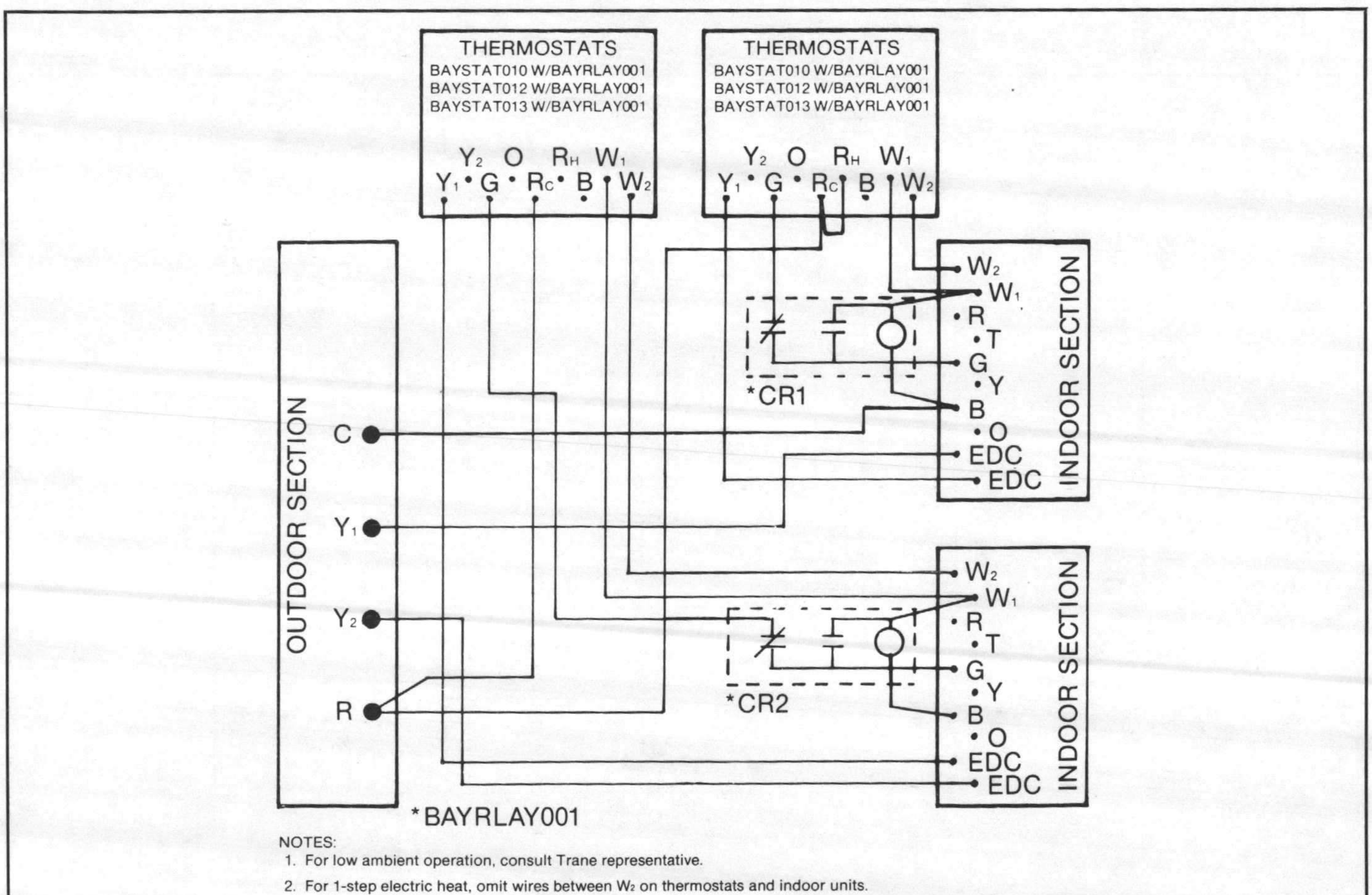
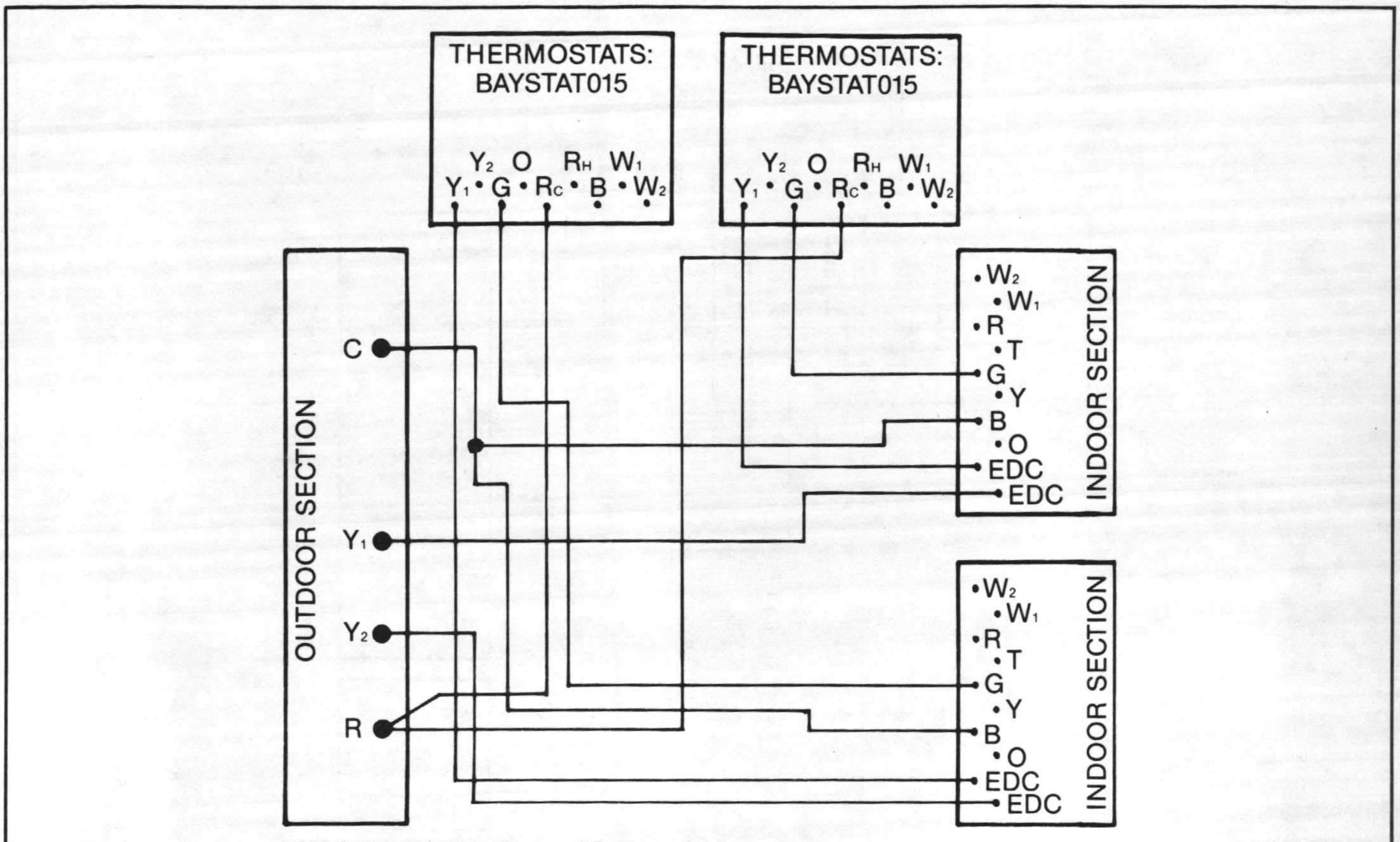


Figure 12 · Field Wiring for BTA150D and BTA180D With Two (2) BWE090C Air Handlers



NOTE: For low ambient operation, consult Trane representative.

Figure 13 - Field Wiring for BTA150D and BTA180D With Two (2) BWE090C Air Handlers Without Electric Heat

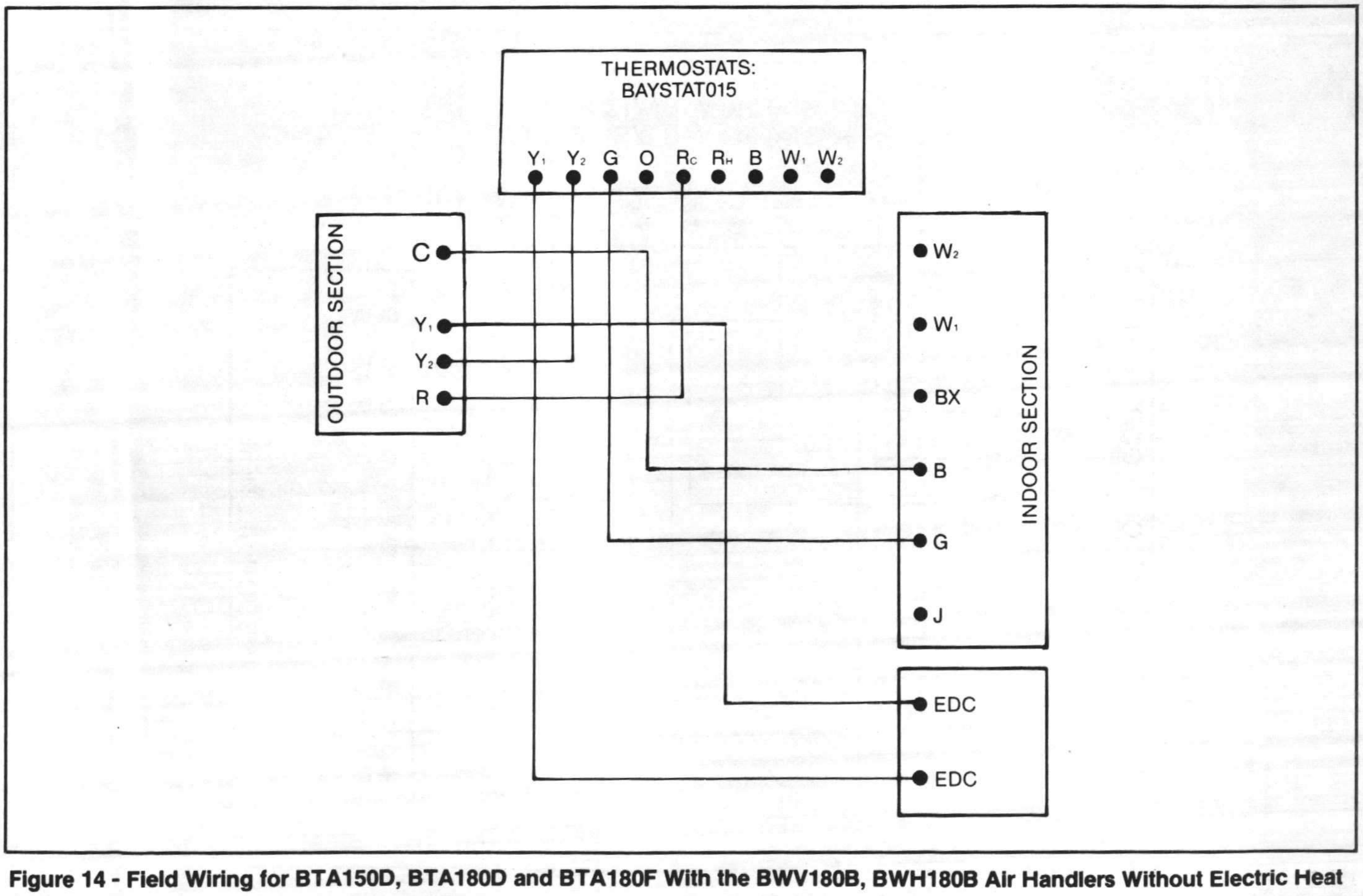


Figure 14 - Field Wiring for BTA150D, BTA180D and BTA180F With the BWV180B, BWH180B Air Handlers Without Electric Heat

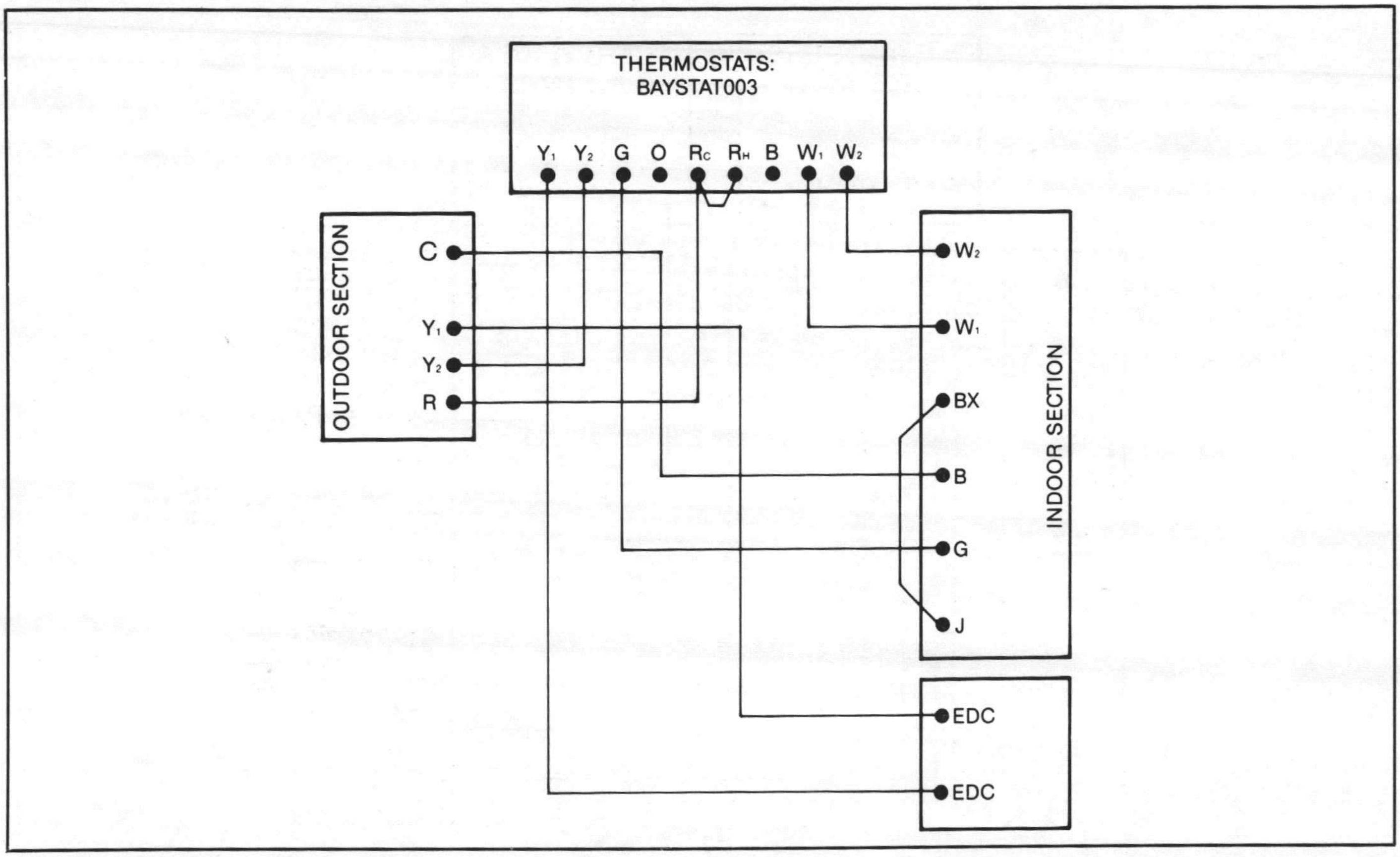


Figure 15 - Field Wiring for BTA150D, BTA180D and BTA180F With the BWV180B, BWH180B Air Handlers With Electric Heat

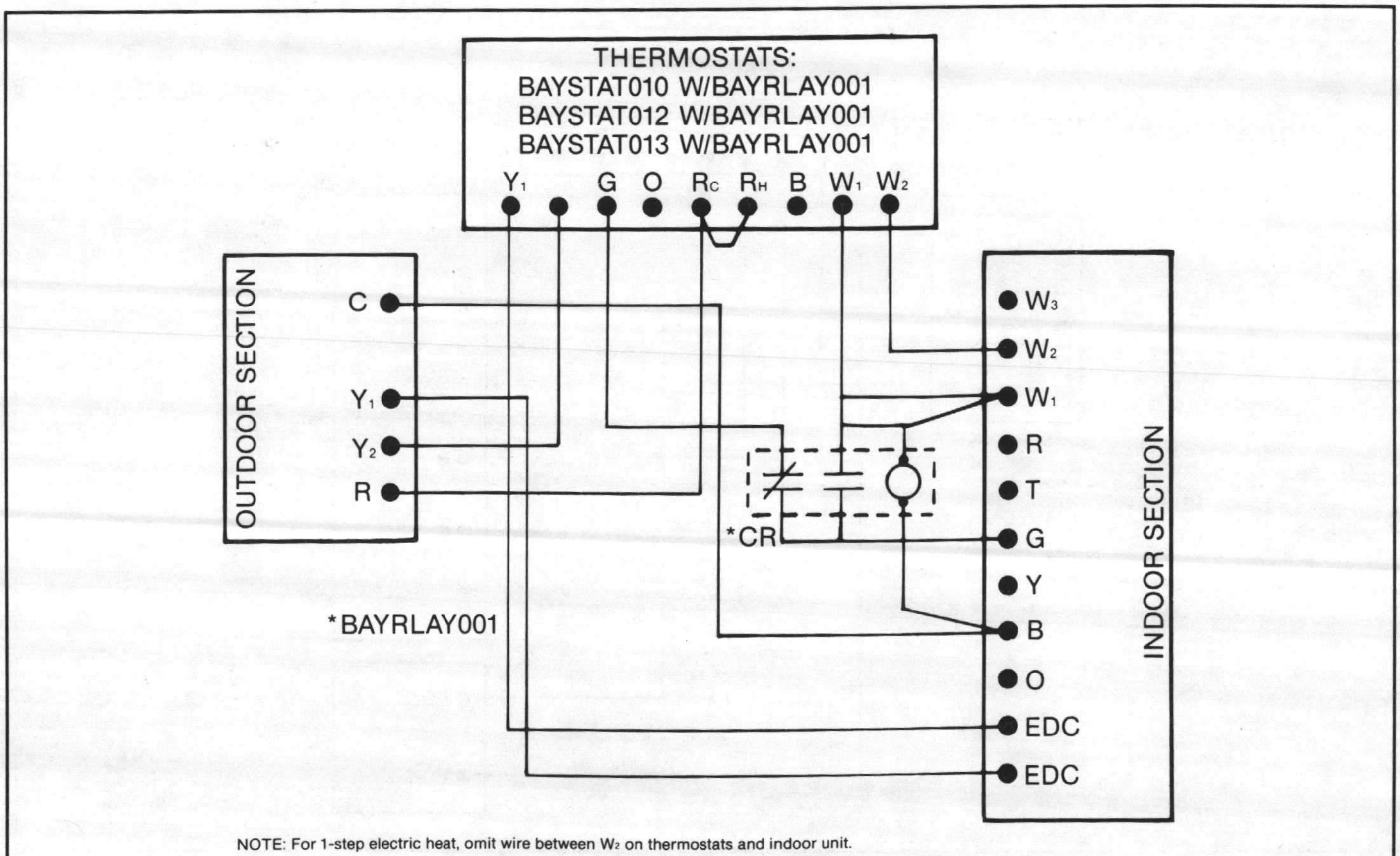


Figure 16 - Field Wiring for BTA120D With BTE120B Air Handler

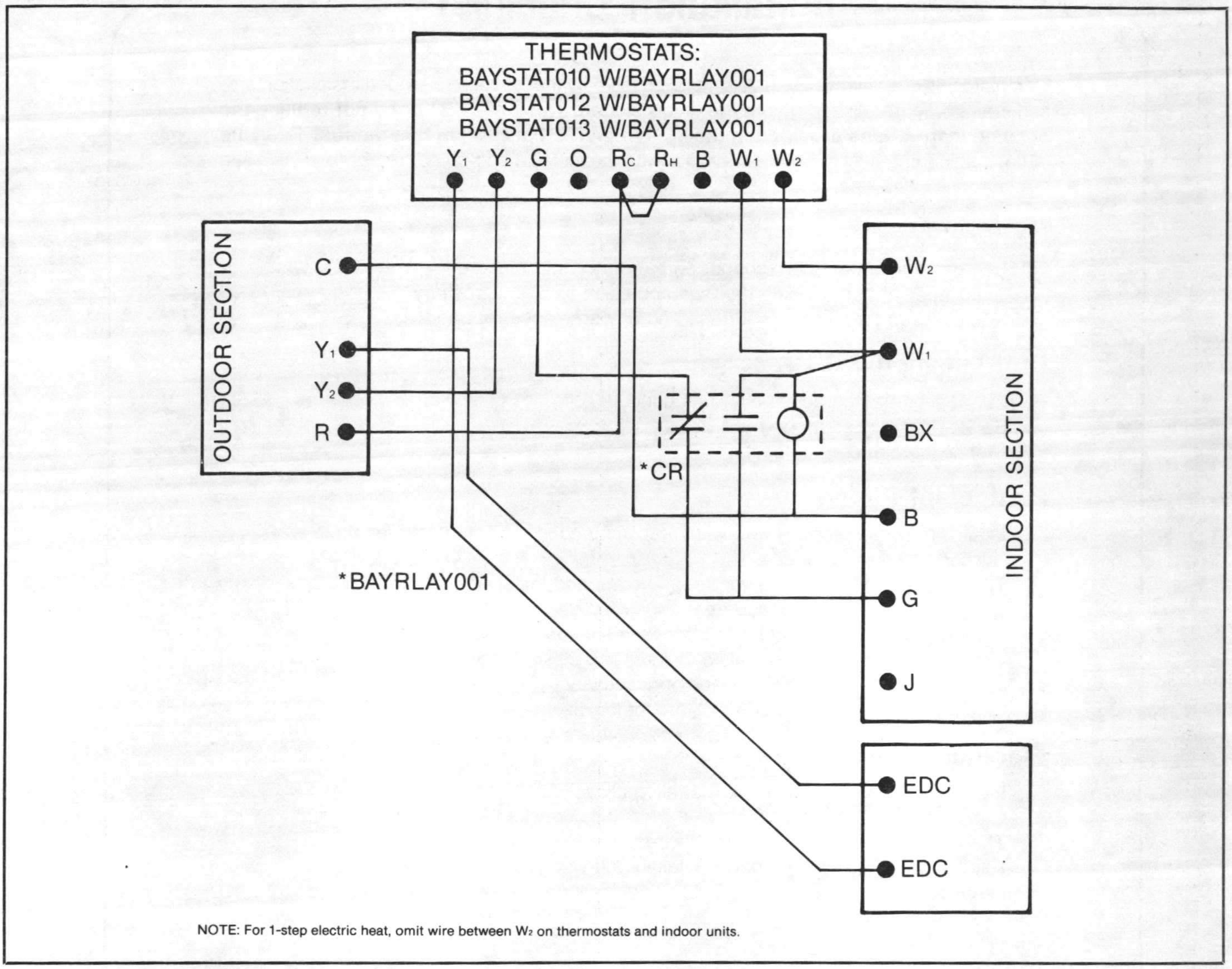


Figure 17 - Field Wiring for BTA150D, BTA180D and BTA180F With the BWV180B, BWH180F Air Handlers

Installation Checklist

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

Receiving

- ☐ Unit nameplate data corresponds with ordering information.
- ☐ Unit inspected for shipping damage and claim filed, if necessary.
- ☐ Unit checked for material shortage and any shortages reported.

Unit Location

- ☐ Condenser air clearances over unit good.
- ☐ Service clearances around unit good.
- ☐ Unit secured in correct location.

Refrigerant Piping

- ☐ Liquid line sized properly and within recommended maximum line length.
- ☐ Suction line sized properly.
- ☐ Thermostatic expansion valve properly sized and installed close to evaporator.
- ☐ Liquid line filter drier installed near expansion valve.
- ☐ Sight glass installed in liquid line between evaporator and filter drier.
- ☐ Liquid line access valve installed in liquid line close to condenser.
- ☐ Low ambient accessories installed, if necessary.
- ☐ Check all unit and piping connections for leaks.

Electrical Wiring

- ☐ Field installed wiring complies with all applicable codes.
- ☐ Compressor contactor and terminal block lugs checked for tightness.
- ☐ Thermostat properly mounted and wired.
- ☐ Any other accessories properly installed and wired.
- ☐ Grounding wires securely bonded to earth ground.

Start-Up

Pre-Start Checks

Before starting the unit, complete the procedures outlined below to make sure the unit is properly installed and ready for start-up.

WARNING: OPEN THE UNIT DISCONNECT SWITCH AND LOCK IT IN THAT POSITION TO PREVENT ACCIDENTAL START-UP. NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE THE UNIT WITHOUT FIRST OPENING THE DISCONNECT SWITCH. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

☐ 1. Inspect all electrical connections to be sure that the wires are securely attached to their terminals. Make sure that all wires are clear of any rotating parts, such as fan blades.

☐ 2. Check the condenser and evaporator fans. Fan blades must be secure on the motor shafts and must rotate freely. Airflow must be unobstructed.

☐ 3. Make sure the evaporator air filters are clean.

☐ 4. Check the evaporator and condenser coils to ensure that they are clean, that the fins are straight, and that there are no obstructions to airflow.

☐ 5. Check the voltage at the line side of the disconnect switch. It should be within 10 percent of the unit nameplate voltage.

Evacuation

After completing the "Pre-Start Checks," use a vacuum pump to remove air, moisture, and contaminants from the system. The system should be evacuated to a pressure of 500 microns or less. Refer to "Evacuation Procedures" in the MAINTENANCE manual.

Refrigerant Charging

With the system properly evacuated, determine the required charge of Refrigerant-22 and charge the system as outlined under "Refrigerant Charging" in the MAINTENANCE manual.

Oil Charge

The compressors on BTA120D to BTA180D, BTA180F units ship with a sufficient oil charge for systems that stay within the maximum line lengths listed in Table 1. As long as the maximum line length is not exceeded, the compressor will have adequate oil.

Initial Start-Up

Normally it is not necessary to energize the crankcase heater prior to intital start-up. However, if more than 30 minutes passes between refrigerant charging and initial start-up, a significant amount of refrigerant could migrate to the compressor. When there is a time lapse between charging and start-up, the crankcase heater should be energized for a minimum of eight hours before starting the unit.

CAUTION: Failure to energize the crankcase heater and wait eight hours before starting the unit may result in excessive foaming at start-up and possible damage to the compressor bearings.

Set the room thermostat as follows to start the unit:

1. Turn the thermostat selector switch to either COOL or AUTO, depending on the thermostat;
2. Place the thermostat fan switch in the AUTO position;
3. Set the thermostat at a point below room temperature.

The unit will operate automatically in response to cooling needs, as determined by the thermostat setting.

Compressor Motor Checks

With the compressor operating, check the amp draw. The amperage should not exceed the "Maximum Allowable Amps" listed in Table 7. The amp draw may be less than the value listed in the table.

Voltage at the compressor terminals must be within the "Allowable Voltage Range" listed in Table 7. If not, check the voltage at the unit terminal block and at the disconnect switch to determine if voltage problems are being caused by feeder line, loose terminals, or defective unit wiring.

Table 7 - Maximum Allowable Amp Draw

Condensing Unit	Electrical Characteristics	Allowable** Voltage Range	Max. Allowable Amps Matched Evap.	Oversized* Evap.
BTA120D300	208-230/60/3	187-253	24	—
BTA120D400	460/60/3	416-506	11	—
BTA120DW00	575/60/3	520-635	9	—
BTA150D300	208-230/60/3	187-253	—	30
BTA150D400	460/60/3	416-506	—	13
BTA150DW00	575/60/3	520-635	—	11
BTA180D300	208-230/60/3	187-253	31	36
BTA180D400	460/60/3	416-506	14	16
BTA180DW00	575/60/3	520-635	11	13
BTA180F300	208-230/60/3	187-254	66	67
BTA180F400	460/60/3	416-508	33	34
BTA180FW00	575/60/3	520-635	27	27

*Evaporator one size larger than condensing unit.
**Allowable voltage range at the unit terminal block.
***Compressor operating at high speed.

Voltage Imbalance Check

Voltage imbalance on three phase systems can cause motor overheating and eventual failure. Maximum allowable imbalance is two percent, which must be measured at the compressor terminals. Voltage imbalance is defined as 100 times the maximum deviation of the three voltages from the average, without regard to sign, divided by the average voltage. For example, if the three measured voltages are 221, 230 and 227, the average voltage would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ volts}$$

and the percent voltage imbalance would be:

$$\frac{100 \times (226-221)}{226} = 2.2\%$$

In this example, 2.2 percent imbalance is not acceptable and could result in as much as 20 percent current imbalance. This will increase the motor winding temperature, and thus decrease the life of the motor.

If more than 2.0 percent imbalance exists, check the voltage readings at the disconnect switch to determine if the imbalance is present in the incoming power lines. If so, the power company should be notified to correct it. If the imbalance is due to problems within the unit, check the unit electrical wiring connections.

Operating Pressures

Install pressure gauges on the discharge and suction line access valves next to the compressor. When the unit reaches stabilized operation, suction and discharge pressures can be read. Refer to "Operating Pressures" in the MAINTENANCE manual to compare the measured pressures with the normal system operating pressures.

Start-Up Log

DATE ____________

I. NAMEPLATE INFORMATION

Model No. ____________ Serial No. ____________

Voltage ____________ RLA ____________

II. COMPRESSOR(S)

A. VOLTAGE AT COMPRESSOR TERMINALS

Comp. No. 1: T1 ________ T2 ________ T3 ________

Comp. No. 2: T1 ________ T2 ________ T3 ________

Voltage Imbalance: Comp. No. 1 ________ Comp. No. 2 ________

B. AMP DRAW

Comp. No. 1: L1 ________ L2 ________ L3 ________

Comp. No. 2: L1 ________ L2 ________ L3 ________

III. OPERATING CONDITIONS

A. COMPRESSOR NO. 1

Discharge Pressure ________ Suction Pressure ________

Liquid Line Pressure ________ Suction Line Temp. ________

Liquid Line Temp. ________ Superheat ________

Subcooling ________ Evap. Entering Air Temp. (DB/WB) ________

Ambient Temp. ________ Evap. Discharge Air Temp. (DB/WB) ________

B. COMPRESSOR NO. 2

Discharge Pressure ________ Suction Pressure ________

Liquid Line Pressure ________ Suction Line Temp. ________

Liquid Line Temp. ________ Superheat ________

Subcooling ________ Evap. Entering Air Temp. (DB/WB) ________

Ambient Temp. ________ Evap. Discharge Air Temp. (DB/WB) ________

IV. CONTROLS

Fans Operating (Yes or No): Fan No. 1 ________ No. 2 ________ No. 3 ________

Crankcase Heater Operating (Yes or No): Comp. No. 1 ________ Comp. No. 2 ________

V. REFRIGERANT PIPING

Evacuation Level ________ System Charge ________

The Trane Company
Light Commercial Group
Guthrie Highway
Clarksville, TN 37040

AN AMERICAN—
STANDARD
COMPANY

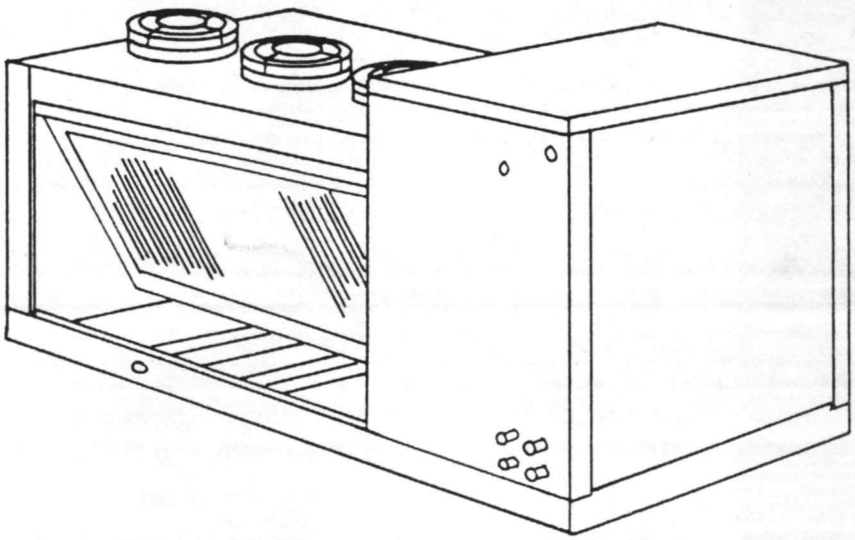
BTA-M-3

OPERATION/MAINTENANCE GUIDE

Split System Condensing Units

Library	Service Literature
Product Section	Unitary
Product	Split System
Model	BTA
Literature Type	Operation/Maintenance
Sequence	3
Date	December 1986
File No.	SV-UN-S/S-BTA-M-3 12/86
Supersedes	New

Models
BTA120D-AB
BTA150D-AB
BTA180D-AB
BTA180F-AB



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.

22-5327-1

Table of Contents

Unit Model Number Description

Trane LCG products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of this multiple-character number is shown below. It will enable the owner or Service Engineer to define operation, components and applicable accessories for a specific unit.

LCG Unit Model Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12
B	T	A	1	2	0	D	3	0	0	A	A

Always "B"

Product Type

TA = Split System Cooling, Outdoor Unit

WE = Split System Cooling or Heat Pump, Convertible Indoor Unit

WV = Split System Cooling or Heat Pump, Verticle Indoor Unit

WH = Split System Cooling or Heat Pump, Horizontal Indoor Unit

Cooling Capacity (MBH)

090 = 90 MBH
120 = 120 MBH
180 = 180 MBH
240 = 240 MBH

Major Design Sequence

Electrical Characteristics

3 = 208-230/60/3
4 = 460/60/3
W = 575/60/3

Secondary Capacity and/or Factory Installed Options

00 = Not Used

Minor Design Sequence

Service Digit

General Information

Periodic Maintenance checklists are provided at the beginning of the MAINTENANCE manual for performing recommended maintenance. These checklists should not be substituted for the detailed information given in appropriate sections of this manual.

A Maintenance Log at the end of the "Periodic Maintenance" section enables the operator/serviceman to maintain a record of system operating data.

Operation

Electrical Sequence of Operation

The typical wiring diagrams provided in Figures 1 and 2 should be used only as a reference for the following discussion. For the actual wiring of your specific unit, refer to the wiring diagram pasted on the inside of the unit's control box cover.

System operation is controlled by a two-stage thermostat, depending upon the number of compressors in the system. Closing the unit disconnect switch supplies power to the control power transformer (T1), the compressor crankcase heaters (CCH1 and CCH2), and the line side of all control contactors.

Depending on the thermostat selected, it may be possible to operate the evaporator fan independently of the compressors by placing the thermostat fan switch in the ON position. This energizes the evaporator fan contactor, starting the fan. If the thermostat has a separate fan switch, moving that switch to the AUTO position will cause the evaporator fan to start in conjunction with the compressor whenever the thermostat calls for cooling.

Dual Compressor Operation

Sensing a need for cooling, the first stage cooling contacts of the thermostat will close. This supplies power to the compressor contactor solenoid coil (CC1), provided that the high pressure control, low pressure control, and reset relay contacts are closed.

The contacts of the compressor contactor close, energizing the first stage compressor, provided that the compressor internal motor winding thermostats are closed.

The compressor has only two leads broken by the compressor contactor. The third leg of the contactor energizes the condenser fan motors. The outdoor temperature determines the number of condenser fans that will start. A fan limit control (FLT) is electrically positioned between both fans #1 and #2 and fans #2 and #3. Depending on the position of these controls, one or more fans may start.

As the cooling load increases, the second stage contacts of the thermostat will close. This supplies power to the solenoid coil of the second stage compressor contactor (CC2), staring the second compressor.

Single Compressor, 2-Speed Operation

Sensing a need for cooling, the first stage cooling contacts of the thermostat will close. Assuming that no safety controls have tripped, this supplies power to the low speed compressor contactor coil (CCS) and outdoor fan relay coil (ODR). Safety controls in this circuit include the high pressure control (HPC), low pressure control (LPC), reset relay (RR), and compressor motor protection module (CMPM).

NOTE: *The compressor contactor cannot be re-energized on the BTA180F for four minutes after winding temperatures have returned to normal following cut-out on excessive temperature, current overload, or power interruption to Terminal T1 of the compressor motor protection module. This provides an anti-short cycle feature on the standard unit. The compressor cannot be re-energized for four minutes following termination of the cooling cycle. This is an option on the dual compressor units.*

Energizing the compressor contactor coil (CCS) closes the CCS contacts in the power circuit, and starts the compressor on low speed. Concurrently, outdoor fan relay coil ODR is energized. This starts the outdoor fan motor(s) by closing the ODR contact in the power circuit. The total number of condenser fans which will operate is dependent upon the outdoor ambient and the resulting position of the FLT switches (see Figure 2).

As the cooling load increases, the second stage contacts of the thermostat will close. This supplies power to the control relay coil (CR), which opens one set of contacts and closes the other on this single-pole, double-throw relay. This, in turn, de-energizes the low speed compressor contactor coil (CCS) and supplies power to the "tie point" compressor contactor coil (CCT) through normally closed auxiliary contacts CCS located in the control circuit. Auxiliary control circuit contacts CCT then close, and power is supplied to the high speed compressor contactor coil (CCF). After the low speed compressor contactor contacts (CCS) in the power circuit open, both the "tie point" and high speed compressor contactor contacts (CCT and CCF) close and the compressor motor switches from low to high speed.

It should be noted that the dual compressor contactor is both mechanically and electrically interlocked in order to protect the compressor motor from having both low and high speed windings energized at the same time. Electrically, this is accomplished with a normally closed auxiliary side switch (CCS) on the "tying" compressor contactor coil (CCT), and a double-pole, double-throw auxiliary side switch (CCT) on both the high and low speed compressor contactor coils (CCF and CCS). See Figures 3 and 4 for further details on this electrical connection.

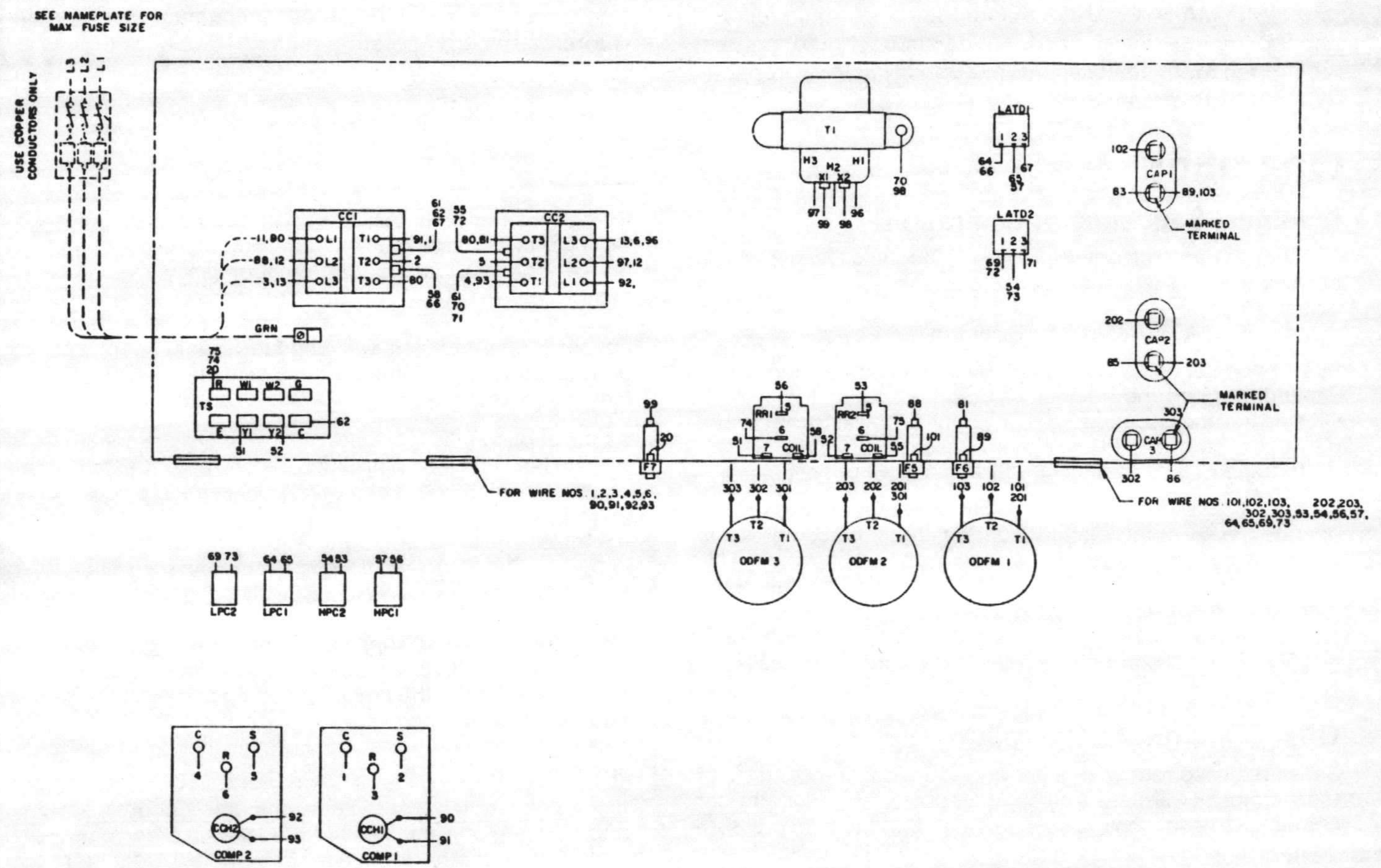
Normally, the compressor will start and operate on low speed before switching to high speed. However, the compressor can start on high speed if the difference between the thermostat setting and the space temperature is great enough. This will be the case in a "pull-down" situation where the unit has been disconnected from normal thermostat control for an extended period of time. It will also occur if the thermostat setting is lowered substantially while the system is off.

NOTE: *The compressor may not start in low speed when a differential pressure greater than 180 psig exists between the high and low side of the refrigerant circuit.*

BTA compressors include two-pole/four-pole motor hookup capability for two speed operation. The compressor operates at approximately 3500 RPM on high speed (two-pole), and at 1750 RPM on low speed (four-pole).

To achieve two speed operation, the motor windings are switched between a parallel connected (high speed) and series connected (low speed) motor winding through the use of low speed, high speed, and tie point contacts on the compressor contactor. This is shown in Figure 3 (high speed) and Figure 4 (low speed).

CAUTION: Extreme care must be taken when making wiring connections in the compressor terminal box. Incorrect hookup can result in immediate compressor failure when power is applied.



(CONTINUED ON NEXT PAGE)

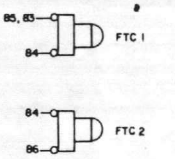
LEGEND	
COMP	COMPRESSOR
CC	COMPRESSOR CONTACTOR
ODFM	OUTDOOR FAN MOTOR
TS	TERMINAL STRIP
TI	TRANSFORMER
F	FUSE
CAP	CAPACITOR
RR	RESET RELAY
HPC	HIGH PRESSURE CONTROL
CCH	CRANKCASE HEATER
LPC	LOW PRESSURE CONTROL
LATD	LOW AMBIENT TIME DELAY
FLT	FAN LIMIT T-STAT

TRANE FORM NO. 6-3563

Figure 1 - Typical Unit Wiring Diagram (Dual Compressor Unit Shown)

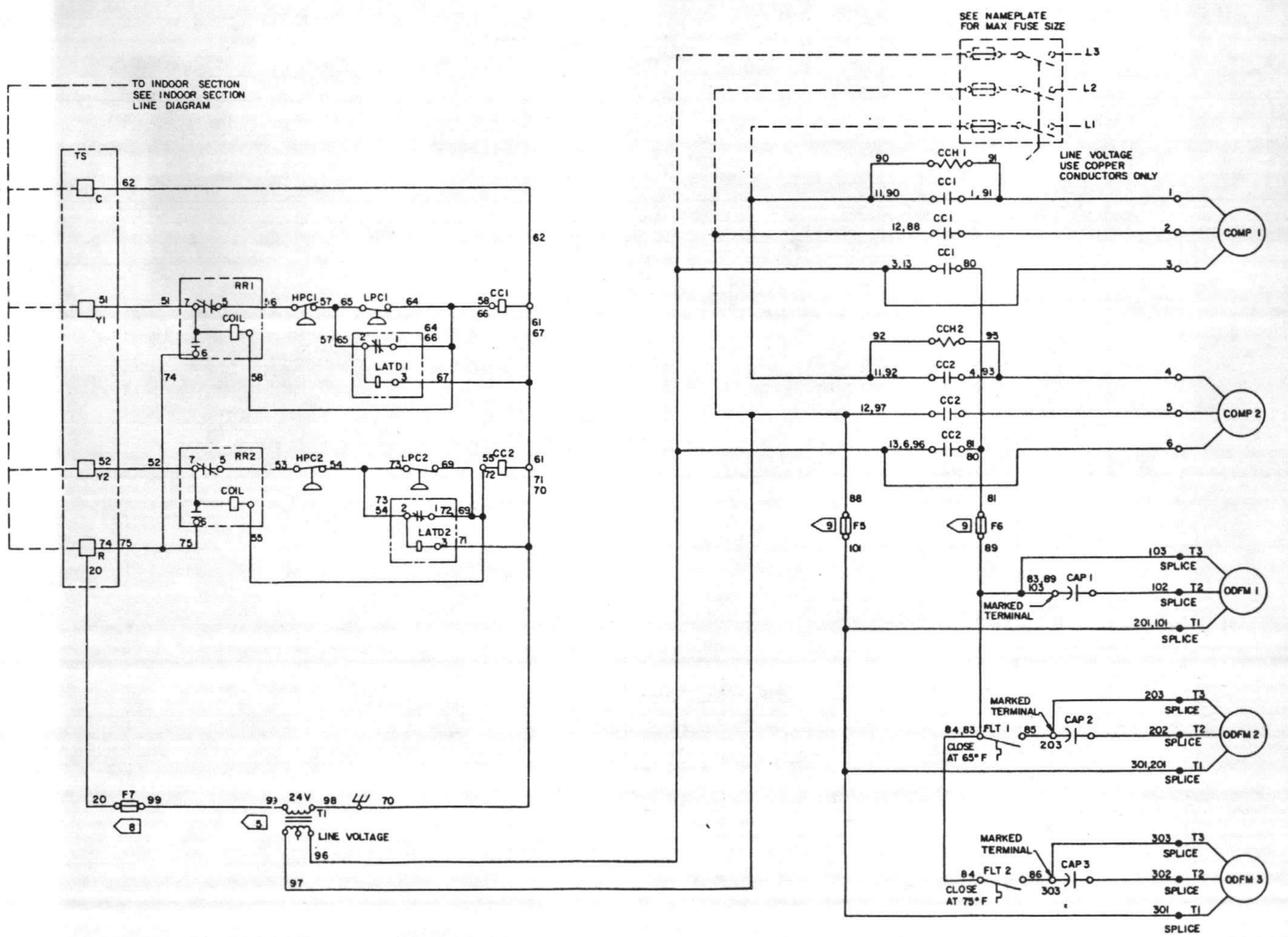
WARNING
DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION
USE COPPER CONDUCTORS ONLY TO PREVENT EQUIPMENT DAMAGE

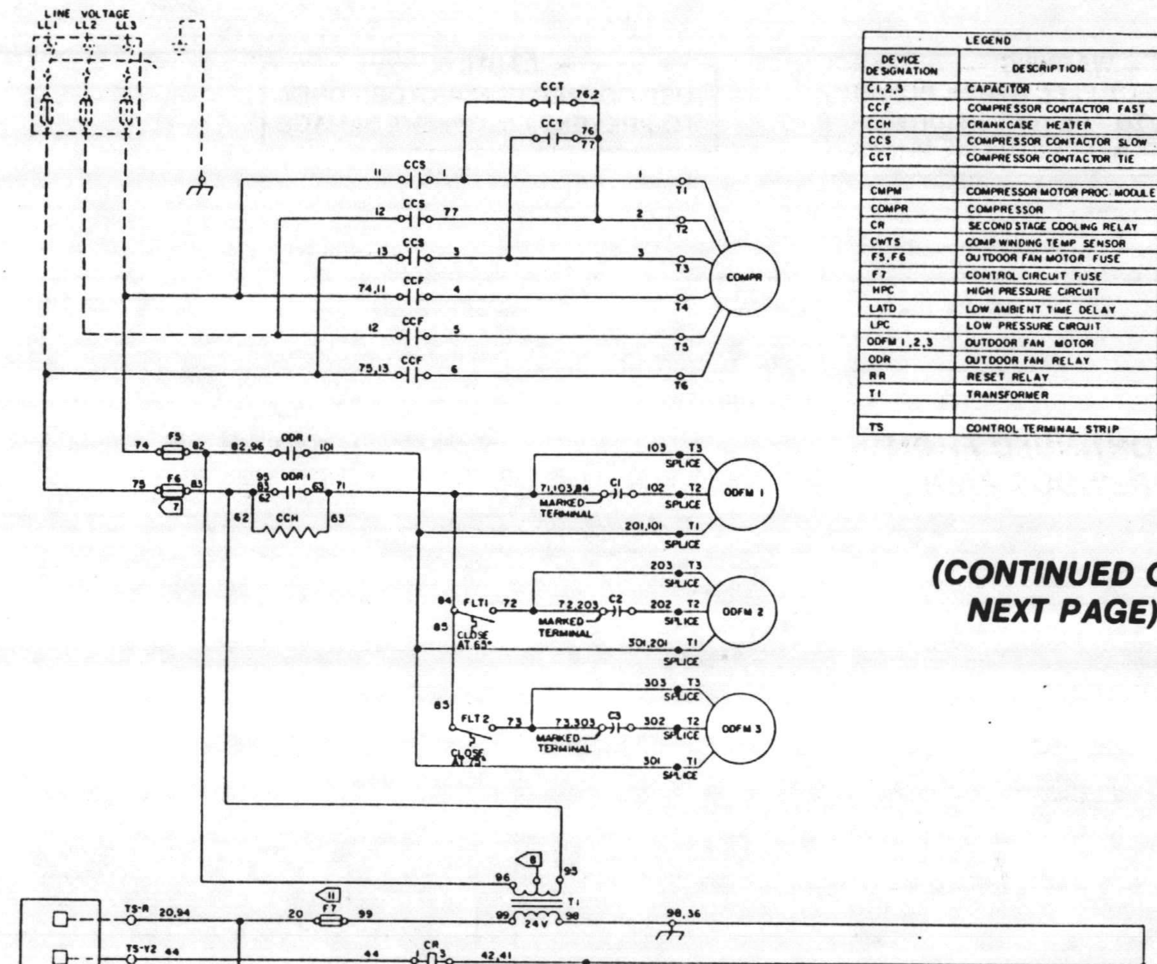


NOTES:
1. SEE NAMEPLATES OF ALL MOTORS FOR VOLTAGE BEFORE CONNECTING TO LINE
2. ALL COMPONENTS AND WIRES SHOWN DOTTED ARE SUPPLIED BY CUSTOMER
3. IF ANY OF THE ORIGINAL WIRES AS SUPPLIED WITH THIS UNIT MUST BE REPLACED, IT MUST BE REPLACED WITH APPLIANCE WIRING MATERIAL RATED 105° C OR EQUIVALENT
4. ALL CUSTOMER WIRING MUST BE IN ACCORDANCE WITH NATIONAL AND LOCAL ELECTRICAL CODES
5. ALL 208-230 VOLT UNITS WILL BE FACTORY WIRED FOR 230 VOLT APPLICATIONS. FOR 208 VOLT APPLICATIONS MOVE LEAD 97 FROM THE 240 VOLT TRANSFORMER TERMINAL TO THE 208 VOLT TERMINAL
6. THREE PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASING CONDITIONS
7. EVAPORATOR APPLICATION TEMPERATURE RANGE +32°F TO +53.5°F
8. REPLACE F7 FUSE WITH BUSSMAN TYPE GLQ & GMQ 3 AMP 300V FUSES ONLY
9. REPLACE F5 AND F6 FUSES WITH 300 V, 30 AMP TYPE SC FUSES ONLY
10. RESET RELAY WILL RESET WHEN POWER IS INTERRUPTED

(CONTINUED FROM PREVIOUS PAGE)



2306-3563



LEGEND	
DEVICE DESIGNATION	DESCRIPTION
C1,2,3	CAPACITOR
CCF	COMPRESSOR CONTACTOR FAST
CCH	CRANKCASE HEATER
CCS	COMPRESSOR CONTACTOR SLOW
CCT	COMPRESSOR CONTACTOR TIE
CMPM	COMPRESSOR MOTOR PROC MODULE
COMPR	COMPRESSOR
CR	SECOND STAGE COOLING RELAY
CWTS	COMP WINDING TEMP SENSOR
F5,F6	OUTDOOR FAN MOTOR FUSE
F7	CONTROL CIRCUIT FUSE
HPC	HIGH PRESSURE CIRCUIT
LATD	LOW AMBIENT TIME DELAY
LPC	LOW PRESSURE CIRCUIT
ODFM 1,2,3	OUTDOOR FAN MOTOR
ODR	OUTDOOR FAN RELAY
RR	RESET RELAY
T1	TRANSFORMER
TS	CONTROL TERMINAL STRIP

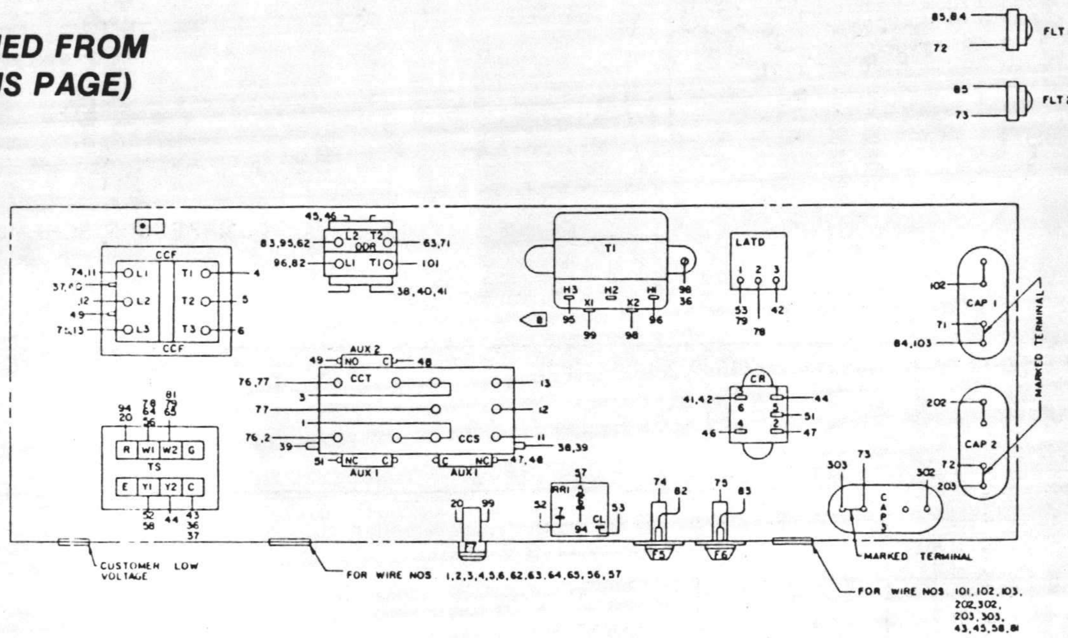
(CONTINUED ON NEXT PAGE)

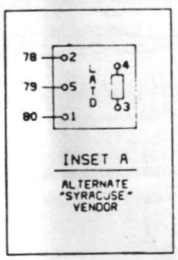
Figure 2 - Typical Unit Wiring Diagram (15 Ton Single Compressor Unit Shown)

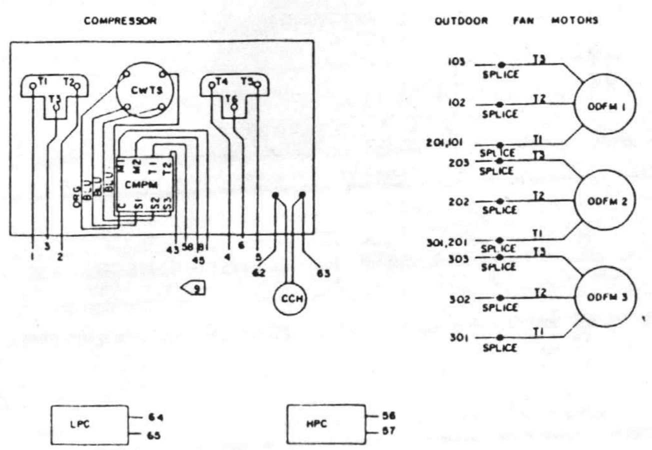
NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25°C (77°F) AT ATMOSPHERIC PRESSURE AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF AND AFTER A NORMAL SHUTDOWN HAS OCCURED. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. NUMBERS ALONG THE RIGHT SIDE OF THE SCHEMATIC DESIGNATE THE LOCATION OF THE CONTACTS BY LINE NUMBER, AN UNDERLINED NUMBER INDICATES A NORMALLY CLOSED CONTACT.
2. ALL WIRING AND DEVICES SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES.
3. IF ANY OF THE ORIGINAL WIRE, AS SUPPLIED WITH THIS UNIT, MUST BE REPLACED, REPLACE IT WITH APPLIANCE WIRING MATERIAL RATED AT 105°C OR EQUIVALENT.
4. THREE PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASING CONDITIONS AND HAVE INTERNAL OVERLOAD PROTECTION.
5. FOR REMAINDER OF CONTROL CIRCUITS, SEE ELECTRICAL DIAGRAM LOCATED ON INDOOR UNIT CONTROL PANEL.
6. RESET RELAY WILL RESET WHEN POWER IS INTERRUPTED.
7. REPLACE F5 AND F6 FUSES WITH 300 VOLT, 30 AMP TYPE SC FUSES ONLY.
8. ALL 208-230 VOLT UNITS WILL BE FACTORY WIRED FOR 230 VOLT APPLICATION. FOR 208 VOLT APPLICATIONS MOVE LEAD 95 FROM THE 240 VOLT TRANSFORMER TERMINAL (H3) TO THE 208 VOLT TERMINAL (H2)
9. CMPM IS LOCATED IN THE COMPRESSOR JUNCTION BOX, TEXAS INSTRUMENT PN 15AA 1105A. COMPRESSOR CONTACTOR CANNOT BE RE-ENERGIZED FOR 4 MINUTES AFTER WINDING TEMPERATURES HAVE RETURNED TO NORMAL FOLLOWING CUT-OUT ON EXCESSIVE TEMPERATURE, CURRENT OVERLOAD OR POWER INTERRUPTION TO TERMINAL 'T1'.
10. EVAPORATOR APPLICATION TEMPERATURE RANGE: 32°F TO 53.5°F
11. REPLACE ONLY WITH BUSSMAN GLQ OR GMQ 3AMP 300V FUSES.

(CONTINUED FROM PREVIOUS PAGE)







WARNING

DISCONNECT ELECTRICAL POWER SOURCE TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK

CAUTION

USE COPPER CONDUCTORS ONLY TO PREVENT EQUIPMENT DAMAGE

IMPORTANT

ANTI-SHORT CYCLE FEATURE IS STANDARD ON THIS UNIT. COMPRESSOR CANNOT BE RE-ENERGIZED FOR 4 MINUTES FOLLOWING TERMINATION OF COOLING CYCLE.

CAUTION

DO NOT ENERGIZE UNTIL UNIT CHECK-OUT AND START-UP PROCEDURE HAS BEEN COMPLETED

2306-3564

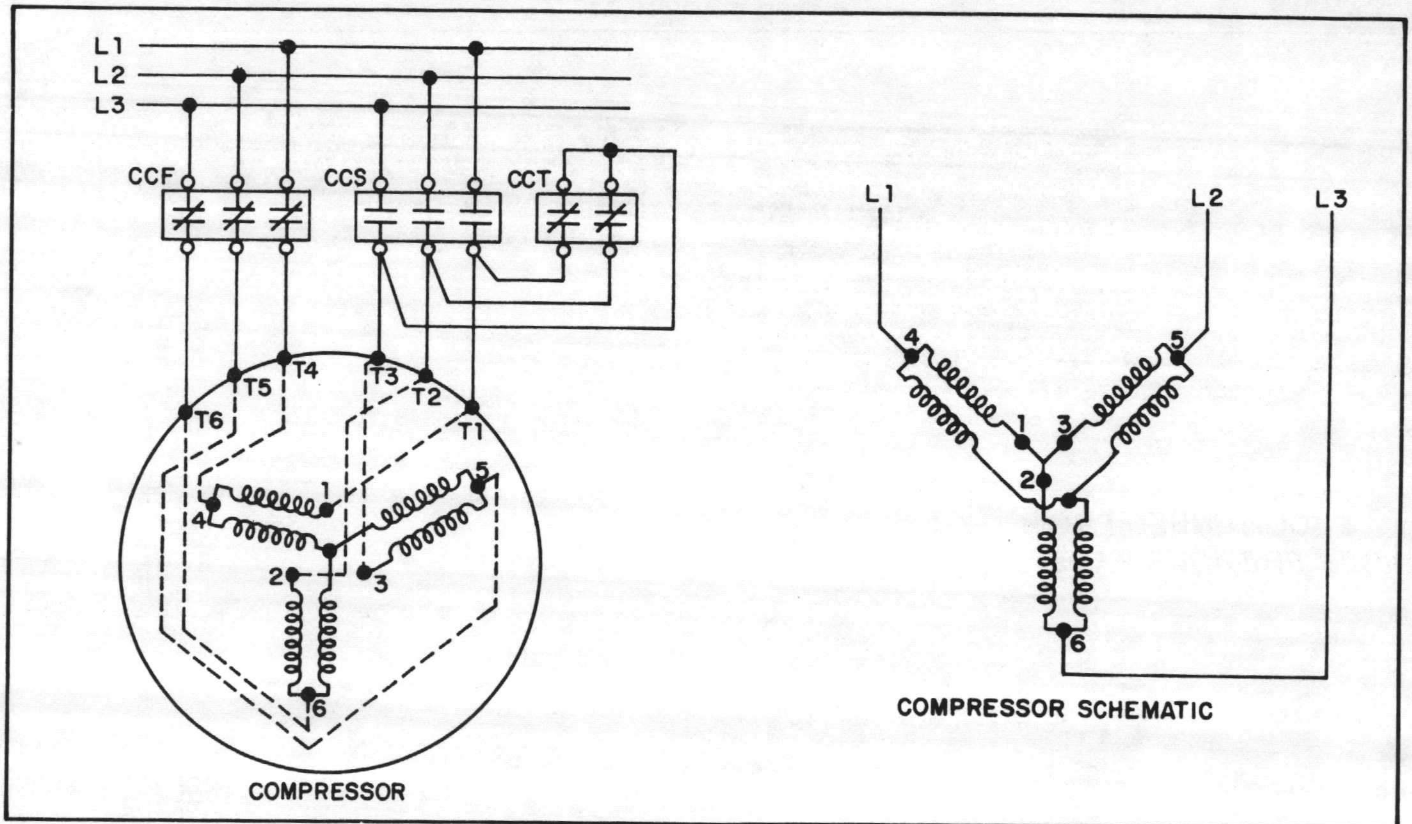


Figure 3 · High Speed Operation (Parallel Connected)

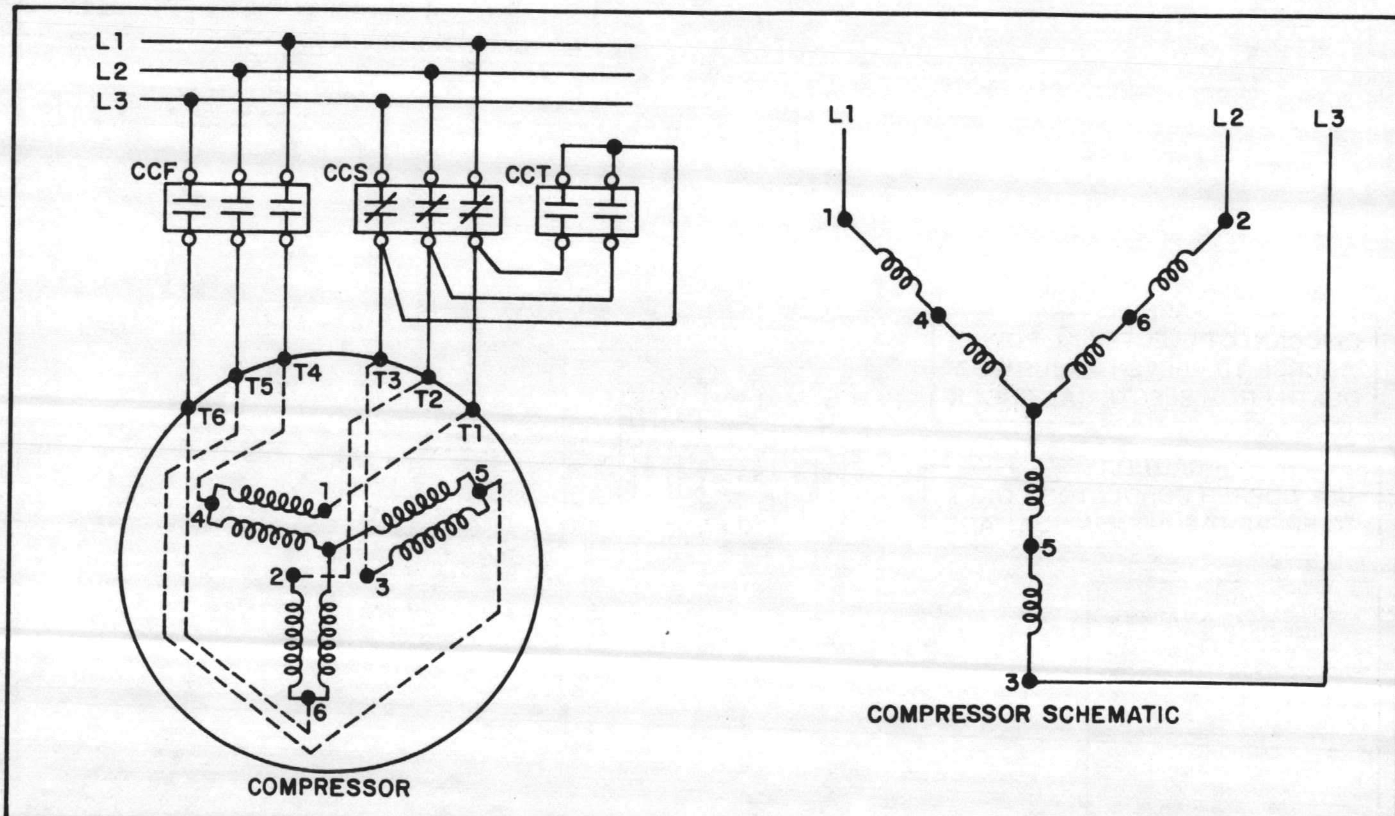


Figure 4 · Low Speed Operation (Series Connected)

Safety Controls

High Pressure Control

BTA150D, BTA180D and BTA180F units have an external high pressure control that prevents excessive compressor discharge pressures. This control opens the electrical control circuit, stopping compressor operation, if the condensing pressure becomes too high. Refer to Table 1 for control settings.

The compressors on BTA120D units are provided with an internal pressure relief valve which automatically vents hot gas onto the winding thermostat whenever condensing pressure becomes excessive. This heat causes the contacts of the winding thermostat to open, and compressor operation ceases until the thermostat cools enough for its contacts to close.

Low Pressure Control

All BTA120-180 units have an external low pressure control that stops compressor operation if the operating pressure is too low. Refer to Table 1 for control settings.

Reset Relay

Whenever the system is stopped by the high or low pressure control, the reset relay locks out the compressor contactor. This prevents the system from recycling until the condition causing the high or low pressure cut-out is corrected, and the relay is manually reset. To reset this relay, turn the room thermostat from COOL to OFF and then back to COOL, or open the unit disconnect switch and reclose it.

Fan Sequencing

Condenser fans are cycled on and off in response to ambient temperature in order to keep the capacity of the condenser relatively constant and to maintain proper system pressures. Figure 5 details the possible condenser fan operating modes.

Motor Overloads

All BTA120-180 units have internal compressor and condenser fan motor overloads. These overloads protect the motors from overheating and automatically reset as soon as they cool.

Condenser Fan Limit Control

The condenser fan limit control (FLT) is a temperature sensor that energizes and de-energizes the condenser fan in response to ambient temperature. As the ambient temperature decreases, the cooling capacity of the condenser increases. The cooling low ambient sensor turns off condenser fans to keep the capacity of the condenser constant and to maintain proper system pressures. Refer to Table 1 for control settings.

Table 1 - Control Settings

CONTROL	CUT-IN	CUT-OUT
High Pressure Control (All Units)	345 PSIG (20)	425 PSIG (±20)
Low Pressure Control (All Units)	48 PSIG (±7)	20 PSIG (±4)
FLT 10 Ton	75 F(±3)	65 F(±3)
FLT 12.5-15 Ton	75 F(±3)	65 F(±3)
FLT 12.5-15 Ton	65 F(±3)	55 F(±3)

FLT = Fan Limit Temperature Control

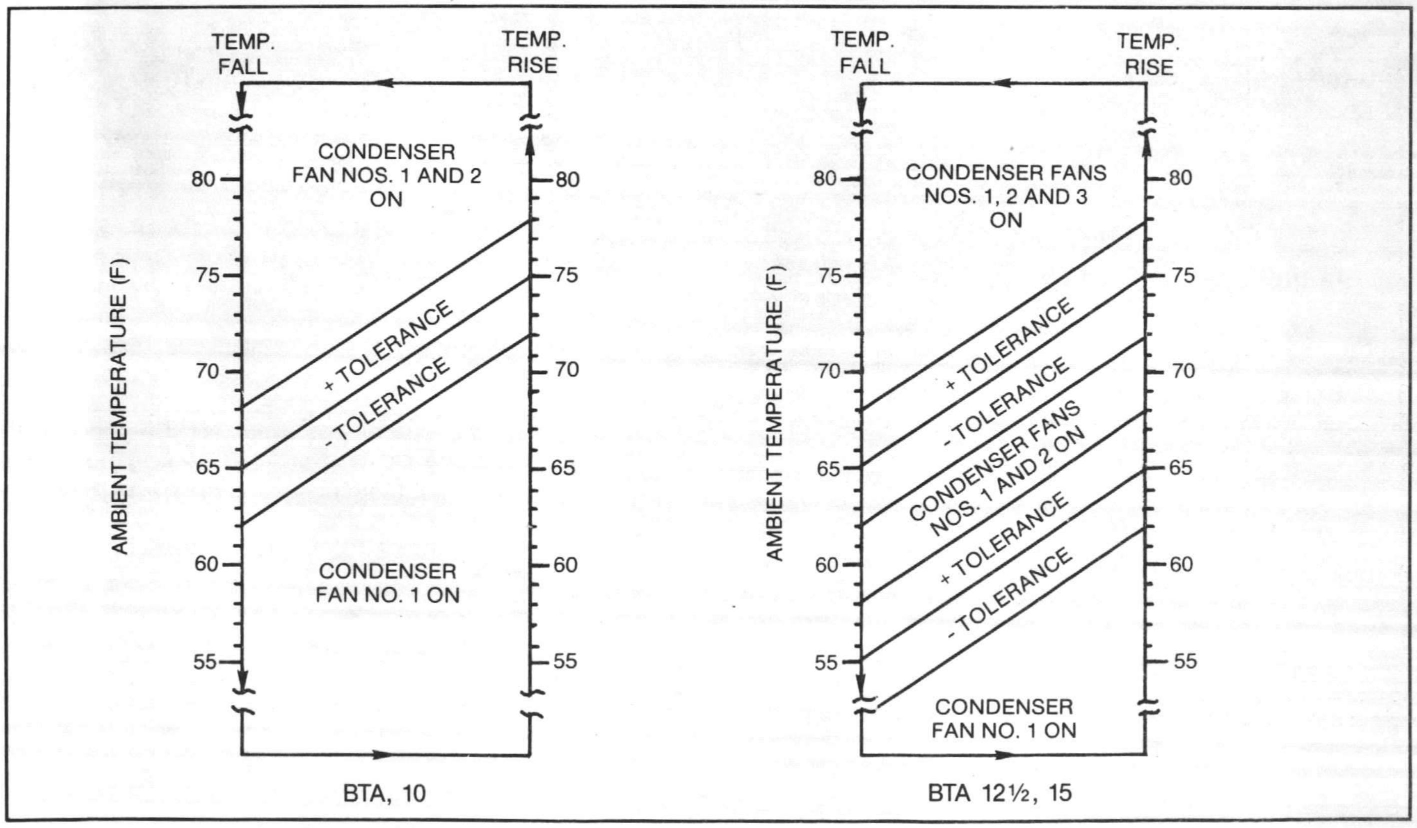


Figure 5 - Condenser Fan Operating Modes

Maintenance

Periodic Maintenance

Perform all of the indicated maintenance procedures at the intervals scheduled. This will prolong the life of the unit and reduce the possibility of costly equipment failure. A MAINTENANCE LOG is provided on page 12 of this manual for recording operating data on a regular basis.

Once a Month

Conduct the maintenance inspections outlined below on a monthly basis during the cooling season.

☐ 1. Inspect the evaporator coil air filters. Clean or replace if necessary.

☐ 2. Inspect the evaporator and condenser coils for dirt and foreign debris. If the coils appear dirty, clean them according to the instructions provided under "Coil Cleaning" in the MAINTENANCE PROCEDURES section of this manual.

Once a Year

The following maintenance practices must be performed at the beginning of each cooling season to ensure efficient unit operation.

WARNING: OPEN THE UNIT DISCONNECT SWITCH AND LOCK IT IN THAT POSITION TO PREVENT ACCIDENTAL START-UP. NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE THE UNIT WITHOUT FIRST OPENING THE DISCONNECT SWITCH. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

☐ 1. Inspect the evaporator coil air filters. Clean or replace if necessary. Depending on filter type and system application, filters may need to be serviced more frequently.

☐ 2. Clean both the evaporator and condenser coils. Follow the procedures outlined under "Coil Cleaning" in the MAINTENANCE PROCEDURES section of this manual.

☐ 3. With the unit disconnect switch open, check to see that each condenser and evaporator fan is securely fastened to its motor shaft. All fans should turn freely and airflow should be unobstructed.

☐ 4. Replace worn or frayed evaporator fan belts. Check the belt tension of the evaporator fans. A 1/2-inch deflection under light hand pressure is normal. Tighten if necessary.

☐ 5. Remove the condensing unit control box cover and inspect the panel wiring. All electrical connections should be secure. Inspect the compressor and condenser fan motor contactors. If the contacts appear severely burned or pitted, replace the contactor (refer to Figure 6). Do not clean the contacts. Inspect the condenser fan capacitors for visible damage.

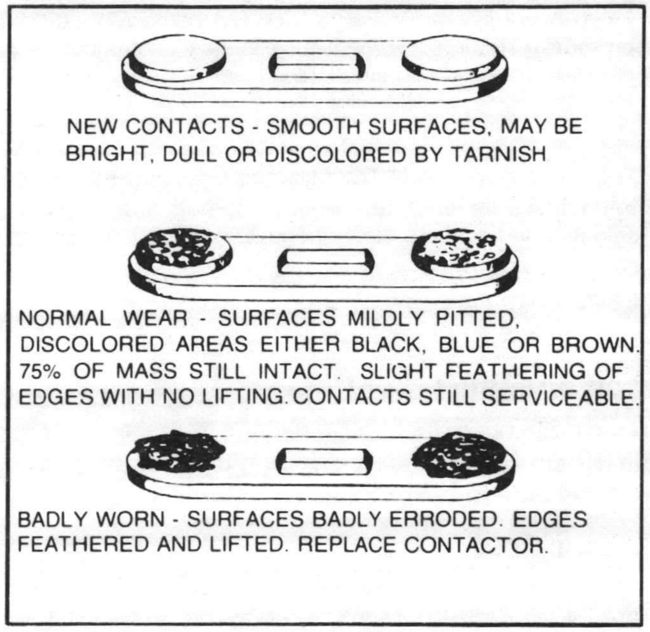


Figure 6 - Compressor Contactor Replacement Guide

☐ 6. Remove any accumulation of dust and dirt from the condensing unit.

☐ 7. Clean and inspect the drain pan of the evaporator unit. Make sure the drain piping is clear.

☐ 8. Check the superheat and subcooling.
   a. The condenser and evaporator coils must be clean before making the following checks.
   b. Determine the superheat of the system. Refer to "Measuring Superheat" in the MAINTENANCE PROCEDURES section of this manual.
   c. Adjust the superheat if necessary (instructions are provided in the "Measuring Superheat" section of this manual).
   d. When the superheat setting is correct, check the subcooling. Refer to "Measuring Subcooling" in the MAINTENANCE PROCEDURES section of this manual.
   e. If the subcooling is low, leak test the system to determine if there is a leak. Refer to "Leak Testing" in the MAINTENANCE PROCEDURES section of this manual.
   f. Charge the system with refrigerant if necessary. Instructions are provided under "Checking Refrigerant Charge" in the MAINTENANCE PROCEDURES section of this manual.
   g. Enter the operating pressures, superheat, and subcooling in the MAINTENANCE LOG provided on the following page.

Shutdown and Start-Up

Shutdown: Short Duration

The system can be shutdown for periods of short duration, such as over the weekend, by moving the thermostat selector switch to the OFF position and the fan switch to the AUTO position.

NOTE: *The unit disconnect switch should remain closed. This will permit the crankcase heater to continue to function, preventing refrigerant from condensing in the compressor oil sump.*

Start-Up: Short Duration

The system is returned to operation after a shutdown of short duration, such as over a weekend, by adjusting the thermostat setting to the desired temperature, placing the thermostat selector switch in the COOL or AUTO position, and setting the fan switch in either the AUTO or ON position.

Shutdown: Seasonal

For seasonal shutdown, open the unit electrical disconnect switch to prevent the unit from starting accidently.

Start-Up: Seasonal

To start the system after an extended period of shutdown, complete the following procedures.

1. Perform all of the "Once A Year" checks listed in the PERIODIC MAINTENANCE section of this manual.
2. Move the thermostat selector switch to OFF.
3. Close the electrical disconnect switch to the condensing unit. This will energize the compressor crankcase heater. If operating properly, the crankcase should be hot to the touch. Wait a minimum of eight hours before turning the room thermostat to the COOL position.

CAUTION: Failure to wait eight hours before turning the room thermostat to COOL may result in damage to the compressor bearings.

4. Start a dual compressor system by adjusting the thermostat setting to the desired temperature, placing the thermostat selector switch in the COOL or AUTO position, and placing the fan switch in either the AUTO or ON position.
5. Adjust the thermostat setting on a single compressor unit so that the compressor will be operating at high speed. Place the thermostat selector switch in either the COOL or AUTO position, and the fan switch in either the AUTO or ON position.
6. Place a clamp-on ammeter on each compressor lead and check the motor amperage. Amperage draw should not be greater than the "Maximum Allowable Amps" given in Table 9.
7. Place the clamp-on ammeter around either of the two leads from each outdoor fan motor run capacitor to determine if the run capacitor is open and must be replaced. The amp draw should not be greater than the nameplate rating for the condenser fan motors.
8. Lower the thermostat setting to the desired temperature.

Maintenance Procedures

This section of the manual describes specific maintenance procedures which must be performed as a part of the unit's maintenance program. Before performing any of these operations, however, be sure that power to the unit is disconnected unless otherwise instructed.

WARNING: WHEN MAINTENANCE CHECKS AND PROCEDURES MUST BE COMPLETED WITH THE ELECTRICAL POWER ON, CARE MUST BE TAKEN TO AVOID CONTACT WITH ENERGIZED COMPONENTS OR MOVING PARTS. FAILURE TO EXERCISE CAUTION WHEN WORKING WITH ELECTRICALLY-POWERED EQUIPMENT MAY RESULT IN SERIOUS INJURY OR DEATH.

Coil Cleaning

Condenser coils must be cleaned **at least once each year**, or more frequently if the unit is located in a "dirty" environment, to help maintain proper unit operating efficiency and reliability. The relationship between regular coil maintenance and efficient unit operation is outlined below:

1. Clean condenser coils minimize compressor head pressure and amperage draw, and promote system efficiency.
2. Clean evaporator coils minimize water carry-over and help eliminate frosting and/or compressor flood back problems.
3. Clean coils minimize required fan brake horsepower and maximize efficiency by keeping coil static pressure loss at a minimum.
4. Clean coils keep motor temperatures and system pressures within safe operating limits for good reliability.

Specific instructions for cleaning condenser coils are provided in the following paragraphs. Follow these instructions as closely as possible to avoid potential damage to the coils.

To clean refrigerant coils, the following equipment is required: a soft brush and either a garden pump-up sprayer or a high pressure sprayer. In addition, a high quality detergent must be used: suggested brands include SPREX A.C., OAKITE 161, OAKITE 166, and COILOX. Follow the manufacturer's recommendations for mixing to make sure the detergent is alkaline with a pH value less than 8.5.

1. Disconnect power to the unit.

WARNING: OPEN UNIT DISCONNECT SWITCH. FAILURE TO DISCONNECT UNIT FROM ELECTRICAL POWER SOURCE MAY RESULT IN SEVERE ELECTRICAL SHOCK, AND POSSIBLE INJURY OR DEATH.

2. Remove enough panels from the unit to gain access to the coil.
3. Protect all electrical devices such as motors and controllers from dust and water spray.
4. Straighten coil fins with a fin rake, if necessary.

MAINTENANCE LOG

DATE	AMBIENT TEMP. (F)	EVAPORATOR ENTERING AIR		COMPRESSOR (HIGH SPEED)		COMPRESSOR (LOW SPEED)		SUPERHEAT		SUBCOOLING (F)
		DRY BULB	WET BULB	SUCTION PRESSURE	DISCHARGE PRESSURE	SUCTION PRESSURE	DISCHARGE PRESSURE	CIRCUIT NO. 1 (F)	CIRCUIT NO. 2 (F)	

5. Use a soft brush to remove loose dirt and debris from both sides of the coil.

6. Mix the detergent with water according to the manufacturer's instructions. The detergent-and-water solution may be heated to a maximum of 150 F to improve its cleansing ability.

WARNING: DO NOT HEAT THE DETERGENT-AND-WATER SOLUTION TO TEMPERATURES IN EXCESS OF 150 F. HIGH-TEMPERATURE LIQUIDS SPRAYED ON THE COIL EXTERIOR WILL RAISE THE PRESSURE WITHIN THE COIL AND MAY CAUSE IT TO BURST, RESULTING IN POSSIBLE INJURY TO SERVICE PERSONNEL AND EQUIPMENT DAMAGE.

7. Place the detergent-and-water solution in the sprayer. If a high-pressure sprayer is used, be sure to follow these guidelines:

- Minimum nozzle spray angle is 15 degrees.
- Spray the solution perpendicular (at a 90 degree angle) to the coil face.
- Keep the sprayer nozzle at least six inches from the coil.
- Sprayer pressure must not exceed 600 psi.

CAUTION: Do not spray motors or other electrical components. Moisture can cause component failure.

8. Spray the leaving air side of the coil first, then spray the entering air side of the coil. Allow the detergent-and-water solution to stand on the coil for five minutes.

9. Rinse both sides of the coil with cool, clean water.

10. Inspect the coil. If it still appears to be dirty, repeat Steps 7, 8 and 9.

11. Replace all unit panels and parts, and restore electrical power to the unit.

12. Remove the protective covers installed in Step 3.

Control Testing

The following procedures can be used to check the operation of the high and low pressure controls. To determine operating pressures, attach gauges to the compressor suction and discharge access valves.

High Pressure Control

1. Open the unit electrical disconnect switch.

2. Disconnect the low voltage lead(s) from the condenser fan relay coil(s). This will de-energize the condenser fans.

3. On BTA150D-BTA180D units only, disconnect Y2 on the control box terminal strip when checking the high pressure control for Compressor No. 1. This will prevent the second compressor from running while checking the control in the first compressor circuit.

4. Close the unit disconnect switch and start the unit. On BTA180F units operate the compressor on high speed.

CAUTION: Be prepared to open the unit disconnect switch immediately if the compressor continues to run after the discharge pressure exceeds the high pressure control cutout range. Failure to do so could damage the system.

5. Observe the rising discharge pressure. When the pressure reaches 425 psig (±20) as shown in Table 1, the compressor should shut off. If the pressure reaches 445 psig without the high pressure switch breaking, immediately open the unit disconnect switch. Check to make sure that the high pressure control attached to liquid line No. 1 is wired to low voltage circuit No. 1. Replace the faulty high pressure control.

6. On BTA150D-BTA180D units, repeat Steps 1 through 5 to test the high pressure control in the second compressor circuit. In place of Step 3, however, reconnect Y2 and disconnect Y1 on the control box terminal strip. This will prevent Compressor No. 1 from running while the control for the second compressor circuit is being tested.

7. Open the unit disconnect switch.

8. Reconnect the wires removed in Step 2 on single compressor units, on in Steps 2 and 6 on dual compressor units.

9. Allow the discharge pressure(s) to drop below the cut-in setting in Table 1, and close the unit disconnect switch. This will also close the reset relay that locked out the compressor contactor when the high pressure control tripped.

10. The unit should start. If not, allow the discharge pressure to decrease further and repeat Step 9.

Low Pressure Control

1. Open the unit electrical disconnect switch.

2. Disconnect the wire that goes to the indoor blower coil from either Terminal T or R on the control box terminal strip. This will de-energize the evaporator fans.

3. On BTA120D-BTA180D units only, disconnect Y2 on the control box terminal strip when checking the low pressure control for Compressor No. 1. This will prevent the second compressor from running while checking the control in the first compressor circuit.

4. Remove the wires from Terminal 2 on the low ambient time delay relay(s). Insulate the wire terminals with electrical tape.

5. Close the unit disconnect switch and start the unit.

CAUTION: Be prepared to open the unit disconnect switch immediately if the compressor continues to run after the suction pressure drops below the low pressure control cutout range. Failure to do so could damage the compressor.

6. Observe the decreasing suction pressure. When the pressure drops to 20 psig (±4) as shown in Table 1, the compressor should shut off. If the pressure reaches 15 psig without the low pressure switch breaking, immediately open the unit disconnect switch. Replace the faulty low pressure control.

7. On BTA120D-BTA180D units, repeat Steps 1 through 6 to test the low pressure control in the second compressor circuit. In place of Step 3, however, reconnect Y2 and disconnect Y1 on the control box terminal strip. This will prevent Compressor No. 1 from running while the control for the second compressor circuit is being tested.

8. Open the unit disconnect switch.

9. Reconnect the wires removed in Steps 2 and 4 on single compressor units, or in Steps 2, 4, and 7 on dual compressor units.

10. Allow the suction pressure(s) to rise above the cut-in setting in Table 1, and close the unit disconnect switch. This will also close the reset relay that locked out the compressor contactor when the low pressure control tripped.

11. The unit should start. If not, allow the suction pressure to rise further and repeat Step 10.

Evacuation

For field evacuation, use a rotary-style vacuum pump capable of pulling a vacuum of 100 microns or less.

When hooking the vacuum pump to a refrigeration system, it is important to manifold the pump to both the high and low side of the system (liquid line access valve and compressor suction access valve). Follow the pump manufacturer's directions as to the proper methods of using the vacuum pump.

CAUTION: Do not, under any circumstances, use a megohm meter or apply power to the windings of a compressor while it is under a deep vacuum. In the rarified atmosphere of a vacuum, the motor windings can be damaged.

The lines used to connect the pump to the system should be copper and of the largest diameter that can practically be used. Using larger line sizes with minimum flow resistance can significantly reduce evacuation time. Rubber or synthetic hoses are not recommended for unit evacuation because they have moisture absorbing characteristics which result in excessive rates of outgassing and pressure rise during the standing vacuum test. This makes it impossible to determine if the unit has a leak, excessive residual moisture, or a continual or high rate of pressure increase due to the hoses.

An electronic micron vacuum gauge should be installed in the common line ahead of the vacuum pump shutoff valve, as shown in Figure 7. Close Valves B and C, and open Valve A. After several minutes, the gauge reading will indicate the minimum blank-off pressure the pump is capable of pulling. Rotary pumps should produce vacuums of less than 100 microns.

Open Valves B and C. Evacuate the system to a pressure of 500 microns or less. Once 500 microns or less is obtained, with Valve A closed, a time versus pressure rise should be performed. The maximum allowable rise over a 15 minute period is 200 microns. If the pressure rise is greater than 200 microns but levels off to a constant value, excessive moisture is present. If the pressure steadily continues to rise, a leak is indicated. Figure 8 illustrates three possible results of the time versus temperature rise check.

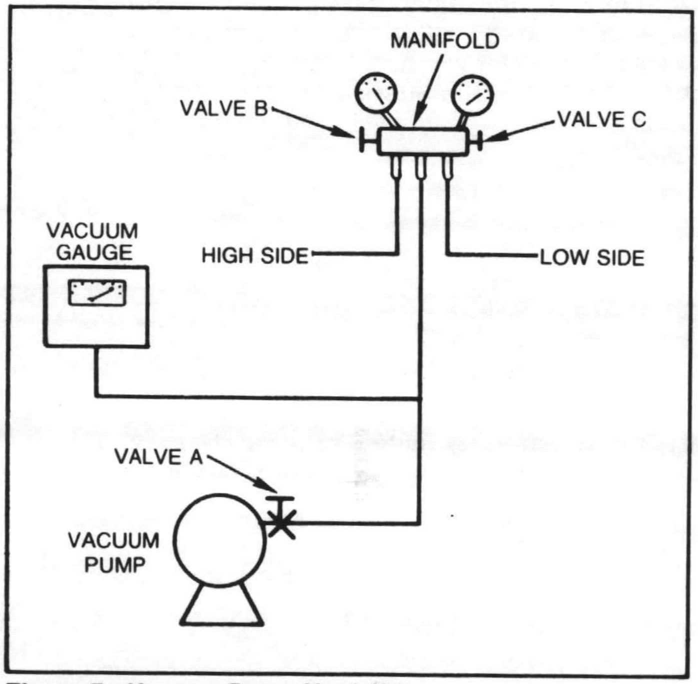


Figure 7 - Vacuum Pump Hook-Up

LEAK TESTING

When leak testing the unit, the following safety precautions must be observed:

WARNING: DO NOT WORK IN A CLOSED AREA WHERE REFRIGERANT OR NITROGEN MAY BE LEAKING. A SUFFICIENT QUANTITY OF VAPORS MAY BE PRESENT TO CAUSE PERSONAL INJURY. PROVIDE ADEQUATE VENTILATION.

WARNING: DO NOT USE OXYGEN, ACETYLENE, OR AIR IN PLACE OF REFRIGERANT AND DRY NITROGEN FOR LEAK TESTING. A VIOLENT EXPLOSION WILL RESULT WHICH COULD CAUSE SERIOUS INJURY OR DEATH.

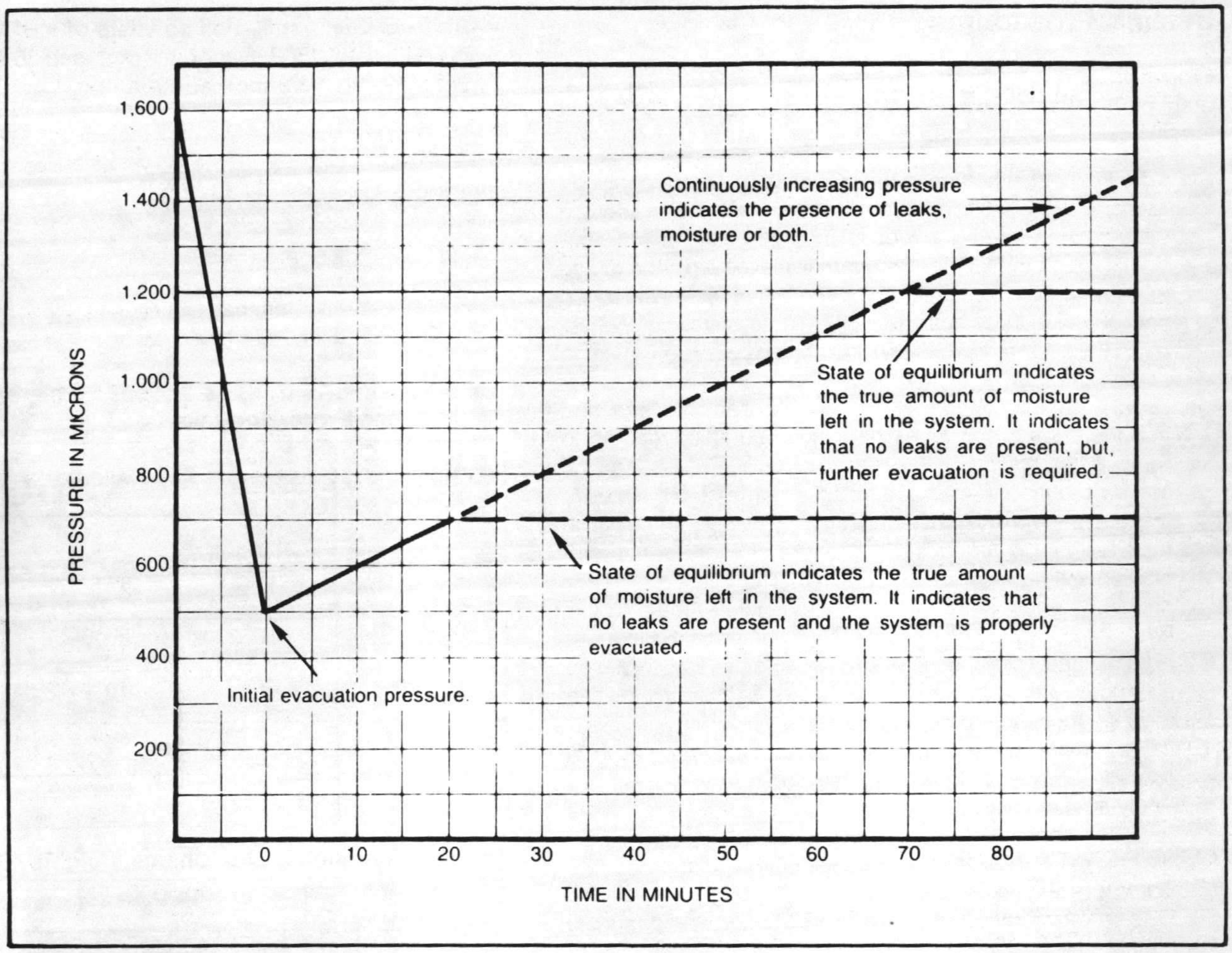


Figure 8 - Time vs. Pressure Rise after Evacuation

WARNING: ALWAYS USE A PRESSURE REGULATOR, VALVES, AND GAUGES TO CONTROL DRUM AND LINE PRESSURES WHEN PRESSURE TESTING THE SYSTEM. EXCESSIVE PRESSURES MAY CAUSE LINE RUPTURES, EQUIPMENT DAMAGE, OR AN EXPLOSION WHICH COULD RESULT IN PERSONAL INJURY OR DEATH.

Leak test the liquid line, evaporator, and suction line at pressures dictated by local codes.

CAUTION: Do not exceed 200 psig when leak testing the system.

1. Charge enough refrigerant into the system to raise the pressure to 100 psig.
2. Use a halogen leak detector or halide torch to check for leaks. Be thorough in this test, checking the interconnecting piping joints, the evaporator unit, and the condensing unit.
3. If a leak is found during the testing, release the test pressure, break the connection, and remake it as a new joint. Refer to the "Brazing Procedures" in this section of the manual for proper brazing techniques.
4. If no leak is found, use nitrogen to increase the test pressure to 150 psig, and repeat the leak test. Soap bubbles should be used to check for leaks when nitrogen is added. If a leak is found after increasing the pressure to 150 psig with nitrogen, release the test pressure and repair the leak.
5. Retest the system to make sure the new connection is solid.
6. If a leak is suspected after the system has been fully charged with refrigerant, use a halogen leak detector, halide torch, or soap bubbles to check for leaks.

Brazing Procedures

Proper brazing techniques are essential when installing refrigerant piping. The following factors should be kept in mind when forming sweat connections.

1. When copper is heated in the presence of air, copper oxide forms. To prevent copper oxide from forming inside the tubing during brazing, sweep an inert gas, such as dry nitrogen, through the tubing. Nitrogen displaces air in the tubing and prevents oxidation of the interior surfaces. A nitrogen flow of one to three cubic feet per minute is sufficient to displace the air. Use a pressure regulating valve or flow meter to control the flow.
2. Ensure that the tubing surfaces to be brazed are clean, and that the ends of the tubes have been carefully reamed to remove any burrs.
3. Make sure the inner and outer tubes of the joint are symmetrical and have a close clearance, providing an easy slip fit. If the joint is too loose, the tensile strength of the connection will be significantly reduced. The overlap distance should be equal to the diameter of the inner tube.
4. Wrap the body of each refrigerant line component with a wet cloth to keep it cool during brazing. Also move line insulation and tube grommets away from the joints. Excessive heat can damage these components.
5. If flux is used, apply it sparingly to the joint. Excess flux will contaminate the refrigerant system.
6. Apply heat evenly over the length and circumference of the joint. The entire joint should become hot enough to melt the brazing material.
7. Begin brazing when the joint is hot enough to melt the brazing rod. The hot copper tubing, not the flame, should melt the rod.
8. Continue to apply heat around the circumference of the joint until the brazing material is drawn into the joint by capillary action, making a mechanically sound and gas-tight connection. Remove the brazing rod as soon as a complete fillet is formed to avoid possible restriction in the line.
9. Visually inspect the connection after brazing to locate any pin holes or crevices in the joint. The use of a mirror may be required, depending on joint location.

Refrigerant Charging

Once the system is properly installed, leak tested and evacuated, refrigerant charging can begin. Liquid refrigerant must be charged into the system through the liquid line access valve, with the compressor shut off.

Refrigerant should be charged into the system by weight. Use an accurate scale or a charging cylinder to determine the exact weight of the refrigerant entering the system. Failure to use either a scale or charging cylinder can lead to under-charging or overcharging, resulting in unreliable operation.

The weights of refrigerant required for the evaporator unit and the condensing unit are given in Table 2. The weight of refrigerant required for the system piping can be determined by measuring the refrigerant lines and using the data in Table 3. The total system operating charge is calculated by adding the charge weight requirements of each part of the system. Refer to the following example.

EXAMPLE: The installation consists of a BTA180D condensing unit, a BWV180B evaporator unit, and 30 feet of 1/2 inch liquid line and 1-3/8 inch suction line.

BTA180D	= 163 oz./circuit
BWV180D	= 94 oz./circuit
Liquid Line (1.137 oz./ft.) x (30 ft.)	= 34 oz./circuit
Suction Line (.203 oz./ft.) x (30 ft.)	= 6 oz./circuit
Total Charge Per Circuit	255 oz./circuit

Since the 15 ton system has two circuits, the total system operating charge required is 510 oz.

Table 2 - Refrigerant charge Weights for Condensing and Evaporator Units

CONDENSING UNIT	CHARGE (IN OUNCES OF R-22)	EVAPORATOR UNIT	CHARGE (IN OUNCES OF R-22)
BTA120D	268 (134/circuit)	BTE120B	112 (56/circuit)
BTA150D	256 (128/circuit)	BWE090C (Two)	158 (79/circuit)
		BWV180B	188 (94/circuit)
BTA180D	326 (163/circuit)	BWE090C (Two)	158 (79/circuit)
		BWV180B	188 (94/circuit)
BTA180F	326	BWV180B	188 (94/circuit)

Table 3 - Refrigerant Line Charge Weights (Ounces/Foot)

TUBE O.D. (INCHES)	LIQUID LINE	SUCTION LINE
3/8	0.610	
1/2	1.137	
5/8	1.827	
3/4	2.738	0.056
7/8		0.078
1 1/8		0.133
1 3/8		0.203
1 5/8		0.288

WARNING: DO NOT APPLY FLAME TO A REFRIGERANT DRUM IN AN ATTEMPT TO INCREASE THE DRUM PRESSURE. UNCONTROLLED HEAT MAY CAUSE EXCESSIVE DRUM PRESSURES AND AN EXPLOSION MAY RESULT.

WARNING: SHOULD LIQUID REFRIGERANT COME IN CONTACT WITH THE SKIN, THE INJURY SHOULD BE TREATED AS IF THE SKIN HAS BEEN FROSTBITTEN OR FROZEN. SLOWLY WARM THE AFFECTED AREA WITH LUKEWARM WATER.

Proceed as follows to charge the system with refrigerant.

1. Charge liquid refrigerant into the liquid line of the No. 1 compressor circuit, using the liquid line access valve. The vacuum within the system will draw some of the required refrigerant into the system. If the pressure within the system equalizes with the pressure in the charging cylinder before the required charge has been drawn in, proceed to Step 2.

   NOTE: On 10, 12.5, and 15 ton units, this charging process must be repeated for compressor circuit No. 2.

2. If the system cannot be completely charged by liquid refrigerant entering the system liquid line as outlined in Step 1, complete the process by charging **gaseous refrigerant** into the suction line. However, at least part of the charge must be in the system prior to starting the compressor. Proceed as follows:

   a. Close the liquid line valve on the manifold gauge set.

   b. Connect the manifold gauge set to the suction and discharge access valves (shown in Figure 9). The manifold valves should be closed.

   c. Turn the refrigerant drum upright so that gaseous refrigerant is drawn off the top.

   d. Start the unit by following the procedures outlined in the INITIAL START-UP section of this manual.

   e. With the condensing unit operating, slowly open the suction line valve on the manifold gauge set. The remainder of the refrigerant will be drawn into the system.

CAUTION: Do not allow liquid refrigerant to enter the suction line. Excessive liquid will damage the compressor.

Checking Refrigerant Charge

Before taking measurements to determine if the system is correctly charged with refrigerant, verify that all other aspects of the system operation are proper. The following conditions must be checked and satisfied.

1. Check the evaporator and condenser fans to ensure that they are rotating in the proper direction, that the fan blades do not have dirt buildup, and that each fan is turning at the proper RPM. Make sure that the evaporator fan RPM is correct for the airflow desired and for the external static pressure being imposed by the duct system.
2. Make sure the evaporator air filters are clean.
3. Check the evaporator and condenser coils to ensure that they are clean, that the fins are straight, and that there are no obstructions to airflow.
4. Measure the suction line superheat and adjust the expansion valve, if necessary. (Refer to "Measuring Superheat" in the MAINTENANCE PROCEDURES section of this manual.) The expansion valve superheat setting must be between 12 and 16 F.

Visually inspect the liquid line sight glass to see if clear liquid is present. Bubbles in the liquid line sight glass indicate either low refrigerant charge, excess liquid line pressure drop, or excess liquid line heat gain.

CAUTION: A clear sight glass does NOT necessarily mean the system has sufficient refrigerant.

After verifying that the system is operating properly, determine if the refrigerant charge is correct. This is accomplished by checking both system operating pressures **and** subcooling leaving the condensing unit.

CAUTION: It is not sufficient to check only operating pressures or only subcooling. Both must be in the acceptable range in order to establish correct system charge.

Operating Pressures:

Measure the suction and discharge line pressures and compare these readings with the normal operating pressures listed in Figures 10-13 and Tables 4-6. Refer to "Operating Pressures" in the MAINTENANCE PROCEDURES section of this manual.

Subcooling:

Determine the system subcooling. (Refer to "Measuring Subcooling" in the MAINTENANCE PROCEDURES section of this manual.) If the system is properly charged, subcooling at the liquid line access valve should be 14 to 19 F.

The system is low on refrigerant if: 1) the suction and discharge pressures are lower than the normal operating pressures as determined from Figures 10-13 and Tables 4-6 **and** 2) liquid subcooling is low (less than 14-19 F on Dual Compressor Units and less than 18-30 F on Single Compressor Units.

The system is overcharged with refrigerant if: 1) the suction and discharge pressures are higher than normal operating pressures **and** 2) liquid subcooling is high (greater than 14-19 F on Dual Compressor Units and greater than 18-50 F on Single Compressor Units.

CAUTION: If both the suction and discharge pressures are low but subcooling is in the acceptable range, the system has a problem other than a shortage of refrigerant. Do not add refrigerant. Refer to the TROUBLESHOOTING section of this manual.

Adding Refrigerant:

Use the suction line access valve to add refrigerant to a system with a low charge, making sure that only refrigerant vapor enters the suction line. Continue to add refrigerant until the subcooling is between 14 and 19 F. At this point, the operating pressures should be within the limits defined by Figures 10-13 and Tables 4-6.

Removing Refrigerant:

If the system is overcharged, some refrigerant must be removed to lower the subcooling to the 14-19 F range. Refrigerant should be discharged from the system slowly to keep oil loss at a minimum. The liquid line access valve can be depressed to remove refrigerant. However, refrigerant should not be discharged into the atmosphere.

WARNING: DO NOT ALLOW REFRIGERANT TO COME IN CONTACT WITH THE SKIN. IF THIS OCCURS, THE INJURY SHOULD BE TREATED AS IF THE SKIN HAS BEEN FROSTBITTEN OR FROZEN. SLOWLY WARM THE AFFECTED AREA WITH LUKEWARM WATER.

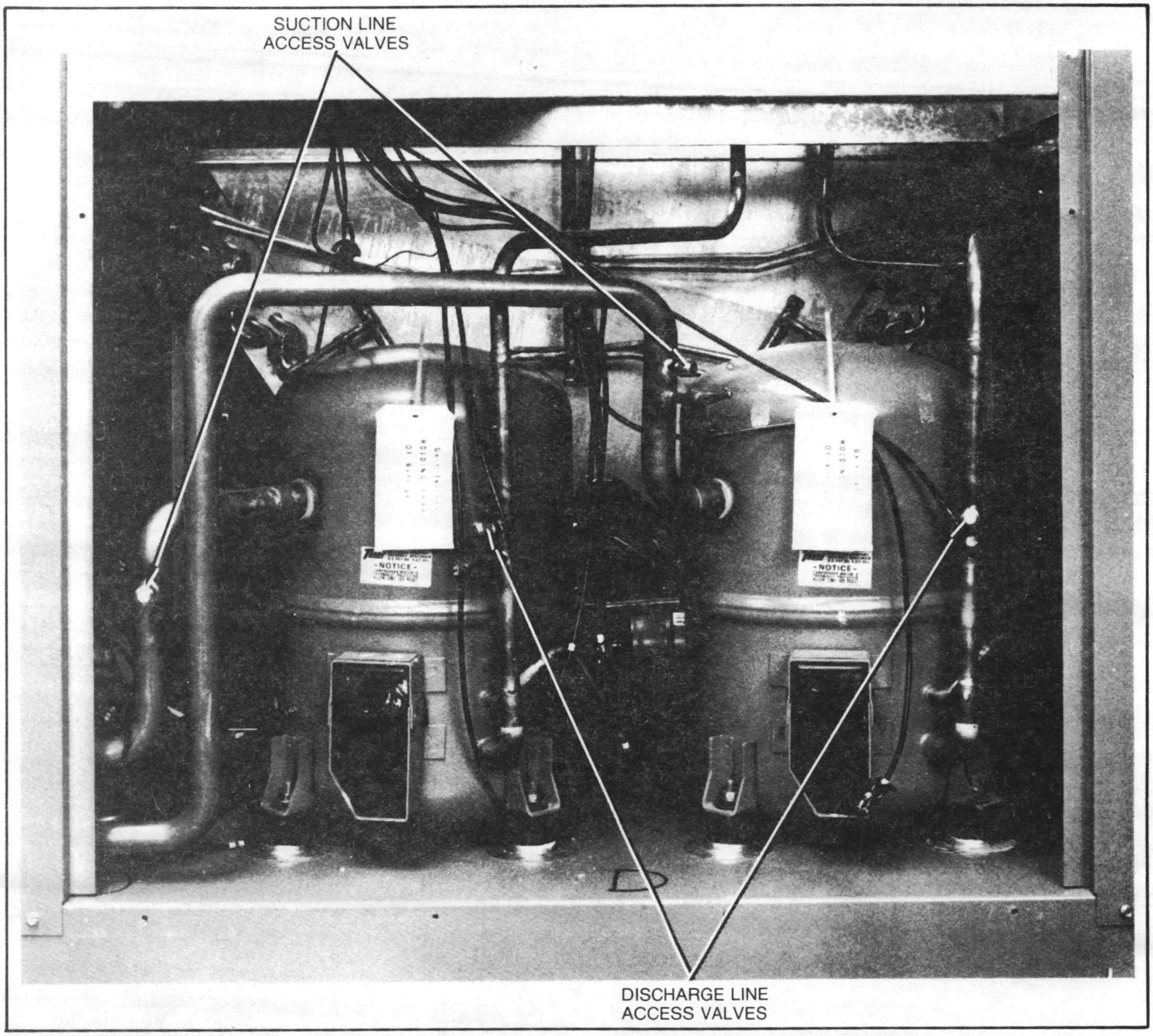


Figure 9 · Compressor Suction and Discharge Access Valves (Dual Compressor Unit Shown)

Operating Pressures

Operating pressure data can be used to determine if the system is operating properly. System malfunctions — such as low airflow, line restrictions, incorrect refrigerant charge, malfunctioning expansion valve, damaged compressor, and so on — will result in pressure variations which are outside the normal range. If the condensing unit and evaporator are checked individually, as described below, the operating pressures can be used to determine which side of the system (high side or low side) is malfunctioning. In addition, the relationship of suction vs. discharge pressure, as well as whether these pressures are higher or lower than expected, will provide valuable clues for determining the specific problem(s).

CAUTION: Operating pressure data, by itself, cannot be used to accurately charge a system. Charging by weight is preferred. If this is not feasible, a combination of operating pressures and subcooling measurement is necessary to properly charge the system. Refer to "Checking Refrigerant Charge" in the MAINTENANCE section of this manual.

Unfortunately, many application variables exist which affect operating pressures. These include indoor dry bulb and wet bulb temperature, outside dry bulb temperature, suction line pressure drop, and evaporator airflow. Since these variables can give misleading results, it is not recommended that operating pressures be used as the sole check of system operation. Further, the following conditions must be satisfied before checking system operating pressures.

1. The outdoor ambient temperature must be between 65 and 105 F. At ambient temperatures outside of this range, meaningful operating pressures cannot be measured.
2. The relative humidity of the air entering the evaporator must be above 40%. If it is less than 40%, meaningful operating pressures cannot be measured.
3. **All** condenser fans must be operating. If necessary, jumper the low ambient fan switches. Be sure to remove the jumpers when the measurements are completed.
4. Do not take measurements if the system includes a low ambient damper and/or hot gas bypass.

Use the following procedure to check operating pressures.

1. Condensing Unit Performance:
   a. Measure pressures (psig) at the suction and discharge line access valves next to the compressor.
   b. Measure the dry bulb air temperature (F) entering the condenser coil.
   c. If the outside ambient is between 65 and 105 F, enter the appropriate graph in Figures 10-13 at the measured suction pressure and condenser ambient. Read the corresponding discharge pressure.
   d. The measured discharge pressure should be within ±7 psi of the graph pressure. If the difference is greater than ±7 psi, the **condensing unit** performance is unacceptable. Refer to the TROUBLESHOOTING section of this manual.

Table 4 - Compressor Suction Pressures (psig)

			CONDENSER AMBIENT, F														
			65			75			85			95			105		
CON-		EVAP.	WET BULB, F			WET BULB, F			WET BULB, F			WET BULB, F			WET BULB, F		
DENSING	EVAP-	AIRFLOW	57	65	72	57	65	72	57	65	72	57	65	72	57	65	72
UNIT	ORATOR	(SCFM)	COMPRESSOR SUCTION PRESSURE (PSIG)														
BTA120D	BTE120B	4000	59	69	79	60	71	81	62	72	83	63	74	84	65	76	86
BTA150D	(2) BWE090C	5000	59	69	79	61	71	81	62	73	83	64	75	85	66	77	87
	BWV180B	5000	61	71	82	62	73	84	64	75	85	66	77	87	68	79	90
BTA180D	(2) BWE090C	6000	58	68	78	60	70	80	61	72	82	63	74	84	65	76	86
	BWV180B	6000	60	70	80	61	72	82	63	74	84	65	76	86	66	77	88
BTA180F	BWV180B	6000	57	67	76	59	69	78	61	71	81	63	73	83	65	75	86

NOTES:
1. Table only good for relative humidity of air entering evaporator greater than 40%.
2. Interpolation between wet bulb temperatures is allowable. Do not extrapolate outside range given.

2. Evaporator Performance:
   a. Measure the actual **wet bulb** temperature (F) of the air entering the evaporator. Be sure to measure the mixed air condition if outside air is being ducted in.
   b. Find the correct combination of condensing unit and evaporator in Table 4. Match the condenser entering air temperature (measured in Step 1b) with the evaporator wet bulb temperature (measured in Step 2a) to determine the correct suction pressure.
   c. Use Table 5 to correct the suction pressure (from Table 4) for the line sizes used in your installation.
   d. Use Table 6 to correct the suction pressure (from Step 2c) for the airflow of your evaporator.
   e. The measured suction pressure at the compressor should be within ±2 psi of the corrected pressure from Tables 4-6. If not, improper **system** operation is indicated. Refer to the TROUBLESHOOTING section of this manual.

CAUTION: Table 4 is not accurate if the relative humidity of evaporator entering air is less than 40%, or if an evaporator/condensing unit combination other than those listed is used.

Table 5 - Suction Pressure Correction for Line Size (PSI)

CONDENSING UNIT	7/8" O.D. SUCTION LINE LENGTH, FEET 0*	25	50	75	100	125*
BTA120D	+0.4	−1.0	−2.4	−3.6	−4.7	−5.8
BTA150D	+0.6	−1.6	−3.6	−5.4	−6.9	−8.4
BTA180D	+0.3	−2.5	−5.0	−7.1	−8.9	−10.6
CONDENSING UNIT	**1-1/8" O.D. SUCTION LINE LENGTH, FEET 0***	**25**	**50**	**75**	**100**	**125***
BTA120D	+0.4	0	−0.4	−0.8	−1.1	−1.5
BTA150D	+0.6	0	−0.6	−1.2	−1.8	−2.3
BTA180D	+0.3	−0.5	−1.3	−2.0	−2.7	−3.4
CONDENSING UNIT	**1-3/8" O.D. SUCTION LINE LENGTH, FEET 0***	**25**	**50**	**75**	**100**	**125***
BTA120D	+0.4	+0.3	+0.1	0	−0.2	−0.3
BTA150D	+0.6	+0.4	+0.2	0	−0.3	−0.5
BTA180D	+0.3	0	−0.2	−0.5	−0.8	−1.1
BTA180F	−0.7	−1.7	−2.6	−3.4	−4.2	−4.9
CONDENSING UNIT	**1-5/8" O.D. SUCTION LINE LENGTH, FEET 0***	**25**	**50**	**75**	**100**	**125***
BTA180F	+0.4	0	−0.4	−0.8	−1.2	−1.6

*0 and 125 feet provided for interpolation purposes only.

Table 6 - Suction Pressure Correction for Airflow (PSI)

COND.	PERCENT OF RATED EVAPORATOR AIRFLOW								
UNIT	-20%	-15%	-10%	-5%	0%	+5%	+10%	+15%	+20%
BTA120D	-2.8	-2.0	-1.3	-0.6	0	+0.6	+1.1	+1.6	+2.1
BTA150D	-2.6	-1.9	-1.2	-0.6	0	+0.5	+1.0	+1.5	+1.9
BTA180D	-2.6	-1.9	-1.2	-0.6	0	+0.5	+1.0	+1.4	+1.9
BTA180F	-2.5	-1.8	-1.2	-0.6	0	+0.5	+1.0	+1.4	+1.8

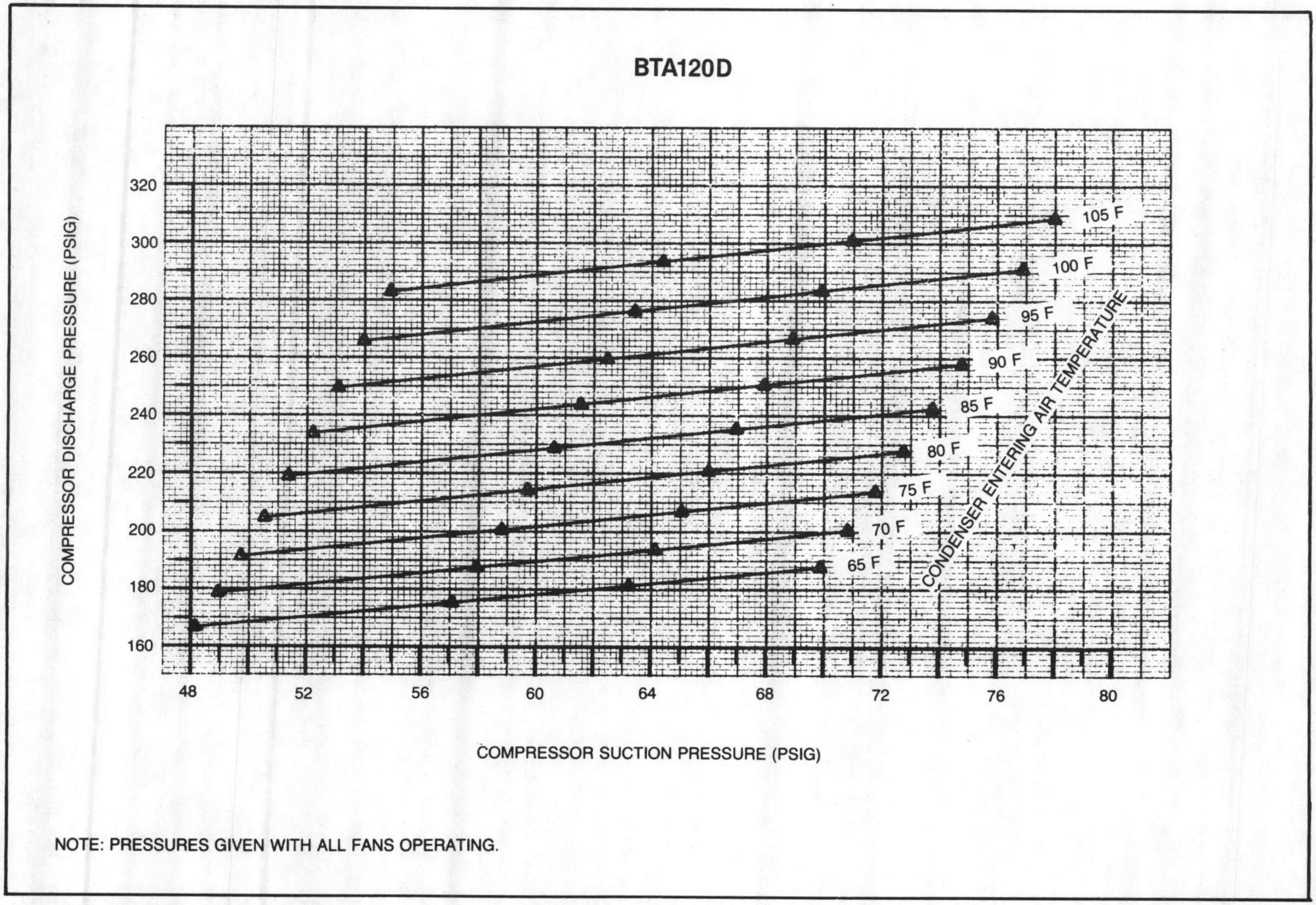


Figure 10 · BTA120D Operating Pressures

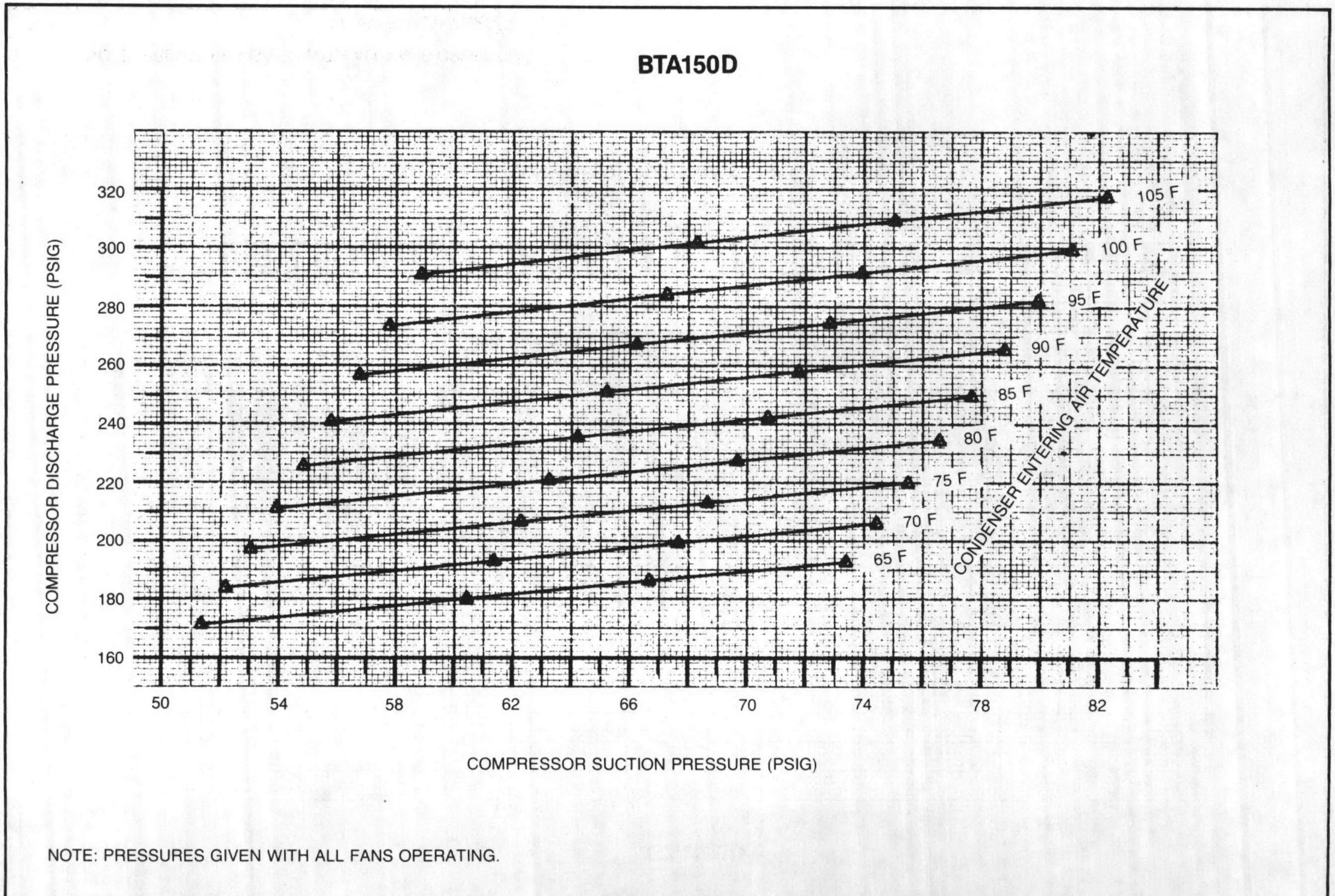
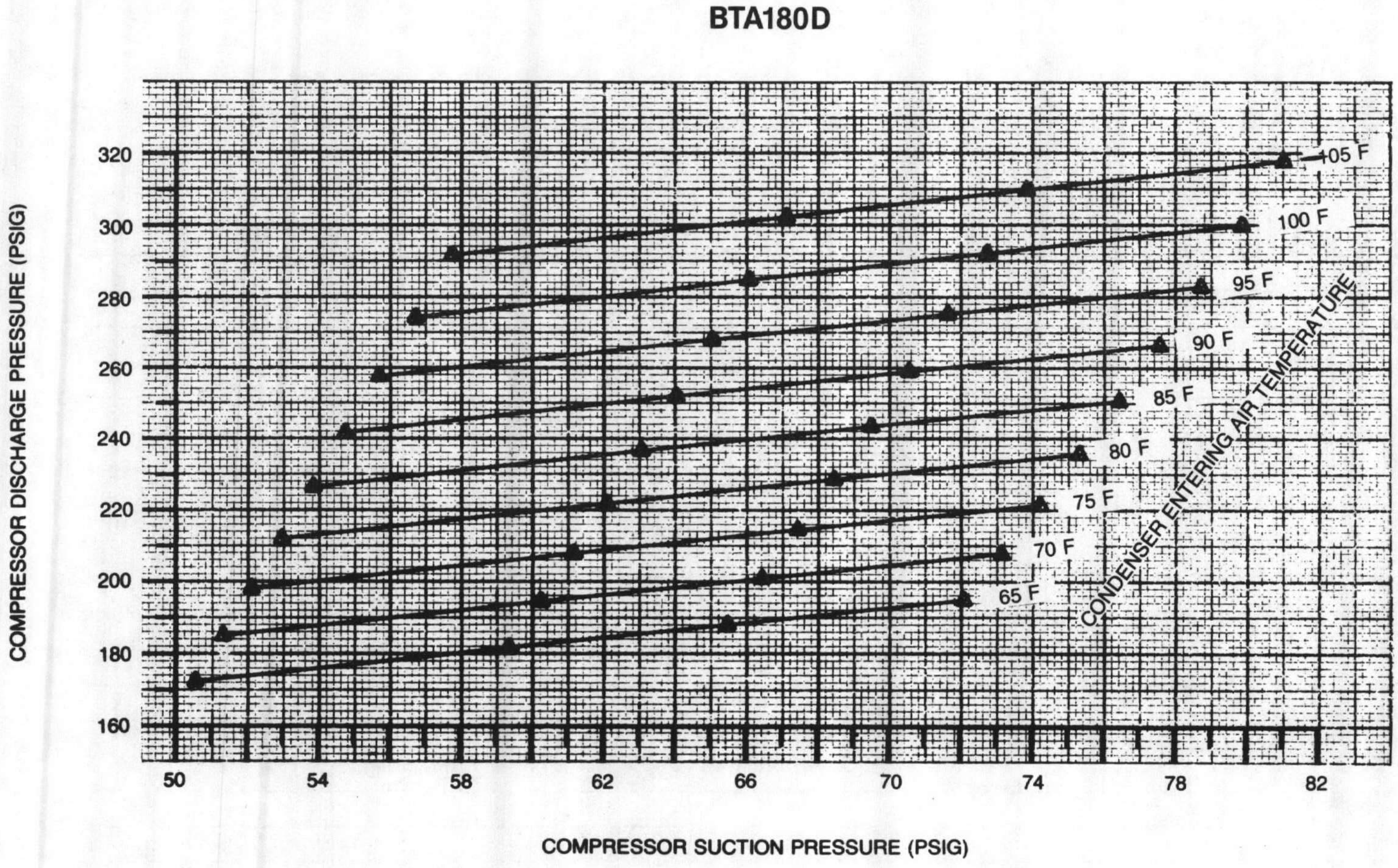
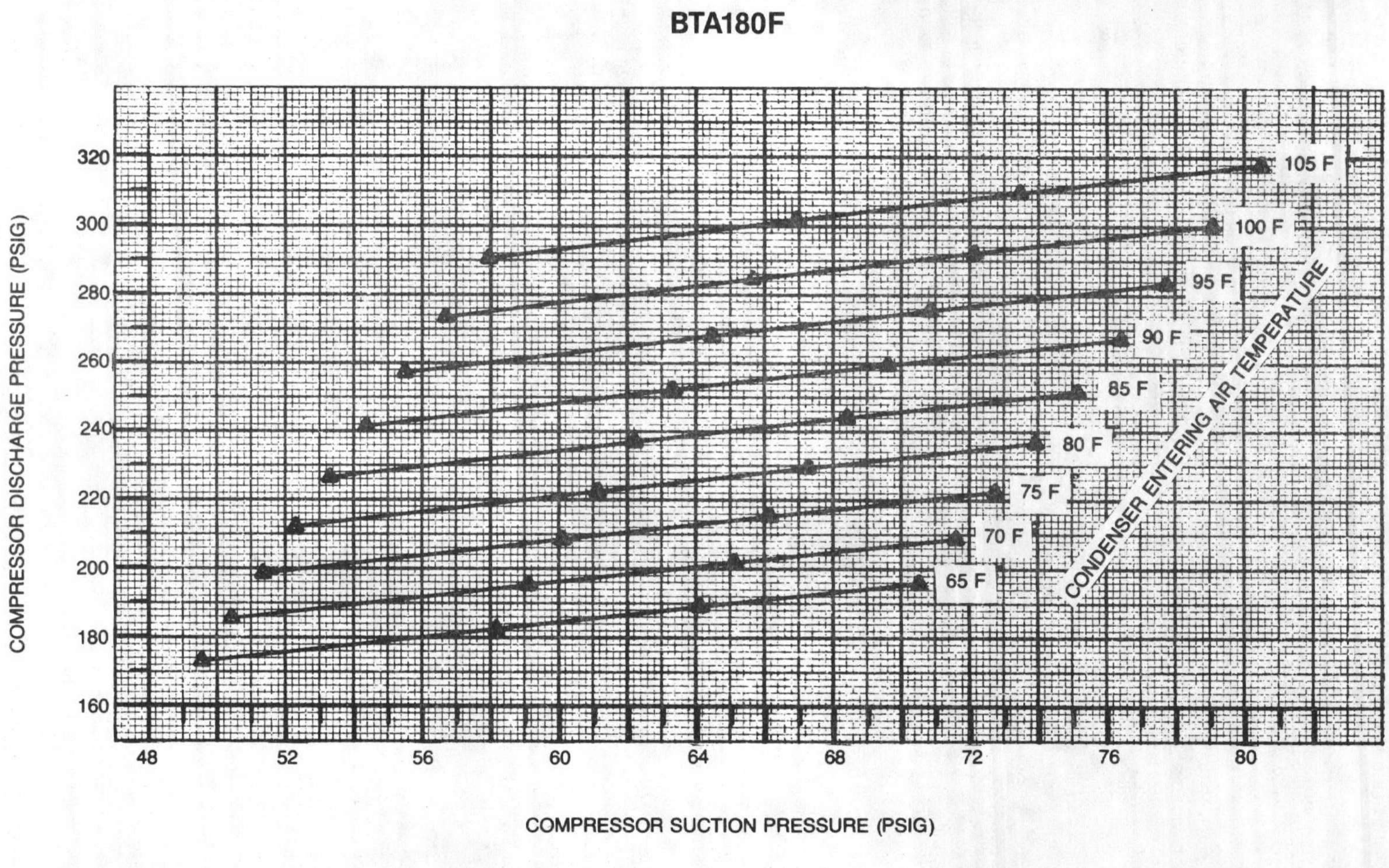


Figure 11 · BTA150D Operating Pressures



NOTE: PRESSURES GIVEN WITH ALL FANS OPERATING.

Figure 12 · BTA180D Operating Pressures



NOTE: PRESSURES GIVEN WITH ALL FANS OPERATING.

Figure 13 · BTA180F Operating Pressures

Measuring Superheat

The "safe" setting range for suction gas superheat on Trane equipment is 12 to 16 degrees at the evaporator. Settings within this range will allow for measurement error. Superheats below 12 degrees can cause refrigerant flood back which could lead to serious compressor damage. Superheat readings above the 16 degree measurement reduce system efficiency by reducing the effective evaporator surface.

To determine suction gas superheat, the pressure at the outlet of the evaporator must be measured and then converted to saturated vapor temperature by using a Refrigerant-22 pressure/temperature chart. The saturated vapor temperature can then be subtracted from the actual suction temperature, which is measured on the suction line close to the expansion valve bulb. The difference between the two temperatures is known as suction gas superheat. On most Trane fan/coil units an access valve has been provided close to the expansion valve bulb. To obtain an accurate reading, this access valve must be utilized when determining suction gas superheat.

Instruments to Use:

1. The gauge used to measure suction pressure should be of the best quality available. Gauges permanently installed on the equipment should not be used. A good quality gauge on a standard refrigerant manifold set is recommended.

2. To measure suction temperature, an electronic temperature tester will be sufficient. Testers manufactured by Robinnaire, Annie, and Thermal are among those available. Glass thermometers do not have sufficient contact area to give accurate readings.

Procedure:

In most cases it is desirable to use a single distributor evaporator with the BTA condensing unit, thereby utilizing one expansion valve. When the system has only one expansion valve, the following procedure should be used for measuring superheat.

1. Cut the suction line insulation to gain access to the suction line. If armaflex is used, it is best to cut around the circumference of the tubing.

2. Clean the line carefully and attach the electronic temperature sensor. Black electrical tape works well when securing the sensor of the temperature tester to the suction line. (Make sure the sensor is making good contact with the tube.)

3. Rejoin the armaflex and seal with plastic tape to prevent sensor contact with ambient air.

   NOTE: *For measurement accuracy the temperature sensor* ***must*** *be installed and insulated properly. Make sure the armaflex extends at least six inches on both sides of the sensor location. Seal both ends of the armaflex to keep ambient air from getting under the insulation and affecting the temperature readings.*

4. Install a pressure gauge to monitor suction pressure.

5. Operate the system for approximately 10 to 15 minutes to be sure that the expansion valve has time to stabilize.

6. To measure superheat, compare the saturated vapor temperature of the refrigerant converted from the suction pressure reading (see Table 7) to the actual temperature measured at the line by the electronic tester. Proper suction superheat is 12 to 16 degrees.

EXAMPLE:
Suction Pressure = 66.0 psig
Suction Temperature = 52 F
Suction Pressure converted to Saturated Vapor Temperature (from Table 11) = 38 F
Suction Superheat = (Actual Line Temp.) − (Saturated Vapor Temp.)
= (52 F) − (38 F)
= 14 F

If initial suction superheat readings fall below 12 degrees, the adjusting stem on the expansion valve should be adjusted clockwise to close the valve, limiting the flow of refrigerant to the evaporator and thus increasing superheat. Adjustment should be made a half turn at a time. Conversely, if the initial suction superheat reading is greater than 16 degrees, the adjusting stem on the expansion valve should be adjusted counterclockwise to open the valve, increasing the flow of refrigerant to the evaporator and thus decreasing superheat. Adjustments should be made until an acceptable reading is obtained. The system should be allowed to restabilize for 10 minutes after each adjustment.

Table 7 · Pressure/Temperature Conversions for Calculating Suction Line Superheat

SATURATED TEMPERATURE	PRESSURE USING REFRIGERANT-22
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

Measuring Subcooling

The following conditions must be satisfied before checking subcooling.

1. The outdoor ambient temperature must be between 65 and 105 F. At ambient temperatures outside of this range, meaningful operating pressures cannot be measured.
2. The relative humidity of the air entering the evaporator must be above 40%. If it is less than 40%, meaningful operating pressures cannot be measured.
3. The compressor must be operating on high speed.
4. **All** condenser fans must be operating. If necessary, jumper the low ambient fan switches. Be sure to remove the jumpers when the measurements are completed.
5. Do not take measurements if the system includes a low ambient damper and/or hot gas bypass.

The proper setting range for liquid subcooling is 18 to 30 F on BTA180F units. Determine the system subcooling as follows:

1. Measure the liquid line pressure at the liquid line access valve installed inside the condensing unit. Convert this pressure reading to saturated temperature by using a Refrigerant-22 pressure/temperature chart (refer to Table 8).
2. Measure the actual liquid line temperature on the liquid line close to the access valve. To ensure an accurate reading, clean the line thoroughly where the electronic temperature sensor will be attached. Glass thermometers do not have sufficient contact area to give accurate readings. After securing the sensor to the line, wrap the sensor and line with insulation to prevent contact with ambient air.
3. Determine the system subcooling by subtracting the actual liquid line temperature (measured in Step 2) from the saturated liquid temperature (calculated in Step 1).
4. If the system is properly charged, subcooling at the liquid line access valve should be 18-30 F on BTA180F units and 14-19 F on BTA120D-BTA180D units.

Table 8 - Pressure/Temperature Conversion for Calculating Liquid Line Subcooling

SATURATED TEMPERATURE	PRESSURE USING REFRIGERANT-22
70	121.4
75	132.2
80	143.6
85	155.7
90	168.4
95	181.8
100	195.9
105	210.8
110	226.4
115	242.7
120	259.9
125	277.9
130	296.8
135	316.6
140	337.2
145	358.9
150	381.5

Table 9 - Maximum Allowable Amps

Condensing Unit	Electrical Characteristics	Allowable** Voltage Range	Max. Allowable Amps Matched Evap.	Oversized* Evap.
BTA120D300	208-230/60/3	187-253	24	—
BTA120D400	460/60/3	416-506	11	—
BTA120DW00	575/60/3	520-635	9	—
BTA150D300	208-230/60/3	187-253	—	30
BTA150D400	460/60/3	416-506	—	13
BTA150DW00	575/60/3	520-635	—	11
BTA180D300	208-230/60/3	187-253	31	36
BTA180D400	460/60/3	416-506	14	16
BTA180DW00	575/60/3	520-635	11	13
BTA180F300	208-230/60/3	187-253	66	67
BTA180F400	460/60/3	416-506	33	34
BTA180FW00	575/60/3	520-635	27	27

*Evaporator one size larger than condensing unit.
**Allowable voltage range at the unit terminal block.

Troubleshooting

The Troubleshooting Chart on the following pages is provided to serve as an aid for identifying the cause of any system malfunctions that may occur. The chart is divided into three columns:

— the "SYMPTOM" column describes the behavior the unit is exhibiting;
— the "PROBABLE CAUSE" column identifies possible sources of malfunction;
— the "RECOMMENDED ACTION" column indicates the procedures required to correct the malfunction.

If operating difficulties are encountered, make the following preliminary checks before referring to the Troubleshooting Chart:

☐ Check the thermostat to ensure that it is properly set, receiving control power, and "making/breaking" on a call for heating or cooling.

☐ Verify that the unit is receiving electrical supply power, and that the fuses are intact.

☐ Check the filters to make sure they are positioned properly, and free of dirt and debris.

After completing the checks listed above, inspect the system for other obvious causes of trouble such as broken fan belts, a clogged condenser coil, or restricted air ducts. If everything appears to be in order, but the unit still fails to operate properly, refer to the appropriate section of the Troubleshooting Chart.

NOTE: *The Troubleshooting Chart which follows is provided solely as a guide for determining the cause of mechanical failure or malfunction. When mechanical problems do occur, Trane recommends that trained service personnel be contacted to help ensure proper diagnosis and repair of the unit.*

WARNING: OPEN THE UNIT DISCONNECT SWITCH AND LOCK IT IN THAT POSITION TO PREVENT ACCIDENTAL START-UP. NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE THE UNIT WITHOUT FIRST OPENING THE DISCONNECT SWITCH. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
A. Compressor does not start, and does not hum. Condenser fans do not operate.	1. No power to unit.	1. Check for the following: a. Disconnect switch open. b. Fuses blown.
	2. No call for cooling.	2. Check for the following: a. Defective thermostat. b. Broken or improper control wiring. c. Blown control power fuse.
	3. Anti-recycle timer has not timed out (if installed).	3. Wait at least five minutes for the anti-recycle timer to time out.
	4. Compressor motor protection module cut out.	4. Check motor windings for open circuit after allowing cool-down time. Refer to Symptom F, "Compressor motor protection module cut out".
	5. Unit locked out by reset relay.	5. Check for the following: a. Excessive discharge pressure. Refer to Symptom L, "Discharge pressure too high". b. Defective high pressure control. c. Low suction pressure. Refer to Symptom I, "Suction pressure too low". d. Defective low pressure control. e. Defective reset relay contacts.
AA. Compressor does not start, and does not hum. Condenser fans operate.	1. Compressor contactor will not close.	1. Check for the following: a. Defective compressor contactor. b. Improper wiring.
	2. Defective compressor.	2. Replace faulty compressor.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
B. Compressor hums, but will not start.	1. Low voltage at the compressor.	1. Check for the following: a. A single blown fuse. b. Low line voltage. c. Defective compressor contactor. d. Loose wiring connections.
	2. Defective compressor.	2. Check for the following: a. Open motor winding. b. Excessive amp draw on all phases.
C. Compressor fails to switch to high speed.	1. No call for second stage of cooling.	1. Check for the following: a. Setpoint too low. b. Defective thermostat. c. Broken or improper control wiring.
	2. Compressor contactor will not close.	2. Same as AA-1.
	3. Defective compressor.	3. Same as AA-2.
D. Compressor short cycles.	1. Intermittent contact in control circuit.	1. Check for the following: a. Defective relay contacts. b. Loose wiring connections.
	2. Poor thermostat placement.	2. Refer to "Thermostat Installation" in the ELECTRICAL WIRING section of this manual.
	3. Defective anti-recycle timer.	3. Replace compressor motor protection module.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
E. Compressor runs continuously.	1. Unit undersized for load (cannot maintain space temperature).	1. Check for cause of excessive load.
	2. Compressor fails to switch to high speed.	2. Refer to Symptom C.
	3. Thermostat setpoint too low.	3. Readjust thermostat.
	4. Defective thermostat or control wiring (conditioned space too cold).	4. Replace thermostat. Replace or repair control wiring.
	5. Welded contacts on compressor contactor.	5. Repair or replace contactor.
	6. Leaky valves in compressor (indicated by operation at abnormally low discharge and high suction pressures).	6. Replace compressor.
	7. Shortage of refrigerant (indicated by reduced capacity coupled with high superheat, low subcooling, and low suction pressure).	7. Find and repair refrigerant leak. Recharge system.
F. Compressor motor protection module cut out.	1. Excessive load on evaporator (indicated by high supply air temperature).	1. Check for the following: a. Excessive airflow. b. High return air temperature.
	2. Lack of motor cooling (indicated by excessive superheat).	2. Check for the following: a. Improper expansion valve setting. b. Faulty expansion valve. c. Restriction in liquid line.
	3. Improper voltage at compressor.	3. Check for the following: a. Low or unbalanced line voltage. b. Loose power wiring. c. Defective compressor contactor.
	4. Internal parts of compressor damaged.	4. Replace compressor.
G. Compressor is noisy.	1. Internal parts of compressor damaged or broken (compressor knocks).	1. Replace compressor.
	2. Liquid floodback (indicated by abnormally cold suction line).	2. Check and adjust superheat.
	3. Liquid refrigerant in the compressor at start-up (indicated by an abnormally cold compressor shell).	3. Replace crankcase heater.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
H. System short of capacity.	1. Low refrigerant charge (indicated by low subcooling and high superheat).	1. Add refrigerant.
	2. Clogged filter drier (indicated by temperature change in refrigerant line through drier).	2. Replace filter drier or core of drier.
	3. Incorrect thermostatic expansion valve setting.	3. Readjust expansion valve.
	4. Expansion valve stuck or obstructed (indicated by high superheat and high space temperature).	4. Repair or replace expansion valve.
	5. Low evaporator airflow.	5. Check filters. Adjust airflow.
	6. Noncondensibles in system.	6. Evacuate and recharge system.
	7. Leaky valves in compressor (indicated by operation at abnormally low discharge and high suction pressures).	7. Replace compressor.
I. Suction pressure too low.	1. Shortage of refrigerant (indicated by high superheat and low subcooling).	1. Find and repair refrigerant leak. Recharge system.
	2. Thermostat set too low (indicated by low discharge pressure and low space temperature).	2. Readjust thermostat.
	3. Low airflow.	3. Check for clogged filters, incorrect fan speed, or high duct static pressure.
	4. Clogged filter drier.	4. Check for frosting on filter drier. Replace if necessary.
	5. Expansion valve power assembly has lost charge.	5. Repair or replace expansion valve power head assembly.
	6. Obstructed expansion valve (indicated by high superheat).	6. Clean or replace valve.
J. Suction pressure too high.	1. Excessive cooling load (indicated by high supply air temperatures).	1. See Symptom E, "Compressor runs continuously".
	2. Overfeeding of expansion valve (indicated by abnormally low superheat and liquid flooding to compressor).	2. Adjust superheat setting and check to see that remote bulb is properly attached to suction line.
	3. Suction valves broken in open position (indicated by noisy compressor).	3. Replace compressor.
	4. Compressor on low speed.	4. Refer to Symptom C.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
K. Discharge pressure too low.	1. Shortage of refrigerant (indicated by low subcooling and high superheat plus bubbles in sight glass).	1. Repair leak and recharge system.
	2. Broken or leaky compressor discharge valves (indicated by suction and discharge pressures that equalize rapidly after shutdown).	2. Replace compressor.
	3. Condenser fan control stuck in closed position (contacts closed when temperature is below 60 F).	3. Replace defective control.
	4. Unit running below minimum operating ambient.	4. Provide adequate heat pressure controls or a unit ambient lockout switch.
	5. Low ambient damper stuck open (indicated by low discharge pressure).	5. Repair or replace damper operator.
L. Discharge pressure too high.	1. Too little or too warm condenser air; restricted air flow.	1. Clean coil. Check fan and motors for proper operation.
	2. Air or noncondensible gas in system (indicated by exceptionally hot condenser and excessive discharge pressure).	2. Evacuate and recharge system.
	3. Overcharge of refrigerant (indicated by high subcooling, low superheat, and high suction pressure).	3. Remove excess refrigerant.
	4. Excessive system load.	4. Reduce load.
	5. Defective condenser fan or fan control (indicated by one fan off and high condenser pressure).	5. Repair or replace fan or control.
	6. Defective or inoperative low ambient dampers.	6. Repair or replace defective parts.

The Trane Company
Light Commercial Group
Guthrie Highway
Clarksville, TN 37040

AN AMERICAN—
STANDARD
COMPANY

BTA-M-3

Technical Literature Printed in USA

TAB PLACEMENT HERE

DESCRIPTION:

(3)

☐ Tab page did not contain hand written information

☑ Tab page contained hand written information
*Scanned as next image

(3)

TRANE

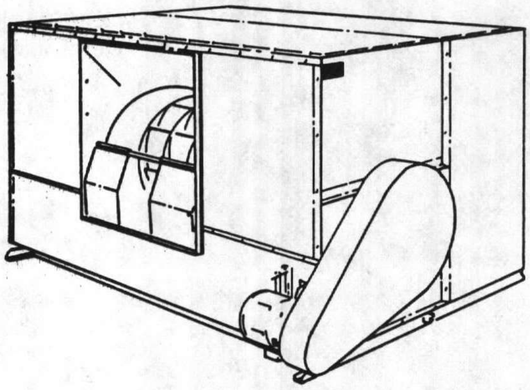
Maintenance CLCH-M-2

Library	**Service Literature**
Product Section	**Air Handling**
Product	**Central Station Air Handlers**
Model	**Climate Changers**
Literature Type	**Maintenance**
Sequence	**2**
Date	**January 1986**
File No.	**SV-AH-CLCH-CLCH-M-2-186**
Supersedes	

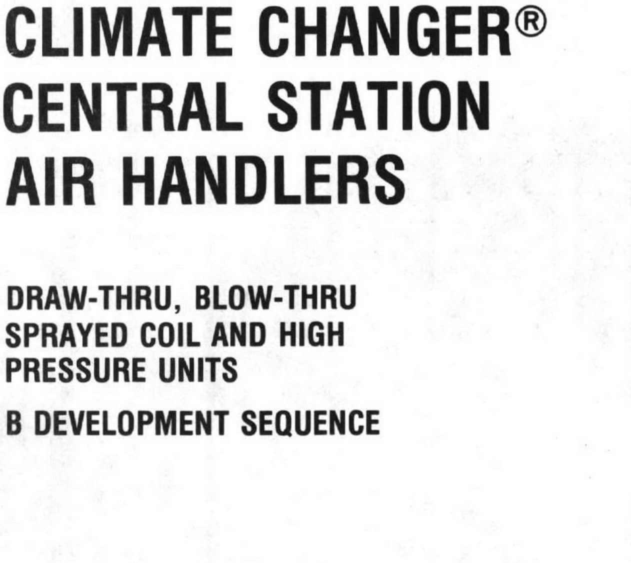
CLIMATE CHANGER® CENTRAL STATION AIR HANDLERS

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'.

TABLE OF CONTENTS

SUBJECT **PAGE**

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:

$$\frac{100 \times \{ [226-221] + [230-226] + [227-226] \}}{2 \times 226} =$$

2.2% (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.

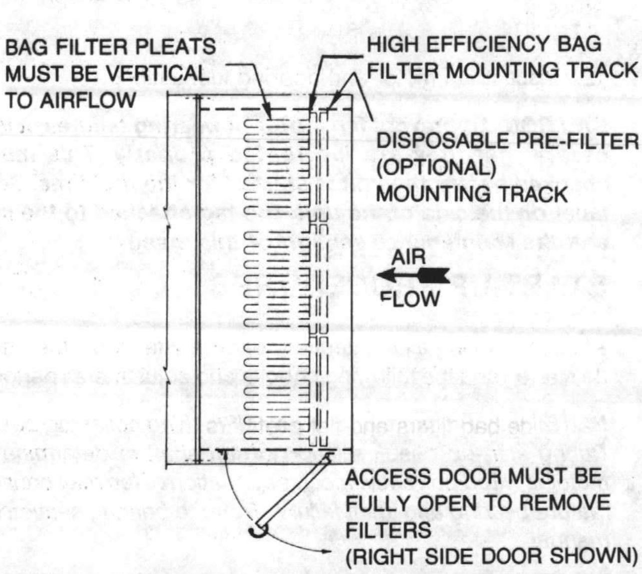


FIGURE 1 - Filter Mounting Track Location (Top View)

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.*

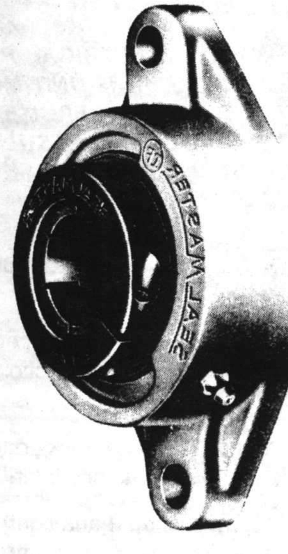


FIGURE 2 - Flange Type Bearing with Grease Fitting and Squeezeloc Tightener

TABLE 2 - Recommendations for Grease Lubricated Fan Bearings

OPERATING CONDITIONS	GREASING INTERVALS -20 F To 140 F	GREASING INTERVALS 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.

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.

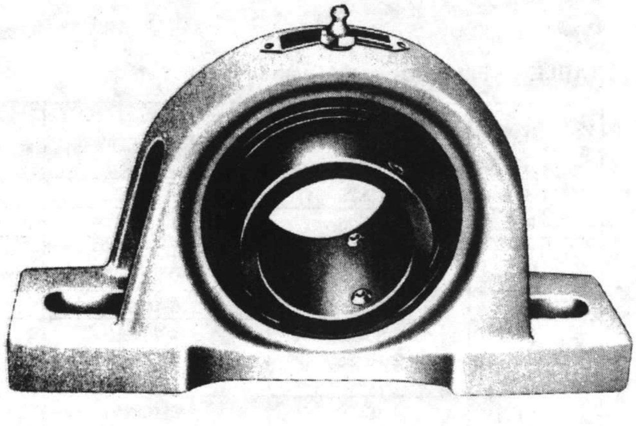


FIGURE 3 - Pillow Block Type Bearing with Grease Fitting and Double Lock Setscrew Arrangement

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.

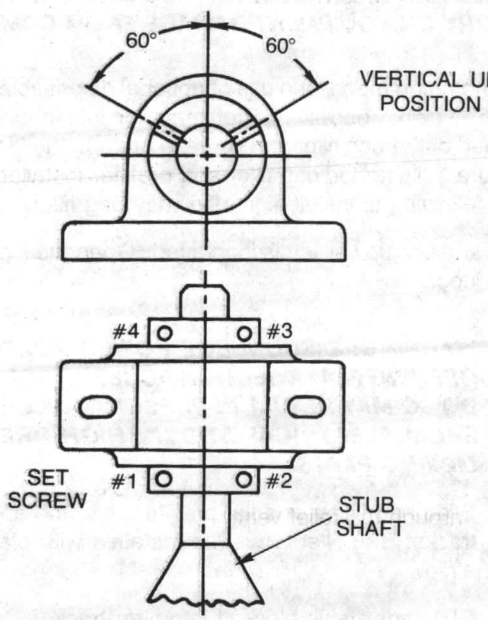


FIGURE 4 - Instruction Sketch for Pillow Block Bearing with Double Lock Setscrew

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.

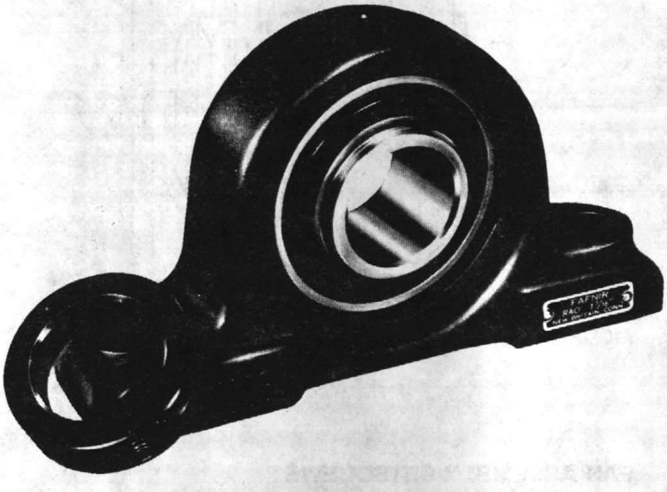


FIGURE 5 - Pillow Block Type Bearing with Grease Fitting and Self-Locking Collar Arrangement

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
1/4" - 20 UNC	4	6
1/4" - 28 UNF	4	7
5/16" - 18 UNC	8	14
5/16" - 24 UNF	9	16
3/8" - 16 UNC	14	24
3/8" - 24 UNF	16	28
7/16" - 14 UNC	30	42
7/16" - 20 UNF	35	45
1/2" - 13 UNC	40	69
1/2" - 20 UNF	47	83
9/16" - 12 UNC	57	99
9/16" - 18 UNF	68	118
5/8" - 11 UNC	86	150
5/8" - 18 UNF	101	176
3/4" - 10 UNC	146	254
3/4" - 16 UNF	173	301
7/8" - 9 UNC	206	358
7/8" - 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 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.

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.

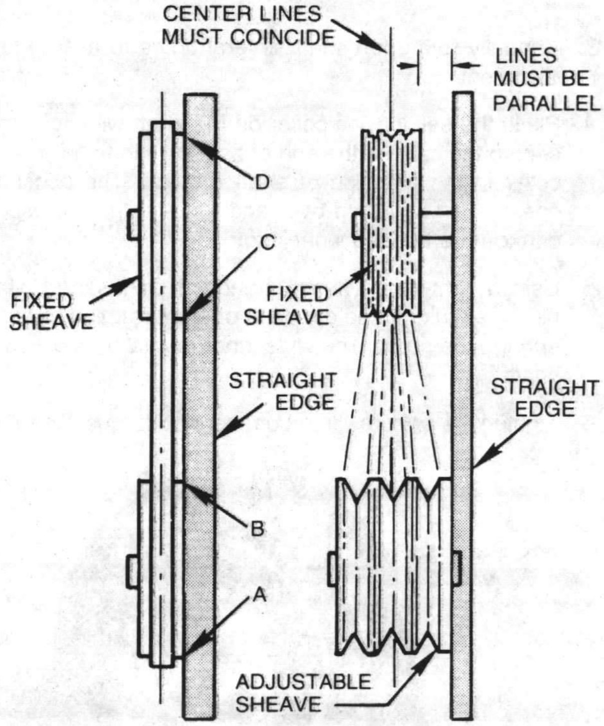


FIGURE 7 - Sheave Alignment

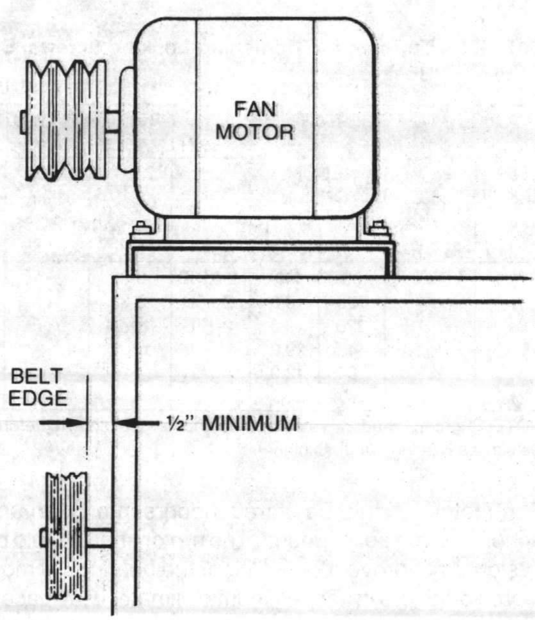


FIGURE 6 - Minimum Allowable Distance Between Frame Work and Fan Sheave

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 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)

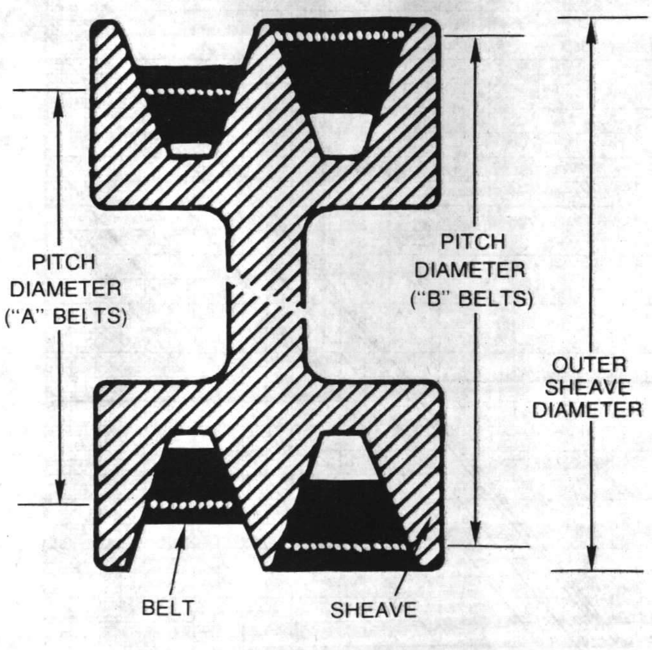


FIGURE 8 - Fan Sheave Pitch Diameter

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.

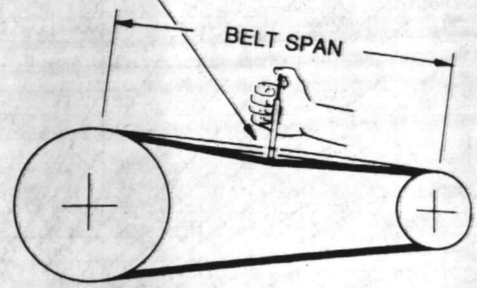


FIGURE 9 - Belt Tension Measurement

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.

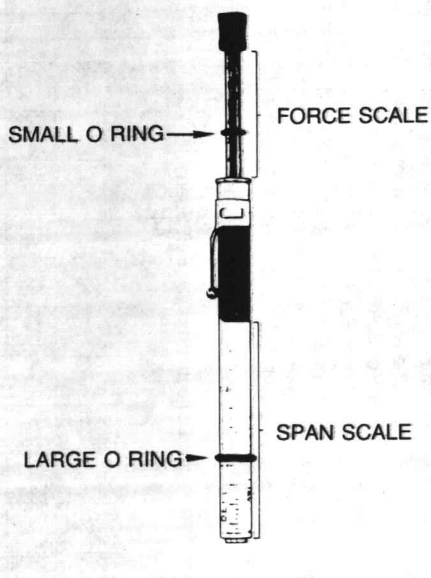
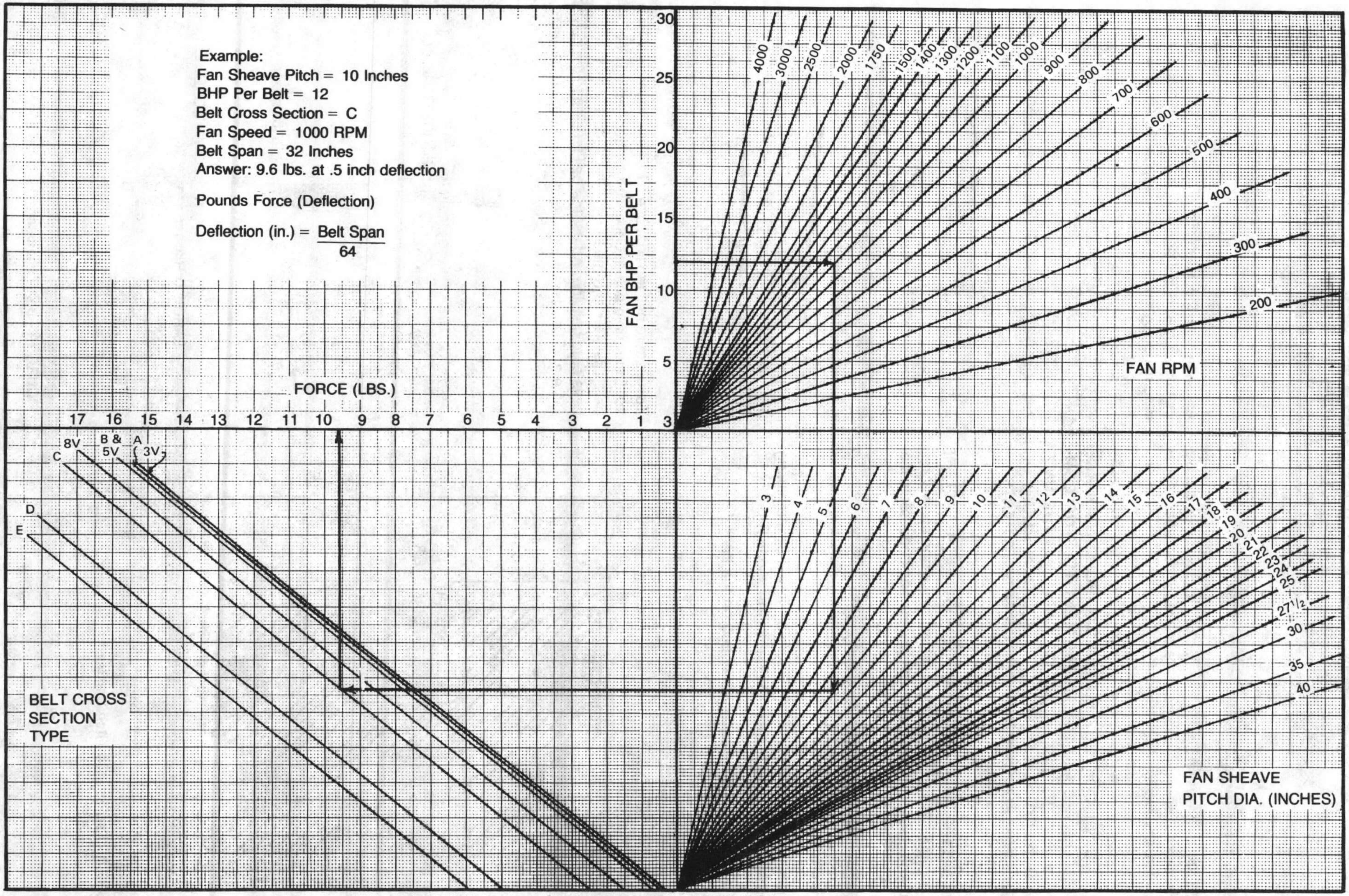


FIGURE 10 - Belt Tensioner

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

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

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

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

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

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.*

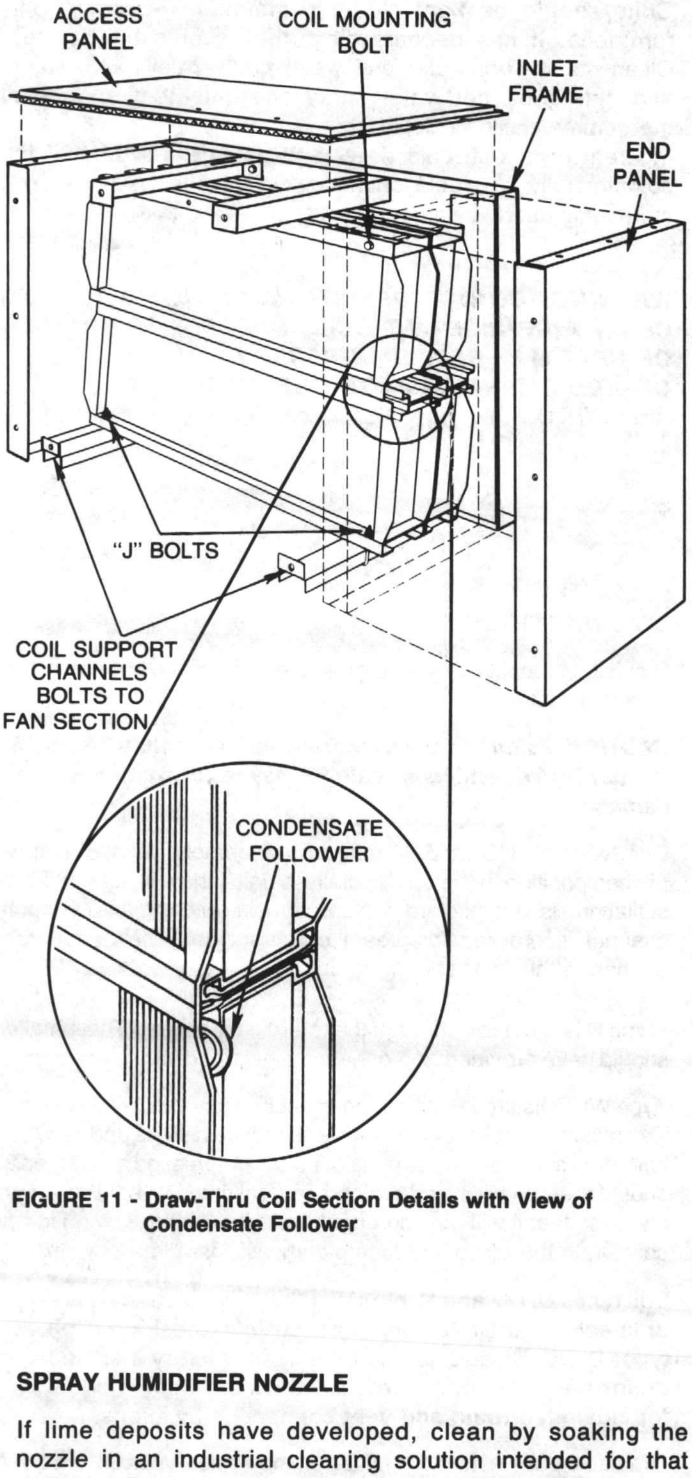


FIGURE 11 - Draw-Thru Coil Section Details with View of Condensate Follower

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.

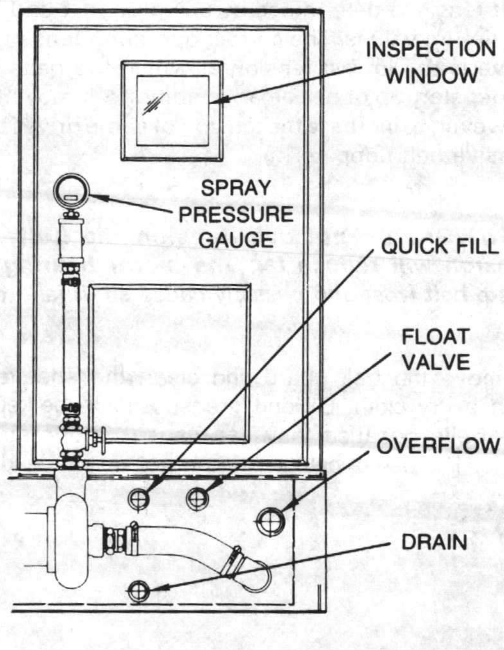


FIGURE 12 - Sprayed Coil Unit Tank Connections

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.

PRINTED BY PRODUCTION SERVICES — LA CROSSE JH/DL

TAB PLACEMENT HERE

DESCRIPTION:

C1

☐ Tab page did not contain hand written information

☑ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

(4)

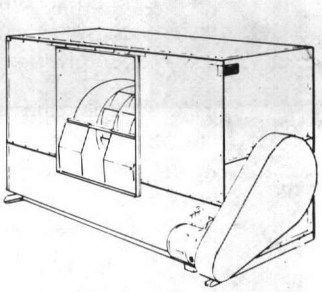
TRANE™

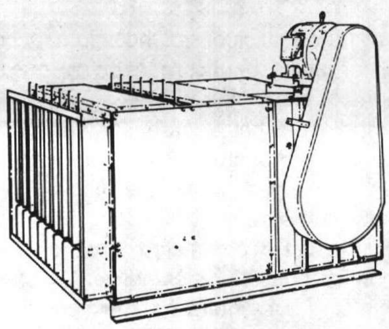
Installation Maintenance

TORR-IM-2D

Library	**Service Literature**
Product Section	**Heating**
Product	**Cabinet Heaters**
Model	**Torrivents, Force-Flo**
Literature Type	**Installation/Maintenance**
Sequence	**2D**
Date	**February, 1986**
File No.	**SV-TD-CAB-TORR-IM-2D-286**
Supersedes	**TORR-IM-2C and SUPPLEMENT MAY — 1984**

TORRIVENTS® AND CABINET FANS





MODELS
TVDB3 THRU TVDB63
CBDB3 THRU CBDB63
TMZ6 THRU TBZ63

LITERATURE CHANGES: Revise Figure 25.

TABLE OF CONTENTS

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

X39640268-02

GENERAL INFORMATION

Torrivents and Cabinet Fans are air handlers designed to provide complete heating and dehumidifying with steam and hot water coils.

The unit nameplate contains unit and model number information.

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. A Periodic Maintenance Checklist at the beginning of the Maintenance section provides the suggested routine maintenance schedule. These checklists should not be substituted for the detailed information and procedures contained in appropriate sections of the manual.

RECEIVING AND HANDLING

SHIPPING

Torrivents® and Cabinet Fans are shipped either assembled or in sections, depending upon unit size and configuration. All units or sections of units are attached securely to skids. Nuts, bolts and washers for assembling the units are attached to one of the skids. Motors ship separately when their size or location on the unit prevent safe transit in shipping (i.e. side-mounted motors). 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 arrange 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 hoising 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.

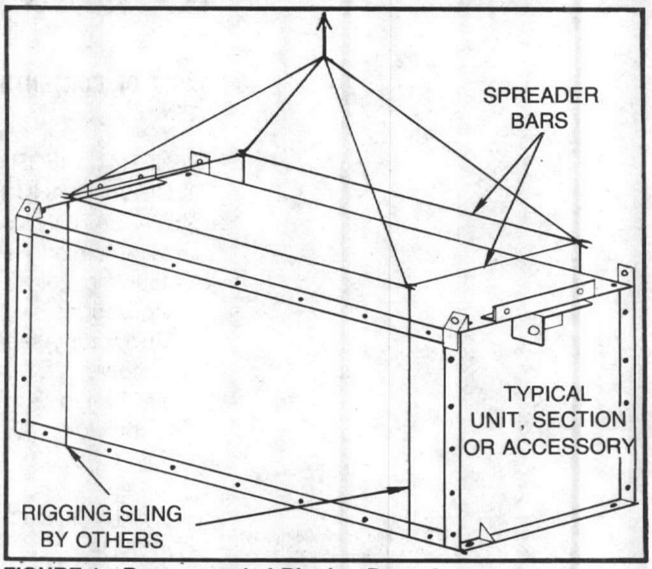


FIGURE 1 - Recommended Rigging Procedure

TABLE 1 - Torrivent and Cabinet Fans Approximate Operating Weights Less Motors (In Pounds)

	UNIT SIZE								
	3	6	7	8	9	10	12	14	17
	Cabinet Fan								
Basic Unit	115	160	235	230	375	275	380	400	665
	Torrivent								
Casing									
With 1-Row Coil	—	688	—	784	—	899	959	1,144	1,324
With 2-Row Coil	—	702	—	812	—	942	1,036	1,230	1,430
	Torrivent Multizone								
Casing Only	—	625	—	685	—	785	835	1,005	1,150
With 1-Row Coil	—	688	—	784	—	899	959	1,144	1,324
With 2-Row Coil	—	702	—	812	—	942	1,036	1,230	1,430
	UNIT SIZE								
	21	25	31	35	41	50	63	73	86
	Cabinet Fan								
Basic Unit	605	840	840	1,590	1,750	2,140	2,600	3,200	3,600
	Torrivent								
Casing									
With 1-Row Coil	1,102	1,370	1,505	2,153	2,699	3,032	3,628	—	—
With 2-Row Coil	1,233	1,646	1,737	2,610	2,986	3,360	4,063	—	—
	Torrivent Multizone								
Casing Only	1,205	1,560	1,785	2,300	3,235	3,410	4,200	—	—
With 1-Row Coil	1,409	1,774	2,070	2,642	3,633	3,881	4,784	—	—
With 2-Row Coil	1,534	1,908	2,225	2,861	3,875	4,148	5,102	—	—

NOTE:
1-row coil weights based on Type N, 132 fins/ft Steam Coil.
2-row coil weights based on Type W, 80 fins/ft Water Coil.

TABLE 2 - Approximate Motor Weights (LBS.)*

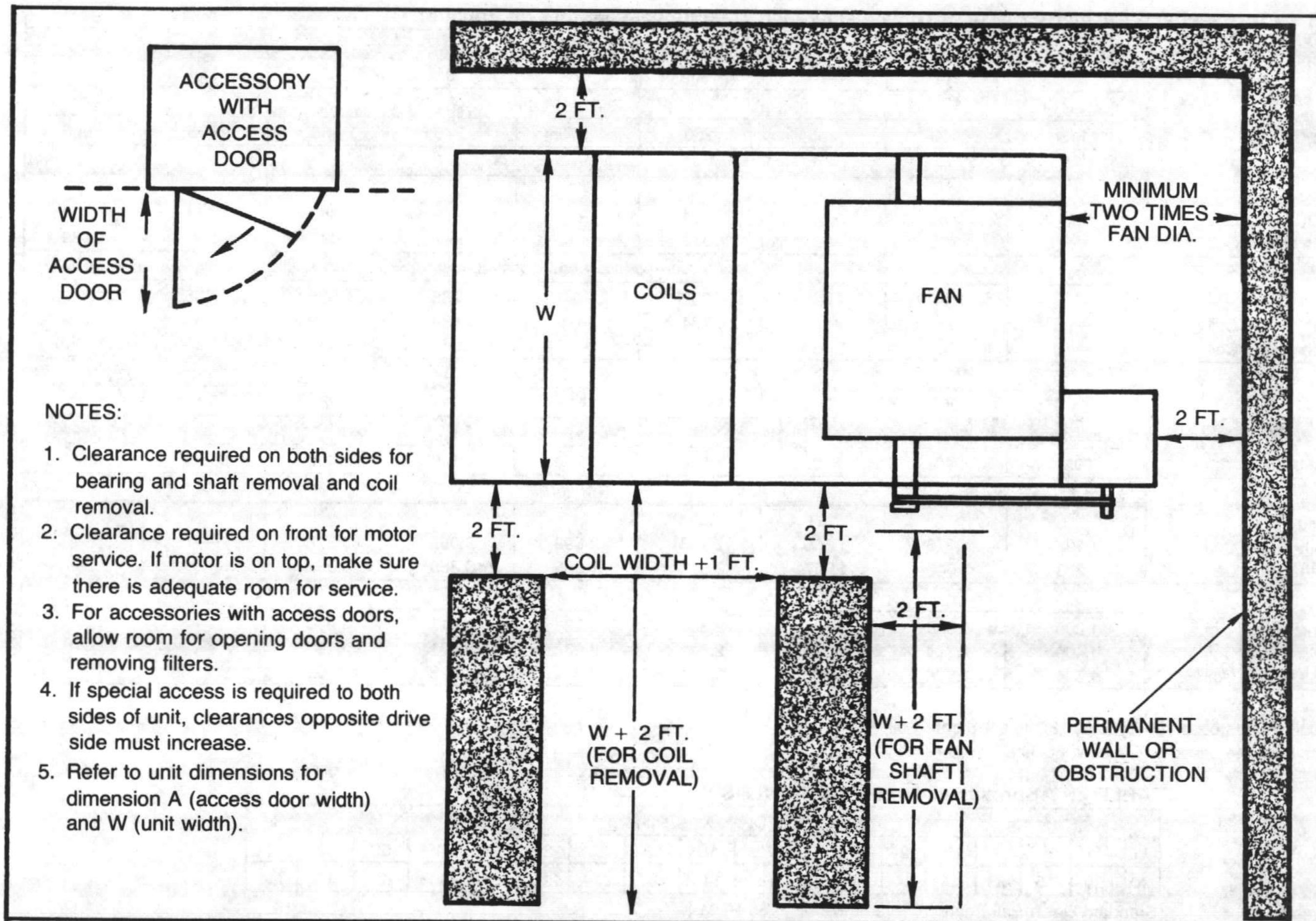
MOTOR HORSEPOWER																	
¼	⅓	½	1	1½	2	3	5	7½	10	15	20	25	30	40	50	60	75
20	20	25	33	44	44	71	82	127	144	187	214	263	300	409	460	560	660

*Standard Open Ball Bearing T-Frame Motor. 1750 RPM.

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	1,550
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	—	—	—	—
Exhaust Air Econimizer	—	—	—	—	—	182	256	270	319	340	380	437	519	623	750	869	—	—

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



NOTES:

1. Clearance required on both sides for bearing and shaft removal and coil removal.
2. Clearance required on front for motor service. If motor is on top, make sure there is adequate room for service.
3. For accessories with access doors, allow room for opening doors and removing filters.
4. If special access is required to both sides of unit, clearances opposite drive side must increase.
5. Refer to unit dimensions for dimension A (access door width) and W (unit width).

FIGURE 2 - Recommended Clearances

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 and without electric preheat (UL Standard 883).
3. The foundation or mounting platform must be large enough to include unit 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. Allow room for proper ductwork and electrical connections.

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 Z-bar mounting legs and isolators, which extend beyond the unit dimensions.*

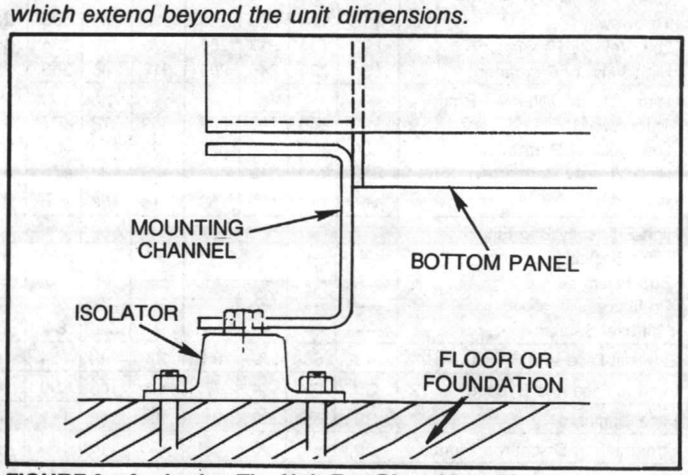


FIGURE 3 - Anchoring The Unit For Sizes 35 to 63

Level the unit after installation by adjusting the isolator leveling 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 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.

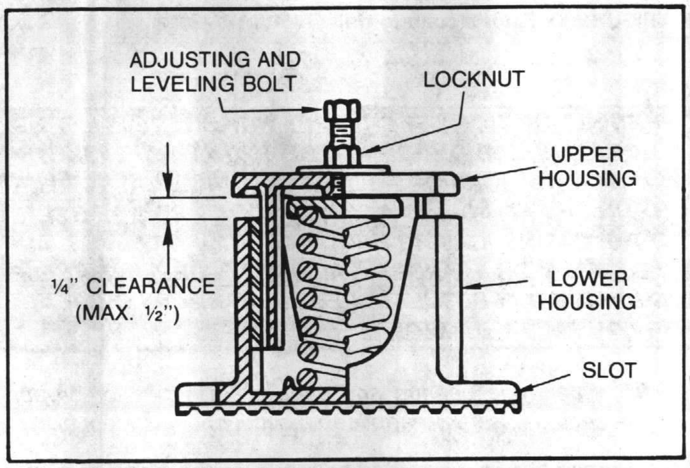


FIGURE 4 - Spring Type Isolator Adjustment

UNIT ASSEMBLY — MULTIZONE UNIT SIZES TMZ35 TO TMZ63

Multizone unit sizes 35 through 63 are shipped in two sections. Mounting rails are also shipped separately for field assembly and installation. Assemble the unit before mounting by following these procedures:

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

1. Secure the fan section to the mounting rails.
2. Apply the provided sealing tape over the bolt holes of the flange that will be used connect the fan and coil sections. See Figure 5.
3. Bolt the coil section to the fan section, through the sealing tape.
4. Bolt the coil section to the mounting rails.

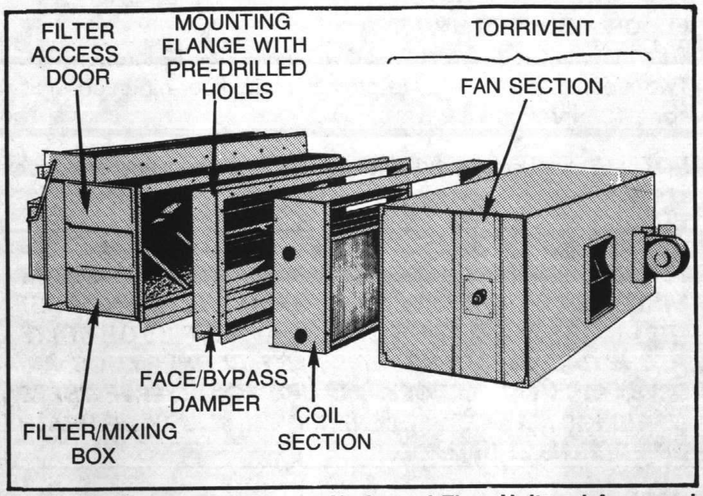


FIGURE 5 - Exploded View of a Horizontal Floor Unit and Accessories

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 mounting flange, for face and bypass damper section and or accessory, is standard on all sizes except 8, 10, 17, 21 and 31. The factory bolts an external angle at the bottom of the coil section to allow field mounting of non-flange sections (Figure 6).*

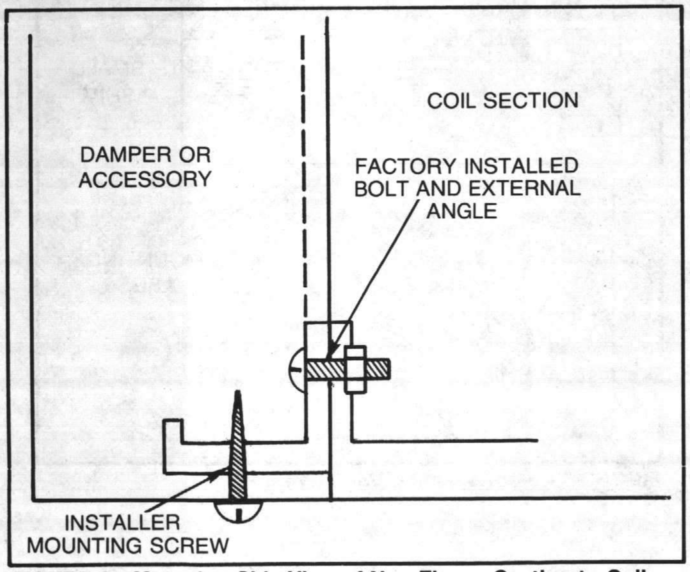


FIGURE 6 - Mounting Side View of Non-Flange Section to Coil Section

FLOOR-MOUNTED UNITS

Four mounting legs are provided with units size T2 through T31. Two mounting channels are provided with floor-mounted units sizes T35 through T63.

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

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. Attach the mounting legs or channels to the unit, if necessary. See Figures 7 and 8. Note: When installing floor mounting legs it may be necessary to remove the bottom panel screw. This will allow the mounting leg to rest flush with the unit.
2. Anchor the isolators to the floor.
3. Mount the unit on the isolators.
4. Attach any accesories.
5. Level the unit.

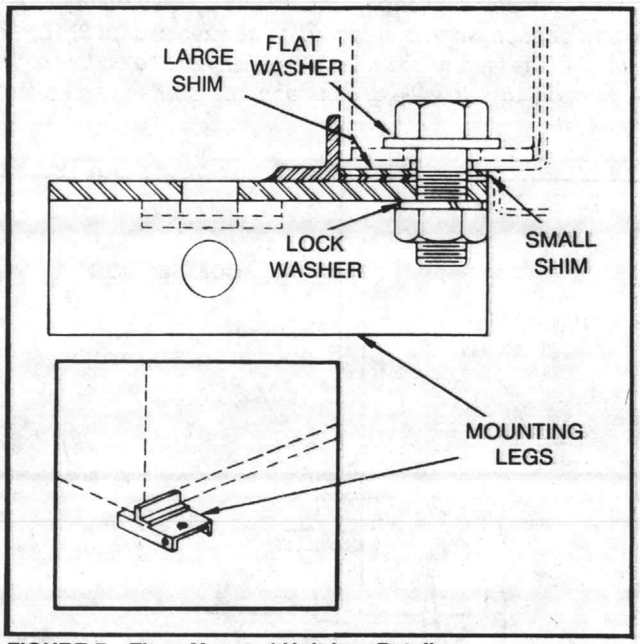


FIGURE 7 - Floor-Mounted Unit Leg Detail

CEILING-MOUNTED UNITS

Four mounting legs are supplied for unit sizes T3 through T31. Vertical Inverted units are provided with eight mounting legs. Two mounting channels are provided with unit sizes T35 through T63.

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

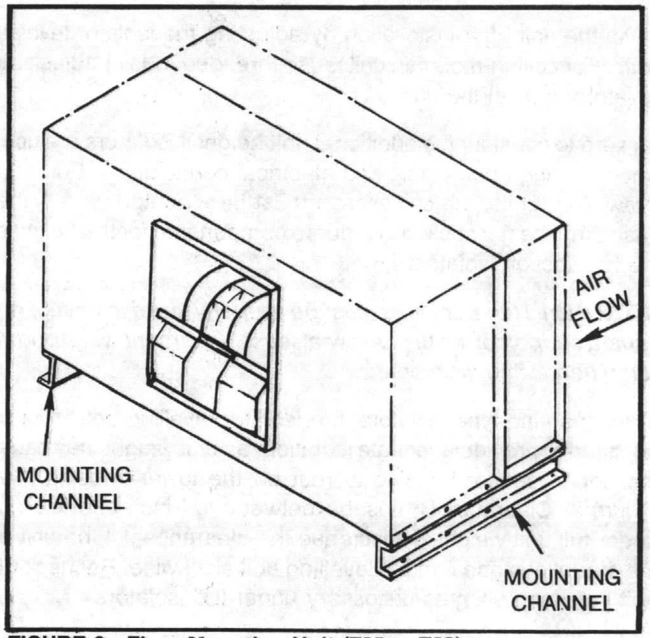


FIGURE 8 - Floor-Mounting Unit (T35 to T63)

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. Prepare the field-provided hanger rods and isolator assemblies, as shown in Figures 9 and 10, according to the unit mounting hole dimensions.
2. Mount the suspension device from the ceiling.
3. Attach any accessories to the unit.
4. Hoist the unit and attach it to the field-supplied hanger rods.
5. Level the unit.

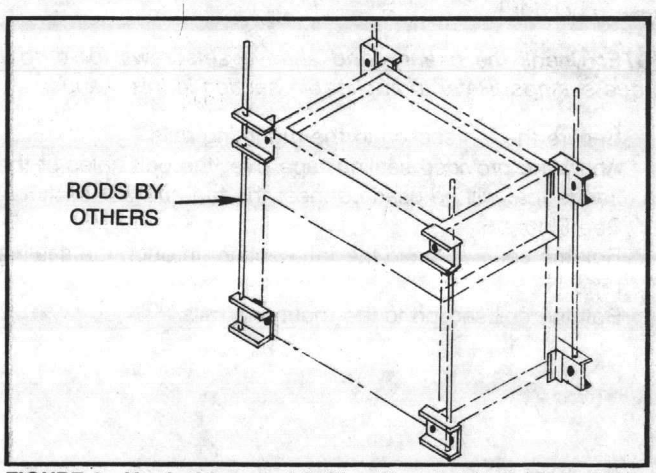


FIGURE 9 - Vertical Inverted Ceiling-Mounted Unit (T3 to T31)

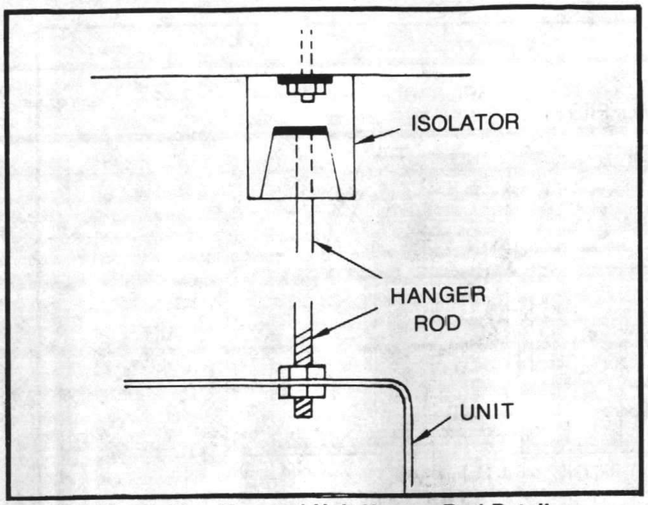


FIGURE 10 - Ceiling-Mounted Unit Hanger Rod Detail

WALL-MOUNTED UNITS
Four mounting legs are provided with all T3 through T31 units. Unit size T35 is provided with two full mounting channels. The mounting legs or channels are to be attached to field-supplied wall rails, as shown in Figure 11.

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.

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

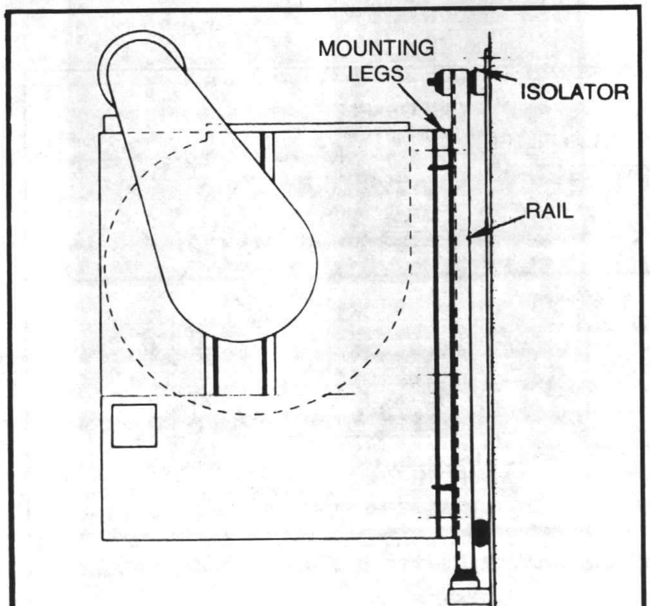


FIGURE 11 - Wall Mounted Units

1. Attach any accessories to the unit.
2. Attach the mounting legs to the unit, if necessary.
3. Secure the rails with isolators to the mounting legs or channels.
4. Hoist the unit to the wall and secure to the wall rail.
5. Level the unit.

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 on 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 contract with water droplets. Care must be taken to avoid water carryover in standard units.*

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 12 and 13. 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 14. 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.*

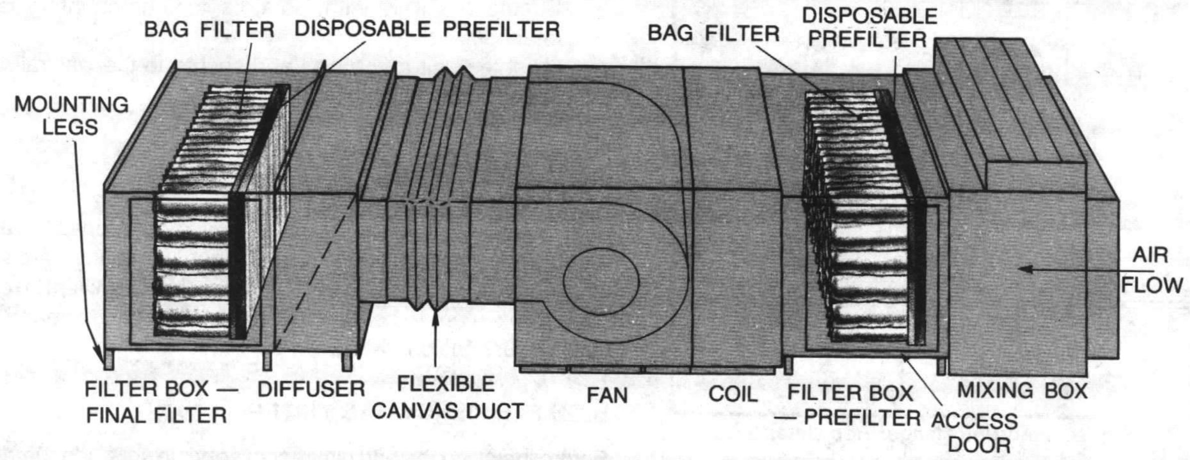


FIGURE 12 - High Efficiency Bag Filter Installation With Draw-Thru Unit (Used as Pre-Filter and Final Filter)

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 UL Listed units, the canvas discharge duct is not provided. Install a field-provided connector which meets the requirements of NFPA 90A Sect. 2.1 to 2.1.2.3.

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 12 and 13. Field-supplied isolators should be used on the filter section mounting legs to control vibration. 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 14. 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.

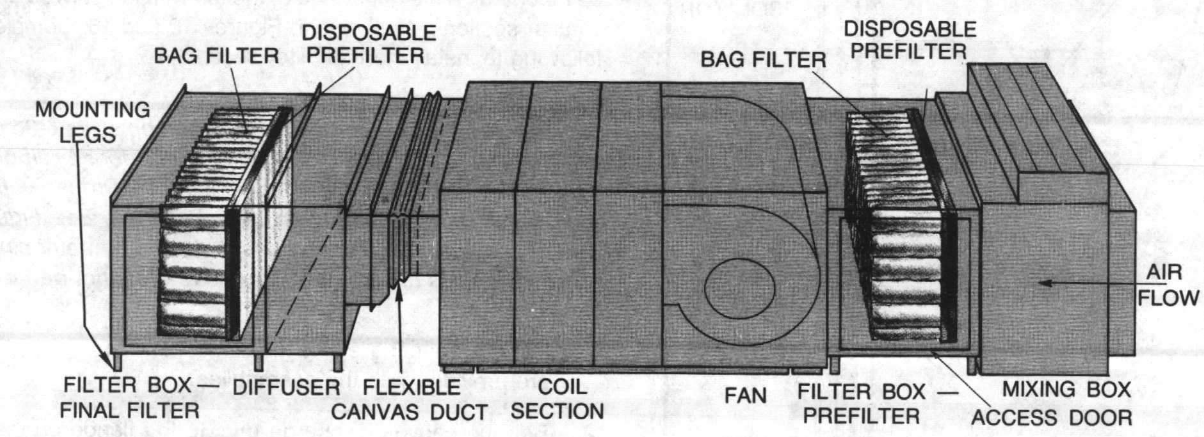


FIGURE 13 - High Efficiency Bag Filter Installation With Single-Zone Blow-Thru Unit (Used as Pre-Filter and Final Filter)

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 requirements are the same. See Figure 14 for filter arrangement. 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 block off 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.

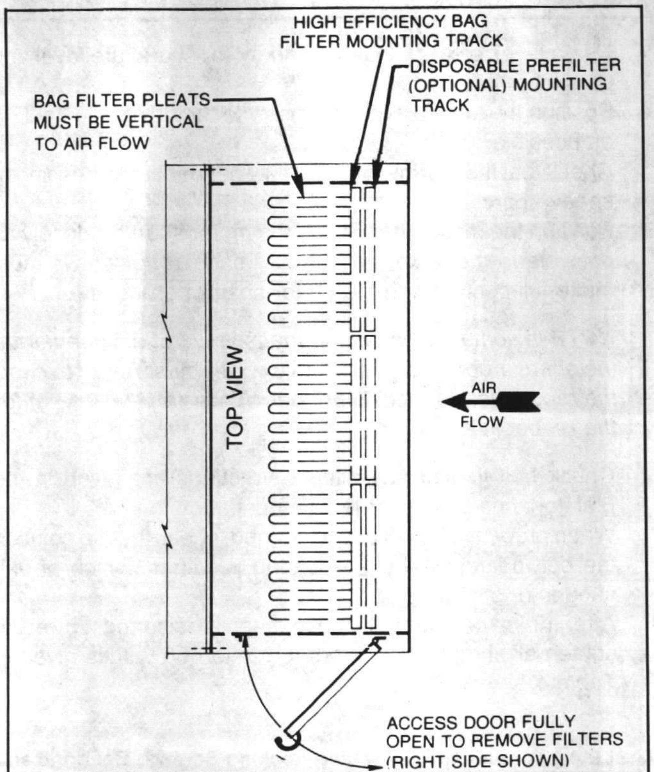


FIGURE 14 - Filter Mounting Track Location (Top View)

***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 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.

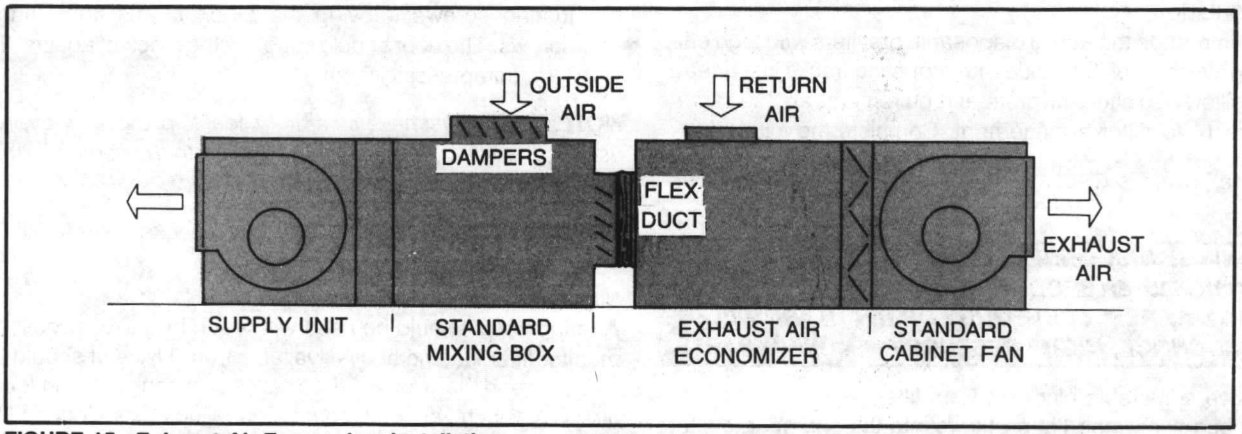


FIGURE 15 - Exhaust Air Economizer Installation

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 15. 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 back-wheeling 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 before unit operation. Complete the following:

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.

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.

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. Check belt tension. Detailed instructions are given in the Maintenance section of this manual.
7. When properly aligned and tensioned, check that no point on the belt nearest the drive bearing is within ½-inch of unit flanges or structural supports.
8. After drive components have been positioned correctly, tighten all sheave set screws to the torque values given in 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.	COLLAR	SCREW DIA.	HEX SIZE ACROSS FLATS	RECOM. TORQUE INCH LBS.	RECOM. TORQUE 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.

DAMPERS

DRIVE ROD ASSEMBLY — 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.

1. Loosen the damper rod clip screws and extend each drive rod 1-1/2 inches beyond the edge of the damper assembly flange. See Figure 16.
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. See Figure 17.

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 17 illustrates an example that uses two damper segments.
4. Set all other zones with the same procedure given above.

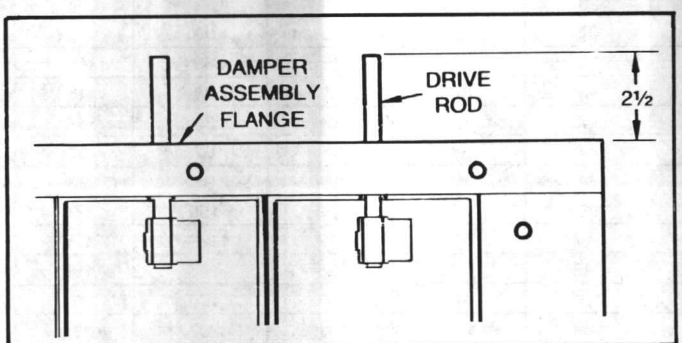


FIGURE 16 - Zone Damper Blade Assembly

***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 are to be furnished 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.

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.

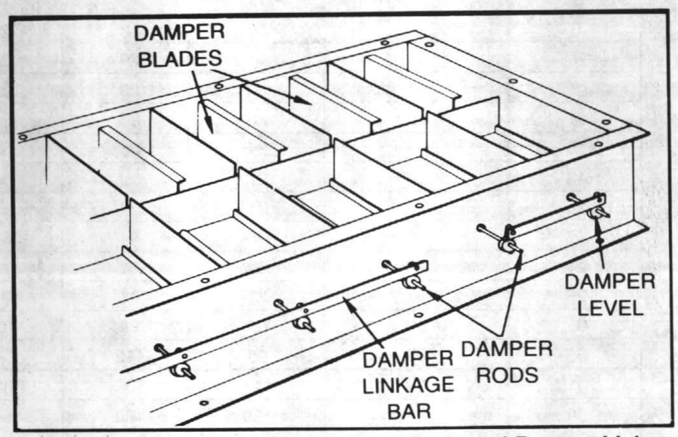


FIGURE 17 - Setting the Zone Damper Rods and Damper Linkage

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

TABLE 6 - Internal Face and Bypass 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	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 opposite 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

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

VARIABLE INLET GUIDE VANES

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

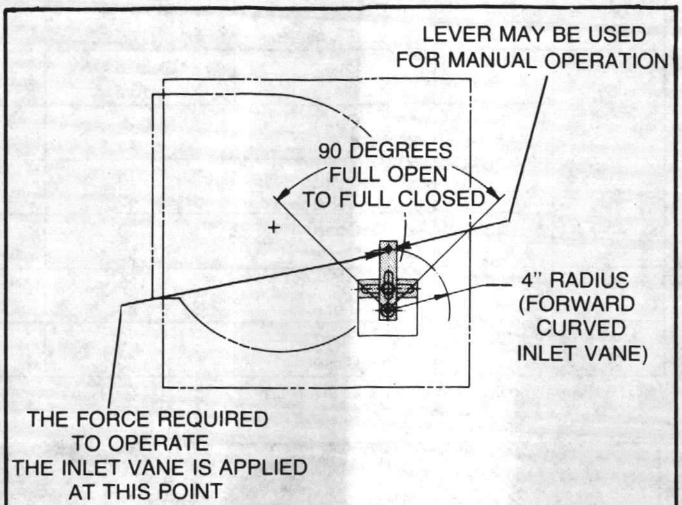
Inlet guide vane operator motors are to be provided and installed by the contractor, according to the operating torques given in Tables 9, 10 and 11. Control lever stroke and radius is given in Figure 18.

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 18 for typical inlet vane operation. Figures 19 and 20 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.)	2,000 FPM FORCE (LBS.)	3,000 FPM TORQUE (IN.-LBS.)	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, BY OTHERS)

(OPPOSITE DRIVE SIDE ONLY)

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

FIGURE 18 - 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.)	2,000 FPM FORCE (LBS.) 4" ARM	3,000 FPM TORQUE (IN.-LBS.)	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.

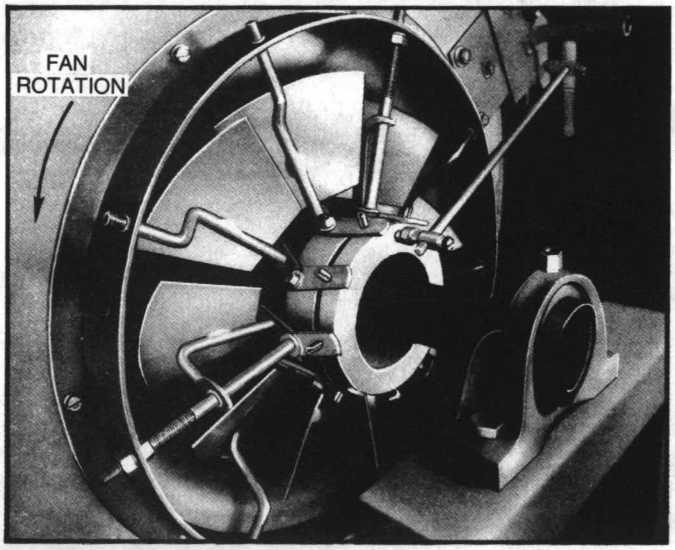


FIGURE 19 - Forward-Curved Inlet Vanes

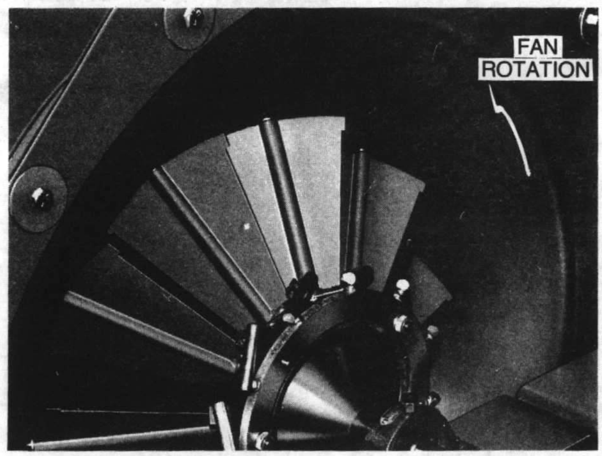


FIGURE 20 - Airfoil Inlet Vanes

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 resticted 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 21. 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 21.

On two-fan units, both fan discharge openings should be jointed to a common duct after the recommended length of straight run. Figure 22 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 23. 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.*

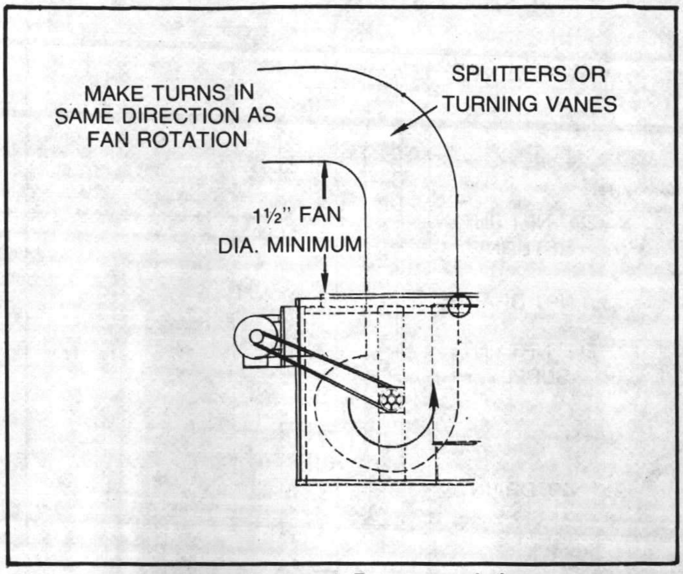


FIGURE 21 - Discharge Ductwork Recommendations

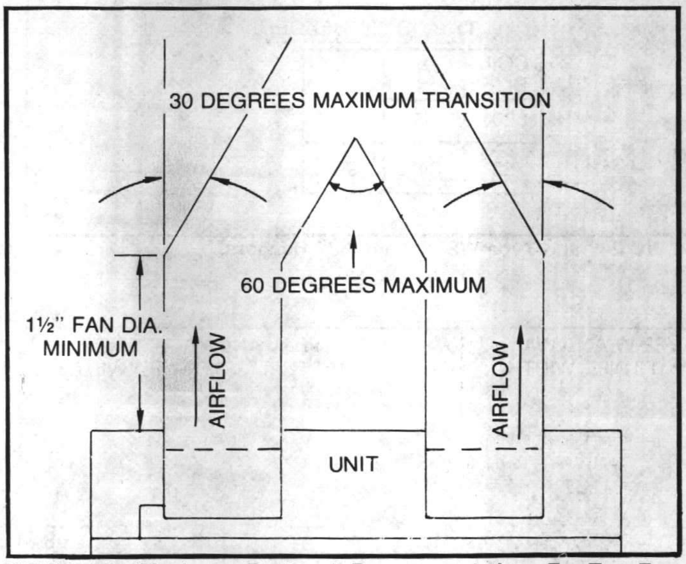


FIGURE 22 - Discharge Ductwork Recommendations For Two-Fan Units

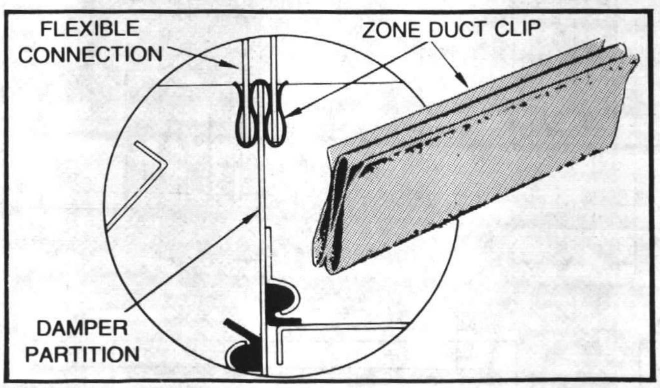


FIGURE 23 - Zone Duct Clip Installation

PIPING

GENERAL COIL PIPING RECOMMENDATIONS

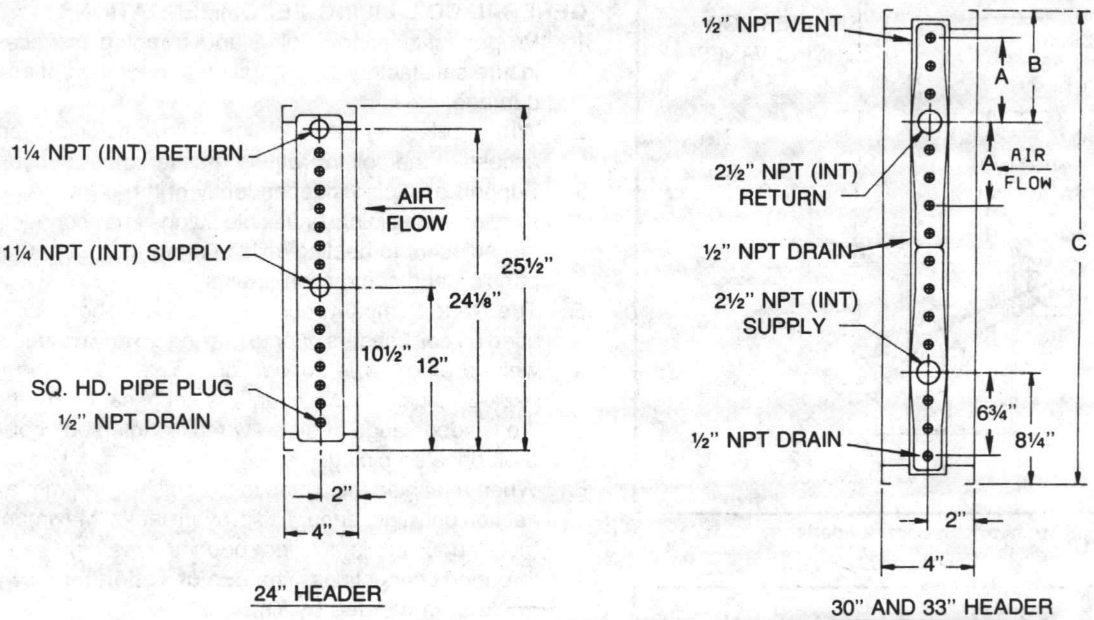
1. Proper installation, piping and trapping is necessary to insure satisfactory coil operation and to prevent operational damage.
2. When selecting coil location, allow sufficient space for access to the coil for routine maintenance and service.
3. Support all piping independently of the coils.
4. Provide 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.
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 temperature.

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

Coil types D, DD, K, N, NS, A, AA, WA, WS and 2-row W may be adequately drained in their pitched position in the unit. (Type N is drainable through the return connection.) The installer must provide appropriate piping for adequate drainage.

NOTE: *Chilled Water Coils can also be used for Hot Water to 220 F.*

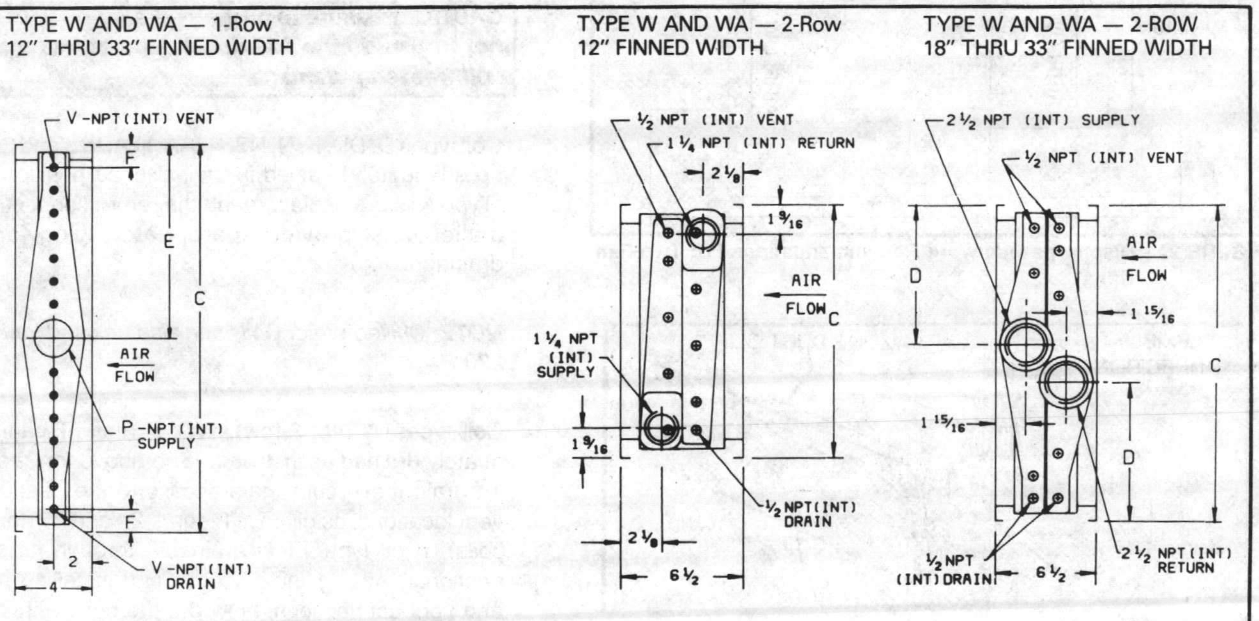
Coil types W (not 2-row), WC, P and TT cannot be adequately drained as installed. (See above for 2-row W coils.) To drain these coils, gain access to the header drain and vent locations, as given in Figures 24 and 25 (for W and WC coils). (Coil type TT is drainable through its supply connections.) After gaining access and installing proper drain and vent connections, blow out the coils with compressed air, fill and drain the coils with full-strength ethylene glycol several times, and then drain the coils as completely as possible.



COIL SIZE	C	B
30	31½"	8¼"
33	34½"	9¾"

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

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



1-Row

FINNED WIDTH	C	E	F	K	P (NPT)	V (NPT)	W (NPT)
12	13½	6	1½	1½	1¼	½	4⅜
18	19½	9¾	1½	1¾	2½	½	4⅞
24	25½	12¾	1½	1¾	2½	½	4⅞
30	31½	15¾	1½	2	2½	½	5⅜
33	34½	17¼	1½	2	2½	½	5⅜

2-Row

FINNED WIDTH	C	D
12	13½	—
18	19½	8¼
24	25½	11¼
30	31½	14¼
33	34½	15¾

FIGURE 25 - Coil Type W/WA Connections With Drain and Vent Locations (12",18", 24", 30", and 33" Headers)

SUPPLY AND RETURN CONNECTIONS

Coil supply and coil return piping connections are indicated on the outside panels of the unit. Piping openings are provided in the unit side panels. Table 12 lists coil connection sizes.

NOTE: *Chilled Water Coils can also be used for Hot Water to 220 F.*

TABLE 12 - Water and Steam Coil Connection Size (Inches)

COIL TYPE	HEADER HEIGHT	CONNECTION SIZE (IN.) SUPPLY	RETURN	DRAIN & VENT
W	18, 24, 30, 33	2½	2½	½
D	18, 24, 30, 33	2½	2½	½
DD	18, 24, 30, 33	2½	2½	½
P2	18, 24, 30	¾	¾	½
P4	18, 24, 30	1	1	½
P8	18, 24, 30	1¼	1¼	½
K	18, 24, 30, 33	2½	2½	½
WC	18	1	1	½
	24	1¼	1¼	½
	30, 33	2½	1½	½
WA	18, 24, 30, 33	2½	2½	½
N, NS	18	2	1	NA
	24	2½	1¼	NA
	30, 33	3	1¼	NA
A, AA	18	2½	1	NA
	24, 30, 33	2½	1¼	NA
TT	18, 24, 30, 33	¾	¾	NA

NOTE: Connections are N.P.T. internal.

STEAM COIL PIPING

Refer to Figures 26 to 32 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.

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.
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 drain and continuous discharge operation. Locate the steam trap discharge at least 12 inches below the condensate return trapping. 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.

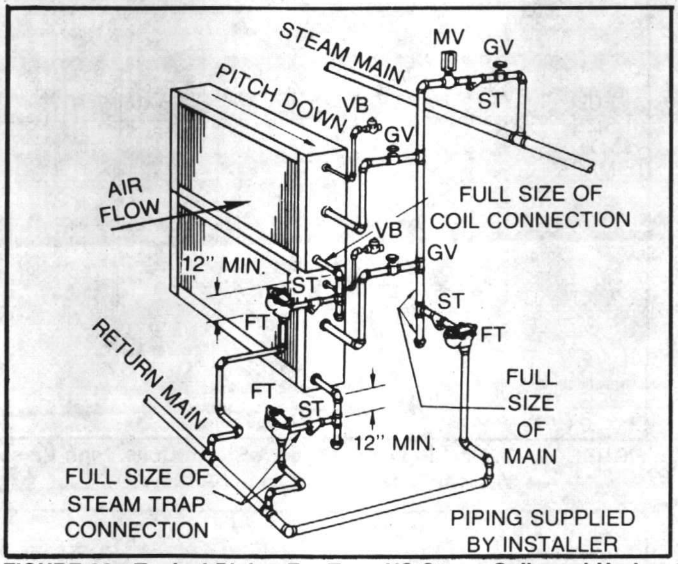


FIGURE 26 - Typical Piping For Type NS Steam Coils and Horizontal Tubes for Horizontal Airflow

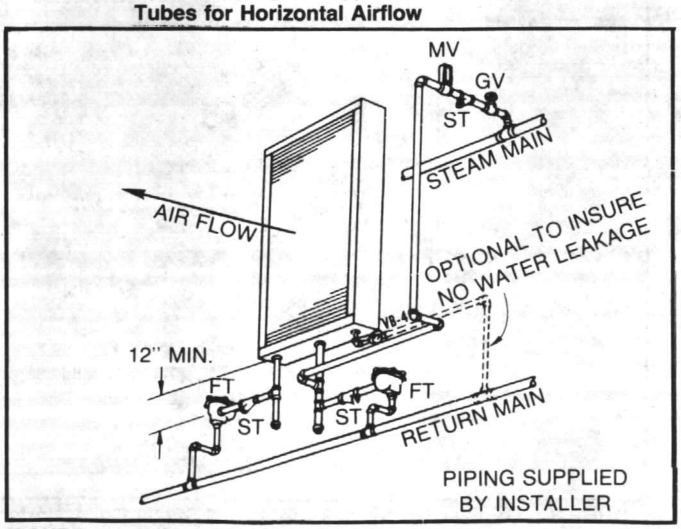


FIGURE 27 - Typical Piping for Type NS Steam Coils and Vertical Tubes for Horizontal Airflow

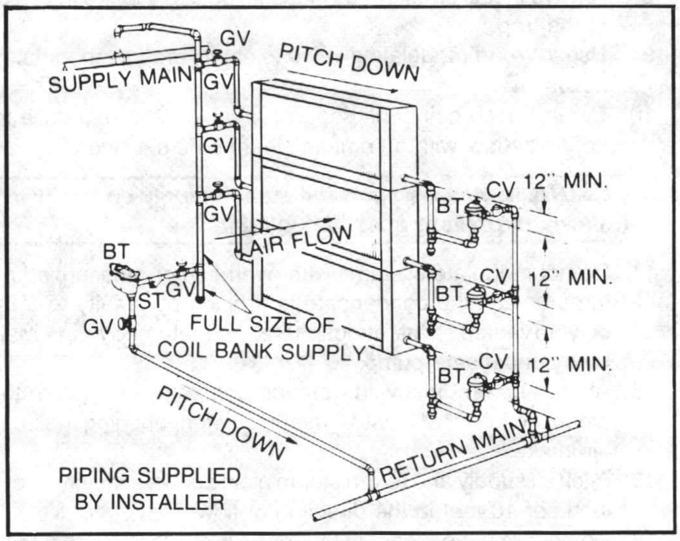


FIGURE 28 - Typical Piping for Type A Steam Coils, High Pressure Horizontal Tubes for Horizontal Airflow

Codes for System Components:

FT - Float and Thermostatic Steam Trap
BT - Bucket Steam Trap
GV - Gate Valve
OV - Automatic Two-Position (On-Off) Control Valve
TV - Automatic Three-Way Control Valve
VB - Vacuum Breaker, 15 Degree Swing Check Valve
CV - Check Valve
ST - Strainer
AV - Automatic or Manual Air Vent

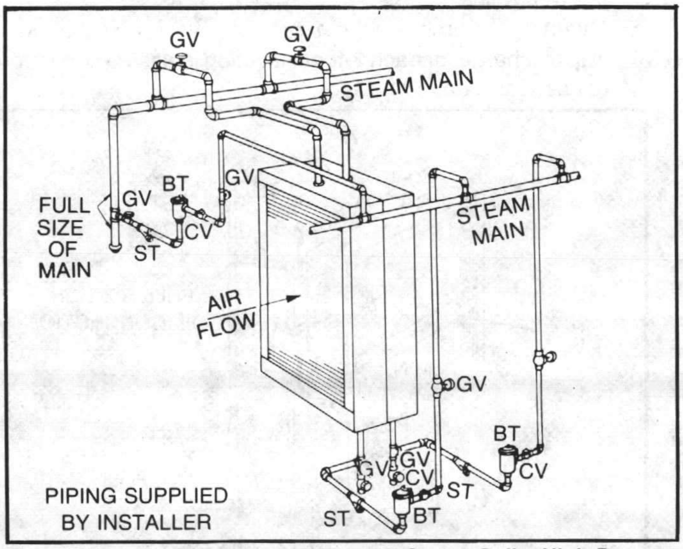


FIGURE 29 - Typical Piping for Type A Steam Coils, High Pressure Vertical Tubes for Horizontal Airflow

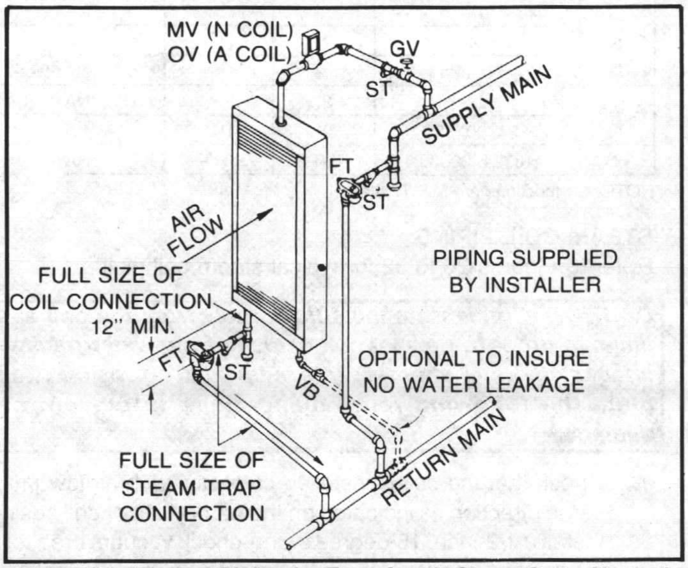


FIGURE 31 - Typical Piping for Type A or N Steam Coils, Vertical Tubes for Horizontal Airflow

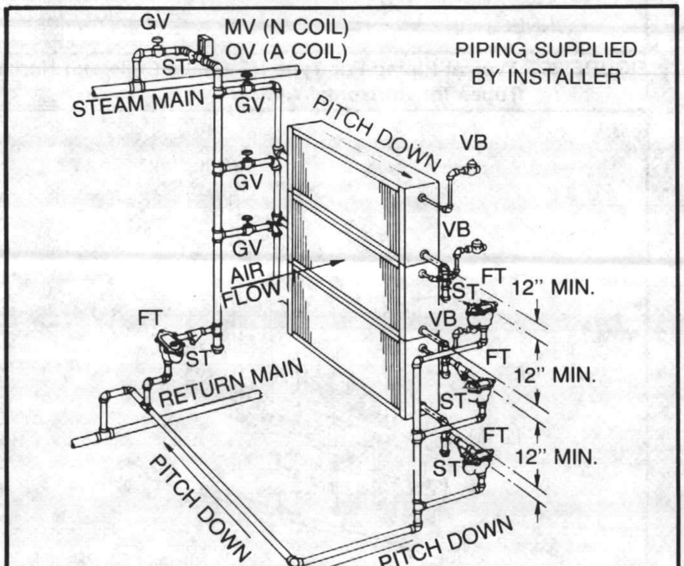


FIGURE 30 - Typical Piping for Type A or N Steam Coils, Horizontal Tubes for Horizontal Airflow

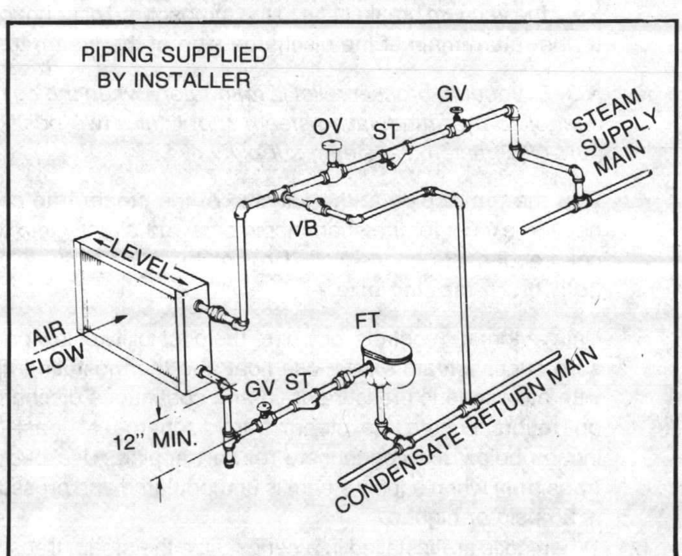


FIGURE 32 - Type T Steam Coils, Horizontal Tubes for Horizontal Airflow

HOT WATER COIL PIPING

Refer to Figures 33 to 35 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 and WA 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.

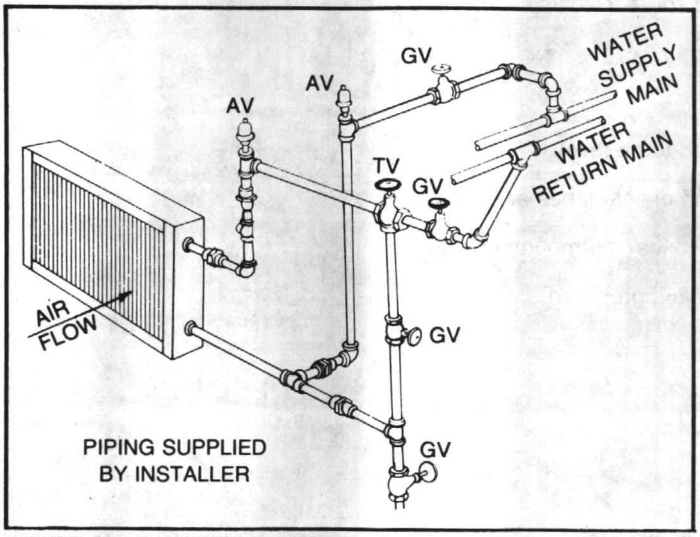


FIGURE 33 - Typical Piping for Type WC Water Coil

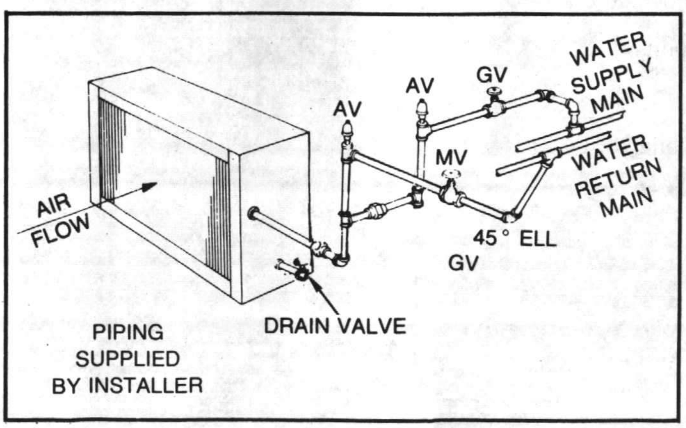


FIGURE 34 - Typical Piping for Type W, Two-Row Water Coil

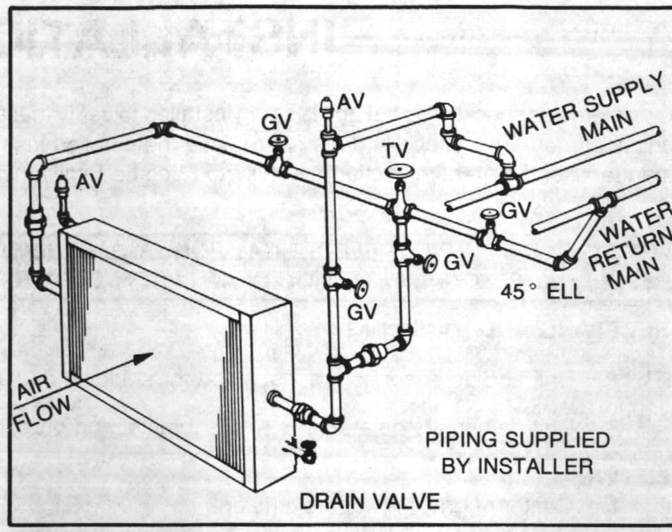


FIGURE 35 - Typical Piping for Type W or WA, One-Row Water Coil

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 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-horsepower 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. Unit is fastened to isolators.

☐ 9. 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.

(Continued on next page)

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.
- ☐ 6. Belt tension is correct.
- ☐ 7. **All sheave and bearing set screws are tightened to the correct torques.**
- ☐ 8. Belt guard is installed.

DAMPERS

- ☐ 1. Multizone 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. Provisions are made for properly draining and venting all coils.
- ☐ 2. Supply and return coil connections are made.
- ☐ 3. 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. Fused disconnect switch is installed within sight of unit.
- ☐ 5. Motor overload protective devices are installed.

RETURN THIS MANUAL TO THE UNIT FOR FUTURE REFERENCE. IMPORTANT START-UP AND MAINTENANCE INFORMATION FOLLOWS THE INSTALLATION SECTION.

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 tensions and sheave setscrews. Belt tension, sheave alignment and setscrew torques for the motor assembly are given in the Maintenance section.
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.
7. Check that the air filters are in place and that all dampers are set properly.
8. All unit access panels must be in place. All screws, nuts and bolts must be tightened to their proper torques.
9. If the unit includes fan paralleling control, open it fully.

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

START-UP PROCEDURES

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

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 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 1/2-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 unstables 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.

3. Measure voltage at all three wires. Maximum allowable voltage imbalance is 2 percent. Voltage imbalance is defined as 100 times the sum of the deviation of the three voltages from the average voltage, 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:

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

$$= 2.2\% \text{ (UNACCEPTABLE)}$$

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

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 1/2 inch wg.

EVERY THREE TO SIX MONTHS

***NOTE**: The procedures listed in this section should be completed between 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. Align sheaves and check 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 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. Clean fan wheels and fan shaft. Remove rust from fan shaft with an emergy cloth and recoat the shaft with L.P.S. 3 or an equivalent.

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

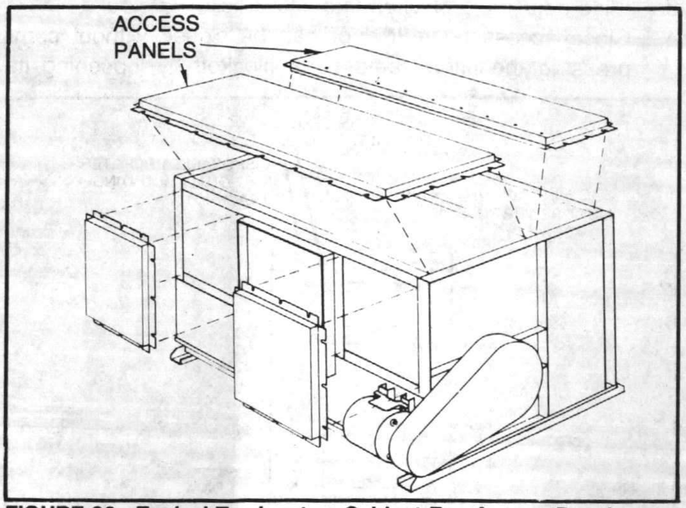


FIGURE 36 - Typical Torrivent or Cabinet Fan Access Panel Arrangement on Sizes 35 and Larger

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

☐ 6. Recalibrate the filter manometer.

ACCESS PANELS

Removable access panels are provided on all units to perform necessary maintenance and to provide access for parts replacement. See Figure 36.

MAINTENANCE PROCEDURES

FILTERS

Table 12 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 toward the fans.

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 throughly 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 upstream and downstream of the filter is 1 inch wg. A manometer should have been installed for surveillance of pressure drop across the filter.

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 37 illustrates bag filter and prefilter installation. Complete the following to install high efficiency bag filters.

1. Ensure that power is disconnected.

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 OF 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.

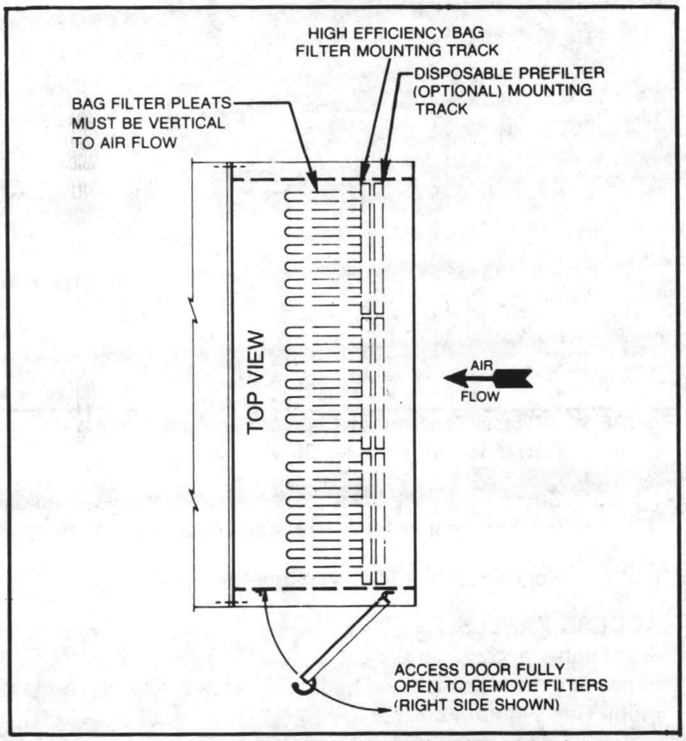


FIGURE 37 - Filter Mounting Track Location (Top View)

***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.*

FAN BEARING LUBRICATION

Fan bearings (see Figure 38) 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 14 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. Add grease, preferably when bearing is warm, until a light bead of grease appears at the bearing grease seal while turning the fan wheel manually.

   ***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.

TABLE 13 - Filter Sizes and Quantities Per Set

UNIT SIZE	2-INCH FLAT FILTER BOX	COMBINATION & MEDIUM FILTER BOX	HIGH CAPACITY BOX	BAG FILTER AND PREFILTER	4-INCH PLEATED FILTER BOX
3	1-20x25	2-16x25	2-20x25	—	1-20x25
6	2-20x25	4-16x25	4-20x25	—	2-20x25
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	2-20x20 2-16x25 1-16x20
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
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	—	6-20x20 18-20x25
86	21-20x25 7-20x20	42-20x25	49-20x25	—	21-20x25 7-20x20

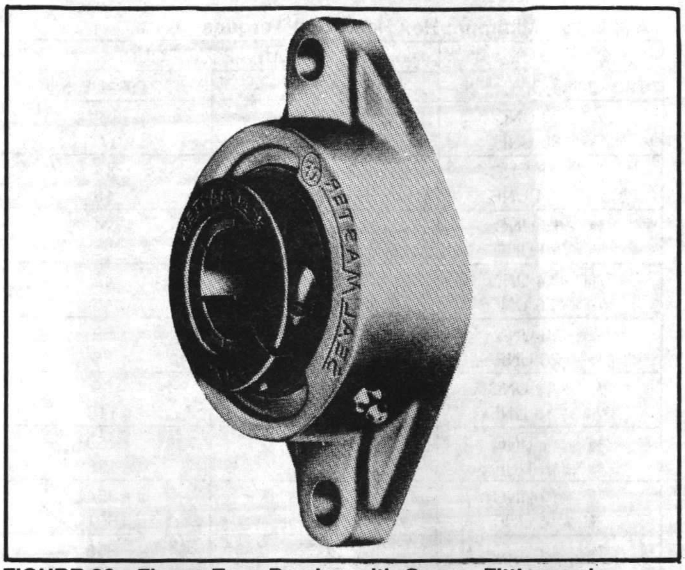


FIGURE 38 - Flange Type Bearing with Grease Fitting and Squeezloc Tightener

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 39. Complete the following:

1. Rotate the shaft until the double lock bearing setscrews are in the vertically up position as shown in Figure 40.
2. Without V-Belt tension, snug (hand tight) all four setscrews of the double lock bearing in the numerical sequence as shown in Figure 40.

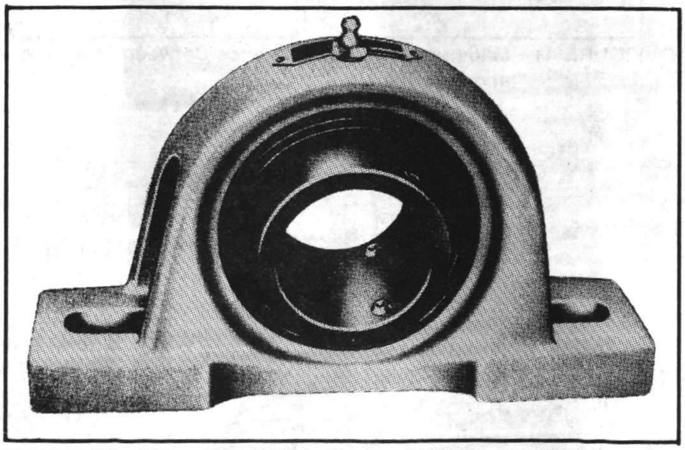


FIGURE 39 - Pillow Block Type Bearing with Grease Fitting and Double Lock Setscrew Arrangement

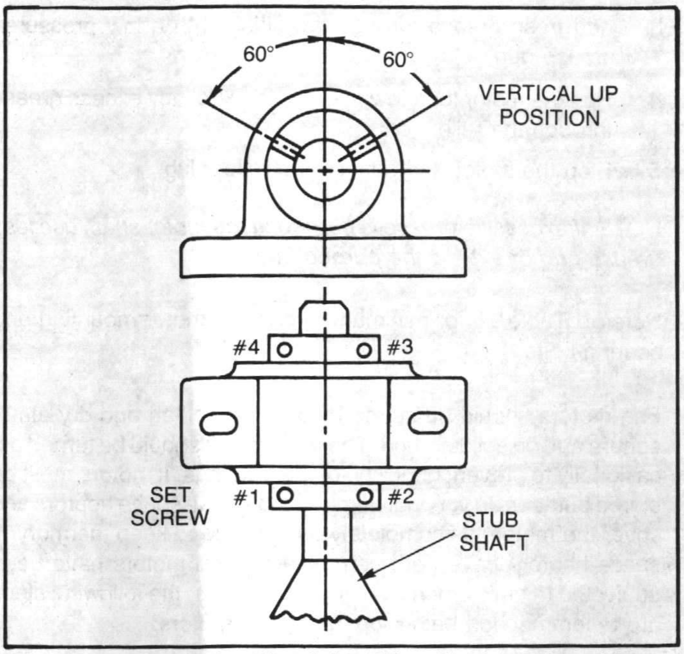


FIGURE 40 - Instruction Sketch for Pillow Block Bearing with Double Lock Setscrew

TABLE 14 - Recommendations for Grease Lubricated Fan Bearings

OPERATING CONDITIONS	GREASING INTERVALS -20 F To 140 F	GREASING INTERVALS 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 No. 2	-20 F to 250 F	
Shell Alvania No. 2	-20 F to 250 F	
Mobil Mobilux No. 2	-20 F to 250 F	
Exxon Unirex No. 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.

3. Torque each setscrew of the double lock bearing in the numerical sequence to 66 inch-pounds. See Figure 40.

FAN MOTORS

Inspect periodically for excessive vibration or temperature. Operating conditions will vary the frequency of inspection and lubrication. Table 15 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:

1. Turn the motor off. Make sure it cannot accidentally restart.
2. Remove the relief plug and clean out any hardened grease.

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

3. Add fresh grease through the fitting with a low pressures 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 purged at the motor shaft, use less grease and/or extend the purged interval.*

Refer to Table 16 for minimum torques of motor mounting and bearing bolts.

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 the 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 41.

TABLE 15 - 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 16 - Minimum Hex Head Bolt Torques

BOLT SIZE	TORQUE - FOOT/POUNDS	
	GRADE 2	GRADE 5
1/4" - 20 UNC	4	6
1/4" - 28 UNF	4	7
5/16" - 18 UNC	8	14
5/16" - 24 UNF	9	16
3/8" - 16 UNC	14	24
3/8" - 24 UNF	16	28
7/16" - 14 UNC	30	42
7/16" - 20 UNF	35	45
1/2" - 13 UNC	40	69
1/2" - 20 UNF	47	83
9/16" - 12 UNC	57	99
9/16" - 18 UNF	68	118
5/8" - 11 UNC	86	150
5/8" - 18 UNF	101	176
3/4" - 10 UNC	146	254
3/4" - 16 UNF	173	301
7/8" - 9 UNC	206	358
7/8" - 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.

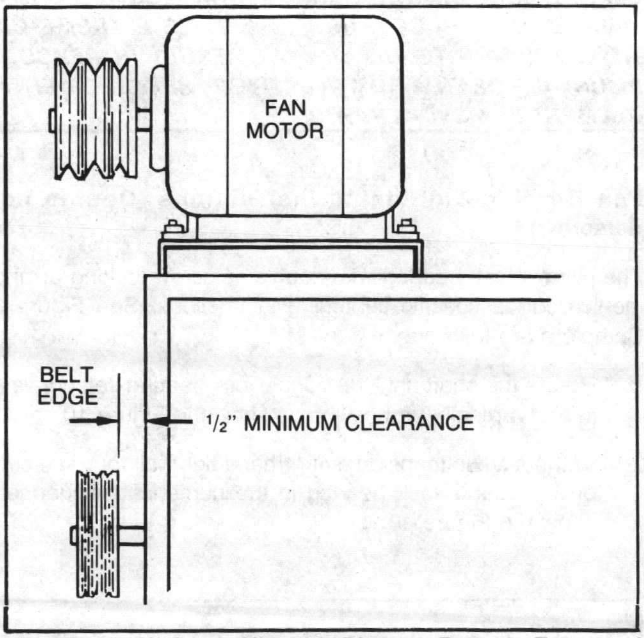


FIGURE 41 - Minimum Allowable Distance Between Framework and Fan Sheave

Align the fan and motor sheaves by using a straightedge as shown in Figure 42. 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 17.

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.

FAN WHEEL CLAMPS

The clamps that hold the fan hub on the shaft must be properly positioned and tightened to ensure safe fan operation. The clamps should be replaced whenever the wheel or shaft is replaced.

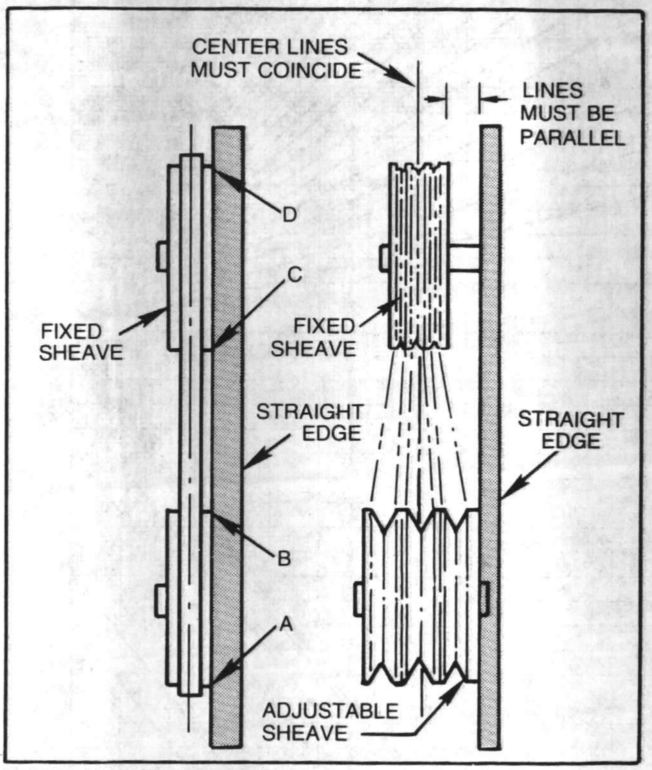


FIGURE 42 - Sheave Alignment

TABLE 17 - 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.

On fans that are 20 inches or smaller, position the two-piece clamp over the hub so that the hub tab goes through the clamp slot. 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 ASSEMBLY SETSCREWS

Check and adjust fan wheel, bearing and sheave setscrews whenever a component is removed or an adjustment is made. Refer to Table 17 for recommended torques.

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 43 found by measuring where the middle of the belt rides in the sheave)
4. Type of belt cross-section (stamped on the belt)

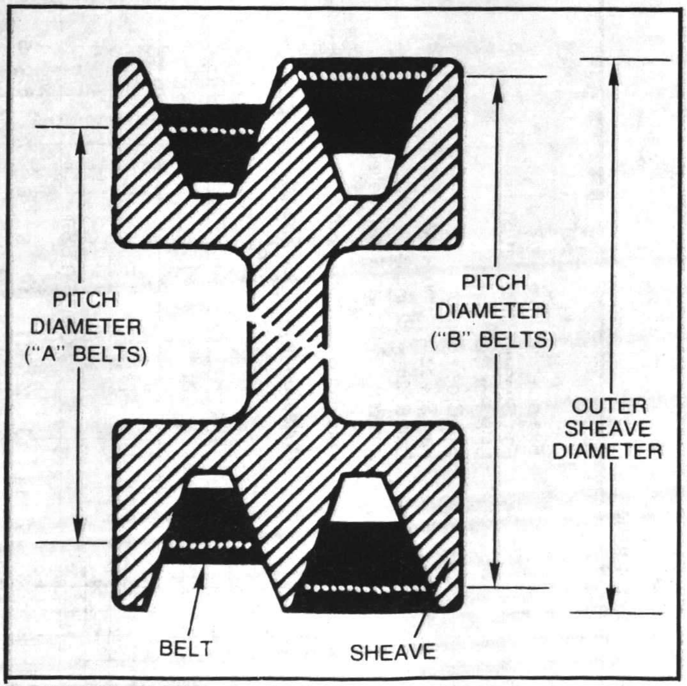
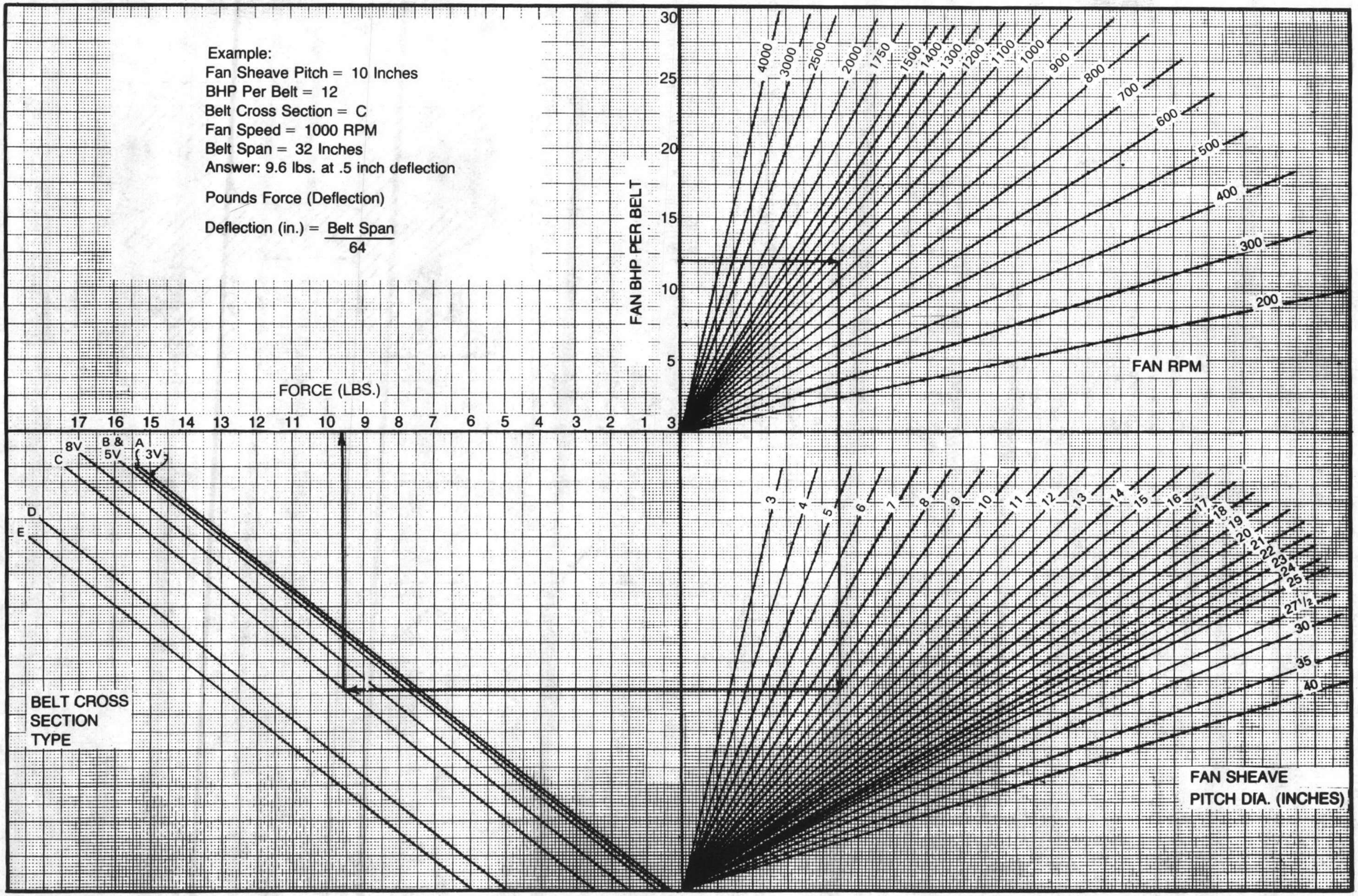


FIGURE 43 - Fan Sheave Pitch Diameter

CHART 1 - Belt Tension



As shown in the example of Chart 1, the correct tension (pounds force) is 9.6 pounds, at 1/2-inch deflection. Deflection is determined by dividing the belt span distance by 64, as shown in Figure 44.

To measure belt tension, use a belt tensioner as shown in Figure 45. 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.

For belt cross-section types not given in Chart 1, refer to Table 18 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 17)

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

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

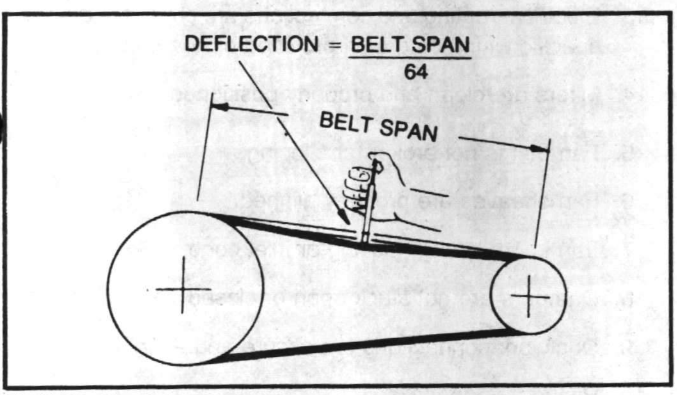


FIGURE 44 - Belt Tension Measurement

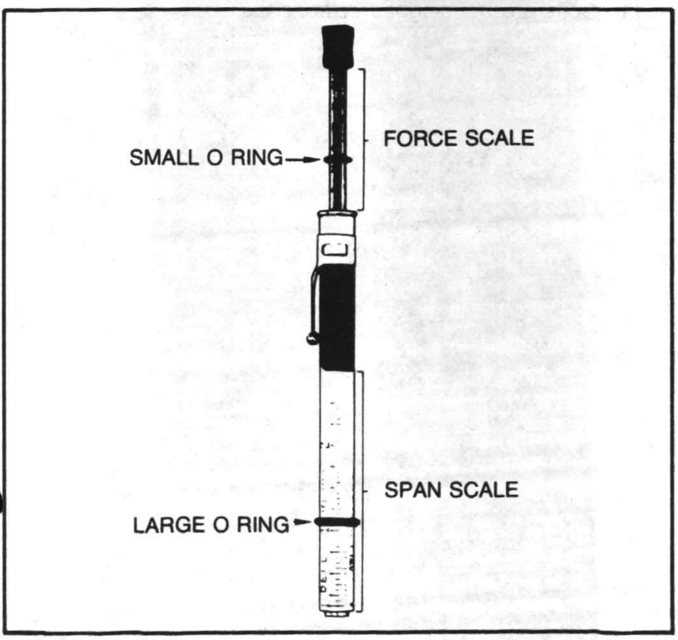


FIGURE 45 - Belt Tensioner

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

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

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

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

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

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 18 are minimum values. The correct operating tension for a V-belt drive is the lowest tension at which the belts will not slip under the peak load conditions. It may be necessary, however, to increase the tension of some drives to reduce excessive belt flopping or to reduce excessive start-up squealing.

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.

TABLE 18 - 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

COIL CLEANING

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

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 D, DD, K, N, NS, A, AA, WA, WS and 2-row W may be adequately drained in their pitched position within the unit. (Type N is drainable through the return connection.) The installer should have provided appropriate piping for adequate drainage.

Coil types W (not 2-row), WC, P and TT cannot be adequately drained if installed pitched. (See above for 2-row W coils.) To drian these coils, blow out the coils with compressed air, fill and drain the tubes with full-strength ethylene glycol several times, and then drain the coil as completely as possible. If no access was provided to the coil vent and drain locations through the unit panel, refer to the Installation/Piping section of this manual.

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

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

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.

TROUBLE ANALYSIS

SYSTEM CHECK

Before repairing or replacing any 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 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.

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.
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.

SYMPTOM	POSSIBLE CAUSE	RECOMMENDED ACTION
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.
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.

TRANE

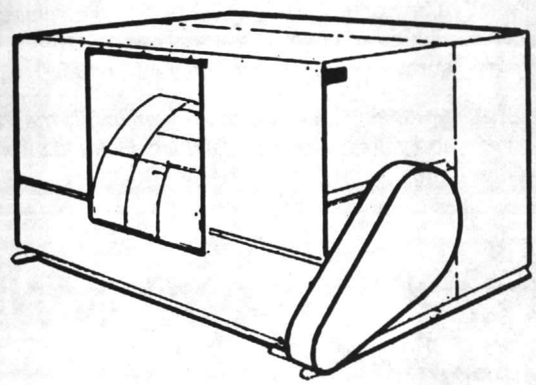
Installation CLCH-IN-3A

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)

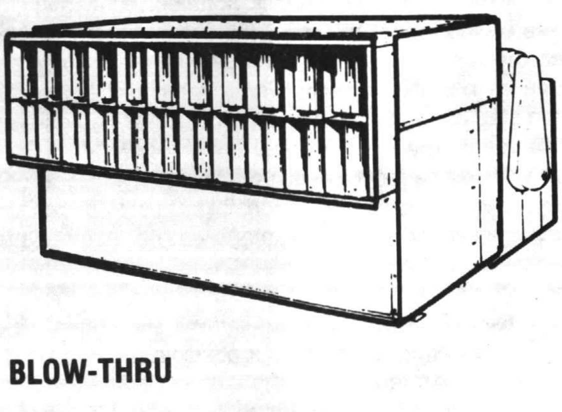
CLIMATE CHANGER® CENTRAL STATION AIR HANDLERS

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.

TABLE OF CONTENTS

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.

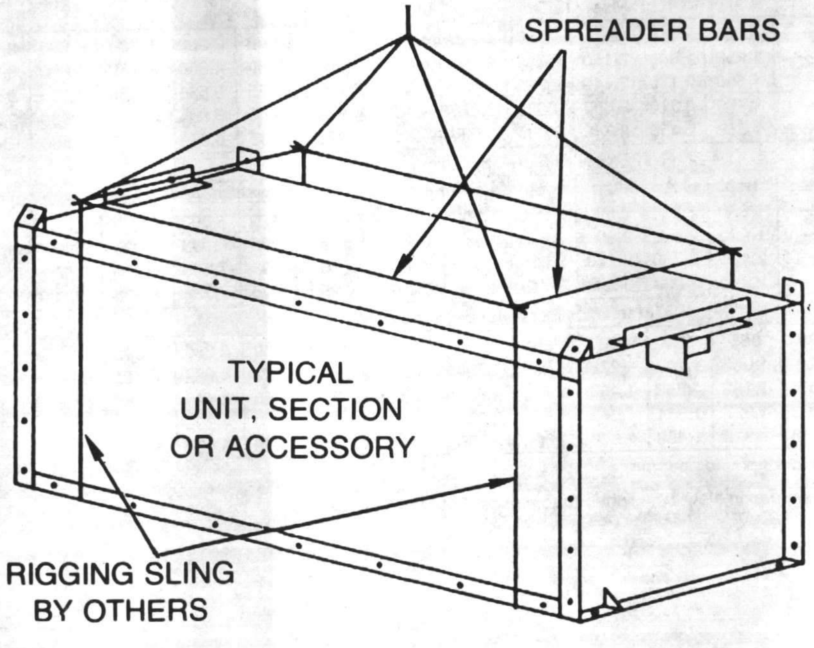


FIGURE 1 - Recommended Rigging Procedure

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.

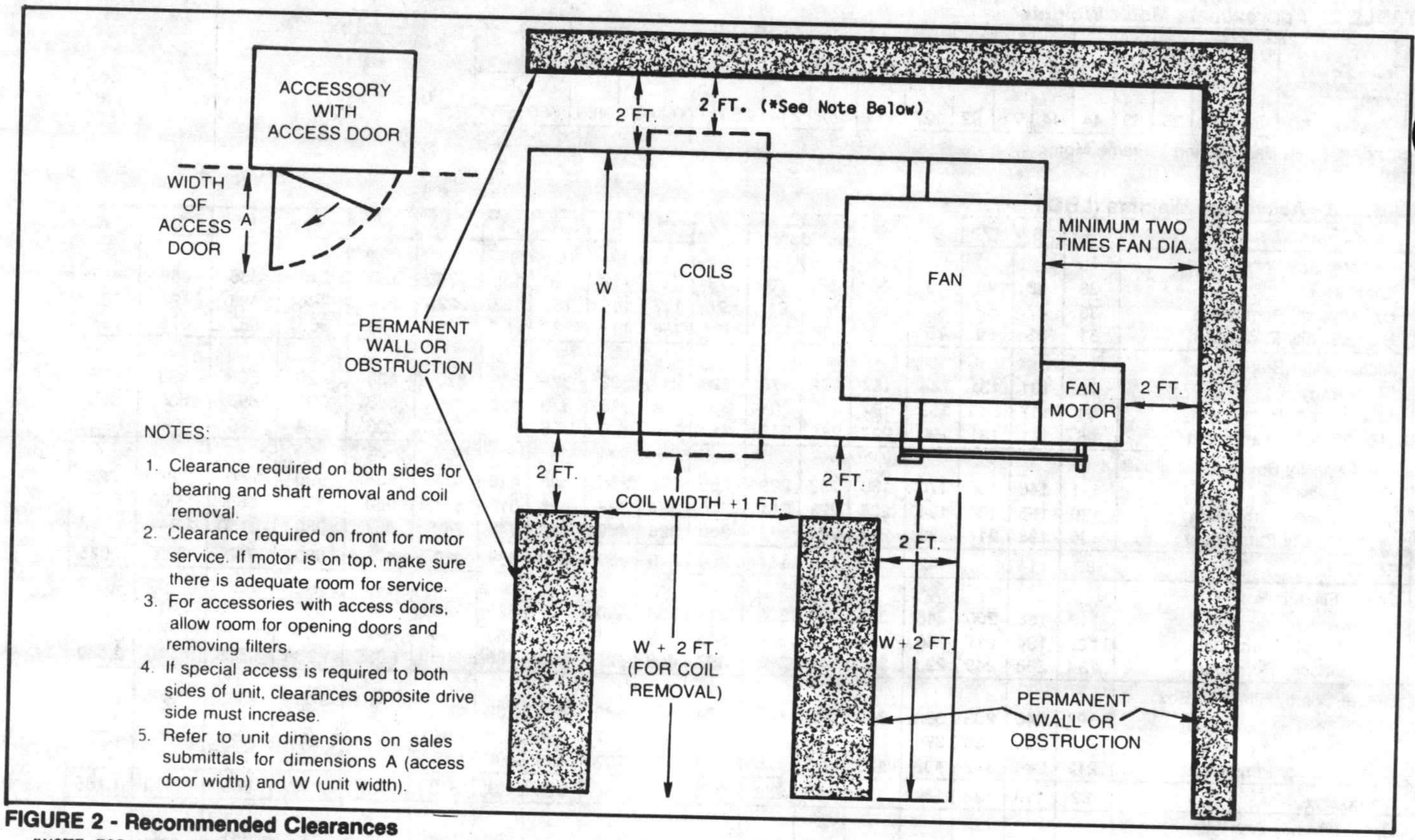


FIGURE 2 - Recommended Clearances

*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.

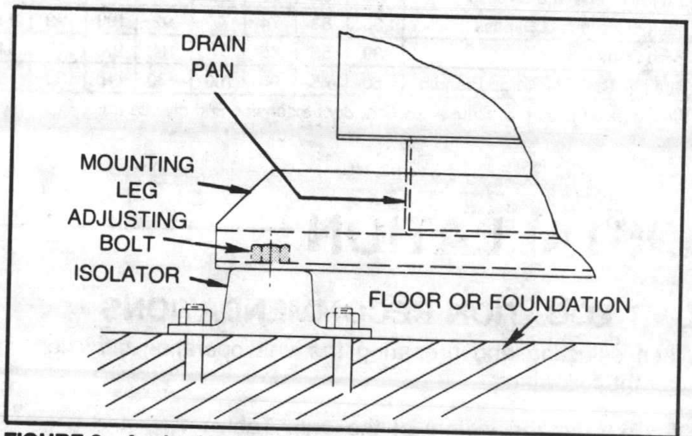


FIGURE 3 - Anchoring the Unit

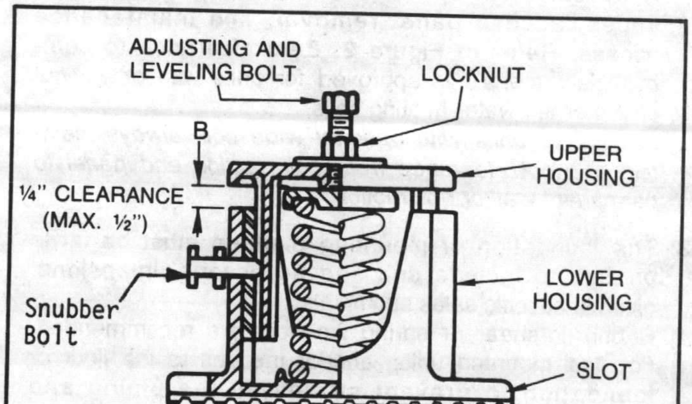


FIGURE 4 - Spring-Type Isolator Adjustment

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.*

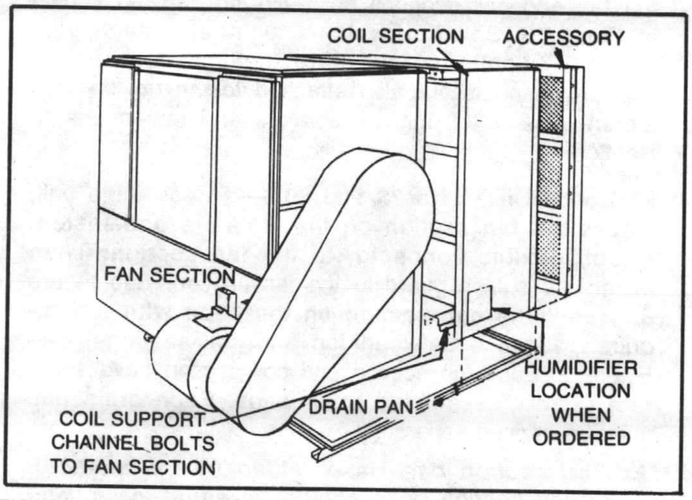


FIGURE 5 - Exploded View of the Horizontal Draw-Thru Unit Size 63

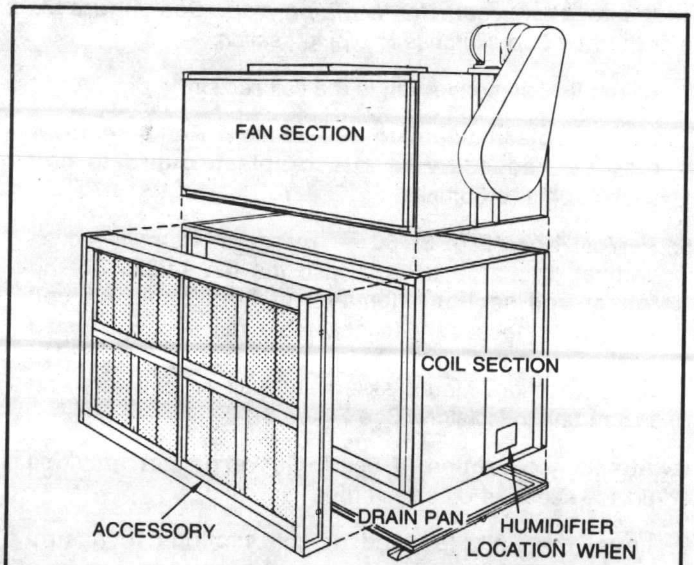
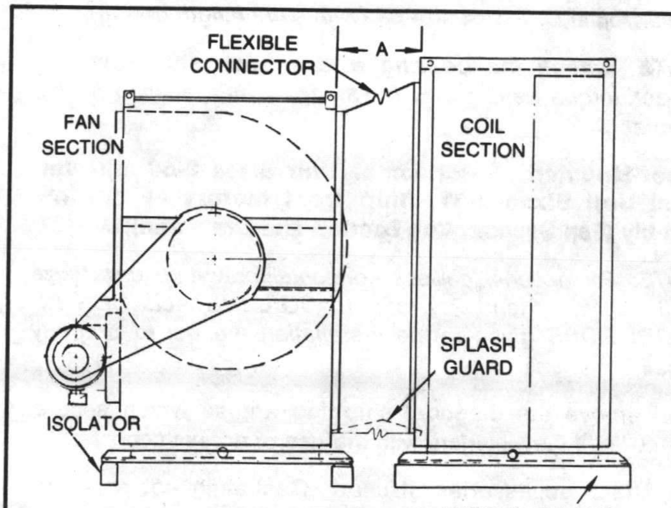


FIGURE 6 - Exploded View of the Vertical Draw-Thru Unit Sizes 35 through 50

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

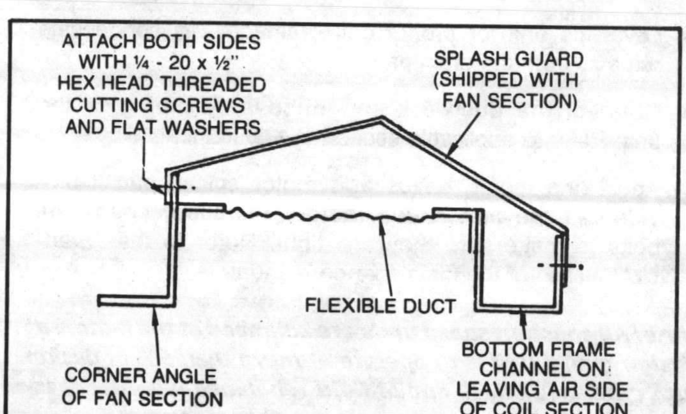


FIGURE 8 - Splash Guard Installation

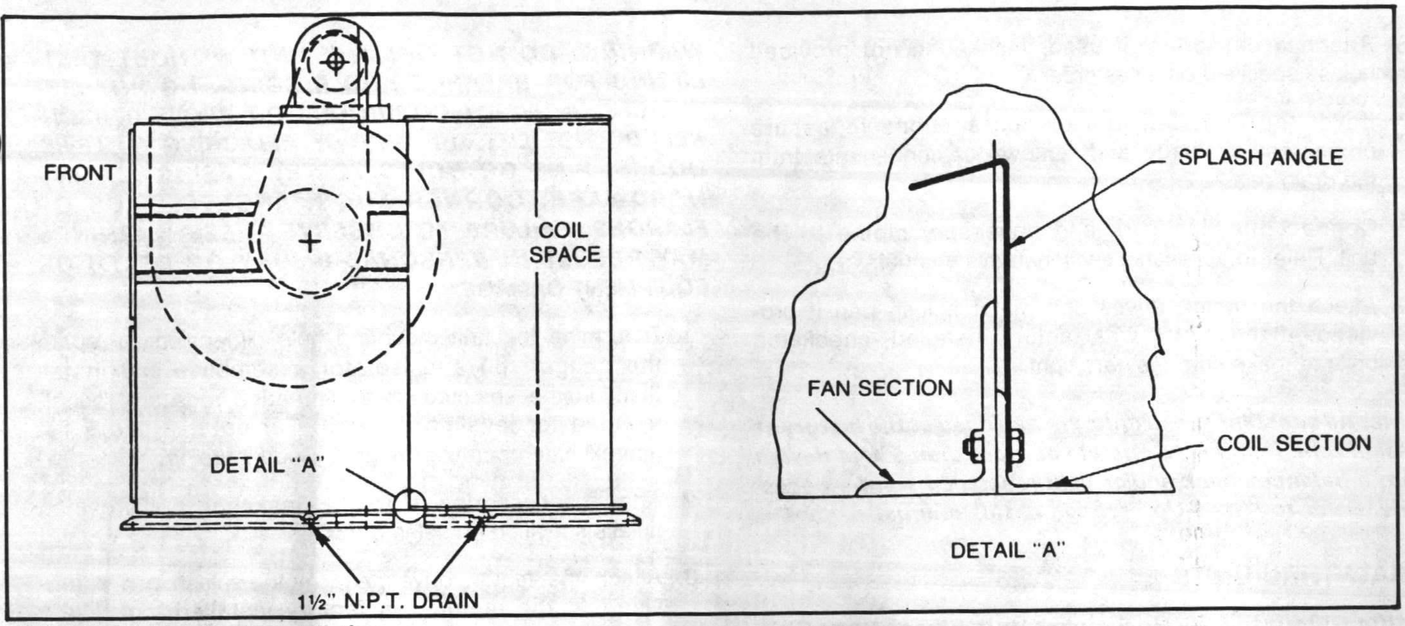


FIGURE 9 - Splash Angle Installation

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.

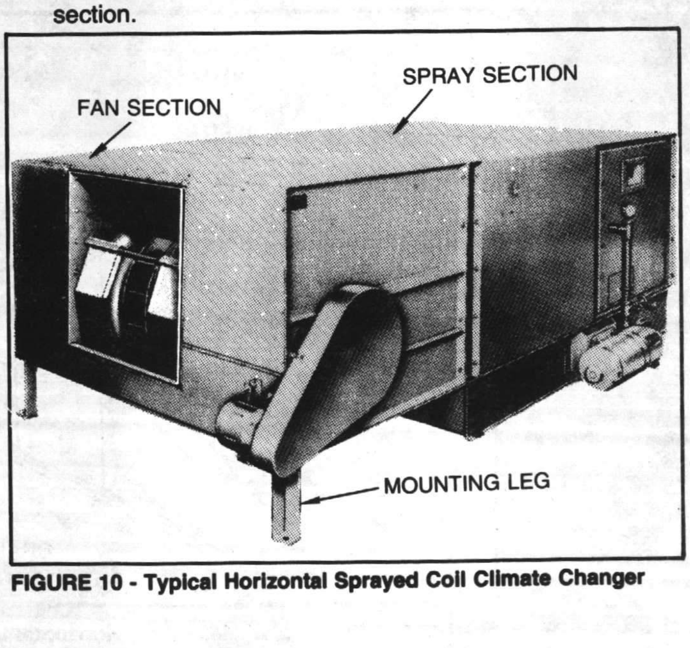


FIGURE 10 - Typical Horizontal Sprayed Coil Climate Changer

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.

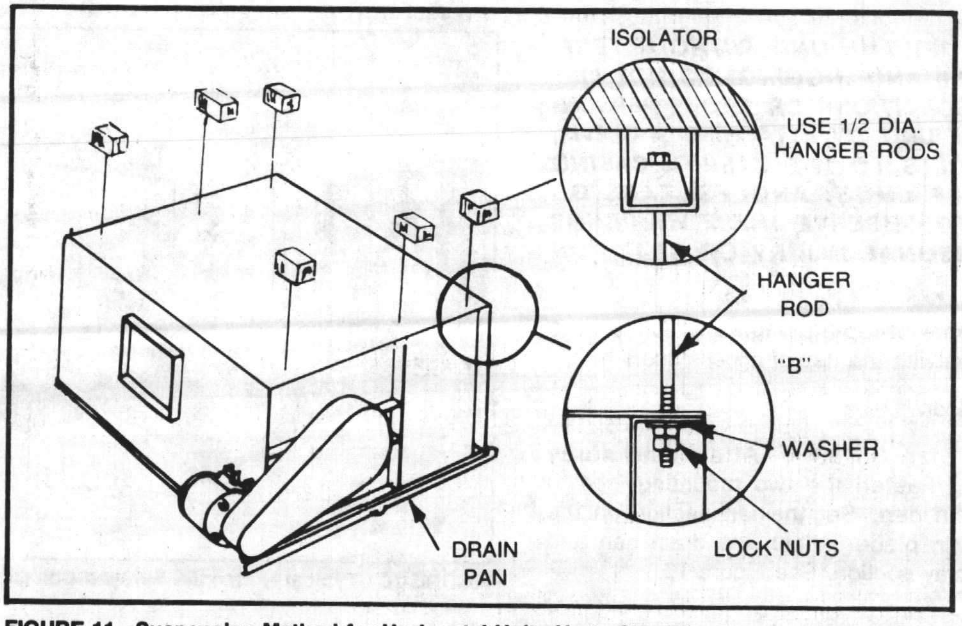
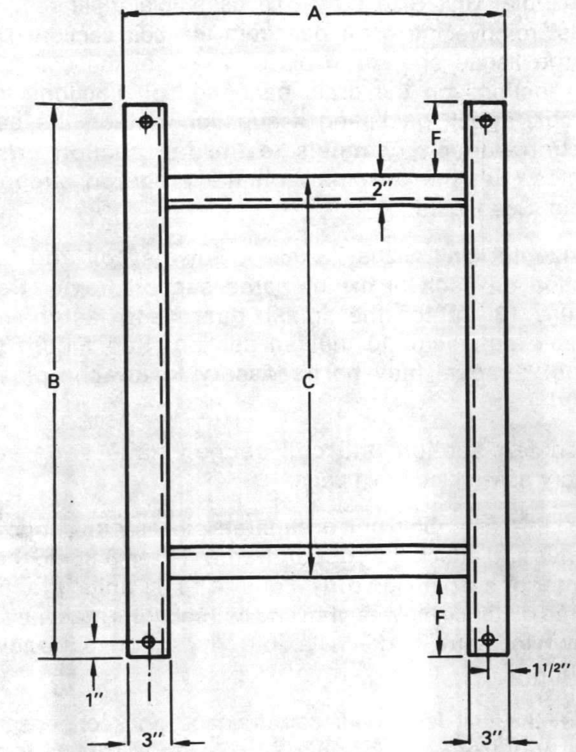


FIGURE 11 - Suspension Method for Horizontal Units Up to Size 31



Vertical Dimensions (Inches) With Wide Coil

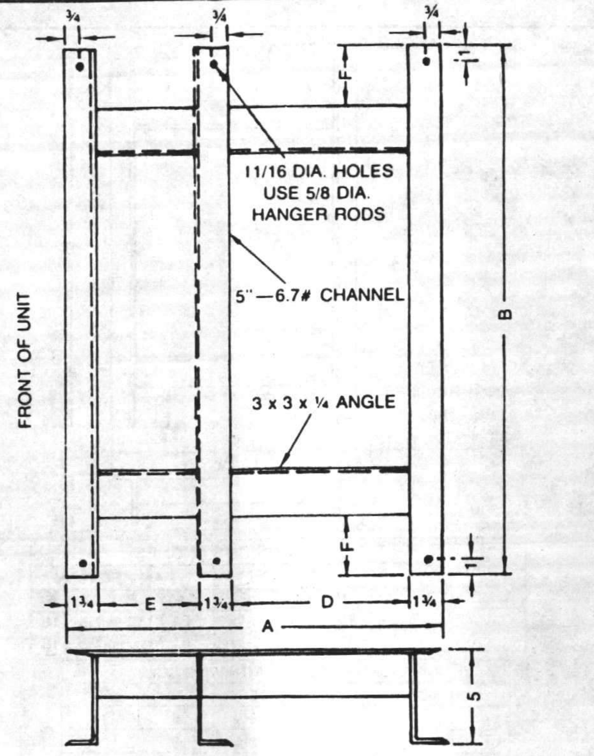
UNIT SIZE	A	B	C	F
3	23 7/8	54	34	10
6	23 7/8	75	55	10
8	28 7/8	66	46	10
10	28 7/8	75	55	10
12	32 7/8	81	61	10
14	32 7/8	90	70	10
17	32 7/8	111	91	10
21	36 7/8	129	109	10
25	42 7/8	135	115	10
31	42 7/8	135	115	10

Horizontal Dimensions (Inches) With Wide Coil

UNIT SIZE	A	B	C	F
3	32 3/4	54	34	10
6	34 3/4	75	55	10
8	44 3/4	66	46	10
10	44 3/4	75	55	10
12	48 3/4	81	61	10
14	48 3/4	90	70	10
17	48 3/4	111	91	10
21	52 3/4	129	109	10
25 Arr. 1 & 2	52 3/4	135	115	10
25 Arr. 3 & 4	58 3/4	135	115	10
31 Arr. 1 & 2	52 3/4	135	115	10
31 Arr. 3 & 4	58 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 1/2	132 5/8	40 1/16	34 3/16	10 1/2
#41	84 1/2	135 5/8	43 1/16	36 3/16	10 1/2
#50	90 1/2	135 5/8	46 1/16	39 3/16	10 1/2
#63	97 1/2	143 5/8	50 1/16	42 3/16	14 1/2

DIMENSIONS (INCHES) WITH WIDE COIL					
UNIT SIZE	A	B	D	E	F
35	79 1/2	149 5/8	40 1/16	34 3/16	19 1/2
41	84 1/2	159 5/8	43 1/16	36 3/16	22 1/2
50	90 1/2	159 5/8	46 1/16	39 3/16	22 1/2
63	97 1/2	152 5/8	50 1/16	42 3/16	19 1/2

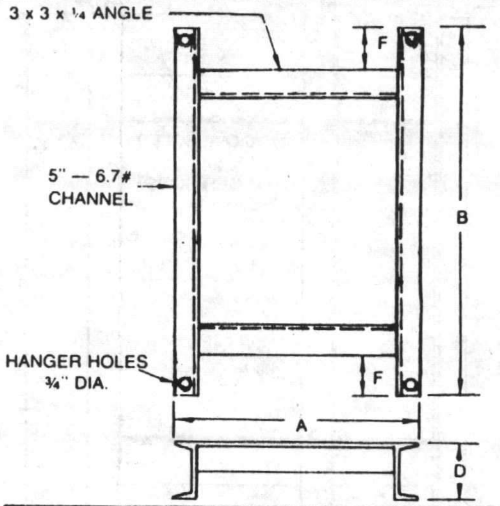
NOTE: Above sketch does not apply to Sprayed Coil Units.

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.



UNIT SIZE	DIMENSIONS (INCHES)							
	COIL SECTION				FAN SECTION			
	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.

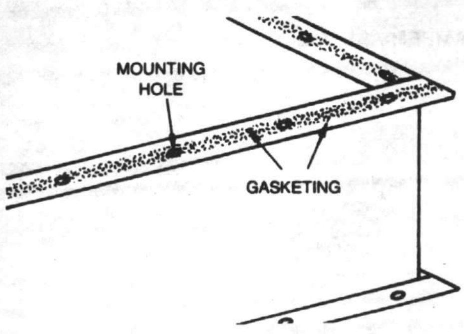


FIGURE 14 - Installation of Gasketing on the Damper Section

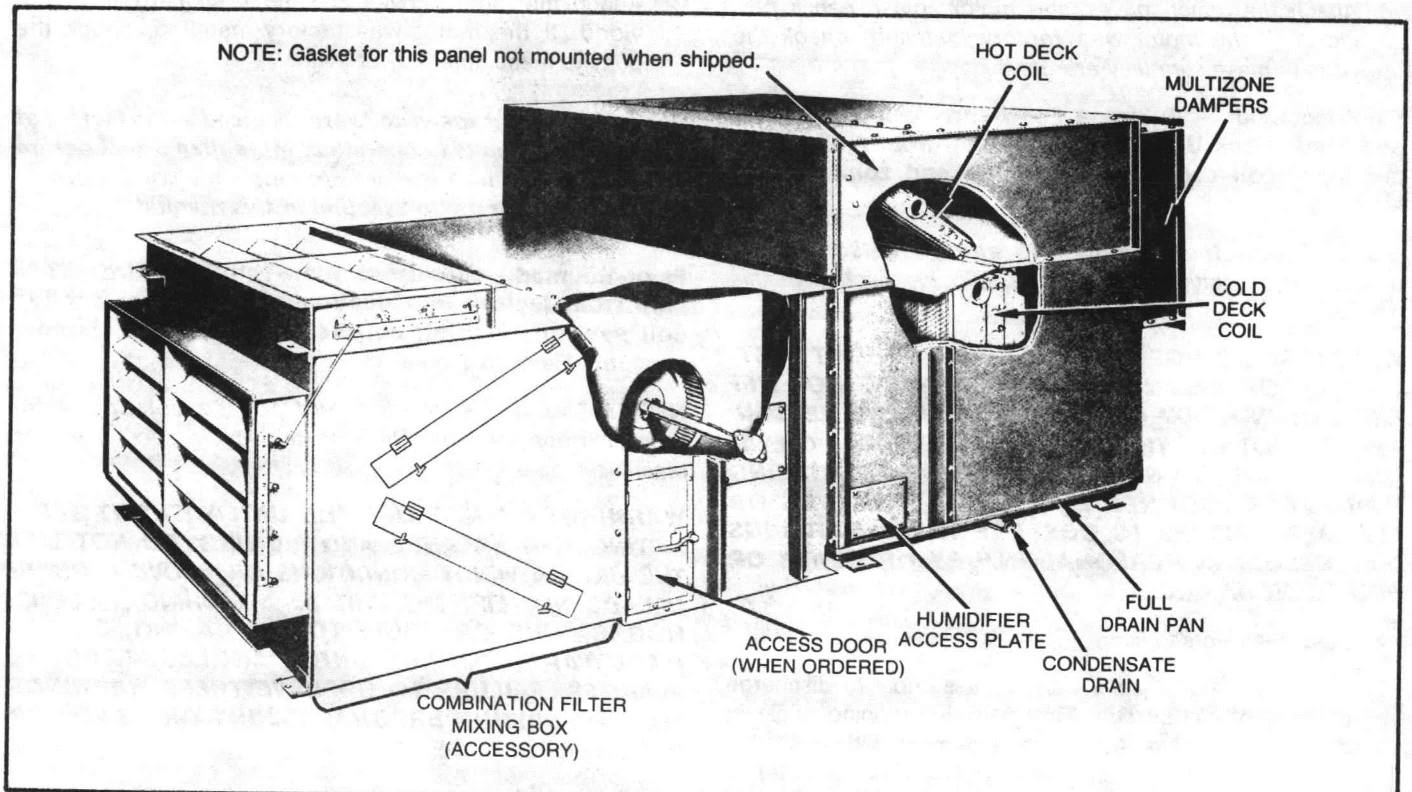


FIGURE 15 - Multizone Blow-Thru Climate Changers

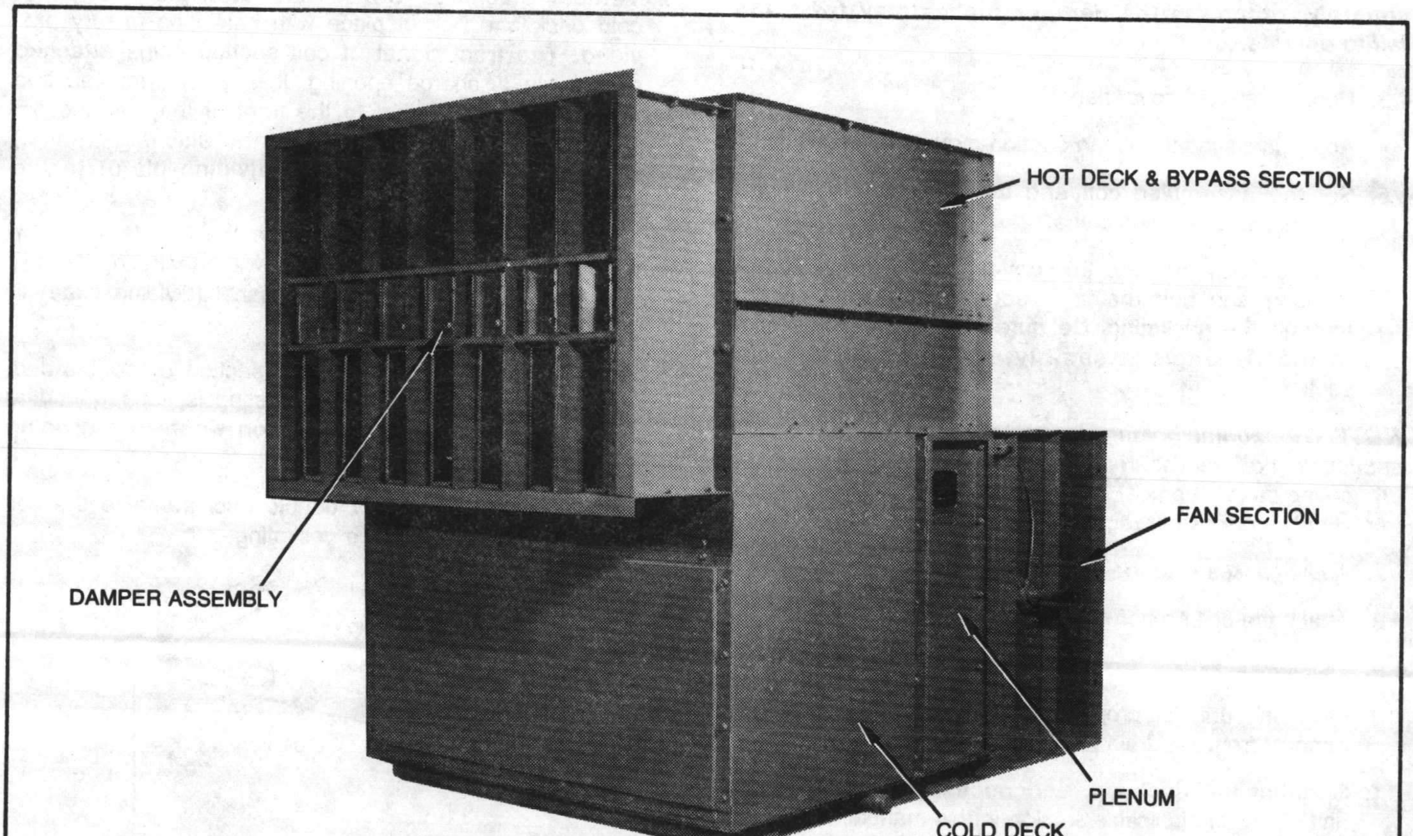


FIGURE 16 - Typical Three Deck Horizontal Discharge Climate Changer

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.

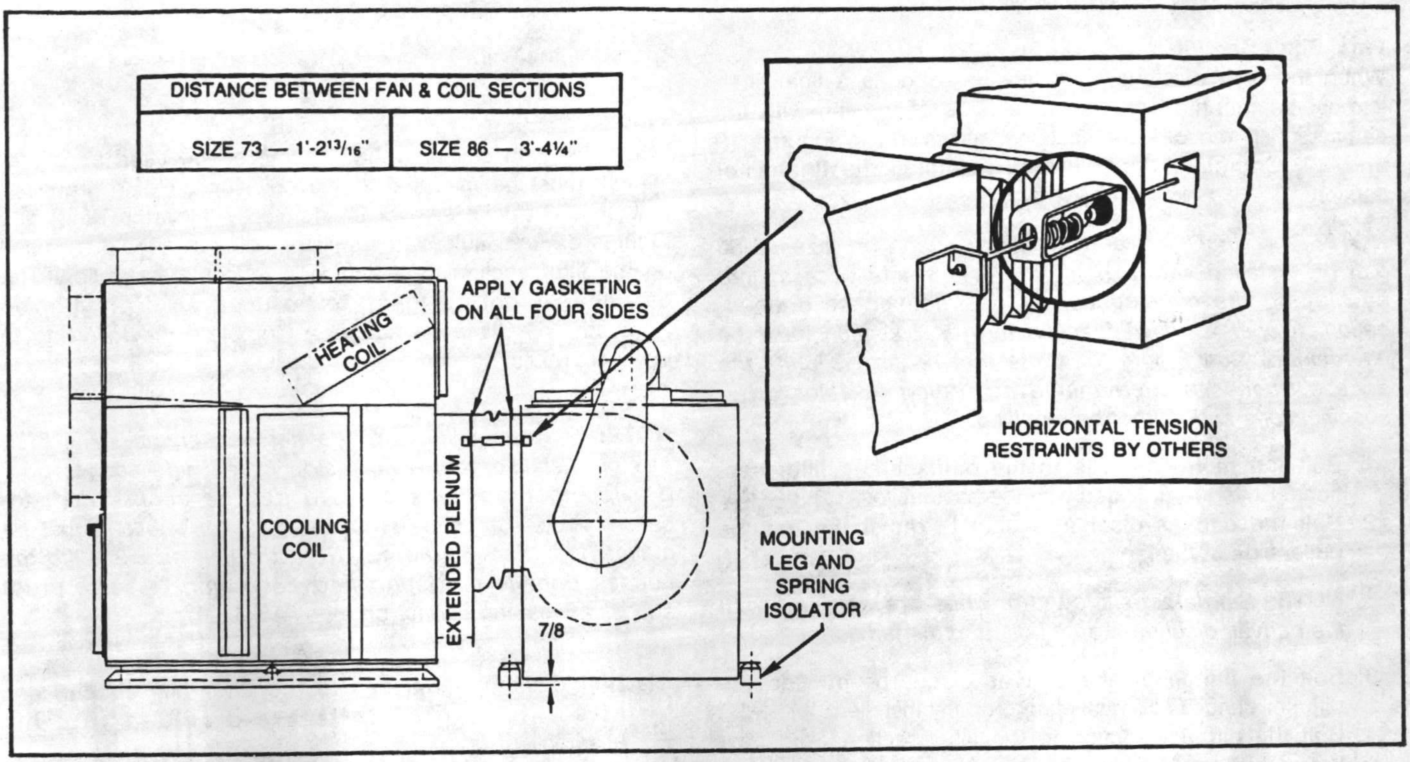


FIGURE 17 - Fan and Coil Section Ductwork Connections for Blow-Thru High Pressure Units

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 carryover in standard units.*

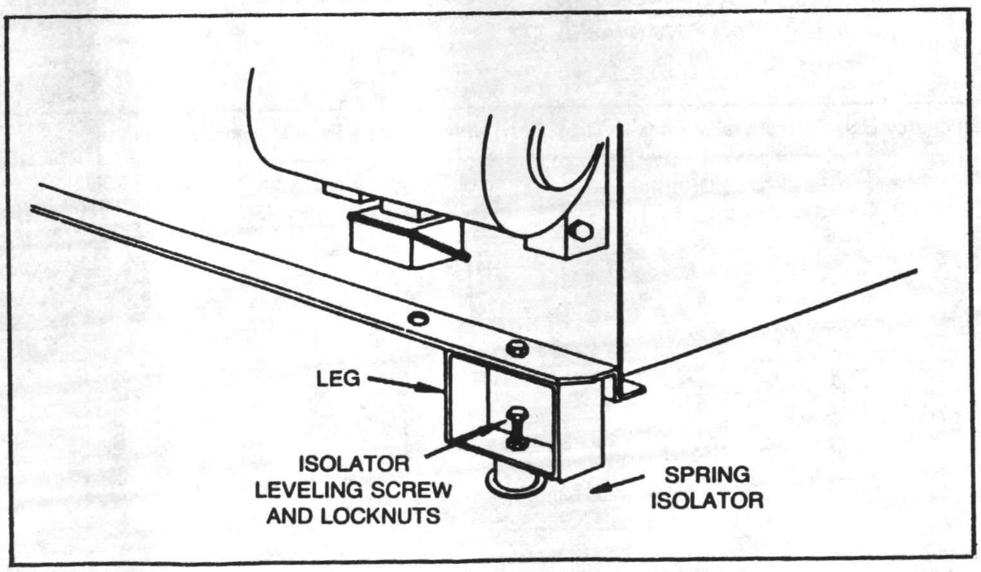


FIGURE 18 - Attaching the Mounting Leg and Spring Isolator to the High Pressure Sprayed Coil Unit

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.

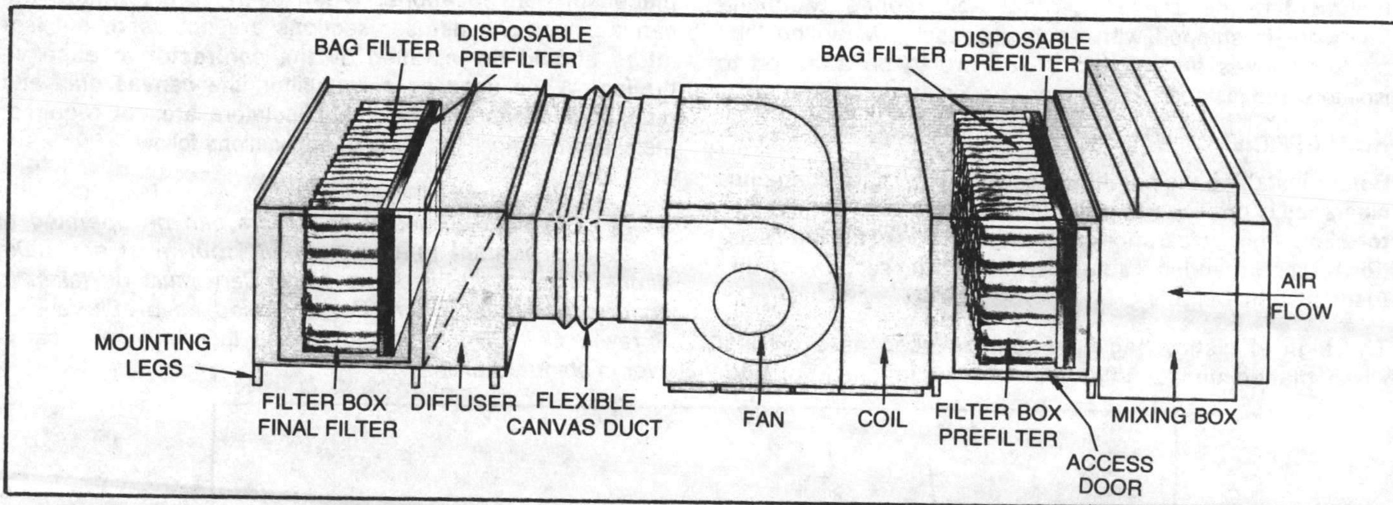


FIGURE 19 - High Efficiency Bag Filter Installation with Draw-Thru Unit (Used as Pre-Filter and Final Filter)

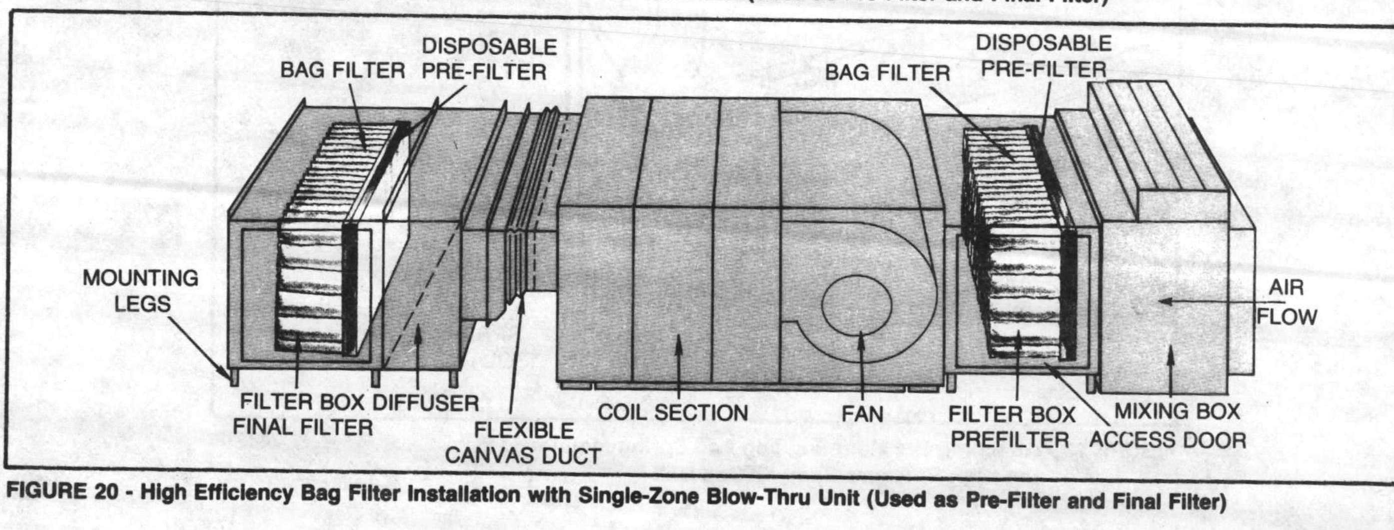


FIGURE 20 - High Efficiency Bag Filter Installation with Single-Zone Blow-Thru Unit (Used as Pre-Filter and Final Filter)

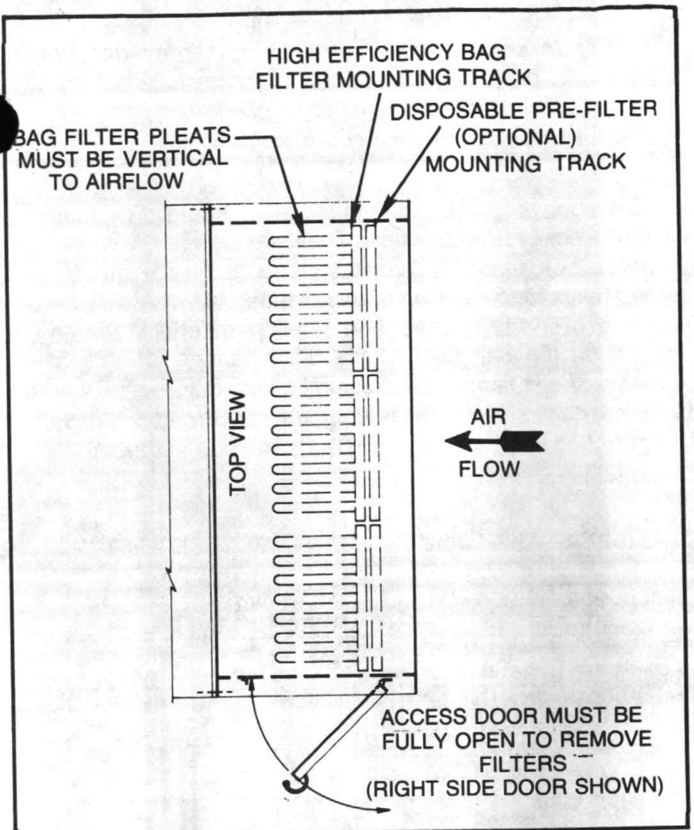


FIGURE 21 - Filter Mounting Track Location (Top View)

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.

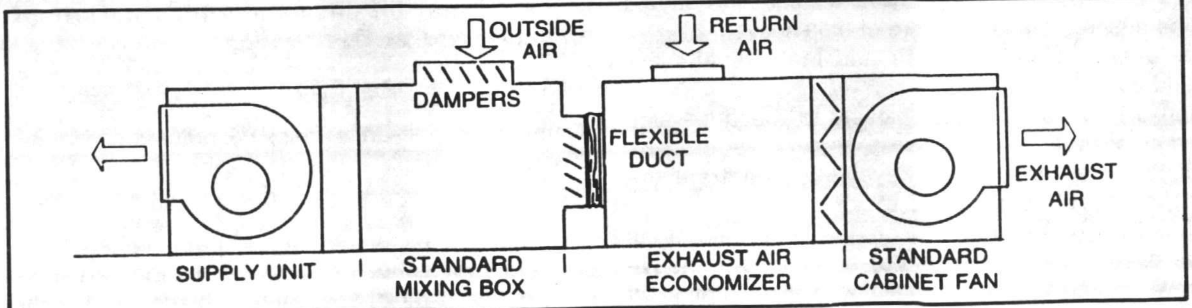


FIGURE 22 - Exhaust Air Economizer Installation

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 multi-groove 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.

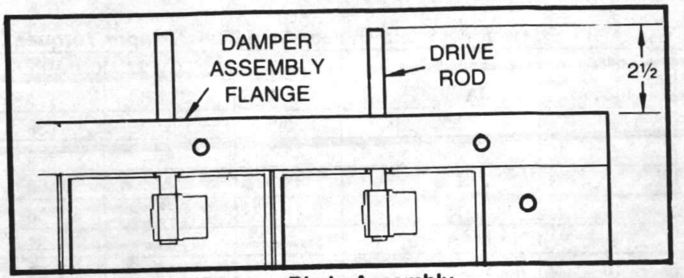


FIGURE 23 - Zone Damper Blade Assembly

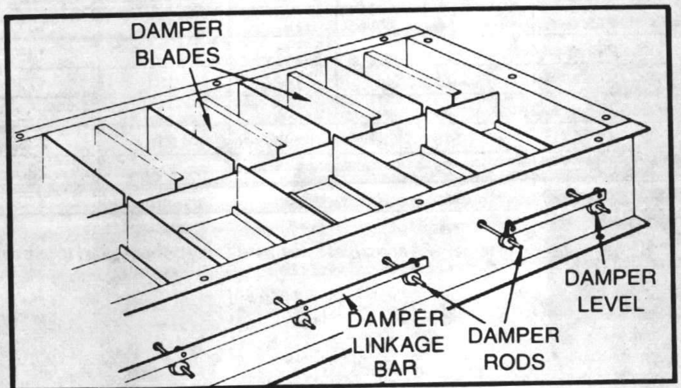


FIGURE 24A - Setting the Zone Damper Rods and Damper Linkage

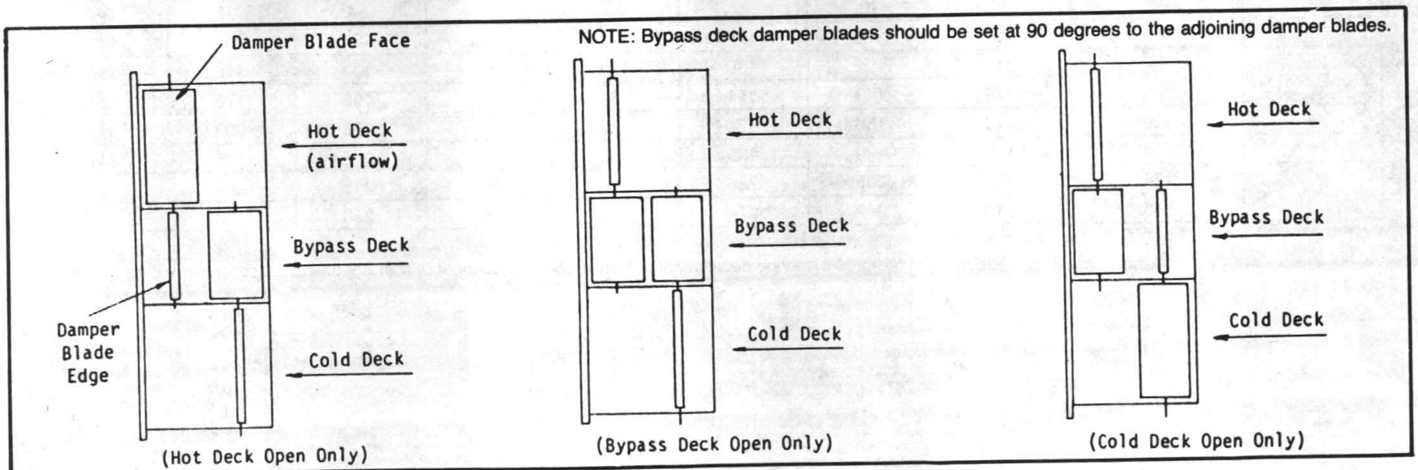


FIGURE 24B - Proper Three-Deck Multizone Damper Blade Configuration

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

UNIT SIZE	STANDARD DAMPER	LOW LEAK DAMPER 1" ΔP	2" ΔP	3" ΔP	4" ΔP	ULTRA-LOW LEAK DAMPER 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 SIZE	STANDARD DAMPER	LOW LEAK DAMPER 1" ΔP	2" ΔP	3" ΔP	4" ΔP	ULTRA-LOW LEAK DAMPER 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.

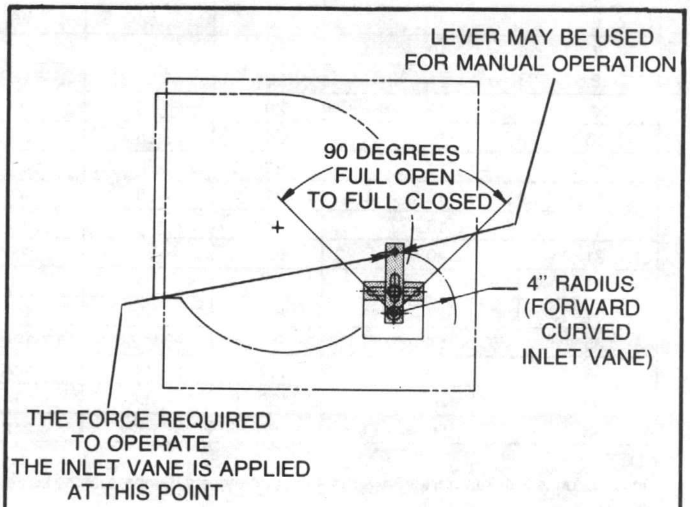
Inlet guide vane operator motors, if not factory provided, are to be provided and installed by the contractor, according to the operating torques given in Tables 9, 10, and 11. Control lever stroke and radius is given in Figure 25.

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.)	2,000 FPM FORCE (LBS.)	3,000 FPM TORQUE (IN.-LBS.)	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 3/8" 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.)	2,000 FPM FORCE (LBS.) 4" ARM	3,000 FPM TORQUE (IN.-LBS.)	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.

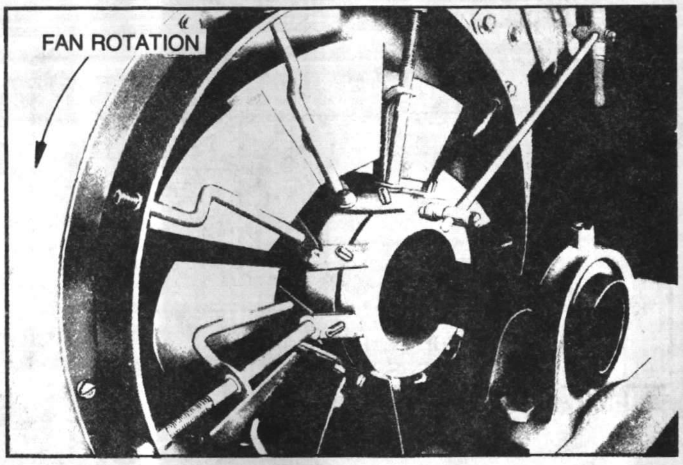


FIGURE 26 - Forward Curved Inlet Vanes

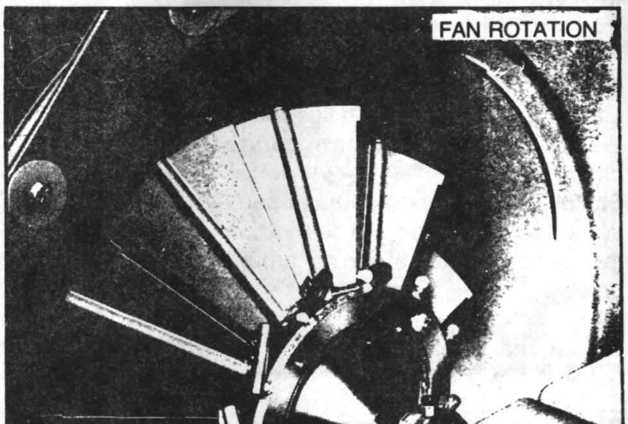


FIGURE 27 - Airfoil Inlet Vanes

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.

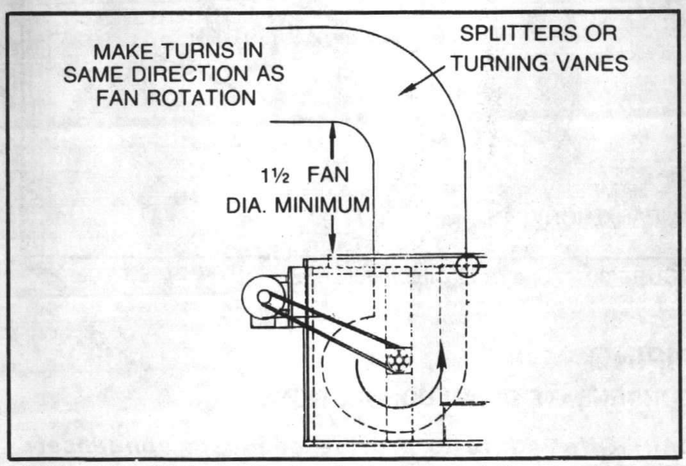


FIGURE 28 - Discharge Ductwork Recommendations

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.*

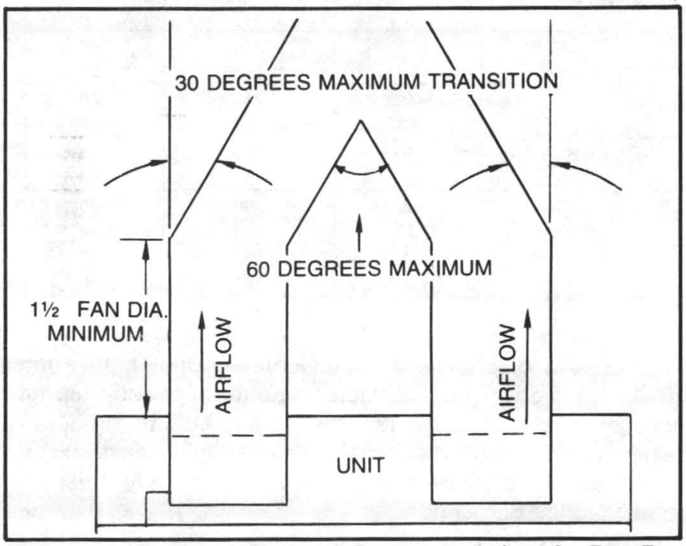


FIGURE 29 - Discharge Ductwork Recommendations for Two-Fan Units

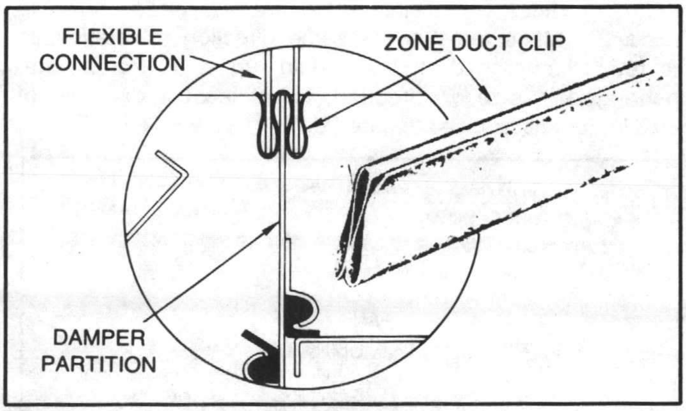


FIGURE 30 - Zone Duct Clip Installation

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.

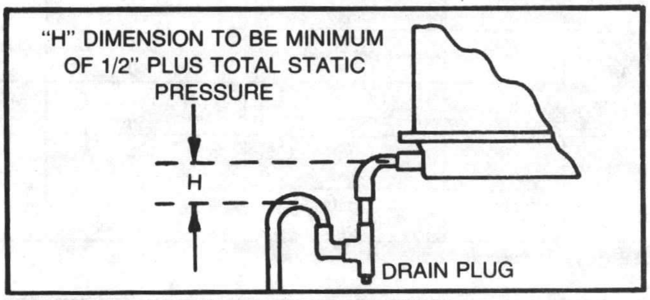


FIGURE 31 - Drain Trap for Draw-Thru Units

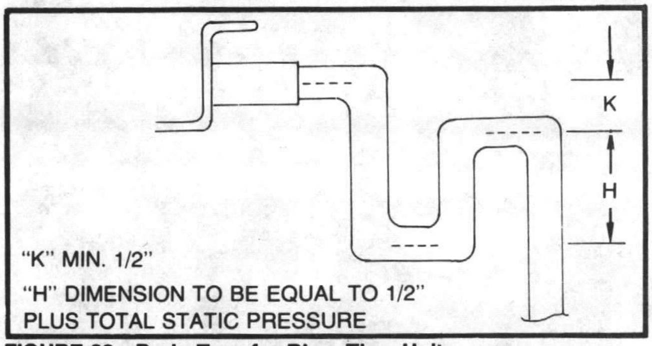


FIGURE 32 - Drain Trap for Blow-Thru Units

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.

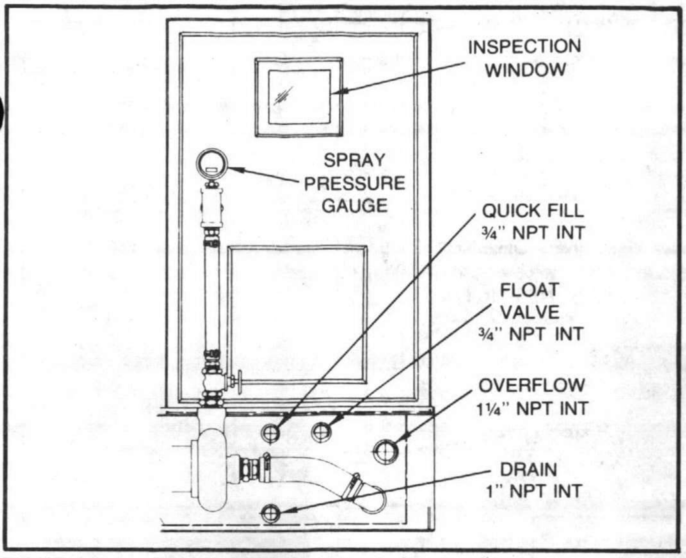


FIGURE 33A - Sprayed Coil Unit Tank Connections

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.*

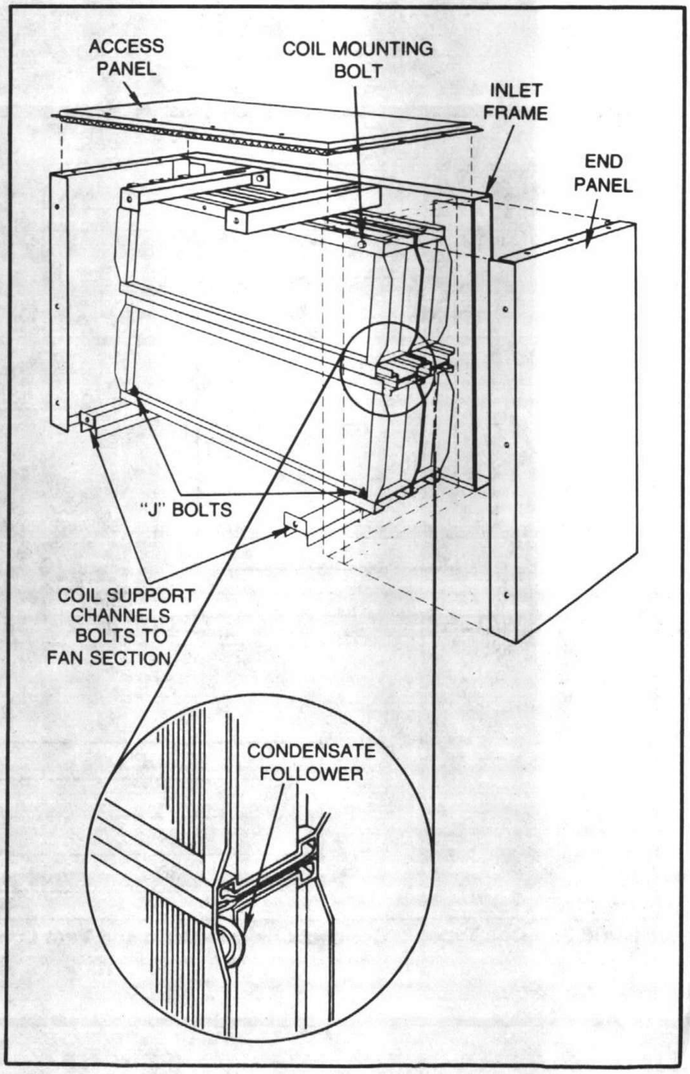
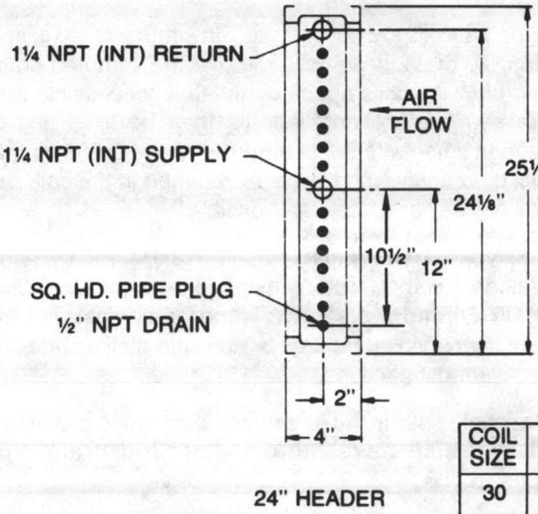
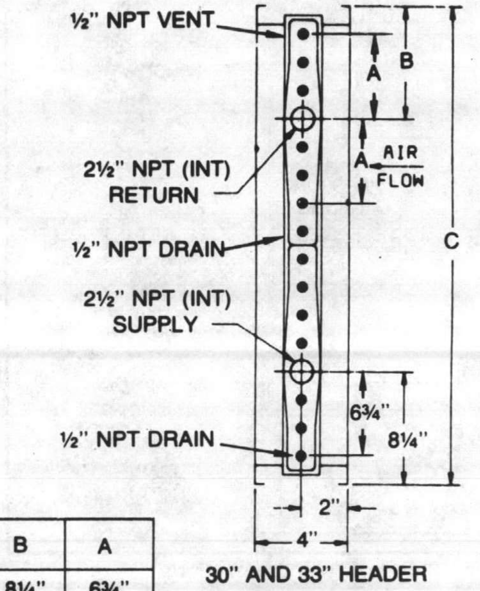


FIGURE 33B - Draw-Thru Unit Coil Section Details with View of Condensate Follower

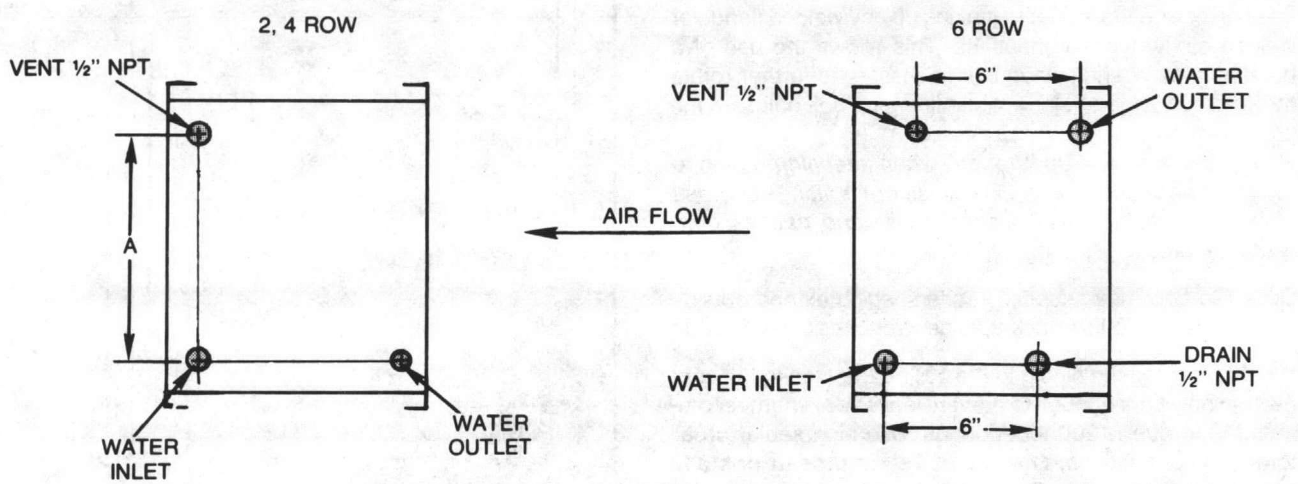




COIL SIZE	C	B	A
30	31½"	8¼"	6¾"
33	34½"	9¾"	8¼"

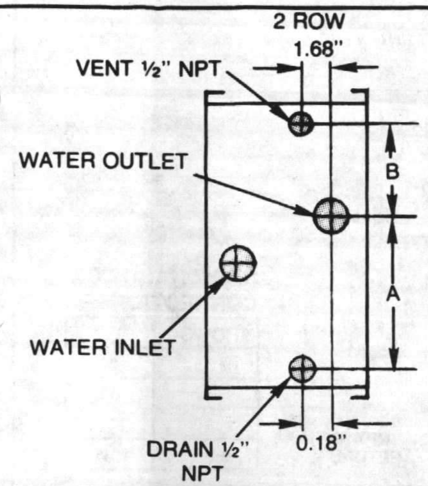
NOTE: COIL CONNECTIONS AVAILABLE RIGHT OR LEFT HAND
(DETERMINED BY FACING INTO AIRFLOW)

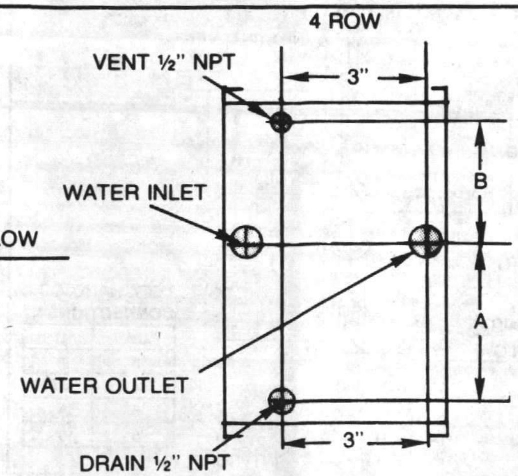
FIGURE 34 - Coil Connections With Drain and Vent Locations (Type WC 24" and Type WS 30" and 33" Headers)



HEADER	A
18"	16½"
24"	22½"
30"	28½"

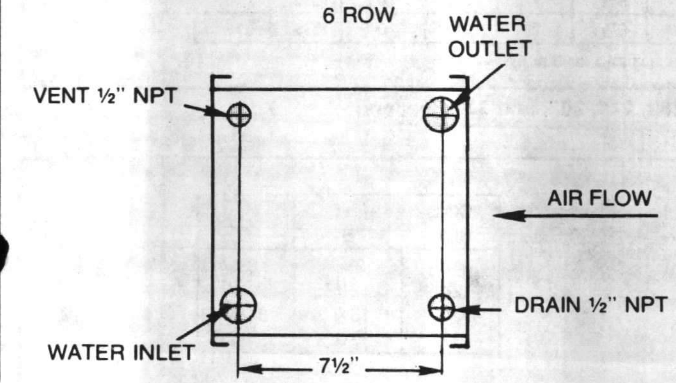
FIGURE 35 - Coil Type P2 Connections with Drain and Vent Locations (18", 24" and 30" Headers)

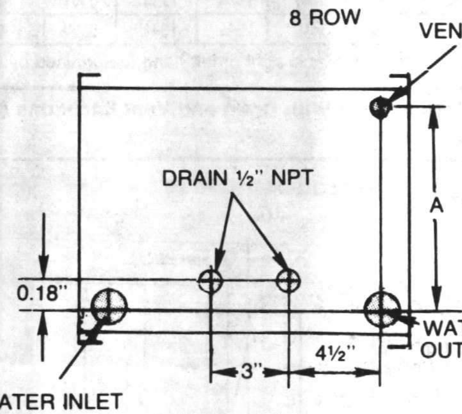




HEADER	A	B
18"	10½"	6"
24"	13½"	9"
30"	16½"	12'

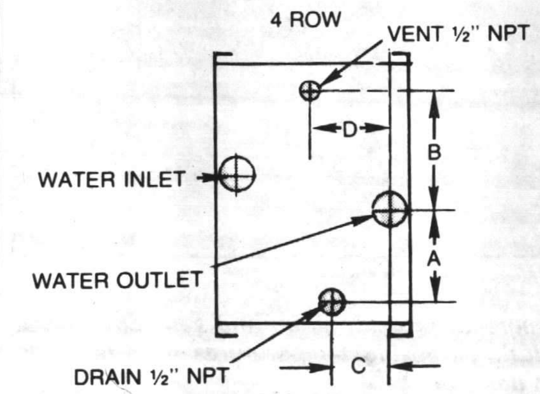
HEADER	A	B
18"	7½"	9"
24"	10½"	12"
30"	13½"	15"



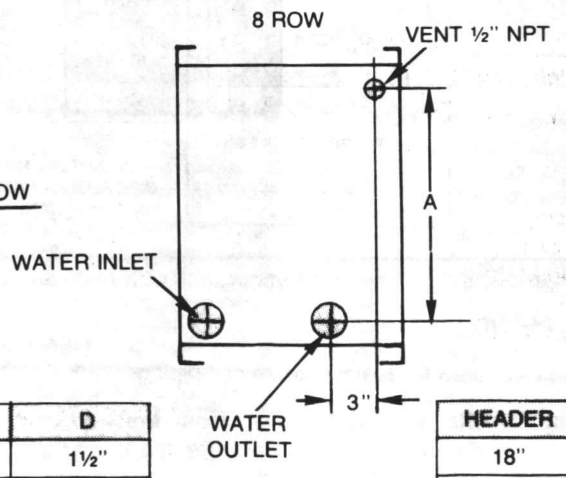


HEADER	A
18"	16¹¹⁄₁₆"
24"	22¹¹/₁₆"
30"	28¹¹/₁₆"

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

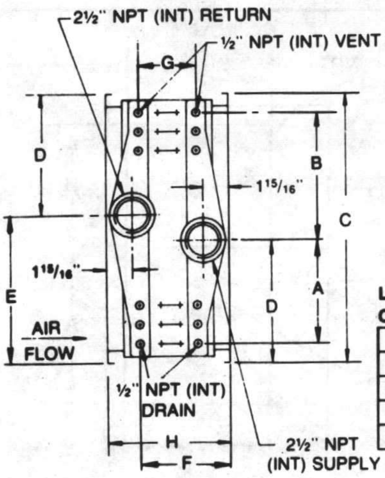


HEADER	A	B	C	D
18"	7½"	9"	1½"	1½"
24"	10½"	12"	0"	4½"
30"	13½"	15"	1½"	1½"



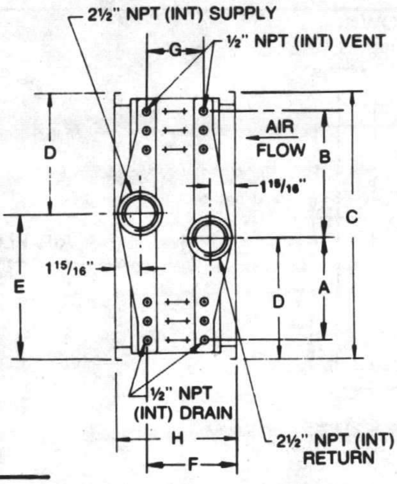
HEADER	A
18"	16½"
24"	22½"
30"	28½"

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

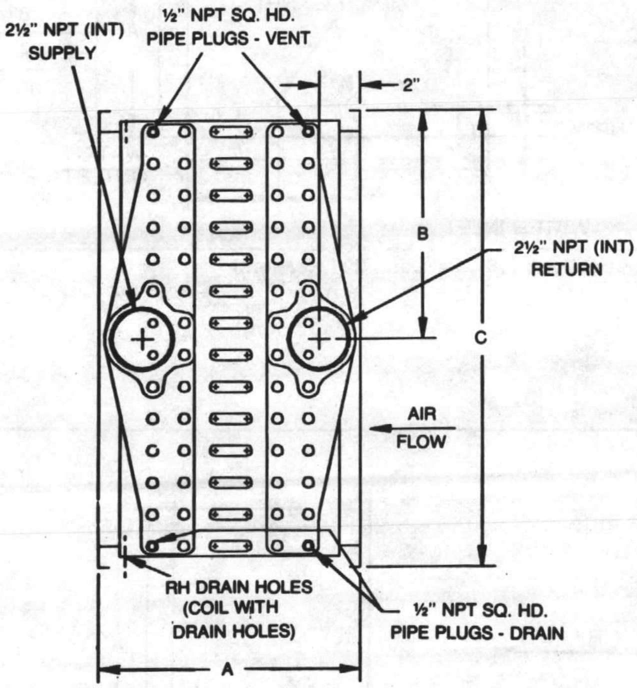
ROWS	G
3	3
4	4½
6	7½
8	10½

					2-ROW		4-ROW		6-ROW		8-ROW	
COIL SIZE	A	B	C	D	E	H	F	H	F	H	F	H	F

COIL SIZE	A	B	C	D	E	2-ROW H	2-ROW F	4-ROW H	4-ROW F	6-ROW H	6-ROW F	8-ROW H	8-ROW 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 24 30, 33	1.0 1.25 2.5	1.0 1.25 1.5	0.5 0.5 0.5	0.5 0.5 0.5
WA	18, 24, 30, 33	2.5	2.5	0.5	0.5
N, NS	18 24 30, 33	2.0 2.5 3.0	1.0 1.25 1.25	NA NA NA	NA NA NA
A, AA	18 24, 30, 33	2.5 2.5	1.0 1.25	NA NA	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	7/8	1 3/8
	3	7/8	1 5/8
	6	1 1/8	2 1/8
	12	1 3/8	2 1/8
24	2	7/8	1 5/8
	4	7/8	1 5/8
	8	1 1/8	2 1/8
	16	(2)1 1/8	(2)2 1/8
30	2	7/8	1 3/8
	4	7/8	1 5/8
	5	7/8	2 1/8
	10	1 3/8	2 1/8
	20	(2)1 3/8	(2)2 1/8
33	3	7/8	1 5/8
	7	1 1/8	2 1/8
	11	1 3/8	2 1/8
	22	(2)1 3/8	(2)2 1/8

NOTE: Connections are piping OD.

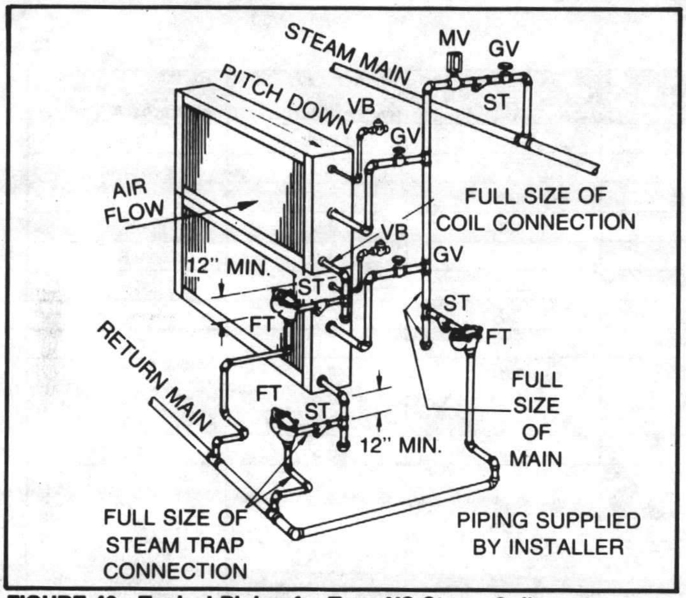


FIGURE 40 - Typical Piping for Type NS Steam Coils and Horizontal Tubes for Horizontal Airflow

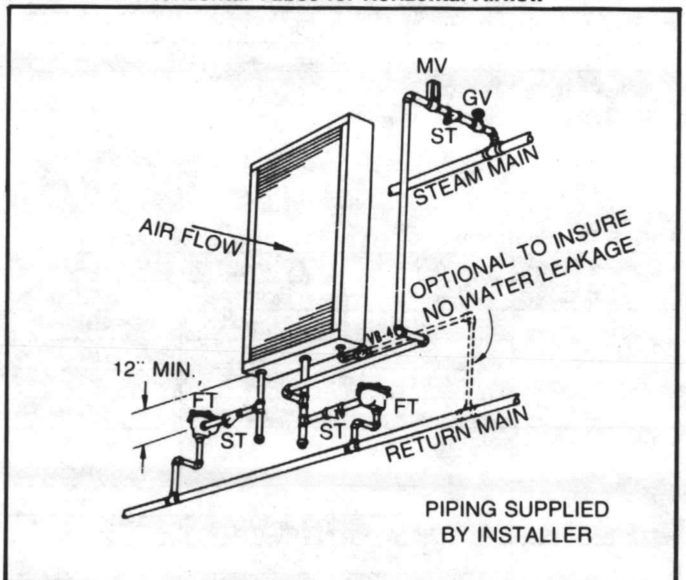


FIGURE 41 - Typical Piping for Type NS Steam Coils and Vertical Tubes for Vertical Airflow

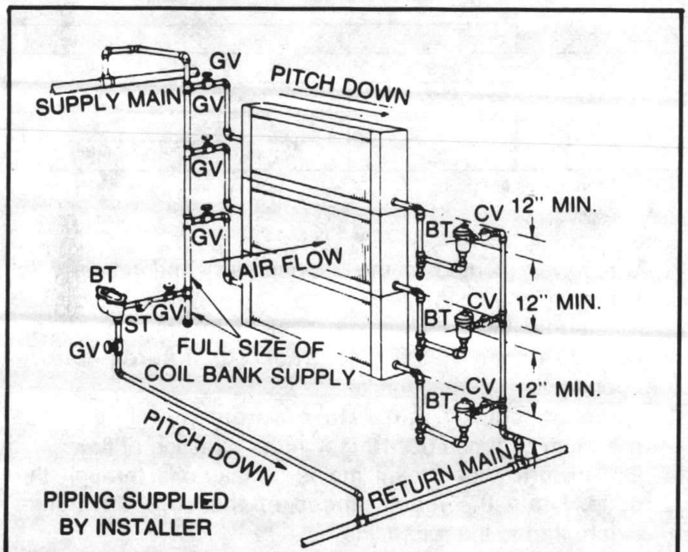


FIGURE 42 - Typical Piping for Type A Steam Coils, High Pressure, Horizontal Tubes for Horizontal Airflow

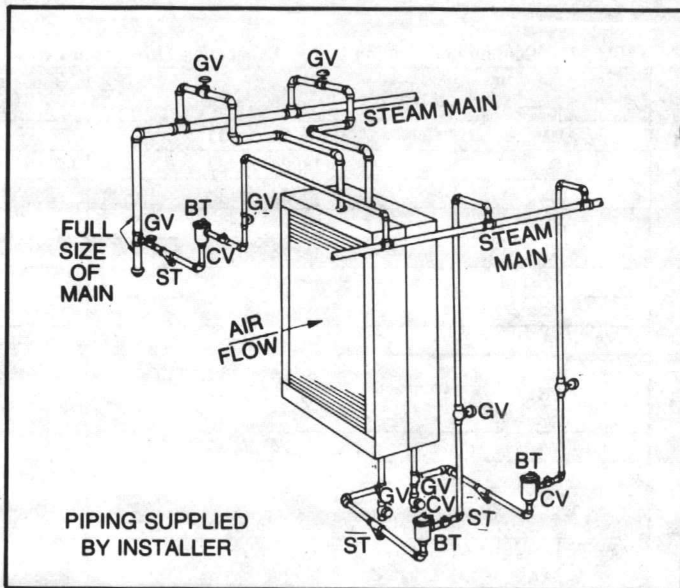


FIGURE 43 - Typical Piping for Type A Steam Coils, High Pressure, Vertical Tubes for Horizontal Airflow

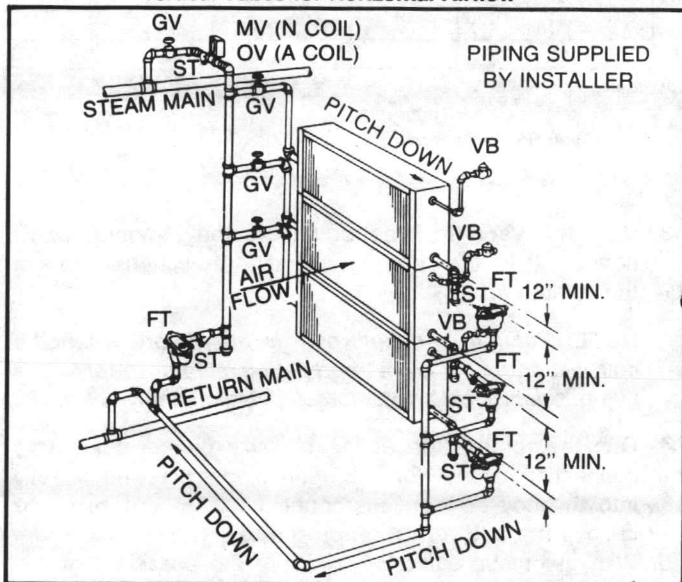


FIGURE 44 - Typical Piping for Type A or N Steam Coils, Horizontal Tubes for Horizontal Airflow

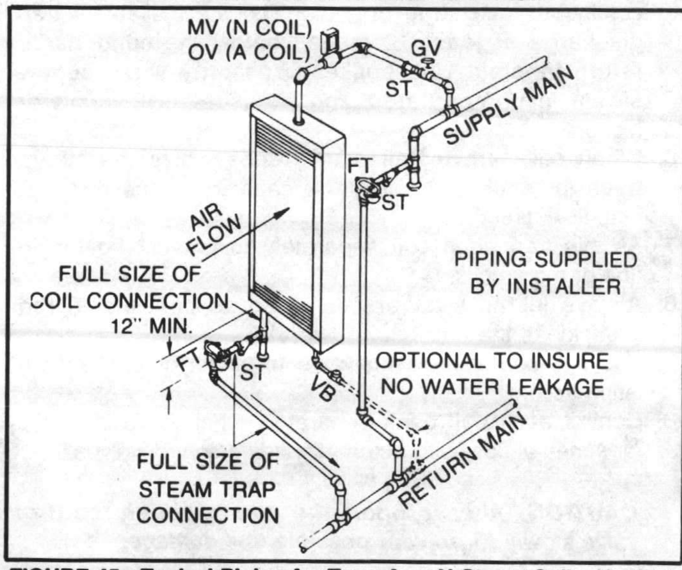


FIGURE 45 - Typical Piping for Type A or N Steam Coils, Vertical Tubes for Horizontal Airflow

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.

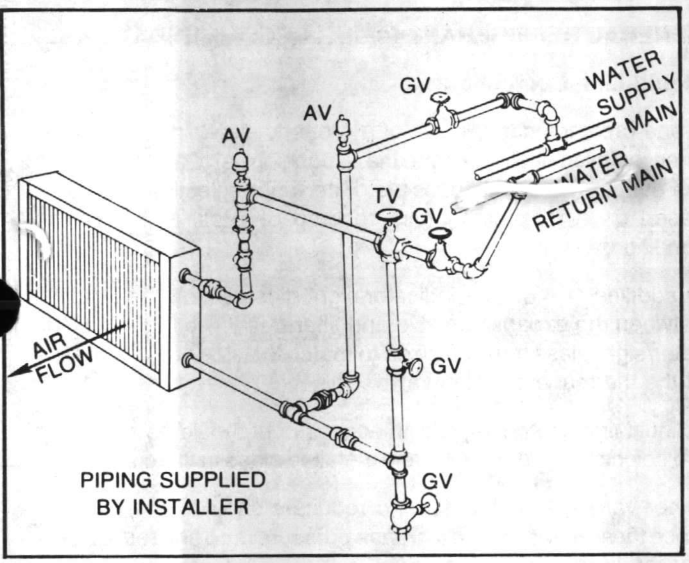


FIGURE 46 - Typical Piping for Type WC Water Coil

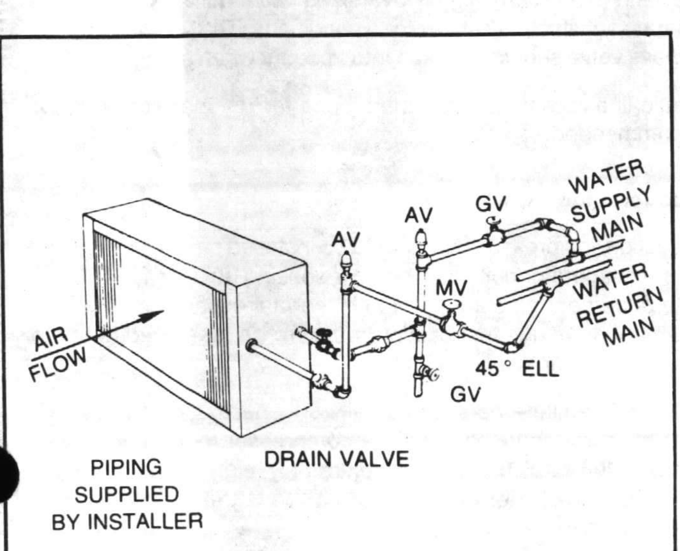


FIGURE 47 - Typical Piping for Type W, Two-Row Water Coil

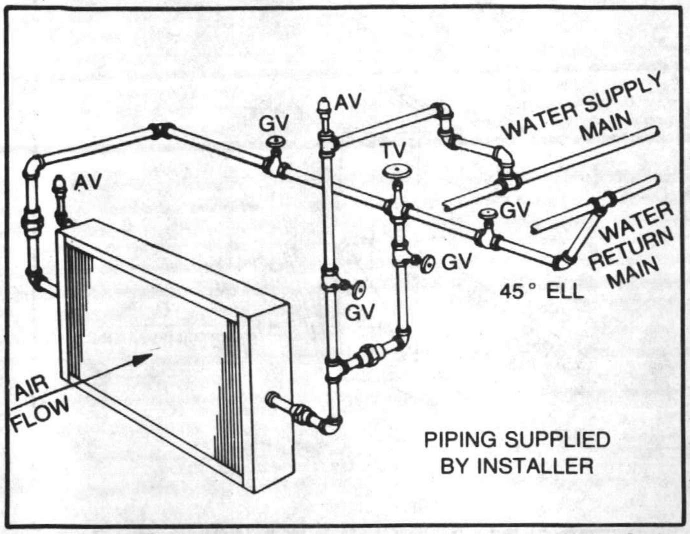


FIGURE 48 - Typical Piping for Type W or WA, 1-Row Water Coil

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.

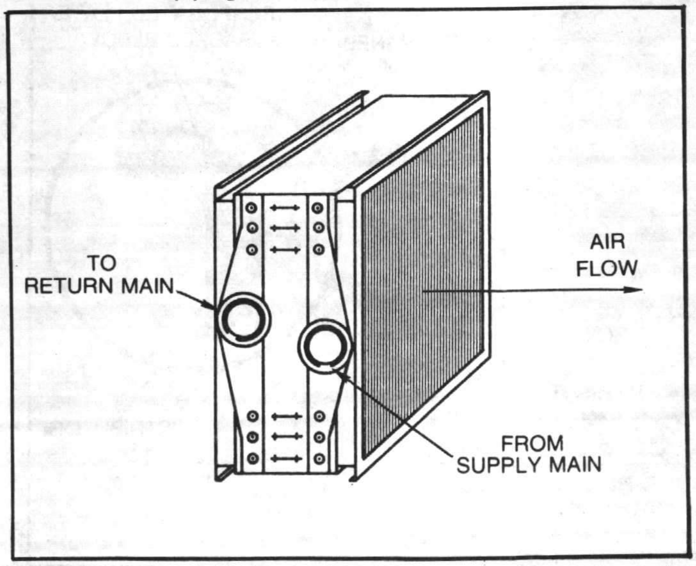


Figure 49 - Typical Piping for Type D, W or K Water Cooling Coils with End Connections.

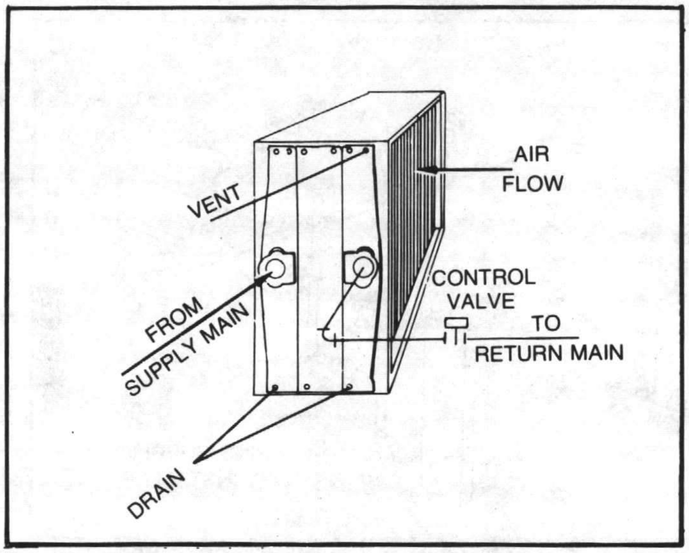


Figure 50 - Typical Piping for Type DD Water Cooling Coil with Center Connections.

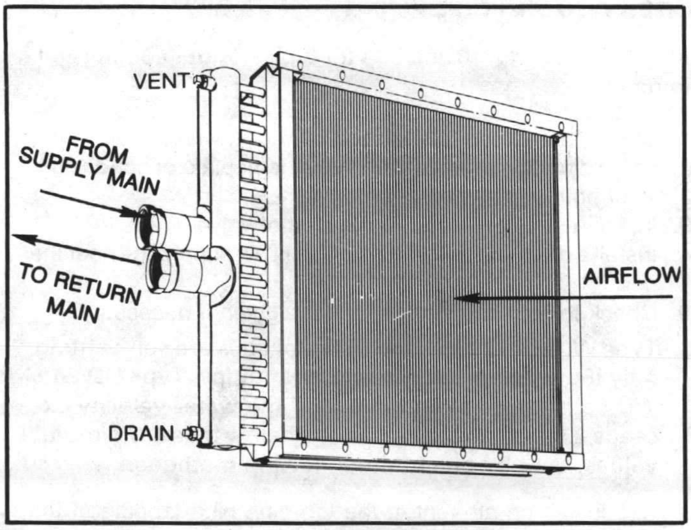


Figure 50A - Typical Piping for 2-Row, Type WL and DL Water Coil with Drain and Vent Locations.

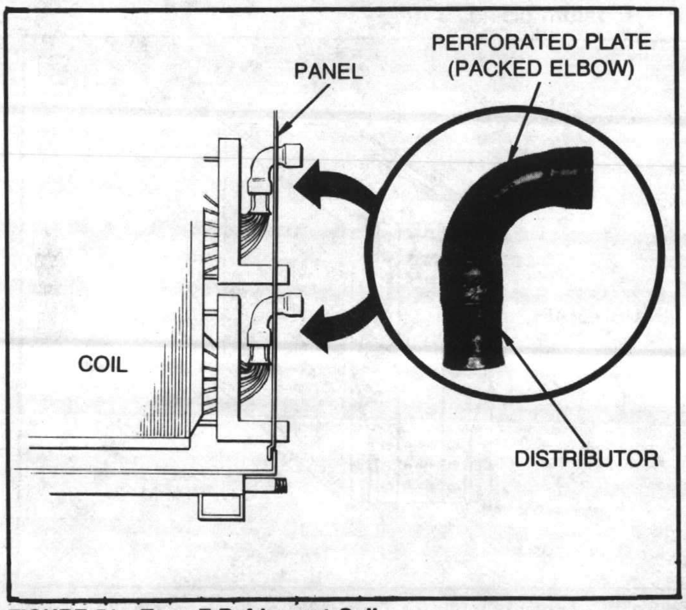


FIGURE 51 - Type F Refrigerant Coil

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:

$$\frac{100 \times \{ [226\text{-}221] + [230\text{-}226] + [227\text{-}226] \}}{2 \times 226} =$$

$$2.2\% \text{ (Unacceptable)}$$

   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.

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.

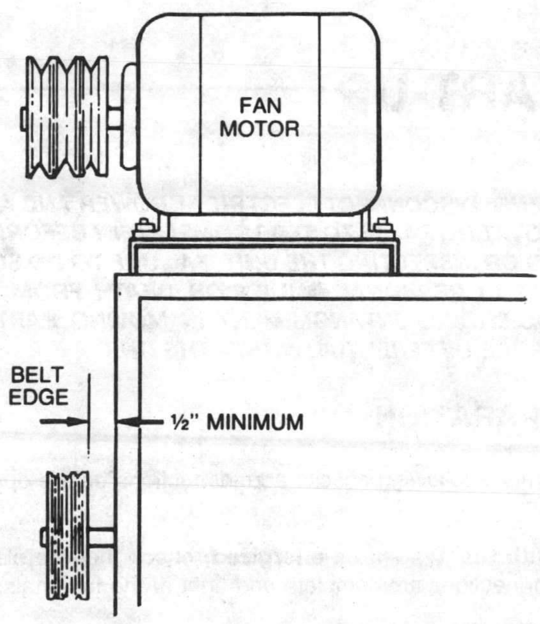


Figure 52 - Minimum Allowable Distance Between Frame Work and Fan Sheave.

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.

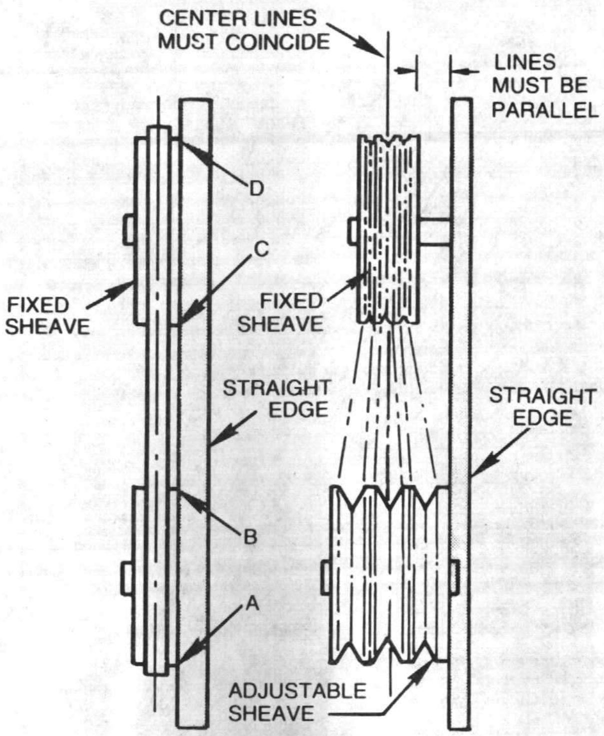


Figure 53 - Sheave Alignment

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)

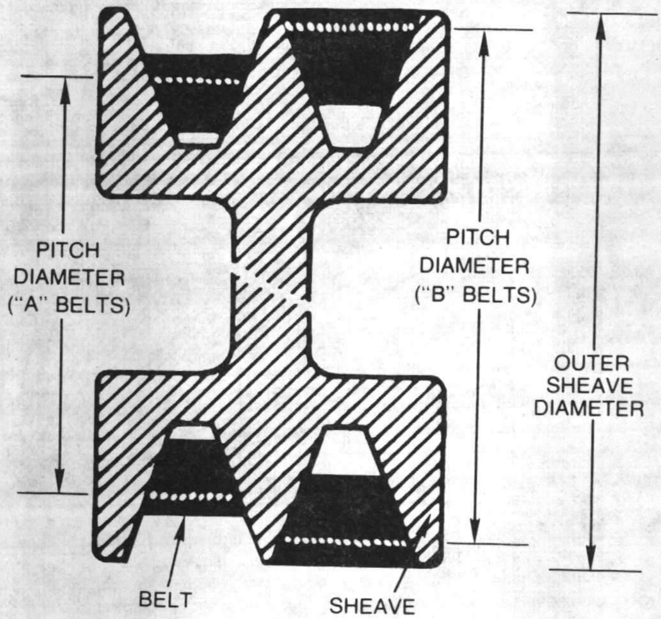


Figure 54 - Fan Sheave Pitch Diameter

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.

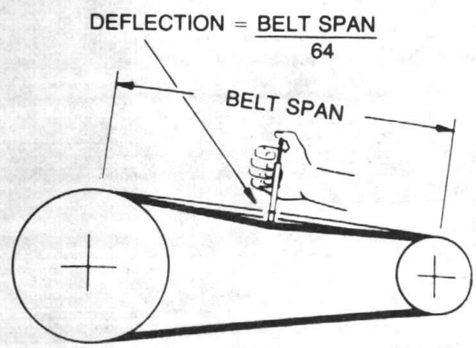
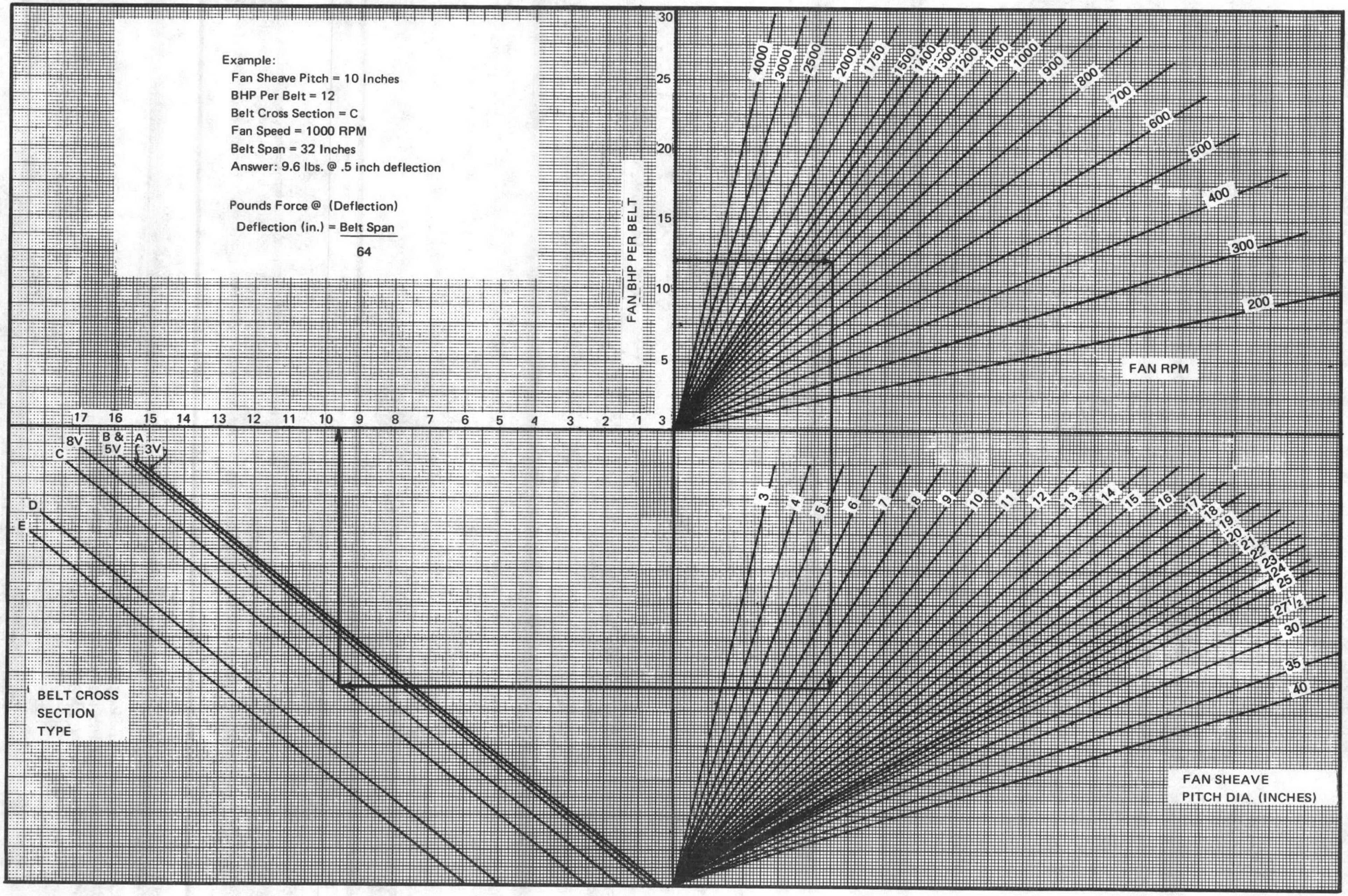


Figure 55 - Belt Tension Measurement

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.

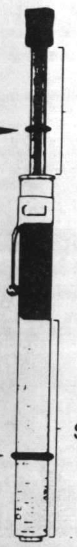


Figure 56 - Belt Tensioner

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.

PRINTED BY PRODUCTION SERVICES — LA CROSSE JH/DL

TAB PLACEMENT HERE

DESCRIPTION:

5

☐ Tab page did not contain hand written information

☒ Tab page contained hand written information
*Scanned as next image

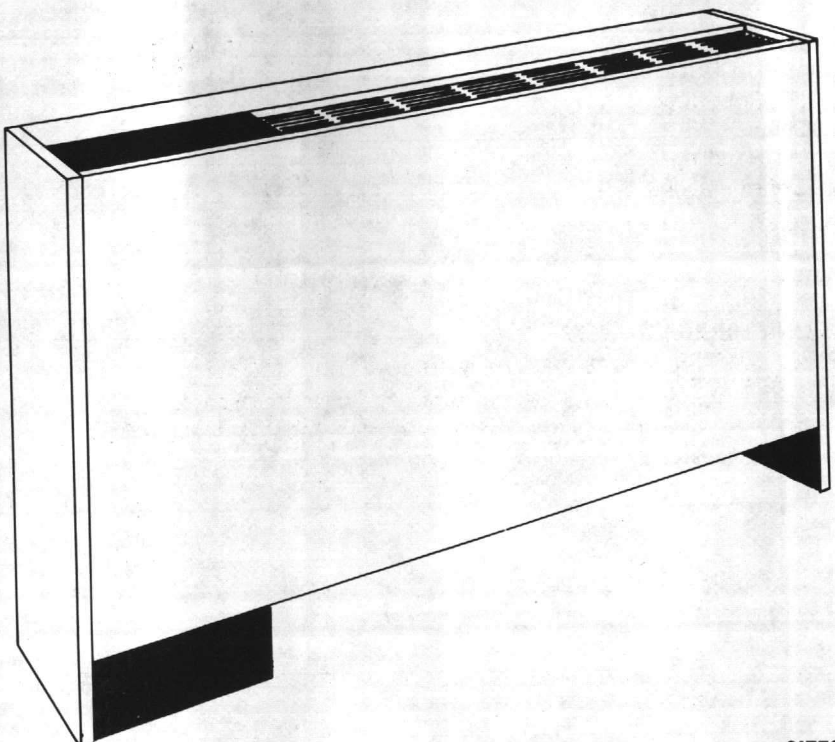
Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Installation Maintenance

Library	**Service Literature**
Product Section	**Air Term. Devices & Htg. Products**
Product	**Fan-Coil Air Conditioners - Unitrane**
Model	**UNT**
Literature Type	**Installation-Maintenance**
Sequence	**1B**
Date	**March 1985**
File No.	**SV-TD-FCAC-UNT-IM-1B-385**
Supersedes	**UNT-IM-1A (Aug 82)**
Ordering No.	**UNT-IM-1B**

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.

UNITRANE®
FAN-COIL AIR CONDITIONERS



MODELS	**SIZES**
A - Vertical Concealed	**(02-12)**
B - Vertical Cabinet	**(02-12)**
C - Horizontal Concealed	**(02-12)**
D - Horizontal Cabinet	**(02-12)**
E - Horizontal Recessed	**(02-06)**
H - Vertical Recessed	**(02-06)**
K - Low Vertical Concealed	**(02-06)**
L - Low Vertical Cabinet	**(02-06)**

COMMERCIAL SYSTEMS GROUP
LA CROSSE, WISCONSIN 54601-7599
PRINTED IN U.S.A.

LITERATURE CHANGES:

A- Drain hose clamp eliminated; installation and maintenance checklists, recessed model weights, grille free air table, valve shipping bracket removal note, paint instructions added; installation procedures rearranged; filter access panel removal clarified; electric coil table updated.

B- Size nomenclature changed; unit leveling instructions added; unit dimensions for Models E and H; dimension correction to duct; filter access panel drawing revised; drain line pitch note added.

TABLE OF CONTENTS

MODEL NUMBER DESCRIPTION

Trane products are identified by a multiple character model number that precisely identifies a particular type of unit. An explanation of the multiple character number is shown below. It will enable the owner or Service Engineer to define operation, components and accessories.

B 2 5 A L 04

MODEL TYPE
- A - Vertical Concealed
- B - Vertical Cabinet
- C - Horizontal Concealed
- D - Horizontal Cabinet
- E - Horizontal Recessed
- H - Vertical Recessed
- K - Low Vertical Concealed
- L - Low Vertical Cabinet

OUTLET

Vertical
- 1 - Integral Top Grille
- 2 - Quadrifuser Top Grille
- 3 - Top Duct Collar

Horizontal
- 1 - Integral Front Grille
- 2 - Quadrifuser Front Grille
- 3 - Front Duct Collar

Low Vertical
- 1 - Integral Top Grille
- 2 - Quadrifuser Top Grille
- 3 - Top Duct Collar

UNIT SIZE
- 02
- 03
- 04
- 06
- 08
- 10
- 12

AUXILIARY COIL TYPE
- 0 - None
- E - Electric
- L - Water

MAIN COIL TYPE
- A - Standard Water
- D - High Temperature Rise Water

INLET

Vertical
- 2 - Return Air Toe Space
- 3 - 0 to 25% Fresh Air Back
- 5 - 0 to 100% Fresh Air Back-Mixing Base

Horizontal
- 1 - Integral Back Grille
- 2 - Exposed Fan
- 4 - Back Duct Collar
- 6 - Integral Bottom Grille

Low Vertical
- 2 - Return Air Toe Space
- 3 - 0 to 25% Fresh Air Back

***NOTE:** All High-Capacity Fan-Coil units will have an "H" as the last character (i.e. B25AL04H).*

GENERAL INFORMATION

UniTrane® Fan-Coil units are room air conditioners designed for cooling and heating load capabilities of 200 to 1400 cfm. Horizontal models, in concealed, recessed, or cabinet installations, are suspended from the uppermost ceiling by installer-supplied threaded rods or lag screws. Vertical floor units are also available in concealed, recessed or cabinet models. Low Vertical floor units are concealed or cabinet models that can be installed under low windows or other wall obstructions.

Basic unit components, as shown in Figure 1, consist of a water coil, an auxiliary water or electric coil, flat filters, a condensate drain pan, one or two fans, and a fan motor. A variety of motor controls, valve packages and other options are available for special units.

To determine specific options, refer to the unit model number and the Model Number Description given here. The sales order will further identify unit details and accessories.

An Installation Checklist is given at the end of the Installation section of this manual. Complete the checks after installation is accomplished to ensure proper and safe operation of the unit.

Fan-Coil units which are equipped with any steam applications are considered "special." The installer is responsible for the piping connections for these units.

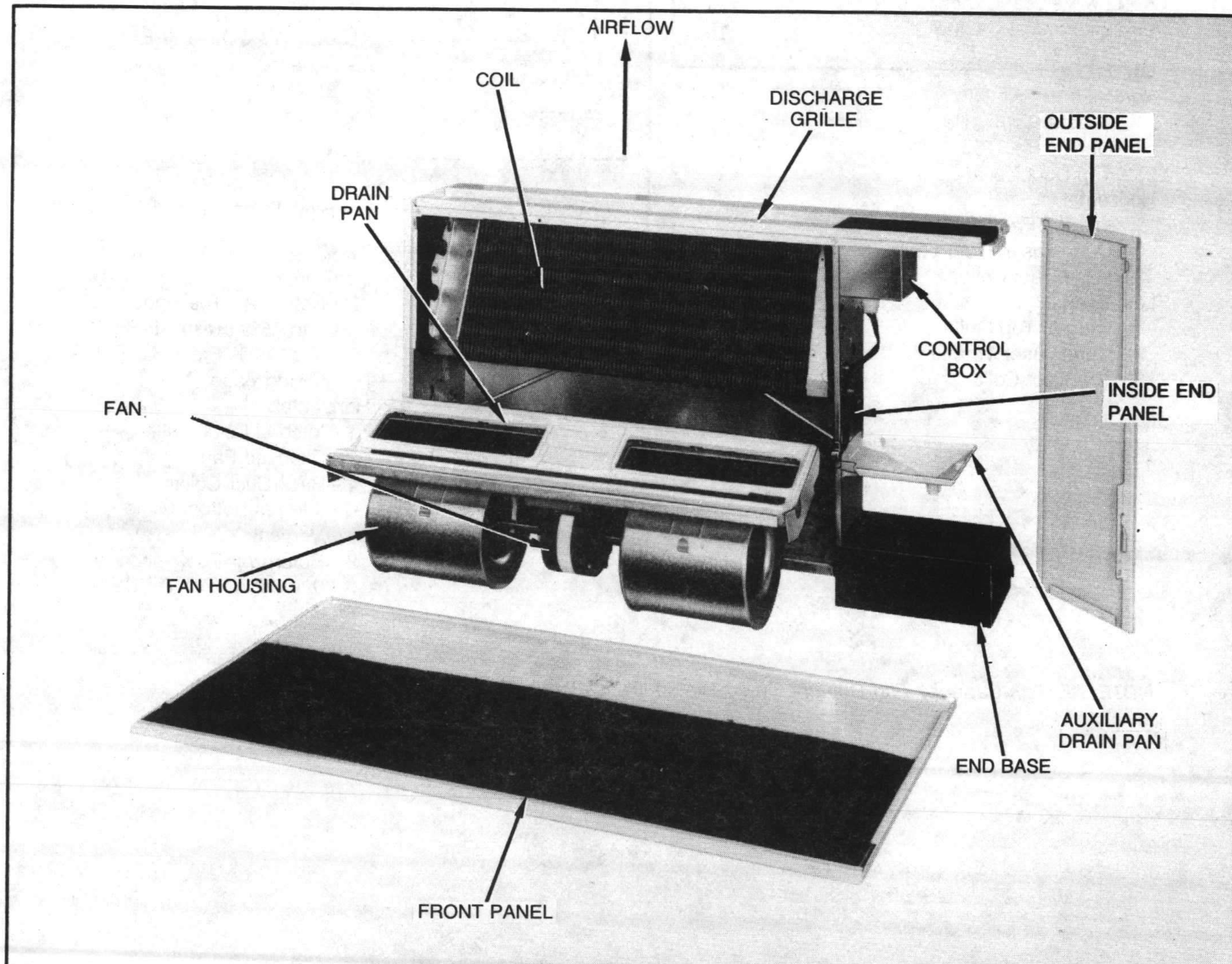


FIGURE 1 - Typical UniTrane Components (Vertical Cabinet Model Shown)

INSTALLATION

RECEIVING AND HANDLING

UniTrane® Fan-Coil units are packaged in individual cartons for maximum protection during shipment, as well as for easy handling and storage on the job site. Tagging information is provided on each carton to properly locate the unit in the floor plan.

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

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 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. Check the unit casing, fan rotation, coils, condensate pan, factory-wired conduit, filters and all options or accessories.
3. Inspect the unit for concealed damage before it is stored and as soon as possible after delivery. **Concealed damage must be reported to the delivering carrier 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 damage immediately by phone and mail if any damage is found. Request an immediate joint inspection of the damage by the carrier and consignee.
7. Notify the Trane sales representative of the damage and arrange for repair. Do not repair the unit, however, until damage is inspected by the carrier's representative.

Refer to the Installation Considerations in this manual before setting the unit in place. For approximate shipping weights, see Table 1.

INSTALLATION CONSIDERATIONS

For proper installation and operation, check each of the following before mounting the units:

1. Allow adequate space for the unit and free air or service clearances. See Figures 2 through 14 for unit dimensions. For specific unit dimensions, refer to the sales submittals. For servicing and routine maintenance, leave the area clear around the front panels, end panels and toe space in accordance with local or national electric codes. Provide removable panels in the ceiling for horizontal units. See Table 2 for grille minimum free air areas.
2. Before installing any unit, make sure proper allowances have been made at each unit location for piping and electrical connections. Refer to the sales submittals.
3. Check that the floor is strong enough to support unit weights, as given in Table 1. For ceiling units, adequate support rods must be supplied by the installer.
4. All units must be mounted level. For vertical or low vertical floor units, prepare the floor to be level before mounting. Use threaded rods to level ceiling-suspended units.
5. Set unit level by checking the casing. Do not use coils or drain pan for checking level as they are pitched as shipped to provide proper drainage.
6. The Trane Company (and the industry in general) recommends a condensate connection line pitch of 1" drop per foot.
7. Before installing a concealed or recessed unit, be sure the opening is the correct size. For recessed units, the front panel must attach properly to the unit and conceal the wall opening. Generally, the recess opening should be 2 inches less than the overall width and height of the front panel. Refer to specific submittals for dimensions.
8. The installation of Model C32-U units (horizontal concealed, with duct collar outlet and exposed fan inlet) must meet the requirements of N.F.P.A. Standard 90A or 90B with regard to the use of concealed ceiling spaces as return air plenums.
9. Normal painting practice dictates that the surface should be free of oil, grease and dirt and should be scuff sanded prior to painting.

   If latex paints are to be used, an intermediate alkyd primer coat must be used for best adhesion after proper preparation of the surface. In lieu of the intermediate alkyd primer coat, other surface preparation methods for latex paint such as liquid sandpaper or hand sanding results in good adhesion in some cases. This is true only when a high grade latex paint is used.

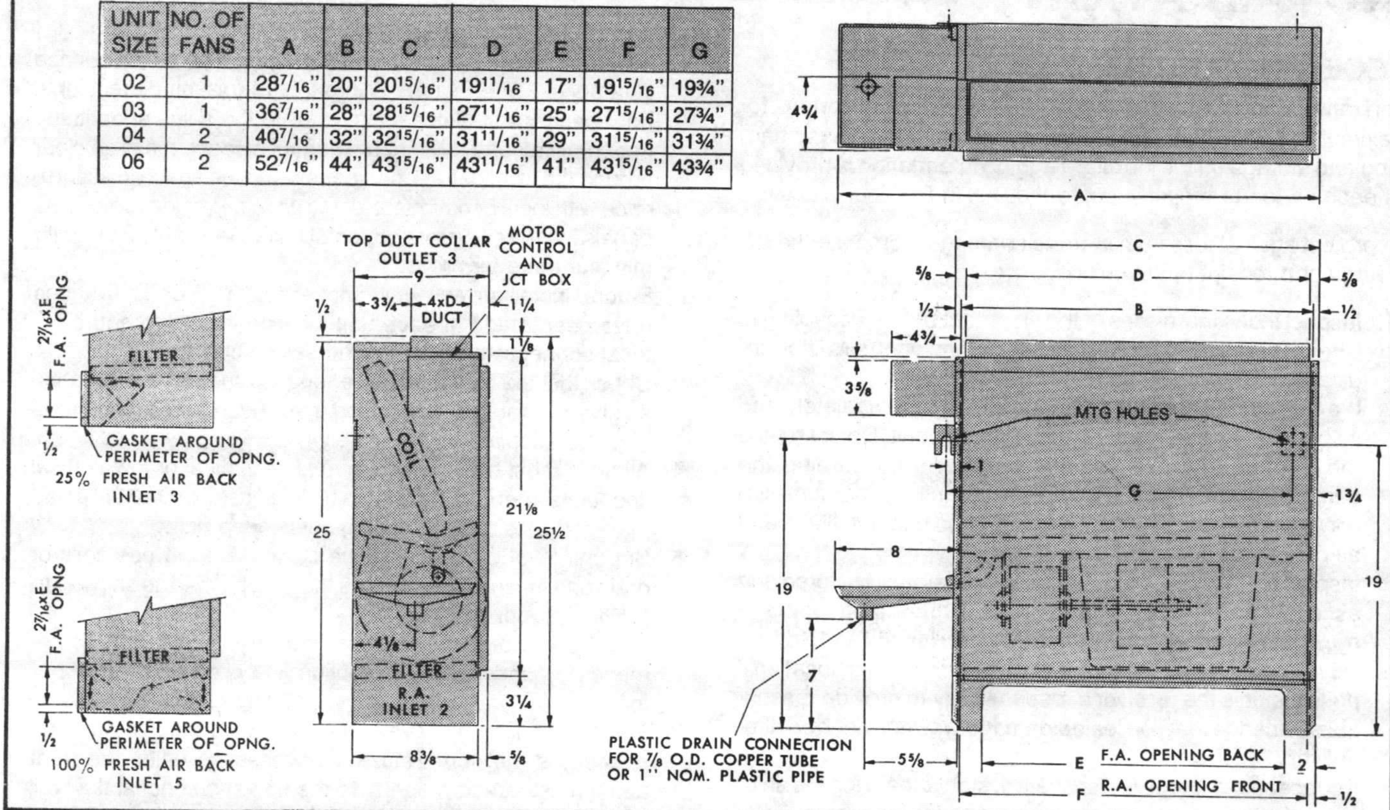
TABLE 1 - Approximate Shipping Weights (Pounds)

UNIT SIZE	CABINET MODELS	CONCEALED MODELS
02	65	55
03	80	65
04	95	80
06	115	100
08	185	125
10	215	150
12	235	170

TABLE 2 - Grille Free Air Area Minimums (Square Inches)

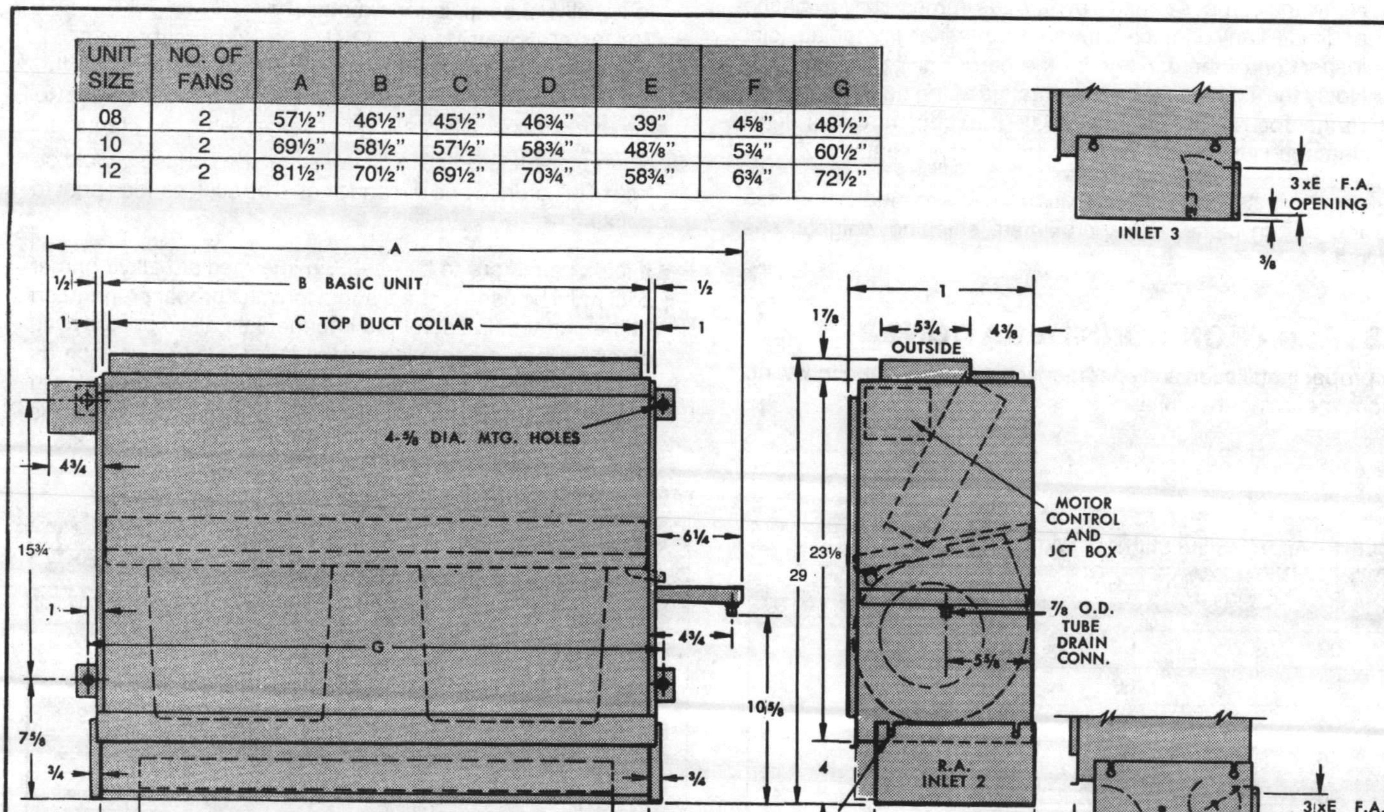
UNIT SIZE	MODELS					
	VERTICAL		HORIZONTAL		LOW VERTICAL	
	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET
02	65	62	102	82	56	50
03	82	87	144	115	78	73
04	94	99	164	132	100	95
06	129	138	226	182	133	129
08	187	226	306	285	—	—
10	235	283	396	356	—	—
12	283	339	488	428	—	—

NOTE: ARI capacities are obtained with grille free areas in this table.



UNIT SIZE	NO. OF FANS	A	B	C	D	E	F	G
02	1	28 7/16"	20"	20 15/16"	19 11/16"	17"	19 15/16"	19 3/4"
03	1	36 7/16"	28"	28 15/16"	27 11/16"	25"	27 15/16"	27 3/4"
04	2	40 7/16"	32"	32 15/16"	31 11/16"	29"	31 15/16"	31 3/4"
06	2	52 7/16"	44"	43 15/16"	43 11/16"	41"	43 15/16"	43 3/4"

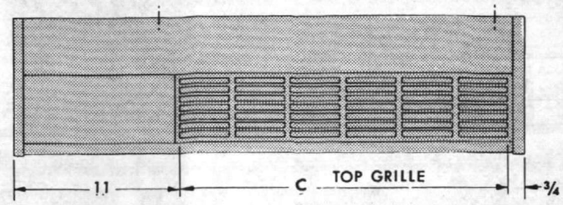
FIGURE 2 - Unit Dimensions for Model A (Vertical Concealed) Units, 02 to 06 Sizes



UNIT SIZE	NO. OF FANS	A	B	C	D	E	F	G
08	2	57½"	46½"	45½"	46¾"	39"	4⅝"	48½"
10	2	69½"	58½"	57½"	58¾"	48⅞"	5¾"	60½"
12	2	81½"	70½"	69½"	70¾"	58¾"	6¾"	72½"

FIGURE 3 - Unit Dimensions for Model A (Vertical Concealed) Units, 08 to 12 Sizes

UNIT SIZE	NO. OF FANS	A	B	C	D	E	F
02	1	31½"	20"	19¾"	17"	19$^{15}/_{16}$"	19¾"
03	1	39½"	28"	25¾"	25"	27$^{15}/_{16}$"	27¾"
04	2	43½"	32"	31¾"	29"	31$^{15}/_{16}$"	31¾"
06	2	55½"	44"	43¾"	41"	43$^{15}/_{16}$"	43¾"



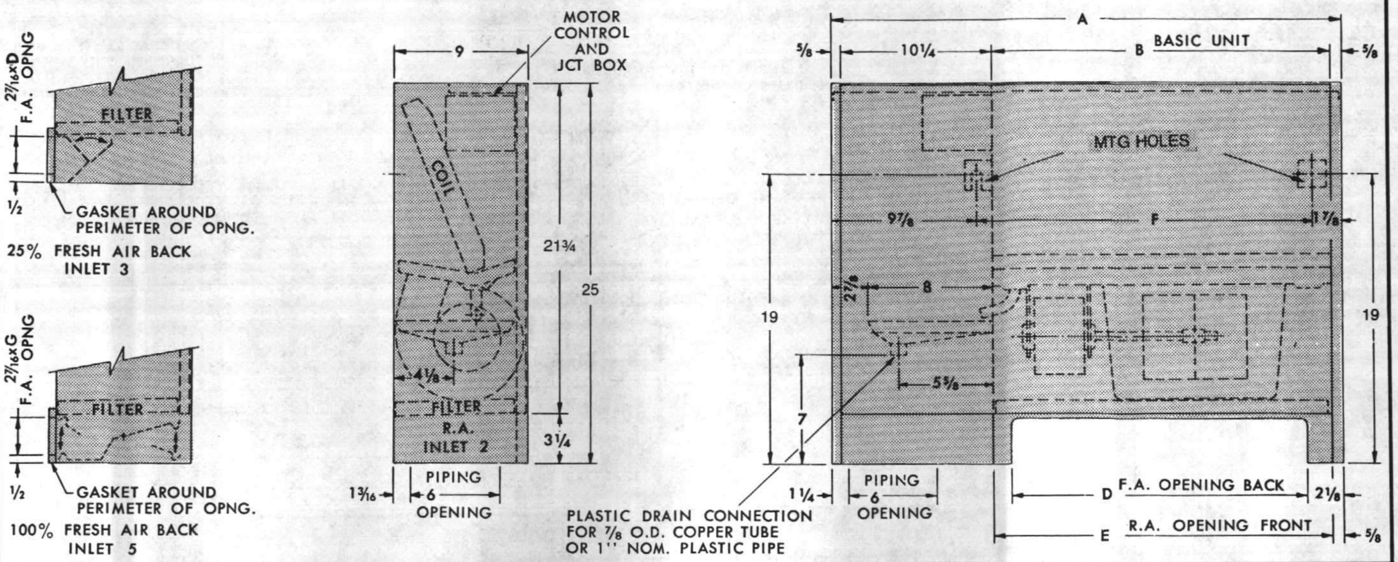


FIGURE 4 - Unit Dimensions for Model B (Vertical Cabinet) Units, 02 to 06 Sizes

UNIT SIZE	NO. OF FANS	A	B	C	D	E	F	G	H
08	2	60"	46½"	47¾"	48½"	46¾"	39"	8⅞"	12⅛"
10	2	72"	58½"	59¾"	60½"	58¾"	48⅞"	10"	13⅛"
12	2	84"	70½"	70¾"	72½"	70¾"	58¾"	11"	14¼"

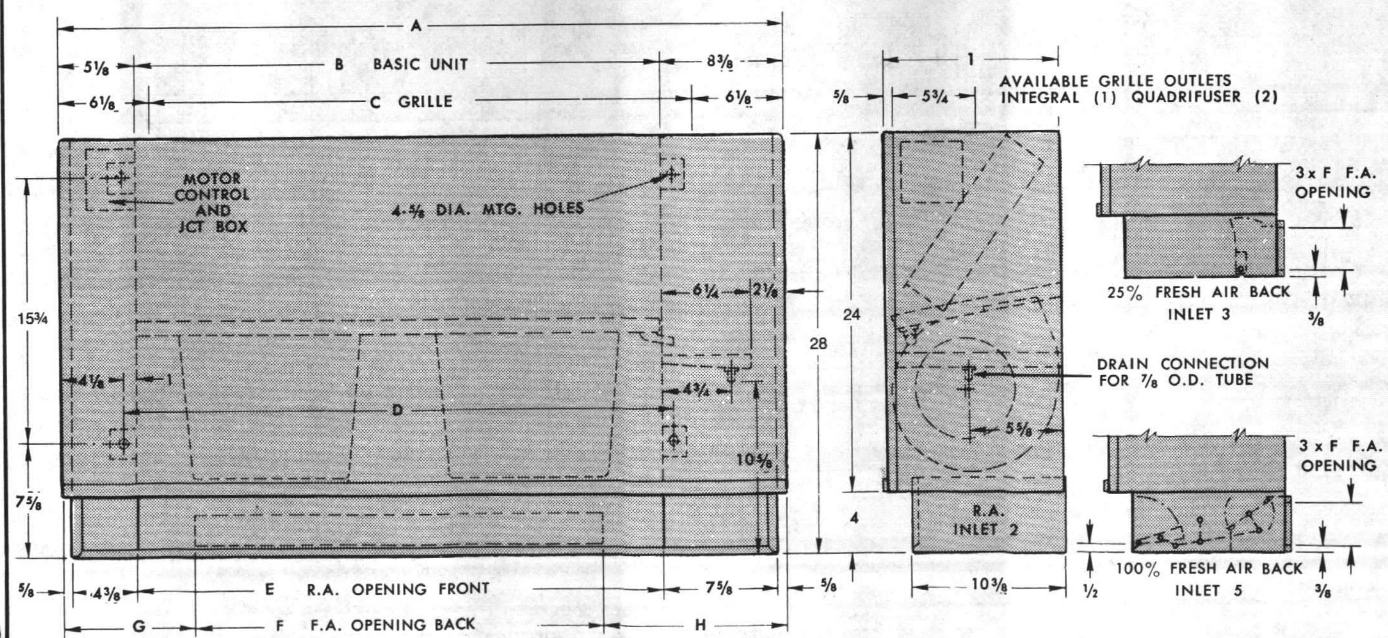


FIGURE 5 - Unit Dimensions for Model B (Vertical Cabinet) Units, 08 to 12 Sizes

UNIT SIZE	NO. OF FANS	A	B	C	D	E
02	1	25⅛"	23"	18⅜"	20¾"	20"
03	1	33⅛"	31"	26⅜"	28¾"	28"
04	2	37⅛"	35"	30⅜"	32¾"	32"
06	2	49⅛"	47"	42⅜"	44¾"	44"

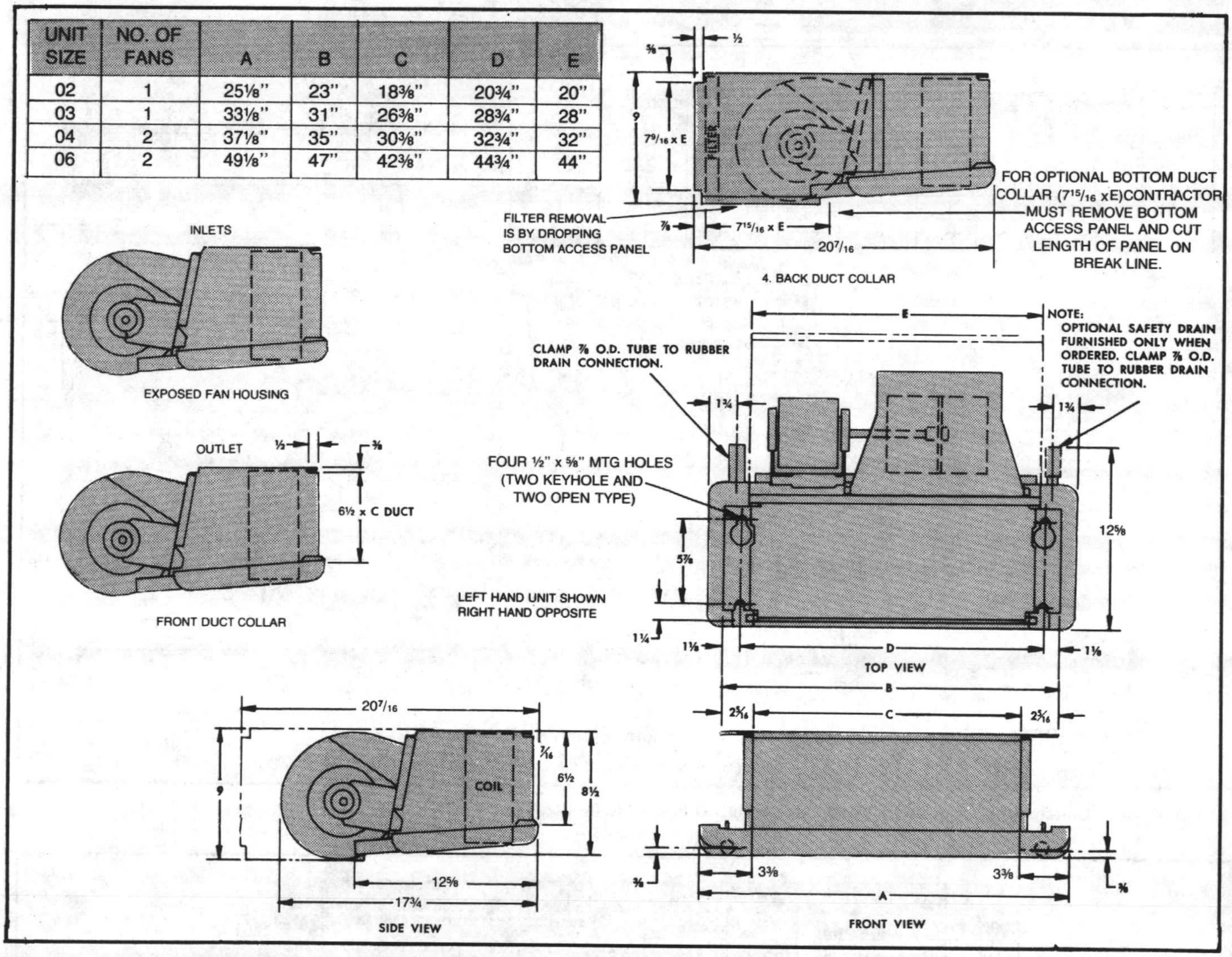


FIGURE 6 - Unit Dimensions for Model C (Horizontal Concealed) Units, 02 to 06 Sizes

UNIT SIZE	NO. OF FANS	A	B
08	2	46½"	45½"
10	2	58½"	57½"
12	2	70½"	69½"

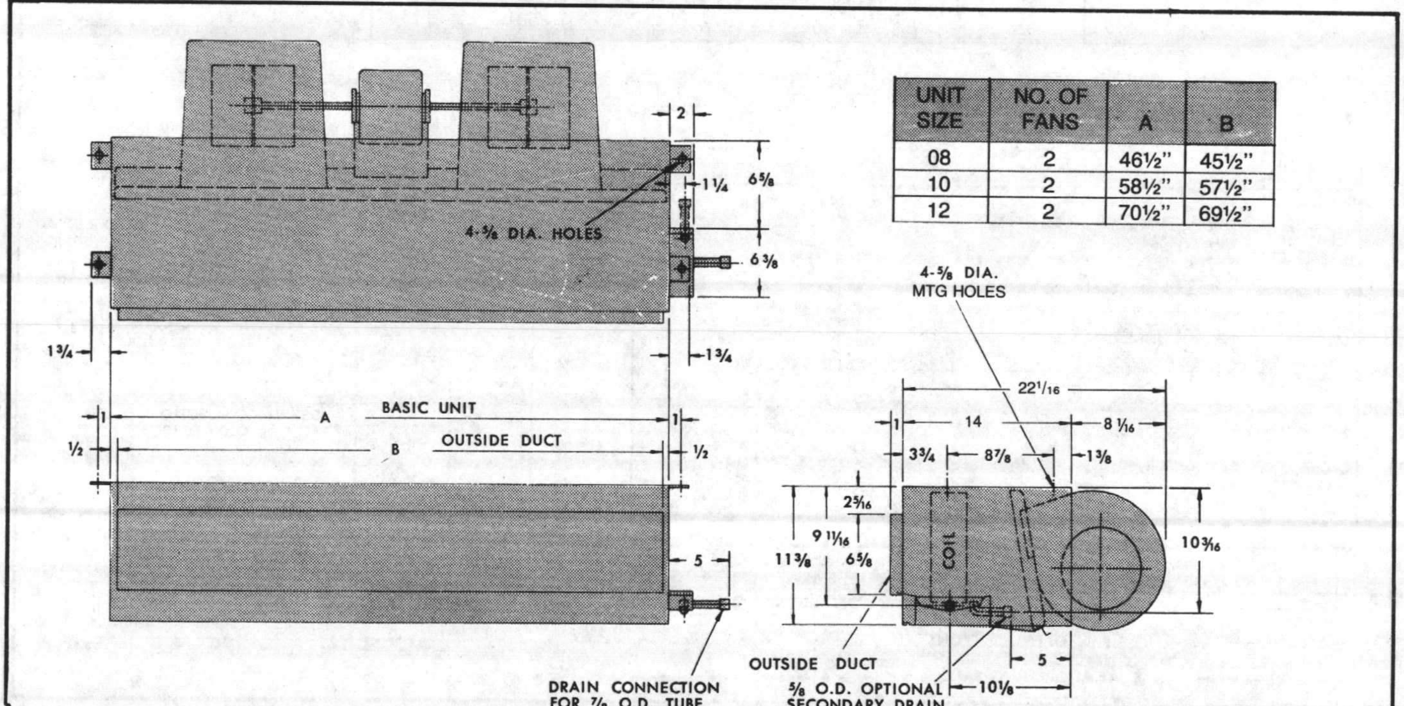
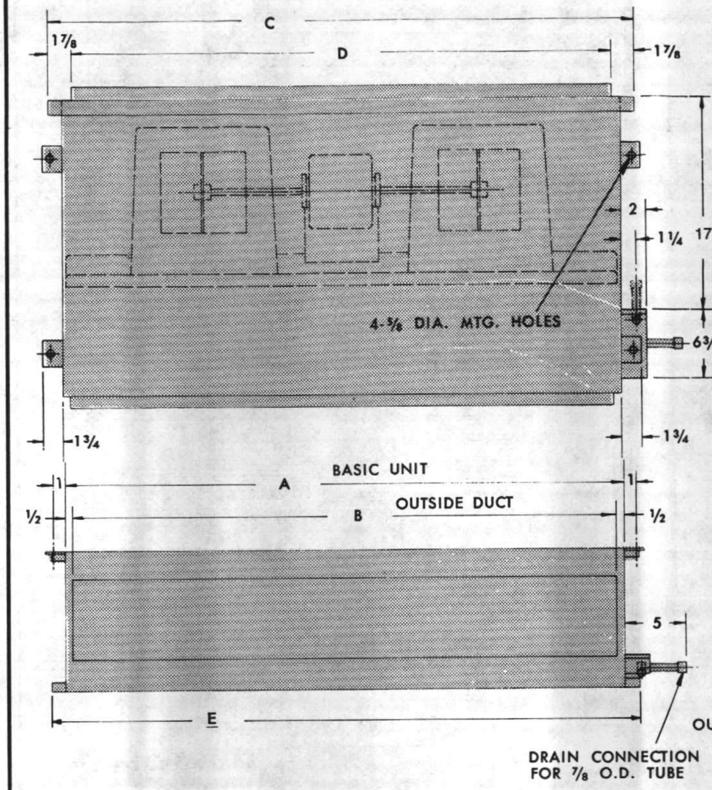


FIGURE 7 - Unit Dimensions for Model C32 (Horizontal Concealed) Units, 08 to 12 Sizes



UNIT SIZE	NO. OF FANS	A	B	C	D	E
08	2	46½"	45½"	48¾"	45"	47⅜"
10	2	58½"	57½"	60¾"	57"	59⅜"
12	2	70½"	69½"	72¾"	69"	71⅜"

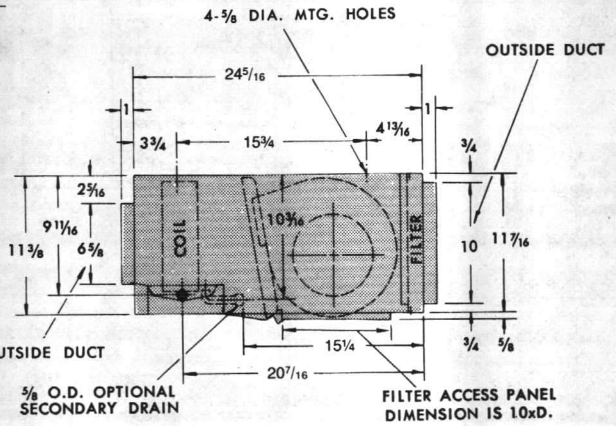
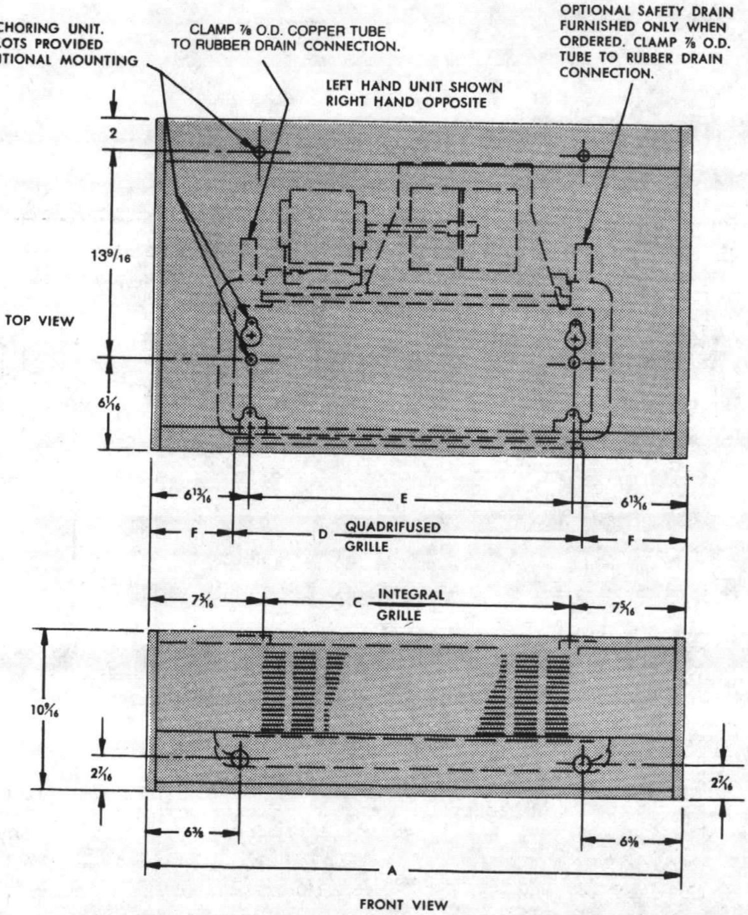
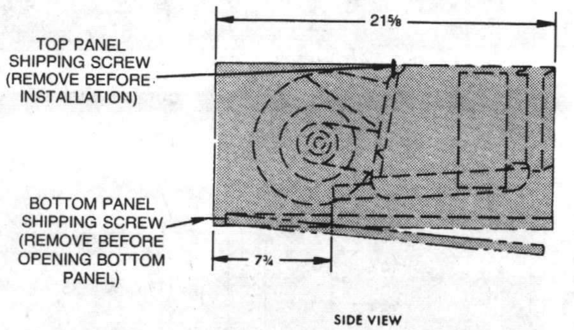


FIGURE 8 - Unit Dimensions for Model C34 (Horizontal Concealed with Inlet Plenum) 08 to 12 Sizes

UNIT SIZE	NO. OF FANS	A	C	D	E	F
02	1	34⅜"	19¾"	21"	20¾"	6 11/16"
03	1	42⅜"	27¾"	26½"	28¾"	7 15/16"
04	2	46⅜"	31¾"	32"	32¾"	7 3/16"
06	2	58⅜"	43¾"	43"	44¾"	7 11/16"





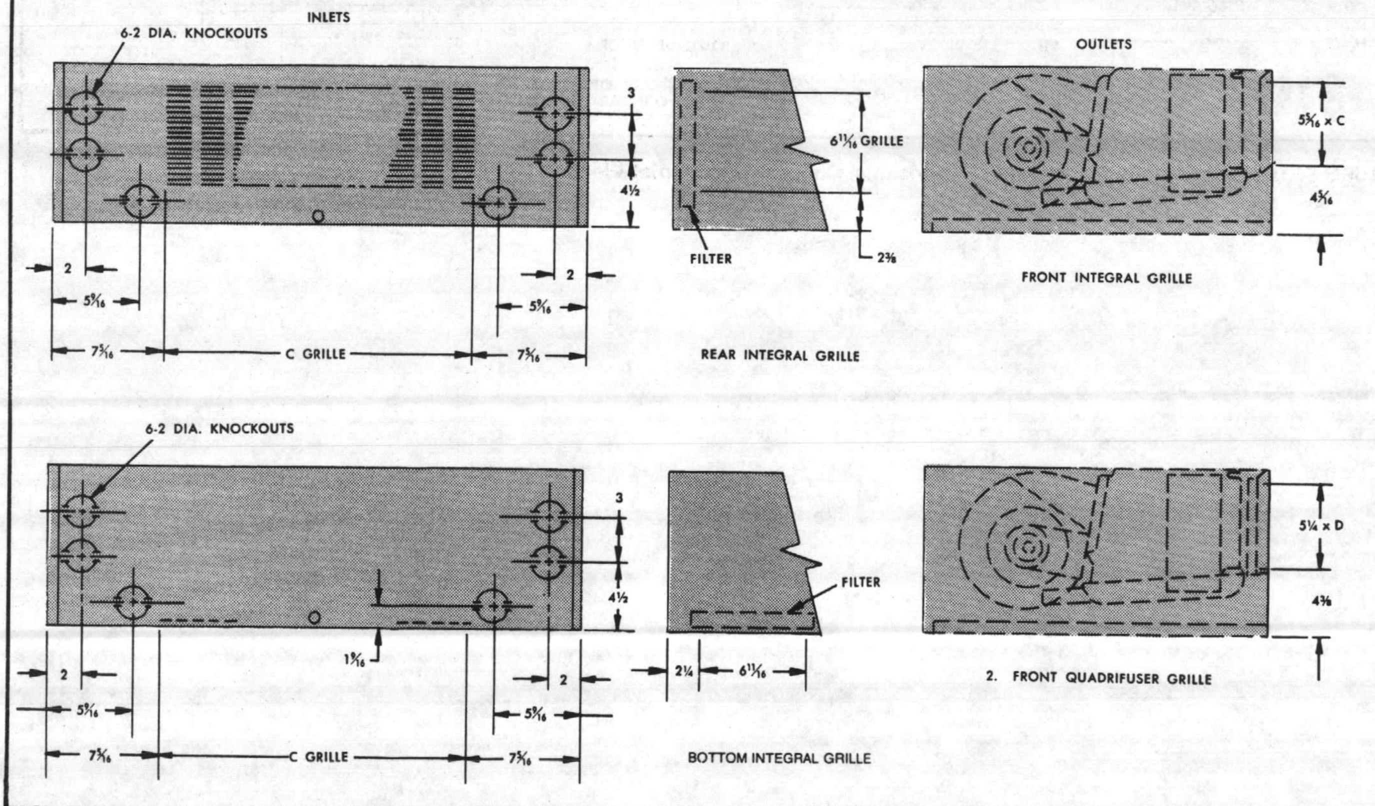


FIGURE 9 - Unit Dimensions for Model D (Horizontal Cabinet) Size 02 to 06

UNIT SIZE	NO. OF FANS	A	B	C	D	G
08	2	60"	46½"	38¾"	45¾"	10⅝"
10	2	72"	58½"	55¼"	57¾"	8⅜"
12	2	84"	70½"	66¼"	69¾"	8⅞"

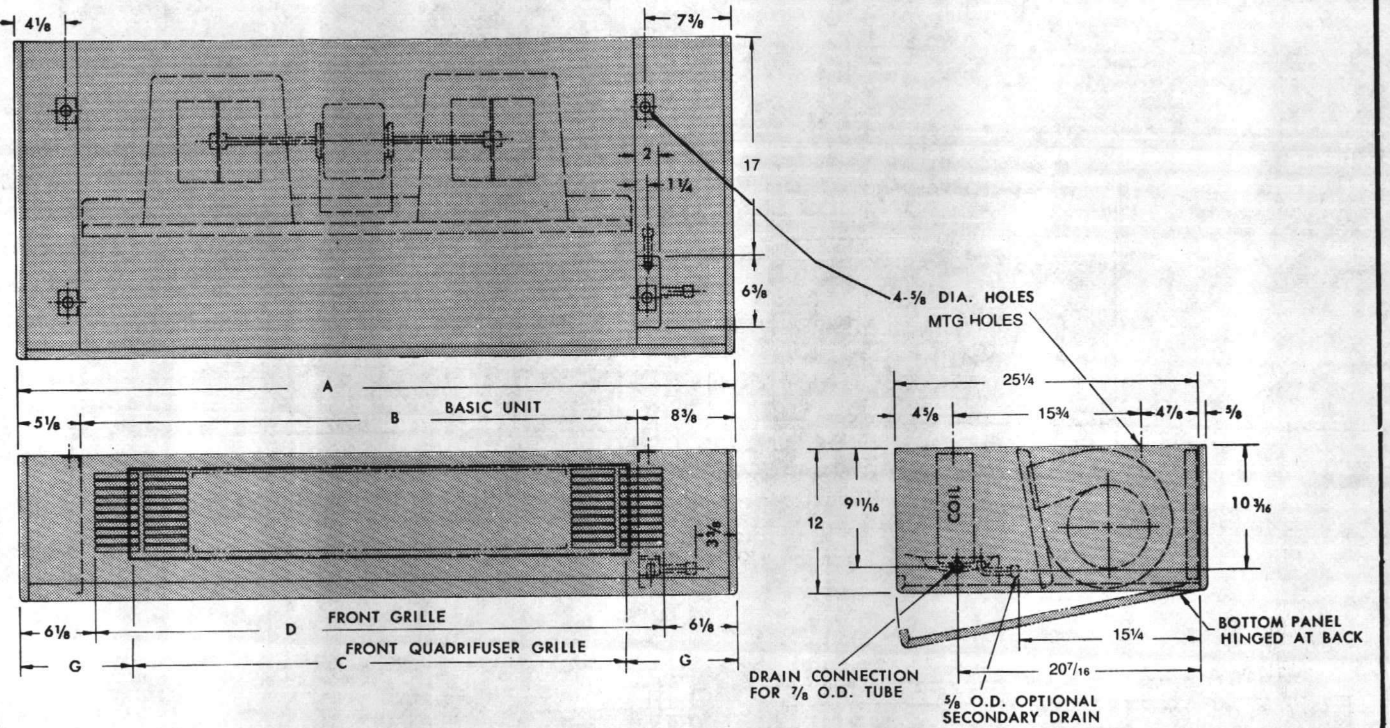


FIGURE 10 - Unit Dimensions for Model D (Horizontal Cabinet) Units, 08 to 12 Sizes

UNIT SIZE	NO. OF FANS	A	B	C	D	E	F	G
02	1	36 3/16"	34 9/16"	18½"	19¾"	32¼"	33 1/16"	35 1/16"
03	1	44 3/16"	42 9/16"	26½"	27¾"	40¼"	41 1/16"	43 1/16"
04	2	48 3/16"	46 9/16"	30½"	31¾"	44¼"	45 1/16"	47 1/16"
06	2	60 3/16"	58 9/16"	42½"	43¾"	56¼"	57 1/16"	59 1/16"

LEFT HAND UNIT SHOWN
RIGHT HAND OPPOSITE

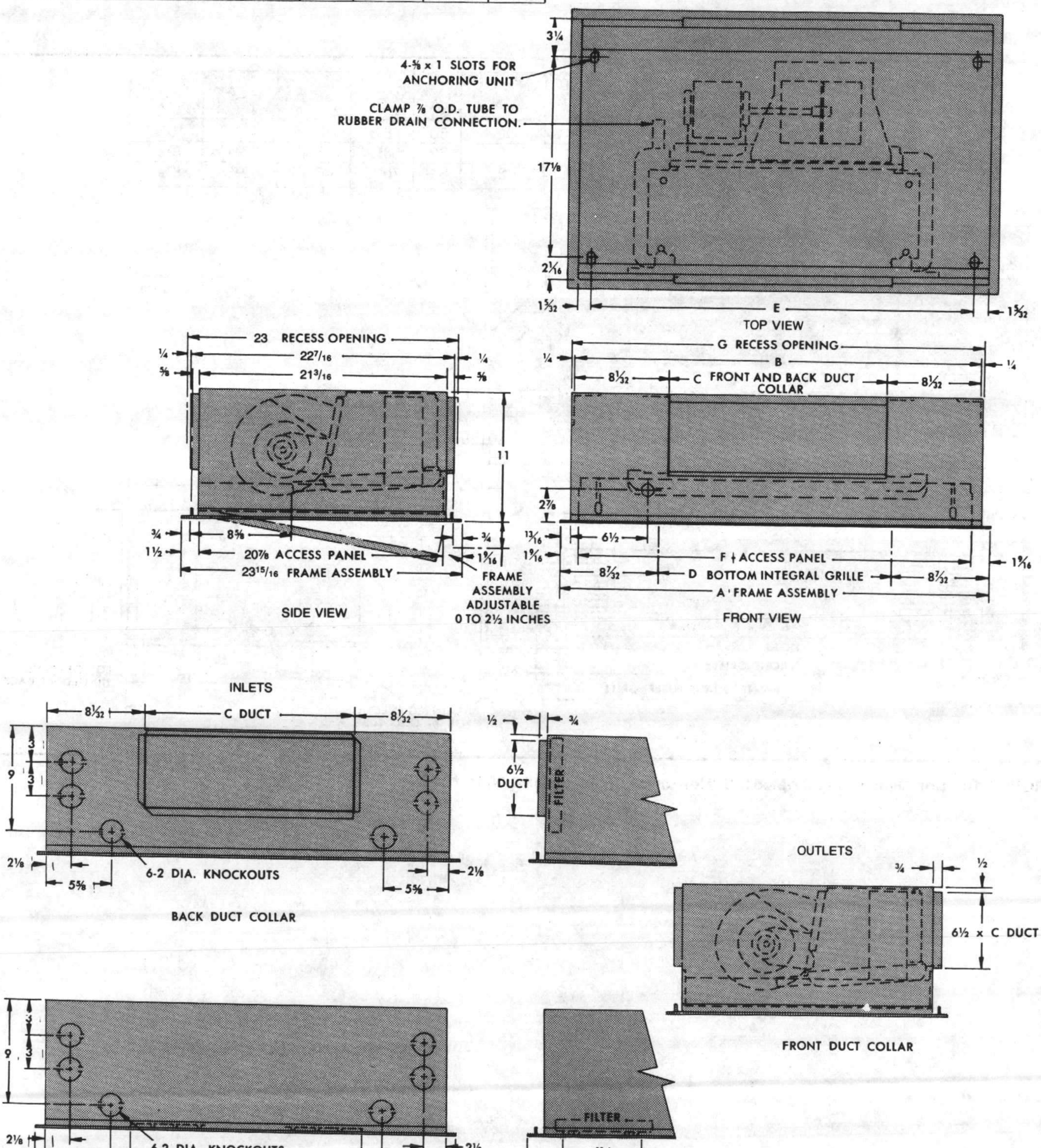
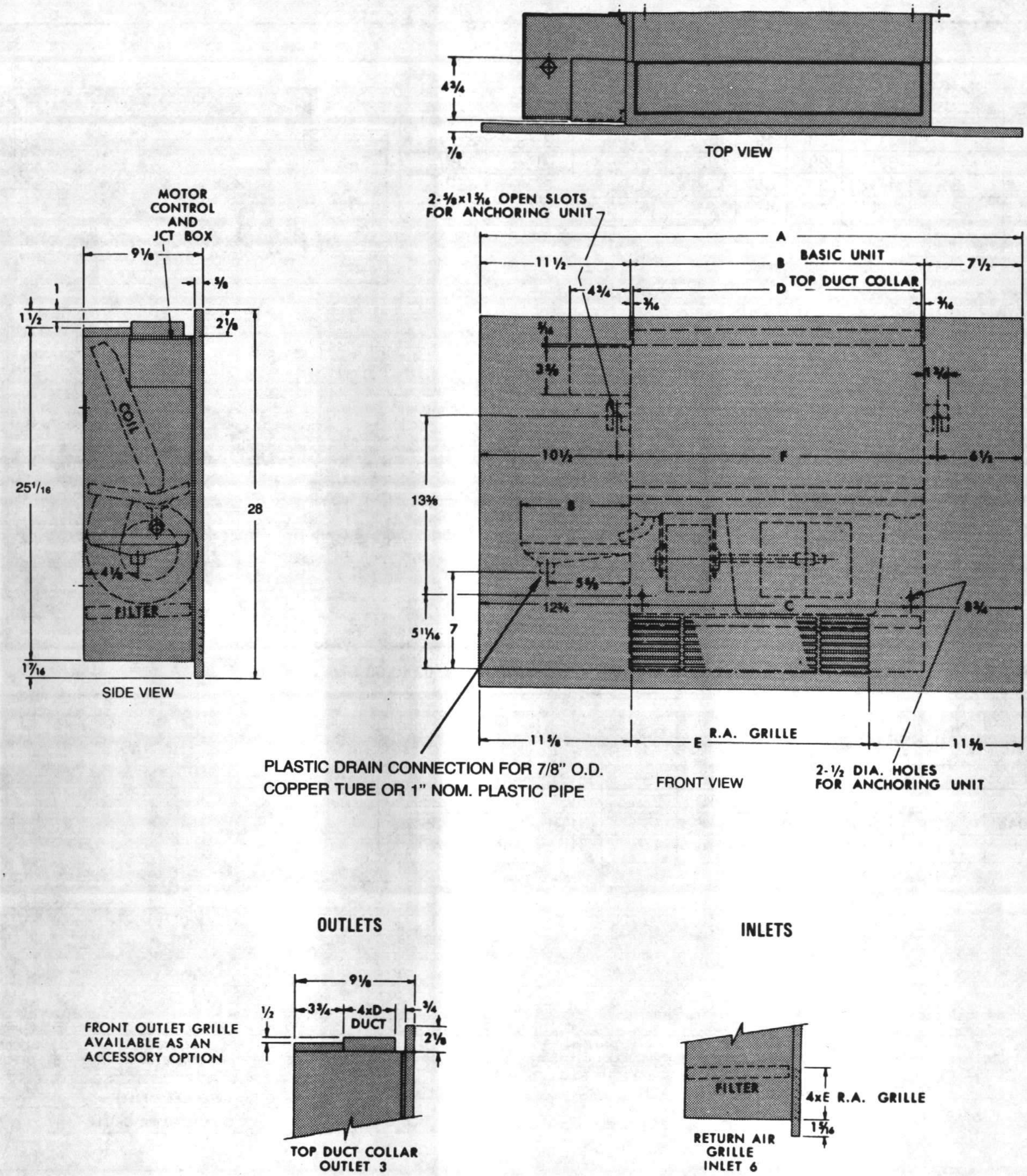


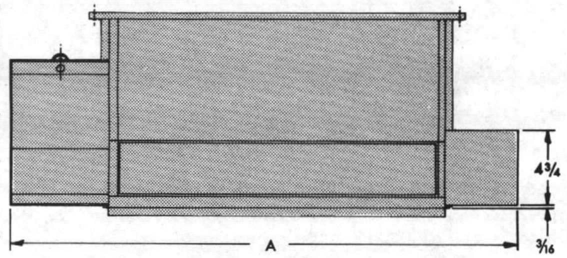
FIGURE 11 - Unit Dimensions for Model E (Horizontal Recessed) Sizes 02-06



UNIT SIZE	NO. OF FANS	A	B	C	D	E	F
02	1	39"	20"	17½"	19¹¹/₁₆"	15¾"	22"
03	1	47"	28"	25½"	27¹¹/₁₆"	23¾"	30"
04	2	51"	32"	29½"	31¹¹/₁₆"	27¾"	34"
06	2	63"	44"	41½"	43¹¹/₁₆"	39¾"	46"

FIGURE 12 - Unit Dimensions for Model H (Vertical Recessed) Sizes 02-06

UNIT SIZE	NO. OF FANS	A	B	C	D	E	F	G
02	1	31½"	20"	19"	15½"	19 15/16"	3 19/32"	22 11/16"
03	1	39½"	28"	27"	15½"	27 15/16"	7 19/32"	30 11/16"
04	2	47½"	36"	35"	31"	35 15/16"	3 27/32"	38 11/16"
06	2	59½"	48"	47"	31"	47 15/16"	9 27/32"	50 11/16"



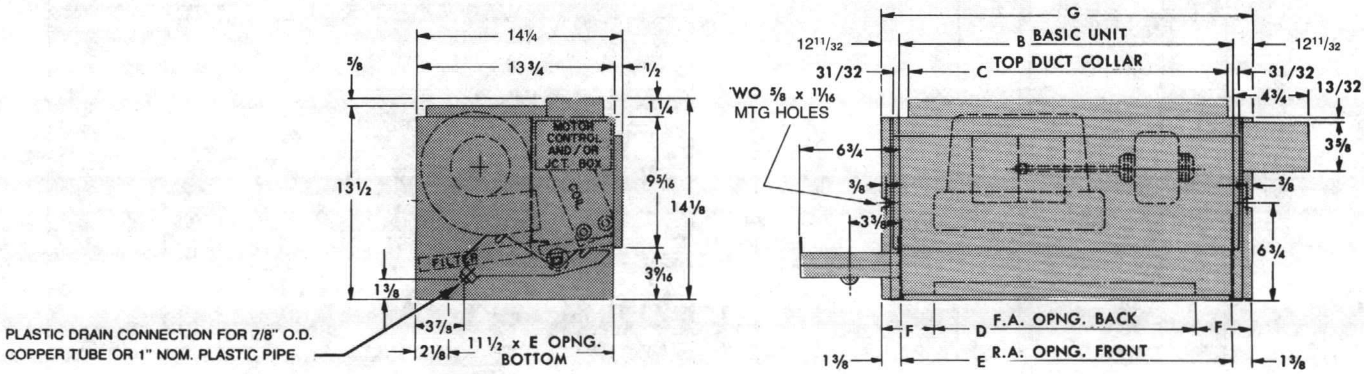


FIGURE 13 - Unit Dimensions for Model K (Low Vertical Concealed) Units, 02 to 06 Sizes

UNIT SIZE	NO. OF FANS	A	B	C	D	E	F	G
02	1	33¾"	20"	19¾"	19½"	15½"	9⅛"	19¾"
03	1	41¾"	28"	27¾"	27½"	15½"	13⅛"	25¾"
04	2	49¾"	36"	35¾"	35½"	31"	9⅜"	35¾"
06	2	61¾"	48"	47¾"	47½"	31"	15⅜"	47¾"

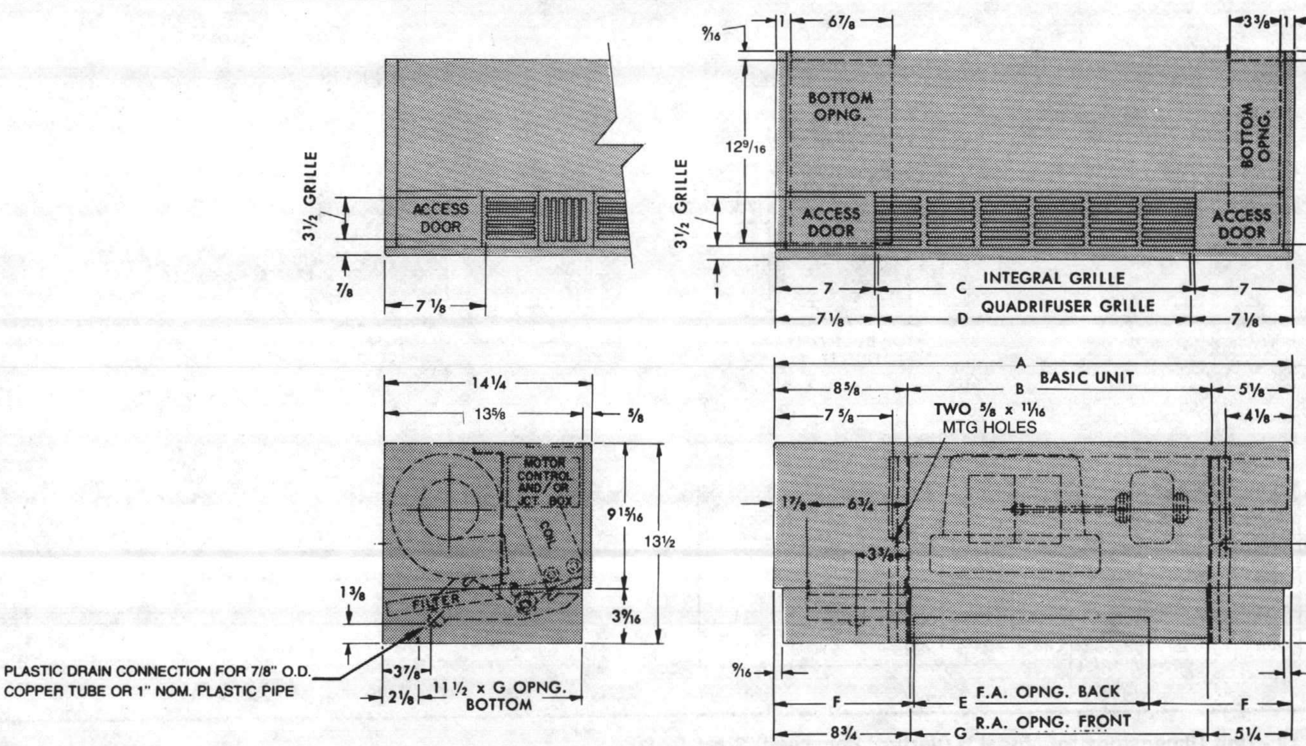


FIGURE 14 - Unit Dimensions for Model L (Low Vertical Cabinet) Units, 02 to 06 Sizes

MOUNTING

VERTICAL AND LOW VERTICAL UNITS

All floor models are attached to the wall with the brackets provided, through the mounting holes in the rear of the unit. Mounting fasteners are to be supplied by the installer.

NOTE: *Before installing the vertical recessed unit (Model H), check the recess opening to be sure that the front panel will attach properly to the unit and will conceal the wall opening. The recess opening should be two inches less than the overall width and height of the front panel.*

To install vertical and low vertical models, complete the following:

1. For unit sizes 08 to 12, mark and prepare the mounting holes in the wall. For unit sizes 02 to 06, install the mounting bracket that is supplied with the unit, as shown in Figure 15. ***NOTE:*** *The mounting bracket is found attached to the inside end panel either above or below the auxiliary drain pan.* The bracket anchoring bolts should be selected according to wall construction and supplied by the installer.
2. Set the unit in place on the mounting bracket.
3. Remove the unit front panel. For cabinet models, the front panel will drop forward after it has been pulled upward approximately 1/2-inch. For the recessed unit, loosen two Allenhead screws before lifting the panel up. On concealed units, the panel is removed by loosening the sheet metal screws.
4. Remove the unit end panel. For cabinet unit sizes 02 to 06, release the two screws on the front edge of the panel and slide it forward. For cabinet unit sizes 08 to 12, remove the four screws and lift off panel. All other vertical units have open end pockets.
5. Level the unit casing and attach the unit to the wall (08 to 12 unit sizes).
6. Remove the shipping brace from under the fan board and place the filter, if ordered, in the filter channel.
7. Complete piping and wiring to the unit, as instructed in the next sections of this manual. Always replace the unit front and end panels before starting the unit.

CAUTION: Failure to replace the end panels and filters before starting the unit may result in equipment damage due to motor overload and dirty coils.

HORIZONTAL UNITS

Horizontal units are designed to be suspended from the ceiling on threaded rods or lag screws furnished by the installer. Holes are provided at the top of the unit. The ceiling opening must be large enough for the unit installation.

NOTE: *When installing Model C32-U units, the requirements of NFPA Standard 90A or 90B must be followed, regarding the use of concealed ceiling spaces as return air plenums.*

To install a horizontal model, complete the following:

1. On cabinet models 02-06, remove the shipping screw through the access hole and in the top panel, as shown in Figure 9. Lower the hinged bottom panel by turning the Allenhead locks at the front edge of the bottom panel.
2. Install the suspension rods or suspension device, as furnished by the installer.
3. Hoist the unit into position. See Table 1 for unit weights.
4. Level the unit on its casing and tighten the mounting bolts or lag screws.
5. If supplied, remove the shipping brace from under the fan board and install the air filter (optional).
6. Complete piping and wiring connections, as given in this manual. Replace all unit panels before starting the unit.

CAUTION: Failure to replace end panels and filters before starting the unit may result in equipment damage due to motor overload and dirty coils.

DUCT CONNECTIONS

The Trane Company recommends 24 gauge galvanized sheet metal duct to be supplied by the installer. Duct collars are provided at the unit air outlet of all concealed and recessed units, except for horizontal concealed sizes 02-06 as shown in Figure 6. A duct connection is provided for the 02-06 horizontal concealed units. See Figure 16 for horizontal unit duct dimensions and configuration. To attach, slip the duct into the unit and fasten the duct and unit flange together with screws.

To use the optional bottom duct connection on horizontal units, remove the bottom access panel and cut it along the break as shown in Figure 17. Re-install the panel piece A on the bottom of the unit. Remove the filter and attach ductwork at the new duct location. Install the access panel piece B on the back duct collar and attach securely. Use holes provided.

NOTE: *The original filter cannot be used when the bottom duct connection is used on horizontal units. A special filter arrangement must be provided by the installer.*

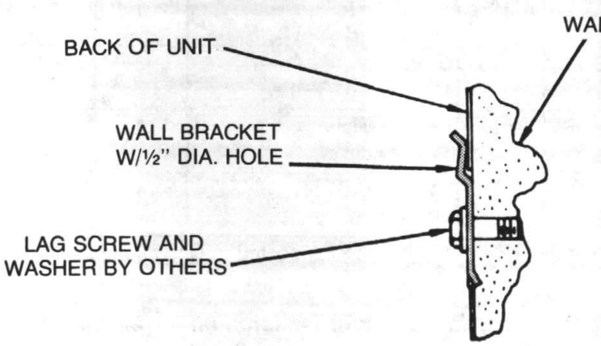
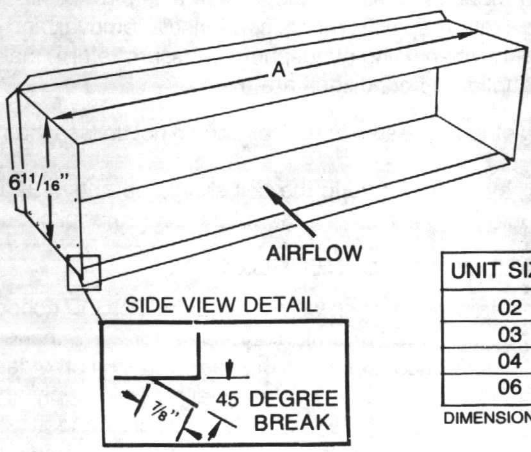


FIGURE 15 - Mounting Bracket Installation



UNIT SIZE	A
02	18½
03	26½
04	30½
06	42½

DIMENSIONS - IN.

FIGURE 16 - Duct Dimensions and Configuration

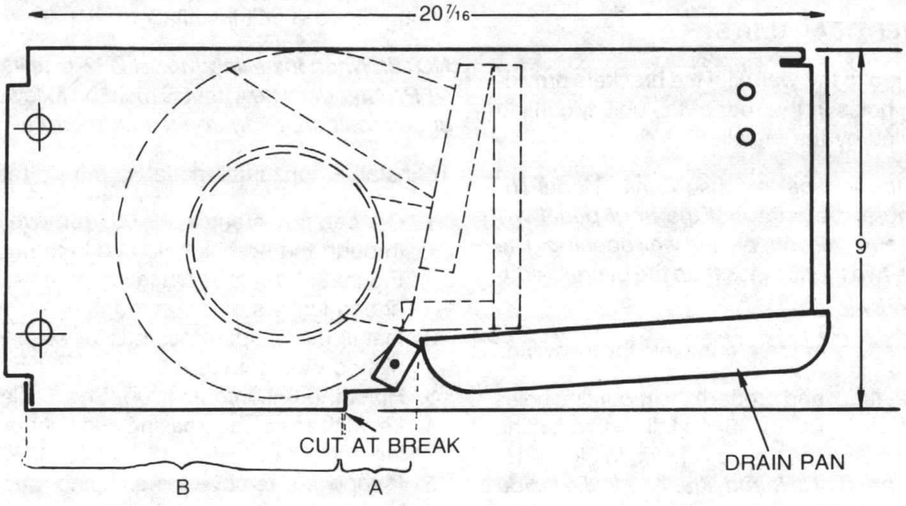


FIGURE 17 - Filter Access Panel Removal

PIPING

COIL CONNECTIONS

Before connecting pipes to the piping package, remove the valve support shipping brackets in the end pocket. To complete piping connections, open the stop valves and attach the piping package to the coil, with any necessary accessories. Coil connection sizes are given in Tables 3 and 4. See Figures 18, 19 and 20 for coil connection locations. Refer to sales submittals for specific connection locations.

NOTE: *When special piping packages are furnished on Horizontal Cabinet Models D and E, knockouts may not match up with the piping connections.*

CAUTION: Failure to open the stop valves before brazing or soldering to the coil may result in damage to the valve seats.

NOTE: *The valve stem packing may require tightening.*

CAUTION: Remove the auxiliary drain pan from both horizontal and vertical 02 to 06 units before soldering. Failure to do so may result in damage to the plastic pan from dripping solder or from excessive temperature.

If desired, steam may be used in auxiliary water coils in horizontal and low vertical units of 02 to 06 size. To prevent water hammer, do not use a modulating steam supply with single-row coils. In order to obtain rated capacity, proper condensate removal, and to avoid freeze-up when using atmospheric pressure return, make sure that the following conditions are met:

1. Entering steam pressure to the coil should not be less than 2 psig.
2. Entering air temperature to the coil should be above 32 F.
3. Coil should be installed with the tubes level - not pitched.

CONDENSATE DRAIN CONNECTIONS

The neoprene drain connection will accept a 7/8-inch OD copper tube. Insert the tube into the drain connection for 2-7/8 inches. Attach a 5/8-inch OD copper tube to the safety drain, if provided. Hose clamps must be provided by the installer. The supply and return piping should not interfere with the auxiliary condensate drain pan. Auxiliary drain pan should be installed as shown in Figure 22.

TABLE 3 - Coil Connection Sizes for Vertical and Low Vertical Models (Inches)

UNIT SIZE	COIL TYPE	COIL DESCRIPTION	NO. ROWS	COIL* CONN.
		VERTICAL MODELS		
02-06	AO	12" Water	1	5/8 O.D.
08-12	AO	10½" Water	2	7/8 O.D.
02-06	DO	12" Water High Temp. Rise	2	5/8 O.D.
08-12	DO	12" Water High Temp. Rise	2	7/8 O.D.
02-06	L	9" Auxiliary Hot Water	1	½ O.D.
08-12	L	10" Auxiliary Hot Water	1	½ O.D.
		LOW VERTICAL MODELS		
02-06	AO	7½" Water	2	5/8 O.D.
02-06	L	3⅓" Auxiliary Hot Water	1	½ O.D.

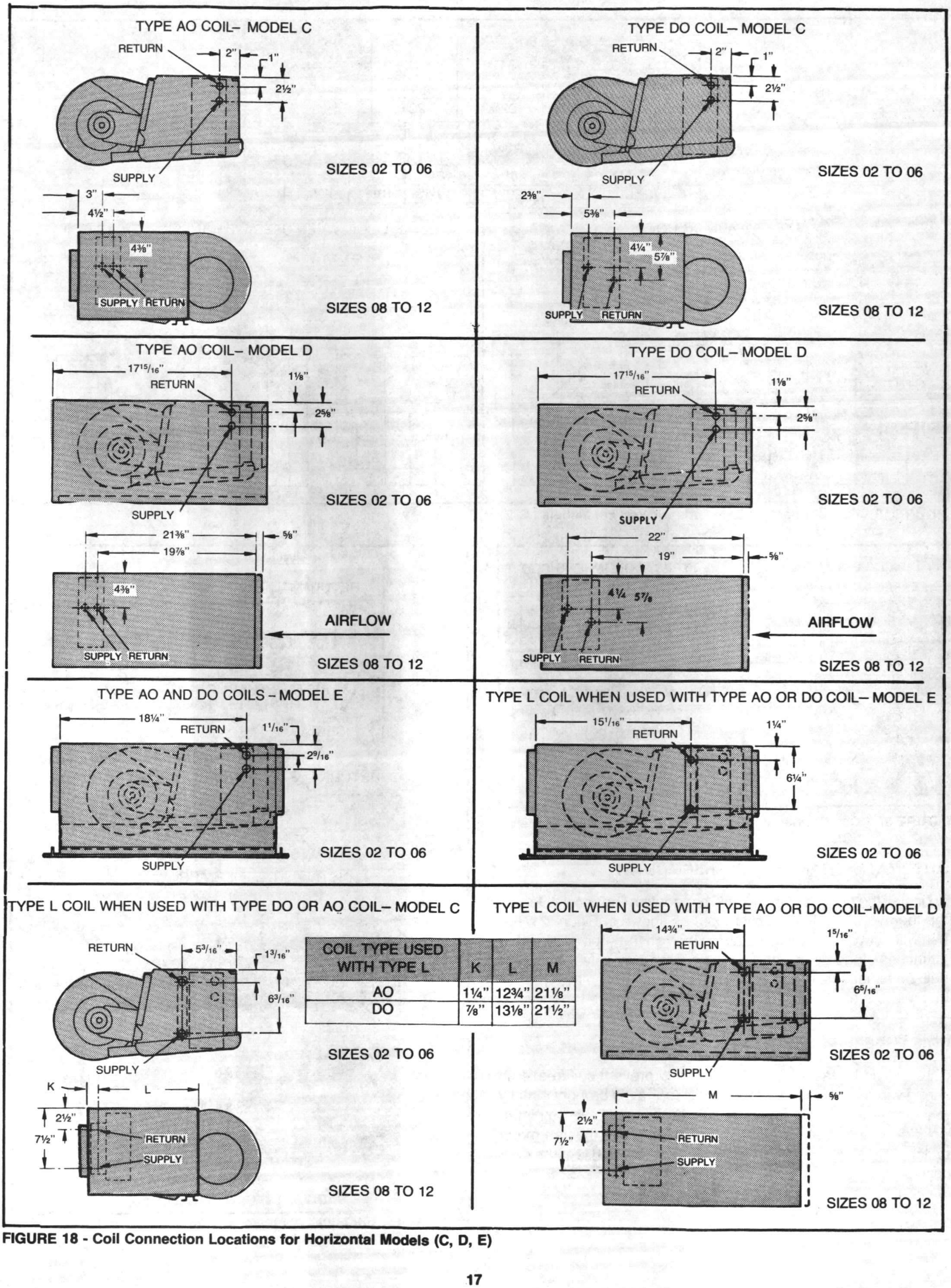
* O.D. dimension of tubes to be connected to UniTrane coil.

TABLE 4 - Coil Connection Sizes for Horizontal Models (Inches)

UNIT SIZE	COIL TYPE	COIL DESCRIPTION	NO. ROWS	COIL* CONN.
02-06	AO	7½" Water	2	5/8 O.D.
08-12	AO	9" Water	2	7/8 O.D.
02-06	DO	7½" Water High Temp. Rise	2	5/8 O.D.
08-12	DO	9" Water High Temp. Rise	3	7/8 O.D.
02-06	L	6⅔" Auxiliary Hot Water	1	½ O.D.
08-12	L	6⅔" Auxiliary Hot Water	1	½ O.D.

* O.D. dimension of tubes to be connected to UniTrane coil.

CAUTION: Insertion of a condensate line larger than specified above may result in damage to the drain connector. Insertion of a condensate line smaller than specified may result in leakage.



COIL TYPE USED WITH TYPE L	K	L	M
AO	1¼"	12¾"	21⅛"
DO	⅞"	13⅛"	21½"

FIGURE 18 - Coil Connection Locations for Horizontal Models (C, D, E)

COIL TYPE	B	C	D	E
AO	5¾"	23½"	22¾"	4⅜"
DO	6⅛"	22⅞"	22"	4⅞"

COIL TYPE USED WITH TYPE L	F	G	H	J
AO	20 1/16"	18¾"	10"	9¼"
DO	20½"	19¼"	10½"	9 13/16"

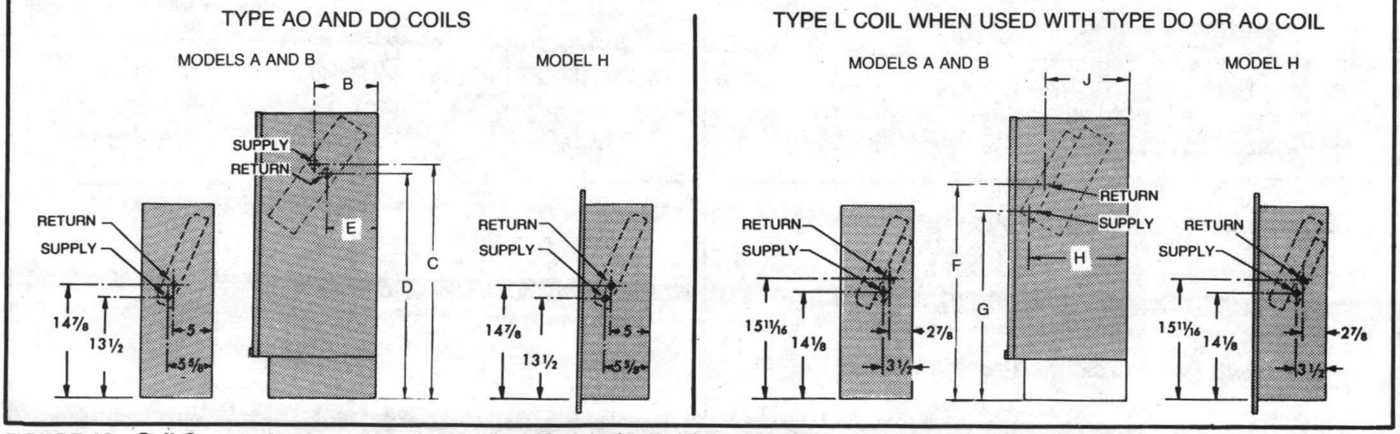


FIGURE 19 - Coil Connection Locations for Vertical Models (A, B, H)

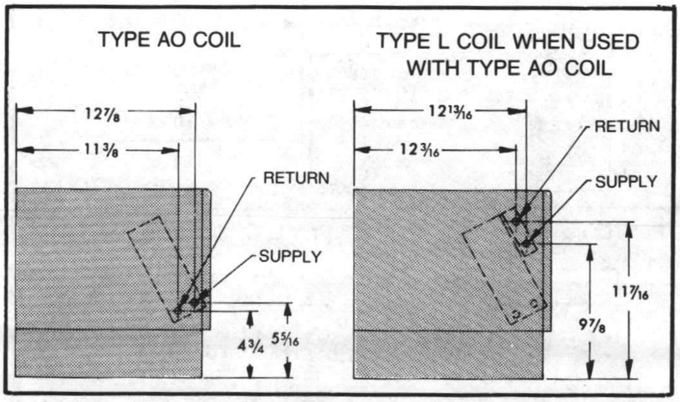


FIGURE 20 - Coil Connection Locations for Low Vertical Models (K,L)

AUTOMATIC CHANGEOVER THERMOSTAT

To install the optional Automatic Changeover Thermostat, locate the thermostat on the supply runout as shown in Figure 21. For use with a two-way valve, install the bulb on the supply line within 12 inches of the riser. For use with a three-way valve, install the bulb on either side of the supply line stop valve. The two types of bulbs and their installations are shown in Figure 21.

COIL FREEZE PROTECTION

Care should be taken with all systems to prevent coil freeze-up during winter operation when cold outdoor air is brought directly to the fan-coil unit. This can usually be accomplished by interlocking an automatic outdoor air damper with the fan-motor switch. The air damper must close when the switch is in the OFF position. Entering air temperature should be above 32 F.

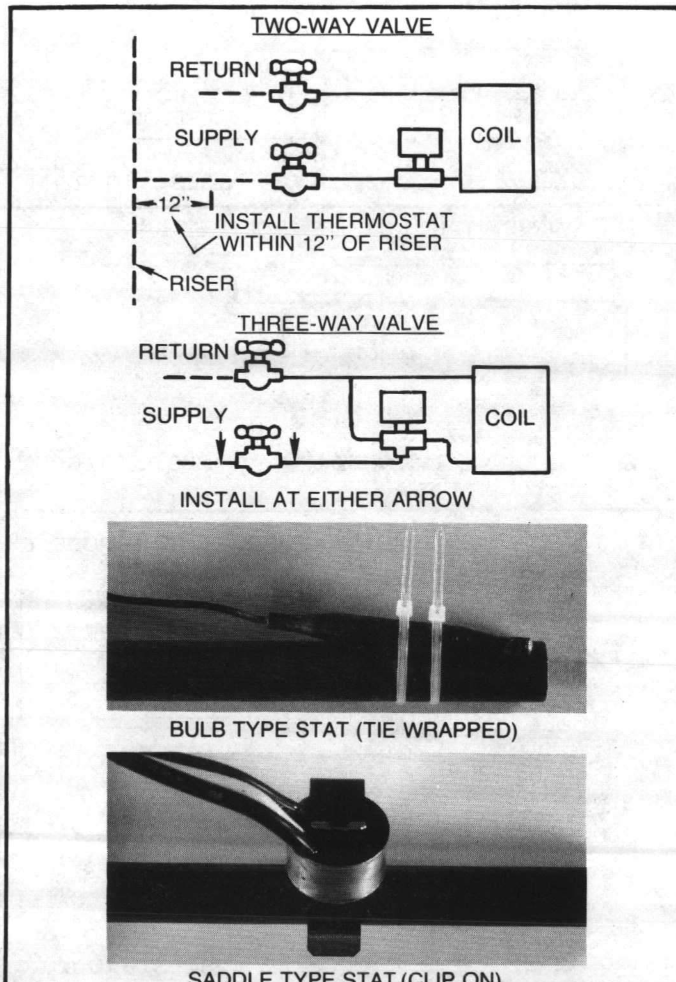


FIGURE 21 - Automatic Changeover Thermostat Installation

WIRING

WARNING: DISCONNECT ELECTRICAL POWER SOURCE AND SECURE IN THAT POSITION BEFORE SERVICING THE UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK.

CAUTION: Use only copper conductors for wiring connections. Unit terminals are not designed to accept other types of wiring. Aluminum or other conductors may cause overheating and unit damage.

For wiring and installation, refer to the wiring diagrams supplied with the unit inside the control box cover for specific connections and connection requirements. Supply voltage connections are made at the junction box in the unit end pocket or in the combination motor control/junction box. (The bottom end pocket is open.) Wiring connections to a remote thermostat or fan motor switch must also be made at this box. All internal wiring is complete to this point. Refer to Table 5 for junction box location. See Table 6 for electric coil characteristics. Some electric coil units will require separate power leads for the coil and fan motor control circuits.

TABLE 5 - Junction Box Location for Electric Connections

UNIT SIZE	MODELS	MAIN COIL SIDE	SIDE OPPOSITE MAIN COIL
02-06	Vertical	X	
02-06	Horizontal W/O Electric Heat		
	- 2-Pipe Electric Piping Package	X	
	- 4-Pipe Electric Piping Package	X	
	- Pneumatic Piping Package		X
	- Without Piping Package	X	
02-06	Horizontal W/Electric Heat		X
02-06	Low Vertical W/Auxiliary Coil	X	
02-06	Low Vertical W/O Auxiliary Coil		X
08-12	Vertical		X
08-12	Horizontal		X

NOTE:
Electric junction box is furnished by Trane unless otherwise specified.

TABLE 6 - Electric Coil Data

UNIT SIZE	NO. OF ELEMENTS: HIGH SPEED	NO. OF ELEMENTS: MEDIUM OR LOW SPEED	KW	MBH	HIGH SPEED OPERATION, AMPERES PER PHASE: ONE PHASE - TWO WIRE 120V	208V	240V	277V	THREE PHASE - THREE WIRE 208V	240V	480V
02	3	3	1.0	3.4	8.3	—	—	3.6	—	—	—
	6	3	2.5	8.6	—	12.0	10.4	9.0	7.0	6.0	3.0
03	3	3	1.5	5.1	12.5	—	—	5.4	—	—	—
	6	3	3.75	12.8	—	18.0	15.6	13.5	10.4	9.0	4.5
04	3	3	2.0	6.8	16.6	—	—	7.2	—	—	—
	6	3	5.0	17.1	—	24.0	20.8	18.0	13.9	12.0	6.0
06	3	3	2.4	8.2	20.0	—	—	—	—	—	—
	3	3	3.0	10.2	—	—	—	10.8	—	—	—
	6	3	7.5	25.6	—	36.0	31.2	27.0	20.8	18.0	9.0
08	3	3	4.0	13.7	—	—	16.7	14.4	11.1	9.7	4.8
10	3	3	5.0	17.1	—	—	20.8	18.1	13.9	12.0	6.0
12	3	3	6.0	20.4	—	—	—	21.7	16.7	—	7.2
	3	3	5.4	18.4	—	—	22.5	—	—	13.0	—

NOTE:
Electric Heating Coils are not available as standard with the following units:
- Low Vertical Units.
- 08 to 12 size Horizontal Cabinet units with quadrifuser grilles.
- 08 to 12 size units with type D coils.
- 02 to 06 size high KW units with type D coils.

INSTALLATION CHECKLIST

The following checklist is provided as an abbreviated guide to the detailed installation procedures given in this manual. This list should be used by the installing contractor to ensure that all necessary procedures have been completed. For more complete information, refer to the appropriate sections in this manual.

WARNING: DISCONNECT ELECTRICAL POWER AND ALLOW 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. Units are checked for shipping damage.
- ☐ 2. Unit location is prepared for weight, level, service access and cutouts.
- ☐ 3. Unit is mounted securely to the floor and wall or ceiling support rods.
- ☐ 4. Unit casing is level.
- ☐ 5. Drain line has a drain line pitch of 1" drop per foot.
- ☐ 6. Ductwork connections are complete.
- ☐ 7. Valve shipping brackets are removed.
- ☐ 8. Coil connections are complete.
- ☐ 9. Condensate drain pan connections are complete.
- ☐ 10. Automatic Changeover Thermostat is installed (optional).
- ☐ 11. Coil freeze protection is provided.
- ☐ 12. Electrical supply power is connected according to wiring diagrams provided on the unit.

CAUTION: Use of conductors other than copper may result in overheating and damage to the unit.

- ☐ 13. Start-Up preparation is complete and unit is in the proper operating mode.
- ☐ 14. Owner-operator is instructed on unit operation.

RETAIN THIS INSTALLATION/MAINTENANCE MANUAL WITH THE UNIT FOR FUTURE REFERENCE.

START-UP

PREPARATION

Before starting the unit, complete the following checks:

- ☐ 1. Make sure the valve support shipping brackets are removed.
- ☐ 2. Check that the unit is level on the casing.
- ☐ 3. Ensure that the auxiliary drain pan pitches toward the drain lip from all directions. Piping must not touch the auxiliary drain pan or force it out of position.
- ☐ 4. On horizontal units of 02 to 06 size, check that the drain pan liner insulation fits into the 1/4-inch wide groove under the auxiliary drain pan lip. See Figure 22.
- ☐ 5. Secure all electrical connections at their terminals.
- ☐ 6. Ensure that all filters and unit panels are in place.

OPERATION

Fan-Coil UniTrane® operation is controlled by a motor speed switch, a thermostat, and a summer-winter switch (optional). Vertical units have unit or wall-mounted controls. Horizontal unit controls are wall-mounted.

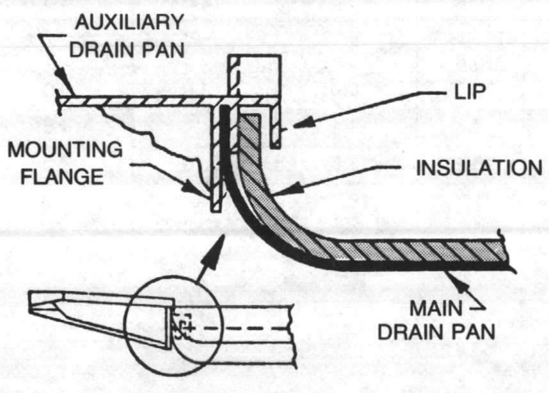


FIGURE 22 - Auxiliary Drain Pan on Horizontal Units of 02 to 06 Size

The motor speed switch controls the fan and is one of two types. The switch labeled OFF-HI-MED-LOW provides additional cooling by turning the switch to a higher speed. The switch type labeled MAN-OFF-AUTO provides continuous operation in the MANUAL position and operates only to meet the thermostat setpoint in the AUTO position.

Unit-mounted thermostats are labeled COOL-WARM and should be adjusted on the range according to the arrows on the knob. Wall-mounted thermostats usually have a dial to select an approximate temperature.

The optional summer-winter switch may be manual or automatic. The manual switch is labeled SUMMER-WINTER or HEAT-COOL. The automatic type of changeover switch is an integral part of the control circuit which reverses the thermostat action in accordance with water temperature changes.

On units with electric heat, the coil contactors are interlocked with the motor speed switch, so electric heat is possible only when the fan is in operation. The electric heat operating circuit includes a high temperature cut-out switch with automatic reset. When coil temperature exceeds the setpoint of the cut-out (210 F), the heating coil will de-energize and the fan will continue to run. The control circuit may also include a fan override thermostat to provide fan operation to cool the heating coil after manual shutoff.

Care should be taken with all systems to prevent coil freeze-up during winter operation, when cold outdoor air is brought directly to the fan-coil unit. On single-coil units, this can usually be accomplished by interlocking an automatic outdoor air damper with the fan-motor switch. The air damper should close when the switch is in the OFF position. On two-coil units, the heating coil should be in the preheat position and the automatic damper operator interlocked with the fan switch.

MAINTENANCE

PERIODIC MAINTENANCE CHECKLIST

The following checklist is provided as a recommended maintenance schedule. Detailed instructions for specific maintenance procedures are given after the checklist.

WARNING: DISCONNECT ELECTRICAL POWER AND 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.

EVERY MONTH

☐ 1. Inspect the unit air filters. Clean or replace clogged filter element.

☐ 2. Check the primary and auxiliary drain pans to be sure that they are clean and free to carry the flow of condensate through the drain line.

EVERY SIX MONTHS

☐ 1. Oil the fan motor.

EVERY YEAR

☐ 1. Inspect the unit casing for chips or corrosion. Clean or repair to protect unit protection.

☐ 2. Inspect the fan wheel and housing for damage. Rotate the fan wheel manually to be sure no obstructions block its movement.

☐ 3. Inspect the coil fins for excessive dirt or damage. Remove dirt and straighten fins.

☐ 4. Clean and tighten all electrical connections.

MAINTENANCE PROCEDURES

WARNING: DISCONNECT ELECTRICAL POWER AND 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.

FILTERS

Change or clean air filters at least twice a year. Filters will require more frequent care under high load conditions or dirty air. A clogged air filter reduces airflow, causing the high temperature cutout on electric heat units to shutoff the unit.

Table 7 lists filter sizes. Filters are available in 1/2-inch or 1-inch widths. Disposable, permanent (cleanable), or replaceable media filters are acceptable for all units. To replace disposable filters, remove filter from the unit and dispose of entire filter and frame. Replace with new filter in the proper direction. To replace filters with replaceable media, remove the filter and frame from the unit, replace media in the frame, and re-install the filter frame facing the proper direction.

To clean permanent filters, remove the filter and wash it in water to remove dust, dirt and lint. Then wash the filter with a mild alkali solution to remove the old filter oil. Rinse in clean, hot water and allow to dry. Recoat both sides of the filter with Air Maze Filter Kote W or an equivalent, using immersion or a spray gun. Allow to drain and dry thoroughly before re-installing the filter.

TABLE 7 - Filter Sizes (Inches)

UNIT SIZE	VERTICAL AND HORIZONTAL	LOW VERTICAL
02	19⅞ x 8¼	19½ x 8
03	27⅞ x 8¼	27½ x 8
04	31⅞ x 8¼	35½ x 8
06	43⅞ x 8¼	47½ x 8
08	45¾ x 11	—
10	57¾ x 11	—
12	69¾ x 11	—

DRAIN PANS

The primary and auxiliary drains should be cleaned to allow condensate flow. On 02 to 06 horizontal units, ensure that the drain pan liner insulation fits into the 1/4-inch groove provided for it under the auxiliary drain pan lip, as in Figure 22. To remove the auxiliary drain pan from vertical 02 to 06 units, first slide the pan up, then pull it away from the unit.

CAUTION: Failure to proceed with caution when removing the auxiliary drain pan may result in damage to the unit by breaking the pan's plastic mounting tabs.

MOTOR OIL

Bearing oilers are provided on the fan motor. It is recommended that motors be oiled twice a year with six to eight drops of SAE Number 10 non-detergent oil.

CAUTION: Do not operate the fan motor without the air filter or front panel in place. Excessive air handled by the fan may cause equipment damage due to motor overload.

REPAIR

FAN BOARD REMOVAL

When servicing fans or motor, follow these procedures to remove the fan board.

WARNING: DISCONNECT ELECTRICAL POWER AND 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.

VERTICAL MODELS

1. Remove the front access panel.
2. Disconnect the motor lead quick-connect plug at the junction box in the end pocket.
3. Pull the lower half of the red plastic drain tube from the upper half (02-06 only).
4. Remove the fan board mounting screws.
5. Lower the front edge of the fan board assembly about two inches and pull assembly out of the unit.

HORIZONTAL UNITS

☐ Open the bottom panel on recessed and cabinet models (Model 'E' sizes 02-06, Model 'D' — all sizes).

☐ **C32 Models**

1. Disconnect the motor wiring at the control box.
2. Remove fan board mounting screws.
3. Remove fan board assembly through the bottom of unit.

☐ **C34 Models**

1. Disconnect motor wiring at control box.
2. Remove bottom access panel.
3. Remove fan board mounting screws.
4. Remove fan board assembly through the bottom of access opening.

MOTOR REPLACEMENT

The special motor in the 02 to 06 size fan-coil units cannot be repaired or rewound. If the motor fails, order a replacement from The Trane Company. Use the unit serial number and unit size when ordering a new motor.

With the fan board assembly pulled out of the unit, motor replacement procedure will be evident upon inspection of the assembly. For most units, the clips which hold the fan housing together must be removed in order to get at the fan wheel-to-motor shaft allen screws. Fan housing-to-fan board mounting clips and screws should be removed. All clips may be reused for reassembly. Be careful not to spring them out of shape when removing.

When reassembling, make sure the fan wheel is centered in the fan housing and not rubbing on either side.

NOTE: *Controls such as thermostats may be repaired locally; repair should be supervised by the control manufacturer's representative.*

TAB PLACEMENT HERE

DESCRIPTION:

6

☐ Tab page did not contain hand written information

☒ Tab page contained hand written information
*Scanned as next image

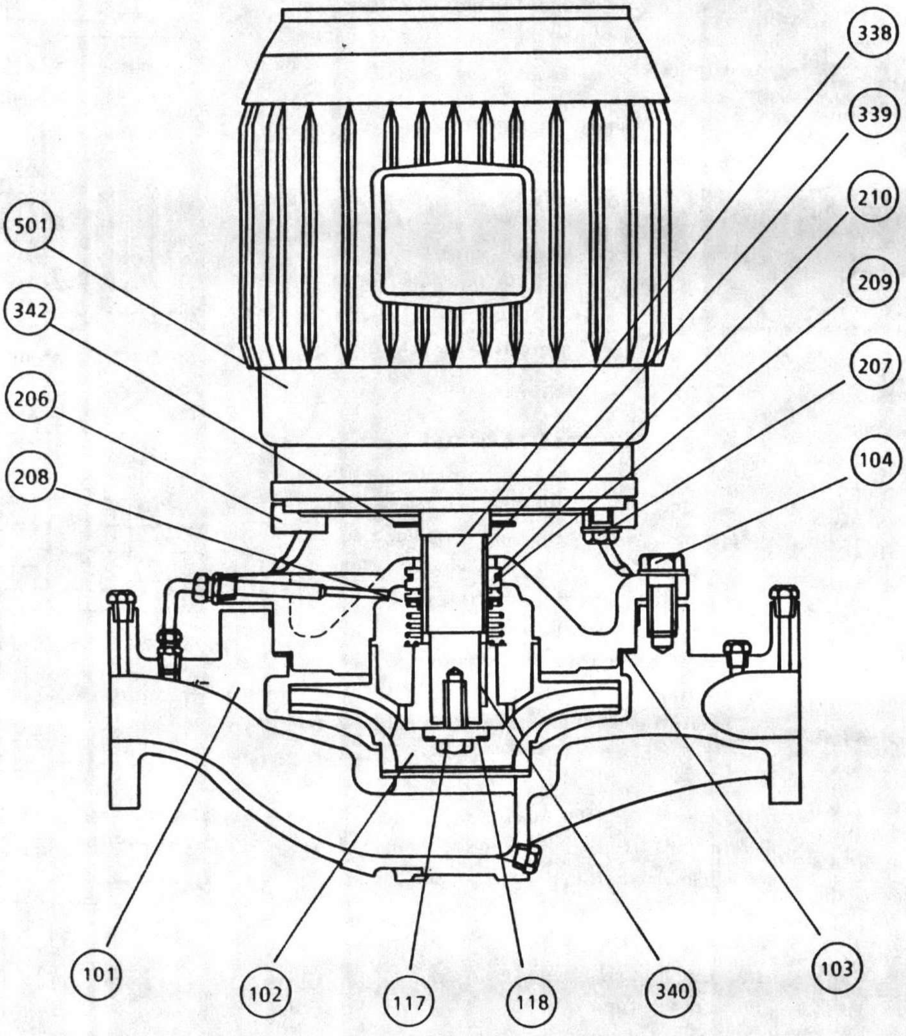
Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

ARMSTRONG CENTRIFUGAL PUMPS

INSTALLATION AND OPERATING INSTRUCTIONS

File No.:	5043.64
Date:	June 17, 1987
Supersedes:	
Date:	

SERIES 4380 VERTICAL IN-LINE PUMPS
CLOSE COUPLED ARRANGEMENT



ITEM DESCRIPTION

101 Volute

102 Impeller

103 Volute Gasket

104 Volute Capscrew

117 Impeller Capscrew

118 Impeller Washer

206 Motor/Pump Bracket

207 Motor capscrew

208 Mechanical Seal

209 Seat Insert

210 Seat Insert Gasket

338 Shaft

339 Shaft Sleeve

340 Impeller Key

342 Water Slinger

501 Motor

STORAGE

Make sure that the unit is kept perfectly clean. Do not remove crating or plastic wrapping until the pump is ready for installation. For long term storage, the pump must be placed in a dry environment. Rotate the shaft periodically to prevent pitting of the finished surfaces and keep the rotating element free.

UNCRATING

After removing the pump from the crate, make sure the equipment is in good order and that all components are received as called for on the packing slip. Any shortages or damage should be reported immediately. Use extreme care in handling the unit, placing slings carefully so that stress will not be imposed on the pump. NEVER PLACE CABLE SLINGS AROUND THE PUMP SHAFT. The eye bolts or lifting lugs on the motor are intended for lifting only the motor and not the complete unit.

LOCATION

Locate the pump where it is easily accessible for inspection and servicing, and provide adequate head room for pump withdrawal. Do not locate the pump in damp atmospheres unless the motor enclosure is suitable for the environment. Do not operate the motor unless the surrounding environment is clear of construction dust and debris.

INSTALLATION AND OPERATING INSTRUCTIONS

SERIES 4380

ARMSTRONG CENTRIFUGAL PUMPS, PROPERLY INSTALLED AND GIVEN REASONABLE CARE AND MAINTENANCE, WILL PERFORM SATISFACTORILY FOR A LONG PERIOD OF TIME. THESE INSTRUCTIONS DESCRIBE THE PROCEDURES WHICH MUST BE FOLLOWED TO ENSURE TROUBLE-FREE OPERATION.

INSTALLATION

The most important consideration in installing a vertical in-line pump, is to make sure the pump is free to 'float' with expansion and contraction of the piping. Recommended arrangements are:

(a) Floor mounted supports under Armstrong Suction Guide and Flo-Trex Valve (Fig. 1)
(b) Supported from the ceiling by pipe hangers (Fig. 2)
(c) Floor mounted saddle supports (Fig. 3)

Where required, additional floor support may be obtained as shown in Fig. 4. The piping must be installed in such a manner that the pump is not used as a pipe support. When the pump is installed per Fig. 4, it is necessary to have a vibration insolation pad and use flexible connectors.
Do **NOT** support the unit by the motor eye bolts (Fig. 5) or by any other part of the motor.
Do **NOT** rigidly connect the pump to a permanent base (Fig. 6)
Do **NOT** install the unit with the shaft horizontal.

PIPING

Piping is simple and straight-forward with a vertical in-line pump. The unit fits in the line like a valve. Do not use flexible connectors on the suction or discharge. These are not necessary. All piping must be supported independent of pump. Piping must not impose strain on pump flanges.

VALVING

Install gate valves or butterfly valves on the suction and discharge sides to permit isolation from the system for servicing. A check valve should also be installed on the discharge side.

ELECTRICAL

Check to see that the electrical data stamped on the motor nameplate corresponds with the power supply available at the installation. Refer to the motor wiring diagram (normally located inside the motor terminal box) and check that the motor leads are properly connected. Inspect the circuit fuses and/or heater elements to make sure that they are correctly sized for the application.

ROTATION

*See Final Check. Energize the motor briefly. CAUTION! DO NOT START PUMP WITHOUT LIQUID IN THE CASING; DAMAGE TO THE MECHANICAL SEAL WILL RESULT. Check the rotation of the pump. This should correspond to the directional arrow (i.e. clockwise when looking down on top of the motor). To reverse the rotation of a three phase motor, interchange two of the leads.

PUMP LUBRICATION

Lubrication is not required. There are no bearings in the pump.

MOTOR LUBRICATION

Refer to the motor installation and operating instructions and follow the lubrication procedures recommeded by the motor manufacturer.

SYSTEM CLEANLINESS

Before starting the pump, the system must be thoroughly cleaned, flushed and drained, then replenished with clean liquid. Welding slag and other foreign materials, 'stop leak' and cleaning compounds, excessive or improper water treatment, are all detrimental to the pump internals. Proper operation cannot be guaranteed if any of these conditions are allowed to exist. Do not use pump for water treatment injection.

*FINAL CHECK

Particular care must be taken to double check the following before the pump is started up:

(a) Liquid in pump?
(b) Rotation OK?
(c) Unit properly supported?
(d) Voltage supply OK?
(e) Overload protection OK?
(f) Is the system clean?
(g) Are motor bearings protected from construction dust?
(h) Is the mechanical seal vented?

ARMSTRONG WARRANTY DOES NOT COVER ANY DAMAGES TO THE EQUIPMENT RESULTING FROM FAILURE TO OBSERVE THE ABOVE PRECAUTIONS.

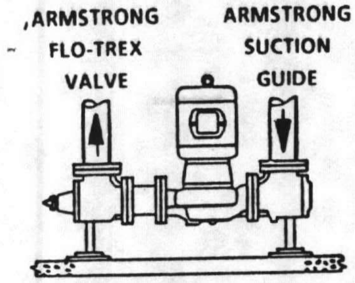


Fig. 1 Recommended Installation

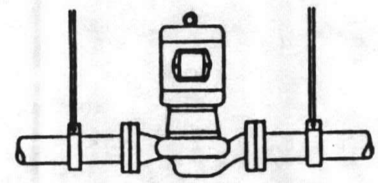


Fig. 2 Pipe Hanger Support

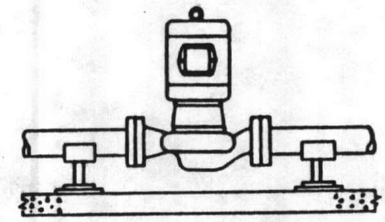


Fig. 3 Floor Saddle Support

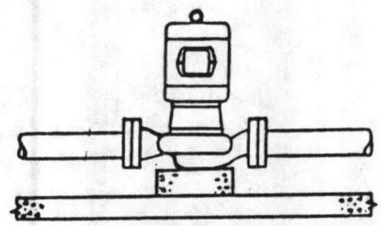


Fig. 4 Additional Floor Support

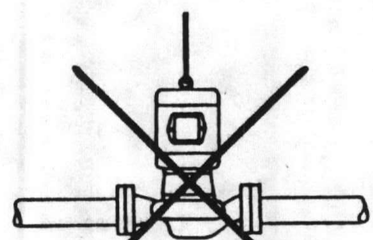


Fig. 5 Not Recommended

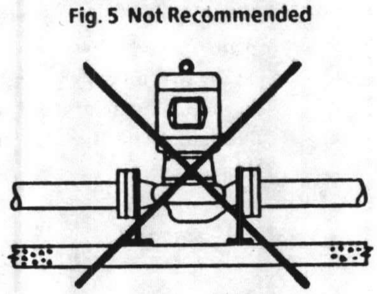


Fig. 6 Not Recommended

Armstrong PUMPS

SERIES 4380
2 x 2 x 10
VERTICAL—IN—LINE
INSIDE MECHANICAL SEAL

FILE NO.: 5043.9197
DATE: January 12, 1987
SUPERSEDES:
DATE:

SUBMITTAL

JOB
Air Conditioning System
Bldg 1041
Camp Lejeune, N.C.
ENGINEER McKim & Creed
CONTRACTOR Sneeden, Inc.

REPRESENTATIVE
Morgan Kirkman Assoc
ORDER NO. ____ DATE ____
SUBMITTED BY ____ DATE ____
APPROVED BY ____ DATE ____

PUMP DESIGN DATA			
NO. OF PUMPS:	1		
TAG:	P-1		
CAPACITY:	39 gpm	USGPM	
HEAD:	71'	FT.	
LIQUID:	Water	VISCOSITY:	
TEMPERATURE:	45 °F	SPECIFIC GRAVITY:	

MOTOR DESIGN DATA			
HP: 3		RPM: 1750	
FRAME SIZE: 182		ENCLOSURE: ODP	
VOLTS: 240	HERTZ: 60	PHASE: 1	
FLANGE SIZE —2".			

MATERIALS OF CONSTRUCTION				
ANSI FLANGE RATING	☑ 125 LB. CAST IRON		☐ 250 LB. DUCTILE IRON	
CONSTRUCTION	☑ BRONZE FITTED	☐ ALL IRON	☐ BRONZE FITTED	☐ ALL IRON
VOLUTE	CAST IRON	CAST IRON	DUCTILE IRON	DUCTILE IRON
IMPELLER	BRONZE	CAST IRON	BRONZE	CAST IRON
FLUSH LINE	COPPER	STEEL	COPPER	STEEL
GASKET	CONFINED NON-ASBESTOS FIBER			
MAXIMUM CASING WORKING PRESSURE	140 PSIG AT 250° F 175 PSIG AT 180° F		325 PSIG AT 250° F 375 PSIG AT 100° F	

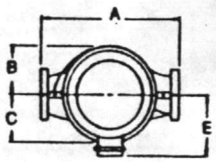
MECHANICAL SEAL DESIGN DATA		
STYLE	INSIDE UNBALANCED	NOTES
TYPE	TYPE 21	(1) STEEL ROTATING HARDWARE WILL BE SUBSTITUTED WHEN ALL IRON PUMPS ARE SUPPLIED.
ROTATING FACE	CARBON (3)	
STATIONARY SEAT	NI—RESIST	(2) NOT SUITABLE FOR USE ON OIL SERVICE.
SECONDARY SEAL	EPDM (2)	
SPRINGS	304 ST. STL.	(3) TUNGSTEN CARBIDE WILL BE SUBSTITUTED WHEN DUCTILE IRON PUMPS ARE SUPPLIED.
ROTATING HARDWARE	BRASS (1)	

OPTIONAL EQUIPMENT

* Meets MIL-P-16077

REMARKS

PERFORMANCE CURVE ....SEE REVERSE SIDE

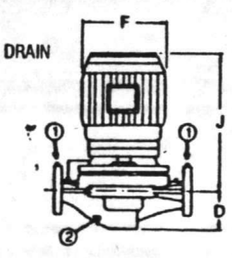


DIMENSIONS

PUMP	A	B	C	D
	19	6¾	6¾	5⅜

(1) ¼" GAGE TAPPINGS

(2) ¼" DRAIN



MOTOR (O.D.P.)

HP 3600	HP 1800	FRAME SIZE	DIMENSIONS E	DIMENSIONS F	DIMENSIONS J	SHIP. WT.
	2	145	6	7½	15¾	219
	3	182	7	9½	20⅛	247
	5	184	7	9½	20⅛	261
	7½	213	9⅜	10⅞	25⅝	340
20		254	10⅜	13	25	480
25		256	10⅜	13	25	485
30		284	11⅜	13	25	550
40		286	11⅜	13	25	550
50		324	12¼	14¼	27⅛	700

ALL DIMENSIONS ARE TYPICAL. ALL DIMENSIONS ARE IN INCHES.
FOR EXACT INSTALLATION DATA, PLEASE WRITE FACTORY FOR CERTIFIED DIMENSIONS.

TAB PLACEMENT HERE

DESCRIPTION:

7

☐ Tab page did not contain hand written information

☒ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

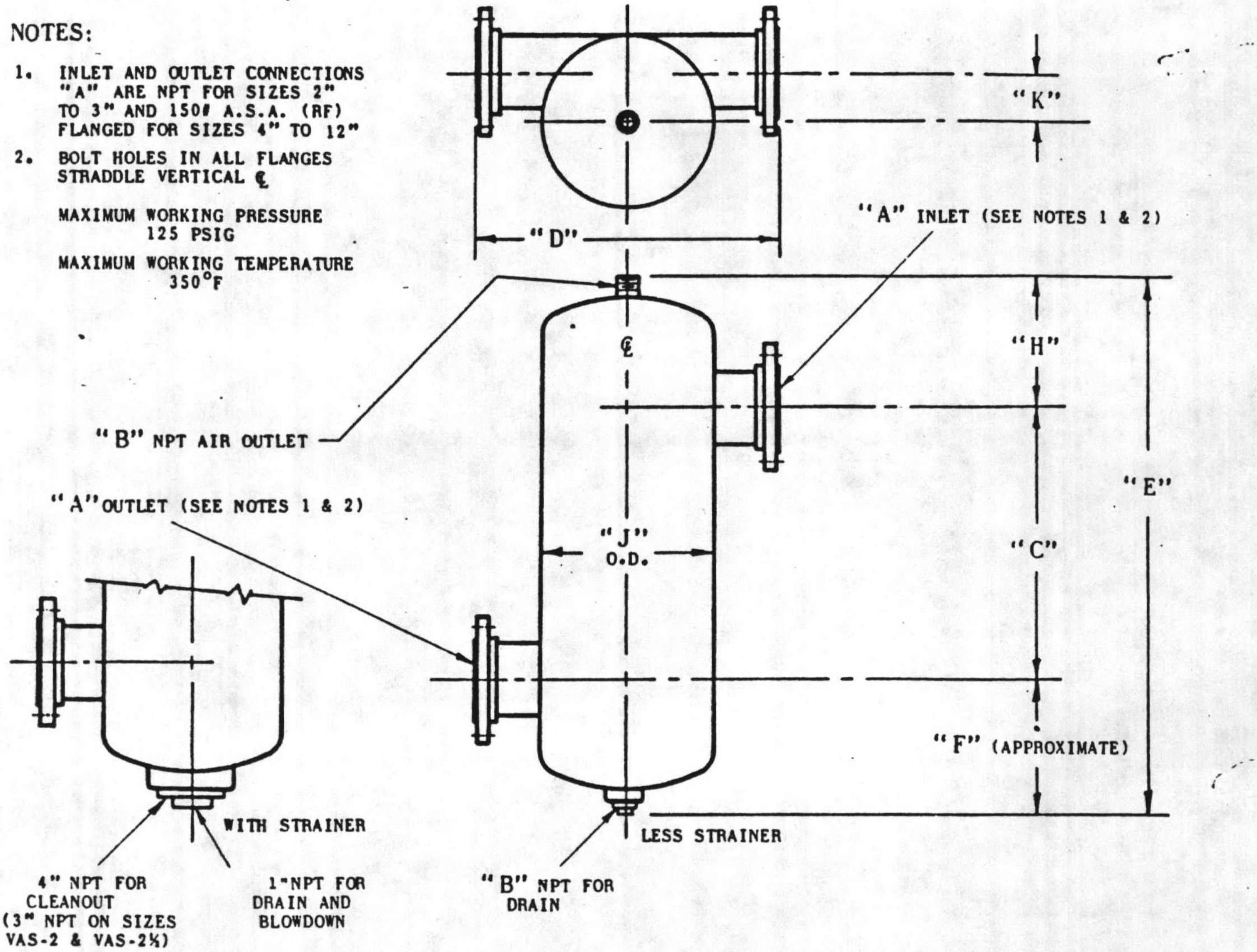
DIMENSIONAL DATA - ARMSTRONG VORTEX AIR SEPARATOR

NOTES:

1. INLET AND OUTLET CONNECTIONS "A" ARE NPT FOR SIZES 2" TO 3" AND 150# A.S.A. (RF) FLANGED FOR SIZES 4" TO 12"
2. BOLT HOLES IN ALL FLANGES STRADDLE VERTICAL ℄

MAXIMUM WORKING PRESSURE 125 PSIG

MAXIMUM WORKING TEMPERATURE 350°F



MODEL NUMBER		DIMENSIONS (IN INCHES)											MAX. FLOW USGPM LESS STR.	MAX. FLOW USGPM WITH STR.	APPROX. WEIGHT LBS.	
LESS STR.	WITH STR.	A	B	C	D	E (LESS STRAINER)	F (LESS STRAINER)	E (WITH STRAINER)	F (WITH STRAINER)	H	J	K			LESS STR.	WITH STR.
VA-2	VAS-2	2	1	6	10	18-1/2	6 1/2	19-1/4	7-1/8	6-1/8	5-13/16	1-3/4	60	60	22	25
VA-2½	VAS-2½	2½	1	7	12	18-7/8	5-7/8	19-5/8	6-3/4	6	6-7/8	1-7/8	90	90	27	30
VA-3	VAS-3	3	1	7-1/2	14	20-3/8	6-5/8	21-1/2	7-3/4	6-1/4	8-7/8	2-9/16	180	180	33	36
VA-4	VAS-4	4	1-1/2	9-1/2	18	24-1/2	7-3/4	25-1/2	8-3/4	7-1/4	11	3-1/8	310	310	65	75
VA-5	VAS 5	5	1-1/2	11	20	27-3/4	8-5/8	28-3/4	9-5/8	8-1/8	13-1/8	3-5/8	550	500	88	98
VA-6	VAS-6	6	1-1/2	12-1/2	24	31-1/4	9-5/8	32 3/8	10 3/4	9-1/8	16-3/8	4-11/16	910	725	140	150
VA-8	VAS-8	8	2	16	28	39-3/8	12	40-3/8	13	11-3/8	20-1/2	5-11/16	1850	1250	270	280
VA-10	VAS-10	10	2	20	32	46-7/8	13-3/4	47-7/8	14-3/4	13-1/8	24-1/2	6-5/8	3550	2000	390	400
VA-12	VAS-12	12	2	26	38	57-3/8	16	58-3/8	17	15-3/8	30	8-5/8	4700	2800	830	1030

SINCE 1908
wessels company

1625 E. EUCLID
DETROIT, MI 48211
313-875-5000
TELEX: 249456

1900 PETRA LANE
PLACENTIA, CA 92670
714-524-0744

SUBMITTAL

Type 'NA' ASME PLAIN STEEL EXPANSION TANKS

Models 12NA33 To 42NA96

Submittal Sheet No. NA 103

JOB. A/C System - Bldg #1041 Camp LeJeune

Unit Tag No. ______

Engineer McKim & Creed

Contractor Sneeden, Inc.

Wessels Representative Morgan Kirkman Assoc

Order No. ______ Date ______

Submitted By ______ Date ______

Approved By ______ Date ______

DESCRIPTION

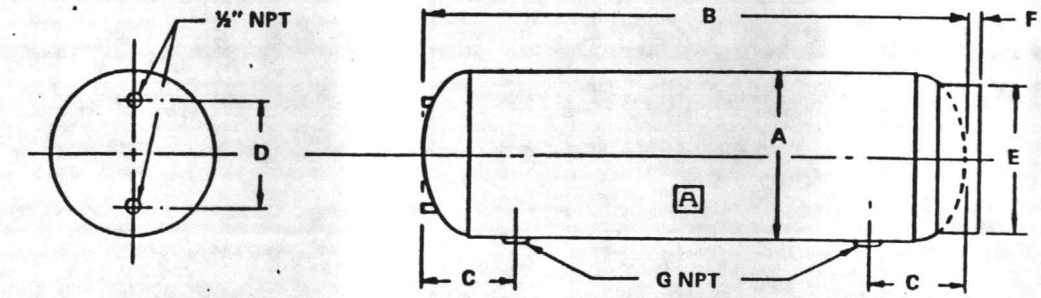
Wessels Type NA Tanks are ASME plain carbon steel expansion tanks. They are designed to absorb the expansion forces and control the pressure in heating/cooling systems.

CONSTRUCTION

Shell: Carbon steel
Heads: Carbon steel

PERFORMANCE LIMITATIONS

Maximum Design Pressure:
Models 12NA33 TO 16NA72 150 PSIG
Models 20NA62 TO 42NA96 125 PSIG
Maximum Design Temperature: 450°F



DIMENSIONS & WEIGHTS

Meets MIL-T18560

GALLON CAPACITY	MODEL NUMBER	A	B	C	D	E	F	G	WGT. LBS.
→ 15	12NA33	12	33	7"	8"	11-1/2"	7/8"	1"	44
24	12NA51	12	51	7"	8"	11-1/2"	7/8"	1"	62
30	14NA48	14	48	8-3/8"	10"	11-1/2"	1-1/8"	1"	72
40	14NA63	14	63	8-3/8"	10"	11-1/2"	1-1/8"	1"	92
60	16NA72	16	72	9-1/4"	12"	11-1/2"	1-1/8"	1"	120
80	20NA62	20	62-1/2	10"	16"	18"	1-1/2"	1"	136
100	20NA78	20	78	10"	16"	18"	1-1/2"	1"	168
120	24NA65	24	65	11-1/8"	20"	18"	1-1/2"	1"	218
135	24NA72	24	72	11-1/8"	20"	18"	1-1/2"	1"	238
175	30NA62	30	62-1/4	13-1/2"	22"	24"	2"	1-1/2"	338
220	30NA77	30	77	13-1/2"	22"	24"	2"	1-1/2"	368
240	30NA84	30	84	13-1/2"	22"	24"	2"	1-1/2"	394
305	30NA105	30	105-3/4	13-1/2"	22"	24"	2"	1-1/2"	486
295	36NA72	36	72	14-3/4"	28"	30"	2-1/2"	1-1/2"	502
400	36NA93	36	92-1/2	14-3/4"	28"	30"	2-1/2"	1-1/2"	645
505*	36NA120	36	120	14-3/4"	28"	–	–	1-1/2"	810
525*	42NA96	42	96	18"	28"	–	–	2"	895

Ring stand not provided on 505 and 525 gallon tanks, 11" x 15" manhole furnished on 525 gallon.

TAB PLACEMENT HERE

DESCRIPTION:

8

☐ Tab page did not contain hand written information

☑ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

ENVIROCON, INC.

HIGHWAY 264 WEST
P.O. BOX 7349
WILSON, N.C. 27895-7349

PHONE 1-919-291-4618
PHONE 1-919-832-1851

MAINTENANCE & OPERATIONS MANUAL

FOR

BUILDING 1041 AC SYSTEM

CAMP LEJEUNE, NC

Envirocon, Inc.

P.O. Box 7349, Hwy. 264 West • Wilson, North Carolina 27893
(919) 291-4618

BLDG. 1041 - CAMP LEJEUNE

PROGRAM CLOCK CONTROL - 7-DAY SCHEDULE FOR FCU'S

Program Clock T/C, is provided to permit operation of FCU's, Chill Water Pump and Chiller. The daily program schedule would be set by the Government.

Timed Override Switch (TOS-1) is provided to manually override Time Clock program for a select period of time up to six hours.

TC-1, Remote Bulb Thermostat located in the outside air, is provided to lockout FCU's Fans, Chill Water Pump and Chiller whenever the outside air temperature falls below its set point of 55°F. Relay R1 is provided to interface with Chill Water Pump Starter, HOA Switch, auto mode. The packaged Chiller Control Circuit is wired to prevent starting of Chiller unless the Chill Water Pump Starter is made, Chiller Flow Switch is made, and Chiller Time Delay Relay is timed to make (approximately 30 seconds). TC-1 acts in reverse mode on rise in outside air temperature above 55°F.

All Fan Coil Units have automatic controls provided, mounted and wired by unit manufacturer which includes: Speed Fan SWITCH and Disconnect, and Cooling Only Return Air Thermostat.

Fan Coil Units power supply is routed through Control Contactor Panel for Program Clock interface. All power and loadside wiring is supplied by electrical contractor (Div. 16).

PRISONERS MESS AND STAFF DINING CONTROL (AH-1):

General: AHU-1 is started by placing HOA Switch (located on Unit Starter in M.E.R.) in an automatic position for the following sequence of control:

The Prisoners Mess Room thermostat is a dual thermostat (direct acting) for both heating and cooling operation. While in the heat operation and on a fall in space temperature below 70°F, the N.O. Steam Valve will open to admit steam to the unit coil in a gradual manner to maintain space temperature. Also, the unit fan is started, PE-1, to deliver heat to the area. Whenever the space rises a couple of degrees above 70°F, the fan is stopped by the action of N.C. PE-1. On a rise in space temperature above 70°F, the unit fan is off, DEADBAND space temperature will drift to higher temperature of 76-78°F and - PE-2 will re-start unit fan. A continued rise in space conditions will bring on cooling by the action of PE-3. Upon fall in temperature, the reverse of the action will ensue.

(continued)

Envirocon, Inc.

P.O. Box 7349, Hwy. 264 West • Wilson, North Carolina 27893
(919) 291-4618

The unit fan HOA Switch placed in the hand position permits the system to operate as stated previously, with exception that the fan runs continuously.

Outside Air Thermostat TC-2 is provided to lock-out mechanical cooling anytime the outside air falls below 55°F. Also, through starter auxiliary, mechanical cooling is locked out unless fan starter is energized.

STAFF DINING AIR VOLUME CONTROL

Whenever AHU-1 is operating in heat mode, T-2 acts on a rise in space temperature to gradually close the Volume Damper M-1 to its fixed minimum position. A fall in temperature will open damper to deliver more heat if available. The amount OF HEAT available is controlled by the Prisoners Mess thermostat. Whenever AHU-1 is operating in the cooling mode, EP-1 is energized by PE-4, transferring T-2 thermostat output through a reversing delay, thus making T-2 a direct action controller. On a rise in space conditions, Volume Damper M-1 is opened fully to deliver mechanical cooling whenever it is made available by the Prisoners Mess Room thermostat. On a fall in space conditions, the reverse will ensue.

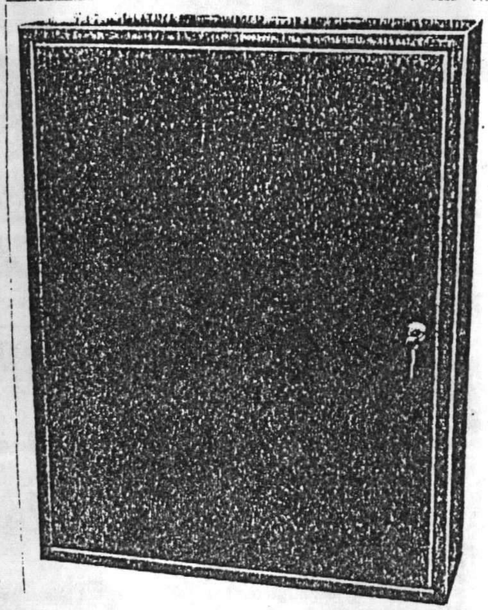
ENVIROCON, INC.

HIGHWAY 264 WEST
P.O. BOX 7349
WILSON, N.C. 27895-7349

PHONE 1-919-291-4618
PHONE 1-919-832-1851

CONTROL PANEL CABINETS

GENERAL DESCRIPTION



The control panel cabinet is designed to provide a convenient method of surface mounting and protecting either pneumatic or electric control devices.

The use of simple "hook-and-hanger" wallmounting bracket, plus a subpanel on which the control devices are mounted, permits rapid installation of the cabinet (ring) during construction and simple mounting of the finished subpanel at the required time.

The cabinet door may be hinged either on the left or right hand side through the use of a springtype pivot hinge. Two or more cabinets may be mounted side by side or over and under to handle specific requirements. This eliminates the need for large, heavy-to-handle single panels. To join individual cabinets use knockouts and fasten with appropriate nipples and lock nuts. This provides a neat flexible installation.

SPECIFICATIONS

Model No.: 30101 24"wide X 24" high x 8"
30102 24"wide X 32" high X 8"
30105 24"wide X 36" high X 8"
30100 16"wide X 20" high X 8"

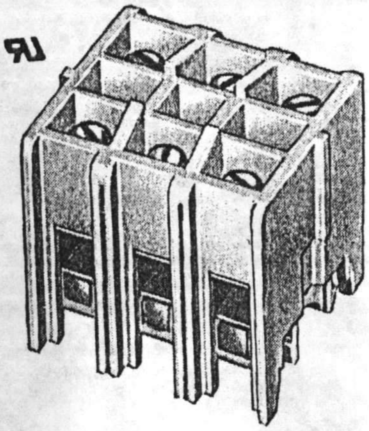
Doors: Spring loaded pivot hinge permits left or right hinging and features key operated latch to prevent tampering.

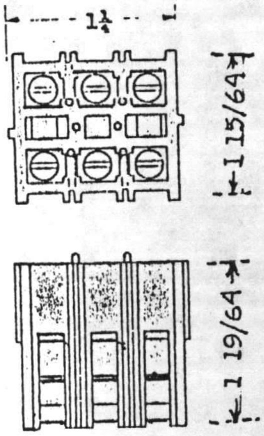
Finish: Baked enamel: Blue

Construction:

Cabinet:	16 gauge steel
Subpanel:	16 gauge steel
Door:	16 gauge steel

NFT3





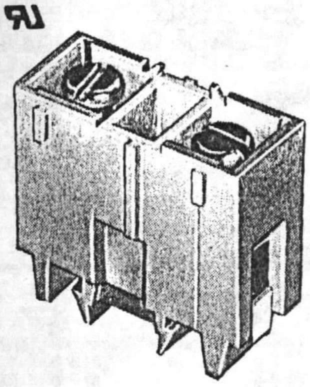
600 volt
wire range #22-8

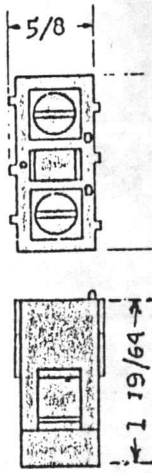
NFT3 is similar to the NFT2 in voltage and wire capacity, except this design allows more space for wiring when space is not at a premium. The circuit to circuit spacing is slightly more than ⅜" for each wire installation. All screws are backed off ready for wire insertion into the maintenance minimizing breathing action collar.

ACCESSORIES

CP MARKING PENS CPR RED CPB BLACK	NR12½ NR37½ STAINLESS STEEL MOUNTING RAILS	NFTA72 ALUMINUM MOUNTING RAIL	SOA72 STAND-OFF CHANNEL FOR NFTA	MT12½ MARKING TAPE	TEP TEST PROBE	JN3 JUMPER

NFT1





600 volt
wire range #18-4

NFT1 is a compact medium duty block designed for flexibility of wire termination. This block can be inserted at any point in a row of terminal blocks to handle wires larger than standard control circuits. These can also be grouped for ease of building a power system.

NFT1 incorporates the Connectron maintenance minimizing clamping collar.

ACCESSORIES

CP MARKING PENS CPR RED CPB BLACK	NR12½ NR37½ STAINLESS STEEL MOUNTING RAILS	NFTA72 ALUMINUM MOUNTING RAIL	SOA72 STAND-OFF CHANNEL FOR NFTA	MT12½ MARKING TAPE	JN1 JUMPER

FOR ALUMINUM RATINGS CONSULT FACTORY

Catalog dimensions are for guidance only.

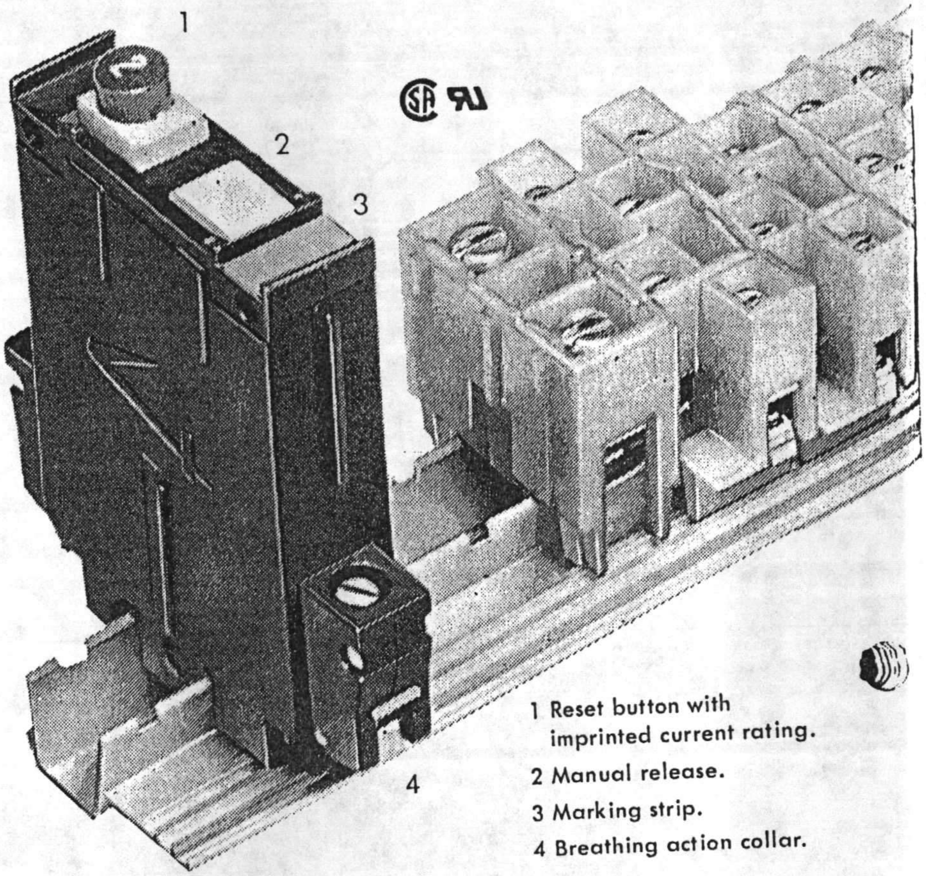
CONNECTRON INC.

CIRCUIT BREAKER

NFTCB1

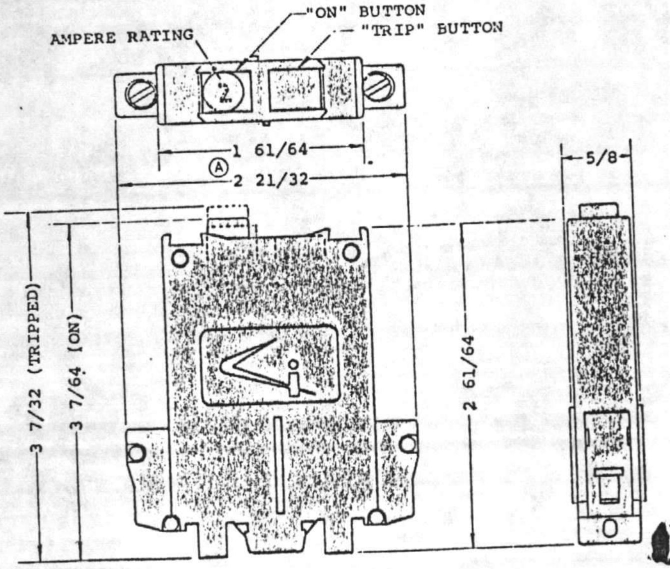
The safe, convenient, Connectron circuit breaker terminal blocks eliminate problems inherent in protecting branch circuits with fuses. These circuit breaker terminal blocks provide protection for solenoid and relay coils, current transformers, and other control components used in all types of automated machinery equipment. The circuit breakers can be mounted on the same mounting rails as other Connectron terminal blocks for a complete terminal system.

Circuit breaker buttons are clearly marked with the correct amperage rating and can double as a manual "ON" "OFF" switch as desired. The breakers are rated at 240 volts AC maximum with a short circuit rating of 2000 amps for all breaker ratings.



1 Reset button with imprinted current rating.
2 Manual release.
3 Marking strip.
4 Breathing action collar.

Optional "normally-opened" & "normally-closed" auxiliary contacts allow signaling and system interlocking.



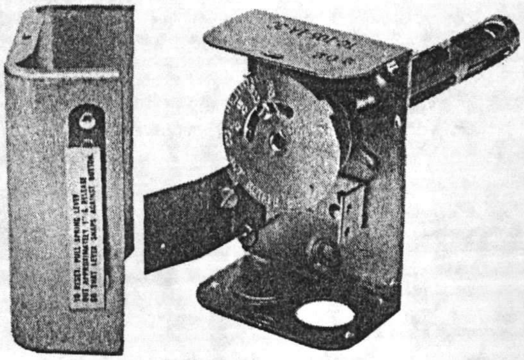
When ordering CAT #NFTCB1 please specify:
Ampere Rating
CAT. #NFTCB1 [ ] [ ]
AUXILIARY CONTACTS(IF NEEDED)
A ---Normally Open—2 wire
B----Normally Closed—2 wire
C ---Normally Open & Closed—3 wire
AB--Normally Open & Closed—4 wire
Contact rating 3A @ 120V—1.5A @ 240V
12" connecting leads provided as part of breaker

CEMCO

"Quality"...A Personal Commitment

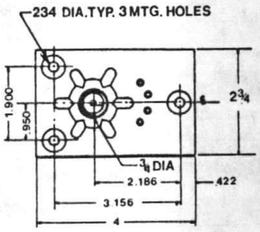
Safety Devices

FIRESTAT



ORDERING CODE:
TC-105-1A-3C-Adjustable Setting
TC-205-1A-3C-Fixed Setting

Helix bimetal senses sudden increase in duct temperature such as in a fire and operates to turn off the blower. Electrical capacity ¾ Hp 125 VAC. Available in 5″, 7½″, or 11″ element lengths. Manual reset button. Setting is field adjustable through 100° - 250°F range. U.L. Listed. Use Fan and Limit code sheet on preceding page to order.

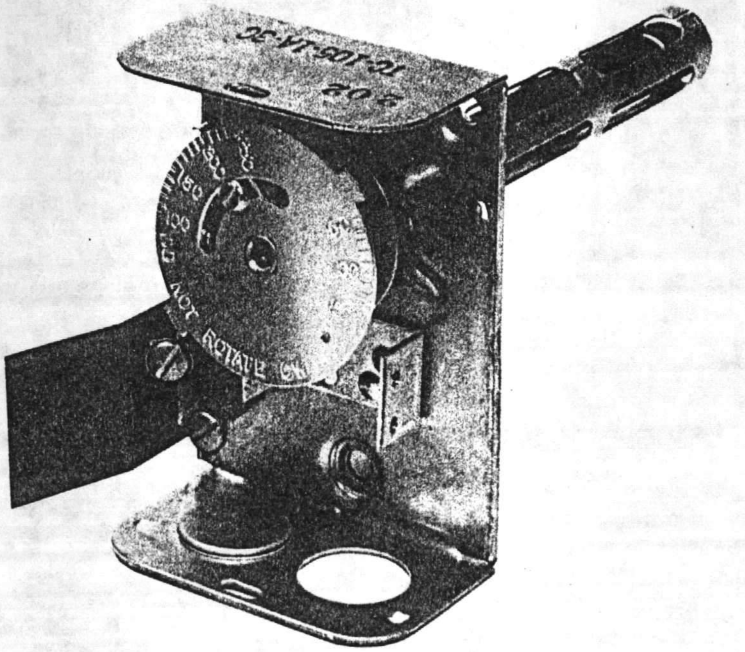


BOTTOM VIEW OF CONTROL
SHOWN WITH COVER REMOVED

HI TEMPERATURE LIMIT CONTROL

ORDERING CODE: TC-105-1A-CW

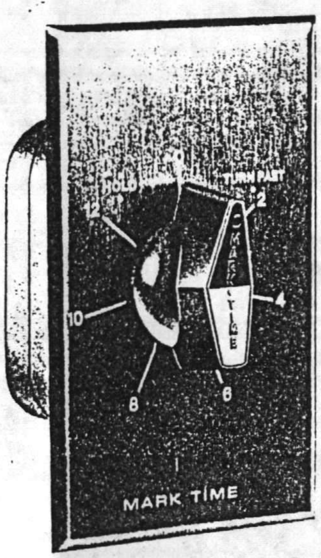
Circuit opens on rise of temperature. Operating range in air 250° - 350°F. Electrical capacity ¾ Hp 125 VAC. Same size as firestat. Available in 5″, 7½″, or 11″ element length. Check factory for higher operating range controls. Automatic Reset. U.L. Recognized. Use Fan and Limit code sheet on preceding page to order.



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.

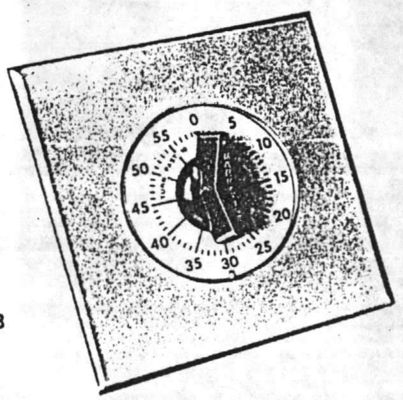
Hold Feature: Holds current "ON" without operation of timing mechanism; timing begins when knob is turned to a time period.

"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.

Dayton

INSTALLATION INSTRUCTIONS

SPDT TEMPERATURE CONTROL

MODEL 2E399

FORM
5S1776

DAYTON ELECTRIC MANUFACTURING CO. CHICAGO 60648

1177/9.9M

ATTENTION: READ CAREFULLY BEFORE ATTEMPTING TO INSTALL OR OPERATE YOUR DAYTON SPDT TEMPERATURE CONTROL. RETAIN FOR FUTURE REFERENCE!

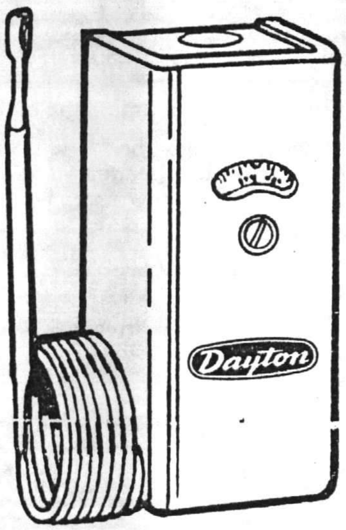
Description

This temperature control is designed for use on equipment that requires a closed circuit for both rise and fall in temperature. Its single pole, double throw switch action offers both open-on-rise terminals as well as close-on-rise terminals.

In addition to general use, this control is also suitable for use as an outdoor thermostat or as a change-over control.

A mounting bracket is furnished for mounting the bulb.

This control has capillary tubing between the temperature sensitive bulb and the switch mechanism, permitting the switch mechanism to be mounted at any convenient location while the temperature sensitive bulb is located in the fluid or medium being controlled.



Specifications

Range: -30 to $+90^{o}$F.
Differential: 4½ to 40^{o}F.
Switch Action: SPDT
Capillary Length: 8 ft.
A.C. Electrical Rating –
Motor Rating (Full Load): 7.4A at 120V.
3.7A at 240V.
Valves and Relay: 2.9A at 25V, 4.4A at 120V.

Safety

CAUTION – DISCONNECT POWER SUPPLY UNTIL INSTALLATION IS COMPLETE.

Installation

The switch mechanism of this control may be mounted in any location provided that the temperature and humidity of the air in which it is located do not cause a condensation on the switch parts.

The sensitive element or "bulb" should be located in the **average temperature** of the controlled area.

Capillary tubing should be led over a path that protects it from injury from blows, cuts, etc., avoid kinking and twisting. It should be attached to some surface at frequent points along its length and not be permitted to hang loosely. Excessive capillary should be coiled and secured at some convenient protected location close to the switch mechanism.

The bulb should be handled with reasonable care also. A dent or sharp bend may change the calibration and cause the control to cycle at a temperature different than the dial setting.

Installation (continued)

WIRING

All wiring should be done according to local and national electrical codes and ordinances.

This control has a single-pole, double-throw snap action switch. The top left-hand terminal (red) is the common terminal. The top right-hand terminal (blue) has open-on-rise switch action. The bottom center terminal (white) has close-on-rise switch action.

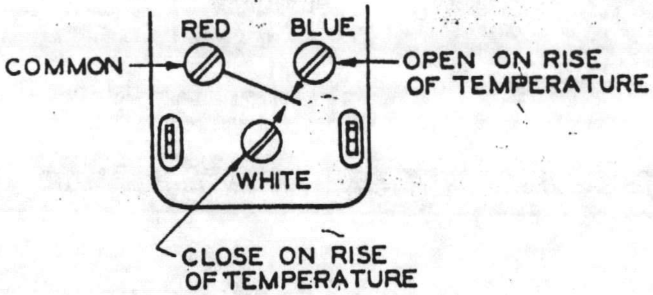
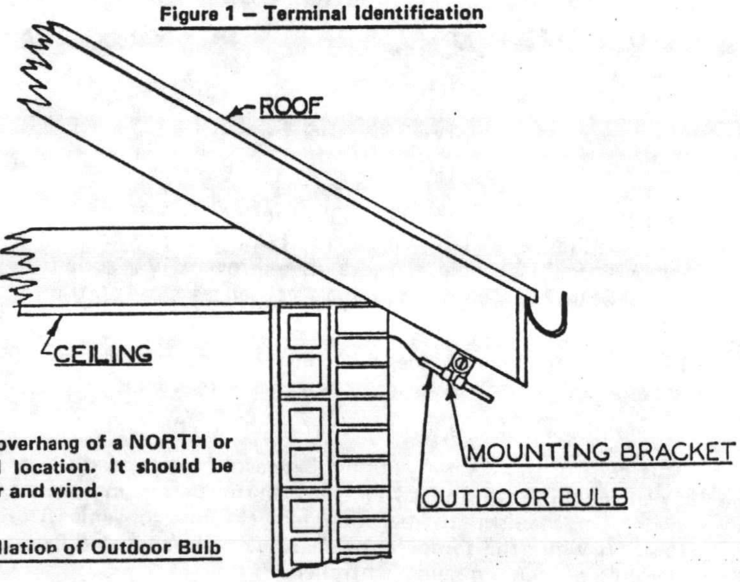


Figure 1 – Terminal Identification

INSTALLATION OF OUTDOOR BULB

When used as a changeover control or outdoor thermostat, the bulb of this control should be located so as to measure the actual outdoor air temperature. A mounting bracket is provided on some models for mounting the bulb.

The mounting bracket should be fastened to some convenient outside part of the building that is shielded from the direct rays of the sun, the direct fall of rain and snow, and sufficiently above the ground to keep it out of snow and ice.



The underside of the eaves or overhang of a NORTH or NORTHEAST roof is a good location. It should be exposed to the circulation of air and wind.

Figure 2 – Installation of Outdoor Bulb

Operation

SETTING

1. Insert screwdriver in the center slot and turn the dial until the right hand indicator "B" points to the lowest temperature of the cycle.
2. Turn the differential adjusting screw "C" until the left hand indicator "D" points to the highest temperature of the cycle.

Indicator "B" points to temperature at which R-B contacts are to close (and R-W contacts are to open).

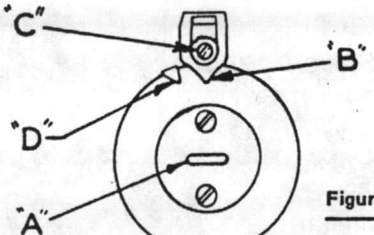


Figure 3 – Dial Settings

DAYTON 1-YEAR LIMITED WARRANTY

Dayton Controls are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use (rental use excluded), for one year after date of purchase.

Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be repaired or replaced at Dayton's option. For warranty claim procedures, see "Prompt Disposition" below. This warranty gives purchasers specific legal rights, and purchasers may also have other rights which vary from state to state.

WARRANTY DISCLAIMER. Dayton has made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit for a particular purpose, or that the products will necessarily conform to the illustrations or descriptions.

Except as provided below, no warranty or affirmation of fact, express or implied, other than as stated in "LIMITED WARRANTY" above is made or authorized by Dayton, and Dayton's liability in all events is limited to the purchase price paid.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some states do not allow limitations on how long an implied warranty lasts, consequently the above, limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

PROMPT DISPOSITION. Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within warranty. For any product believed to be defective within warranty, first write or call dealer from whom product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date and number of dealer's invoice, and describing the nature of the defect. If product was damaged in transit to you, file claim with carrier.

DAYTON ELECTRIC MFG. CO., 5959 W. HOWARD ST., CHICAGO, ILLINOIS 60648

INSTALLATION INSTRUCTIONS

POWER RELAYS

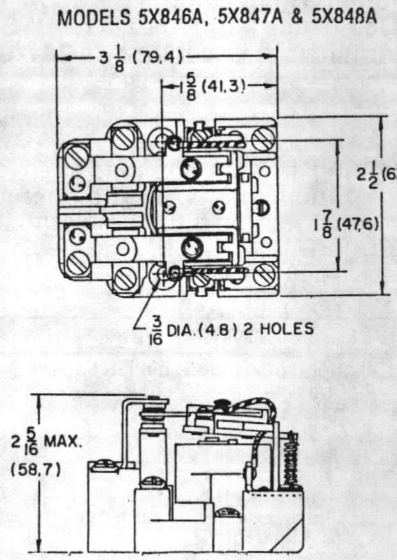
MODELS 5X846A THRU 5X851A

FORM
5S1823
5805

DAYTON ELECTRIC MANUFACTURING CO. CHICAGO 60648

0278/056/80M

ATTENTION: READ CAREFULLY BEFORE ATTEMPTING TO INSTALL OR SERVICE DAYTON RELAYS! RETAIN FOR FUTURE REFERENCE.



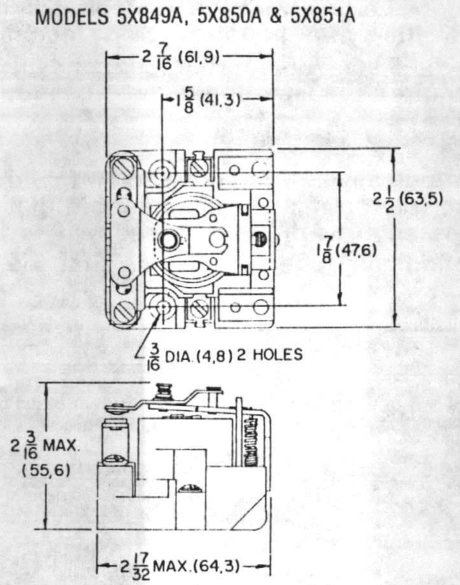


Figure 1 — Dimensions

Description

This series of Dayton heavy duty power relays are UL listed. They are for use with motors, solenoids, heater loads, and other resistive loads. The single pole relays with double-make contacts are suitable as motor and solenoid controllers. The double pole relays are used when two circuits require switching. Coil and contact connections are made by binder head screw terminals.

Specifications

Two contact combinations are available on these relays. One is single pole single throw normally open double make (SPST-NO-DM) and the other is double pole double throw (DPDT). The SPST-NO-DM version is rated 30 amps up to 300 VAC, 12 amps at 480 VAC, 10 amps at 600 VAC, each rating at 50/60 Hz, .75 or greater power factor; 1½ horsepower motor load at 120 thru 600 VAC, 50/60 Hz; 30 amps at 28 VDC, resistive load. The double pole relay is rated 30 amps up to 300 VAC, 6 amps at 480 VAC, 5 amps at 600 VAC, each rating at 50/60 Hz, .75 or greater power factor; 1 horsepower motor load at 120 thru 600 VAC, 50/60 Hz; 30 amps at 28 VDC, resistive load.

Dielectric withstanding voltage is 1500 VAC RMS between open contacts, 2200 VAC RMS between all other mutually insulated conductive elements. The silver alloy contacts are gold flashed to enhance shelf life.

The binding head screw terminals on the contacts are size 8-32 and will accommodate wiring as large as #10 AWG. The binding head screw terminals on the energizing coils are size 6-32 and will accommodate wiring size up to #14 AWG. Use either solid copper wire or stranded copper wire. Mounting requires two #8 screws. See "Installation" instructions for mounting details.

General Safety Information

1. Do not use contacts for electrical loads greater than the rated loads given under "Specifications."
2. Make certain that correct voltage is applied to energizing coil as marked on the relay.
3. Energizing coil and contact circuits must be properly protected with fuses or other effective protecting devices.
4. Use electrical wire of size and type that complies with the National Electrical Code and local codes.
5. Avoid installation in excessively moist, hot, or dusty locations.
6. Provide adequate protection to prevent access by unauthorized or unqualified persons.
7. Provide adequate clearance around the relay to prevent short circuiting and to allow servicing access and free air circulation.
8. Make certain that all electrical power is disconnected when installing, servicing or removing relay.
9. These relays should not be used in explosive atmospheres or when flammable vapors or fumes may come in contact with the relay. Special explosion proof components must be used for such applications.

Installation

1. See section entitled "General Safety Information" before proceeding with installation.
2. Make certain that all electrical power is shut off before installing relay.
3. Select a location for installing the relay that is free of dust, vapor and gaseous contaminants. The relay should be installed in a protective enclosure if contact contamination is likely to occur.
4. The relay should be mounted either with the relay mounting flange horizontal, or with the mounting flange vertical with the contacts pointing down. Up-side-down mounting is not recommended.
5. Two #8 screws with round or pan type heads are required to fasten the relay to its mounting surface. Exact screw length is dependent upon the thickness of the mounting panel and whether or not a nut is used. The relay mounting base is 3/8" in. thick. The mounting screw holes should be 1-7/8" apart, center-to-center.
6. To connect electrical wiring, unscrew each terminal screw enough to allow placing each wire conductor under its respective screw head. Strip 1/2" in. of insulation from the end of each wire conductor and bend it around the screw approximately 180 degrees to form a loop. If the wire is stranded, tin the exposed strands with solder before bending. Tighten the screw. Do not over tighten. Do not use larger than #10 AWG wire on contact terminals or larger than #14 AWG wire on coil terminals.

Maintenance

1. Periodically use compressed air to blow off dust and foreign matter. Make certain that the compressed air is dry and filtered.
2. Periodically check for signs that indicate that malfunctioning is approaching, such as rapid built-up of contaminants, erratic operation, excessive contact wear or pitting. Refer to "Trouble Shooting Chart."

Trouble Shooting Chart

SYMPTOM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Load is not energized, or does not operate.	1. Loose connections. 2. Blown fuses or tripped circuit breakers. 3. Open coil. 4. Incorrect operating control voltage. 5. Relay is incorrectly wired. 6. Operating device that keys relay coil is defective. 7. Load is defective. 8. End of contact life.	1. Tighten any loose connections. 2. Check line fuse, control fuse, and circuit breakers. 3. Check coil continuity with ohm meter. If open, replace relay. 4. Check control circuit to insure voltage is same as stated on relay. 5. Check wiring to determine if relay is wired as intended. 6. Check that relay will operate when power is applied directly to its coil. 7. Check that load operates properly when power is applied directly to it. 8. Replace relay.
Load will not de-energize.	1. Incorrect wiring. 2. Contacts are shorted.	1. Inspect all connections to insure proper wiring. Remove power from coil to see if load de-energizes. If not, contacts are shorted. Contact armature should move inward when power is applied to coil, and move outward when power is removed. 2. Disconnect power leads to contacts. Check contact continuity with coil de-energized. If there is continuity, replace relay.
Erratic Operation.	Contacts sticking or contact pitting.	Clean pole face and mating armature surface with Freon type TF or TMC — also clean contacts. Burnish contacts with a contact burnishing tool.
Rapid build-up of contaminants.	Environment.	Use compressed air to remove dust, etc. Use a protective enclosure.

LIMITED WARRANTY

Dayton Relays are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use (rental use excluded), for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be repaired or replaced at Dayton's option. For warranty claim procedures, see "Prompt Disposition" below. This warranty gives purchasers specific legal rights, and purchasers may also have other rights which vary from state to state.

WARRANTY DISCLAIMER. Dayton has made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit for a particular purpose, or that the products will necessarily conform to the illustrations or descriptions.

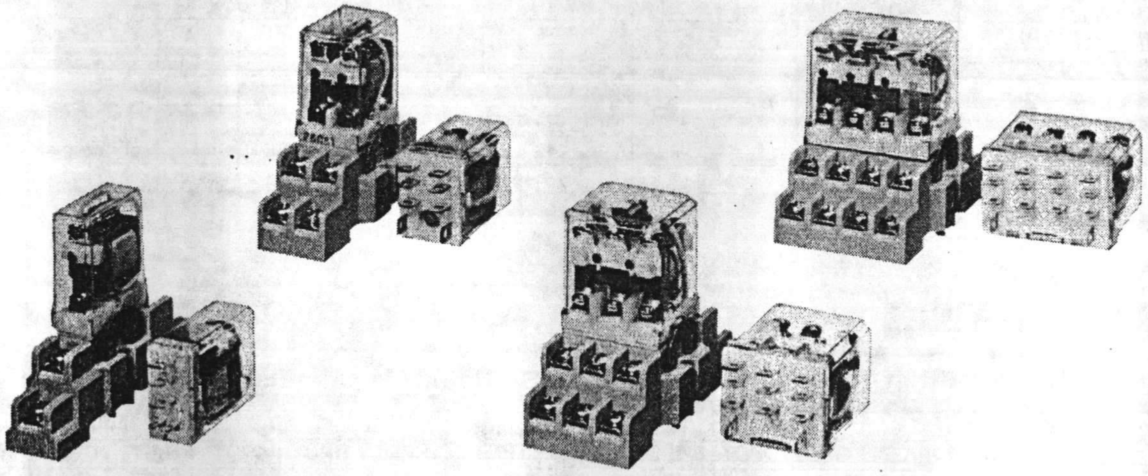
Except as provided below, no warranty or affirmation of fact, express or implied, other than as stated in "LIMITED WARRANTY" above is made or authorized by Dayton, and Dayton's liability in all events is limited to the purchase price paid.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some states do not allow limitations on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

PROMPT DISPOSITION. Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within warranty. For any product believed to be defective within warranty, first write or call dealer from whom product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date and number of dealer's invoice, and describing the nature of the defect. If product was damaged in transit to you, file claim with carrier.

**DAYTON ELECTRIC MFG. CO., 5959 W. HOWARD ST.
CHICAGO, ILLINOIS 60648**

MIDGET POWER TYPE RELAYS
LARGE CAPACITY 10AMP-1, 2, 3, and 4 POLES



GENERAL

IDEC'S yellow RH relays are similar to our general purpose RR-Series in they have a full 10 amp switching capacity. Compact in size the RH-Series relays allows the designer to save space in small control equipment.

These "Midget Power" relays come with SPDT, DPDT, 3PDT and 4PDT contact configurations driven by standard AC or DC coils with a choice of either blade or PCB mount—0.078 in. (2mm) terminals. Top bracket mounting is available for SPDT and DPDT terminal blade models.

FEATURES

- Miniature size package allows compact system designing.
- 10 amp contact capacity.
- Dielectric strength—up to 2,000 volts.
- UL recognition and CSA approved (3PDT UL recognition pending).
- Indicator light or check button available on 2 and 4-pole models.
- Complete accessories include IDEC'S broad family of sockets, hold-down springs, and mounting tracks.

UL Recognized
File No. E67770
E59804A
E64245

CSA Approved
File No. LR35144

UL Recognized and CSA Certified
(SPDT, DPDT and 4PDT) 3PDT U.L. recognition pending

COIL RATINGS

Rated Voltage (V)		Rated Current (mA) ±15% at 20°C 60 Hz SPDT	60 Hz DPDT	60 Hz 3PDT	60 Hz 4PDT	50 Hz SPDT	50 Hz DPDT	50 Hz 3PDT	50 Hz 4PDT	Coil Resistance (Ω) ±10% at 20°C SPDT	DPDT	3PDT	4PDT	Continuous Applied Voltage (Max.) 20°C	Pick up Voltage (min.) at 20°C
AC	6V	150	200	280	330	170	238	330	387	18.8	9.6	6.0	5.4	110% of rated voltage without overheating	80% of rated voltage
	12V	75	100	140	165	86	118	165	196	76.8	40.5	25.3	21.2		
	24V	37	50	70	83	42	59.7	81	98	300	156.7	103	84.5		
	120V	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	7680	4280	2770	2220		
	*240V	—	5.5	7.1	8.3	—	6.5	8.2	9.8	—	15720	12110	9120		
		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT		
DC	6V	128		150		240		250		47	40	25	24	110% of rated voltage without overheating	80% of rated voltage
	12V	64		75		120		125		188	160	100	96		
	24V	32		36.9		60		62		750	650	400	388		
	48V	18		18.5		30		31		2660	2660	1600	1550		
	*110V	—		9.1		12.8		15		—	12100	8600	7340		

Note: Rated voltages marked with * are not available for SPDT models.

CONTACT RATING

UL Rated (RH1, RH2, RH4)

Voltage (V)	Resistive (A) SPDT, DPDT	Resistive (A) 4PDT	Inductive (A) SPDT, DPDT	Inductive (A) 4PDT
120 AC	10	10	7	7.5
240 AC	10	7.5	7	5
28 DC	10	10	7	
30 DC	10		7	

Horse power rating: 1/3 HP . . . @ 240V AC, 1/6 HP . . . @ 120V AC

CSA Rated Nominal Rating (RH1, RH2, RH4)

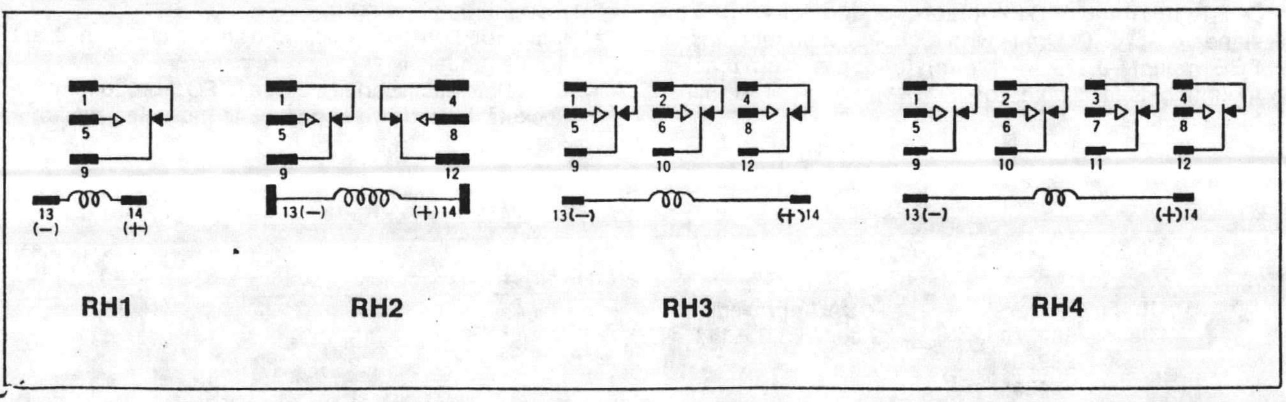
Voltage (V)	Resistive (A) SPDT	Resistive (A) DPDT	Resistive (A) 4PDT	Inductive (A) SPDT	Inductive (A) DPDT	Inductive (A) 4PDT
110 AC	10	10	10	7	7.5	7.5
220 AC	7	7.5	7.5	4.5	5	5
30 DC	10	10	10	7	7.5	

Nominal Rating for RH3

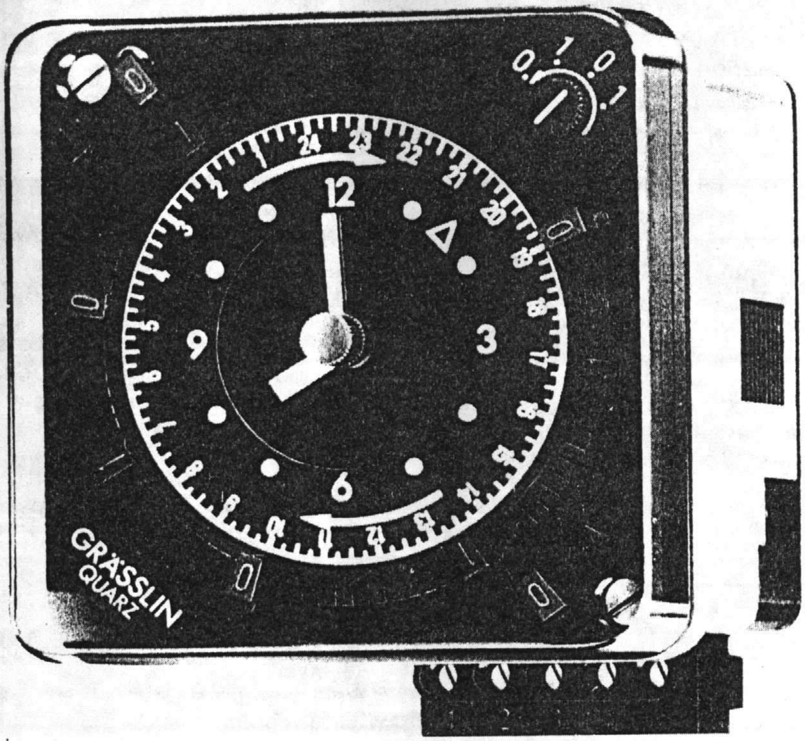
Voltage (V)	Resistive (A) 3PDT	Inductive (A) 3PDT
110 AC	10	7.5
220 AC	7.5	5
30 DC	10	7.5

U.L. recognition pending

CIRCUIT DIAGRAM



MIL 2008 Time Switches by Grasslin



ENERGY CONTROL WITH SWITCHING ACCURACY

- Compact size
- Genuine clock face
- Daily or weekly program
- Running reserve option
- High rated gold-plated silver contacts
- Modern dustproof design
- Manual override with indicator
- Easy programming

MIL 2008 S, MIL 2008 Q

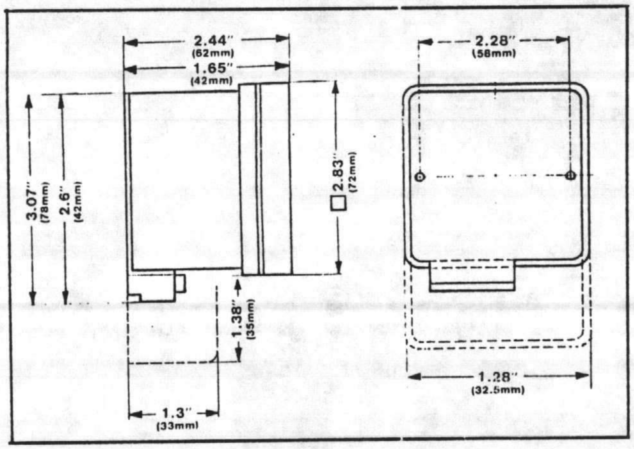
Technical Data	Synchronous Model	Quartz Stabilized Model
• Clock Drive 24V, 120V or 240V 60Hz	Yes	Yes
• Switching Contacts, SPDT, 10Amp, 250V	Yes	Yes
• Switching Time		
Weekly Program, 1 Hour Intervals, 3 Hour min.	Yes	Yes
Daily Program, 15 Minute Intervals, 30 Minute min.	Yes	Yes
• Running Reserve	Optional - 12 Hrs.	50 Hrs.
• Synchronous Motor Power Consumption	2 Watts	---
• Quartz Stabilized Stepping Motor Power Consumption	---	5.5 Watts
• Ambient Temperature Range	−4° to 130° F	−4° to 122° F
• Surface, Flush or DIN Rail Mounting	Yes	Yes
• UL recognized and CSA approved	yes	yes

The MIL 2008 time controls are universally proven products incorporating the latest design technology and the highest quality standards. Their small size, versatility and different mounting configurations make them ideally suited for all time based control applications.

Models available include both synchronous and quartz driven, with spring reserve for hostile environments of 12 hours or battery back-up for 50 hours. All models are available with 24-hour or 7-day program dial.

The genuine clockface allows for accurate setting and also serves as a clock. Its unique construction prevents the clockface hands from being accidentally pushed out of synchronization with the dial. Colorful green (on) and red (off) trippers make programming self-evident and permit quick readout of programs. The standard manual switch and program status indicator allow for immediate override without reprogramming the time control.

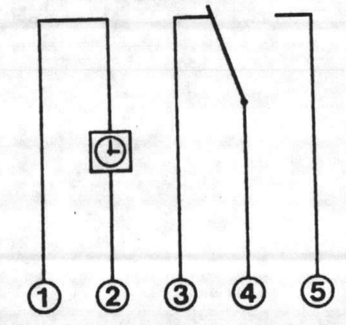
The economically priced MIL 2008 time controls are available with indoor or outdoor enclosures for stand-alone applications.



Legend for ordering MIL 2008
SF = Synchronous
QF = Quartz
R = Reserve
W = Weekly Program
T = Daily Program
u = SPDT Switch (standard)
E = Flush Mount Bracket

e.g.
MIL 2008 QFRWu - 120 Volts
Quartz stabilized weekly time switch with reserve, SPDT switch.
Note: Specify voltage

Terminal Connections



Distributed by:

GRASSLIN CONTROLS CORPORATION
45 Spear Road, Ramsey, NJ 07446
Tel: 201-825-9696

SWITCH OVER TO GRASSLIN!

Printed in U.S.A. 020 US 01.84

RUSKIN®

PO BOX 129 Grandview, Mo. 64030

RCD 45 SERIES
CONTROL DAMPERS FOR THE TEMPERATURE CONTROL INDUSTRY

RCD45 SERIES FEATURES

- **STRONG FRAME**

  Roll formed galvanized steel, double thickness reinforced for structural strength equal to 13 gage channel type frames.

- **RUGGED BLADES**

  Triple v-groove, 16 gage galvanized steel. Parallel or opposed action available.

- **LEAKAGE OPTIONS**

— ½% maximum leakage for Model RCD46, which meets the often specified "less than 10 cfm/ft² leakage at 4" w.g. Δ P".
— 1% maximum leakage for Model RCD45.
— 2+% leakage for Model RCD44.

- **SHAKEPROOF LINKAGE**

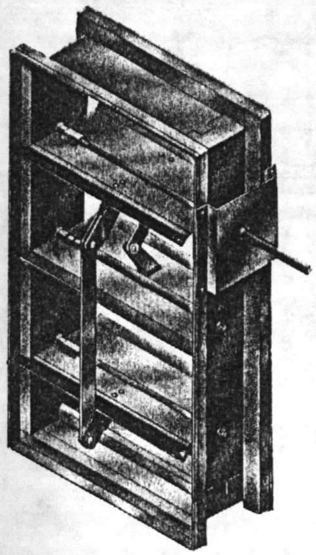
  Low maintenance face linkage.

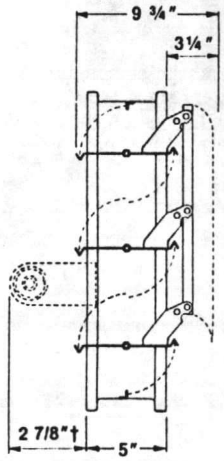
- **LONG LIFE AXLES AND BEARINGS**

  Hex axles lock firmly with blades.
  Noncorrosive bearings operate smoothly.

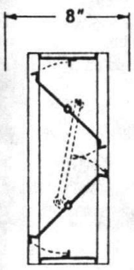
- **SECURE OPERATING SHAFT**

  Low friction outboard ball bearing support eliminates torque loss and operating problems. Factory installed jackshaft provided on multiple sections.





PARALLEL BLADE



OPPOSED BLADE

Low profile frame illustrated is typical for units under 14" high.

†Jackshaft used only on multiple section dampers.
* Unit furnished approximately ¼" smaller than given opening dimensions.
**Maximum section width varies with static pressure. Consult Ruskin when the application involves pressures in excess of 2.5 inches w.g. or air velocities in excess of 2000 fpm.

STANDARD CONSTRUCTION

FRAME
5" x 1" x 16 gage galvanized steel channel with corner braces. Low profile top and bottom 3½" x ⅜" x 16 gage galvanized steel channel on units under 14" high. Slightly different frame (see back of page) supplied with dampers made at Ruskin's California plant.

BLADES
Maximum 8" wide, 16 gage galvanized steel on approximately 8" centers.

SEALS
RCD46 — Flexible metal jamb seals and EPDM blade seals.
RCD45 — Flexible metal jamb seals and polyurethane foam blade seals.
RCD44 — No jamb or blade seals.

LINKAGE
Exposed. Concealed in frame on units under 14" high.

AXLES
½" plated steel hex.

BEARINGS
Synthetic.

CONTROL SHAFT
Removable ½" diameter control shaft extends 6" beyond frame. Outboard support bearings supplied with all single section dampers for field mounted motors. Factory installed jackshaft provided on multiple section dampers.

FINISH
Mill.

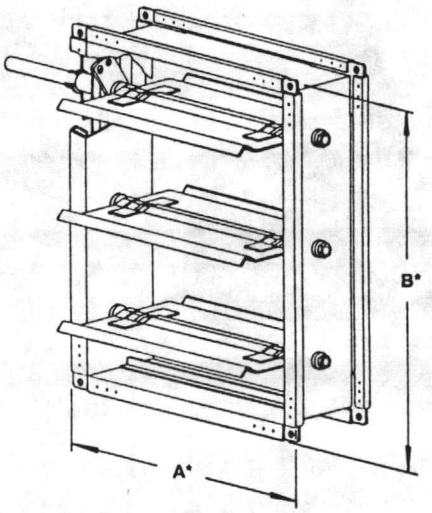
MINIMUM SIZE (A x B Dimensions)
Single blade, parallel action — 5"w x 5"h.
Two blade, parallel or opposed action, concealed linkage — 5"w x 8"h.
Two blade, parallel or opposed action, exposed linkage — 8"w x 14"h.

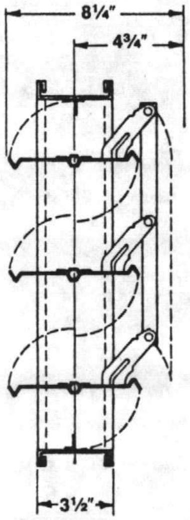
MAXIMUM SIZE (A x B Dimensions)**
Single section — 48"w x 72"h.
Multiple section assembly — Unlimited size.

Spec RCD45-1186/Replaces RCD45-886

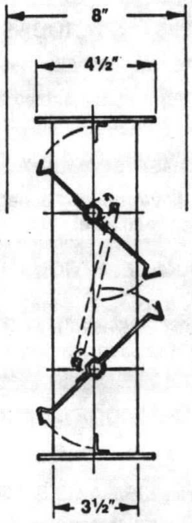
CALIFORNIA PLANT ALTERNATE FRAME

RCD45 dampers supplied from the Ruskin California Plant are constructed with a frame as shown in the following details.





PARALLEL BLADE



OPPOSED BLADE

Low profile frame illustrated is typical for units under 14" high.

BRACING OF MULTIPLE SECTION DAMPER ASSEMBLIES

RCD45 Series dampers are intended to be self supporting only in largest single section size. Multiple section damper assemblies may require bracing to support the weight of the assembly and to hold against system pressure. Ruskin recommends appropriate bracing to support the damper horizontally at least once for every 8′ of damper width. Vertical assemblies and higher system pressures may require more bracing.

INSTALLATION

Thrust bearings are required on dampers with blades running vertically but not recommended when dampers are equipped with jamb seals. Order vertical blade dampers with blades running in A dimension, as illustrated, but add note to "Provide thrust bearings — dampers will be installed with blades vertical."

Dampers must be installed square and free from racking. Opposed blade dampers must be operated from a power blade. All dampers must be operated from the linkage side of dampers with off center linkages.

RUSKIN®

P.O. Box 129
Grandview, MO 64030
816 761 7476
Telex 42 4192
Easylink 62894886

PHILIPS INDUSTRIES INC.

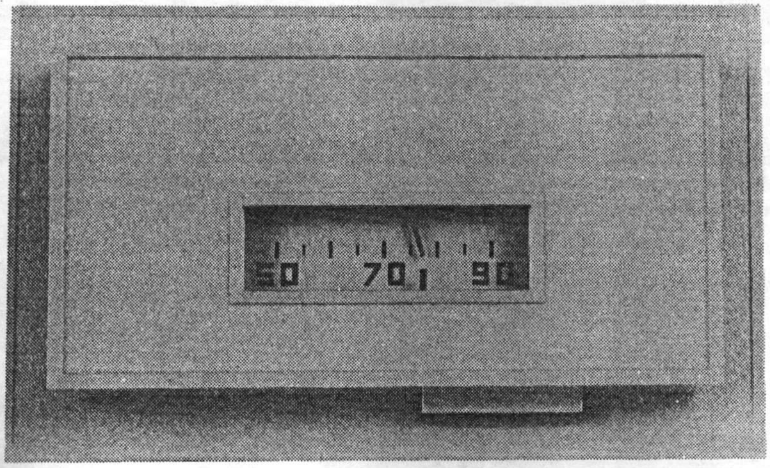
KMC

KREUTER MANUFACTURING COMPANY

DATA SHEET

CTC-1501
CTC-1502

Room Thermostat
Single Temperature
Two-Pipe



DESCRIPTION

The CTC-1501 and CTC-1502 room thermostats are designed for use in HVAC systems for the control of pneumatic valves and damper actuators. These units are fully proportional, two-pipe type, relay thermostats which require main air at the thermostat.

Single set-point units for either direct-acting or reverse-acting applications, these thermostats offer several mounting methods, including the ability to mount on a 2"x 4" electrical box.

The cover design allows for a visible or concealed thermometer, exposed or concealed set-point, or a blank window. In addition, stops are available which allow a locked set-point or a restricted adjustment range.

Celsius markings, vertical scales and special finishes are available if required.

SPECIFICATIONS

MODELS: CTC-1501; direct acting
CTC-1502; reverse acting

SUPPLY PRESSURE: 20 psig (1.38 bar) operating
30 psig (2.07 bar) maximum
(port m)

AIR CONSUMPTION: .7 scfh @ 20 psig (.33 l/m)

SET-POINT RANGE: 55° to 85°F (13° to 29°C)

PORPORTIONAL BAND: 4°F (22.2°C)

MATERIAL: Biege ABS

THERMOMETER: Bimetal

COVER TYPES: Full cover furnished

WEIGHT: 4.0 ounces without packaging

AMBIENT LIMITS: +40°F/+120°F operating
(+4°C/ +49°C)
−40°F/+140°F shipping
(−40°C/+60°C)

ORDERING INFORMATION

SPECIFY:
A. Model Number
B. Vertical cover if required
C. Celsius scale if required
D. Adjustable stops if required
E. Opaque window if required
F. 3/32" ID Tygothane spring tube kits if required

ORDER FROM:
Local KMC Dealer or
Kreuter Manufacturing Co.

DIMENSIONS

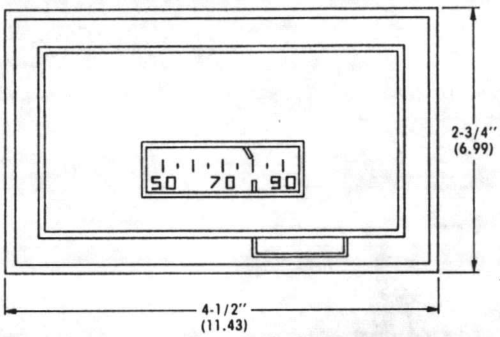


FIGURE 1

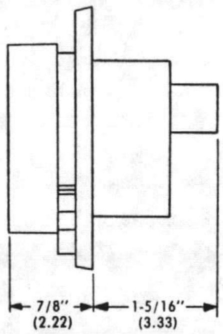


FIGURE 2

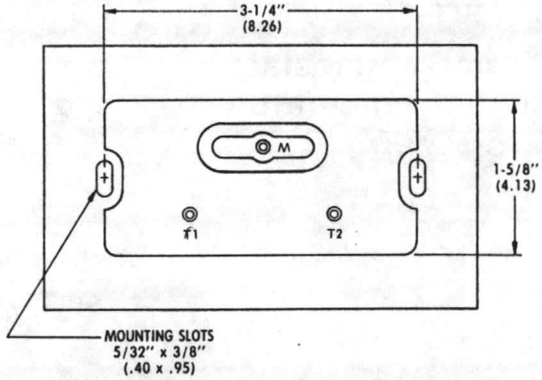


FIGURE 3

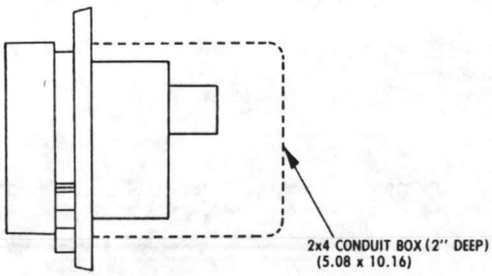


FIGURE 4

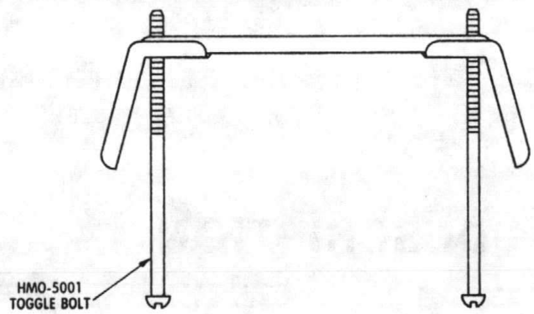


FIGURE 5

INSTALLATION - CALIBRATION

As shown above in figures 4 and 5, these units may be mounted in several ways. Each thermostat base contains two mounting slots which are sized to directly match a 2" x 4" electrical handy box, or they may be mounted directly to a hollow wall using the HMO-5001 toggle bolt assembly, which must be ordered separately.

Each unit is furnished with 6-32 x 1-¼" mounting screws. 3/32" I.D. tygothane tubing, and adaptor fittings for standard ¼" O.D., F.R. tubing are available and must be ordered separately.

Upon receipt, no thermal calibration should be required. However, an output gauge tap is located under the thermostat cover, and complete calibration instructions can be found on installation/calibration sheet #IC-048 which is packed with each unit.

This series of room thermostat should be supplied with clean, dry, control, air only. No attempt should be made to use any other meduim.

MAINTENANCE

Each CTC-1501 and CTC-1502 thermostat is constructed with long-term reliability in mind. The thermostat cover is not readily removable, so the chance of occupant damage is reduced.

While there are no routine maintainence requirements, careful installation will enhance performance. Care should be taken to keep the unit clear from dust during job construction.

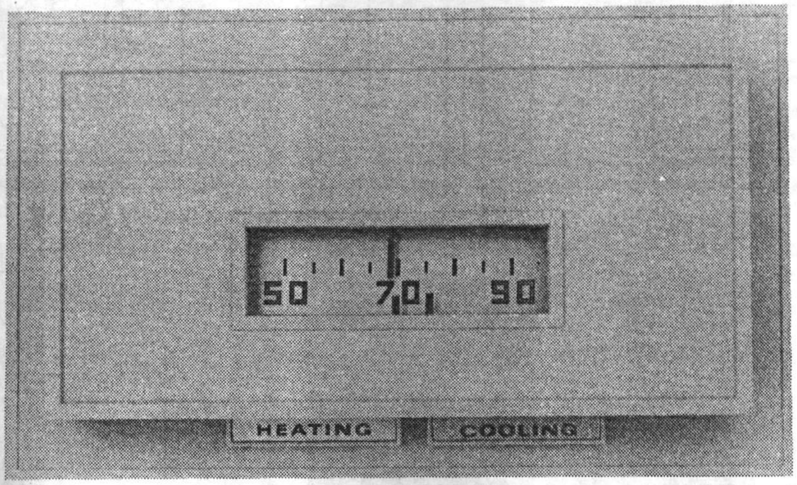
KMC

KREUTER MANUFACTURING COMPANY

DATA SHEET

CTC-1503
CTC-1504
CTC-1505
CTC-1506

Room Thermostat
Dual/Dead-Band
Two-Pipe



DESCRIPTION

This series of pneumatic thermostats was designed for the control of valves and damper actuators in HVAC systems. These are fully proportional, two-pipe, relay units which require main air at the thermostat.

Dual units for heating-cooling applications are available with any combination of direct-acting or reverse-acting set-points to allow complete flexibility in system design. Individual set-point sliders allow for an adjustable dead-band between control points.

The cover design allows for a visible or concealed thermometer, exposed or concealed set-points, or a blank window. In addition, stops are available which allow a locked set-point or a restricted adjustment range.

Celsius markings, vertical scales and special finishes are available if required.

SPECIFICATIONS

MODELS: CTC-1503; D.A. Cooling-R.A. Heating
CTC-1504; D.A. Cooling-D.A. Heating
CTC-1505; R.A. Cooling-R.A. Heating
CTC-1506; R.A. Cooling-D.A. Heating

SUPPLY PRESSURE: 20 psig (1.38 bar) operating, 30 psig (2.07 bar) maximum (port m)

AIR CONSUMPTION: 1.5 scfh @ 20 psig (.33 l/m)

SET-POINT RANGE: 55° to 85°F (13° to 29°C)

PORPORTIONAL BAND: 4°F (22.2°C)

MATERIAL: Biege ABS

THERMOMETER: Bimetal

COVER TYPES: Full cover furnished

WEIGHT: 4.0 ounces without packaging

AMBIENT LIMITS: +40°F/+120°F operating (+4°C/ +49°C)
−40°F/+140°F shipping (−40°C/+60°C)

ORDERING INFORMATION

SPECIFY: A. Model Number
B. Vertical cover if required
C. Celsius scale if required
D. Adjustable stops if required
E. Opaque window if required
F. 3/32" ID Tygothane spring tube kits if required

ORDER FROM:
Local KMC Dealer or
Kreuter Manufacturing Co.

DIMENSIONS

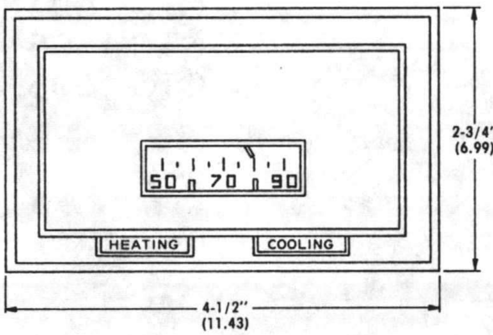


FIGURE 1

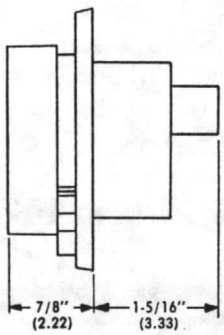


FIGURE 2

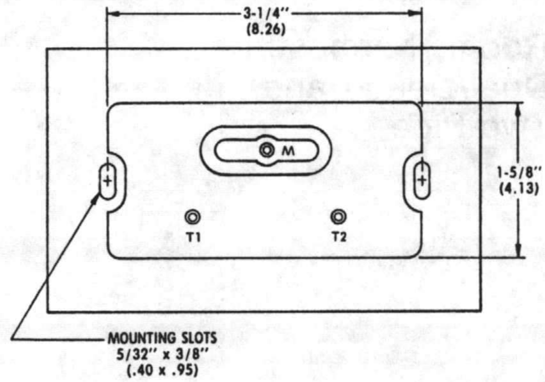


FIGURE 3

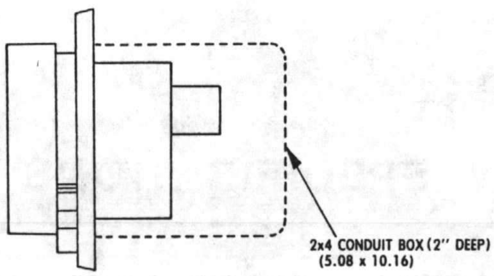


FIGURE 4

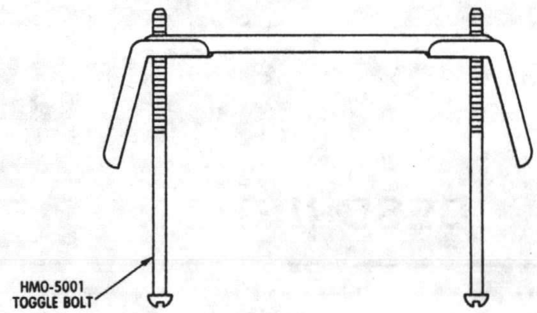


FIGURE 5

INSTALLATION - CALIBRATION

As shown above in figure 4 and 5, these units may be mounted in several ways. Each thermostat base contains two mounting slots which are sized to directly match a 2" x 4" electrical handy box, or they may be mounted directly to a hollow wall using the HMO-5001 toggle bolt assembly, which must be ordered separately.

Each unit is furnished with 6-32 x 1-¼" mounting screws. 3/32" I.D. tygothane tubing, and adaptor fittings for standard ¼" O.D., F.R. tubing are available and must be ordered separately.

Upon receipt, no thermal calibration should be required. However, an output gage tap is located under the thermostat cover, and complete calibration instructions can be found on installation/calibration sheet #IC-048 which is packed with each unit.

This series of room thermostat should be supplied with clean, dry, control air only. No attempt should be made to use any other meduim.

MAINTENANCE

Each CTC-series thermostat is constructed with long-term reliability in mind. The thermostat cover is not readily removable, so the chance of occupant damage is reduced.

While there are no routine maintenance requirements, careful installation will enhance performance. Care should be taken to keep the unit clear from dust during job construction.

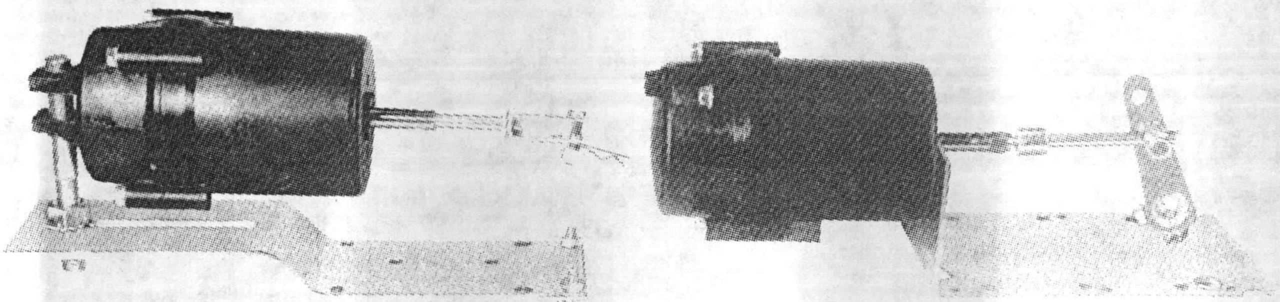
KMC

KREUTER MANUFACTURING COMPANY

DATA SHEET

MCP-1030
MCP-1130

Damper Actuator
3" Stroke



MADE IN USA

DESCRIPTION

The MCP-1030 and MCP-1130 series of Pneumatic Damper Actuators are designed for use in pneumatic control systems for positioning of automatic air dampers. The actuators may be used for either gradual or two-position applications.

The actuators are available in right-angle bracket mounting and post mounting. Both styles may be furnished with a positive positioner.

SPECIFICATIONS

EFFECTIVE AREA: 7 sq. in. (45 sq. cm.)

NORMAL STROKE: 3.0 inches (76 mm)

SUPPLY PRESSURE: 0 to 20 PSIG (0-1.4 Bar) normal operating; 30 PSIG (2.07 Bar) maximum

MATERIALS: Body, glass-filled nylon; diaphragm, neoprene

SPRING RANGES: 3-12, 5-10, 8-13, 10-15 and 4-8

POSITIVE POSITIONER: Start point adjustable; span fixed at 5 PSI (.34 Bar) standard; 10 PSI (.69 Bar) optional. Metal and non-metal positioners available.

DAMPER RATING: Gradual = 12 sq. ft. (1.1 sq. m.) @ 1000 FPM.Two-Position = 15 sq. ft. (1.4 sq. m.) @ 1000 FPM

CONNECTIONS: 3/16" (4.7 mm) nipples for ¼" (6.4 mm) O.D. polyethylene tubing

WEIGHT: 3.25 pounds (1.47 KG)

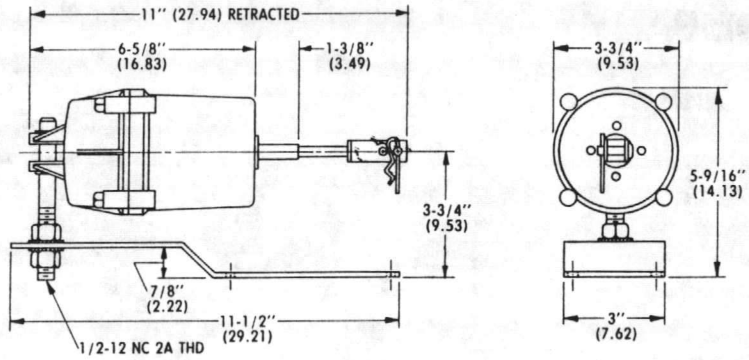
AMBIENT LIMITS: +40/+120°F operating (+4/+49°C)
−40/+140°F shipping (−40/+60°C)

ORDERING INFORMATION

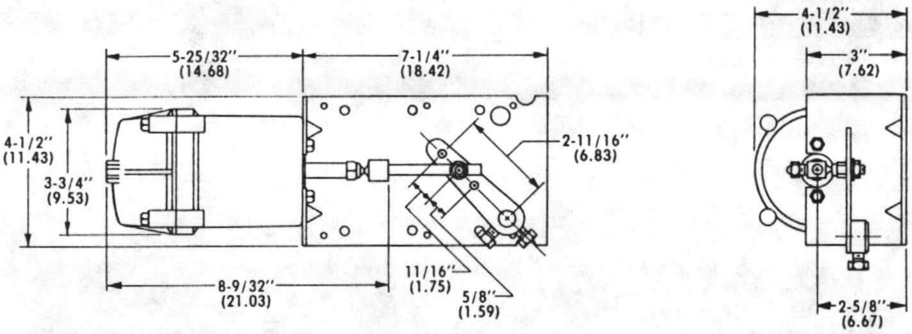
SPECIFY: Complete Model number as applications dictate

ORDER FROM:
Kreuter Manufacturing Co.

DIMENSIONS



MC-1130



MCP-1030

INSTALLATION - CALIBRATION

Best results are obtained when actuators are mounted on the outside of the duct or air handling unit. This method of mounting offers the advantages of ease of installation, ready access for service and isolation from internal duct conditions.

The angle bracket actuator requires no additional mounting devices. Position the angle bracket so that one of the two cutouts in the front is adjacent to the damper shaft. The selection depends on whether clockwise or counter-clockwise rotation of the damper shaft is required. Install the crank arm loosely on the damper shaft before the bracket is firmly affixed to the ductwork. Use sheet metal screws to attach the bracket to the ductwork, line up the crank arm, check the position of the damper, and tighten the crank arm set screws. The actuator is then positioned to provide the 90° rotation normally required.

For models supplied with a positioner, the MCP-1030 and MCP-1130 models are pre-piped from the positioner output to the actuator input with ¼" FR polyethylene tubing. The input signal to the positioner is connected to port 2, and main air to the center port of the positioner.

Although the positioned actuator itself contains an 8-13 PSI Spring, the positioner allows it to operate over any 5 PSI span, with the start-point being adjustable from 3 to 12 PSI. To change positioner start-point, the desired signal pressure should be applied to port 2 of the positioner, and the start-point adjustment rotated until the actuator just starts to stroke. The span of the actuator is fixed by the standard 5 PSI feedback spring on the positioner. If a wider span is desired, this spring may be replaced with an optional 10 PSI span spring.

These actuators should be used only with clean, dry control air. No attempt should be made to use any other medium.

MAINTENANCE

The MCP-1030 and MCP-1130 series are ruggedly designed for long-term reliability. Although there are no distinct maintenance requirements, care should be taken during installation to assure smooth linkage operation.

KMC

KREUTER MANUFACTURING COMPANY

DATA SHEET

RCC - 1001
RCC - 1012
RCC - 1101
RCC - 1112

Reversing Relays
Adjustable; Pilot
Capacity

MADE IN USA

DESCRIPTION

The RCC-1000 series pilot capacity reversing relays are designed for reversing a proportional signal from a controlling device. The relays are factory adjusted to decrease the branch line pressure as the input pressure increases. A bias adjustment is provided to retard or advance the output if required.

These devices are used where the desired output signal to the controlled device is to be the reverse of the source signal. Two different factory calibration points may be selected, for 8 psi or 9 psi crossover depending on system requirements.

Their size and light weight make them suitable for in-line mounting. The unit may be mounted in any position, and the RCC-1101 & RCC-1112 are furnished with a right angle mounting bracket.

SPECIFICATIONS

RCC - 1001: 9 psi calibration; w/o bracket
RCC - 1012: 8 psi calibration; w/o bracket
RCC - 1101: 9 psi calibration; w/ bracket
RCC - 1112: 8 psi calibration; w/ bracket

MAXIMUM PRESSURE: 30 psig (2.07 bar)

CONNECTIONS: 3/16" (4.7 mm) nipples for ¼" (6.4 mm) O.D. polyethylene tubing

AIR CONSUMPTION: 0.6 scfh (.283 l/m)

AIR CAPACITY: 0.6 scfh (.283 l/m) @ 20 psig (1.38 bar)

MATERIAL: ABS

WEIGHT: 1.5 oz. w/o bracket; 2.0 oz. with

AMBIENT LIMITS: +40°F/+120°F operating (+4°C/+49°C)
−40°F/+140°F shipping (−40°C/+60°C)

MOUNTING: In-line via air connections, or bracket

BIAS ADJUSTMENT: ± 15 psi

ORDERING INFORMATION

SPECIFY: MODEL NUMBER

ORDER FROM:
Local KMC Dealer or
Kreuter Manufacturing Co.

DIMENSIONS

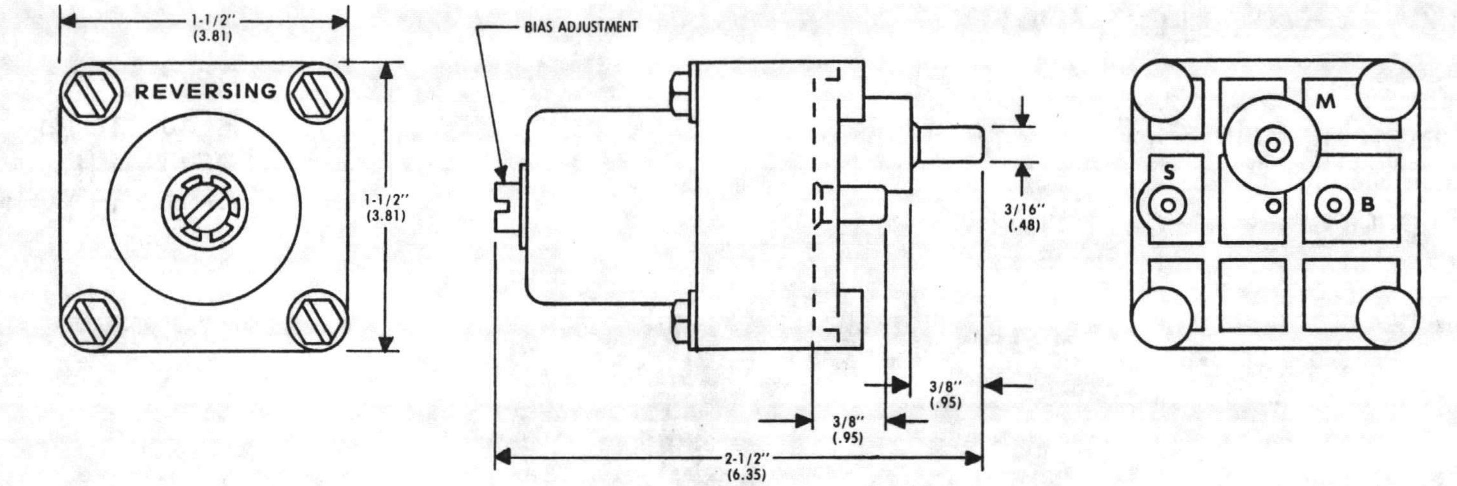


FIGURE 1

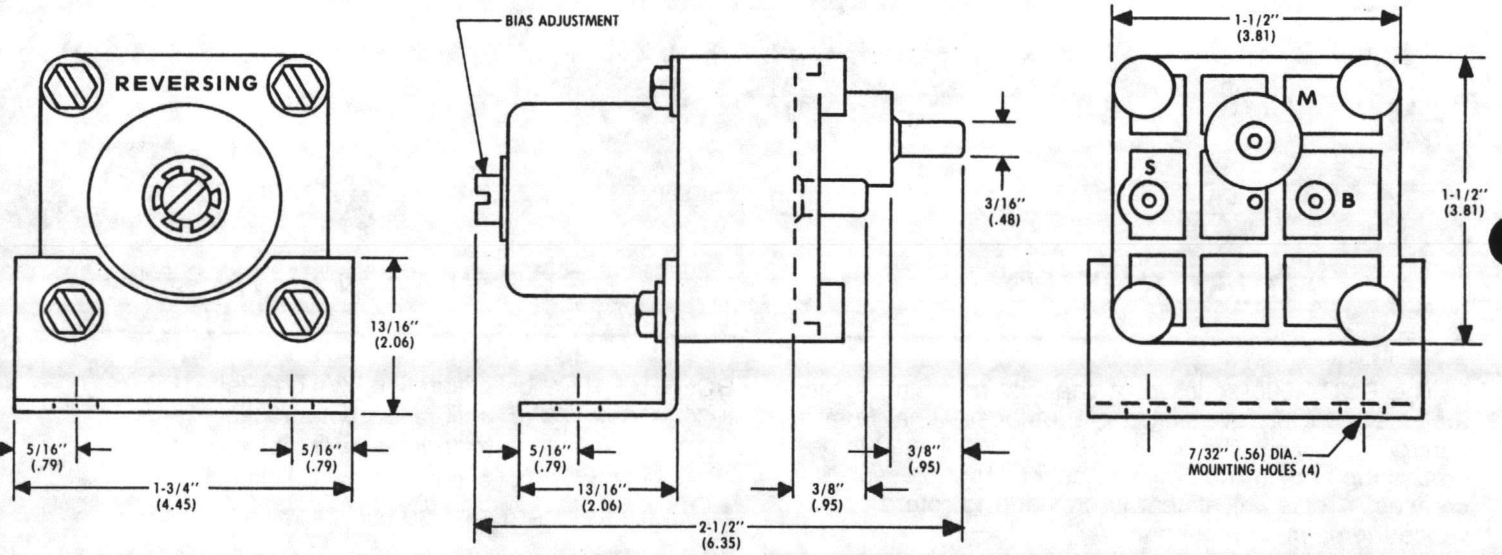


FIGURE 2

INSTALLATION - CALIBRATION

As shown above, in figure 1, the RCC-1001 and RCC-1012 reversing relays are designed for in-line mounting. The connections are sized to readily accept ¼" O.D. polyethylene tubing. The RCC-1101 and RCC-1112 shown in figure 2 are furnished with integral right angle mounting brackets.

The M port is main air, port S is the input and port B is the output.

These relays should be used with clean, dry, control air. No attempt should be made to use any other medium.

MAINTENANCE

Each reversing relay is constructed to assure trouble free operation. While there are no maintenance requirements, caution should be taken to assure that the tubing will not be kinked during installation.

DYNACON INC
Post Office Box 29220, Richmond, Virginia 23229
5801 School Avenue, Richmond, Virginia 23228
(804) 262-0376

Product Data K-700-1
E-P RELAYS (PLASTIC BODY)
July 1, 1986

"EPY" and "EPJ" Series PLASTIC BODY E-P RELAYS

GENERAL DESCRIPTION

The "EPY" and "EPJ" series Electric-Pneumatic Relays are two position, three-way solenoid air valves commonly used to interface between electrical and air or pneumatic circuits. With a lightweight valve body molded from high strength Celcon, these E-P Relays are provided with barb connections for 1/4" polyethylene tubing at all three air ports.

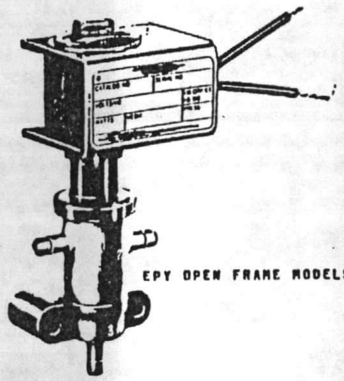
Typical applications include switching branch or main air signals from one source or pressure to another; supplying pressure to or exhausting pressure from control devices such as damper motors or valves; and, initiating a change in control function such as in occupied-unoccupied, summer-winter, or outdoor change over applications.

All models are U. L. LISTED.

"EPY" OPEN FRAME MODELS

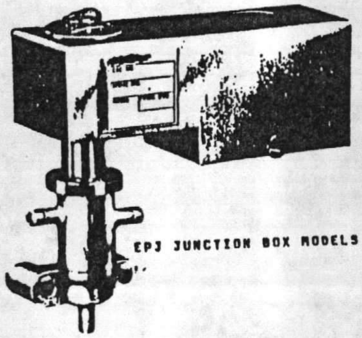
With their compact and lightweight (4.5 ounces) design, the "EPY" Open Frame E-P Relays are IDEAL FOR PANEL MOUNTING. Two mounting holes are molded into the valve body. The "EPY" series can be mounted in any position, and the coil can be rotated through 360 degrees.

The 24 VAC, 120 VAC and 240 VAC "EPY" models are supplied with 18-inch leadwires. All other models have 6-inch leads.



EPY OPEN FRAME MODELS

"EPJ" JUNCTION BOX MODELS



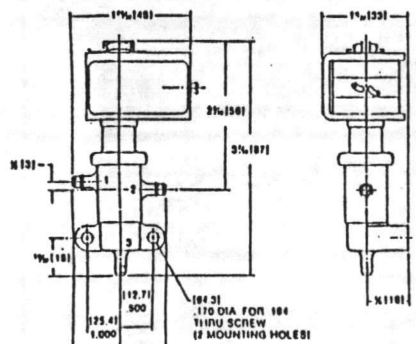
EPJ JUNCTION BOX MODELS

The "EPJ" series E-P Relays are supplied with a NEMA 1 Junction Box Enclosure are are IDEAL FOR EITHER WALL OR PANEL MOUNTING. The Junction Box includes two knockouts for 1/2" conduit and an integral grounding screw for easy wiring. Coil leads extending into the Junction Box are 6-inches.

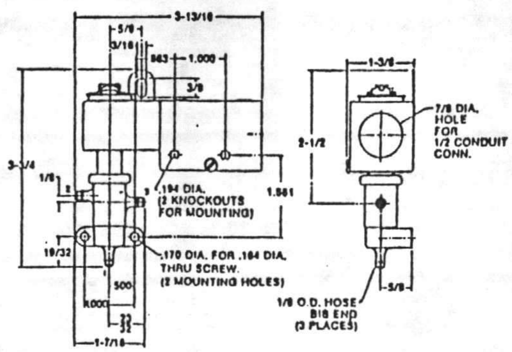
Two mounting holes are molded into the valve body, and an additional mounting ear is provided on the Junction Box. The "EPJ" models can be mounted in any position, and the coil and Junction Box rotated through 360 degrees.

SPECIFICATIONS

	EPY OPEN FRAME MODELS	EPJ JUNCTION BOX MODELS
AIR CONNECTIONS	Barbs for 1/4" Poly Tubing	Barbs for 1/4" Poly Tubing
ELECTRICAL CONNECTIONS	18" Leads on 24, 120, 240 VAC; 6" Leads on All Other Voltages	NEMA 1 Junction Box Enclosure; 6" Leadwires
AVAILABLE VOLTAGES	24,120,208,240,480 VAC, 24 VDC	24,120,208,240,480 VAC, 24 VDC
MAXIMUM AMBIENT TEMPERATURE	110 degrees F	100 degrees F
POWER CONSUMPTION	5.7 Watts (AC), 9.7 Watts (DC)	5.7 Watts (AC), 9.7 Watts (DC)
MAX. OPERATING PRESS. DIFF.	30 PSI	30 PSI
CAPACITY	Cv 0.06	Cv 0.06
WEIGHT	4.5 Ounces	7 Ounces
AGENCY LISTINGS	UL, CSA	UL, CSA
SWITCHING ACTION (ALL) 3 = "Common" Port 2 = "Normally Open" Port 1 = "Normally Closed" Port	Universal - Air Pressure at Any Port. When de-energized, COMMON and NORMALLY OPEN ports are connected, and NORMALLY CLOSED port is blocked. When energized, COMMON and NORMALLY CLOSED ports are connected, and NORMALLY OPEN port blocked.	



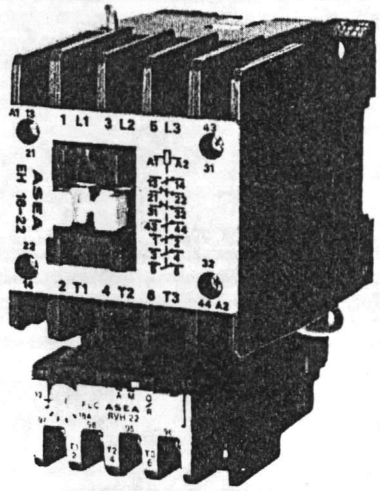
"EPY" OPEN FRAME MODELS



"EPJ" JUNCTION BOX MODELS

Features

Compact Design
Starters



SIZE 2

- Compact space savings design
- Six NEMA sizes, 00-2 with in-between sizes
- Maximum horsepower ratings
- Fast, snap-on DIN rail mounting
- Lowest possible contact bounce
- Computer designed magnet structure
- UL, CSA, & most international standards
- Snap-on front mounted accessories available including mechanical latch, pneumatic timer, and 2 & 4 pole auxiliary contact blocks
- 2 N.O. & 2 N.C. auxiliary contacts are standard on NEMA sizes ¾ to 2
- Touch safe, finger-proof design for sizes 00 & 0
- Easy coil change without tools
- Captive terminal screws
- High reliability
- Long trouble free mechanical life
- Class 10 close coupled adjustable overload relay
  - Single phase & phase unbalance protection
  - Isolated alarm circuit (N.O.) contact
  - Ambient compensation from −20°C to +65°C
  - Manual test
  - Manual or automatic reset
  - Factory calibrated and tested for high accuracy
  - Self contained heater coils — no field installation is necessary (Included in price)
  - Wide adjustment range

NEMA and EH COMPACT DESIGN RATINGS COMPARISON

NEMA SIZE	NEMA RATING MAX. H.P. RATINGS 230V	NEMA RATING MAX. H.P. RATINGS 460V	EH HORSEPOWER RATING MAX. H.P. RATINGS 230V	EH HORSEPOWER RATING MAX. H.P. RATINGS 460V	ASEA TYPE
00	1.5	2	2	5	EH-9
0	3	5	3	7.5	EH-12
¾	—	—	5	10	EH-16
1	7.5	10	7.5	15	EH-22
1½	—	—	10	20	EH-32
2	15	25	15	30	EH-40

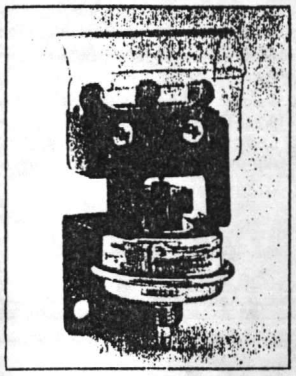
STARTER RATING INFORMATION

NEMA SIZE SINGLE	NEMA SIZE 3-PHASE	ASEA TYPE	AMPERE RATING	MAX. HP SINGLE PHASE 115V	MAX. HP SINGLE PHASE 230V	MAX. HP 3-PHASE 230V	MAX. HP 3-PHASE 460V	MAX. HP 3-PHASE 575V	OPEN STARTER OUTLINE DIMENSIONS WIDE	HIGH	DEEP	WGT. LBS.	TERMINAL WIRE SIZE
00	00	EH 9	12	½	2	2	5	5	2 1/8	4 29/64	4 29/64	1.3	(2)AWG.#12
00+	0	EH 12	18	¾	2	3	7½	7½	2 1/8	4 29/64	4 29/64	1.3	(2)AWG.#12
0	¾	EH 16	18	1	3	5	10	15	2 21/32	4 11/16	4 29/64	1.75	(2)AWG.#10
¾	1	EH 22	27	1½	3	7½	15	20	2 21/32	4 11/16	4 29/64	1.9	(2)AWG.#10
1	1½	EH 32	35	2	5	10	20	25	3	5 29/32	4 7/16	2.5	AWG.# 8
2	2	EH 40	45	3	7½	15	30	40	3	6 11/32	4 11/64	2.5	AWG.#10

DYNACON INC
Post Office Box 29220, Richmond, Virginia 23229
5801 School Avenue, Richmond, Virginia 23228
(804) 262-0376

Product Data K-700-3
P - E SWITCHES
July 1, 1986

PNEUMATIC - ELECTRIC SWITCHES (Panel Mount)



GENERAL DESCRIPTION

Dynacon's 3000-series relays are pneumatic-electric switches designed to convert a pneumatic signal to an electrical output. In operation, movement of a diaphragm (in response to changes in pressure) actuates a SPDT electric switch to provide switching action.

Typical applications include using a predetermined air pressure signal (PE relay setpoint) to complete an electrical circuit for on/off control of pumps, fans, air compressors, duct heaters, electric strip heaters, pilot lights or alarms, or other electrical equipment.

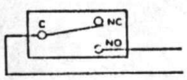
These relays are supplied less case and cover, and are intended for mounting in panels or other suitable enclosures. All models feature rugged steel construction for general purpose use and are supplied with insulators shielding electrical connections.

U.L. Recognized under U.L. File #MH11121, Guide #MFHX2.

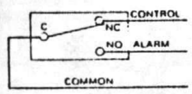
ELECTRICAL SPECIFICATIONS	PE-3040 and PE-3083					PE-3033			
	24V	120V	240V	277V	480V	24V	120V	240V	277V
Inductive:									
Full Load Amps	---	16	12	8.3	---	---	12	12	8.3
Locked Rotor Amps	---	96	72	49.8	---	---	72	72	49.8
Non-Inductive Amps	22	22	22	22	22	20	20	20	20
Pilot Duty (VA)	154	771	1157	924	---	115	578	1157	924
Switch Action	S.P.D.T.					S.P.D.T.			
Switch Connections	#8 Screws & Cup Washers					1/4" Quick Connects			

MECHANICAL SPECIFICATIONS	
Setpoint (All Models)	2 to 22 PSIG Adjustable (with Visual Setpoint Scale)
Differential	0.8 PSIG Fixed (All Models)
Maximum Operating Pressure	75 PSIG (All Models)
Temperature Range	32 to 190 Degrees Fahrenheit (All Models)
Pressure Media	Air or Fluids Compatible with Plated Steel & Buna-N
Pressure Connections	PE-3040 and PE-3033: 1/4" Barb. PE-3083: 1/8" MPT.
Mounting	Two 7/32" Holes [on 1-1/4" centers] in "Z" Bracket

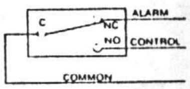
FIGURE I. SPDT SWITCHING ACTION (All Models).



Switch Position Below Setpoint

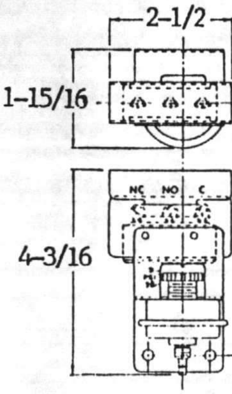


To Prove Excessive Flow or Pressure

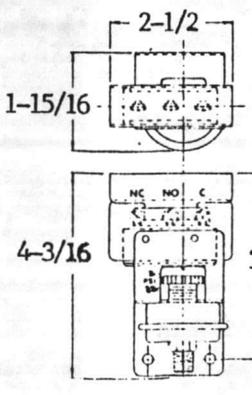


To Prove Insufficient Flow or Pressure

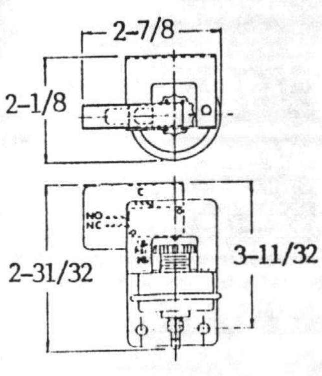
FIGURE II. DIMENSIONS.



PE-3040



PE-3083



PE-3033

Envirocon, Inc.
P.O. Box 7349, Hwy. 264 West • Wilson, North Carolina 27893
(919) 291-4618

The following information on trouble shooting a complaint of no heating or cooling is given as a guide for someone to use. It does not list all possible troubles but does list the most common ones.

The following information on maintenance is given as a guide for the owner to use in setting up a specific maintenance schedule that will fit his particular system. This guide should be used in conjunction with and to supplement the respective manufacturer maintenance data.

The owner should note that the guide enclosed most likely contains information on some equipment that was not used in his system. This information might be useful to the owner on other buildings or systems that he maintains.

For any heating and air conditioning system to continue to operate in an energy efficient manner it is very important that the temperature control system continue to operate properly. To insure this, it is very important to perform maintenance checks on the system.

Trouble Shooting

The list described below is not meant to be an exact and comolete list but is intended to give the maintenance personnel a place to start. The items listed below are the most common causes of trouble.

(A) Complete Heating and Cooling System Not Operating

1. If the system is time clock controlled, check the following:
    a. Be sure the time clock setting is correct.
    b. Be sure time clock is indexed for "Day" or "On" operation.
    c. Check to be sure control power is present.
    d. Check any safety or outside air limit control to be sure it is operating and set properly.
    e. Check indexing switches if used.

(B) A.H.U. Not Operating

1. Check to be sure it is indexed to operate from respective time clock or system control.
2. If it is, check any safety controls used (Firestat, Freezerstat, Smoke detector, etc.)
3. Check starter over loads. (Also, check to be sure the control power disconnect switch, if used, is on.)
4. Check to be sure power is present and that starter operates.
5. Check to be sure control or indexing voltage is present.

(C) Entire Zone or Unit Not Heating or Cooling

1. Check to be sure unit is running.
2. If not running, check as described in "B" above.
3. Check setting of respective thermostat and sub-bases switches if used.
4. Check to be sure that heating or cooling medium is available. (Hot water, steam, chilled water, electric heat or condensing unit operation.)
5. Check to see that respective heating or cooling control operates as it should.
6. If electric controls, check to see if control power is available.

If pneumatic controls, check to see if air pressure is available.

(D) A Single Zone Not Heating or Cooling

1. Check to be sure unit is running.
2. If not running, check as described in "B" above.
3. Check setting of zone thermostat and sub-base switch if used.
4. Check to be sure heating or cooling medium is available.
5. Check to see that zone control device operates (Variable volume motor on mixing box motor; H. W., steam, or C. W. valve motor; zone damper motor) operates from respective thermostats.
6. If electrical controls, check to be sure power is available to that particular zone control. If pneumatic controls, check to be sure air pressure is available.

(E) Boiler Will Not Operate

1. Check to be sure main power and control power is available.
2. Check to be sure it is indexed to operate from system controls, time clock, operating control, outside air thermostat, etc..
3. Check safety controls (L.W.C.O., High Limit, Flame Safety Controls). Note that sometimes 2, LWCO and/or High Limits are provided and one may be manual reset type.
4. Check to see if H. W. pump is operating. Sometimes boiler operation is interlocked with H. W. pump operation.
5. Check outdoor thermostat if used.
6. Check to be sure fuel is available.

(F) Chiller Will Not Operate

1. Check to be sure main power and control power is present.
2. Check to be sure it is indexed to operate from system controls, time clock, operating control, outside air thermostat, etc..
3. Check safety controls, especially the the flow switches. (Chilled & condenser water)
4. Check chilled water and condenser pump operation. Sometimes chiller operation is interlocked with C. W. and/or condenser water pump operation.

F - continued

5. Check outdoor thermostat if used.

G - Pump Will Not Operate

1. Check to be sure main power and control power is present.
2. Check to be sure it is indexed to operate from system controls, time clock, outside air thermostat, etc.
3. Check starter overloads. (Also check to be sure the control power disconnect switch, if used, is on.)
4. Check outdoor thermostat if used.

H - Package Rooftop A/C Unit Will Not Operate

1. Check to be sure it is indexed to operate from respective time time clock, or system controls, if used.
2. Check respective wall thermostat and subbase switches if used.
3. Check power to unit.
4. Check circuit breaker or fuses that are installed in unit.
5. Check control power and/or control fuse if used.
6. Check safety controls (firestat, freezerstat, smoke detector, etc.)

I - Fan Coil Unit or Unit Ventilator Will Not Operate

1. Check to be sure it is indexed to operate from respective time clock, or system controls, if used.
2. Check respective wall thermostat and subbase switch, if used.
3. Check power to unit.
4. Check circuit breaker or fuses that are installed in unit.
5. Check control power and/or control fuse if used.
6. Check safety controls (firestat, freezerstat, smoke detector, etc.)
7. Check position of fan speed switch if used.

1

(F) Heat Pump or Condensing Unit

1. Check to be sure it is indexed to operate from respective time clock, or system controls if used.
2. Check respective wall thermostat and sub-base switches.
3. Check power to unit.
4. Check circuit breaker or fuses that are installed in unit.
5. Check control power and/or control fuse if used.
6. Check safety controls (Firestats, Freezerstats, smoke detectors, High & Low pressure switches, Timers, etc.).
7. If they are water cooled units, they may have a water flow switch and a low temperature switch.

(G) Electric Duct Heater

1. Check to be sure it is indexed to operate from respective controller and/or thermostat.
2. Check to be sure respective supply air fan is operating.
3. Check to be sure main power and control power is present.
4. Check air flow switch if provided.
5. Check auto and manual reset High Limits.
6. Check melting type High Limits in power legs inside heater.
7. Check to be sure heater coils are not open.

MAINTENANCE

Temperature Controls

The control system needs bo be checked for complete and proper operation at least once each year. It is recommended that at least the following be done:

Daily- If the system is pneumatic, do the following: If no auto traps are used on the air compressor, the air tank and filter must be drained daily to prevent moisture from getting into the system.

Weekly- Check time clock operation and system indexing switches to be sure that they are set properly.

If the system is pneumatic, do the following:

1. Check oil level in air compressor.
2. Check air drier to be sure it is operating.
3. Check air filter glass to be sure it is dry. If not, check air drier operation and auto traps on drier and compressor.
4. If oil appears in air filter glass, check air compressor. It is imperative that no oil or water get into the control air system. If excess oil continues to appear, either rebuild or replace the compressor or an oil filter can be installed in the line.

Quarterly

If the system is pneumatic, do the following:

1. Check air compressor operation.
2. Change oil in air compressor.
3. Check air and oil filter, if used, in air line. Replace oil filters as needed.
4. Check drain traps if used.
5. If two compressors are used check to be sure alternater is working. If no alternater was supplied, readjust pressure switch to change lead compressor. Check to be sure a manual alternating switch was not installed before changing PE switch setting.

Annually

1. Operate each thermostat and switch to be sure it operates its respective valve, damper motor, or electric motor as required.

2. Visually check all control valves for leaks around bonnett and packing nuts. Replacement packing is available from control manufacturers.

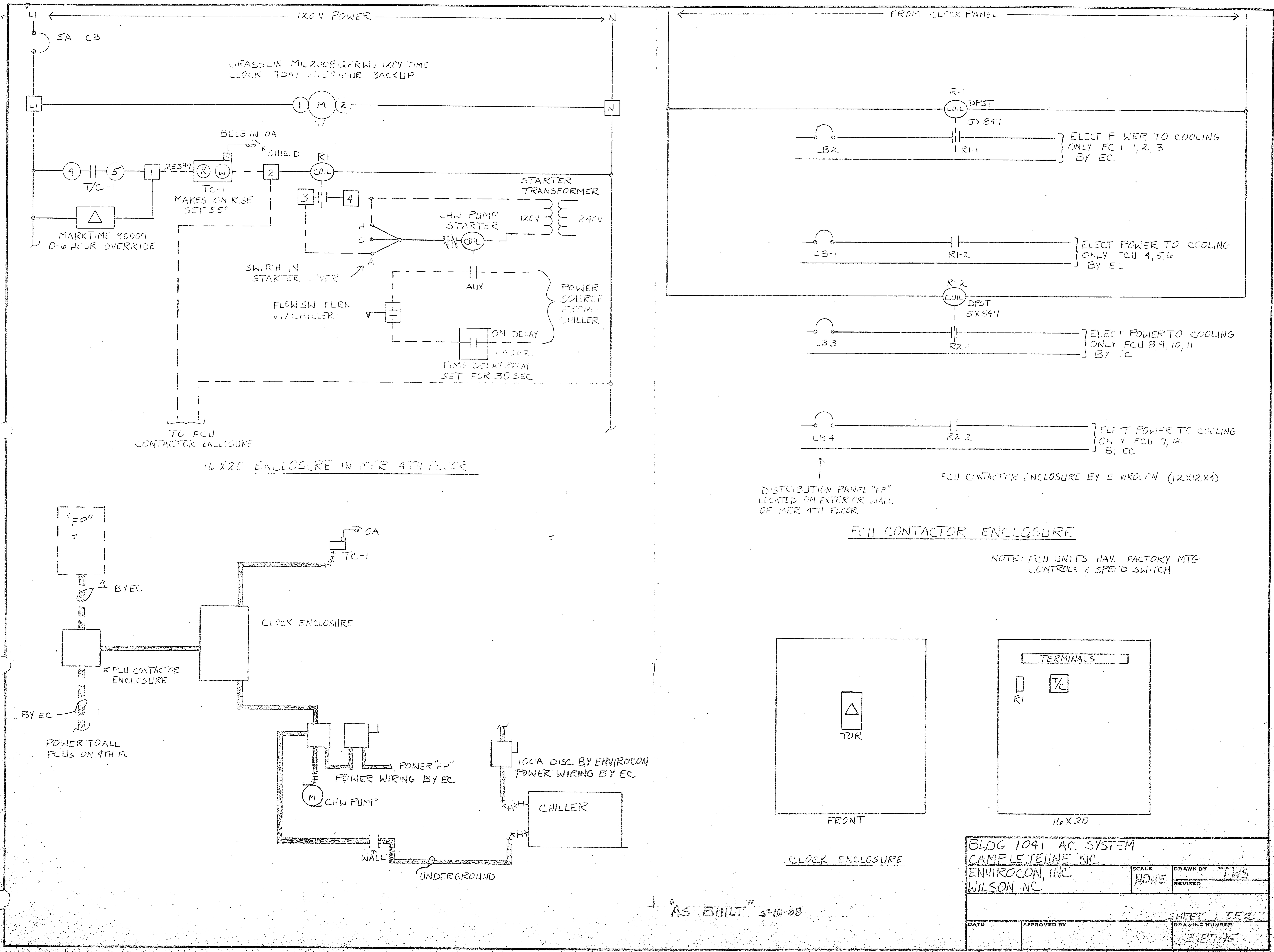
3. Check settings on all remote thermostats to be sure they are set properly.

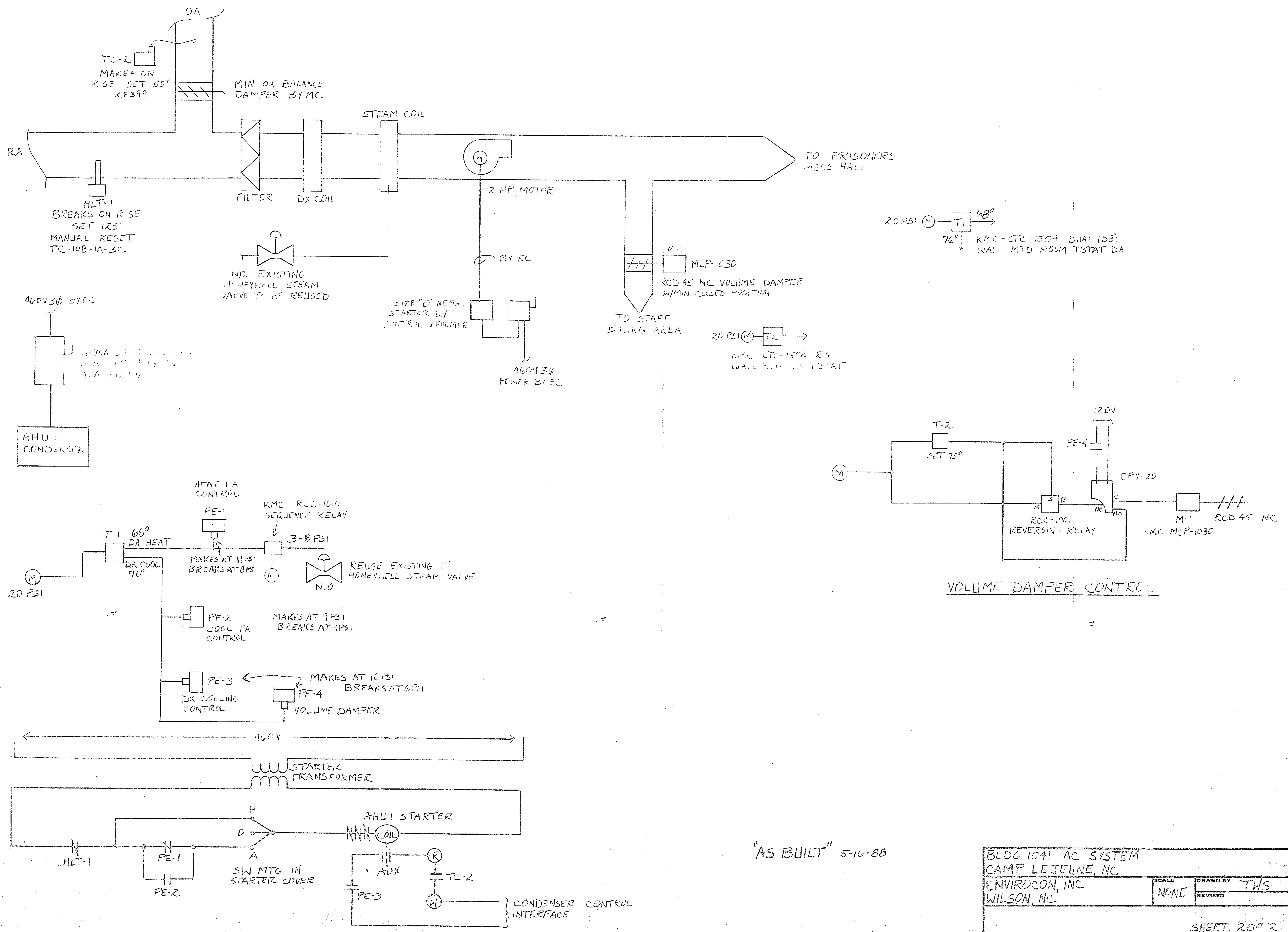
4. Check all safety controls and smoke detectors for proper operation.

5. Check operation of each automatic damper to be sure it operates freely and that linkage is adjusted properly.

6. Lubricate control damper bearings as required.

7. If pneumatic, check the safety relief valve on the compressor and the low pressure side of the PRV.


120V POWER
L1
N
5A CB
GRASSLIN MIL2008QFRWL 120V TIME CLOCK 7DAY W/50 HOUR BACKUP
M
BULB IN OA
SHIELD
R1
COIL
T/C-1
2E399
TC-1
MAKES ON RISE
SET 55°
STARTER TRANSFORMER
120V
240V
CHW PUMP STARTER
MARKTIME 90007
0-6 HOUR OVERRIDE
H
O
A
SWITCH IN STARTER COVER
AUX
POWER SOURCE FROM CHILLER
FLOW SW FURN W/CHILLER
ON DELAY
TIME DELAY RELAY
SET FOR 30 SEC
TO FCU
CONTACTOR ENCLOSURE
16X20 ENCLOSURE IN MER 4TH FLOOR
FROM CLOCK PANEL
R-1
DPST
5X847
CB2
R1-1
ELECT POWER TO COOLING ONLY FCU 1, 2, 3 BY EC
CB-1
R1-2
ELECT POWER TO COOLING ONLY FCU 4, 5, 6 BY EC
R-2
DPST
5X847
CB3
R2-1
ELECT POWER TO COOLING ONLY FCU 8, 9, 10, 11 BY EC
CB-4
R2-2
ELECT POWER TO COOLING ONLY FCU 7, 12 BY EC
DISTRIBUTION PANEL "FP" LOCATED ON EXTERIOR WALL OF MER 4TH FLOOR
FCU CONTACTOR ENCLOSURE BY ENVIROCON (12X12X4)
FCU CONTACTOR ENCLOSURE
NOTE: FCU UNITS HAVE FACTORY MTG CONTROLS & SPEED SWITCH
"FP"
BY EC
FCU CONTACTOR ENCLOSURE
BY EC
POWER TO ALL FCUs ON 4TH FL.
OA
TC-1
CLOCK ENCLOSURE
POWER "FP"
POWER WIRING BY EC
CHW PUMP
100A DISC. BY ENVIROCON
POWER WIRING BY EC
CHILLER
WALL
UNDERGROUND
TOR
FRONT
TERMINALS
R1
T/C
16X20
CLOCK ENCLOSURE
"AS BUILT" 5-16-88
BLDG 1041 AC SYSTEM
CAMP LEJEUNE NC
ENVIROCON, INC
WILSON NC
SCALE NONE
DRAWN BY TWS
REVISED
SHEET 1 OF 2
DATE
APPROVED BY
DRAWING NUMBER 318705



"AS BUILT" 5-16-88

BLDG 1041 AC SYSTEM CAMP LEJEUNE, NC ENVIROCON, INC WILSON, NC	SCALE NONE	DRAWN BY TWS REVISED
DATE	APPROVED BY	SHEET 2 OF 2 DRAWING NUMBER 318705