CONAIR™

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USER GUIDE

UGH028-0605

Portable Chiller

Models PA, PR and PW

5-40 Tons

Corporate Office: 412.312.6000 | Instant Access 24/7 (Parts and Service): 800.458.1960 | Parts and Service: 814.437.6861

Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date:

Manual Number: UGH028-0605

Serial Number(s):

Model Number(s):

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CONAIR SERIES PORTABLE PA, PR, PW
OPERATION & MAINTENANCE MANUAL

CONTENTS

1.0.0 INTRODUCTION

On behalf of everyone at Conair thank you for purchasing this equipment. With over 40 years experience in developing and implementing customized Process Cooling solutions for customers around the world, we firmly believe that our equipment is second to none and that the solution provided for you in this equipment has been engineered and manufactured using only the highest quality, state of the art components, to give trouble free service with a minimum of maintenance. It is in everyone's best interest if you read this manual thoroughly and where applicable, familiarize yourself with the checklists and tips contained here, and adhere to the safety and maintenance schedules outlined. Proper care and attention to maintenance and operating procedures will ensure an extended service life and minimum downtime of your equipment.

1.1.0 Your unit is self-protected by a series of safety controls integrated in the control system. These have been finely set to obtain both adequate protection and optimum efficiency from your unit.

1.2.0 Before you start to install your unit, we urge you to carefully read through and digest this literature to familiarize yourself with its contents.

2.0.0 UNCRATING AND CHECKING UNIT FOR DAMAGE

2.1.0 Remove packaging material and examine unit for shipping damages. The consignee is responsible for making claims to the transportation agent and any damage should be reported immediately.

2.2.0 Also report any damage to Conair.

3.0.0 LOCATION OF UNIT

3.0.1 Your chiller is built on a preformed frame and must be located on flat level ground.

3.0.2 Unit must **not** be located in confined areas where air flow and heat dissipation are restricted.

3.0.3 Unit requires a minimum of 36" clearance on all sides to provide adequate room for maintenance.

3.0.4 Unit should be close to an outside wall or the roof to minimize length of ductwork (units with high pressure fan option only).

3.0.5 The portable chiller is generally sized for a dedicated system. The unit should be mounted close to the process load. If a long process pipe run is required, a check valve should be installed at the process outlet connection to prevent run-back at shutdown and the overflow connection should be utilized.

3.0.6 Make sure a floor drain and city water are available nearby your proposed location.

3.1.0 AIR COOLED MODULES

3.1.1 Unit must **not** be located close to heat sources where abnormally high temperatures are encountered. Maximum standard design ambient condition is 95ºF.

3.1.2 Unit must not be located in areas where dusty or corrosive atmosphere is encountered.

3.2.0 WATER COOLED MODULES

3.2.1 Unit(s) should be close to a source of water for condenser cooling.

3.2.2 Unit(s) should be installed in a horizontal position where it is accessible for maintenance.

3.2.3 Unit(s) should be located where ambient temperature does not drop below 50ºF. Standard units are not designed for outside operation.

3.3.0 REMOTE AIR-COOLED MODULES

3.3.1 Unit must not be located close to heat sources where abnormally high temperatures are encountered. Maximum standard design ambient condition is 95ºF.

3.3.2 The unit is supplied with a holding refrigerant charge. Be sure ball valves on refrigerant discharge line and the receiver are closed before beginning refrigerant piping.

3.3.3 Refrigerant piping should be performed by a certified refrigeration mechanic and in accordance with local codes and guidelines.

4.0.0 INSTALLATION

4.0.1 You have now determined the desired location of the unit. When moving, unit must be supported by the frame only - ensure lifting cables or chains do not damage components, controls, or piping etc.

4.0.2 Condenser Piping (Water Cooled Units) See Diagram A.

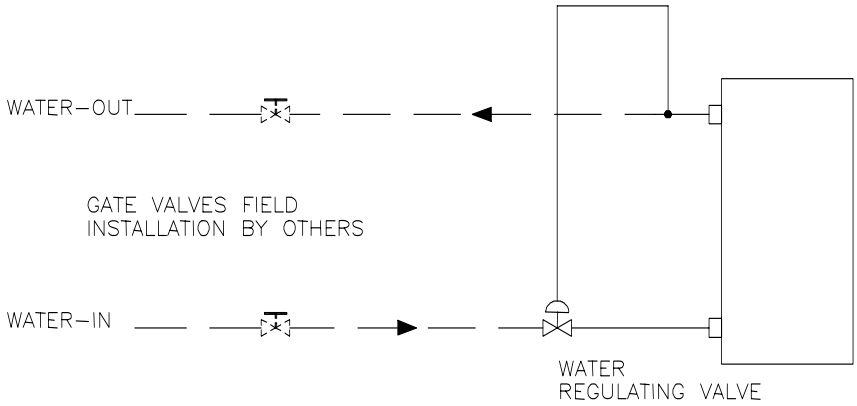


Diagram A: Condenser Piping

4.0.3 Water supply should be 85ºF. maximum and 60 psi pressure minimum.

4.0.4 The condenser is supplied with one water-in connection (including a water regulating valve), and one water-out connection.

4.0.5 It is recommended that ball valves be installed on both water-in and water-out lines for isolating condenser.

4.0.6 Piping sizing. See 4.1.2

4.0.7 To operate efficiently the condenser must be kept clean. It is strongly recommended that water treatment and additives be included in the condenser water system to control calcium and magnesium scale, algae and fungi, together with regulating bleed-off. The additives should contain chemical corrosion inhibitors. To obtain correct water additive(s), a reputable water treatment company should be contacted to provide analysis. Unit failure through plugged or contaminated condensers (or chiller vessels) is not covered by warranty. Chilled water should also include corrosion inhibitors if glycol solution is not used.

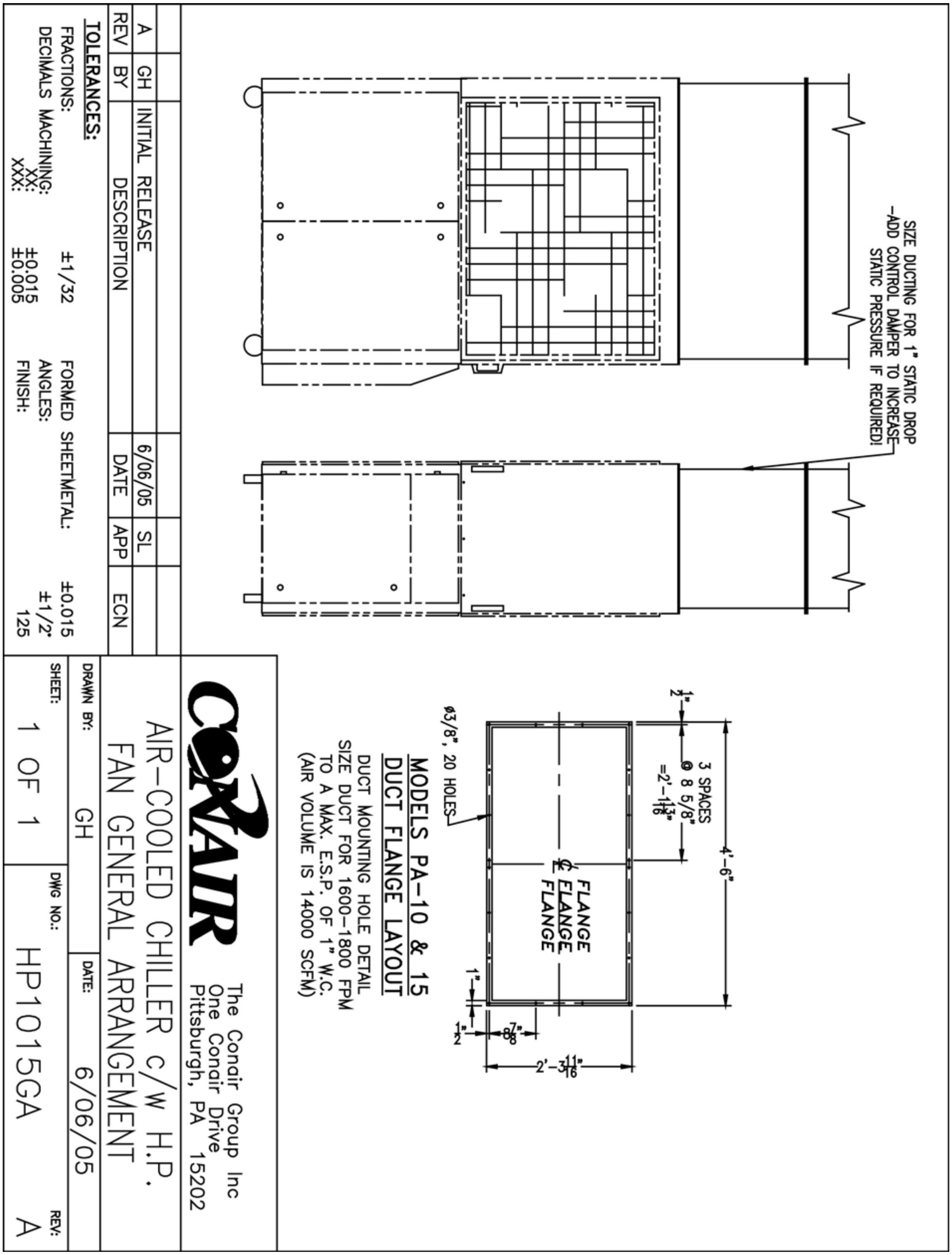
4.0.8 Condenser Ductwork (high pressure fan Air-Cooled units). See drawing HP-1015 for PA-10 and PA-15 units.

4.0.9 Conair "PA" Models (5 to 15 ton units with high pressure fan option and PA20, 25, 30) come as standard with top air discharge which facilitates the installation of ductwork with a minimum of bends. The size of the ductwork must be larger than the combined discharge openings in the unit including the space between the exits.

-E.S.P. is 1" for PA-10 and 15 (3 phase 60 Hz).
-E.S.P. is 1.25" for PA-20, 25 and 30 (3 phase 60 Hz).

All bends must be long sweep bends to avoid any sharp angles which would resist smooth air flow. Please note that with a system of dampers, the discharge warm air can be directed inside the plant in the winter to supply or supplement plant heat, or directed outside in the summertime to provide excellent air movement and ventilation. The dampers may be either mechanically or automatically controlled. For automatic dampers, a motor actuator with a spring return should be selected so that in the de-energized position the dampers close to the outside and open to the inside.

4.0.10 It is recommended that gravity operated dampers be installed at the roof or wall line to prevent cold air entering during the winter months and thus causing possible freeze-ups or condensation on the ductwork.


SIZE DUCTING FOR 1" STATIC DROP
-ADD CONTROL DAMPER TO INCREASE
STATIC PRESSURE IF REQUIRED!
MODELS PA-10 & 15
DUCT FLANGE LAYOUT
DUCT MOUNTING HOLE DETAIL
SIZE DUCT FOR 1600-1800 FPM
TO A MAX. E.S.P. OF 1" W.C.
(AIR VOLUME IS 14000 SCFM)
Ø3/8", 20 HOLES
3 SPACES
@ 8 5/8"
=2'-1 13/16"
4'-6"
1"
1/2"
8 7/8"
2'-3 11/16"
FLANGE
℄ FLANGE
FLANGE
The Conair Group Inc
One Conair Drive
Pittsburgh, PA 15202
AIR-COOLED CHILLER c/w H.P.
FAN GENERAL ARRANGEMENT
DRAWN BY: GH
DATE: 6/06/05
SHEET: 1 OF 1
DWG NO.: HP1015GA
REV: A
A GH INITIAL RELEASE 6/06/05 SL
REV BY DESCRIPTION DATE APP ECN
TOLERANCES:
FRACTIONS: ±1/32
DECIMALS MACHINING:
XX: ±0.015
XXX: ±0.005
FORMED SHEETMETAL: ±0.015
ANGLES: ±1/2°
FINISH: 125

4.1.0 **PROCESS PIPING**

4.1.1 The chiller is supplied with one water-in and one water-out connection (with flow control valve). These are to be connected to the chiller pump and the holding tank respectively.

To operate efficiently the chiller vessel must be kept clean. Precautions as per 4.0.7 should be considered. It is recommended that a strainer be installed between the chiller pump and chiller vessel.

Failure through plugged or contaminated chiller vessel is not covered by warranty.

Keeping the tank cover lid in the closed position would help prevent dust and other foreign material from contaminating the water.

4.1.2 The process piping should be sized to adequately deliver the required flow to the various processors.

For piping under pressure, the following are accepted guidelines for maximum flow rates:

3/4"	5 US GPM
1"	10 US GPM
1-1/4"	20 US GPM
1-1/2"	30 US GPM
2"	55 US GPM
2-1/2"	90 US GPM
3"	155 US GPM
4"	320 US GPM
6"	950 US GPM

These capacities are based on SCH.40 black pipe with an approximate pressure loss of 10 ft. per 100 ft. of pipe length or a maximum velocity of 10 fps.

For extended pipe runs (200 ft. or longer) it may be necessary to oversize the pipe. Check with a Conair representative.

4.2.0 **ELECTRICAL SUPPLY**

4.2.1 The supply voltage must be within plus or minus 10% of the nameplate voltage and is connected through a fused disconnect sized to accommodate the nameplate amperage.

Unit has been built to conform to National Electric Codes and all additional wiring should conform to National and Local Codes prevailing. Refer to attached electrical schematic.

4.3.0 MAKE-UP AND DRAIN

4.3.1 A city water supply should be located nearby for connection to automatic make-up valve on reservoir. To satisfy local by-laws, it may be necessary to install a back-flow preventer in the supply line.

4.3.2 Drain and overflow lines should be connected to drains as required by local by-laws.

4.4.0 GLYCOL SYSTEM (when selected under design conditions)

4.4.1 Your portable chiller system can operate using a glycol solution. Check that the following conditions are met. DO NOT use glycol solutions in an open cooling tower system.

4.4.2 The glycol selected should be of a non-corrosive type that will not react with the mold material and gaskets.

4.4.3 The glycol selected must be of a non-foaming type or an anti-foaming agent must be added.

4.4.4 The glycol solution should be mixed to protect at least to 15ºF below your desired temperature, and should be checked regularly to see that the proper concentration is maintained.

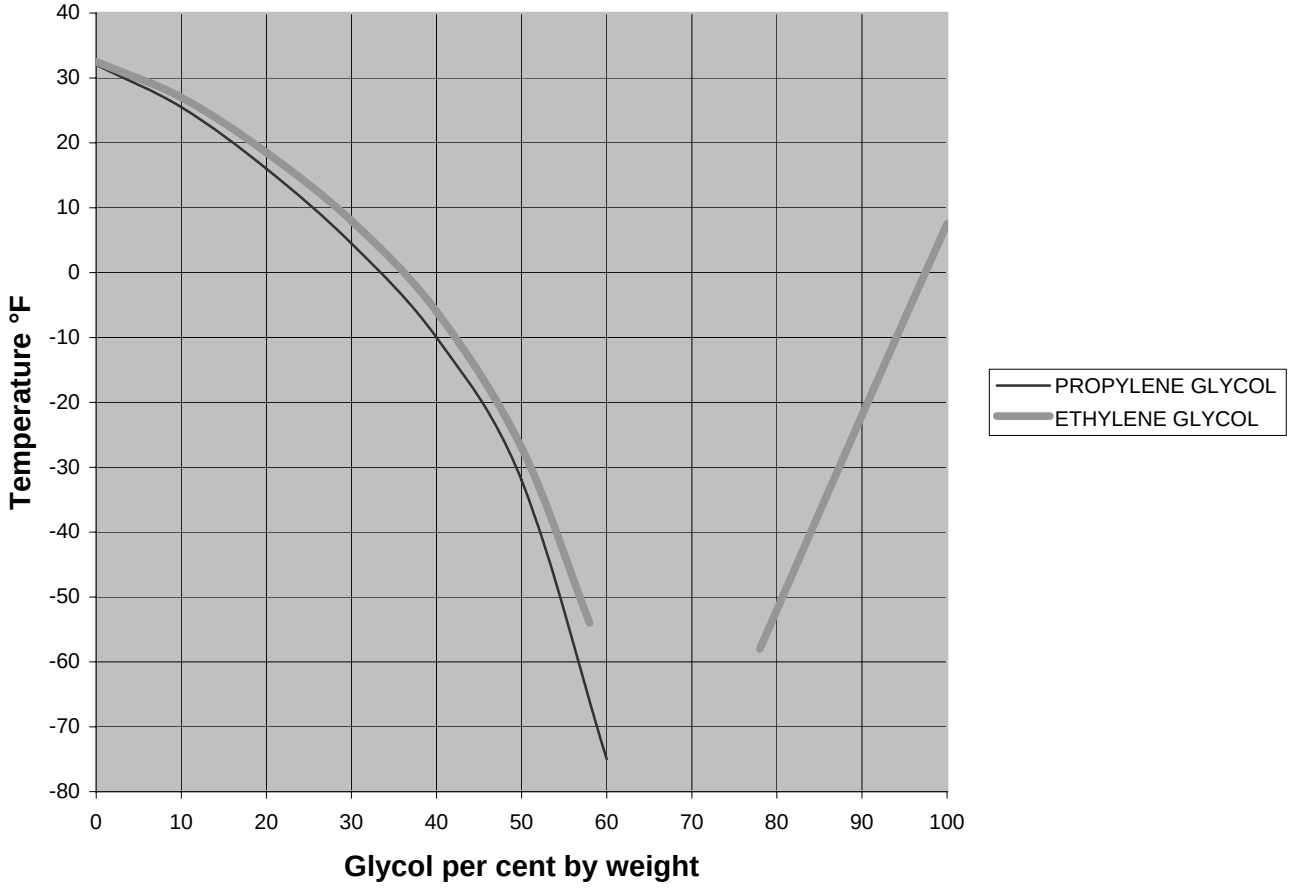
4.4.5 When operating your system with glycol, it is recommended that a low level alarm be installed. Contact a Conair representative for further details.

4.4.6 Since glycol has a different specific gravity than water, the pump discharge pressure will vary with different solution concentrations. It is imperative that the motor running amps do not exceed nameplate amps. This can be accomplished by adjusting the valve on the pump discharge or reducing the diameter of impeller.

4.4.7 When first filling your glycol system use water to flush out lines and tank of debris. Drain system, clean tank, and fill with glycol solution.

4.4.8 Typical freezing points for glycol are shown in the graph on the following page.

Temperature Vs. Glycol Percentage



NOTES:

1. **DO NOT** use 100% ethylene glycol (freezing point 10ºF).
2. The graph above is only a rough guide. Please refer to glycol manufacturer's information.

5.0.0 INSTALLATION CHECK

5.0.1 Your installation is now complete. Do not switch unit on. Make a complete visual check of unit for damage sustained during installation.

5.0.2 Check all terminal screws in control panel making sure they are tight.

5.0.3 You are now ready for start up and require the services of a qualified refrigeration serviceman. A minimum of five (5) hours before start-up, and with the chiller switch(es) in "off" position, the fused disconnect must be put on. This allows the compressor crankcase heater to evaporate the refrigerant in the crankcase oil. A heat load to the chiller must be available for start up.

6.0.0 START-UP PROCEDURE

6.0.1 This procedure can only be performed by a qualified refrigeration serviceman. Before this procedure can be started, the crankcase heater must be on for a minimum of (5) five hours and heat load to the chiller vessel must be available.

High and low pressure refrigerant gauges must be attached to their respective connections on the compressor service valves. Thermometers must be located in water-in and water-out service wells located on chiller vessel piping. Well should be filled with water to increase heat conductivity.

Set thermostat to 100ºF. This senses discharge water temperature to process.

6.0.2 Open suction and discharge valves (PR-only) on compressor and replace bonnet.

6.0.3 Check for refrigerant gas leaks.

6.0.4 Check crankcase oil level where applicable (15-40 ton). Refer to 7.0.5.

6.0.5 Control settings are factory set and should not require alteration.

6.0.6 On the water cooled units, start up chiller and process pumps, and condenser pump (provided by the customer). On the air cooled condenser units, start up chiller and process pumps. Run for several minutes to get air out of system. Refer to 10.0.0.

6.0.7 With main disconnect switch already in "on" position and chiller pump running, lower thermostat setting until compressor starts and amber light comes on.

On air cooled units, the condenser fan will turn on automatically when compressor starts. Make sure fan rotation is correct.

6.0.8 Allow unit to run continuously for ten minutes under full load conditions. Check sight glass for adequate refrigeration charge and conditions. Check complete system for gas leaks.

6.0.9 Adjust flow control valve on chiller vessel inlet so that temperature differential is 9ºF - 10ºF across chiller vessel.

6.0.10 Check water flow protection control. Turn switch for chiller pump to "off". The flow and unit run lights should go off. Turn switch back to "on" and the flow and unit run lights should come back on, allowing compressor to restart.

6.0.11 The thermostat senses discharge water temperature to process and should **not** be set to desired process water temperature. This setting should be less than 45ºF for water (rather than Glycol) systems.

7.0.0 OPERATING INSTRUCTIONS

7.0.1 The disconnect to your unit should be on for a minimum of five (5) hours before unit is started: this is to allow the crankcase heater to evaporate any refrigerant in the oil. It is advisable to leave the disconnect on at all times except for extended shut-downs.

7.0.2 For water cooled units both chiller and condenser pumps must be turned on. If a cooling tower system is used, this must also be turned on. With air cooled units, the chiller pump must be turned on.

7.0.3 Set operating thermostat to desired temperature. Refer to 6.0.11

7.0.4 Allow unit to run for ten minutes and check the refrigerant sight glass. If there are bubbles in the liquid line sight glass, allow the unit to run but call a qualified refrigeration serviceman as soon as possible. If the button is bright yellow, shut unit down and call in a qualified serviceman. This procedure must be followed when the unit is started up or a minimum of once a month.

7.0.5 Check crankcase oil by observing oil sight glass in compressor. Oil should be halfway up the sight glass -do not consider foam on top of oil. This procedure must be followed when the unit is started up or a minimum of once a month.

7.0.6 Observe the unit for short cycling - compressor starting up and stopping frequently. Unit must not be allowed to run for an extended period on short cycle conditions. Call your Conair representative for control adjustments.

7.0.7 Observe unit for abnormal vibrations and abnormal noises from the compressor and piping.

7.0.8 When shutting down unit, turn off chiller pump and process pump. Turn off tower system if not required.

7.0.9 Controls and valves must not be tampered with. It is only necessary to adjust the thermostat as required.

7.0.10 Water must be kept clean and contaminates controlled. See 4.0.7
Failure through plugged, contaminated or corroded chiller vessel is not covered by warranty.

7.1.0 SYSTEM SAFETY

7.1.1 Several safety switches are wired into the portable chiller circuit to help prevent problem conditions from damaging the unit. The following switches will shut down the compressor and/or prevent the compressor from running if the setting is not satisfied.

7.1.1 FLOW SWITCH (1/2FLS): The flow switch detects flow through the evaporator and prevents the compressor from running and eliminates a potential freeze-up problem.

7.1.2 HIGH PRESSURE SWITCH (PSH1/2): The high pressure switch is located on the discharge side of the compressor and opens if the pressure within the line is greater than the desired setting (350 psi for PA units and 300 psi for PW units).

7.1.2 LOW PRESSURE SWITCH (PSL1/2): The low pressure switch is located on the suction side of the compressor and opens if the pressure within the line is less than the desired setting (generally 60 psi).

7.1.2 FREEZESTAT (PR.1, TSH2): The freezestat is located on the outlet water side of the evaporator and senses the leaving temperature. If the temperature becomes too low (less than 40ºF for water), the compressor will shut down and prevent any further cooling of the water and thus prevent freeze-up of the evaporator. This is to be manually reset.

7.2.0 **FX10 MEDIUM UNIT INTERFACE (MUI)**

Up Arrow — Cursor Up / Increase numeric value / Change logic state

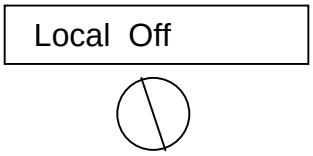
Down arrow — Cursor Down/Decrease numeric value

Right arrow — Next Page/Cursor right on Associated Menu
Alarm acknowledge (*hold for 3 seconds*)

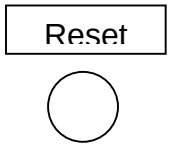
Left arrow — Previous Page/Cursor left on Menu
Override start delay(*hold for 3 seconds*)

Escape — Cancel change/return to Main Menu

Enter — Select/Initiates “Data change”/Accept
Alarm Silence

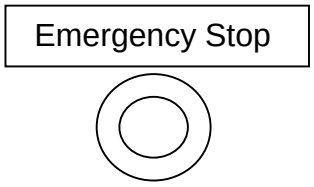


Panel Selector Switch
Selects system operating mode for:-
Local (stop/start)
Off (Normal shutdown of compressor and pumps)
Remote (Stop/Start chiller from remote location)



Panel Push Button

Trip Reset (Enables a restart after compressor trip)



Panel Push Button
Emergency Stop (removes control circuit power)

Associated Menus

- mnu Alarms
- mnu Set Points
- mnu System Status
- mnu Freeze SP
- mnu Password
- mnu Parameters
- mnu Sensor Status
- mnu Help Screens.
- mnu MUI info
- mnu Pump Control
- mnu Maintenance reqd

User Parameters (Password protected [2221])

- mnu Freeze SP

Service Parameters (password protected contact Berg Chilling)

- mnu Compressor Page1
- mnu Compressor Page2
- mnu Calibration

Control Sequence

1. Power up delay has completed
2. Selector switch is turned to system on
3. Recirc pump and process pump start in sequence.
4. There is a adjustable time delay after pumps start before the compressor comes available to start safeties are now monitored and will alarm if one is present. If all safeties are good and the temperature requires the compressor to run the compressor will start.
5. The refrigerant solenoid will stay closed until the pump out value is reached.
6. The hot gas valve is controlled from the process temp and will cycle on and off to control set point.
7. The compressor control is from the evaporator inlet temperature. If under low load conditions the temperature continues to drop and the inlet temp drops to set point the compressor will cycle off.
8. The compressor will cycle on when the temperature rises above the proportional band value. If the compressor is short cycled it will be prevented from starting until the anti timer times out.
9. On a failure of any of the safetys linked to compressor control the compressor will shut down the alarm event screen will come up, the active alarm light will flash and the audible alarm will sound. The pumps will continue to run as normal.
10. The audible alarm and alarm output are turned off by pressing the silence key for 2 seconds.
11. When an alarm event is reset the alarm reset required light will flash to indicate the compressor requires a reset before it will be available to start again.
12. If the Chiller pump fails, or the Standby pump fails in the Standby mode, the compressor will shut down on no flow.
13. If a service warning alarm is activated the chiller will operate as normal. The “Maintenance Reqd” is for information only.

7.2.1 **MUI PAGE DISPLAYS**

HOME

txt	Portable Chiller	
num	Power up Dly Min - *This time can be by-passed contact Berg Chilling*	
num	SetPoint	$^{o}F/^{o}C$
num	Process	$^{o}F/^{o}C$
num	Evap In	$^{o}F/^{o}C$
num	Evap Out	$^{o}F/^{o}C$
num	Suct	PSI
num	Disch	PSI
num	C1 Run	Hrs
num	C2 Run	Hrs
num	Freeze SP	$^{o}F/^{o}C$

note:- *Displayed Temperature units of ^{o}F or ^{o}C are changed with the "units" parameter in "SetPoints" page*

ALARMS

Displays list of active alarm "Events"

To clear an alarm from event screen: With the cursor on the event push the right arrow key for 3 seconds the [N] no acknowledgment on the left of the screen will change to a [A] acknowledgment the event will clear after leaving the alarm menu.

List of events:

1. *Sensor fail*
2. *Freeze fail*
3. *Run time reset*
4. *No Flow*
5. *Maintenance*
6. *Pump fail*
7. *Comp fail*
8. *Refrig press*
9. *CCH*
10. *Level*

SETPOINTS

txt	Set Point	
num	Set point	^{o}F/^{o}C
num	HI AL Offset	Fr/ ^{o}C *from evaporator out has a ten minute delay. Note- Audible alarm only.*
num	HI AL Delay	Sec
pref	Units of Meas	DegF (DegC)

PUMPS *For pumps to run in manual, the System switch should be in either "Local" or "Remote".*

When the Standby Pump is not in use, set:-
a) CHR OFF, b) PROC OFF c) PUMP MAN to STOP
Note when the Standby Pump is selected for CHR or PROC the corresponding pump is disabled.

txt	PUMP CONTROL	
log	Chiller Pump	(Auto/Man)
log	Chiller Pump	(Stop/Start)
log	Process Pump	(Auto/Man)
log	Process Pump	(Stop/Start)
log	Standby CHR	(On/OFF)
log	Standby PROC	(On/OFF)
log	Standby pump	(Auto/Man)
log	Standby pump	(Stop/Start)

SYSTEM STATUS

txt	Digital In Status	
log	Comp Start	(Failed/OK)
log	Comp called	(Yes/No)
log	System Start	(On/Off)
log	High Press	(Fault/OK)
log	Low Press	(Fault/OK)
log	Flow	(Fault/OK)
log	CHR Pmp Cont	(ON/OFF)
log	Proc Pmp Cont	(ON/OFF)
log	Stby Pmp Cont	(ON/OFF)
log	Start Switch	(ON/OFF)
log	Trip Reset	(ON/OFF)

log	Comp 1 Contr	(ON/OFF)
log	Comp 2 Contr	(ON/OFF)
log	Level	(Low/OK)
log	CCH	(Fail/OK)

SENSOR STATUS

t**xt** **SENSOR STATUS**

log	Process	OK (Bad)
log	Evap Out	OK (Bad)
log	Evap In	OK (Bad)
log	Disch	OK (Bad)
log	Suct	OK (Bad)

FREEZE SP

num Freezstat SP ^{o}F/^{o}C *Low limit for evaporator leaving temperature*

RUNTIME RST *Compressor run time reset when counter has reached its maximum or when compressor service is done.*

txt Runtime Reset
txt Toggle ON and OFF
txt to reset the counter
log ERT counter RST ON (OFF)

PARAMETERS

txt PARAMETERS P1 of 3
num LP Trip SP PSI *Low pressure alarm value*
num Comp Offset ^{o}Fr/^{o}C *Compressor Setpoint Offset*
num Comp Eff SP ^{o}F/^{o}C *Compressor effective Setpoint*
num Comp On PB % *Value that compressor on off operation is done, control from evaporator entering temp*
num LP Pumpout SP PSI *System pump-out value on compressor start-up*
num PowerUpDelay min *Time delay on power up before compressor can start. Pumps can still be operated. Delay can be overridden from MUI left arrow*
num CompAnticycle min *Time between consecutive starts of compressor*
num HG Dead Band ^{o}Fr/^{o}C *Operating differential from set-point*
num First Stage Dly sec Delay for lead compressor
num HG SP OFFSET ^{o}Fr/^{o}C *Hot gas setpoint offset from main set-point*
num HG EFF SP ^{o}F/^{o}C *Actual hot gas set-point with offset. Control is done from process temperature.*

PARAMETERS continued

log UL Selector Process /evap leaving *Can set what sensor hot gas valve controls from.(program default is process)*
num Setpoint limit min °F/°C *Limits user setpoint setting*

PARAMETERS P2 OF 3

txt PARAMETERS P2 OF 3

num	AI 1 OFFSET	PSI
num	AI 1 OFFSET	PSI
num	AI 4 OFFSET	Fr/**°C**
num	AI 5 OFFSET	Fr/°C
num	AI 6 OFFSET	Fr/°C

PARAMETERS P3 OF 3

txt PARAMETERS P3 OF 3
log Comp1 Available/Not Avail
log Comp2 Available/Not Avail
log CompISONDelay sec *Compressor Interstage ON Delay time*

MUI INFO

txt LED Legend
txt #1 Comp 1 ON
txt #2 Comp 2 ON
txt #3
txt #4 Hot gas bypass ON
txt #5 Chiller pump ON
txt #6 Process pump ON
txt #7 Standby Pump ON
txt #8 Reset Required *Light will flash indicating a alarm event has ended and a reset is required to start the compressor.*

MAINTENANCE REQD

txt	MAINTENANCE REQD P1	
txt	ALARM>SETPOINT	
txt	IMMINENT PROBLEM	
num	HPAlarmSP	PSI
num	HPAlarmDelay	MIN
log	HP Status	OK/Fault
mum	LPAlarmSP	PSI
num	LPAlarmDelay	MIN
log	LP Status	OK/Fault
num	DeltaT SP	Fr/ ^{o}C
num	DeltaTAlarmD	MIN
log	DeltaT Status	Ok/Fault
num	RT Alarm SP	Hrs
txt	MAINTENANCE REQD P2	
num	C1 Runtime Reset	ON/OFF
num	C2 Runtime Reset	ON/OFF
txt	Toggle ON to OFF	
txt	to reset counter	

The ” Maintenance Required” menu is not password protected and can be adjusted by operator. The message when in alarm will be “Maintenance Reqd”. The auditable alarm will sound and can be silenced as normal. Unit will continue to operate normally but the alarm active light will flash until condition does not exist. If unit is turned off, alarms reset and timing starts again.

Help Screens
Page 1 of 10

Use **[<]** & **[>]**
To scroll pages

High press fail
Water cooled:
Hi cond water temp
Lo water flow
Fouled cond
Check strainers
Air cooled:
High Amb Temp
Dirty coil ,filters
Fan rotation, Belt
Damper position
Sw man reset req

Low Press Fail
Lo Ambient
Ref Leak
Dirty Evap
Call for service!

Oil Fail
Oil press switch
Call for service!
Crank case heater fail
Chk heater

Comp fail
Chk fuses
Chk single phasing

Chk applied volts
Chk short to gnd
Chk comp rotation
Chk disch temp
Chk overload
May req man reset

Flow Fail
Chk recir Pump
Chk valves open
Chk strainers
Chk flow switch

Freeze Fail
Evap wat temp low
Chk SP of AL
Low operating SP
Chk strainers
Chk for low flow

Sensor Fail
Chk wiring
Replace sensor

Pump fail
Chk fuses
Chk single phasing
Chk applied volts
Chk short to gnd
Chk pump rotation
Chk overload

Service Warning
A condition exists that requires service to be done. If not repaired unit may shutdown on a alarm, operate with lower capacity or have a component failure.

To Change the Temp SetPoint:-

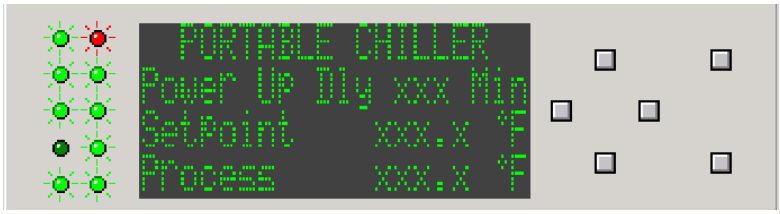
From the Home Page

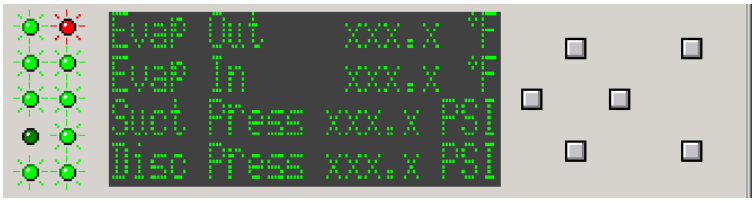
Press “Esc” to see the Main Menu and Associated Menus
“Cursor Right” to the Set Points Menu
Press “Enter” to select the Set Points Menu
Press “Enter” again and the cursor position is highlighted and flashing
Move Cursor to the desired data point
Press “Enter” and the current data will flash

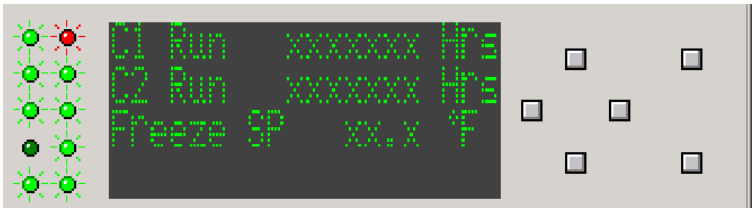
Change the value with the UP/DOWN arrow keys
Press “Enter” and hold for 1 seconds to accept the value
Confirm value has changed.

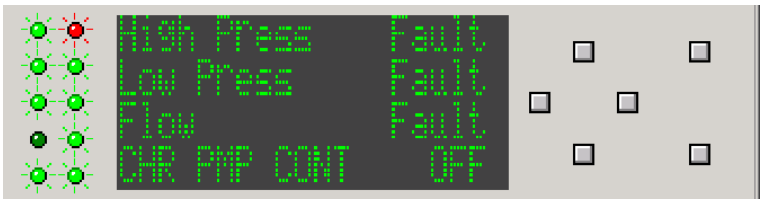
Reset after alarm event:
On an alarm event the screen will display the alarm message.
With this message the red alarm light will flash on the MUI and the audible alarm will sound.
To silence the alarm turn the system switch to silence.
The alarm messages are display as general messages (C1 Refrigerant failure) or specific messages (Evaporator Flow). When the display is a general message use the input status screens to identify the specific failure.
The red light on the MUI will continue to flash until the alarm event has ended, the reset is either manually or a automatic.
When the alarm event has ended number 8 light on the MUI will flash to indicate that a reset is required before the compressor can run.
Turn the system switch to reset
Some of the auto reset alarms reset with-in a sort time and the red flashing alarm event light will not flash only the No. 8 reset required light will flash.

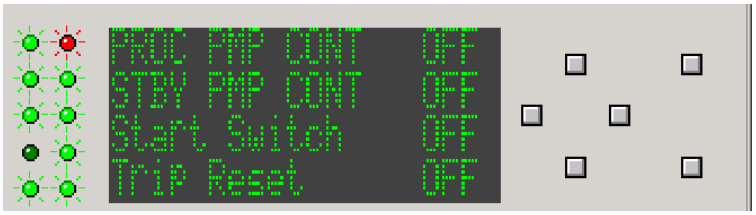
7.2.2 **MUI SCREEN EXAMPLES**











8.0.0 TROUBLESHOOTING

8.1.0 **Condition:** Unit will not run, chiller pump start switch in "ON" position.

	Cause	Correction
8.1.1	No power.	Check a) Main disconnect. b) Fuses. c) Loose connections. d) Wiring and power lead to unit.
8.1.2	Wrong voltage supplied	Voltage to unit must be within 10% of nameplate rating and balanced.
8.1.3	Control circuit open	Check a) Off/On switches. b) Safety switches – reset if necessary. c) Control transformer and fuses. d) Motor starter over-loads or contactors.
8.1.4	Open water flow and/or pressure switch	Check a) Chiller pump rotation and operation. b) Y-strainer for restriction. c) Faulty switch. d) Pressure settings – valve open/closed.

8.2.0 **Condition:** Pump running - Compressor not running.

	Cause	Correction
8.2.1	Temperature control set higher than temperature of liquid in system.	Lower thermostat setting.
8.2.2	Freeze control set above temperature liquid in system.	Lower freeze control setting without compromising section 1.2.0.
8.2.3	Refrigerant low pressure open.	a) Check refrigerant charge. Sight glass should be clear while compressor running. Call serviceman if continuous bubbling occurs – check for leaks and recharge with designated

			refrigerant only.
		b)	Clogged filter drier. Check for pressure and or temperature drop across filter drier and have it replaced by serviceman if necessary.
		c)	Liquid line valve or suction side service valve on compressor partially closed – open fully.
		d)	Liquid line solenoid not opening fully or coil defective. Have replaced by service man if necessary.
		e)	TX valve inoperative. Check thermo bulb and capillary tube for damage. Replace if necessary.
		f)	Restricted water flow to condenser, adjusting water flow regulating valve. Check air dampers. If temperature outside is below 60°F close dampers to outdoor and open to indoor. If temperature in plant is below 60°F, restrict air flow to condenser to maintain head pressure 190 psi – 225 psi.
8.2.4	Oil Pressure switch open.		Wait two (2) minutes – reset switch. If conditions repeat, call serviceman.
8.2.5	Low oil level		Do Not add oil. Call Conair.
8.2.6	Refrigerant high pressure switch open.		Air Cooled – Check:
		a)	Cleanliness of air filters.
		b)	Rotation of fans.
		c)	Fan belt condition.
		d)	Condenser for cleanliness.
		e)	Obstruction of condenser inlet or outlet.
		f)	Position of dampers.
		g)	Reset switch.
			Water Cooled – Check:
		a)	Temperature and quantity of water supply to condenser.
		b)	Condenser for scale and cleanliness. Clean with brush or chemicals if necessary.
		c)	Reset switch.
		d)	Have serviceman check switch and replace if necessary.
8.2.7	Compressor Thermistor open.	a)	Allow at least two (2) hours before restarting.

b) Call serviceman if problem continues.

8.3.0 **Condition:** Unit runs continuously – not enough cooling.

	Cause	**Correction**
8.3.1	Restricted condenser flow.	See 10.2.6.
8.3.2	Unit low on refrigerant.	See 10.2.3.
8.3.3	Inefficient compressor.	Call serviceman.
8.3.4	Refrigerant circuit faulty.	Call serviceman.
8.3.5	Load too great.	Call Conair representative.

9.0 Maintenance Schedule: Chiller Systems

Qualified Tradespersons Only Shall Complete these Services

		Bi-Monthly	Quarterly	Every 6 Months	Start-up	
	Check refrigerant pressures & temperatures.	X			X	
	Check compressor oil level & pressure.		X		X	Mfg. literature
	Check applied voltages		X		X	± 10% & balanced
	Check for proper compressor rotation				X	(please see Conair)
	Check water inlet & outlet temperatures at full load	X			X	
	Check chiller approach temperature	X			X	~ 10°F
	Check chiller superheat	X			X	~ 15°F
	Check setting & operation of all safety controls	X			X	
	Check setting & operation of thermostat	X			X	
	Check setting & operation of freezestat	X			X	40°F for water
	Test & confirm operation of compressor unloading circuits		X		X	
	Check all motor running voltages & currents		X		X	± 10% ≥ FLA
	Check for refrigerant & oil leaks	X			X	

Note: See Start-Up in manual

Services to be done by Maintenance Persons

		Daily	Weekly	Monthly	Every 6 Months	Yearly	
	Check for signs of refrigerant or oil leaks		X				
	Check refrigerant sight glass (color should be clear when running)	X					Mfg. literature color
	Check compressor oil level	X					Mfg. literature
	Check & record water inlet & outlet pressures at evaporator.		X				
	Check vibration levels	X					
	Check noise levels	X					
	Clean evaporator					X	Ⓐ
	Clean condenser					X	Ⓐ
	Re-tighten all fasteners						

Ⓐ S&T Info
A/C condenser info

Ⓑ consult your local contractor or Conair.

Maintenance Schedule: Air Cooled Condensers

Services to be done by Maintenance Persons

		Daily	Weekly	Monthly	Every 6 Months	Yearly	
	Check condenser fan cycling operation		X		X		
	Check fans for proper rotation		X		X		
	Check condenser fin condition			X			(clean as needed)

Qualified Tradespersons Only Shall Complete these Services

		Bi-Monthly	Quarterly	Every 6 Months	Start-up	
	Check condenser air filter.		X			(replace if dirty)
	Grease condenser fan motor(s)				X	(if applicable)
	Check belts					
	Check dampers					
	Clear area of debris					

Maintenance Schedule: Water Cooled Condensers

Qualified Tradespersons Only Shall Complete these Services

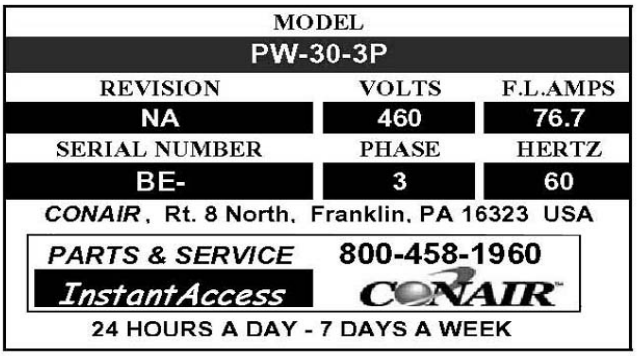
		Bi-Monthly	Quarterly	Every 6 Months	Start-up	
	Check operation of regulating valve.		X		X	

Services to be done by Maintenance Persons

		Daily	Weekly	Monthly	Every 6 Months	Yearly	
	Check general condition					X	
	Check water temperature			X			
	Check water is clean (low in hardness)						

SERIAL PLATE & EQUIPMENT IDENTIFICATION

A serial plate like the one shown below has been affixed to the apparatus, and it gives the following information:



(Example of Serial Plate)

- Whenever using this manual, check first that the serial number on the inside cover is identical to that on the serial plate of the equipment.
- In all correspondence with Conair, please refer to the manufacturing serial number, for true identification of the equipment.
- Whenever contacting Conair, be sure to state the manufacturing serial no.(s), and model no.(s).

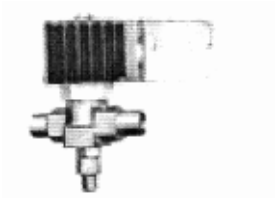
May 1995/ Bulletin 30-11

SPORLAN

SOLENOID VALVES

Installation and Servicing Instructions

NOT FOR USE ON HAZARDOUS OR CORROSIVE FLUIDS



The molded MKC-1 coil fits the A3, E3, W3, E5, B6, E6, W6, R183, R184 and R246 series normally closed solenoid valves and all solenoid valves in the field that are equipped with the KC-1 coil.

The OMKC-1 coil fits the XUP series rapid cycle solenoid valves.

The MKC-2 coil fits the B9, E9, B10, E10, B14 E14, W14, 619, E19, W19, B25, E25, W25, B33, E33, E34, E42 series normally closed solenoid valves and the 180 solenoid pilot control …and all solenoid valves in the field that are equipped with the old style KC-2 coil.

When changing from the old KC model coils to the current MKC molded model coils, discard the coil housing, coil housing bottom plate, two coil sleeves (not used with KC-1 coil) AND THE SPACER.

The OMKC-2 coil fits the OB9, OE9, OB10, OE10, OB14, OE14, OB19, OE19, OB25, OE25, OB33, OE33, OE34, OE42 series normally open solenoid valves and the XRN, XRM, XPO series rapid cycle solenoid valves.

Other Sporlan Valve products using a molded coil are as follows:
MKC-1 — SORIT-12, SORIT-15, SORIT-20, 8D, 12D and 10G.
MKC-2 — 16D, DDR-20, SHGB(E)-15, OLDR-15 and OLDR-20.
OMKC-2 — LDR-1 S LDR-20 XTM and XTO.

To insure peak performance, solenoid valves must be selected and applied correctly; however, proper installation procedures are equally as important. The following instructions list the essential points for correct installation.
An exploded view of a typical Solenoid Valve is illustrated in Figures 5, 5A and 6.
Position — All standard solenoid valves may be mounted horizontal, on its side or in a vertical line with the exception of the following: A3 dated 6-86 or before, MA32, MA42 MA50, MA5A, MA17A, XUP, XRN, XRM and XPO series, which **MUST** be installed in horizontal lines with the coil housing no more than 45° from vertical. The direction of flow is indicated by an **arrow** or the word **IN** on the valve body.
NOTE: Solenoid Valves having a type number starting with the letter X" are Special Solenoid Valves (non-standard). Contact Sporlan Valve Company, Washington, MO if valve mounting is in question.

SOLDER CONNECTIONS

Because of possible damage to valve components due to the high temperatures of soldering and brazing, all Sporlan Solenoid Valves with solder connections are shipped hand tight to facilitate disassembly with the exception of the following: E Series (Extended End Connections) and Types A3, (M)B33S2, OB33S2, MA42S3 and MA50S3. The following steps outline the recommended procedures to be used when installing these valves.
Soldering Precautions — Solder connections on Sporlan Solenoid Valves are either copper or brass. Any of the commonly used types of solder are satisfactory with these materials. Regardless of the type of solder used, it is important to avoid over-heating the valve.
In all cases it is necessary that the valve be completely disassembled before any heat is applied to the valve body with the exception of the following: E Series (Extended End Connections) and Types A3, (M)B33S2, 053352, MA42S3 and MA50S3
The tip of the soldering torch should be large enough to avoid prolonged heating of the connection during the soldering operation. Overheating can also be minimized by directing the flame away from the valve body.

Type A3S1

1. Remove the coil assembly.
2. Locate the word IN or the directional arrow on the valve body.
3. Place the valve in the line in the proper direction of flow and solder.
4. Replace the coil assembly and tighten coil hex screw.

Types B6, B9, B10, B14, B19 and B25 Series

1. Remove the coil assembly, enclosing tube and nut, all internal parts, and manual lift stem assembly.
2. Locate the word IN or the directional arrow on the valve body.
3. Place the valve in the line in the proper direction of flow and solder

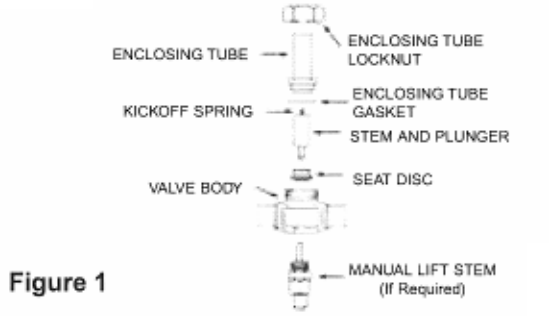


Figure 1

4. Re-assemble as follows, see Figures 1, 5, and 5A
   a. Place the seat disc into the valve body with the smaller diameter end facing up.
   b. Place the enclosing tube gasket onto the valve body above the threads.
   c. Hold the plunger with one hand so that the pointed end is resting in the pilot port of the disk. Make sure the small spring is in place on the top of the plunger. **(NOTE: Does not apply to normally open and rapid cycle series.)**
   d. With the other hand, place the enclosing tube over the plunger, making sure the enclosing tube gasket is in position.
   e. Replace the enclosing tube locknut and tighten. (See recommended torque in the table below.)
   f. Replace manual lift stem and tighten.
   g. Replace the coil assembly. **(NOTE: For normally open and rapid cycle valves replace spacer and spacer cup with coil assembly.)**

NOTE: Because of the enclosing tube gasket construction, excessive tightening of the enclosing tube locknut is not required. Please observe the torques listed in table.

Types: All E Series (Extended End Connections)

May be brazed into the line without disassembly because the valve contains extended connections. Use caution by placing a wet rag or chills on the extensions at the body to prevent excessive overheating. Follow type A3S1 installation instructions.

FLANGED CONNECTIONS—PIPE or SOLDER

Solenoid valves with flanged connections may be installed without disassembly. In most cases the flanges are packed disassembled from the valve body. Therefore, they may be installed in the line before the valve is installed. Care must be exercised to be certain that the correct flange is installed on the inlet line in order to properly match the flow direction of the valve. If the valve is installed backwards, it will not function properly.

Types MA5A3, MA17A3, MA32P3, MA42P3, MA50P3

Avoid the use of excessive amounts of pipe sealing compounds. It will interfere with the valve operation if it comes in contact with the valve's internal parts.

Types B33S2, MB33S2, OB33S2, MA42S3, MA50S3
These valves are supplied with a two piece flange assembly, a semi-steel flange ring and a brass solder bushing. The flange should be placed on the pipe before the bushing is soldered or brazed. The soldering discussion given under “Solder Connections” applies for these valves except where the discussion deals with non-flanged valves only.

With Types MA42S3 and MA50S3 care must be exercised to use the correct flange and bushing in order to correspond with its mating flange on the valve for correct flow direction.

These valves have male flange connections on the inlet of the valve; therefore, the flange and bushing for the inlet must be the female pair.

INSTALLATION—ALL VALVES

Mounting — A Type 1216-1 universal mounting bracket, Figure 2, is available, when ordered. It fits all standard Sporlan Solenoid Valves except the Types W3, MA32, B33, E33, E34, E42, MA42, MA50, (K)(B)R183, (K)(B)R184, (K)(B)R246 series and the Type 180 Solenoid Pilot Control. The slots in the bracket will match the tapped holes in the standard solenoid valves so that they may be secured by two screws supplied with the bracket. A locknut is also furnished for use with Types MA5A3 and MA17A3. Both types of installations are shown in Figure 2. The manual lift stem seal cap is replaced after the locknut is tightened against the bracket.

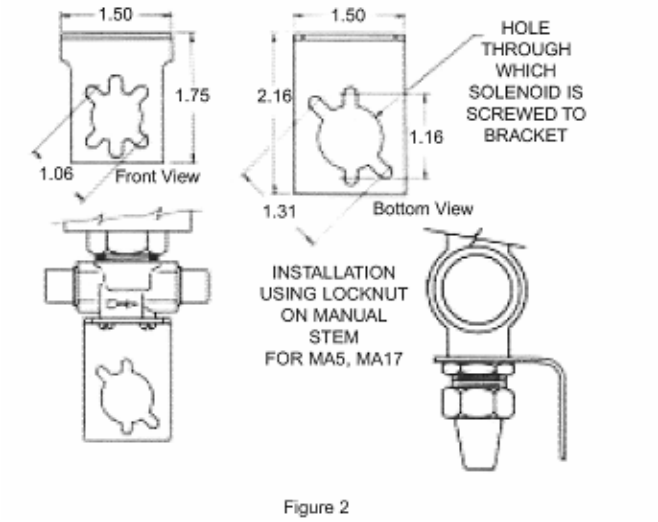


Figure 2
INSTALLATION FOR TYPES A3, E3*, E5* B6, S6*, W6, B9, E9*, B10, E10, B14, E14, W14, B19, E19, W19, B25, E25, W25 Series and Types MA5A, MA17A Solenoid Valves.
*Are not supplied standard with mounting holes.

Wiring — Check the electrical specifications of the coil to be sure that they correspond to the available electrical service.

The 1/2” BX conduit connection or junction box on the coil may be rotated to any position by loosening the coil hexscrew. Solenoid valves with four-wire dual voltage coils have a wiring diagram decal, Figure 3, on the coil housing or bracket. This illustrates which wires to connect for either 120, 208 or 240 volt operation. Wiring and fusing (when used) must comply with prevailing local and national wiring codes and ordinances.

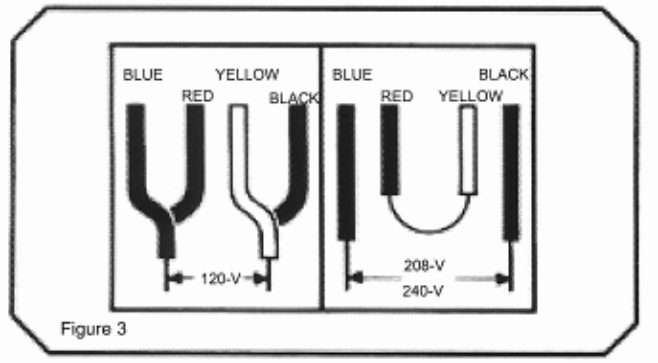


Figure 3

Direct current Valves — A surge protector is supplied with each solenoid valve with a 115 volt DC coil. The surge protector is necessary to absorb the high counter-voltage generated when the circuit is broken, thereby protecting the electrical contacts of the thermostat. It should be wired as shown in Figure 4

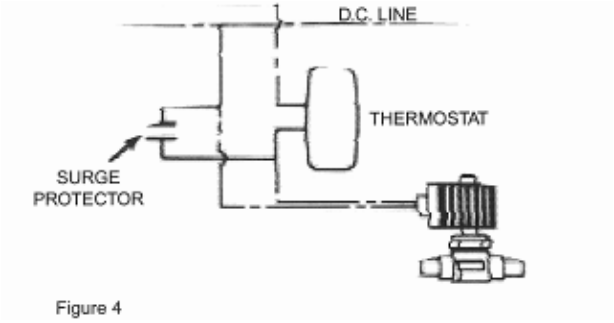


Figure 4

TRANSFORMER SELECTION

COIL KIT	24v/50-60c Current Amperes		120v/50-60c Current Amperes		240v/50-60c Current Amperes		Transformer Rating Volt-Amperes
	In-rush	Holding	In-rush	Holding	In-rush	Holding	For 100% of rated MOPD of Valve
MKC-1	1.9	.63	.39	.14	.19	.09	60
MKC-2	3.1	1.4	.60	.26	.31	.13	100
KC-3	7.9	1.9	1.7	.41	.83	.21	250

SERVICING INSTRUCTIONS

CAUTION — Dangerous hydraulic pressures may develop if a hand valve is installed in the liquid line ahead of the solenoid valve and the hand valve is closed while the solenoid valve is closed. This may cause extrusion of the teflon seat in the disc. Extrusion may cause the valve to fail to open, fail to close and/or have excessive seat leakage. Also the line between these two valves should be pumped down completely before disassembling the solenoid valve for service.

TYPICAL MALFUNCTIONS

There are only three possible malfunctions: 1. Coil burnout. 2. Failure to open. 3. Failure to close. Each is discussed below.

COIL BURNOUT

Coil burnouts are extremely rare unless caused by one of the following:

1. Improper electrical characteristics.
2. Continuous over-voltage, more than 10%.
3. Under-voltage of more than 15%. This applies only if the operating conditions are such that the reduced MOPD causes stalling of the plunger, which results in excessive current draw.
4. Incomplete magnetic circuit due to the omission of parts such as: coil housing, coil sleeves, coil spring, coil housing bottom plate or plunger on the KC model coil and coil yoke, coil back-plate or plunger on the MKC molded model coils.
5. Mechanical interference with plunger movement which may be caused by a deformed enclosing tube.
6. Voltage spike.
7. Valve ambient exceeds 120°F.

FAILURE TO OPEN (Normally Closed Types)

1. Coil burned out or an open circuit to coil connections.
2. Improper electrical characteristics.
3. In pilot operated valves, dirt, scale, or sludge may prevent the piston, disc or diaphragm from lifting. This could also be caused by a deformed body.
4. High differential pressure that exceeds the MOPD rating of the valve.
5. Diameter reduction of synthetic seating material in pilot port because of high temperatures and/or pressures, or severe pulsations. Contact Sporlan Valve Co., Washington, Mo.

The problem of dirt can be avoided by installing a Sporlan Catch-All Filter-Drier upstream from the solenoid valve. The Catch-All Filter-Drier will retain much smaller particles than a conventional strainer.
Use a Sporlan strainer for water applications upstream of every industrial solenoid valve.

FAILURE TO CLOSE

1 Valve is oversized.
2 In pilot operated valves, dirt, scale, or sludge may prevent the piston, disc or diaphragm from closing. This could also be caused by a deformed body
3. Held open by the manual lift stem.
4. In pilot operated valves only, a damaged pilot port may prevent closing.
5. A floating disc due to severe discharge pulses, contact Sporlan Valve Co., Washington, Mo.
6. Have voltage feedback to the coil after the coil de-energizes.

MISCELLANEOUS

1. Water Hammer — Industrial solenoid valves or other quick acting valves may cause water hammer when installed on water lines. If this occurs, it may be minimized by the use of a standpipe installed in the piping near the solenoid valve inlet. Commercially available shock absorbers may also be used to reduce this noise.
2. AC Hum — This problem may be caused by a loose coil housing on a KC model coil. On rare occasions this may be caused by loose coil sleeves, in which case deforming them slightly will eliminate the hum. A loose coil hex screw or coil locknut may cause this problem on the MKC molded model coils.
   Foreign material between the magnetic top plug and the plunger in the Types A3, E3, W3, E5, B6, E6, W6, B9, E9, B10, E10, B14, E14, W14, B19, E19, W19, B25, E25, W25, B33, E33, E34 and E42 Series Solenoid valves may cause AC hum also.

On water applications, deposits may accumulate in the valve which could cause AC hum. This may be eliminated by cleaning or flushing the valve.

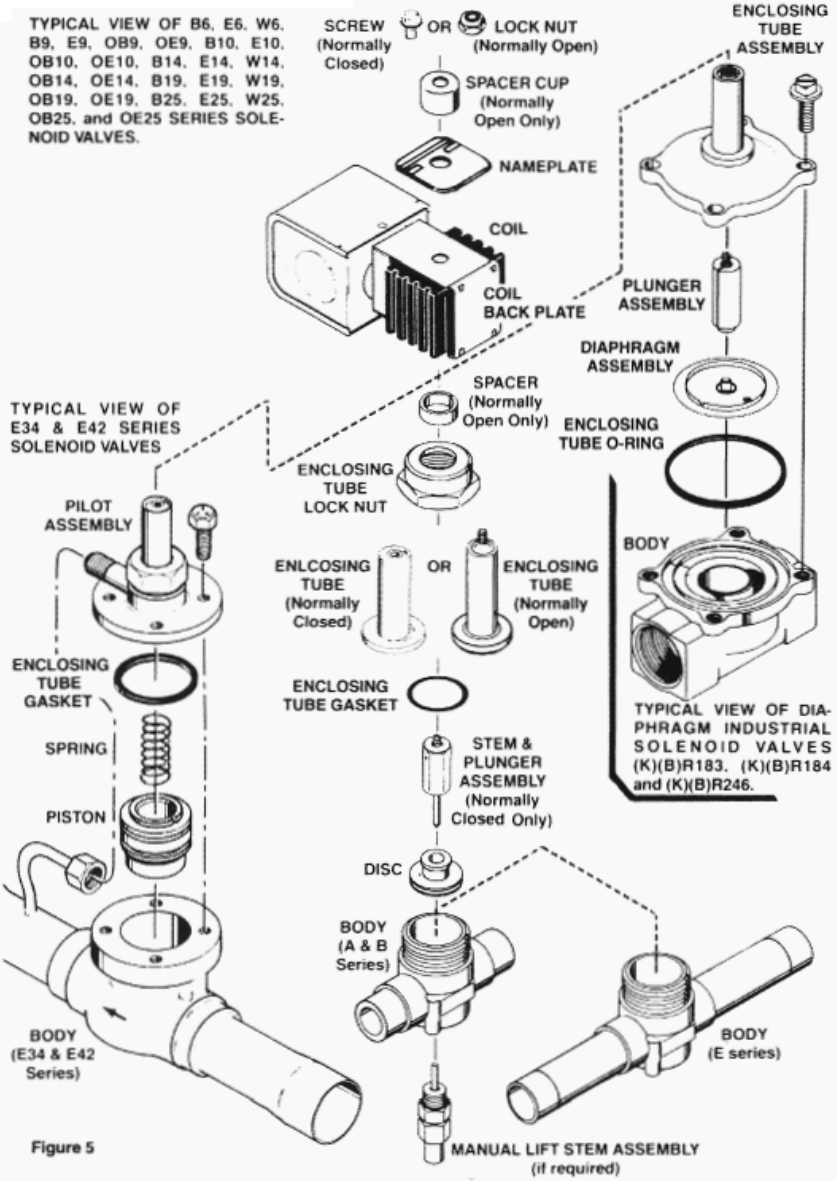
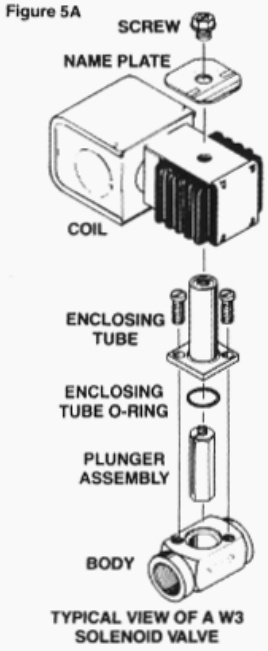
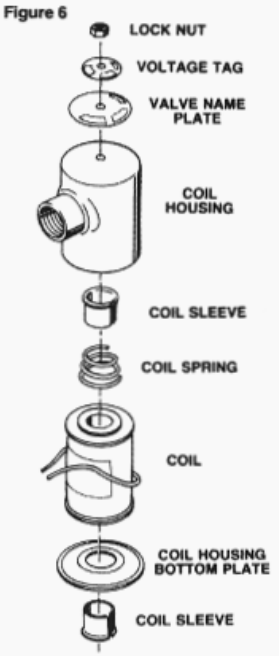


Figure 5





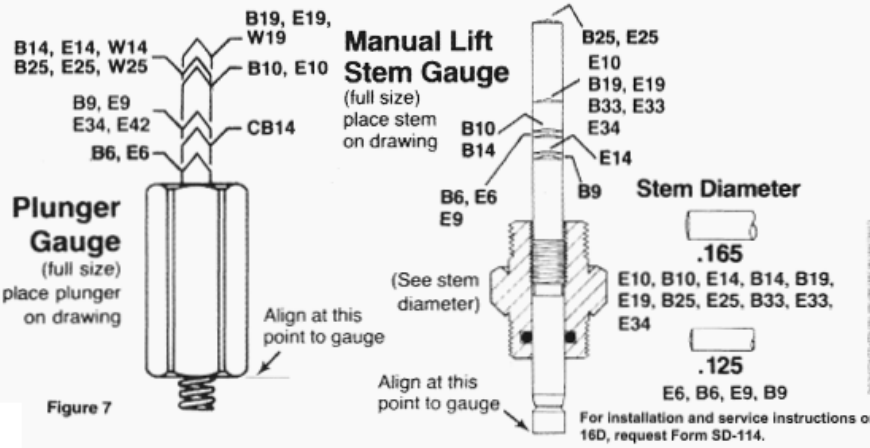


Figure 7

Figure 7 contains a full size plunger gauge, and a manual lift stem gauge for easy identification of parts. Be sure to gauge from the end of the manual lift stem. Do not gauge from the packing gland assembly.

For installation and service instructions on Three-Way Heat Reclaim Valves Type 8D, 12D & 16D, request Form SD-114.

BULLETIN 230-10-5
July 1996
Supersedes January 1996

SPORLAN

Solenoid Replacement Parts Kits

Cross Reference Chart

USED IN VALVE TYPE			INTERNAL PARTS KIT[1]		COIL KIT
WITHOUT MANUAL LIFT STEM	WITH MANUAL LIFT STEM	OLD TYPE NUMBER	CURRENT NUMBER	OBSOLETE NUMBER	
-	-	10-S, 10-F, 10, P	-	-	MKC-2
B6S1, B6F1, B6P1, E6	MB6S1, MB6F1, MB6P1, ME6	-	KS-B6/E6	-	MKC-l
B9S2, B9F2, B9P2, E9	MB9S2, MB9F2, MB9P2, ME9	-	KS-B9/E9	-	MKC-2
OB9S2, OB9F2, OB9P2, OE9	-	-	KS-OB9/OE9	-	OMKC-2
B10S2, B10F2, E10	MB10S2, MB10F2, ME10	-	KS-B10/E10	-	MKC-2
OB10S2, OB10F2, OE10	-	-	KS-OB10/OE10	-	OMKC-2
B14S2, B14P2, E14	MB14S2, MB14F2, ME14	-	KS-B14/E14	-	MKC-2
0B14S2, OB14P2, OE14	-	-	KS-OB14/OE14	-	OMKC-2
DB14S2, DB14P2, DE14	DMB14S2, DMB14P2, DME14	-	KS-DB14	-	MKC-2
B19S2, B19P2, E19	MB19S2, MB19P2, ME19	-	KS-B19/E19	-	MKC-2
OB19S2, OB19P2, OE19	-	-	KS-0B19/OE19	-	OMKC-2
DB19S2, DB19P2, DE19	DMB19S2, DMB19P2, DME19	-	KS-DB19	-	MKC-2
B25S2, B25F2, E25	MB25S2, MB25P2, ME25	-	*KS-B25/E25*	-	MKC-2
OB25S2, OB25P2, OE25	-	-	KS-0B25/0E25	-	OMKC-2
B33S2, B33P2, E33	MB33S2, EMB33S2, ME33	-	KS-B33/E33	-	MKC-2
OB33S2, OB33P2, OE33	-	-	KS-OB33/OE33	-	OMKC-2
E34	ME34	-	KS-E34	-	MKC-2
0E34	-	-	KS-OE34	-	OMKC-2
E42	ME42	-	KS-E42	-	MKC-2
0E42	-	-	KS-OE42	-	OMKC-2
XUP	-	-	KS-XUP	-	OMKC-l
XRN	-	-	KS-XRN	-	OMKC-2
XRM	-	-	KS-XRM	-	OMKC-2
XPO	-	-	KS-XPO	-	OMKC-2
A17S3, A17P3	MA17S3, MA17P3, MA17A3	43S, 43P, 53-P	KS-A17[2] KS-MA17[2]	KD-43 KS-83	KC-3 or HKC-3
DA17S3, DA17P3	DMA17S3, DMA17P3, DMA17A3	43-S, 43-P, 83-P	KS-DA17	KS-4303 KS-8303	KC-3 or HKC-3
A24S3, A24P3	MA24S3, MA24P3	4303-S, 4303-P, 8303-P 4306-P, 4308-P	-	*KS-A24	KC-3 or HKC-3
DA24S3, DA24P3	DMA24S3, DMA24P3	5303-S, 5303-P 5306-P, 5308-P	-	*KS-DA24	KC-3 or HKC-3
B32, B32P3, C32S3	MA32S3, MA32P3, MB32S3 MB32P3, MC32S3	90-P, 90-S, 9001-S 9001-P, 9005-S	KS-MA32	KS-90	KC-3 or HKC-3
DB32S3, DB32P3, DC32S3	DMA32S3, DMA32P3 DMB32S3, DMB32P3 DMC32S3	9002, 9002-P, 9003-S 9003-P 9006-S	KS-DMA-32	KS-9002	KC-3 or HKC-3
B42, EB42	MA42S3, MA42P3, MB42S3	100	KS-MA42	KS-100	KC-3 or HKC-3
-	MA50S3, MA50P3	110	KS-MA50	KS-110	KC-3 or HKC-3
-	MA5A3	35-P	KS-MA5	KS-35	KC-3 or HKC-3
W3P1	-	-	KS-W3	-	MKC-l
RWP1	-	-	KS-RW3	-	MKC-1

W6P1	-	-	KS-W6	-	MKC-1
W7P1	-	-	KS-W7	-	MKC-2
W14P2	-	-	KS-W14	-	MKC-2
W19P2	-	-	KS-W19	-	MKC-2
W25P2	-	-	KS-W25	-	MKC-2
R183P1, KR183P1 R184P1, KR184P1	-	-	KS-R18	-	MKC-l
BR183P1, KBR183P1 BR184P1, KBR184P1	-	-	KS-BR18	-	MKC-1
R246P1	-	-	KS-R24	-	MKC-l
BR246P1, KBR246P1	-	-	KS-BR24	-	MKC-1

[1] Internal parts kits showing both an old number and a new number are identical and are interchangeable.
[2] KS-A17 and KS-MA17A are interchangeable. * Available while quantities last.

Cross Reference Chart (con't)

USED IN VALVE TYPE			INTERNAL PARTS KIT		COIL KIT
WITHOUT MANUAL LIFT STEM	**WITH MANUAL LIFT STEM**	**OLD TYPE NUMBER**	**CURRENT NUMBER**	**OBSOLETE NUMBER**	
8D7B/8D7C 8D9B/8D9C	-	-	KS-8D	-	MKC-1
12D11B/12D11C 12D13B/12D13C	-	-	KS-12D	-	MKC-1
16D17B/16D17C	-	-	KS-16D	-	MKC-2
8D7B-SC/8D7C-SC 8D9B-SC/8D9C-SC		-	KS-80-SC	-	MKC-1
12D11B-SC/12D11C-SC 12D13B-SC/12D13C-SC	-	-	KS-12D-SC	-	MKC-1
16D17B-SC/16D17C-SC	-	-	KS-16D-SC	-	MKC-2
8D & 12D PILOT	-	-	KS-8D/12DP	-	MKC-1
160 PILOT	-	-	KS-16DP	-	MKC-2
8D-SC & 12D-SC PILOT	-	-	KS-8D/12DP-SC	-	MKC-1
16D-SC PILOT	-	-	KS-16DP-SC	-	MKC-2
10G	-	-	KS-10G		MKC-1
10G-B PILOT	-	-	KS-10GP-B	-	MKC-1
10G-C PILOT	-	-	KS-10GP-C	-	MKC-1

OBSOLETE VALVES

-	-	W24P3	-	KS-W24	KC-3 or HKC-3
-	-	A6S1, A6F1, A6P1	-	KS-A6	MKC-1
-	-	A9S2, A9F2, A9P2	-	KS-A9	MKC-2
A10F2, A10S2	A10S2, A10F2	-	-	*KS-A10	MKC-2
A14S2, A14P2	A14S2, A14P2	-	-	KS-A14	MKC-2
-	-	12-S, 12-F, 12-P	-	KS-12	KC-12 or HKC-12
-	-	1210S, 1210F, 1210P	-	KS-1210	KC-12 or HKC-12
-	-	1240S, 1240F, 1240P	-	KS-124O	KC-12 or HKC-12
-	-	14-S, 14-F, 14-P	-	KS-14	MKC-2
-	-	20-S	-	*KS-20	KC-12 or HKC-12
-	-	73-S, 73-P	-	*KS-73	KC-12 or HKC-12
-	-	7303-S, 7303-P	-	*KS-7303	KC-12 or HKC-12

*Available while quantities last.

Solenoid Valve Enclosing Tube Kit

Cross Reference Chart

ENCLOSING TUBE KIT NUMBER	*VALVE TYPE
KE-6	(M)B6/E6, W6, 10G
KE-9	(M)B9/E9, C(M)B9/C(M)E9 (M)E34, (M)E42, 16D/16D-SC
KE-10/14	(M)B10/E10, C(M)B10/C(M)E10 (M)B14/C(M)E14, W14
KE-19	(M)B19/E19, C(M)B19/C(M)E19 W19
KE-25	(M)B25/(M)E25, W25
KE-33	(M)B33/(M)E33
KE-8D/12D	80/120, 80-SC, 120-SC
KE-MA32	MA32
KE-MA42	MA42, EMB42
KE-MA50	MA50
KE-18/24	R18, KR18, KBR18, R24 KR24, KBR24

*Enclosing tube kit includes:

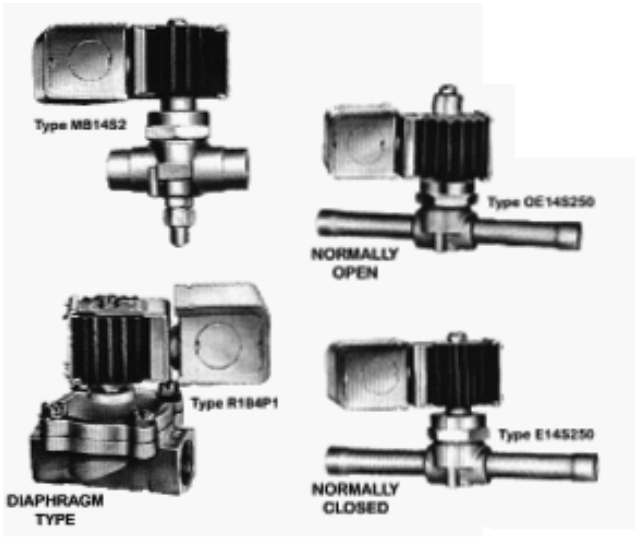
-Enclosing Tube
-Coil Housing Screw
-Tetraseal or O-Ring

Form 30-122 March 1998

SPORLAN Solenoid Valves & Coil Replacement Guide Select Solenoid Valves According to Capacity — NOT Line Size

INDUSTRIAL SOLENOID VALVES						
VALVE SERIES	CURRENT VALVE TYPES			CURRENT REPLACEMENT	OBSOLETE VALVE TYPES	CURRENT REPLACEMENT
	DISC	DIAPHRAGM	WITH STAINLESS STEEL INSERT			
W3	W3P1	—	—	MKC-1	—	—
W6	W6P1	—	—	MKC-1	XKA	MKC-1
W14	W14P2	—	—	MKC-2	XJQ	MKC-2
W19	W19P2	—	—	MKC-2	4306-P, 4308-P	KC-3
W25	W25P2	—	—	MKC-2	W24P3, 5306-P, 5308-P	KC-3
R183	—	R183P1 BR183P1	KR183P1 KBR183P1	MKC-1	W7P2	—
R184	—	R184P1 BR184P1	KR184P1 KBR184P1	MKC-1	—	—
R246	—	R246P1 BR246P1	KR246P1 KBR246P1	MKC-1	—	—

AMMONIA (R-717) SOLENOID VALVES				
CURRENT VALVE TYPES	CURRENT REPLACEMENT COILS	LIQUID CAPACITIES (TONS)	OBSOLETE VALVE TYPES	CURRENT REPLACEMENT COILS
MA5A3	KC-3	16.0	35, 34, 33, 32, 30	KC-3
MA17A3	KC-3	143	83, 8303, 82, 80	KC-3
MA32P3	KC-3	250	90	KC-3
MA42P3	KC-3	550	100	KC-3
MA50P3	KC-3	1000	10	KC-3



NOMENCLATURE – E Series

O	M	E	10	S	2	5	0	**	S
Normally Open	Manual Lift Stem	Design Series	Port Size In 1/32”	Connections Solder	Coil Size	Connection Size In 1/8”	Connection Type 0=ODF X ODF 1=ODF X ODM 2=ODM X ODF 3=ODM X ODM	Overall Length	Spade Coil

** No dash number indicates standard length: -1, -2, -3 etc. thru -19 indicates nonstandard longer or shorter overall lengths;
-20 thru -32 indicates other deviation from standard. contact Washington, Missouri.

NOMENCLATURE – A, B, & W Series

O	†F	†H	D	M	B	25	S	2
Normally Open	Fungus Proof Coil	High Temperature Coil	Direct Connected	Manual Lift Stem	Design or Series A, B, & W Series	Port Size In 1/32”	Connections P=Pipe F=SAE Flare S=ODF Solder	Coil Size MKC-1 MKC-2 KC-3

† KC-3 only

THE ABOVE PREFIXES MAY BE ADDED TO BASIC VALVE TYPE NUMBER (B25S2) TO REQUEST SPECIAL FEATURES.

INSTALLATION AND MAINTENANCE FOR CBE's

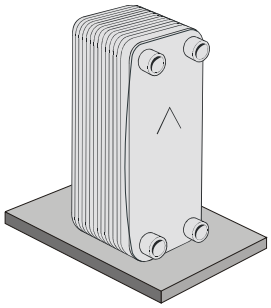
Mounting
Connections
    General
Threaded connections
Allowable Connection Loads for Pipe Assembly Conditions
Soldering Connections
Soldering Procedure
Welding Connections
Strainers
Insulation
Installation of CBEs in Different Applications
Single-Phase Applilcations, e.g. Water/Water or Water/Oil
Refrigerant Applications in General
Refrigerant Applications and Evaporators; V-Type CBEs, e.g. V27 or V45
Refrigerant Applications and Expansion Valves
Refrigerant Applications and Freezing Protection – To prevent freezing
Cleaning of the CBEs
Warranty
Disclaimer

Mounting

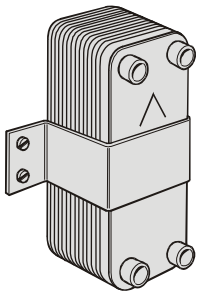
Never expose the unit to pulsations or excessive cyclic pressure or temperature changes. It is also important that no vibrations are transferred to the heat exchanger. If there is a risk of this, install vibration absorbers. In the case of larger connection diameters, we advise you to use an expanding device in the pipeline. Use e.g. a rubber mounting strip as a buffer between the CBE and the mounting clamp.

In single-phase applications such as e.g. water to water or water to oil, the mounting direction has little or no effect on the performance of the heat exchanger, but in two-phase applications, the orientation of the heat exchanger becomes very important. In two-phase applications, SWEP's CBEs should be mounted vertically, with the arrow on the front plate pointing upwards.

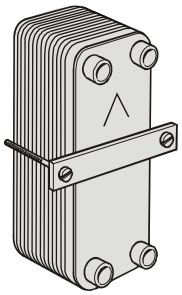
Several mounting suggestions for SWEP CBEs are shown below. Mounting stud bolts, in different versions and locations, are available on the CBEs as an option.



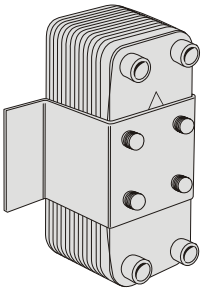
Supported from the bottom



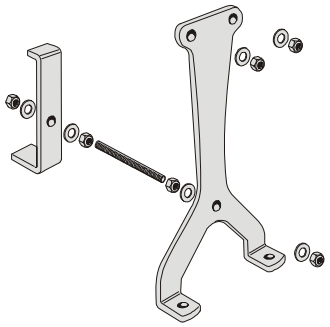
Sheet metal bracket (rubber insert between bracket and exchanger)



Crossbar and bolts (rubber insert between the crossbar and exchanger)



Equipped with mounting stud bolts on the front or back cover plate



Support legs are available for some CBEs

For smaller CBEs it is also possible to mount the unit by simply suspending it from the pipes/connections.

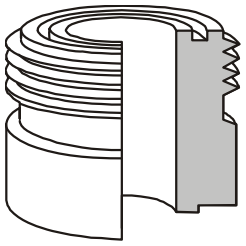
Connections

General

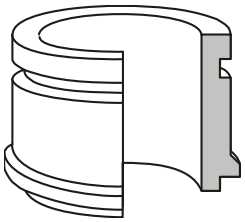
All connections are brazed to the heat exchanger in the general vacuum brazing cycle, a process which gives a very strong seal between the connection and the cover plate. However, take care not to join the counterpart with such force that the connection is damaged.

Depending on application, there are a lot of options available for the connections, different versions and locations, e.g. Compac® flanges, SAE flanges, Rotalock, Victualic, threaded connections and welding connections. It is important to have the right international or local standard of connection, as they not always are compatible.

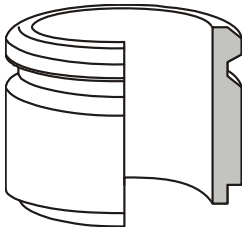
Rotalock Connections



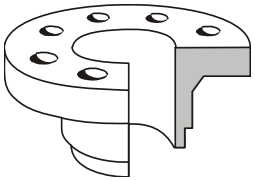
Victualic Connections



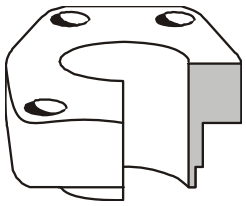
Welding Connections



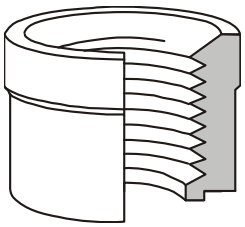
Flanges of DIN Type, Compac® flanges

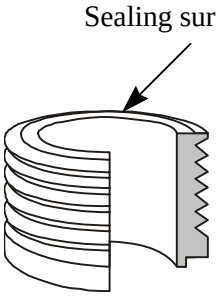


Flanges of SAE Type



SAE O-Ring Connections





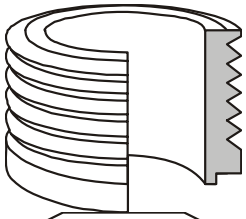
Some connections have an external heel. The purpose of the heel is to simplify the pressure and leakage testing of the CBE in production.

Some connections are equipped with a special plastic cap to protect the threads and sealing surface of the connection and to prevent dirt and dust from entering the CBE. This plastic cap should be removed with care, in order not to damage the thread or any other part of the connection. Use a screwdriver, pliers or knife.

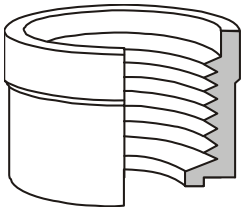
Threaded connections

Threaded connections can be female or male of well-known standards such as, ISO-G, NPT and ISO 7/1. The exterior can also be hexagonal which is shown below.

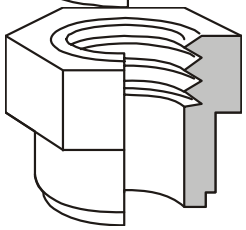
Externally Threaded Connections (Male)



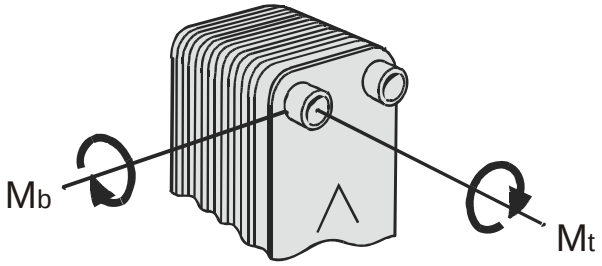
Internally Threaded Connections (Female) of Standard Type



Internally Threaded Connections (Female) with a Hexagonal Exterior



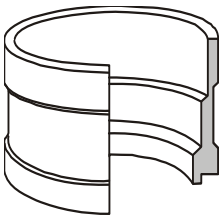
Allowable Connection Loads for Pipe Assembly Conditions



The maximum allowable connection loads given below are valid for low-cycle fatigue. The maximum allowable connection loads given below are valid for low cycle fatigue. If high cycle fatigue is involved special analysis should be made

Pipe Size	**Shear Force, Fs**		**Tension Force, Ft**		**Bending Moment, Mb**		**Torque, Mt**	
	(kN)	**(kp)**	**(kN)**	**(kp)**	**(Nm)**	**(kpm)**	**(Nm)**	**(kpm)**
½"	7	0.7	5	0.5	40	4	70	7
¾"	24	2.4	5	0.5	40	4	230	23
1"	23	2.3	8	0.8	90	9	310	32
1 ¼"	29	3.0	13	1.3	175	18	530	54
1 ½"	33	3.4	19	1.9	310	32	700	71
2"	43	4.4	27	2.8	510	52	1200	122
2 ½"	89	9.1	36	3.7	780	80	2900	296
4"	146	14.9	82	8.4	2700	277	8100	827

Soldering Connections



The soldering connections (sweat connections) are in principle designed for pipes with dimensions in mm or inches. The measurements correspond to the internal diameter of the connections. Some of SWEP's soldering connections are universal, i.e. fit both the mm and inch pipes. These are denominated xxU, such as the 28U which fits both the 1 1/8" and 28.75 mm.

All CBEs are vacuum-brazed with either a pure copper filler or a nickel-based filler. Under normal soldering conditions (no vacuum), the temperature should not exceed 1470°F (800°C). Too much heat could change the material structure resulting in internal or external leakage at the connection. Because of this we recommend that all soldering is made with silver solder containing min. 45% silver. This type of solder has a relatively low soldering temperature and high moistening and fluidity properties.

When soldering flux is used in order to remove oxides from the metal surface. This property makes the flux potentially very aggressive. Consequently, it is very important to use the correct amount of flux. Too much, might lead to severe corrosion, so no flux should be allowed to enter the CBE.

Soldering Procedure

The hard silver soldering procedure for all CBE connections can be carried out without any use of cooling water, neither by dimpling under water nor e.g. water flow through the waterside of the exchanger.

1. Clean the joints to be soldered. Clean the inside of the connection on the CBE and the outside of the pipe. Degrease the connection properly with some kind of solvent, e.g. Tri.
2. Apply flux to the inside of the connection and the outside of the pipe.
3. Center the pipe into the connection.
4. Avoid oxidation on the inside of the pipe by sending a flow of nitrogen through the pipe and the CBE during the soldering process.
5. It is important that the connection and the pipe are evenly heated.

6. At the correct soldering temperature (1112° F) the connection has a slightly red color.
7. The first part of the collings is done by keeping the nitrogen flowing through the exchanger. The final cooling could be done with water which removes the last hardened flux on the inside and outside around the solder.

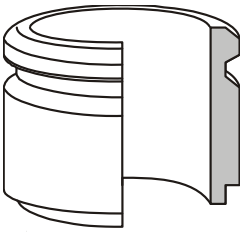
The minimal compound of silver must be at least 45%. Below you find an example of such a solder.

Tab. 2 Solder and flux

	Compound (%)				Melting range
	Ag	Cu	Cd	Zn	ºC
Hard silver solder: 454 Flux: 800 F	45	15	24	16	620-635 600-800

Welding Connections

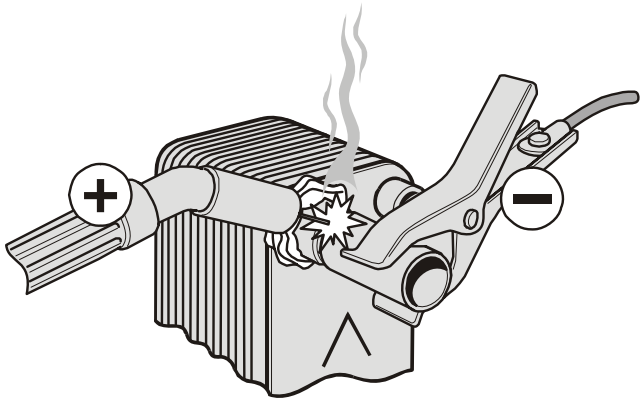
Welding is only recommended on specially designed welding connections. All SWEP's welding connections are executed with a 30° chamfer on top of the connection. Do not weld on pipes on other types of connections. The measurement in mm corresponds to the external diameter of the connection.



Welding Procedure

Protect the unit from excessive heating by:
a) using a wet cloth around the connection.
b) making a chamfer on the joining tube and connection edges as shown.

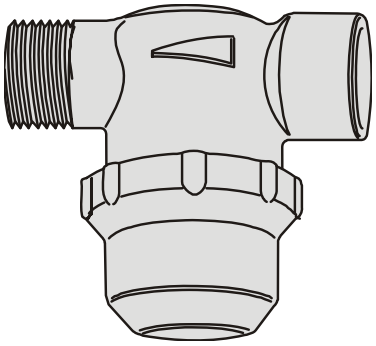
Use TIG or MIG/MAG welding. When using electrical welding circuits, connect the ground terminal to the joining tube, not to the back of the plate package.

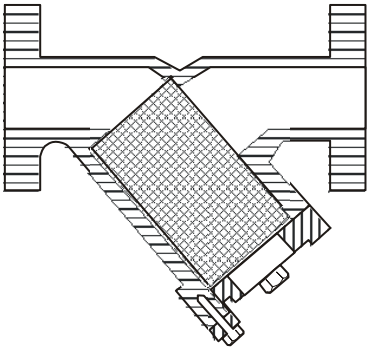


Internal oxidation can be reduced by a small nitrogen flow.

Strainers

If any of the media contains particles larger than 1 mm, we recommend that a strainer be installed before the exchanger with a size of 16-20 mesh (number of openings per inch). The particles could otherwise block the channels, causing bad performance, increased pressure drop and risk of freezing. Some strainers can be ordered as CBE accessories.

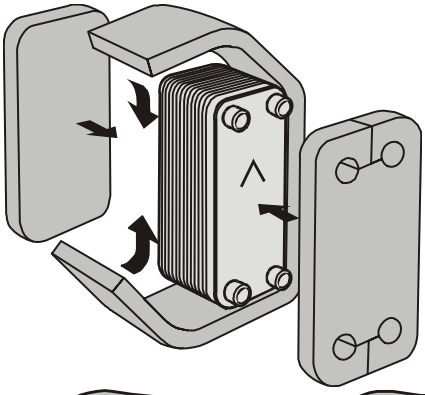




Insulation

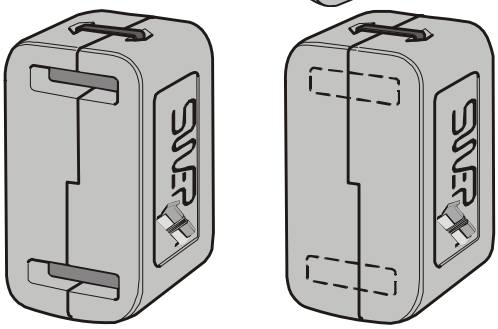
Insulation for Refrigerant Applications

CBE insulation is recommended for evaporators, condensers or district heating applications, etc. For refrigeration, use extruded insulation sheets, e.g. Armaflex or equivalent which also can be supplied by SWEP.



Insulation for Heating Applications

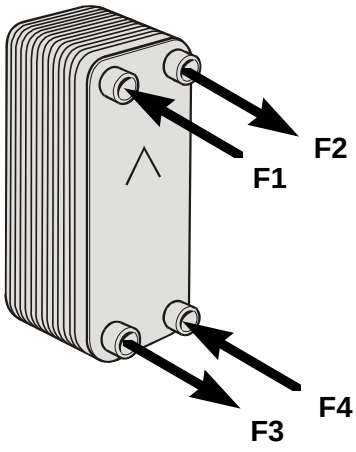
For heating applications, various types of insulation boxes can be used. The working temperature range defines which insulation is recommended. SWEP can supply some of these insulation types as optional accessories.



Installation of CBEs in Different Applications

Single-Phase Applications, e.g. Water/Water or Water/Oil

Normally, the circuit with the highest temperature and/or pressure should be connected on the left side of the heat exchanger when the arrow is pointing upwards. For example, in a typical water-to-water application, the two fluids are connected in a counter-current flow, i.e. the hot water inlet in connection F1, outlet F3, cold water inlet F4, outlet F2. This is because the right-hand side of the heat exchanger contains one channel more than the left-hand side, and the hot medium is thus surrounded by the cold medium to prevent heat loss.



Refrigerant Applications in General

In all refrigerant applications it is very important that every refrigerant channel is surrounded by a water/brine channel on both-hand sides. Normally the refrigerant side must be connected to the left-hand side and the water/brine circuit to the right side of the CBE. If the refrigerant is incorrectly connected, to the first and last channel, instead of water/brine, the evaporation temperature will drop, with the risk of freezing and very bad performance. SWEP CBEs used as condensers or evaporators should always be fitted with adequate connections on the refrigerant side.

Condenser: The refrigerant (gas) is connected to the upper left connection and the condensate to the lower left connection. The water/brine circuit inlet is connected to the lower right connection and the outlet to the upper right connection. SWEP CBE used as condensers should always be fitted with soldering connections on the refrigerant side.

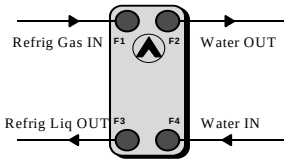


Fig. 4 Connection location: Condenser

Evaporator: The refrigerant (liquid) is connected to the lower left connection and the gas to the upper left connection. The water/ brine circuit inlet is connected to the upper right connection and the outlet to the lower right connection. SWEP CBE used as condensers should always be fitted with soldering connections on the refrigerant side.

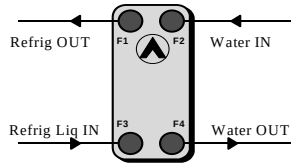
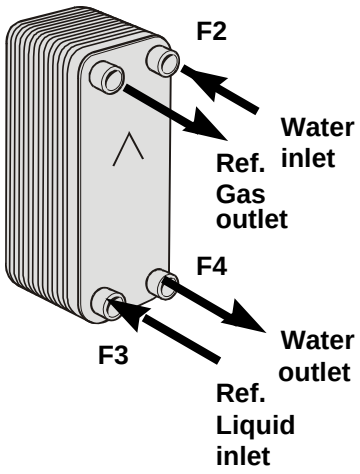


Fig. 5 Connection location: Evaporator

Refrigerant Applications and Evaporators; V-Type CBEs, e.g. V27 or V45

The V-type CBEs are equipped with a special distribution device at the refrigerant inlet, i.e. normally port F3. The purpose of the distribution device is to evenly distribute the refrigerant in the channel

The refrigerant liquid should be connected to the lower left connection (F3) and the refrigerant gas outlet to the upper left connection (F1). The water/brine circuit inlet should be connected to the upper right connection (F2) and the outlet to the lower right connection (F4).



Refrigerant Applications and Expansion Valves

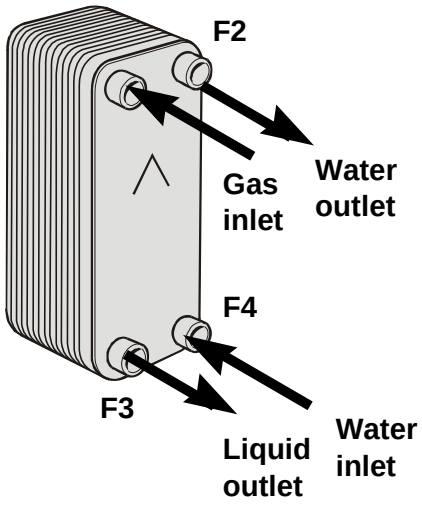
The expansion valve should be placed close to the inlet connection, whereas the bulb should be mounted about 500 mm from the vaporized refrigerant outlet connection. The pipe diameter between the expansion valve and the CBE should be the same as the diameter of the refrigerant liquid line.
For V-type CBEs, the pressure drop in the internal distribution system must be added to the pressure drop in the expansion valve to arrive at the total pressure drop. Normally, selecting the next larger size valve will give satisfactory performance.

Refrigerant Applications and Freezing Protection - To prevent freezing

a) Use a filter < 1 mm, 16 mesh (see previous chapter on Strainers).
b) Use an antifreeze when the evaporation temperature is close to liquid-side freezing.
c) Use a freeze protection thermostat and flow switch to guarantee a constant water flow before, during and after compressor operation.
d) Avoid the “pump-down” function.
e) When starting up a system, wait a moment before starting the condenser (or have reduced flow through it).

Refrigerant Applications and Condensers

The refrigerant (gas) should be connected to the upper left connection, F1, and the condensate to the lower left connection, F3. The water/brine circuit inlet should be connected to the lower right connection, F4, and the outlet to the upper right connection, F2.



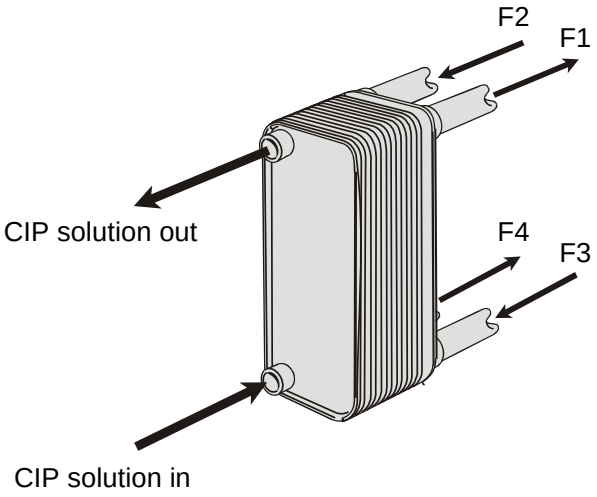
Cleaning of the CBEs

Thanks to the normally very high degree of turbulence in CBEs there is a self-cleaning effect in the channels. However, in some applications the fouling tendency can be very high, e.g. when using extremely hard water at high temperatures. In such cases it is always possible to clean the exchanger by circulating a cleaning liquid (CIP - Cleaning In Place). Use a tank with weak acid, 5% phosphoric acid or, if the exchanger is frequently cleaned, 5% oxalic acid. Pump the cleaning liquid through the exchanger.

For tough installations we recommend factory-installed CIP connections/valves for easy maintenance.

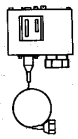
For optimum cleaning, the cleaning solution flow rate should be a minimum of 1.5 times the normal flow rate, preferably in a back-flush mode. After use, do not forget to rinse the heat exchanger carefully with clean water. A solution of 1-2% sodium hydroxide (NaOH) or sodium bicarbonate ($NaHCO_3$) before the last rinse ensures that all acid is neutralized. Clean at regular intervals

For further information about cleaning of the CBEs, please consult SWEP’s CIP information or your local SWEP company.



INSTRUCTIONS

KP 1, KP 2, KP 5, KP 7W, KP 7B



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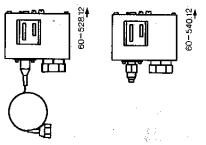
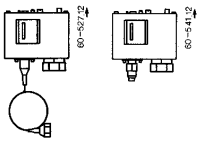
Types

The controls can be used with R12, R22, R 500 and R 502 refrigerants.
CAUTION: Do not install these controls on ammonia systems.

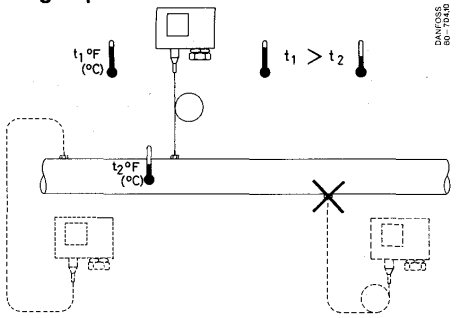


Auto reset: KP 1, KP 2, KP 5, KP 7W



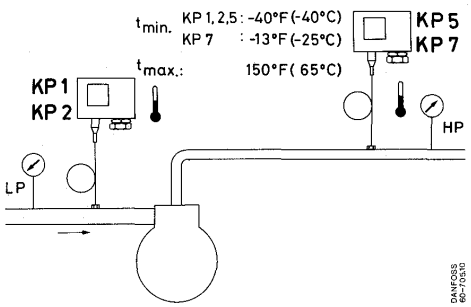
Manual reset: KP 1, KP 5, KP 7B

Mounting requirements

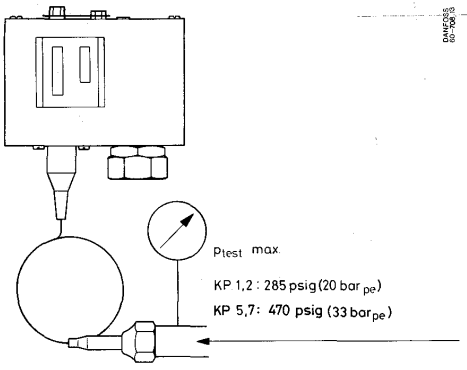


CAUTION: Do not mount the control in a position where dirt, sediment, or oil will affect the operation of the control.

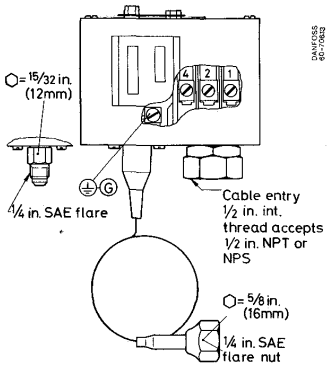
Ambient temperatures



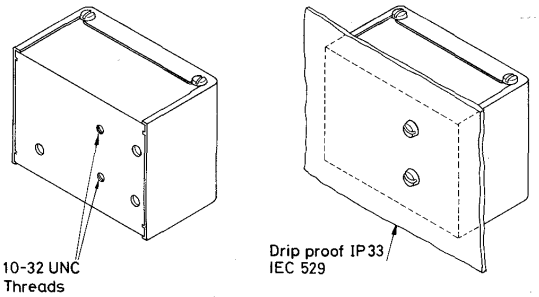
Test pressure (p_{TEST})



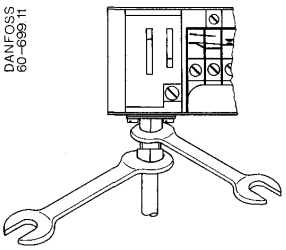
Connections



Enclosure



CAUTION: The mounting panel must be plane to avoid damage of control



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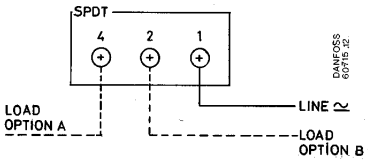
Wiring

CAUTION: Disconnect power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.
All wiring should conform to the National Electrical Code and local regulations.

Terminal block



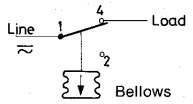
CAUTION: Use terminal screws furnished in the contact block.
Use tightening torque 20 lb. in. (2.3 Nm).
Use copper wire only.

Contact load ratings

120 V a.c.	16 FLA, 96 LRA
240 V a.c.	8 FLA, 48 LRA
240 V d.c.	12 W pilot duty

Load Option A

CUT-OUT on pressure drop
Wire terminals 1-4:
CUT-IN = High Set Point (HSP)
see "Setting"
CUT-OUT = Low Set Point (LSP)
see "Setting"



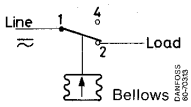
Terms 1-4 close on pressure rise
Terms 1-4 open on pressure drop

Example: CUT-IN = 30 psig
CUT-OUT = 10 psig

This means CUT-IN = HSP = 30 psig
and CUT-OUT = LSP = 10 psig

Load Option B

CUT-OUT on pressure rise
Wire terminals 1-2:
CUT-IN = Low Set Point (LSP)
see "Setting"
CUT-OUT = High Set Point (HSP)
see "Setting"



Terms 1-2 close on pressure drop
Terms 1-2 open on pressure rise

Example: CUT-IN = 250 psig
CUT-OUT = 350 psig

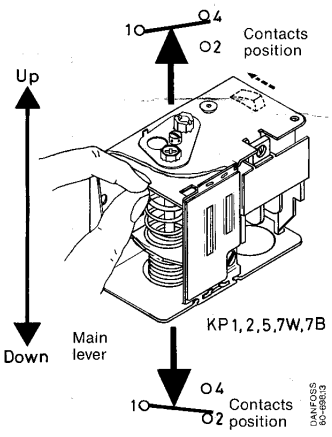
This means CUT-IN = LSP = 250 psig
and CUT-OUT = HSP = 350 psig

Note: ↓ = bellows movement on pressure drop
Note: ↑ = bellows movement on pressure rise
Note: The free terminal can be used for signal purpose

Manual tripping

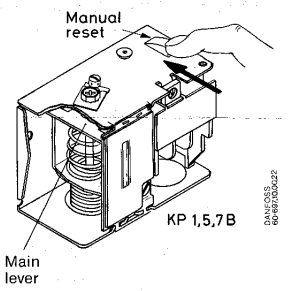
(Electrical contacts/wiring test)

TRIP (main lever)
Use FINGERS ONLY!
(Do NOT use screwdriver)



Note:
KP 1, KP 5 and KP 7B w/man. reset: Push manual reset knob during manual tripping

Manual reset

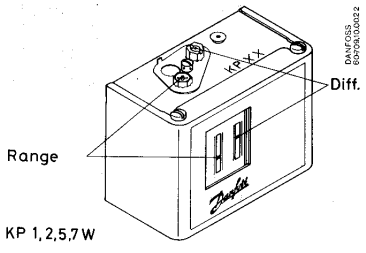


To resume control operation after safety cutout, push reset knob as indicated.

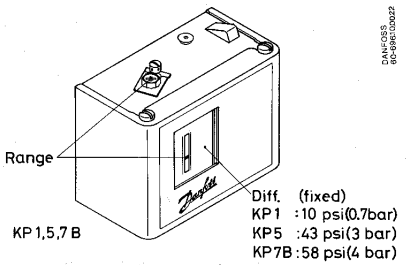
Note:
KP 1, man. reset is possible only after a pressure rise of 10 psi (0.7 bar).
KP 5 and KP 7B, man. reset is possible only after a pressure drop of respectively 43 psi (3.0 bar) and 58 psi (4.0 bar)

Adjustment spindle (s) location

Auto reset



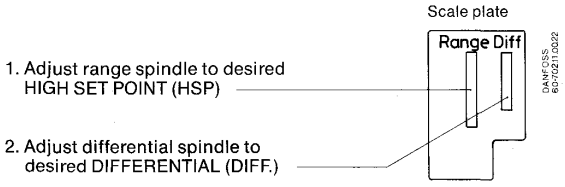
Manual reset



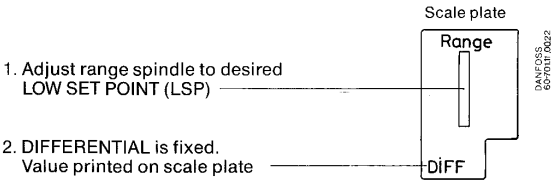
Setting

(see also "Wiring")

KP 1 (auto. reset), KP 2, KP 5, KP 7W and KP 7B



KP 1 (manual reset ONLY)



Note:
KP 5 (manual reset) and KP 7B have fixed diff.
Value printed on scale plate.

HIGH SET POINT minus DIFFERENTIAL equals LOW SET POINT

Example:

HSP	–	DIFF.	=	LSP
30 psig	–	20 psi	=	10 psig
(2.1 bar)		(1.4 bar)		(0.7 bar)

If terminals 1-4 are used: CUT-IN = HSP
CUT-OUT = LSP
If terminals 1-2 are used: CUT-IN = LSP
CUT-OUT = HSP

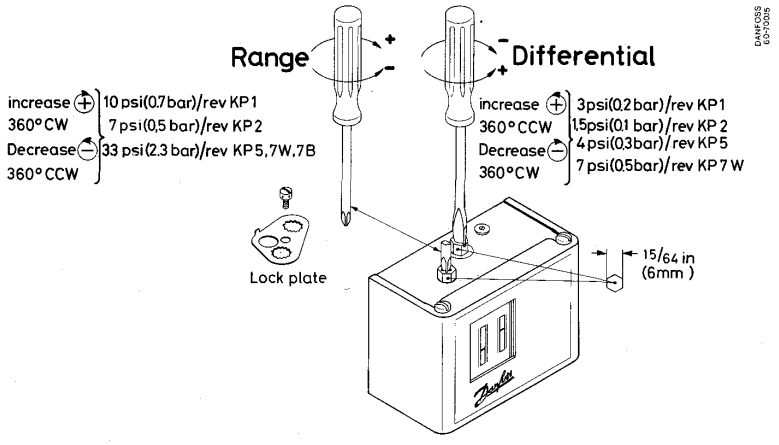
LOW SET POINT plus DIFFERENTIAL equals HIGH SET POINT

Example:

LSP	+	DIFF.	=	HSP
12 psig	+	10 psi	=	22 psig
(0.8 bar)		(0.7 bar)		(1.5 bar)

Adjustment

See instruction printed on top of control



Note:
Remove lockplate before adjustment.
Replace lockplate after adjustment
(if desired)

September 1996/ BULLETIN 10-11

SPORLAN

Thermostatic Expansion Valves
INSTALLATION, FIELD SERVICE & ASSEMBLY

INSTALLATION

For peak performance, it is important to select a Sporlan thermostatic expansion valve with the correct capacity, selective charge, external or internal equalizer, etc. See Bulletins 10-9 and 10-10 for complete application information. Equally important is the proper installation, which can determine the success or failure of the entire system.

A. VALVE LOCATION

Thermostatic expansion valves may be mounted in any position, but they should be installed as close to the evaporator as possible. If a refrigerant distributor is used with the expansion valve, best performance is obtained if the distributor is mounted directly to the valve outlet. If the distributor cannot be mounted directly to the valve outlet, the distance between the valve outlet and distributor should not exceed 24 inches or refrigerant distribution problems may occur. Also, the tube connecting the valve outlet and distributor can be sized smaller to maintain refrigerant velocity and better distribution. Elbows located between the expansion valve and distributor will hinder proper distribution and therefore, are not recommended.

Best distribution is usually obtained if the expansion valve feeds vertically up or down into the distributor, System manufacturers, however, have successfully applied distributors in other orientations. See Bulletin 20-10 for application and selection information on refrigerant distributors.

While not always convenient nor possible, valve Types BI, F, FB, and O are easier to service if mounted in a vertical and upright position. If mounted in a horizontal position, the internal parts must be carefully reassembled to prevent damage to them. Also, some consideration should be taken in mounting the larger sized expansion valves. They must be adequately supported since system vibration and the weight of the valve may cause valve connections to fracture.
If a hand valve is located on the outlet side of the thermostatic expansion valve it should have a full sized port. No restrictions should appear between the thermostatic expansion valve and evaporator, except a refrigerant distributor if one is used.

Sporlan Thermostatic Expansion Valves having Selective Charges C, Z, L, or X may be installed and operated in most locations. The amount of thermostatic charge and the bulb size are such that the bulb retains control despite a colder valve body or diaphragm case. The exception is when the element is subjected to sub-zero temperatures for extended periods of time during an off-cycle. In this case, start-up may be prolonged until the bulb and element are warmed sufficiently to open the valve.

To minimize the possibility of charge migration, the Sporlan Flow-Master P and VGA air conditioning charges or ZP refrigeration charges should be installed so the diaphragm case is warmer than the bulb. Special noncondensable charges without MOP and double diaphragm hydraulic elements with MOP are available for system manufacturers to overcome this potential problem.

Occasionally, thermostatic expansion valves are located in corrosive atmospheric conditions that can damage the valve and/or element assembly. Due to this possibility, the valve must be protected with appropriate materials to prevent premature failure. Consult specialists in protective coatings.

PRECAUTIONS—WHEN VALVE IS INSTALLED AT CONSIDERABLE HEIGHT ABOVE LIQUID RECEIVER

When the evaporator and thermostatic expansion valve are located above the receiver, there is a static pressure loss in the liquid line. This is due to the weight of the column of liquid refrigerant, and this weight may be interpreted in terms of pressure loss in pounds per square inch as shown in Table-3, Page 15, Bulletin 10-10. If the vertical lift is great enough, vapor or *flash gas* will form in the liquid line causing a serious reduction in the capacity of the thermostatic expansion valve.

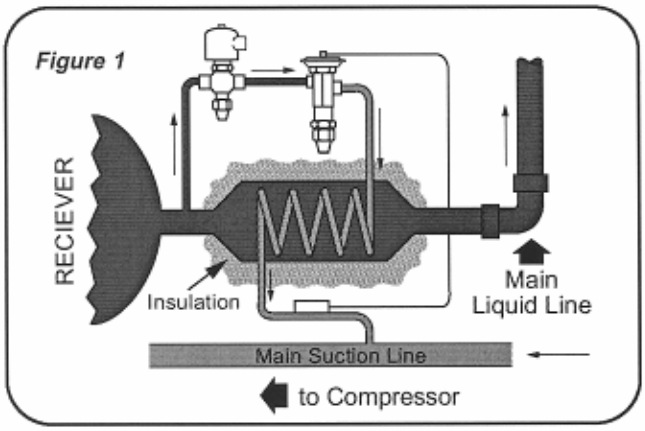
When an appreciable vertical lift is unavoidable, precautions should be taken to prevent the accompanying pressure loss from producing liquid line vapor. This can be accomplished by providing enough subcooling to the liquid refrigerant, either in the condenser or after the liquid leaves the receiver. Subcooling is determined by subtracting the actual liquid temperature from the condensing temperature (corresponding to the condensing pressure). A subcooling calculation example is provided on Pages 15 and 16 of Bulletin 10-9.

Liquid subcooling is provided by the following methods:
1. In the condenser
2. Suction — liquid heat exchanger
3. Special devices

Method-1 will provide sufficient subcooling for the simple short-coupled system that has only moderate liquid line pressure drop.

Method-2 will usually not provide more than 20° F subcooling on air conditioning systems operating at normal head pressures. The amount of subcooling will depend on the design and size of the heat exchanger and on the operating suction and discharge pressures.

Method-3 may be used to provide considerable subcooling required for systems with excessive vertical lift. The following special devices are the most commonly used methods.
a. Water coils in heat exchange relationship with the liquid line.
b. Separate refrigeration system.
c. Special heat exchanger which uses a portion of the refrigerant to cool the main body of liquid. See Figure-1.



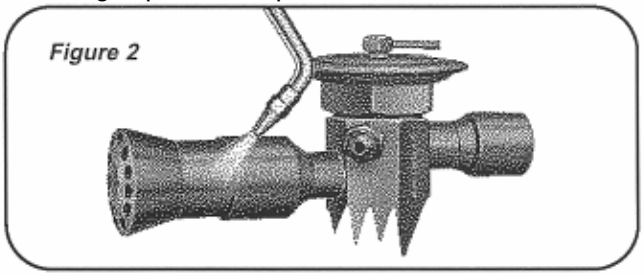
Ordinarily the conventional suction — liquid heat exchanger is installed near the evaporator, where the suction vapor is the coldest, to re-condense any vapor in the liquid line. When the primary purpose of the heat exchanger is to prevent the formation of flash gas — particularly on systems that have a long liquid line or excessive vertical lift —install the heat exchanger near the receiver before the vertical lift occurs. (This also applies to the special devices described in Method 3). Because vapor in the liquid line considerably increases friction losses, the total pressure drop available across the expansion device on these type of systems is reduced. Also, the suction line and liquid line should be carefully insulated to minimize heat gain if sub-cooled below ambient temperature.

IMPORTANT — Preventing the formation of vapor in liquid lines having high pressure losses does not eliminate the requirement that an adequate pressure drop must be available across the thermostatic expansion valve. The capacity tables show valve capacities at pressure drops lower than normal. For thermostatic expansion valve application data and capacities at pressure drops below those listed, consult Sporlan Valve Company.

B. SOLDER TECHNIQUE

It is not necessary to disassemble solder type valves such as Types 5, EBF/SBF, EBS and O when soldering to the connecting lines. Any of the commonly used types of solders, e.g., 95-5, Sil-Fos, Easy-Flo, Phos-Copper, Stay Brite 8 or equivalents may be used for copper to copper connections. When soldering a brass refrigerant distributor to the valve, appropriate solders for these connections such as 955, Easy-Flo, Stay Brite 8 or equivalents may be used. It is important, however, regardless of the solder used, to direct the flame away from the valve body and avoid excessive heat on the diaphragm, Figure-2. As an extra precaution, a wet cloth may be wrapped around the body and element during the soldering operation.

This precaution will prevent overheating the valve body which could damage the superheat spring and result in floodback problems. In addition, the Type 0, EBF/SBF, and EBS valve contain synthetic parts which can be damaged due to overheating, resulting in poor valve performance.

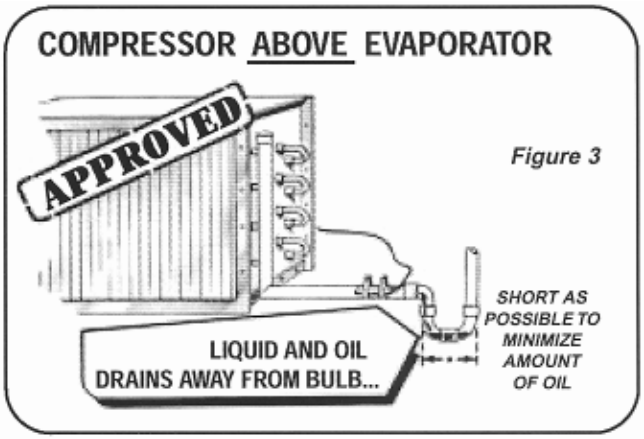


C. BULB LOCATION and INSTALLATION

The location and installation of the bulb is extremely important to the proper performance of the system and care should be taken with its final location.
Accepted principles of good suction line piping should be followed to provide a bulb location that will give the best possible valve control. When system manufacturers have piping recommendations that differ from the general industry recommendations and Sporlan's suggestions shown in this section, those recommendations should be used. When specific recommendations are not available, the suggestions below should be used.

The bulb should be attached to a horizontal suction line at the evaporator outlet (See Figures 3, 4, and 5). If the bulb cannot be located in that manner, it may be located on a ***descending*** vertical line only (as shown in Figure-5 for "pumpdown control). The bulb should never be located in a trap or downstream of a trap in the suction line. Liquid refrigerant or mixture of liquid refrigerant and oil boiling out of the trap will falsely influence the temperature of the bulb and result in poor valve control.

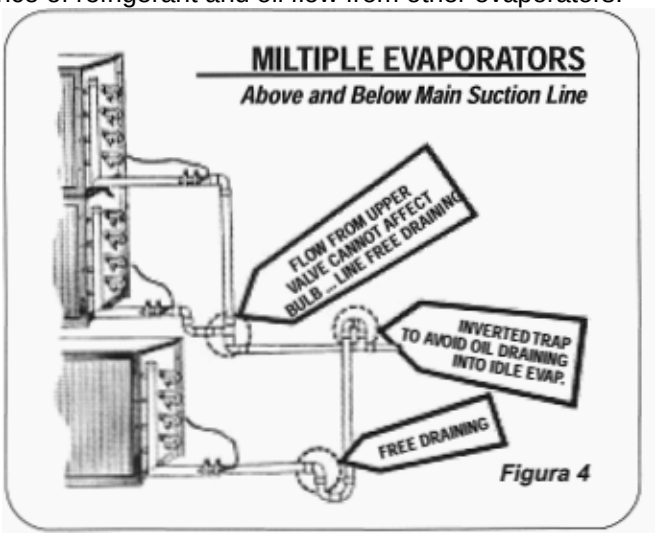
On suction lines 7/8" OD and larger, the surface temperature may vary slightly around the circumference of the line. On these lines, it is generally recommended that the bulb be installed at 4 or 8 o'clock on the side of the horizontal line, and parallel with respect to the direction of flow. On smaller lines the bulb may be mounted at any point around the circumference, however, locating the bulb on the bottom of the line is not recommended as an oil-refrigerant mixture is generally present at that point. Certain conditions peculiar to a particular system may require a different bulb location than normally recommended. in these cases the proper bulb location may be determined by trial.



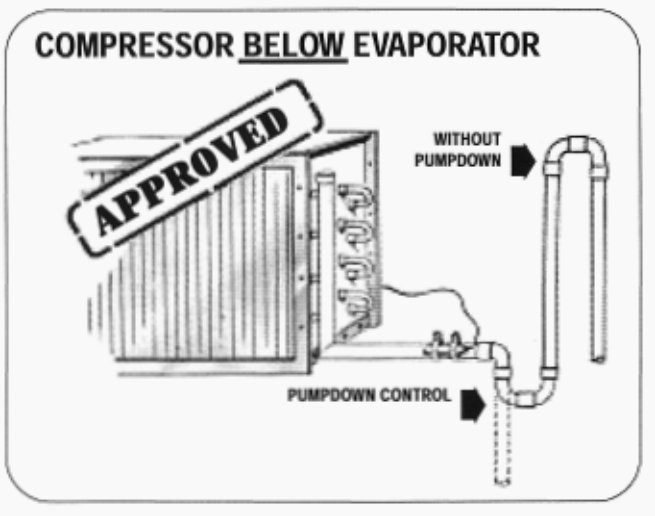
For satisfactory expansion valve control, ***good thermal contact*** between the bulb and suction line is essential. The bulb should be securely fastened with two bulb straps to a clean, straight section of the suction line.

Recommended suction line piping usually includes a horizontal line leaving the evaporator to which the thermostatic expansion valve bulb is attached. This line is pitched slightly downward, and when a vertical riser follows, a short trap is placed immediately ahead of the vertical line, see Figure-3. The trap will collect any liquid refrigerant or oil passing through the suction line and pre-vent it from influencing the bulb temperature.

On multiple evaporator installations the piping should be arranged so that the flow from any valve cannot affect the bulb of an-other. Approved piping practices including the proper use of traps insures individual control for each valve without the influence of refrigerant and oil flow from other evaporators.



For recommended suction line piping when the compressor is located below the evaporator see Figure-S. The vertical riser extending to the height of the evaporator prevents refrigerant from draining by gravity into the compressor during the off-cycle. When a pumpdown control is used, the suction line may turn immediately down without a trap.



On Commercial and Low Temperature Applications requiring Sporlan Selective Charges C, Z, or X the bulb should be clamped on the suction line at a point where the bulb temperature will be the same as the evaporator temperature during the off-cycle. This will insure tight closing of the valve when the compressor stops. If bulb insulation is used on lines operating be-low 32° F, use nonwater absorbing insulation to prevent water from freezing around the bulb.

On brine tanks and water coolers, the bulb should be below the liquid surface where it will be at the same temperature as the evaporator during the off-cycle. When locating the bulb in a brine tank, paint it and the capillary tubing with pitch or other corrosion resistant paint.

IL for practical reasons, the bulb must be located where its temperature will be higher than the evaporator during the off-cycle, a solenoid valve must be used ahead of the thermostatic expansion valve.

On Air Conditioning Applications having thermostatic expansion valves equipped with Flow-Master Types P or VGA elements, the bulb may be located inside or outside the cooled space or duct The valve body should not be located in the air stream leaving the evaporator. Avoid locating the bulb in the return air stream unless it is well insulated.

D. EXTERNAL EQUALIZER CONNECTION

For a complete explanation of when an externally equalized valve should be used refer to Pages 5 and 6, Bulletin 10-9. Valves supplied with an external equalizer ***will not operate*** unless this connection is made.

The equalizer connection should be made at a point that will most accurately reflect the pressure existing in the suction line at the bulb location. See Figure 6. Generally, the connection is immediately downstream of the bulb. However, equipment manufacturers sometimes locate them in return bends or suction headers that are compatible with their specific design requirements. The difference between the pressure at the equalizer connection and the suction pressure at the bulb location should not exceed reasonable pressure drop values. The values shown in Table 1 on Page 5 of Bulletin 10-9 can be used as a guide in determining the value.

If any evaporator pressure or temperature control valves are located in the suction line at or near the evaporator outlet, the equalizer must be connected on the evaporator side of these valves.

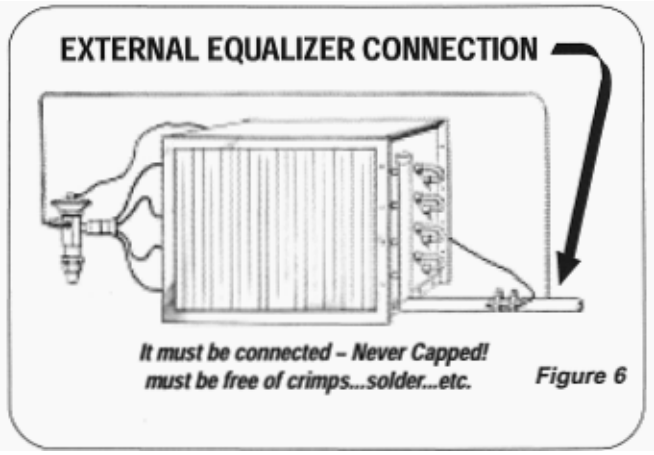


Figure 6

E. DRIERS, STRAINERS, and ACCESSORIES

Most Sporlan thermostatic expansion valves are equipped with built-in inlet screens of varying mesh sizes depending on the valve size and type. These strainers are effective only in removing particles of scale, solder, etc. which could obstruct the closure of the pin and seat.

Moisture and smaller particles of foreign material are equally harmful to the system and must be removed for peak system performance. Field experience has proven, without a doubt, that most expansion valve failures are due to the presence of dirt, sludge, and moisture in the system. Furthermore, the performance and life of other system components are also seriously affected by these foreign materials. The Sporlan ***Catch-All Filter-Drier*** removes dirt, moisture, acids, and sludges, and insures the circulation of clean, dry refrigerant through the system at all times.

For all refrigeration and air conditioning applications we recommend that a Sporlan Catch-All Filter-Drier be installed in the liquid line ahead of the thermostatic expansion valve. See Bulletin 40-10 for complete Catch-All specifications.

Further system protection is easily and inexpensively provided with the installation of a Sporlan ***See-All.*** The See-All is a combination liquid and moisture indicator that visually indicates if there is a shortage of refrigerant in the liquid line, or if the moisture content of the refrigerant is at a dangerous level. See Bulletin 70-10 for complete See-All specifications.

Figure 7

F. TEST PRESSURES and DEHYDRATION TEMPERATURES

For better leak detection an inert *dry* gas such as nitrogen or CO_2 may be added to an idle system to supplement the refrigerant pressure.

CAUTION: Inert gases must be added to the system carefully through a pressure regulator. Unregulated gas pressure can seriously damage the system and endanger human life. Never use oxygen or explosive gases.

Excessive low side pressures can shorten the life of the thermostatic expansion valve diaphragm. Table-1 lists the maximum low side test pressure that can safely be applied with the expansion valve connected to the

evaporator. These maximum pressures are well above the minimum field leak test pressures for low sides, listed by the ANSI/ASHRAE Standard 15-1994 or latest revision.
Table-1 refers to the maximum low side test pressures which are in contact with the underside of the valve diaphragm. Since only the valve inlet fitting and passages (not the valve diaphragm) are subjected to high side pressures, the valve will withstand any reasonable *HIGH SIDE TEST PRESSURES* in excess of the values listed in the ANSI/ASHRAE Standard. The external equalizer line should be disconnected if there is any possibility of exceeding the recommended maximum pressures listed below.

TABLE I
MAXIMUM LOW SIDE TEST PRESSURES

VALVE TYPE	psig
(B)I, X, NI, F, FB, (E)BF/SBF, RI, G, EG, C, S, EBS, Small O	450
D, P, H, Large O	425
A, M, V, W	400

If elevated temperatures are used to assist in dehydrating the system, the thermostatic expansion valve should not be exposed to temperatures exceeding those shown in Table-2

TABLE 2
MAXIMUM DEHYDRATION TEMPERATURES DEGREES F

REFRIGERANT	THERMOSTATIC CHARGE					
	L	C	Z	X	VGA	P TYPE & ZP Series
12, 134a	190	190	250	210	–	250
22	160	160	185		250	
404A, 502, 507	150	150	170		–	
717 (Ammonia)	150	190	235	–	–	–

Table-2 refers to the maximum dehydration temperatures when the bulb and valve body are subjected to the same temperature. On L, C, Z, and X charges, 250°F maximum valve body temperature is permissible ***IF THE BULB TEMPERATURE*** *does* not exceed those shown in the table.

G. EXPANSION VALVE ADJUSTMENT

Each Sporlan Thermostatic Expansion Valve is thoroughly tested and set at the factory before shipment. This factory superheat setting will be correct and no further adjustment is required for the majority of the applications. However, there are many factors which can affect the performance of a thermostatic expansion valve. These factors are independently variable and all of them cannot be compensated for in the design of a valve. When the application or operating conditions require a different valve setting due to one or more of the factors listed below, the valve may be adjusted to obtain the required operating superheat. Therefore, an adjusting stem is provided on all standard valves. The valve should be set with the system as near as possible to design conditions.

Factors which affect valve performance and may make it necessary to adjust the valve are:

1. Low temperature differences (TDs) between the refrigerant and the air
2. TEV bulb location
3. Balance between compressor and evaporator
4. Ratio of load to TEV capacity
5. Condenser capacity
6. Operation of several fixtures on multiple installation
7. Seasonal variation in head pressure caused by extreme changes in ambient air temperature.

NOTE: Valve types, F, (E)BF/SBF, Q, A, M, V, K, and W have non-rising adjusting stems and a change in adjustment does not change the stem position.

When setting valves on multi-evaporator refrigeration systems with pressure or temperature sensitive evaporator control valves, the following procedure is recommended:

1. Evaporator Pressure Regulating Valve (ORI Type): the ORI valve is set first at the minimum load condition. Then the expansion valve is adjusted, if necessary, to the desired superheat setting while under the normal operating load condition.
2. Temperature Sensitive Evaporator Regulating Valve (CDA Type): the CDA valve is forced into a fully open position first. Then the expansion valve is adjusted to the desired superheat setting at full load condition. Finally, the CDA is set to the desired air temperature. Contact Sporlan Valve Company or the case manufacturer for additional details on setting the CDA.

When the adjustment is completed on the TEV, always tighten the adjusting stem packing nut and replace the seal cap tightly.

Many expansion valves are made non-adjustable for use on Original Equipment Manufacturers' units, particularly those valves used on residential air conditioning and heat pump systems. These valves are set at a superheat predetermined by the manufacturers' laboratory tests and cannot be adjusted in the field.

Some non-adjustable models are modifications of standard adjustable type valves. This is done by using a solid bottom cap instead of one equipped with an adjusting stem and seal cap. These valves can be identified by an N preceding the standard valve designation. Adjustable bottom cap assemblies are available for converting most nonadjustable valves to the adjustable type. However, this is rarely required. If symptoms indicate that a valve adjustment is needed, carefully check the other possible causes of incorrect superheat, before attempting an adjustment.

HOW TO DETERMINE SUPERHEAT CORRECTLY

1. Measure the temperature of the suction line at the point the bulb is clamped.

2. Obtain the suction pressure that exists in the suction line at the bulb location by either of the following methods:

a. If the valve is externally equalized, a gauge in the external equalizer line will indicate the desired pressure directly and accurately.

OR

b. Read the gauge pressure at the suction valve of the compressor. To the pressure add the estimated pressure drop through the suction line between bulb location and compressor suction valve. The sum of the gauge reading and the estimated pressure drop will equal the approximate suction line pressure at the bulb.

3. Convert the pressure obtained in 2a or 2b above to saturated evaporator temperature by using a temperature-pressure chart.

4. Subtract the two temperatures obtained in 1 and 3 — the difference is superheat.

Figure-8 illustrates a typical example of superheat measurement on an air conditioning system using Refrigerant-22. The temperature of the suction line at the bulb location is read at 52 F. The suction pressure at the compressor is 66 psig and the estimated suction line pressure drop is 2 psi…
66 psig +2 psig =68 psig at the bulb, which is equivalent to a 40°F saturation temperature. 40°F subtracted from 52°F = 12°F superheat.

NOTE: Refrigerated case manufacturers frequently use a “temperature difference” method to approximate superheat. This procedure consists of measuring the temperature of a location on the evaporator which is representative of saturated vapor temperature; and, then subtracting that temperature from the outlet evaporator temperature which is measured at the bulb location.
While this method of reading “superheat” is acceptable on those manufacturer’s cases where the pressure drop through the evaporator is low, Sporlan does not recommend the “temperature difference” method for other types of systems.

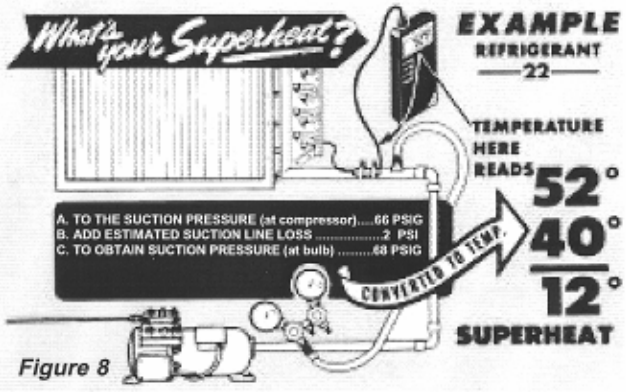


Figure 8

HOW TO CHANGE THE SUPERHEAT SETTING

To reduce the superheat, turn the adjusting stem COUNTER-CLOCKWISE. To increase the superheat, turn the adjusting stem CLOCKWISE. When adjusting the valve, make no more than one turn of the stem at a time and observe the change in superheat closely to prevent *over-shooting* the desired setting. As much as 30 minutes may be required for the new balance to take place after an adjustment is made.

If in doubt about the correct superheat setting for a particular system, consult the equipment manufacturer. Ma general rule, the proper superheat setting will depend on the amount of temperature difference (TD) between refrigerant temperature and the temperature of the air or other substance being cooled. Where high TD’s exist, such as on air conditioning applications, the superheat setting can be made as high as 15°F without noticeable loss in evaporator capacity. Where low TD’s exist, such as in low temperature blower coil applications, a superheat setting of 10°F or below is usually recommended for maximum evaporator capacity. It is these applications that the TEV will more than likely need to be adjusted.

For the correct valve setting on factory built equipment, manufacturers’ recommendations should be followed. Some manufacturers specify the superheat directly; others may recommend valve adjustment to a given suction pressure at certain operating conditions, or until a certain frost line is observed. Such recommendations, however they are stated, represent the results of extensive laboratory testing to determine the best possible operation.

FIELD SERVICING

The thermostatic expansion valve is erroneously considered by some to be a mysterious and complex device. As a result, many valves are needlessly replaced when the cause of the system malfunction is not immediately recognized.

Actually the thermostatic expansion valve performs only one very simple function — it keeps the evaporator supplied with enough refrigerant to satisfy all load conditions. It is not a temperature control, suction pressure control, a control to vary the compressor’s running time or a humidity control.
How effective the valve performs is easily determined by measuring the superheat as outlined in Figure-8. Observing the frost on the suction line, or considering only the suction pressure may be misleading. Checking the superheat is the first step in a simple and systematic analysis of thermostatic expansion valve performance.

- If not enough refrigerant is being fed to the evaporator—the superheat will be high.
- If too much refrigerant is being fed to the evaporator—the superheat will be low.

Although these symptoms may be attributed to improper thermostatic expansion valve control, more frequently the origin of the trouble lies elsewhere.

NOTE: Thermostatic expansion valves with permanent bleed ports **(BP)** or Rapid Pressure Balancer **(RPB)** construction are applied on many air conditioning and refrigeration systems by original equipment manufacturers. Each application is tested and approved by the manufacturer. The primary function of these devices is to equalize high-to-low side pressures during the off cycle to assist on start-up of low starting torque compressors.

However, some PP type valves are applied to allow small amounts of liquid refrigerant to pass for compressor motor cooling. The specific function of the feature on a given unit must be determined from the system manufacturer. Once that is determined, it is easier to trouble shoot the system.
The primary cause of difficulty with either the BP or RPB feature is dirt and other foreign materials that restrict or plug them. And if the system purpose intended for either feature is not being satisfied, the valve probably needs cleaning or replacing.

As stated in Bulletin 10-9, the RPB type valve is not to be applied on systems using high starting torque compressors or "hard-start" electrical components, on outdoor coils of heat pumps, or on any refrigeration system, and it should **not** be used to replace BP type valves that are applied on those types of systems. On systems other than those described above, the RPB type valve can replace the BP type valve when necessary. Usually it is advisable to replace a valve with one of the same specification unless advised differently. Consult with the system manufacturer for assistance.

A **COMPLAINT:**
"Valve does not feed enough refrigerant."

SYMPTOMS:
'Load temperature (air or water leaving evaporator) too high.
•Superheat too high.
'Suction Pressure lower than normal with compressor unloader locked out or hot gas bypass shut off.★

THE CAUSE MAY BE:

1. MOISTURE — Water or a mixture of water and oil frozen in the valve port or working parts of the valve will prevent proper operation.

This is a common source of trouble on expansion valves. Since the valve is the first cold spot in the system, moisture will freeze and block the valve open, closed, or any position in between. If the valve is frozen in the intermediate position so that flow is restricted, the superheat will be high.

REMEDY — Install a Sporlan Catch-All Filter-Drier in the liquid line for removal of moisture from the refrigerant and oil. See Bulletin 40-10.

To determine a safe level of moisture in the system, install a Sporlan See•All Moisture and Liquid Indicator. See Bulletin 70-10.
Excessive moisture has a damaging effect on all system components regardless of the evaporating temperature. It must be removed for trouble-free performance.

2. DIRT or FOREIGN MATERIAL — Contaminants such as copper oxide scale, metal chips, oil breakdown sludge, etc. will restrict the flow of refrigerant when it collects in strainers or other liquid line accessories. This produces a shortage of refrigerant at the thermostatic expansion valve port. Conventional strainers frequently allow the material to pass through the screen and obstruct the flow at the valve port. If a See•All is installed downstream of the restriction, bubbles will be visible. This should not be confused, however, with a refrigerant shortage or excessive liquid line pressure loss which are also indicated by bubbles in the See•All.

REMEDY — Locate and remove the foreign material creating the restriction. Install a Sporlan Catch-All FilterDrier to provide effective filtration of the refrigerant. See Bulletin 40-10.

3. WAX — Certain systems are contaminated with small amounts of wax which will precipitate at low temperatures in systems with Refrigerants 22 or 502. Since the thermostatic expansion valve represents the first cold point in the refrigeration cycle, wax is most likely to form at the valve port.

It is sometimes difficult to observe the wax in a valve because it may exist in solid form only at very low temperatures. By the time the valve has been taken apart, the temperature has increased enough to cause the wax to melt and thus become difficult to detect. When wax is suspected, it can usually be detected on the pin and seat by packing the valve in dry ice while disassembling.

REMEDY — Clean the valve with solvent before reassembling the valve. The Sporlan HH style Catch-All Filter-Driers have a special activated charcoal desiccant that is designed to remove wax in the liquid line before it causes trouble. Therefore, use these HH style driers (e.g., C-415-S-HH) on all low temperature systems using Refrigerants 22 or 502 to prevent wax problems

4. REFRIGERANT SHORTAGE — See•All or sight glass in the liquid line will show bubbles when the system is short of refrigerant charge. Before adding more refrigerant however, be sure the bubbles are not produced by other causes (See Paragraphs A-2 and A-5).
A lack of refrigerant charge may also be detected by a hissing sound at the thermostatic expansion valve. Some systems not equipped with a liquid line sight glass will have test cocks or other devices for checking the refrigerant level in the receiver.

REMEDY — Add enough refrigerant to obtain desired result.

5. GAS IN THE LIQUID LINE — As explained in Paragraphs A-2 and A-4 above liquid line vapor can be produced by a partially plugged strainer or drier and by a shortage of refrigerant charge. In addition, gas in the liquid line can be caused by air or other noncondensable gases in the system or by excessive pressure losses in the liquid line as a result of:

a. Long or undersized line.

b. Liquid line vertical lift.

REMEDY — Verify the correct liquid line size for the equivalent length and system tonnage. Consult liquid line sizing data published in many manufacturers' catalogs and in text books. If undersized, repipe with the correct size.

Determine amount of vertical lift, and obtain the resulting pressure loss from Table-3, Page 15, Bulletin 10-9. Using the subcooling calculation example provided on Pages 15 and 16 of Bulletin 10-9, find required subcooling necessary to prevent gasification with the existing pressure losses. Provide the necessary subcooling by using one of the methods described.

6. MISAPPLICATION OF INTERNALLY EQUALIZED VALVE or INCORRECT LOCATION OF EXTERNAL EQUALIZER — If the pressure drop through the evaporator exceeds the predetermined values shown in Table-1, Page 5, Bulletin 10-9, an externally equalized valve must be used. When an externally equalized valve is used, the equalizer connection should be made at a point in the suction line that will reflect the pressure existing in the line at the bulb location.

REMEDY — Replace internally equalized valve with one having an external equalizer.

If external equalizer is installed incorrectly, change to correct location.

7. INSUFFICIENT PRESSURE DROP ACROSS VALVE —One of the factors that influence expansion valve capacity is the pressure drop that exists between the inlet and outlet. Anything contributing to a reduction in this pressure drop will reduce valve capacity. Abnormally low condensing pressures, excessive liquid line pressure losses (even with adequate subcooling), undersized distributor nozzle or distributor tubes may also be responsible for a very low net pressure drop across the valve port.

REMEDY — Remove source of pressure loss, or install valve with adequate capacity at the reduced pressure drop. If inlet pressure to valve is low due to low condensing pressure, raise pressure.
If the refrigerant distributor nozzle is undersized replace with correct size. See Bulletin 20-10.

8. DEAD THERMOSTATIC ELEMENT or WRONG THERMOSTATIC CHARGE — If the element has partially or completely lost its thermostatic charge, the valve will be unable to feed sufficient refrigerant or will remain closed. A wrong charge may cause insufficient feed also.

REMEDY — Replace the element if it is dead. If charge is incorrect, replace with proper selective charge — See Pages 7 to 9, Bulletin 10-9.

9. CHARGE MIGRATION (TYPES P, VGA and G CHARGES ONLY) — In order for valves with these charges to maintain control at the bulb, the bulb must be kept at a lower temperature than the element (diaphragm case). If the thermostatic charge does migrate to the element because of a lower element temperature, the valve will throttle.
DETECTION—Warm the element with a cloth saturated with hot water. If this produces more refrigerant feed and reduces the superheat to normal, charge migration is responsible for the starved evaporator.

—CAUSES—
a. Insufficient pressure drop between the valve outlet and bulb location, possibly due to an oversized distributor nozzle or no nozzle at all.

b. Excessive pushrod leakage, which allows the leaking refrigerant to cool the diaphragm case before passing into the equalizer line. This is a rare occurrence and should be carefully checked before arriving at this conclusion.

c. Cold location of thermostatic expansion valve, or condensate drippage on the diaphragm case.

—REMEDIES—

a. Install distributor nozzle correctly sized in accordance with nozzle sizing procedure given in Sporlan Bulletin 20-10.

b. On valves with packed pushrod construction, remove element and tighten the pushrod packing nuts.

c. Relocate the thermostatic expansion valve away from cold outlet air, or condensate drippage.

10. UNDERSIZED VALVE

REMEDY — Install valve sized in accordance with procedure given on Page 16, Bulletin 10-9, or Page 3, Bulletin 10-10.

11. HIGH SUPERHEAT ADJUSTMENT

REMEDY — Turn the adjusting stem counter clockwise until the correct superheat is indicated.

12. FEED-BACK FROM ANOTHER VALVE—Review instructions for Bulb Location.

REMEDY — Check the bulb temperature and calculate the superheat. If superheat is normal but too little refrigerant is flowing through the evaporator, check the piping for possible refrigerant flow from another evaporator affecting the bulb. Re-pipe if necessary. See Figure-4.

13. HIGH PRESSURE DROP THROUGH EVAPORATOR

REMEDY — Check the pressure at the evaporator inlet and outlet with gauges. If pressure difference is greater than the values shown in Table-1, Page 5, Bulletin 10-9, use an externally equalized valve.

14. RESTRICTED, PLUGGED, OR CAPPED EXTERNAL EQUALIZER — If the pressure under the diaphragm builds up due to pushrod leakage and cannot escape through the external equalizer line, the valve will remain closed.

REMEDY — Check the external equalizer line to be sure it is open or not capped

★When system has some form of capacity reduction—cylinder unloaders or hot gas bypass, a low auction pressure will not exist. Therefore, when checking TEV performance, a better analysis Is possible when these devices are locked out or shut off so the suction pressure will respond to variations In load or valve teed.

B COMPLAINT:

"Valve feeds too much refrigerant."

SYMPTOMS:

'Liquid returns to compressor. 'Superheat is low. 'Suction Pressure is normal or higher than normal

THE CAUSE MAY BE:

1. MOISTURE — Water or a mixture of water and oil frozen in the valve port or working parts of the valve will prevent proper operation. This is the most common source of trouble on thermostatic expansion valves. Since the valve is the first cold spot in the system, moisture will freeze and block the valve open, closed, or any position in between. If the valve is held in the open position by ice, liquid flood-back will occur.

REMEDY — Install a Sporlan Catch-All Filter-Drier in the liquid line for removal of moisture from the refrigerant and oil. See Bulletin 40-10.
For additional protection, install a Sporlan See•All Moisture and Liquid Indicator for a positive indication of when a safe moisture level is reached. See Bulletin 70-10.

2. DIRT or FOREIGN MATERIAL — Contaminants such as copper oxide scale, metal chips, oil breakdown sludge, etc. may pass through ordinary strainers and lodge at the thermostatic expansion valve port and prevent the valve from closing.

REMEDY — Disassemble the valve and remove all foreign material from the internal parts. Install a Sporlan Catch•All Filter-Drier in the liquid line. The Catch•All filters out the smallest particles of foreign material that might possibly interfere with the operation of any system component

3. EXPANSION VALVE SEAT LEAK — When the valve port does not seat tightly, refrigerant will pass through during the off-cycle and fill the evaporator with refrigerant. If the seat leak is severe, the valve will feed too much refrigerant during the operating cycle as well. (Not applicable to valves with permanent bleed ports or RPB feature.)

REMEDY — If the valve seat is leaking, a gurgling or hissing sound can usually be heard during the off-cycle. Also, a sight glass or See•All in the liquid line may indicate continued refrigerant flow for a long period after the compressor has stopped. Make certain however, that the bubbles are not the result of *back-flow* through a vertical liquid line.
Disassemble the valve to be certain that dirt or foreign material is not responsible (see B-2). If the pin and seat are worn or damaged and an internal parts kit is available replace the parts. When parts are not available, the valve must be replaced.

4. OVERSIZED VALVE — Check valve ratings considering all the factors which affect its capacity. See Page 16, Bulletin 10-9, or Page 3, Bulletin 10-10.

REMEDY — Install correctly sized valve.

5. INCORRECT BULB INSTALLATION — The bulb should be securely fastened to a straight, clean, section of the suction line using two bulb straps for good thermal contact. Also, the temperature of the bulb should not be influenced by ambient temperature—an external heat source such as a steam pipe or heating coil.

REMEDY — Install bulb correctly. See Installation Instructions.

6. LOW SUPERHEAT ADJUSTMENT

REMEDY — Turn the adjusting stem clockwise until the correct superheat is indicated.

7. INCORRECT THERMOSTATIC CHARGE

REMEDY — Select and install the correct selective charge. See Pages 7 to 9, Bulletin 10-9.

8. INCORRECTLY LOCATED EXTERNAL EQUALIZER

REMEDY — Relocate external equalizer or connection between evaporator and any temperature or pressure sensitive evaporator control valve near bulb location.

9. INEFFICIENT COMPRESSOR — If the compressor is inefficient or for some other reason lacks capacity, the suction pressure will operate higher than normal. This may or may not be accompanied by low superheats.

REMEDY — Consult with compressor manufacturer.

C COMPLAINT:

"Valve feeds too much refrigerant at *start-up only."*

SYMPTOMS:

'Liquid returns to the compressor. 'No superheat
'Suction pressure higher than normal.

THE CAUSE MAYBE:

1. REFRIGERANT DRAINAGE — Drainage of refrigerant from the evaporator (during the off-cycle) when installed at a higher level than the compressor.

REMEDY — Install a trap-riser to top of evaporator or use pump-down control. See Figure-5.

2. COMPRESSOR or SUCTION LINE IN COLD LOCATION —During the period when the system is not in operation, liquid refrigerant will condense at the coldest point in the system. Liquid will condense in the compressor or suction line, if they are located in an ambient temperature below that of the evaporator during the off-cycle. Upon re-starting, this liquid will slug the compressor.

REMEDY — Keep compressor or suction line warm during the off-cycle. Some compressors are equipped with crankcase heaters for this purpose. Another corrective measure is to install a suction line solenoid valve that is de-energized during the off-cycle.

3. RESTRICTED or PLUGGED EXTERNAL EQUALIZER — A momentary flood can occur when the load increases suddenly, such as at start-up because the higher suction pressure cannot reach the underside of the diaphragm and help close the valve. If the pressure under the diaphragm increases due to any pressure leakage around the pushrods, the valve will eventually throttle.

REMEDY — Remove the restriction or plugged portion of the external equalizer.

4. LIQUID LINE SOLENOID VALVE SEAT LEAK or INTERRUPTED PUMPDOWN — Liquid refrigerant can continue to feed the TEV and/or remain in evaporator upon shut-down causing flood-back to the compressor upon start-up.

REMEDY — Disassemble and clean solenoid valve and/or replace damaged internal parts if seat leakage is the problem. If the pumpdown cycle isn't completed before the compressor cycles *off,* or the thermostat calls for cooling and reopens the liquid line solenoid before the evaporator has been properly evacuated, check the low pressure cutoff setting or the electrical controls for possible causes.

5. ANY ONE or MORE OF THE CAUSES SHOWN in SECTION B.

REMEDY — See Section B.

D COMPLAINT:
"Valve doesn't feed properly."

SYMPTOMS:
Poor system performance. Superheat normal or lower than normal. Suction pressure lower than normal with compressor unloaders locked out or hot gas bypass shut off.★

THE CAUSE MAY BE:

1. UNEQUAL CIRCUIT LOADING (Multi-circuit evaporators and parallel evaporators connected to a single refrigerant distributor) — When each circuit is not subjected to the same heat load, the lightly loaded circuits will allow unevaporated refrigerant or low temperature vapor to enter the suction line and throttle the valve. This will cause normally loaded circuits to be deprived of their share of refrigerant. The net result is a loss of refrigerated evaporator surface.

REMEDY — Make necessary modifications which will allow each evaporator circuit to receive the same percentage of the total load. See Bulletin 20-10 for application information on multi-circuit evaporators using a refrigerant distributor.

2. POOR REFRIGERANT DISTRIBUTION (Multi-circuit evaporators and parallel evaporators connected to a single refrigerant distributor) — If the refrigerant distribution is faulty, the circuits receiving the largest portion of refrigerant will have the controlling influence on the thermostatic expansion valve. The result is the same as in Paragraph I above.

REMEDY — Correct refrigerant distribution. See Bulletin 20-10 for complete information on Refrigerant Distributors.

3. LOW LOAD — Low evaporator load may be caused by insufficient air over the coil as a result of an undersized blower, dirty air filters, or an obstruction in the air stream. In addition, frost formation on the coil or low entering air temperatures will reduce the evaporator load.

REMEDY — Correct the condition responsible.

4. FLOW FROM ONE COIL AFFECTING THERMOSTATIC EXPANSION VALVE BULB OF ANOTHER (Multiple evaporator systems only) — The temperature of the bulb may be falsely influenced by flow from another evaporator usually because of incorrect piping.

REMEDY — Correct the piping. See Figure-4.

5. IMPROPER COMPRESSOR-EVAPORATOR BALANCE — If the compressor is too large for the load and evaporator capacity, the low suction pressure which results will cause poor system performance.

REMEDY — Consult with the manufacturer or consulting engineer, or the ASHRAE Handbook on component balancing. If necessary, change or correct the improperly sized component. Hot gas bypass may be used to balance properly.

6. EVAPORATOR OIL-LOGGED — Poor heat transfer occurs and unpredictable performance takes place. If erratic performance is observed over a period of time, and other causes are omitted from consideration, review the amount of oil in the system. Turbulent compressor oil level with little or no return to the compressor sump indicates oil problems.

REMEDY — Remove excessive oil from evaporator and connecting piping. Many times the evaporator temperature will be too low for the oil to be removed. Therefore, the system must be allowed to warm sufficiently to get cold oil to drain. Analyze system components for possible causes of oil problem before restarting the system. Consult with the compressor manufacturer for specific details on their compressor.

★When system has some form of capacity reduction—cylinder unloaders or hot gas bypass, a low suction pressure will not exist. Therefore, when checking TEV performance, a belier analysis is possible when these devices are locked out or shut off so the suction pressure will respond to variations In load or valve feed.

E COMPLAINT:

“System hunts or cycles.”

SYMPTOMS:

‘Suction pressure fluctuates.★ ‘Superheat fluctuates. ‘Valve does not feed enough, and then too much refrigerant.

THE CAUSE MAY BE:

1. SYSTEM CHARACTERISTICS — Certain design characteristics of the system may have an effect on the system’s tendency to hunt or cycle. As an example, after the valve admits refrigerant to the evaporator inlet, there is a time delay before the bulb senses the effect at the evaporator outlet. This time delay is dependent on evaporator length, tube size, and load. Generally, there is more likelihood for hunting to occur when this time interval is long. Other influencing factors are circuit arrangement, load per circuit, and temperature difference.

REMEDY — When hunting is moderate particularly with no floodback, the effect on the system is insignificant and corrections are not necessary. If hunting is severe with floodback to the compressor, check the possible remedies shown in Paragraphs below.

2. VALVE SIZE — An over-sized valve usually aggravates hunting. Carefully check the valve rating considering all the factors affecting its capacity. See Page 16, Bulletin 10-9, or Page 3, Bulletin 10-10.

REMEDY — Replace valve with one correctly sized. On multiple circuit evaporators using a refrigerant distributor, the capacity of the valve can be reduced, within certain limits, by installing a smaller distributor nozzle. See Bulletin 20-10.

3. BULB LOCATION — If the bulb is located in a suction line trap, its temperature will be affected by liquid oil and refrigerant alternately collecting and evaporating at this point. This condition frequently results in severe hunting.

REMEDY — As a temporary measure relocate the bulb away from the trap, and any turbulent areas created by elbows, tees, etc. Also remove the bulb from the air stream or insulate. Re-pipe if necessary. Sometimes another position around the circumference of the suction line will minimize hunting.

Follow the Bulb Installation Instructions given for the best thermostatic expansion valve control.

4. REFRIGERANT and LOAD DISTRIBUTION — In addition to the effects of poor distribution explained in Paragraphs D-I and D-2, hunting also frequently results. This is caused by liquid refrigerant from the overfed circuits occasionally reaching the bulb of the valve.

REMEDY — Correct the faulty distribution.

5. SUPERHEAT ADJUSTMENT — All Sporlan thermostatic expansion valves are preset at the factory to give the best performance on the average system. A valve should not be adjusted unnecessarily, but occasionally another setting may prove to be better.

REMEDY — Turn the adjusting stem clockwise a turn at a time. If the hunting stops or is reduced, turn the adjusting stem counter clockwise a turn at a time to obtain the lowest superheat with stable operation.

6. MOISTURE — As ice forms in a thermostatic expansion valve from excessive moisture, a very erratic hunt may result.

REMEDY — Remove the moisture with the installation of a Sporlan Catch-All Filter-Drier. A safe moisture level can be determined by installing a Sporlan See•All.

★ When system has some form of capacity reduction—cylinder unloaders or hot gas bypass, a low suction pressure will not exist. Therefore, when checking TEV performance, a better analysis is possible when these devices are locked out or shut off so the suction pressure will respond to variations in load or valve feed.

F COMPLAINT:

“System won’t perform properly.”

SYMPTOMS:

‘Cannot get valve to react or regulate at all.

THE CAUSE MAY BE:

1. No refrigerant being fed to evaporator. See Section A.

2. Too much refrigerant being fed to evaporator. See section B.

3. Too much refrigerant being fed to evaporator at start-up only. See Section C.

4. Refrigerant control is erratic. See Section D.

5. System is hunting or cycling. See Section E above.

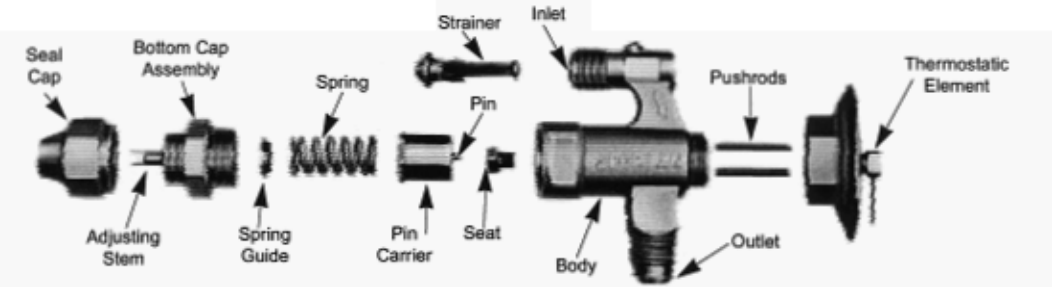
6. The thermostatic expansion valve has been physically abused in an effort to make the valve work properly. This is usually the result of a mistaken analysis. It is frequently assumed that if a valve does not feed properly, it is stuck (either opened or closed). Beating the valve body with a hammer will only distort the body and make it impossible for the valve to work once the real cause is determined.
If a valve "sticks," it is usually due to moisture freezing in the port, dirt and other foreign material restricting or plugging the internal parts, wax forming on the internal parts at low temperatures, or the valve has been physically abused so it cannot function.

REMEDY — Inspect the valve and its internal parts, including the inlet strainer. If plugged or restricted in any way, clean the parts thoroughly, oil the parts with a good grade of refrigerant oil, and reassemble the parts.

If the valve is beyond normal cleaning processes, or if it is physically damaged in any way, replace the valve with its proper replacement model.

FIELD ASSEMBLY INSTRUCTIONS

Sporlan Valves may be opened easily for inspection



NOTE: These field Assembly Instructions apply in part to all Sporlan TEV's. See Figure-9 for an "exploded" view of those models that can be completely disassembled. When a thermostatic expansion valve is to be disassembled for inspection and cleaning, or for replacement of the thermostatic element or the internal parts, the following information should be reviewed for assistance.

Types F dated approximately C84 or earlier and Types I, BI, NI, RI, FB manufactured prior to 1994 do not have replaceable elements nor internal parts kits, but can be disassembled for inspection and cleaning. Type F dated D84 or later, Type S valves dated B69 or later, Type C valves dated C70 or later, and ALL Type C, X, (E)BF/SBF and EBS valves employ packless pushrod construction and internal parts are NOT available for use with them. However, their elements can be replaced and they can be disassembled for inspection and cleaning. Due to the single pushrod construction of the Type (E)BF/SBF and EBS valves, only the bottom cap assembly, pin guide, and superheat spring may be removed for inspection and cleaning.

Early production of the Type F valve with the replaceable element requires a 15/16" **thin jaw**, open end type element wrench such as a Bonney 1230. Subsequent production of the Type F valve and all Types (E)BF/SBF, I, BI, NI, RI, and FB valves require a 1" **thin jaw**, open end type element wrench such as a Bonney 1232. An open end wrench is necessary because of limited space between the body and element of these valves. Precautions must be taken in removing the KT-43 element (F) so the element, body, or connections are not damaged by the wrenches.

While standard open end or adjustable wrenches fit the other element sizes, the **thin jaw** type wrenches are also available for the other element sizes: Bonney 1236 (1-1/ 8") for KT-53 elements, Bonney 1240 (1-1/4") for KT-83 elements, Bonney 1248 for KT-33 elements, and Bonney 1252 for KT-63 & 7 elements.

Replaceable elements and internal parts kits are available for current valves with packed pushrod construction: Types P, H, M, D, and A.

Replaceable elements for Types 0, V, W, and U are also available. However, special field assembly instructions are included with their internal parts kits.

ASSEMBLING INSTRUCTIONS

The following steps are necessary in properly disassembling, inspecting, cleaning, and reassembling a TEV whether the valve is in or out of the refrigerant piping.

1. Before disassembling the valve, be sure the refrigerant pressure in the system has been reduced to a safe level (0 psig).

2. Remove the seal cap and turn the adjustment stem counter-clockwise to relieve the spring force. Count and record the number of turns so adjustment can be returned to its original position.

3. Using appropriate wrenches or a vise to properly support the valve body, remove the element (if a replaceable type), the bottom cap assembly, and the internal parts. (Only remove the bottom cap, pin guide, and superheat spring on Type (E)BF/SBF and EBS valves. **DO NOT** remove the single pushrod from these valves.)

CAUTION: Regardless of whether the valve is in the system or in a vise, care must be taken to prevent distorting the body by exerting too much pressure in tightening the element or in clamping the body in the vise. Also, do not use a wrench on the outer welded edge of the element.

4. Inspect parts, element, and body for any foreign materials or physical damage.

5. On valves with replaceable elements and/or internal parts, replace any items that appear damaged.

6. Clean all parts with solvent, preferably by applying and then blowing off with clean dry compressed air.

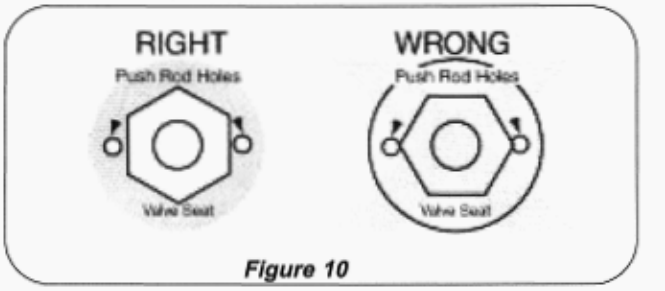


Figure 10

7. To reassemble valves with replaceable seats, screw seat into body with a fairly light pressure since it does not require a heavy pressure to make this small knife edge joint.

CAUTION: Be sure hexagon corners of seat do not protrude into pushrod holes (see Figure- 10).

For valves that do not have replaceable elements or for Type O valves, place the pushrod(s) into the body now.

8. Next, slip the pin and carrier (which have been pressed together at the factory) into the body and tap the pin into the seat to form a true seating surface. It is generally advisable, before tapping these parts together, to check the concentricity of both the pin and seat by engaging the parts by pressing them lightly together with one finger and noting that there is no tendency to stick together. This should be repeated several times after rotating the pin carrier a quarter of a turn. In assembling valves with port sizes of 1/4" and larger which use the flat disc instead of the tapered pin, **DO NOT TAP THE DISC AGAINST THE SEAT.**

9. Now place the spring guide stamping (when used), and spring, in the pin carrier, place the lower spring guide on the opposite end of the spring and screw the bottom cap in place. (Replace the pin guide, spring, and bottom cap assembly together on Type (E)BF/SBF and EBS valves.) After screwing bottom cap assembly in place, carefully tighten, preferably with two 10" wrenches, to seal the metal-to-metal knife edge joint. The sealing surfaces should be free of any foreign material or nicks that might prevent a leak-tight joint.

10. On valves with replaceable elements (except Types O, (E)BF/SBF and EBS), place the pushrods into the body and open the valve several times by pressing do~ on the pins with a flat metal surface. This will help seat the pin properly.

11. Check the height of the pushrod(s) above the element sealing surface with the pushrod gauge (see Figure 12). The gauge is supplied with internal parts kits or can be obtained at no charge upon request. (Since the internal parts of the Type (E)BF/SBF and EBS valves cannot be replaced, it is not necessary to check the pushrod height of these valves.)

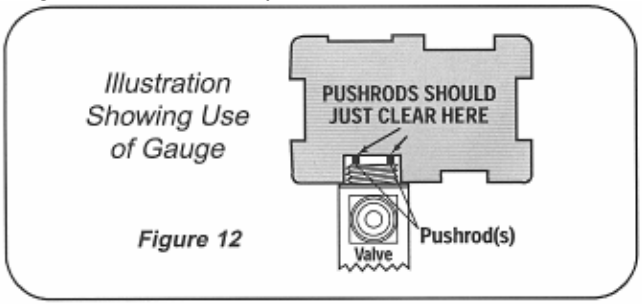


Figure 12

The appropriate gauge numbers for the various TEV's are given in Table 9.

CAUTION: If the element-to-body joint utilizes a gasket, the gasket must be removed before checking pushrod height.

If the pushrod(s) are too long, they must be carefully ground off to the proper length. Clean the pushrod(s) of all dirt and grindings and place them into the body.

12. ELEMENT REPLACEMENT — If the element is damaged or has lost its thermostatic charge, replace it with the same type.

To properly replace the element without damaging the element or the valve body on valves which utilize a gasketed joint, be sure only one gasket is used before assembling the element. In assembling gasketed elements held in place by two cap screws, be sure to pull up the cap screws evenly.

On valves which utilize the threaded type of element with metal-to-metal knife edge joints, always use an appropriate wrench (10") on the wrench flats. **DO NOT** use a wrench on the outer welded edge of the element. The sealing surfaces should be free of any foreign materials or nicks that might prevent a leak-tight joint. A few drops of refrigerant oil on the element threads will facilitate easy assembling and removal.

13. Return the superheat spring adjustment to its original position. Replace the seal cap tightly.

TABLE 9

VALVE TYPE 1①		Use Gauge No.
CURRENT	**OBSOLETE**	
AA(E), LMC-AA(E)	—	I
DA(E), LMC-DA(E)	—	2
PFE or HFE-1-1/2, 3, 4, 5, 8, 12	PFE or HFE-6, 7-1/2, 10, 11	3
PDE or HDE-2-1/2, 5-1/2, 7, 11, 16, 20	PVE or HVE-2, 5, 8, 10, 12, 15, 17, 18	
PDE or HDE-5, 8, 14	PDE or HDE-6, 7-1/2, 9, 12, 13	
PRE or HRE-1-1/2, 4, 6-1/2, 9, 12	PRE or HRE-6, 7-1/2, 11, 13	
—	UFE-12, 17	
	UVE-22, 30	
	UDE-15, 21	
	URE-16, 22	
OFE-23, 32, 40	UFE-23	3A
OVE-40, 55, 70	UVE-40	
ODE-28, 40, 50	UDE-28	
ORE-30, 35, 45	URE-30	
All F Models ② except FF(E).1/8, FV(E).1/4 FD(E)-1/8, FR(E)-1/8	—	4
All G Models except GF(E)-1/8, GV(E)-1/4 GR(E)-1/8	All Small K Models	5
All X Models	—	
MFE-5, 7 1/2, 11, 13, 15, 20 MVE-8, 12, 18, 21, 26, 34	MVE-12, 17 MVE-30	6
MDE-6, 9, 13, 15, 18,25	MDE-14, 20	
MRE-9, 15, 20, 25 KFE or VFE-45, KVE or WE-70 KDE or VDE-55, KRE or VRE-50	—	
MFE-25	MFE-22	7
MVE-42	MVE-40	
MDE-30	MDE-26	
MRE-30	—	
KFE or VFE-35, 55	VFE-50	
KVE or VVE-52, 100 KDE or VDE-40, 65	WE-90 VDE-42, 60	
KRE or VRE-38, 70	—	
WFE-80, 110	WFE-75, 100	
WVE-135, 180	—	
WDE-95, 130	WDE-90, 120	
WRE-100, 130	—	
CF(E) or SF(E). 1/4, ½, 1, 1-1/2, 2, 2-1/2, 3	R and T Models With 83 Elements	8
CV(E) or SV(E) - 1/2, 1, 1-1/2, 2, 3, 4, 5		
CD(E) or SD(E)- 1/4, ½, 1, 1-1/2, 2, 3, 4		
CR(E) or SR(E) – 1/4, ½, 1, 1-1/2, 2, 3, 4		
CFE-5, SFE-5, 6	—	8A
CVE-8, SVE-8, 10		
CDE-6, SDE-6, 7		
CRE-6, SRE-6, 7		
OFE-6, 9, 12		
OVE-1 0, 15, 20		
ODE-7, 11, 14		
ORE-6, 9, 12		
OFE-16, OVE30 ODE-20, ORE-21 ③	—	8B

① Type F (internally and externally equalized) valves dated D84 or later, Type S valves dated B69 or later, Type C valves dated C70 or later, and all Type G (externally equalized only) and X valves have packless pushrod construction and internal parts kits are not available for use with them.

② Applies only to Type F valves with a replaceable element.

③ Formerly used the KT-33-8 element and gauge number 33-8 (redesignated 8B). The KT-33-8 element has been replaced by the KT-83.

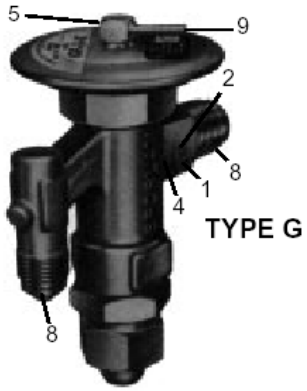
Bulletin 210-60 OCTOBER 1994

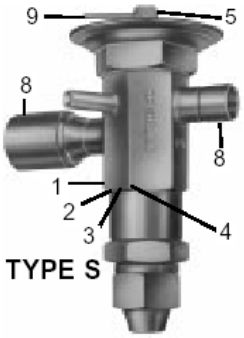
SPORLAN
THERMOSTATIC EXPANSION VALVES

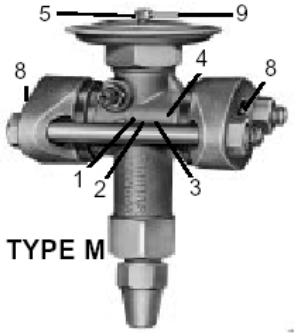
To completely identify a SPORLAN thermostatic expansion valve the following information is required:

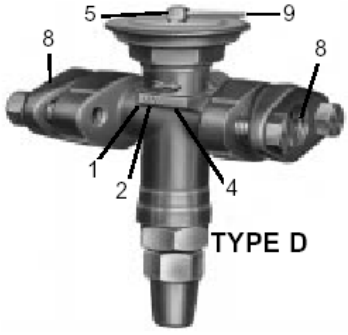
1. Type of valve (body style)
2. Refrigerant
3. External equalizer
4. Capacity in tons of refrigeration or port size
5. Type of thermostatic charge
6. Thermostatic bulb size if other than standard
7. Suffix letters—if any—indicate permanent bleed port or Rapid Pressure Balancer construction. (All valves except Types A & D)
8. Inlet and outlet connection sizes and style
9. Capillary tubing length
10. Prefix letters or number if any

For detailed explanation see Sections 1 thru 10.





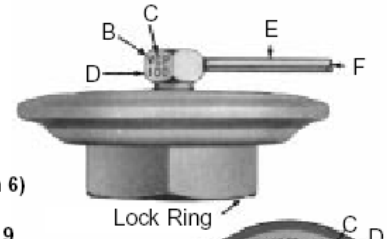




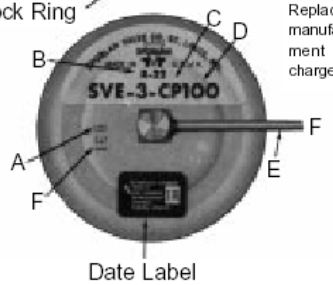
To completely identify a SPORLAN thermostatic element the following information is required:

A. Element size number
B. Refrigerant
C. Thermostatic charge
D. MOP (Maximum operating Pressure) if other than standard
E. Capillary tubing length
F. Bulb size if other than standard (See Section 6)

For detailed explanation see Sections 5, 6 and 9.



Replaceable Thermostatic Elements manufactured after 1991 had the element number and thermostatic charge marked on top of the element.



Refrigerant Designation, Letter and Color Code Used on Decals.

H - R-11- Blue	**J -** R-134a - Blue
F - R12 - Yellow	**L -** R-402A - Sand
E - R-13 - Blue	**S -** R-404A - Orange
T - R-13B1- Blue	**D -** R-500 - Orange
V - R-22 - Green	**R -** R-502 - Pulple
G - R-23 - Blue	**W -** R-503 - Blue
B - R-114 - Blue	**P -** R-507 - Teal
Q - R124 ~ Green	**A** - R-717 - White

1. TYPE VALVE - Sporlan thermostatic expansion valves are available in three body styles — SAE flare, ODF solder, or flange. The first letter or letters stamped on the valve body and shown on the label designates the valve type. Valve types are listed below.

Valve Types (STANDARD)

BF SAE Flare
C SAE Flare
O FPT or Socket Weld
EBF Extended ODF Solder
EBS Extended ODF Solder
F SAE Flare
G SAE Flare
EG ODF Solder
H ODF Solder Flange
M ODF Solder Flange
NI SAE Flare
O ODF Solder
P ODF Solder

RIVE SAE Flare or ODF Solder
S ODF Solder
SBF Extended ODF Solder
V ODF Solder Flange
W ODF Solder Flange
A FPI or Socket Weld

Valve Types (OEM)

BI SAE Flare or ODF Solder
FB SAE Flare or ODF Solder
K ODF Solder
I SAE Flare or ODF Solder
X SAE Flare or ODF Solder

2. REFRIGERANT - Sporlan valves are available for use with most popular refrigerants. The letter stamped on the valve body following the valve type and shown on the label designates the refrigerant. Refrigerant designations are as follows:

H - R-11-Blue
F - R-12 -Yellow
E - R-13-Blue
T - R-13B1-Blue
V - R22 - Green
G - R-23 - Blue
B - R-114-Blue
Q - R-124-Green
J - R134a-Blue
L - R-402A - Sand
S - R-404A - orange
D - R-500 - orange
R - R-502 - Purple
W - R-503 - Blue
P - R-507 - Teal
A - R-717-White

3. EXTERNAL EQUALIZER - The letter “F” immediately following the letter designating the refrigerant is used to denote an external equalizer connection. Physical inspection of the valve will reveal whether or not an external equalizer connection has been provided.

4. CAPACITY IN TONS of REFRIGERATION or PORT SIZE - For all current production valves except the Types (E)BF & SBF, the number following the letters indicates the valve's nominal capacity rating in tons. For example, a valve marked GF-1 is a Type G valve for Refrigerant 12 with a one ton nominal capacity rating. A valve marked SVE-5 is an externally equalized Type S valve for Refrigerant 22 with a five ton nominal capacity rating.

All current production Types (E)BF and SBF valves, and Type (E)BS valves, manufactured prior to 1992 use a letter code designation to indicate its capacity rating. Letter codes are listed in Table A along with their nominal capacity ranges.

TABLE-A — (E)BF & (E)BS CAPACITY CODES

Valve Type	Capacity Code	Nominal Capacity Range		
		R-12	R-22	R-502
(E)BF SBF	AA	1/8—1/3	1/8—2/3	1/8—1/3
	A	1/2—1	3/4—1—1/2	1/2—1
	B	1-1/4—1-3/4	1-3/4 - 3	1-1/4—2
	C	2—3	3-1/4—5-1/2	2-1/4—3
(E)BS	D	4—7	7—11	4—7-1/2

For ammonia valves, (Types A & D) the valve's nominal capacity rating is determined by the outlet discharge tube size and the port size in the valve body. Therefore, the rating can be read from the valve label as shown in Figure 1, or it can be determined by the port and discharge tube size. Ammonia valves are the only valves which have their port size stamped on the body. Prior to January 1954, the valve type and port size were stamped on the topside of the outlet flange for both the Types A & D valve. After this time, this marking was relocated to a boss on the side of the valve body for the Type D valve only.

Listed in Table B are the port and discharge tube sizes, and their associated nominal capacity ratings for the Types A & D valves.

TABLE-B — DISCHARGE TUBE & PORT SIZES

Valve Type	Nominal Capacity Rating (R-717)	Port Size (in)	Discharge Tube Orifice (in)
D	1	1/16	1/32
	2	1/16	1/16
	5	7/64	5/64
	10	3/16	7/64
	15	3/16	5/32
A	20	5/16	1/6
	30	*5/16*	*5/32*
	50	3/8	3/16
	75	3/8	none
	100	7/16	none

5. REFRIGERANT and THERMOSTATIC CHARGE IN ELEMENT - The label on the power element diaphragm case carries designations pertaining to type — charge — capacity and refrigerant. Immediately below the label and stamped in the top of the diaphragm case is a number which indicates the lock ring thread size of the element. This number designates the "element size." See Figure 1.

Prior to 1959 a single digit was used — e.g. 8 — after that time and prior to 1960 a second digit was added to indicate a modified construction — e.g. 81. Subsequent to 1960 this second digit was changed from "1" to "2" and in 1966 from "2" to "3" — e.g. 83 — to indicate further modifications. All current elements are designated with the suffix "3" with the exception of numbers 7 and 1 — their designations are 7 and 12 respectively. See the valve availability guide, Table-F, for a cross reference between valves and element sizes.

Further identification of the element is provided by the use of two or three letters and sometimes two or three numbers marked on top of the element. The first letter indicates the refrigerant and the second letter (and third if used) the selective charge of the element. Numbers, if used, indicate a special MOP or maximum operating pressure. (For refrigerant identification refer to Section 2). Prior to 1992, the refrigerant code and selective charge designation were stamped on the side of the capillary button on top of the diaphragm case. See Figure 1. The Selective Charges C, CP, Z, ZP, VGA, and X are generally applied in the range of temperatures shown in Table-C.

TABLE-C
RECOMMENDED THERMOSTATIC CHARGES

REFRIGERANT	AIR CONDITIONING OR HEAT PUMP	COMMERCIAL REFRIGERATION +50ºF. to -10ºF.	LOW TEMPERATURE REFRIGERATION 0ºF. to -40ºF.	EXTREME TEMPERATURE REFRIGERATION -40ºF. to -100ºF.
12	FCP60	FC	FZ, FZP	—
22	VCP100, VGA	VC	VZ, VZP40	VX
134a	JCP60	JC	—	—
401A	XCP60	XC	—	—
402A	—	LC	LZ, LZP	LX
404A	SCP115	5C	SZ, SZP	SX
502	RCP115	RC	RZ, RZP	RX
507	—	PC	PZ, PZP	PX

The Sporlan Type ZP thermostatic charges have essentially the same characteristics as the conventional Z Cross charges with one exception. They produce a pressure limit or MOP without the use of mechanical devices used in double diaphragm valves. The ZP charges are not intended as replacements for the Z charges — they should only be used where a definite pressure limit is required to prevent motor overloading.

A conventional Type L liquid charge is also available for all commonly used refrigerants in most of our element sizes.

The Types U, O, and K charges formerly used on Ammonia valves have been redesignated Types L, C, and Z respectively, to make them conform with the corresponding charges used on other refrigerants.
A Type VCP, Refrigerant 22 air conditioning or heat pump charge with a 100 psig limit is stamped “VCP100.” See Figure-1.

Table D lists the standard Type “P” charge MOP’s.

TABLE-D
GA. CP, and ZP Charged Valves

Refrigerant	① Thermostatic Charge	Mop-PSIG Factory Air Test	Nominal System
12	FCP60	60	50
	FZP	20	12
22	VGA	110	② 100
	VCP100	100	90
	VCP40	40	30
	VZP	30	20
134a	JCP60	60	50
401A	XCP60	60	50
402A	LZP	45	35
404A	SCP115	115	105
	SZP	45	35
502	RCP115	115	105
	RZP	45	35
507	PZP	45	35

①A numerical suffix on a thermostatic charge designation indicates a special MOP. Omission of the number indicates standard MOP as shown.
②Not as well defined as the other Type “P” charges listed in this table.
Example: VCP1 00 charge has a special air test MOP of 100.

The above system of identification of elements has been in effect since 1936. However, from 1936 to 1943 the letters indicating “refrigerant” and “type of charge” were stamped on the top of the diaphragm case along with the element size number, instead of on the diaphragm case button. Prior to 1936 elements were identified by a serial number. Beginning in 1948 a decal was affixed to the thermostatic element. Therefore, element identification must include lock ring size number, refrigerant, charge, capillary tubing length and pressure limit where applicable.

6. THERMOSTATIC BULB SIZE - The following bulb sizes listed in Table E are standard and are supplied in the majority of instances. When a non-standard ***oversized*** bulb is used on a thermostatic element a third digit, “1”, is added to the “element size” designation — e.g. “831” for a Number 83 element with a large bulb. (See Section 5, for complete explanation of element nomenclature).

7. PERMANENT BLEED PORT or RAPID PRESSURE BALANCER CONSTRUCTION — Air conditioning or refrigeration systems employing split phase or PSC motors which have low starting torques, require high to low side pressure equalization prior to restarting.

A ***permanent bleed port valve*** incorporates an internal bypass or bleed that remains open at all times. Even when the valve closes on system shut down, the bleed permits a continued flow of refrigerant until the pressures are equalized.

In addition to the usual body stampings signifying body type, refrigerant etc., the permanent bleed rate is also stamped on the body for percent bleeds up to and including 50%. For example a bleed rate equivalent to 10% of nominal capacity is shown as “BP/10.”

Permanent bleeds in excess of 50% of nominal capacity are not stamped on the body — a Y number prefix is used to signify this special feature. (See Section 10).
The ***RPB Valve*** presents a major change in the design of thermostatic expansion valves. The RPB bleed is actuated only on the off cycle. Immediately after shut down the evaporator pressure rises and the pin carrier moves to the closed position as in a conventional valve. However, with the RPB design the pin carrier continues its motion and opens the secondary spring loaded bleed port allowing rapid equalization of high and low side pressures. Upon restarting the compressor the secondary bleed port closes and the valve functions in the normal manner. If the RPB feature is incorporated in a valve, the letters "RPB" are stamped on the body. For example—SVE-3-CP100-RPB.

8. INLET and OUTLET CONNECTION SIZES and STYLE-The style — flare, flanged or solder — and the size of the inlet and outlet connections can be determined visually.

9. CAPILLARY TUBING LENGTH - Sporlan Thermostatic Expansion Valves are generally supplied with elements having capillary tubing in increments of 30” and 5 feet. other capillary tube lengths are also available. The length of the capillary tubing can be easily measured.

TABLE-E
STANDARD BULB SIZES — Inches

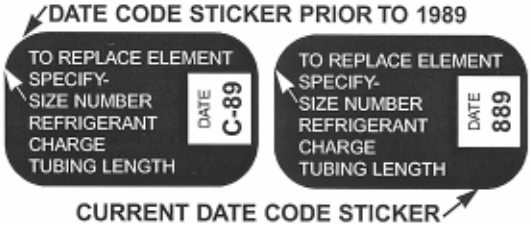
Refrigerant	Charge	Element Size					
		NI (non-replaceable)	Number 43	Number 53	Number 83	Number 33	Number 63
12	FCP60	0.50 OD X 3.00	0.50 OD X 3.00	0.50 OD X 3.00	0.50 OD X 3.50	0.75 OD X 4.00	0.88 OD X 6.00
	FC					0.50 OD X 5.00	
	FZ			0.38 OD X 4.50		0.50 OD X 5.00	
	FZP			0.50 OD X 3.50		0.75 OD X 4.00	
22	VGA		0.75 OD X 2.00	0.75 OD X 2.00	0.75 OD X 2.00	0.75 OD X 4.00	0.75 OD X 4.00
	VCP100		0.50 OD X 3.00	0.50 OD X 3.50	0.50 OD X 3.50	0.75 OD X 4.00	0.88 OD X 6.00
	VC						
	VZ						
	VZP						
	VX		N/A	0.75 OD X 4.00	0.75 OD X 4.00		
134a	JCP60		0.50 OD X 3.00	0.50 OD X 3.50	0.50 OD X 3.50	0.75 OD X 4.00	0.88 OD X 6.00
	JC					0.50 OD X 5.00	
502	RCP115		0.50 OD X 3.00	0.50 OD X 3.50	0.50 OD X 3.50	0.75 OD X 4.00	0.88 OD X 6.00
	RC						
	RZ						
	RZP						
	RX		N/A	0.75 OD X 4.00	0.75 OD X 4.00		

10. PREFIX LETTERS - N - Indicates non-adjustable superheat construction when used as prefix to basic valve type specification. — e.g. NSVE-3-GA. Adjustable bottom cap assembly kits are available for field conversion to a standard adjustable valve.

H - Indicates hermetic construction and Manufacturer's Warranty generally is void if the valve is removed from system or disassembled. Therefore, replacements and repair parts are ***NOT*** available. All valves of this type are also nonadjustable.

Y-Number - When a basic valve type is preceded by the prefix Y and a number, it indicates a special construction made for a particular equipment manufacturer. While some of the parts may be standard and interchangeable, complete valves are generally available only through the equipment manufacturer. A typical designation would be Y335-CVE-2-CP 100. This particular valve has a 60% permanent bleed and a special superheat spring and should not be replaced by a standard valve.

VALVE DATE - All new valves are marked to show the week and year in which they were manufactured. The date code consists of either three or four digits: a one or two digit week code, and a two digit year code. Thus, "889" and "1189" refer to the eighth and eleventh week of 1989. Since a full year exceeds 52 weeks by either one or two days, a 53rd week will occasionally be assigned, extending into the following year. These markings indicate the date of manufacture of the valve only and have no reference to valve type, refrigerant, capacity, or type of charge. Prior to 1989, a sticker placed on the thermostatic element indicated what quarter and year the valve was manufactured. Thus, D87 indicates the last quarter of 1987 and C89 indicates the third quarter of 1989.



(See Figure-1, for location on element.)

FURTHER AIDS TO IDENTIFICATION - Valve identification markings illustrated on Page 1 apply to all types presently manufactured by Sporlan Valve Company. Types G, 5, M and D are used as examples. As an aid in identifying discontinued types of valves which are still in operation, the following data applies. From 1934 through 1936, all valves were identified by means of a serial number. Since 1937 the valve type and refrigerant have been stamped on the body of the valve. Capacities of valves from 1936 to 1944 were shown in either port sizes or tons capacity. However, since January 1944, all valves except Ammonia valves have been marked in tons capacity rather than port sizes. Numbers cast into the external valve parts merely indicate the pattern number of the valve body and are of no value in determining refrigerant, capacity or type of thermostatic charge. They are listed in the valve availability guide Table F, below.

VALVE AVAILABILITY GUIDE

TABLE - F — CURRENT VALVE TYPES

③ Valve Type	NOMINAL CAPACITY Tons of Refrigeration				Connection Style	Element Size No.	① Body Casting No.
	12, 134a, 401A	22	402A, 404A, 502 507	717			
⑧ Nl	1/8, 1/4, 1/2, 1	¼, 1/2, 1	1/4, 1/2, 1	—	SAE Flare	43	—
⑧ RIVE	—	2, 3, 4, 5	—		SAE Flare or ODF Solder		
F	1/8, 1/4, 1/2, 1, 1-1/2, 2	1/4, 1/2, 1, 1-1/2, 2, 2-1/2, 3	1/8, 1/4, 1/2, 1,1-1/2, 2		SAE Flare or ODF Solder		
⑦ (E)BF and SBF	NOMINAL CAPACITY CODES AA, A, B, & C						
Q	1/6, 1/4, 1/2, 1, 1-1/2, 2, 2-1/2	1/3, 3/4, 1, 1-1/2, 2-1/2, 3-1/2, 5	1/6, 1/4, 1/2, 1, 1-1/2, 2, 3				
G	1/8, 1/4, 1/2, 1-1/2, 2	1/5, 1/3, 1/2, 1, 1-1/2, 2, 2-1/2, 3	1/8, 1/4, 1/2, 1, 1-1/2, 2		SAE Flare	53	
EG					ODF Solder		
C	2-1/2, 3, 5	4, 5, 8	3, 4, 6		SAE Flare	83	
S	2, 2-1/2, 3, 5, 6	2, 3, 4, 5, 8, 10	2, 3, 4, 6, 7		ODF Solder		
EBS	7	11	7-1/2				
P	1-1/2, 3, 4, 5, 8, 12	2-1/2, 5-1/2, 7, 11, 16, 20	1-1/2, 3, 4, 6-1/2, 9, 12		ODF Solder Flange	33	
H							
M	5, 7-1/2, 11, 13, 15, 20, 25	8, 12, 18, 21, 26, 34, 42	9, 15, 20, 25, 30			63	107-E
O 83	6, 9, 12, 16	10, 15, 20, 30	6, 9, 12, 21		ODF Solder	83	—
O 33	23, 32, 40	40, 55, 70	30, 35, 45			33	
K	35, 45, 55	52, 70, 100	38, 50, 70			63	707-A
V					ODF Solder Flange		
W	80, 110	135, 180	100, 130			② 63 and 7	707-B
D	—	—	—	1, 2, 5, 10, 15	Pipe Flange	23	⑤ 207A
A				20, 30, 50, 75, 100		12	107

BULLETIN 40-10-3
April 1999

CATCH-ALL

REPLACEABLE CORE TYPE FILTER-DRIER
(C-480 through C-19200 Series)

- **Filtration options**
- **Replaceable secondary filter**
- **Improved ease of assembly**

Developed for today's complex systems, the Catch-All® Filter-Drier's new exclusive filter-within a-filter system enhances shell filtration ability. When used with Sporlan replaceable cores, the new design provides unequaled protection and flexibility.

Flexibility is crucial because today's systems vary more than ever.The new Catch-All shell design accommodates an **optional secondary filter** for use in the liquid line. The development of the secondary filter feature was prompted by changes in system chemistry. Experience has shown circulating POE oil has the ability to scrub and suspend a large concentration of particles. The secondary filter provides unparalleled filtration without adversely affecting the dirt holding capacity of the Catch-All. The filter-within a-flit er concept allows the molded cores to remove the larger sized particles, while the secondary filter removes microscopic particles in circulation. The secondary filter feature is ideal for systems requiring POE oil, and is recommended for system startup or system cleanup after a compressor burnout.

The components used in the Catch-All are compatible with commercially available oils and CFC, HCFC, and HFC refrigerants.

FEATURES

Integral to the redesign are these...

DESIGN FEATURES

- The Catch-All shell utilizes an exclusive filter-within a-filter construction. The new internal assembly, when used with Sporlan molded cores, provides maximum water capacity, excellent acid removal characteristics, the ability to remove products of oil decomposition, and outstanding filtration. The optional replaceable secondary filter offers unsurpassed filtration efficiencies without compromising the CatchAll's ability to hold a large amount of foreign material. The assembly is designed so the cores remove larger sized particles while the secondary filter removes microscopic particles. This unique construction aggressively filters particles circulating in a refrigerant system.

- The shell redesign offers **flexibility.** The new internal assembly can be used with or without the secondary filter. The type of filtration needed depends upon the system requirements or application. Using the assembly without the secondary filter offers the same time tested, field-proven, filtration characteristics expected in a Catch-All Filter-Drier.

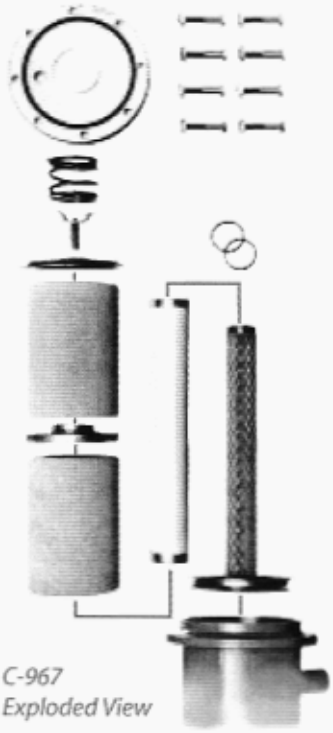
- The internal construction is designed to improve **ease of assembly.** The molded cores simply slide over the center tube, followed by spacer plates (if applicable). The outlet plate is fastened to the assembly by a wing screw. With the addition of a spring, the resulting assembly is easy to install and remove.

- The seal gasket prevents solid contaminants from bypassing the filter. The assembly is held tight against the gasket by a spring. 0-rings are used with the secondary filter to provide a tight seal.

- The internal parts are plated steel — no plastic parts.

- The **bolt and nut attachment** of the end plate allows for simple, trouble-free installation. The nuts lock against the side of the shell for ease in tightening. Other designs, using cap screws threaded into the flange ring, run the risk of twisting off the head of the screw making removal difficult.

- Copper fittings are excellent for fast easy soldering. Fittings are pre-sized for proper fit, and suitable for use with soft solder, silver solder, Sil-Fos, or Phos-Copper. The fittings are brazed to the shell with a high temperature brazing alloy so they never come loose during the brazing operation on the job.



The construction illustrated is used on the C-480 through C-19200 Series Catch-All Filter-Driers (ODF Solder models only) manufactured after 6/99. The C-R420, C-30,000, and C-40,000 Series models differ in construction, but maintain the field-proven features which have been used successfully for many years.

- A **complete line of fitting sizes** are available with solder connections from 1/2" to 2-1/8" ODF.

- Heavy steel shells provide **high bursting strength** and are listed by Underwriters' Laboratories Inc. and Canadian Standards Association.

- The shell exterior uses an **epoxy powder coating to prevent corrosion** even under the most adverse conditions.

APPLICATION

The C-480 through C-19200 Series Replaceable Core Type Catch-All Filter-Driers are designed to be used in the **liquid line**. Place the Catch-All immediately ahead of other liquid line controls, such as the thermostatic expansion valve, solenoid valve, and **See•All® Moisture and Liquid Indicator**. When applied in this way, the filter-drier provides maximum protection for the thermostatic expansion valve and solenoid valve from dirt that may be in the system. If the system contains appreciable amounts of moisture, this location gives the best results in protecting the thermostatic expansion valve from freeze-up. If possible, place the filter-drier in a cold location on the liquid line. Acid capacity is not affected by differences in liquid line temperature.

The secondary filter feature is ideal for systems with POE oil, and is recommended for system start-up or system cleanup after a compressor burnout.

Because of flow considerations, the new C-480 through C-19200 Series Replaceable Core Type Catch-All Filter-Driers are **not** recommended for the suction line. Sporlan manufactures **Replaceable Suction Filter (RSF) shells** specifically for suction line installations. The RSF shell is designed to allow maximum vapor flow with a minimum pressure drop whether the installer is using filter elements or molded cores.

Catch-All Filter-Driers are not recommended in the **discharge line**. There are better locations. The water capacity in this location is greatly reduced due to the high operating temperature.

Catch-All Filter-Driers may be installed in any position, with top or bottom feed. However, it is advisable to mount replaceable core models horizontally so that foreign material cannot drop into the outlet fitting when the cores are removed. Always observe the flow direction. Catch-Alls must never be subjected to reverse flow.

The Catch-All should be installed in the main liquid line for maximum protection. When located in a bypass line, dirt or foreign material may pass into the system through the unprotected line. When a bypass installation is necessary, consult Bulletin 40-10.

The components used in the Catch-All are compatible with commercially available CFC, HCFC, and HFC refrigerants and oils. The new intemal assemblies are **not** suitable for use on ammonia systems. All Replaceable Core Type Catch-All Filter-Driers with NPT female connections, supplied with the tie rod construction, are suitable for CFC, HCFC, and HFC refrigerants plus ammonia.

SPORLAN
SEE•ALL MOISTURE and LIQUID INDICATOR

SERVICE POINTERS

REPLACEMENT INDICATOR PAPER — Sporlan kit K-SA-4 consisting of a new slotted cylinder and indicator paper assembly is available for replacing the indicator in the fused glass style Sporlan See-Ails (1/4" thru 1-1/8" sizes) manufactured since 1984. Replacement is thru the bottom (see SA-14SU below). If the indicator becomes damaged, it is generally recommended that the entire See-All be replaced. However, the parts kit can be used in situations where it is difficult to remove the See-AU.

LIQUID WATER — On occasion it is possible for large quantities of water to enter a refrigeration system. An example would be a broken tube in a water-cooled condenser. If this happens and the **free water** comes in contact with the indicator element, the element will be damaged.

All moisture-indicating elements use a chemical salt (see "How it works"). These salts must be soluble in water in order to change color, **If excessive water is present then the salts will dissolve and permanent damage to the indicator results. It may remain yellow or even turn white.**

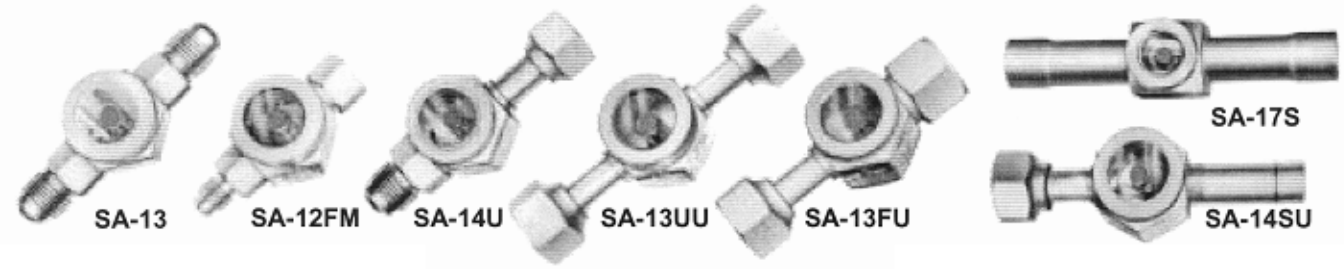
HERMETIC MOTOR BURNOUTS — After a hermetic motor burnout, install a **Catch•All Filter-Drier** to remove the acid and sludge contamination. When the system has operated for 48 hours replace the Catch•All Filter-Drier and at the same time install the See•All.

Since the **acid formed by the burnout** may damage the indicator element of the See-All, it is preferable to install it after most of the contaminants have been removed.

EXCESS OIL — When a system is circulating an excessive amount of oil, the See•All indicator paper may become saturated. This causes the **indicator to appear brown** or translucent and lose its ability to change color, but does not permanently damage the See•All. **Let the See•All remain in the system.** The circulating refrigerant will remove the excess oil, and the indicator element will return to its proper color.

LEAK DETECTORS — Du Pont refrigerant containing **Dytel leak detector** does not damage the See-All indicator paper. However, certain dye type liquid leak detectors may interfere with the color change of the indicator paper. If desired, many of these leak detectors (including Dytel) can be removed by installing a Sporlan ***Catch•All*** in the liquid line. The See•All can then be installed on the system without risk of damaging the indicator paper.

ALCOHOL — Do **NOT** install a See•All on a system that contains methyl alcohol or similar liquid dehydrating agents. Remove the alcohol by using a Catch•All Filter-Drier, and then install the See•All. otherwise the alcohol will damage the See•All color indicator.



HCFC-22 Compliant Scroll® Compressors for Air Conditioning

ZR, ZZ

16K to 373K BTUH

1-1/2 Through 30 Horsepower

R-22

Air Conditioning Applications

Cat. No. 2.201 R2

copeland

Scroll Dimensional Summary

English Measure

Standard Model	Overall Dimensions (Inches)			Mounting Dimensions (Inches)		Stub Tube Connections (ID. Inches)		Weight (Pounds)		No. Per Skid	Dimension Drawing Number
	L	W	H(1)	L	W	Suct.	Disch.	Net	Ship		
ZR16K4	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	46	47	32	2.21DD-2617
ZR16KC	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	46	47	32	2.21DD-2617
ZR18K3	9.50	9.50	14.33	7.50	7.50	0.75 ST	0.5 ST	58	59	32	2.21DD-2546
ZR18K4	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	47	48	32	2.21DD-2617
ZR18KC	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	47	48	32	2.21DD-2617
ZR22K3	9.50	9.50	14.81	7.50	7.50	0.75 ST	0.5 ST	58	59	32	2.21DD-2687
ZR22K4	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	50	51	32	2.21DD-2617
ZR22KC	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	50	51	32	2.21DD-2617
ZR24K3	9.50	9.50	14.81	7.50	7.50	0.75 ST	0.5 ST	58	59	32	2.21DD-2687
ZR24K4	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	60	61	32	2.21DD-2617
ZR24KC	9.50	9.50	14.87	7.50	7.50	0.75 ST	0.5 ST	52	53	32	2.21DD-2617
ZR26K3	9.50	9.50	14.81	7.50	7.50	0.75 ST	0.5 ST	59	60	32	2.21DD-2687
ZR26KC	9.50	9.50	14.81	7.50	7.50	0.75 ST	0.5 ST	59	60	32	2.21DD-2546
ZR28K3	9.50	9.50	14.81	7.50	7.50	0.75 ST	0.5 ST	60	61	32	2.21DD-2687
ZR28KC	9.50	9.50	14.81	7.50	7.50	0.75 ST	0.5 ST	60	61	32	2.21DD-2546
ZR30K3	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	62	63	32	2.21DD-2687
ZR3OKC	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	62	63	32	2.21DD-2546
ZR32K3	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	63	64	32	2.21DD-2687
ZR34K3	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	64	65	32	2.21DD-2687
ZR34KC	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	64	65	32	2.21DD-2546
ZR36K3	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	65	66	32	2.21DD-2687
ZR36KC	9.50	9.50	15.71	7.50	7.50	0.75 ST	0.5 ST	65	66	32	2.21DD-2546
ZR4OK3	9.50	9.50	16.25	7.50	7.50	0.75 ST	0.5 ST	66	67	32	2.21DD-2687
ZR4OKC	9.50	9.50	16.25	7.50	7.50	0.75 ST	0.5 ST	66	67	32	2.21DD-2546
ZR42K3	9.50	9.50	16.25	7.50	7.50	0.75 ST	0.5 ST	67	68	32	2.21DD-2687
ZR42KC	9.50	9.50	16.25	7.50	7.50	0.75 ST	0.5 ST	67	68	32	2.21DD-2546
ZR45KC	9.52	9.52	16.95	7.50	7.50	0.88 ST	0.5 ST	71	72	32	2.21DD-2691
ZR46K3	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	83	84	32	2.21DD-2612
ZR46KC	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	83	84	32	2.21DD-2612
ZR47K3	9.52	9.52	16.95	7.50	7.50	0.88 ST	0.5 ST	72	73	32	2.21DD-2687
ZR47KC	9.52	9.52	16.95	7.50	7.50	0.88 ST	0.5 ST	72	73	32	2.21DD-2691
ZR48K3	9.52	9.52	16.95	7.50	7.50	0.88 ST	0.5 ST	73	74	32	2.21DD-2691
ZR48KC	9.52	9.52	16.95	7.50	7.50	0.88 ST	0.5 ST	73	74	32	2.21DD-2691
ZR49K3	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	87	88	32	2.21DD-2562
ZR49KC	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	87	88	32	2.21DD-2562
ZR54K3	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	90	91	32	2.21DD-2562
ZR54KC	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	90	91	32	2.21DD-2562
ZR57K3	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	94	95	32	2.21DD-2562
ZR57KC	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	92	93	32	2.21DD-2562
ZR61K3	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	92	93	32	2.21DD-2562

Scroll Dimensional Summary

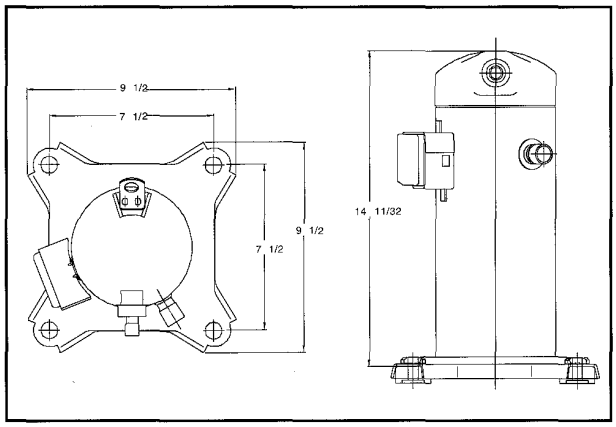
English Measure

Standard	Overall Dimensions			Mounting Dimensions		Stub Tube Connections		Weight		No. Per Skid	Dimension Drawing
	L	W	H(1)	L	W	Suct.	Disch.	Net	Ship		
ZR61KC	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	92	93	32	2.21DD-2562
ZR67KC(2)	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	89	90	32	2.21DD-2562
ZR68KC(2)	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	89	90	32	2.21DD-2562
ZR72KC(2)	9.48	9.71	17.75	7.50	7.50	0.88 ST	0.5 ST	89	90	32	2.21DD-2562
ZR81KC(2)	9.48	9.71	17.96	7.50	7.50	0.88 ST	0.75 ST	92	93	32	2.21DD-2624
ZR84KC(2)	10.38	11.19	19.22	7.50	7.50	1.13 ST	0.88 ST	128	132	12	2.21DD-2629
ZR90K3(2,3)	12.57	14.06	21.17	8.65	8.65	1.75 RK	1.25 RK	220	221	6	2.21DD-2559
ZR94KC(2)	10.38	11.19	19.22	7.50	7.50	1.13 ST	0.88 ST	128	132	12	2.21DD-2629
ZR1O8KC(2)	10.38	11.19	21.50	7.50	7.50	1.38 ST	0.88 ST	138	142	12	2.21DD-2679
ZR125KC(2)	10.38	11.19	21.50	7.50	7.50	1.38 ST	0.88 ST	138	142	12	2.21DD-2679
ZR11M3(2,3)	12.57	14.06	21.17	8.65	8.65	1.75 RK	1.25 RK	220	224	6	2.21DD-3754
ZR12M3(2,3)	12.57	14.06	21.17	8.65	8.65	1.75 RK	1.25 RK	220	224	6	2.21DD-3754
ZR16M3(2,3)	12.57	14.06	21.47	8.65	8.65	1.75 RK	1.25 RK	220	224	6	2.21DD-3754
ZR19M3(2,3)	12.63	13.75	23.30	8.65	8.65	2.25 RK	1.75 RK	249	253	1	2.21DD-3754
ZRT1O8K3(2)	24.65	11.69	18.80	21.50	7.50	1.13 TO	0.75 ST	185	208	2	2.21DD-2550
ZRT114K3(2)	24.65	11.69	18.80	21.50	7.50	1.13 TO	0.75 ST	195	218	2	2.21DD-2550
ZRT122K3(2)	24.65	11.69	18.80	21.50	7.50	1.13 ST	0.75 ST	189	212	2	2.21DD-2550
ZRT136KC(2)	24.65	11.69	18.80	21.50	7.50	1.13 TO	0.75 ST	183	206	2	2.21DD-2550
ZRT144KC(2)	24.65	11.69	18.80	21.50	7.50	1.13 TO	0.75 ST	183	206	2	2.21DD-2550
ZRT162KC(2)	24.65	12.194	19.01	21.50	7.50	1.13 ST	1 ST	189	212	2	2.21DD-2550
ZRT92K3(2)	24.65	11.69	18.80	21.50	7.50	1.13 TO	0.75 ST	171	218	2	2.21DD-2550
ZRT98K3(2)	24.65	11.69	18.80	21.50	7.50	1.13 TO	0.75 ST	179	226	2	2.21DD-2550
ZZ18M3(2)	35.08	17.75	22.40	14.67	8.66	1.65 ST	1.1 ST	473	494	1	2.21DD-2678
ZZ21M3(2)	35.08	17.75	22.40	14.67	8.66	1.65 ST	1.1 ST	473	494	1	2.21DD-2678
ZZ22M3(2)	35.08	17.75	22.40	14.67	8.66	1.65 ST	1.1 ST	473	494	1	2.21DD-2678
ZZ24M3(2)	35.08	17.75	22.40	14.67	8.66	1.65 ST	1.1 ST	473	494	1	2.21DD-2678
ZZ25M3(2)	35.08	17.75	22.40	14.67	8.66	1.65 ST	1.1 ST	473	494	1	2.21DD-2678
ZZ28M3(2)	35.08	17.75	22.72	14.67	8.66	1.65 ST	1.1 ST	473	515	1	2.21DD-2695
ZZ31M3(2)	35.79	19.65	24.53	14.67	8.66	1.65 ST	1.1 ST	479	501	1	2.21DD-0283
ZZ32M3(2)	35.08	17.75	22.40	14.67	8.66	1.65 ST	1.1 ST	481	538	1	2.21DD-0283
ZZ35M3(2)	35.79	19.65	24.53	14.67	8.66	2.13 ST	1.1 ST	501	522	1	2.21DD-0283
ZZ38M3(2)	36.97	20.09	24.57	15.26	8.66	2.13 ST	1.38 ST	521	578	1	2.21DD-0283

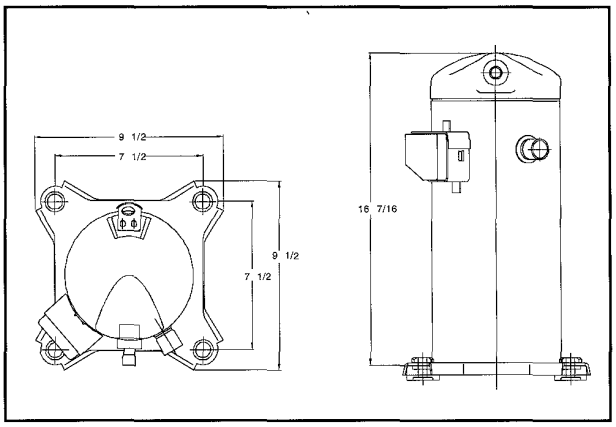
Notes

(1) Height without mounting parts.
(2) Three phase weight.
(3) Standard rotalock connections.

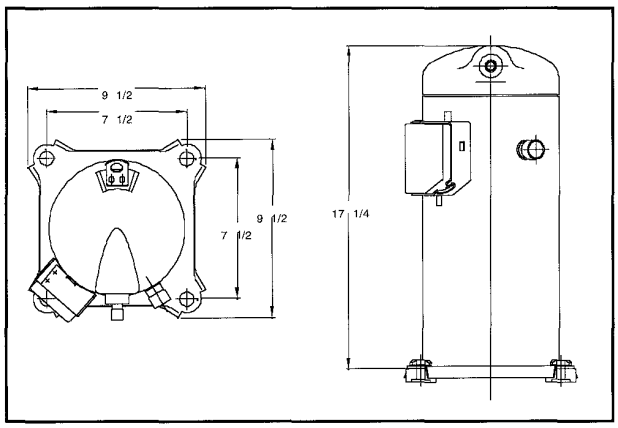
Scroll Dimensional Drawings



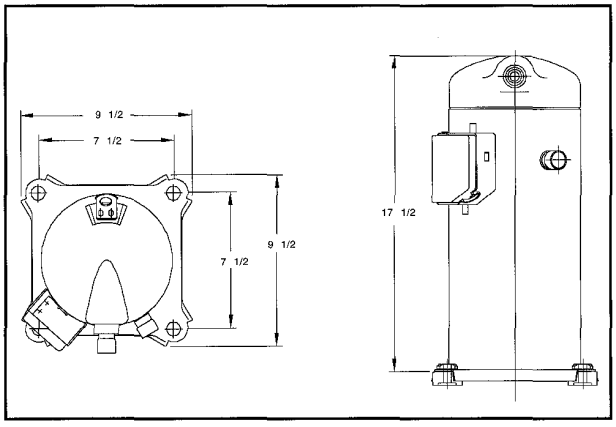
Typical ZRK4/KC Family
(ZR16 - ZR24)



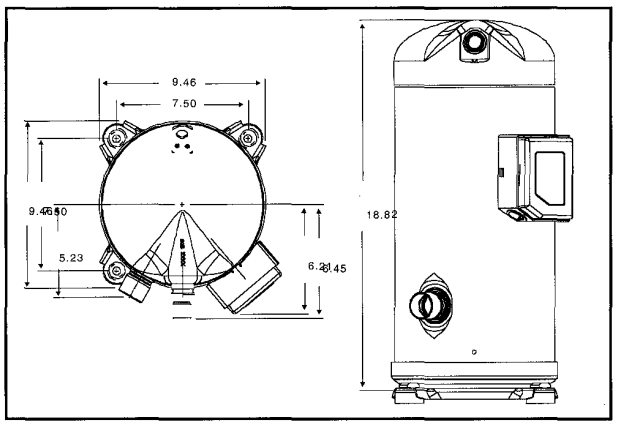
Typical ZRK3/ZRKC Family
(ZR18-ZR45, ZR47-ZR48/ZR26-ZR45, ZR47-ZR48)



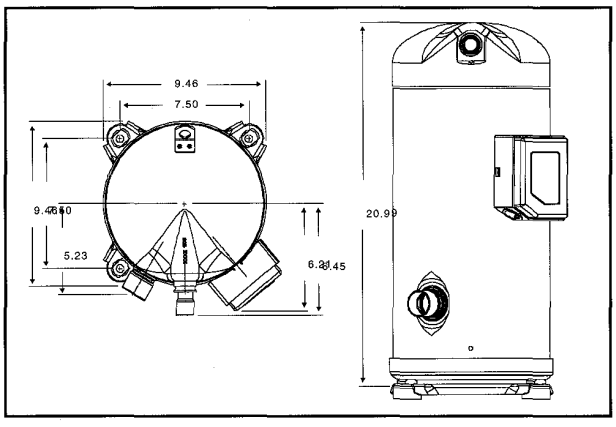
Typical ZRK3/ZRKC Family
(ZR46, ZR49-ZR61/ZR46, ZR49-ZR72)



Typical ZRKC Family
(ZR81)

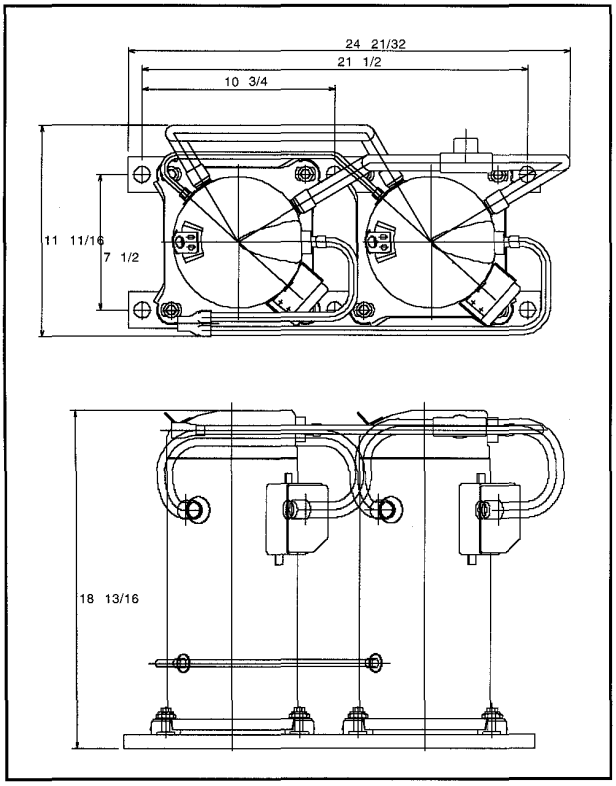


Typical ZRKC Family
(ZR84-ZR94)

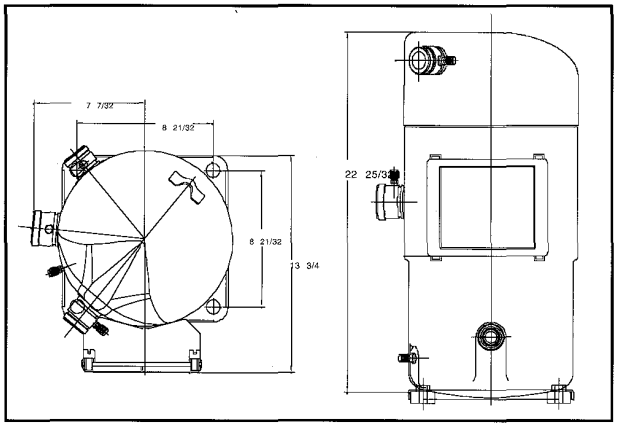


Typical ZRKC Family
(ZR108 - ZR144)

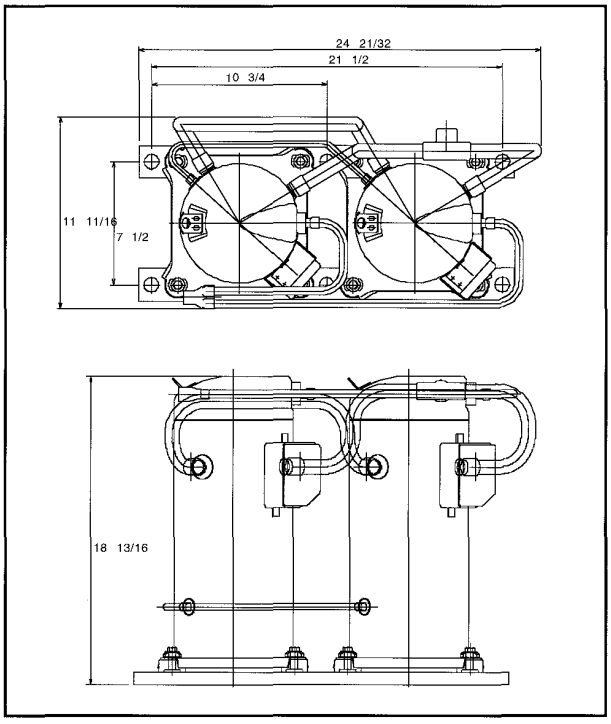
Scroll Dimensional Drawings



Typical ZRT Family
(ZRT92 - ZRT162)

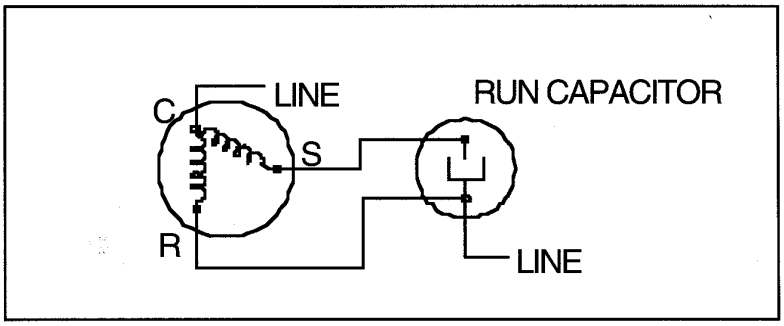


Typical ZRK3/ZRM3 Family
(ZR90K/ZR11M-ZR19M)

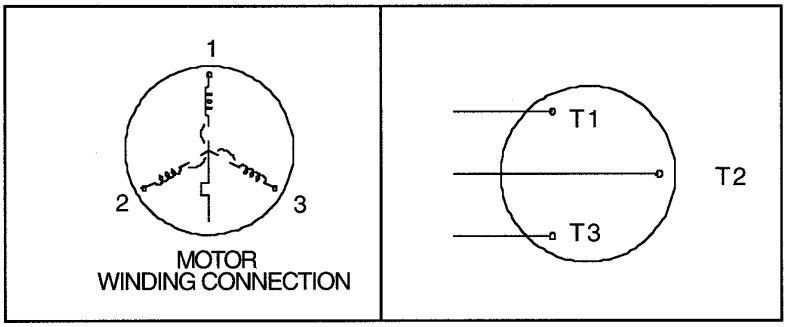


Typical ZZM3 Family
(ZZ18M3 - ZZ38M3)

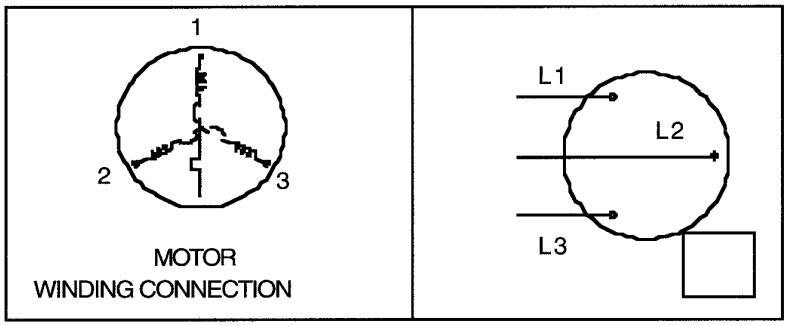
Scroll Wiring Diagrams



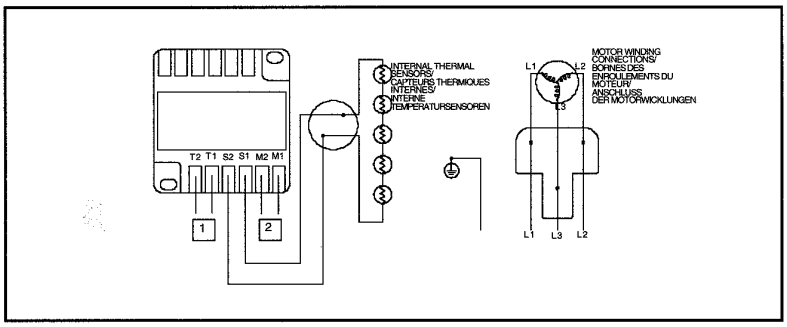
Typical Single Phase ZRK3/K4,ZRKC Family (ZR16 - ZR81)



Typical Three Phase ZRK3, ZRKC Family (ZR22 - ZR81)



Typical Three Phase ZRKC Family (ZR84 - ZR125)



Typical Three Phase ZRK3 Family (ZR90, ZR11M - ZR19M)

Scroll Supplemental Information

Capacitor Data

MFD	Volts	Part Number
30	370	014-0037-10
30	440	014-0037-16
35	370	014-0037-11
35	440	014-0037-17
40	370	014-0037-12
40	440	014-0037-18
45	440	014-0037-19
45	370	014-0037-36
50	440	014-0037-20
50	370	014-0037-40
55	440	014-0037-21
55	370	014-0037-39
60	440	014-0037-22
60	370	014-0037-37
60	370	014-0041-00
80	370	014-0037-38
80	370	014-0041-01

Oil Charges

Model Family	Initial	Recharge
ZR16-24K4	25	21
ZR18-28K3	38	34
ZR30-48K3	42	38
ZR47-48K3 3-phase	46	42
ZR54-61K3 single-phase	56	52
ZR46-61K3 3-phase	66	62
ZR46, 49K3 single phase	66	62
ZRT92-122K3	114	106
ZR90K3-ZR19M3	140	136
ZZ18-38M3	280	274
ZR16-24KC	25	21
ZR26-28KC	38	34
ZR30 - 48KC single phase	42	38
ZR45KC 3-phase	42	38
ZR47-48KC 3-phase	46	42
ZR54 -61KC single phase	56	52
ZR46-61KC 3-phase	66	62
ZR49KG single phase	66	62
ZR67-81KC	60	56
ZR84 - 94KC	85	81
ZR108-125KC	110	106
ZRT136-144KC	114	106
ZRT162KC	120	112

Scroll Supplemental Information

Agency Recognition

Model	U.L. File No.	File Date	C.S.A. File No.
ZR*K3Quantum	SA-2337	6/14/94	LR3104C
ZR*K3 Quest	SA-2337	7/26/93	LR3104C
ZR*K4 Star	SA-2337	11/1/95	LR3104C
ZR*KG Quantum	SA-2337	6/14/94	LR3104C
ZR*KC Quest	SA-2337	7/26/93	LR3104C
ZR*KG Star	SA-2337	11/1/95	LR3104C
ZR*KC Summit	SA-2337	9/27/96	LR3104C
ZR*K3Specter	SA-9747	07/12/1994	LR101508
ZR*M3Specter	SA-9748	07/12/1994	LR101508

Accessories

Model	Volts	Part Number Crankcase Heaters	Part Number Spacer Mounting Assembly
StarZR16KG/4-ZR24KG/4	120v	018-0052-00	527-0044-12
	240v	018-0052-00	
Quantum ZR1 8K-ZR45K, ZR47K-ZR48K	120v	018-0053-07	527-0116-00
Quest ZR46K, ZR49K-ZR81K	240v	01 8-0053-00	
	480v	01 8-0053-01	
	575v	018-0053-02	
Summit ZR84K-ZR125K	120v	018-0047-00	527-0116-00
	240v	01 8-0047-01	
	480v	018-0047-02	
	575v	018-0047-03	
SpecterZR9OK, ZR11M3-ZR19M3	120v	018-0036-01	527-0159-00
	240v	018-0036-00	
	480v	018-0036-02	
	575v	018-0036-03	
Tandem ZRT92K-162K		Quest X 2	527-0150-00
Tandem ZZ1 8M-38M		Specter X 2	527-0165-00
Additional Accessories:			
Polyol Ester Oil Kit			998-E022-01
Heat Pump Discharge Line Thermostat Kit			998-0539-00
3 Phase Voltage Monitor			085-0160-00

Scroll Supplemental Information

Additional Information

Refer to the following application bulletins for Scroll compressor application details.

Bulletin	Description
AE 4-1293	Application Guidelines for Quest 4-6.75 Ton ZR*3/ZR*KG Model Copeland Compliant Scroll Compressors
AE 4-1300	Application Guidelines for 1.5-4 Ton Quantum ZR*K3/ZR*KC Model Copeland Compliant Scroll Compressors
AE 4-1301	Application Guidelines for ZP**K*E Scroll Compressors for R-41 OA
AE 4-1303	Application Guidelines for 7 to 10 Ton ZR*KC Summit Model Copeland Compliant Scroll Compressors

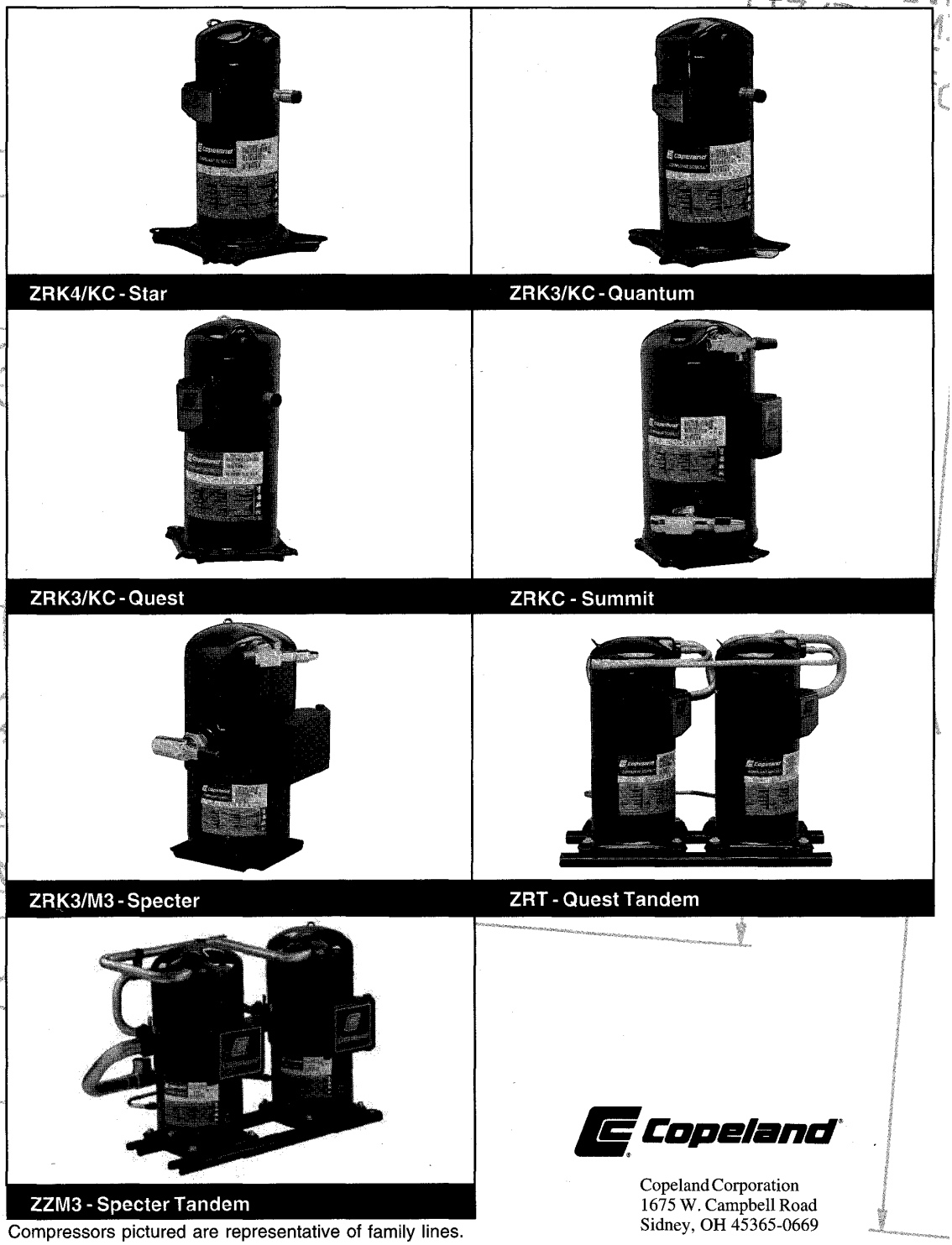
Wiring Diagram Cross Reference

Family	Phase	Electrical Code	Wiring Diagram
ZRK4/KC (18-24)	1	PFV/PFJ	2.21WD-0840
ZRK3 (18-45,47-48)	1	PFV/PFJ	2.21WD-0840
ZRKC (26-45,47-48)	1	PFV/PFJ	2.21WD-0840
ZRK3 (22-45,47-48)	3	TF5/TFD/TFE	2.21WD-1199
ZRKC (45,47-48)	3	TF5/TFD/TFE	2.21WD-1199
ZRK3/ZRKC (46,49-61)	1	PFV/PFJ	2.21WD-0840
ZRK3/ZRKC (46,49-81)	3	TF5/TFD/TFE/TF7	2.21WD-1199
ZRK3/M3 (90K3-19M3)	3	TWD/TWE/TWC/TWR/TW7	2.21WD-1201
ZRKC (84-125)	1	TFD/TFE/TF5/TF7	2.21WD-2629

Voltage Ranges

Voltage Code	60 Hertz Rating			50 Hertz Rating		
	Rating	Min.	Max.	Rating	Min.	Max.
C	208/230-3	197	253	200-3	180	220
D	460-3	414	506	380/420-3	342	462
E	575-3	518	633	-	-	-
M	-	-	-	380/420-3	342	462
R	-	-	-	220/240-3	198	264
V	208/230-1	197	253	-	-	-
W	-	-	-	200/220-3	180	242
5	200/230-3	180	253	200/220-3	180	242
7	380-3	342	418	-	-	-

Compliant Scroll Compressors



Compressors pictured are representative of family lines.

Copeland Corporation
1675 W. Campbell Road
Sidney, OH 45365-0669

Cat. No. 2.201 R2 Revised 10-99
Supersedes 2.201 R1

Printed in U.S.A.
www.copeland-corp.com

JOHNSON CONTROLS

FANs 125, 121
Product/Technical Bulletin F61
Issue Date 0696

F61 Series Standard Flow Rate Switch

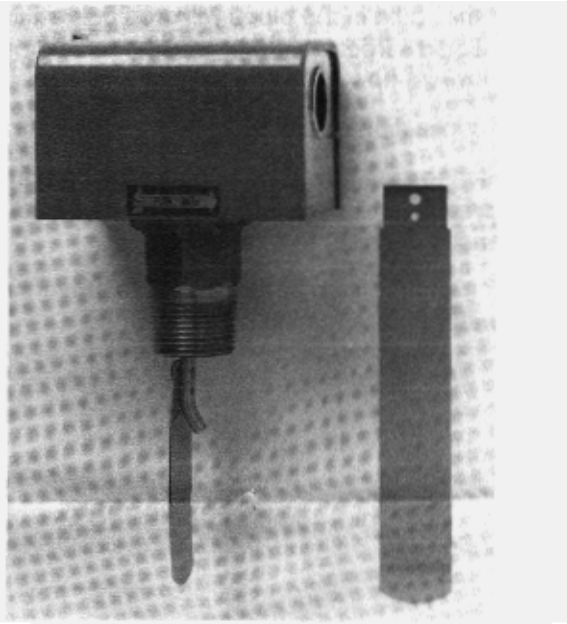


Figure 1: F61KB Flow Switch

The F61 Series Flow Switches are Single-Pole, Double-Throw (SPDT) flow switches that are used in liquid lines carrying water, ethylene glycol, or other liquids not classified as hazardous. They can be wired to energize one device and de-energize another device powered from the same source when liquid flow either exceeds or drops below the set flow rate.

Features and Benefits

Sturdy Steel NEMA 3R Enclosure on MB Models; NEMA 3 Enclosure on LB Models	Allows for use in indoor or outdoor applications; NEMA 3R enclosure (MB models) inhibits the formation of moisture in low temperature applications.
Stainless Steel Bellows (F61 MB-5 Model Only)	Allows for use in liquid lines carrying chlorinated water, treated water from a cooling tower or boiler, or other non-hazardous liquids.
Maximum Liquid Pressure of 150 psig (1034 kPa)	Permits use in a wide range of pressure flow conditions.

Application Overview

Operation

The F61 Flow Switch may be used with liquid pressures up to 150 psig (1034 kPa). An F61MB-1 with the NEMA 3R rain-tight enclosure must be used for applications where liquid temperatures may drop below 32°F (0°C) but remain above -20°F (-29°C). The F61MB-1 is designed for use in high moisture environments.

Note: The F61 Flow Switch cannot be used where the liquid in the pipes will drop below the liquid's freezing point, causing an internal freeze-up.

Typical applications include:

- Switch to shut down the refrigeration compressor on a liquid chiller system if flow stops, reducing chances of chiller freeze-ups.
- Electric immersion heater switch to prove the flow of water before turning on the heater.

The SPDT switch on the F61 KB and F61 LB have color-coded terminals, while the F61 MB has four color-coded wire leads. Red is common, and closes to yellow upon flow increase and to blue upon flow decrease. Green indicates ground. See Figure 2 and Table 1 for switch action and flow rates.

IMPORTANT: All F61 Series Flow Switches are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against or warn of control failure.

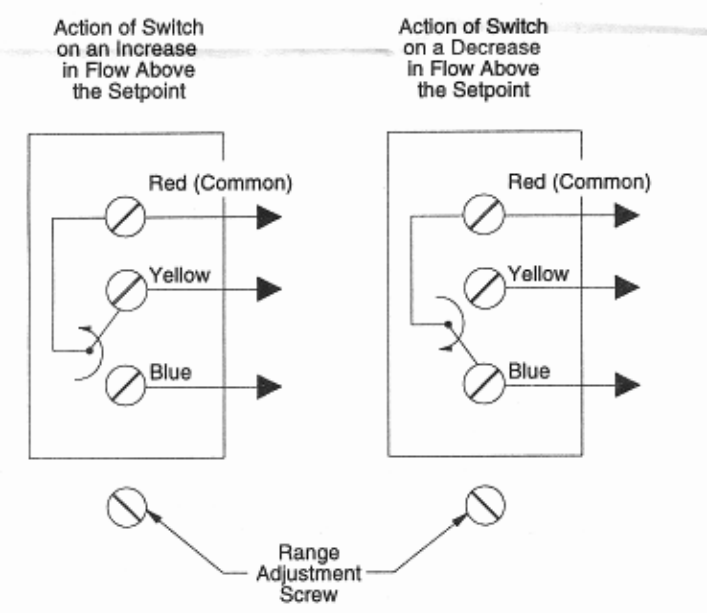
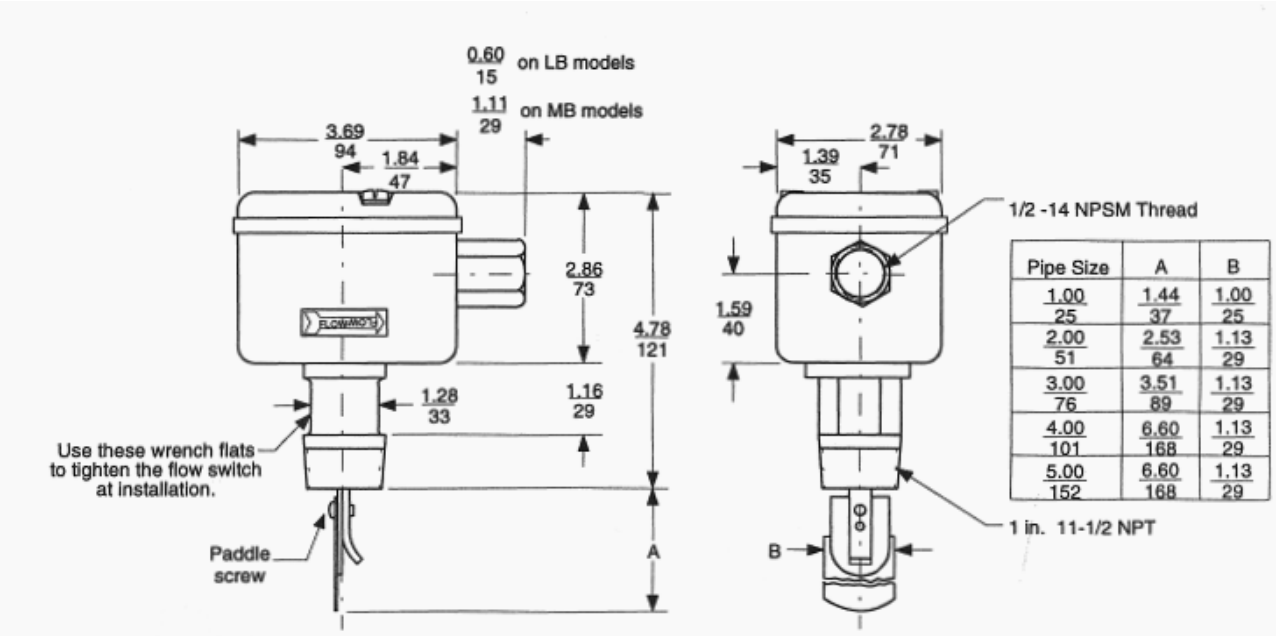


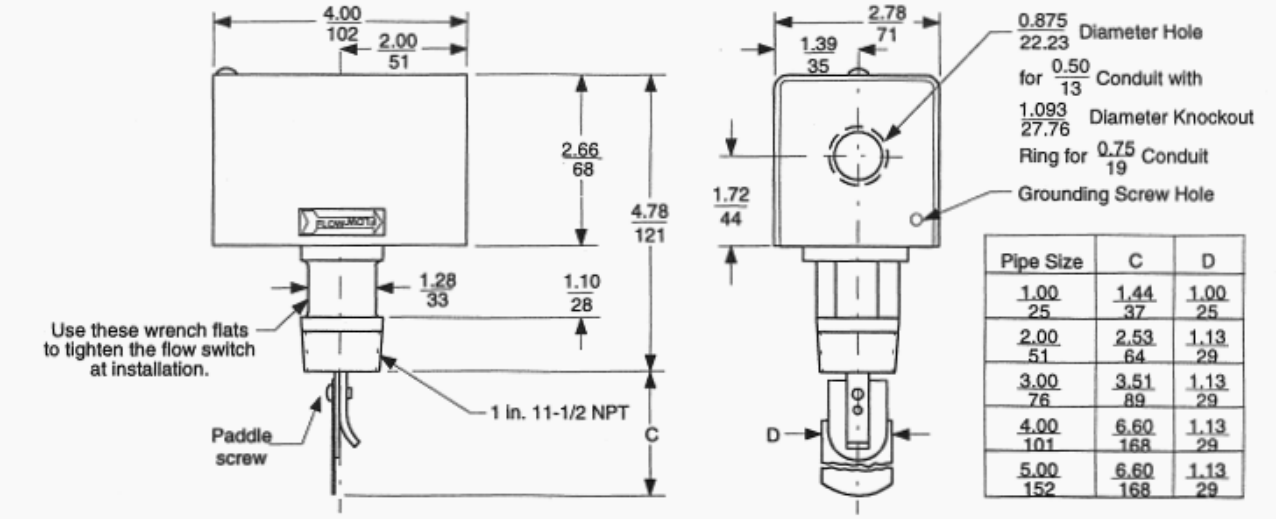
Figure 2: Switch Action

Dimensions



Pipe Size	A	B
1.00 / 25	1.44 / 37	1.00 / 25
2.00 / 51	2.53 / 64	1.13 / 29
3.00 / 76	3.51 / 89	1.13 / 29
4.00 / 101	6.60 / 168	1.13 / 29
5.00 / 152	6.60 / 168	1.13 / 29

Figure 3: F61MB and F61LB Dimensions (in. /mm)



Pipe Size	C	D
1.00 / 25	1.44 / 37	1.00 / 25
2.00 / 51	2.53 / 64	1.13 / 29
3.00 / 76	3.51 / 89	1.13 / 29
4.00 / 101	6.60 / 168	1.13 / 29
5.00 / 152	6.60 / 168	1.13 / 29

Figure 4: F61KB Dimensions (in. /mm)

Wiring

WARNING: Shock hazard.
To avoid possible electric shock or damage to the equipment, disconnect the power supply before the wiring connections or adjustments are made.

IMPORTANT: To prevent moisture from entering and condensate forming inside the NEMA 3R enclosure on the F61 MB models, do not remove the cover gasket or the wire grommet from the conduit opening.

- Make all wiring connections using copper conductors only.
- Install all wiring in accordance with the National Electric Code and local regulations.
- On F61KB and F61LB models, use the terminal screws furnished (8-32 x 1/4 in. binder head). Substitution of other screws will void the warranty and agency approvals.
- On F61 MB models, use the external wire leads.

Adjustments

CAUTION: Improper operation hazard. The switch is factory set at approximately the minimum flow rate (see *Table 1: Typical Flow Rates).* Do not set lower than the factory setting as this may result in the switch failing to return to a “no flow” position.

CAUTION: Equipment damage hazard. Sealed settings (screws marked with black paint) are not intended to be changed. Adjustment attempts may damage the control or cause loss of calibration, voiding the warranty.

the setting of the flow switch:

1. Remove the F61 cover.
2. For higher flow rates, turn the adjusting screw clockwise. To lower the flow rate after it has been raised from the factory setting, turn the adjusting screw counterclockwise. See Figure 9.

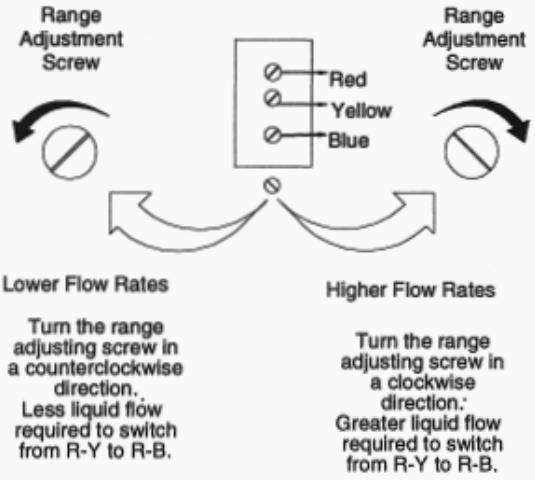


Figure 9: Range Adjustment

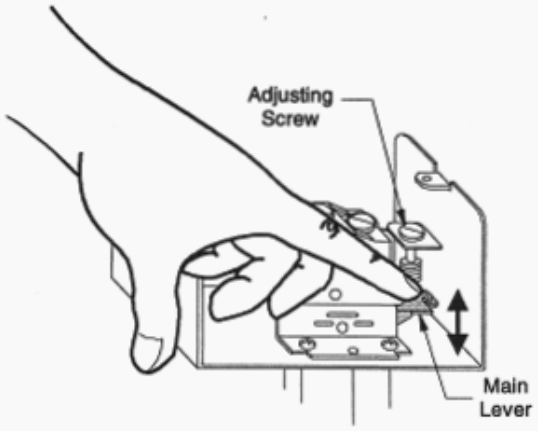


Figure 10: Minimum Adjustment

DUPONT CANADA INC.

MATERIAL SAFETY DATA SHEET

"FREON" 22

CEF00022 Revised 26-APR-l999 Printed 7-JUL-1999

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Corporate MSDS Number : DU000025
Formula : CHClF2
Molecular Weight : 86.47

Product Use

Refrigerant

Propellant/'Blowing Agent

Tradenames and Synonyms

CHLORODIFLUOROMETHANE
FREON(R) is a registered trademark of E.I. du Pont de Nemours and Company. DuPont Canada Inc. is a licensee.

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont Canada, Inc.
P.O. Box 2200
Streetsville
Mississauga, Ontario L5M 2H3

PHONE NUMBERS
Product Information : 1-800-387-2122
Transport Emergency : 1-613-348-3616 (24 HOURS)
Medical Emergency : 1-613-348-3616 (24 HOURS)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
*METHANE, CHLORODIFLUORO	75-45-6	100 WT%

NOTICE FROM DUPONT~ The information on this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

HAZARDS IDENTIFICATION

Potential Health Effects

Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness or death. Intentional misuse or deliberate inhalation may cause death without warning. Vapor reduces oxygen available f or breathing and is heavier than air. Liquid contact can cause frostbite.

HUMAN HEALTH EFFECTS:

Skin contact with the liquid may include frostbite. Prolonged overexposure may cause defatting or dryness of the skin. Eye contact with liquid may include eye irritation with discomfort, tearing, or blurring of vision.

Inhalation may include temporary nervous system depression with anesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness.

Higher exposures may lead to temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation. Fatality may occur from gross overexposure.

Individuals with preexisting diseases of the central nervous or cardiovascular system may have increased susceptibility to the toxicity of excessive exposures.

Carcinogenicity Information

None of the components present in this material at concentrations. equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, immediately remove to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

In case of contact, flush area with lukewarm water. Do not use hot water. If frostbite has occurred, call a physician.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

Ingestion is not considered a potential route of exposure.

Notes to Physicians

Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should only be used with special caution in situations of emergency life support.

FIRE FIGHTING MEASURES

Flammable Properties

Flash Point : Will not burn
Autodecomposition : 632 C (1170 F)

Other burning materials may cause HCFC-22 to burn weakly.

Chlorodifluoromethane is not flammable at ambient temperatures and atmospheric pressure. However, chlorodifluoromethane has been shown in tests to be combustible at pressures as low as 60 psig at ambient temperature when mixed with air at concentrations of 65 volume % air. Experimental data have also been reported which indicate combustibility of “FREON” 22 in the presence of certain concentrations of chlorine.

Fire and Explosion Hazards:

Cylinders may rupture under fire conditions. Decomposition may occur.

Extinguishing Media

As appropriate for combustibles in area. Extinguishant for other burning material in area is sufficient to stop burning.

Fire Fighting Instructions

Use water spray or fog to cool containers. Self-contained breathing apparatus (SCBA) is required if cylinders rupture or contents are released under fire conditions.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Ventilate area, especially low or enclosed places where heavy vapors might collect. Remove open flames. Use self-contained breathing apparatus (SCBA) for large spills or releases.

HANDLING AND STORAGE

Handling (Personnel)

Use with sufficient ventilation to keep employee exposure below recommended limits. “FREON” 22 should not be mixed with air for leak testing. In general, it should not be used or allowed to be present with high concentrations of air above atmospheric pressure. Contact with chlorine or other strong oxidizing agents should also be avoided.

Storage

Clean, dry area. Do not heat above 52 C (125 F).

EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls

Normal ventilation for standard manufacturing procedures is generally adequate. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low or enclosed places.

Personal Protective Equipment

Impervious gloves and chemical splash goggles should be used when handling liquid. Under normal manufacturing conditions, no respiratory protection is required when using this product. Self-contained breathing apparatus (SCEA) is required if a large release occurs.

 # Exposure Guidelines

Applicable Exposure Limits

METHANE, CHLORODIFLUORO

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: 1,000 ppm, 3,540 mg/m3, 8 Hr. TWA, A4
AEL *	(DuPont)	: None Established

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: -40.8 C (-41.4 F)
Vapor Pressure	: 151 psig @ 25 C (77 F)
Vapor Density	: 3.03 (Air=1.0) @ 25 C (77 F)
% Volatiles	: 100 WT%
Evaporation Rate	: >1 (CCl4=1.0)
Solubility in Water	: 0.3 WT% @ 25 C (77 F)
pH	: Neutral
Odor	: Slight ethereal
Form	: Liquified Gas.
Color	: Clear, Colorless.
Liquid Density	: 1.194 g/cm3 @ 25 C (77 F)

STABILITY AND REACTIVITY

Chemical Stability

Material is stable. However, avoid open flames and high temperatures.

Incompatibility with Other Materials

Incompatible with alkali or alkaline earth metals--powdered Al, Zn, Be, etc.

Decomposition

Decomposition products are hazardous. HCFC-22 can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrochloric and hydrofluoric acids, and possibly carbonyl halides.

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

INHALATION:

4 hour, LC50, rat: 220,000 ppm.

The compound is a skin irritant and a slight eye irritant, but is not a skin sensitizer in animals.

Effects from single high exposures include central nervous system depression, anesthesia, rapid breathing, lung congestion and microscopic liver changes. Cardiac sensitization occurred in dogs at 50,000 ppm or greater from the action of exogenous epinephrine.

No toxic effects or abnormal histopathological observations occurred in rats repeatedly exposed to concentrations ranging from 10,000 to 50,000 ppm (v/v). Long-term exposures to 50,000 ppm (v/v) of vapors produced organ. weight increases and a decrease in body weight gain, but no increased mortality or adverse hematological effects. In chronic inhalation studies, HCFC-22, at a concentration of 50,000 ppm (v/v), produced a small, but statistically significant increase of late-occurring tumors involving salivary glands in male rats, but not female rats or male or female mice. In the same studies, no increased incidence of tumors was seen in either species at concentrations of 10,000 ppm or 1,000 ppm (v/v)

Long-term administration in corn oil produced no effects on body weight or mortality.

HCFC-22 was mutagenic in some strains of bacteria in bacterial cell cultures, but not mammalian cell cultures or animals. It did not cause heritable genetic damage in mammals.

A slight, but significant increase in developmental toxicity was observed at high concentrations (50,000 ppm) of HCFC-22, a concentration which also produced toxic effects in the adult animal. Based on these findings, and other negative developmental studies, HCFC-22 is not considered a unique hazard to the conceptus. Studies of the effects of HCFC-22 on male reproductive performance have been negative. Specific studies to evaluate the effect on female reproductive performance have not been conducted, however, limited information obtained from studies on developmental toxicity do not indicate adverse effects on female reproductive performance at concentrations up to 50,000 ppm.

ECOLOGICAL INFORMATION

Ecotoxicological Information

Aquatic Toxicity:

HCFC-22
48 hour EC50 - Daphnia magna: 433 mg,/L

DISPOSAL CONSIDERATIONS

Waste Disposal

Comply with Federal, State, and local regulations. Reclaim by distillation or remove to a permitted waste disposal facility.

TRANSPORTATION INFORMATION

Shipping Information

DOT/IMO
Proper Shipping Name : CHLORODIFLUOROMETHANE
Hazard Class : 2.2
UN No. : 1018
DOT/IMO Label : NONFLAMMABLE GAS

Shipping Containers

Tank Cars.
Tank Trucks.
Cylinders.

Shipping Information -- Canada

TDG
Proper Shipping Name : CHLORODIFLUOROMETHANE
PIN No. : 1018
TDG Class : 2.2

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312
Acute : Yes
Chronic : No
Fire : No
Reactivity : No
Pressure : Yes

HAZARDOUS CHEMICAL LISTS

SARA Extremely Hazardous Substance : No
CERCLA Hazardous Substance : No
SARA Toxic Chemical - See Components Section

Canadian Regulations

CEPA Status : Compliant.

WHMIS Classification:

CLASS A Compressed Gas

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

OTHER INFORMATION

NFPA, NPCA-HMIS

NPCA-HMIS Rating
Health : 1
Flammability : 0
Reactivity : 1

Personal Protection rating to be supplied by user depending on use conditions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : FLUOROPRODUCTS
Address : DuPont Canada Inc.
Box 2200, Streetsville
Mississauga, Ontario, LSM 2H3
Telephone : (905) 821-5935

# Indicates updated section.

End of MSDS

SCOT MOTORPUMP™

•INSTALLATION •OPERATION •MAINTENANCE
INCLUDES MECHANICAL SEAL REPLACEMENT

INSPECTION

Check pump for shortage and damage immediately upon arrival. Note any damage or shortage on bill of lading and file claim with carrier.

EXTERIOR - Pay particular attention to conduit box, external hardware and accessories. Touch up abrasions or scratches with approved paint.

INTERIOR - if serious external damage is noted, or if shaft binds or sticks, disassemble pump and inspect.

HANDLING

Handle with care. Dropping or jarring can damage motor bearings or break pump parts. Lift with lifting hooks or eye bolts (if provided) or rig double sling under motor frame and pump casing. Do not use sling through pump motor adapter or around suction and discharge flanges.

INSTALLATION

LOCATION - Pump location should provide the following:

1. Install as close to liquid supply as possible. Use shortest and most direct suction pipe practical. Suction lift must not exceed limit for pump. NPSH available must equal or exceed pump requirement.
2. A flooded suction is desirable. The suction port must be below liquid level to provide priming.
3. Room for inspection and maintenance.
4. Correct power supply to motor; all wiring should meet National Electrical and Local Codes and regulations.
5. If outdoors, protection from the elements, freezing, and water damage due to flooding.

PIPING - Suction and discharge gauges are useful to check pump operation and are excellent trouble indicators. Install gauges in the lines if pump ports do not have gauge taps. Observe these precautions when installing piping:

1. Support the pipe close to, but independently of the pump.
2. Use the next larger pipe size for suction and discharge.
3. Keep the pipe as straight as possible. Avoid bends and fittings.
4. Remove burrs, sharp edges and ream pipe cuts, to make joints air-tight.
5. Do not spring pipe to make connections. Strain must not be transmitted to pump.
6. Allow for pipe expansion with hot fluids; expansion joints are not recommended.

SUCTION INSTALLATION - Size and install suction piping to keep pressure loss at minimum and to provide correct NPSH by observing the following:

1. The suction pipe should be equal in size or preferably one size larger than the suction connection of the pump. If pipe larger than pump suction is used, an eccentric pipe reducer should be used at the pump.
2. Use 45-degree or long-sweep 90-degree elbows.
3. A valve in the suction is necessary only on positive suction head installation and must not be used to throttle the pump. The suction valve should be installed for maintenance purposes only.

INSTALLATION CONT.

DISCHARGE INSTALLATION - Pumps permit discharge port location at any of four positions, 90 degrees apart. This location can be changed by removing case bolts and rotating casing. Do not slice O-ring or tear fibre gasket. Scot does not recommend bottom vertical discharge due to erratic pump performance. Ensure there is adequate clearance with selected position between wall or tank, motor conduit box, and grease fittings. Casing may extend beyond base or feet.

Short discharge lines may be same size as discharge port. Long runs require pipe larger than discharge port.
Horizontal runs require even grade; avoid high spots and loops. Trapped air will throttle flow and may result in erratic pumping.
Install check and gate valves in discharge line; check valve (if used) between pump and gate valve.

OPERATION

PRE-START - Before initial start of the pump, check as follows:

Check phase, frequency, and voltage of line circuit with motor nameplate.
The rotation must be checked upon installation. Close, then break the contacts quickly and observe rotation of the exposed portion of rotating parts. Rotation must agree with the rotation arrow on the motor. The standard rotation Is counterclockwise when viewed from the suction end. Motor wiring is easily changed in the field by checking the wiring diagram located on the inside of the terminal box cover, or on the motor nameplate.

PRIMING - Pumps installed with a flooded suction can be primed by opening suction valve and allowing liquid to enter the casing. At the same time vent air out the top of the casing.

Pumps installed with a suction lift require priming by other methods, such as foot valves, injectors, or by manually filling casing and suction line.

CAUTION - DO NOT RUN PUMP DRY HOPING IT WILL SELF-PRIME. Serious damage may result if started dry.

STARTING - Proceed as follows to start pump:

Close drain valves and valve in discharge line.
Open all valves in the suction line.
Prime the pump. If pump does not prime properly, or loses prime during start-up, shut down and correct condition before repeating procedure.
For pumps moving high temperature liquids, open warm-up valve to circulate liquid for preheating. Close valve after pump has warmed up.
Start the motor.
When pump is operating at full speed, open discharge valve slowly.

RUNNING - Periodically inspect pump while running. Pump should be checked after first start and following any shut down for repair.

Check pump and piping for leaks. Repair immediately.
Record pressure gauge readings for future reference.
Record voltage, amperage per phase, and kw (if an indicating wattmeter is available).
Adjust pump capacity with discharge valve. **DO NOT** throttle suction line.

FREEZING PROTECTION - Protect pumps shut down during freezing conditions by one of the following methods:

Drain pump; remove all liquid from the casing.
Insulate pump to prevent freezing by moving fluid through pump, or heating ambient condition around pump. Do not let temperature exceed 100' to 150- F.
Fill pump with antifreeze solution.

MAINTENANCE

CLEANING - Remove oil, dust, dirt, water, chemicals from exterior of motor and pump. Keep motor air inlet and outlet open. Blow out interior of open motors with clean compressed air at low pressure. Regularly drain moisture from TEFC motors.

UL LABELED MOTORS - it is imperative for repair of a motor with Underwriters' Laboratories label that original clearances be held; plugs, screws, other hardware be fastened securely, and parts that are replaced be exact duplicates or approved equals. Violation of any of the above invalidates Underwriters' label.

TEMPERATURE - Total temperature, not the rise, is the measure of safe operation for a motor. If temperature by thermometer exceeds limits for insulation class, investigate and change operating conditions.

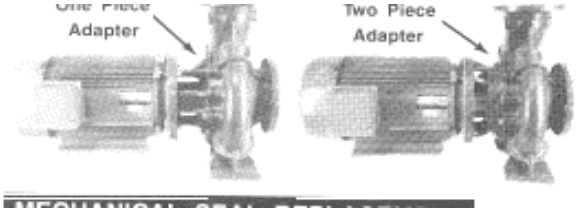
LUBRICATION - Pumps should require no maintenance, other than the motor bearings, according to the following instructions:

DOUBLE SHIELDED AND DOUBLE SEALED.
When prelubricated bearings are furnished no lubrication is required for the life of the bearings. Inspect bearings periodically to determine the condition of the grease and replace the bearings if necessary.

SINGLE SHIELDED W/GREASE FITTING PROVISIONS.
When single shield bearings are furnished periodic inspection, cleaning and relubrication is required. See motor manufacturer's specific instructions for lubrication.

PUMP IDENTIFICATION

The pumps are manufactured with a one piece adapter or a two piece adapter. Identify design from photo's shown below.



MECHANICAL SEAL REPLACEMENT ONE PIECE ADAPTER TCZ & JP FRAME MOTOR

A) Disassembly:

1. Turn off power
2. Close suction and discharge valves.
3. Drain system.
4. Remove bolts holding down motor to foundation.
5. Remove casing bolts.
6. Remove motor and rotating element from casing, leaving casing and piping undisturbed.
7. Insert a screwdriver in one of the impeller waterway passages and back off the impeller retaining nut with a socket wrench, as shown in Fig. 1

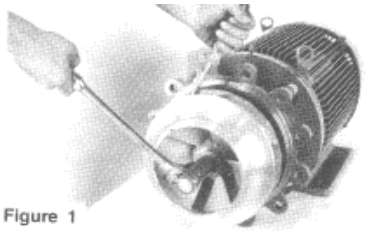


Figure 1

8. Remove impeller from shaft, being careful not to lose the impeller key, spring and seal retainer. If impeller is difficult to remove, it may be necessary to use a bearing puller to pull off impeller.
9. Pry off rotating member of mechanical seal from sleeve by using two (2) screwdrivers (Fig. 2).
10. Remove bolts holding adapter to motor and take off adapter.
11. Place adapter on a flat surface and push out stationary part of mechanical seal.
12. Inspect shaft sleeve. If damaged, or worn, remove from motor shaft and replace with a new one.

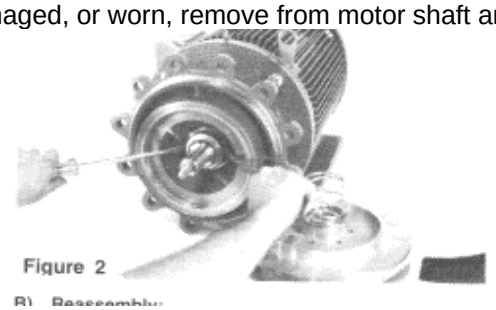


Figure 2

B) Reassembly:

1. Clean gasket and flange faces, seal seat cavity, shaft sleeve and motor shaft.
2. Lubricate seal seat cavity of adapter and rubber cup or O-ring of stationary seat with a soapy water solution. Press the stationary seat in seal seat cavity squarely and evenly, with caution not to chip or scratch the lapped face of seat.
3. Remount the adapter on motor, making sure the motor shaft does not dislocate or chip the stationary seat of the seal. Apply a soapy water solution to the sleeve and the rubber bellows of the rotary seal. Slide rotating member of mechanical seal over sleeve. Replace seal spring and seal retainer. Be sure the rotating seal face stays in the holding collar during installation. Also take extra care not to chip or scratch the lapped faces.
5. Place key in keyway on motor shaft extension. Slide impeller on shaft. Replace impeller retaining nut.
6. Insert a screwdriver in a waterway passage of the impeller holding it against rotation and tighten nut.
7. Remove any burrs caused by screwdriver on the vane of impeller in waterway passage.
8. Slide motor and impeller into the pump case. Replace any damaged gasket.
9. Tighten casing bolts alternately and evenly.
10. Replace hold-down bolts.
11. Check for free rotation after assembly is completed.
12. Close all drain openings using pipe sealant on threads.
13. Reprime before starting. Do not start unit until pump is completely filled with water.

MECHANICAL SEAL REPLACEMENT TWO PIECE ADAPTER TCZ & JP FRAME MOTOR

A) Disassembly:

1. Turn off power.
2. Close suction and discharge valves.
3. Drain system.
4. Remove bolts holding down motor to foundation.
5. Remove casing bolts.
6. Remove motor and rotating element from casing, leaving casing and piping undisturbed.
7. Insert a screwdriver in one of the impeller waterway passages and back off the impeller retaining nut with a socket wrench, as shown in Fig. 1.

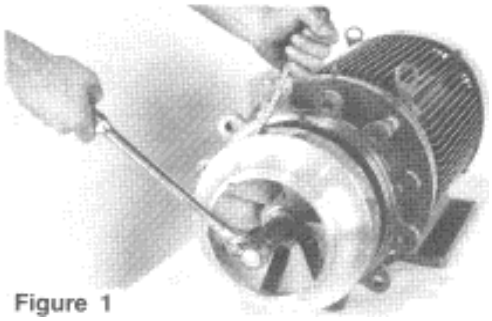


Figure 1

8. Remove impeller from shaft, being careful not to lose the impeller key, spring and seal retainer. If impeller is difficult to remove, it may be necessary to use a bearing puller to pull off impeller.
9. Remove bolts holding backplate to pump adapter. Pry backplate from pump adapter. This process will remove mechanical seal head and shaft sleeve from motor shaft.
   Use caution when removing backplate to eliminate the possibility of marring shaft sleeve.
   See Fig. 2

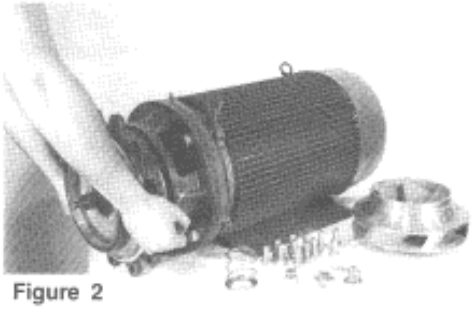


Figure 2

10. Place backplate on a flat surface and push out stationary part of mechanical seal.
11. Remove seal head from shaft sleeve, with caution not to mar or scratch shaft sleeve.
12. Inspect shaft sleeve. If damaged, or worn, replace with new one.

B) Reassembly:

1. Clean gasket and flange faces, seal seat cavity, shaft sleeve or motor shaft.
2. Lubricate seal seat cavity of backplate and rubber cup or 0-ring of stationary seat with a soapy water solution. Press the stationary seat in seal seat cavity squarely and evenly, with caution not to chip or scratch the lapped face of seat.
3. Remount the backplate on pump adapter, making sure the motor shaft does not dislocate or chip the stationary seat of the seal.
4. Replace shaft sleeve.
5. Apply a soapy water solution to the sleeve and the rubber bellows of the rotary seal. Slide rotating member of mechanical seal over sleeve. Replace seal spring and seal retainer. Be sure the rotating seal face stays in the holding collar during installation. Also take extra care not to chip or scratch the lapped seal faces.
6. Place key in key seat and slide impeller on shaft. Replace impeller retaining nut.
7. Insert a screwdriver in a waterway passage of the impeller holding it against rotation and tighten nut.
8. Remove any burrs caused by screwdriver on the vane of impeller in waterway passage.
9. Slide motor and rotating element in casing. Replace any damaged gasket.
10. Tighten casing bolts alternately and evenly.
11. Replace hold-down bolts.
12. Check for free rotation after assembly is completed.
13. Close all drain openings, using pipe sealant on threads.
14. Reprime before starting. Do not start unit until pump is completely filled with water.

WE RECOMMEND STOCKING A SPARE MECHANICAL SEAL OR REPAIR KIT TO ELIMINATE DOWN TIME.

PRESSURE AND TEMPERATURE LIMITATION STANDARD FITTED PUMPS

PUMP NO.	PRESSURE		TEMPERATURE	
	STANDARD	OPTIONAL	STANDARD	OPTIONAL
68, 69	75 PSI	N/A	220'F	275'F
51, 61, 74	75 PSI	150 PSI	220*F	275*F
71, 72, 77, 78, 79, 82	75 PSI	N/A	220'F	275'F
11, 13, 60	75 PSI	150 PSI	220'F	275'F
62	165 PSI	165 PSI	220'F	275'F
ALL OTHERS	175 PSI	175 PSI	220*F	275'F

N/A - NOT AVAILABLE

CAUTION

DO NOT ALLOW EITHER THE DISCHARGE PRESSURE OR THE TEMPERATURE OF THE LIQUID TO EXCEED THE LIMITATIONS LISTED ABOVE

MECHANICAL SEAL REPLACEMENT JM & JP FRAME MOTOR

A) Disassembly:

1. Turn off power.
2. Close suction and discharge valves.
3. Drain system.
4. Remove bolts holding down motor to foundation.
5. Remove casing bolts.
6. Remove motor and rotating element from casing, leaving casing and piping undisturbed.
7. Insert a screwdriver in one of the impeller waterway passages and back off the impeller retaining assembly with a socket wrench, as shown in Fig. 1.

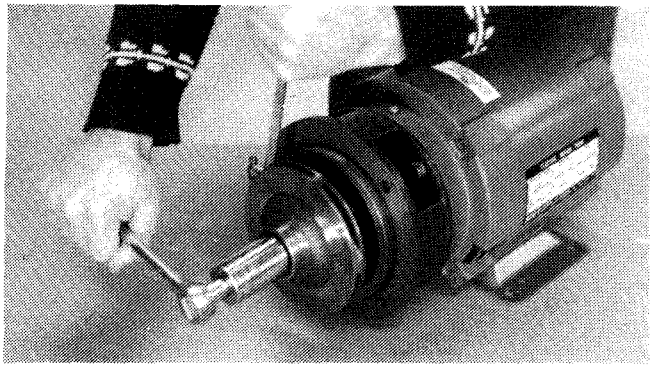


Figure 1

8. Remove impeller from shaft, being careful not to lose the impeller key, spring and seal retainer, If impeller is difficult to remove, it may be necessary to use a bearing puller to
9. Pry off rotating member of mechanical seal from sleeve or stub shaft by using two (2) screwdrivers. (Fig. 2.).

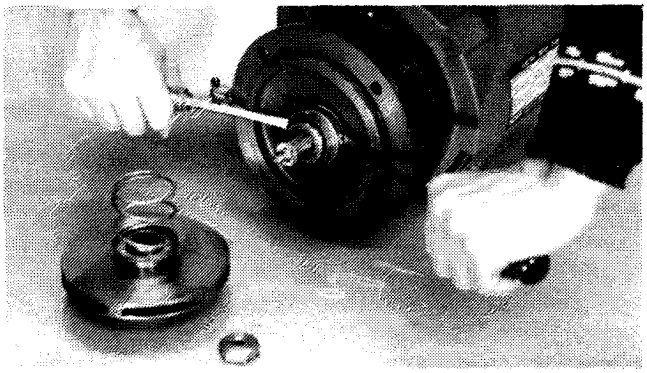


Figure 2

10. Remove bolts holding adapter to motor and take off adapter.
11. Place adapter on a flat surface and push out stationary part of mechanical seal.
12. Inspect shaft sleeve or stub shaft. If damaged, or worn, remove from shaft and replace with a new one.

B). Reassembly:

1. Clean gasket and flange faces, seal seat cavity, shaft sleeve or stub shaft and motor shaft.
2. Lubricate seal seat cavity of adapter and rubber cup or 0-ring of stationary seat with a soapy water solution. Press the stationary seat in seal seat cavity squarely and evenly, with caution not to chip or scratch the lapped face of seat.
3. With motor preferably in vertical position, remount the adapter on motor, making sure the motor shaft does not dislocate or chip the stationary seat of the seal.
4. Apply a soapy water solution to the sleeve or stub shaft and the rubber bellows of the rotary seal. Slide rotating member of mechanical seal over sleeve or stub shaft. Replace seal spring and seal retainer. Be sure the rotating seal face stays in the holding collar during installation. Also take extra care not to chip or scratch the seal lapped faces.
5. Place key in key seat and slide impeller on shaft. Replace impeller retaining nut.
6. Insert a screwdriver in a waterway passage of the impeller holding it against rotation and tighten nut.
7. Remove any burrs caused by screwdriver on the vane of impeller in waterway passage.
8. Slide motor and rotating element in casing. Be sure that any damaged 0-ring or gasket is replaced.
9. Tighten casing bolts alternately and evenly.
10. Replace hold-down bolts.
11. Check for free rotation after assembly is completed.
12. Close all drain openings, using pipe sealant on threads.
13. Reprime before starting. Do not start unit until pump is completely filled with water.

WE RECOMMEND STOCKING A SPARE MECHANICAL SEAL OR REPAIR KIT TO ELIMINATE DOWN TIME

PRESSURE AND TEMPERATURE LIMITATION
STANDARD FITTED PUMPS

PUMP	PRESSURE		TEMPERATURE	
NO.	STANDARD	OPTIONAL	STANDARD	OPTIONAL
68, 69	75 PSI	N/A	220°F	275°F
51, 61, 74	75 PSI	150 PSI	220°F	275°F
71, 72, 77, 78, 79, 82	75 PSI	N A	220°F	275°F
11, 13, 60	75 PSI	150 PSI	220°F	275°F
62	165 PSI	165 PSI	220°F	275°F
ALL OTHERS	175 PSI	175 PSI	220°F	275°F

N/A - NOT AVAILABLE

CAUTION
DO NOT ALLOW EITHER THE DISCHARGE PRESSURE OR THE TEMPERATURE OF THE LIQUID TO EXCEED THE LIMITATIONS LISTED ABOVE.

MECHANICAL SEAL REPLACEMENT

(A) (B) J56 FRAME MOTOR

A) Disassembly:

1. Turn off power.
2. Close suction and discharge valves.
3. Drain system.
4. Remove bolts holding base to foundation
5. Remove casing bolts.
6. Remove motor and rotating element from casing, leaving casing and piping undisturbed. Insert a screwdriver in one of the impeller waterway passages and back off the impeller nut as shown in Fig. 1.

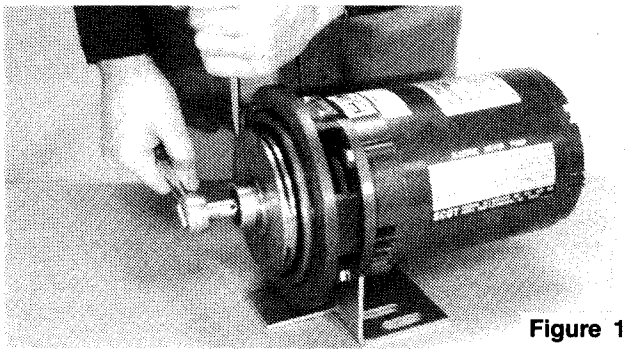


Figure 1

7. Remove motor shaft end cap. Insert a screwdriver in slot of motor shaft. While holding shaft against rotation, unscrew impeller from shaft by turning counterclockwise when facing impeller (Fig. 2).

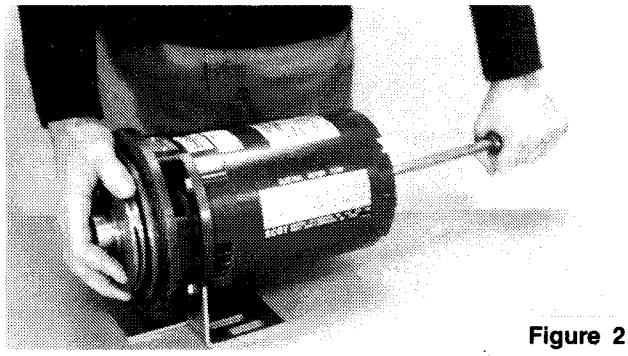


Figure 2

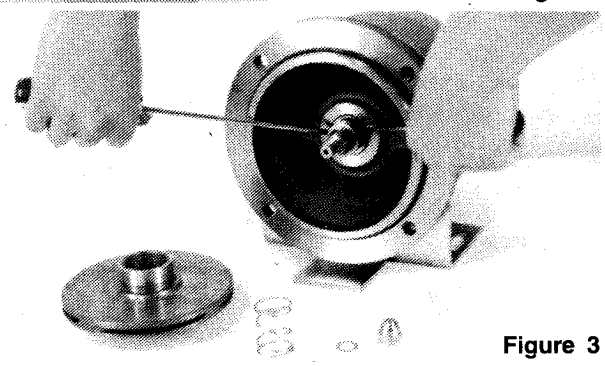


Figure 3

8. Pry off rotating member of mechanical sea! from shaft by using two (2) screwdrivers (Fig. 3).
9. Remove bolts holding adapter to motor and take off adapter.
10. Place adapter on a flat surface and push out stationary part of mechanical seal.

B) Reassembly:

1. Clean gasket and flange faces, seal seat cavity and shaft, in particular shaft shoulder fitting against impeller.
2. Lubricate seal seat cavity of adapter and rubber cup or 0-ring of stationary seal with soapy water solution. Press the stationary seat in seal seat cavity squarely and evenly. Use caution not to chip or scratch the lapped face of seat.
3. Remount the adapter on motor, making sure the motor shaft does not dislocate or chip the stationary seat of the seal.
4. Apply a soapy water solution to the motor shaft and the rubber bellows of the rotary seal. Set the rotating member of mechanical seal on motor shaft. Be sure the rotating seal face stays in the holding collar during installation. Also take extra care not to chip or scratch the lapped seal faces.
5. Hold shaft against rotation as decribed in paragraph 7 of disassembly procedure, and thread impeller on shaft until it is tight against the shaft shoulder.
6. Replace D-washer and impeller nut holding impeller against rotation as indicated in paragraph 6 of disassembly procedure (3 phase motors only).
7. Remove any burrs caused by screwdriver on the vane of impeller in waterway passage.
8. Replace motor and rotating element in casing. Be sure that any damaged 0-ring or gasket is replaced.
9. Tighten casing bolts alternately and evenly.
10. Replace hold-down bolts.
11. Check for free rotation after assembly is completed.
12. Replace motor shaft end cap.
13. Close all drain openings using pipe sealant on threads.
14. Reprime before starting. Do not start until pump is completely filled with water.

MECHANICAL SEAL REPLACEMENT

(V) C56 FRAME MOTOR

A) Disassembly:

1. Follow paragraphs 1 - 6 of instructions for Mechanical Seal Replacement J56 frame.
2. Insert wrench between openings in adapter and place on flats of stub shaft. While holding shaft against rotation, remove the impeller retaining assembly using a 7/16 socket (Fig. 4).

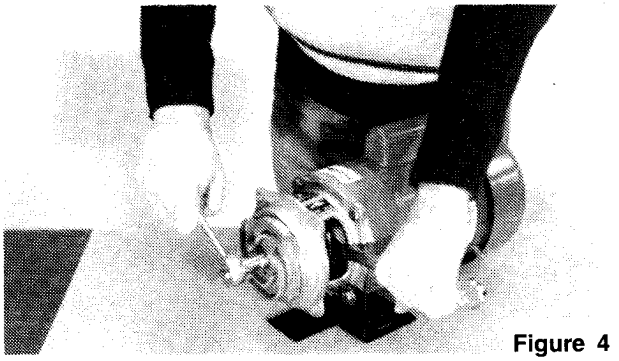


Figure 4

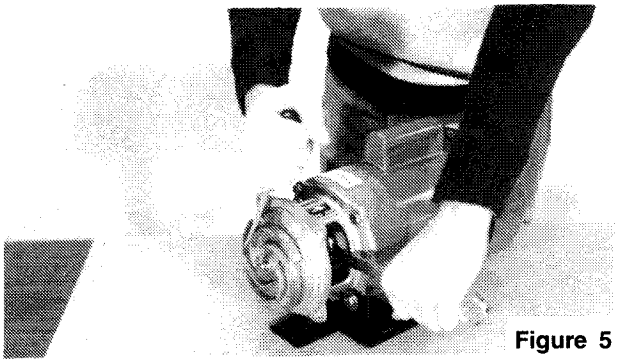


Figure 5

Figure 6

3. Leave the wrench on flats of stub shaft and unscrew the impeller by turning counterclockwise when facing the impeller (Fig. 5).
4. The seat of the seal can now be removed from the impeller (Fig. 6).
5. Disassemble cap screws holding adapter to the motor and remove adapter.
6. Place adapter on a flat surface and push out the mechanical seal head.

B) Reassembly:

1. Clean gasket and flange faces, seal seat cavity, seal head bore and shaft, in particular shaft shoulder fitting against impeller.
2. Lubricate seal seat cavity of impeller and rubber cup or 0-ring of seal seat with a soapy water solution. Press the seat in the seal seat cavity squarely and evenly. Use caution not to chip or scratch the lapped face of seat.
3. Apply pipe sealant on outside of the stainless portion of the seal head to ease head into adapter.

4. Install the seal head by pressing on the stainless lip using a 3” long piece of 1 1/4" PVC pipe.
5. Hold shaft against rotation as discussed in paragraph 3 of disassembly procedure, and thread impeller on shaft until it is tight against the shaft shoulder.
6. Replace impeller retaining assembly holding impeller against rotation as indicated in paragraph 3 of disassembly procedure.
7. Replace motor and rotating element in casing. Be sure that any damaged gasket is replaced.
8. Tighten case nuts alternately and evenly.
9. Replace hold-down bolts.
10. Check for free rotation after assembly is completed.
11. Close all drain openings using pipe sealant on threads.
12. Reprime before starting. Do not start unit until pump is completely filled with water.

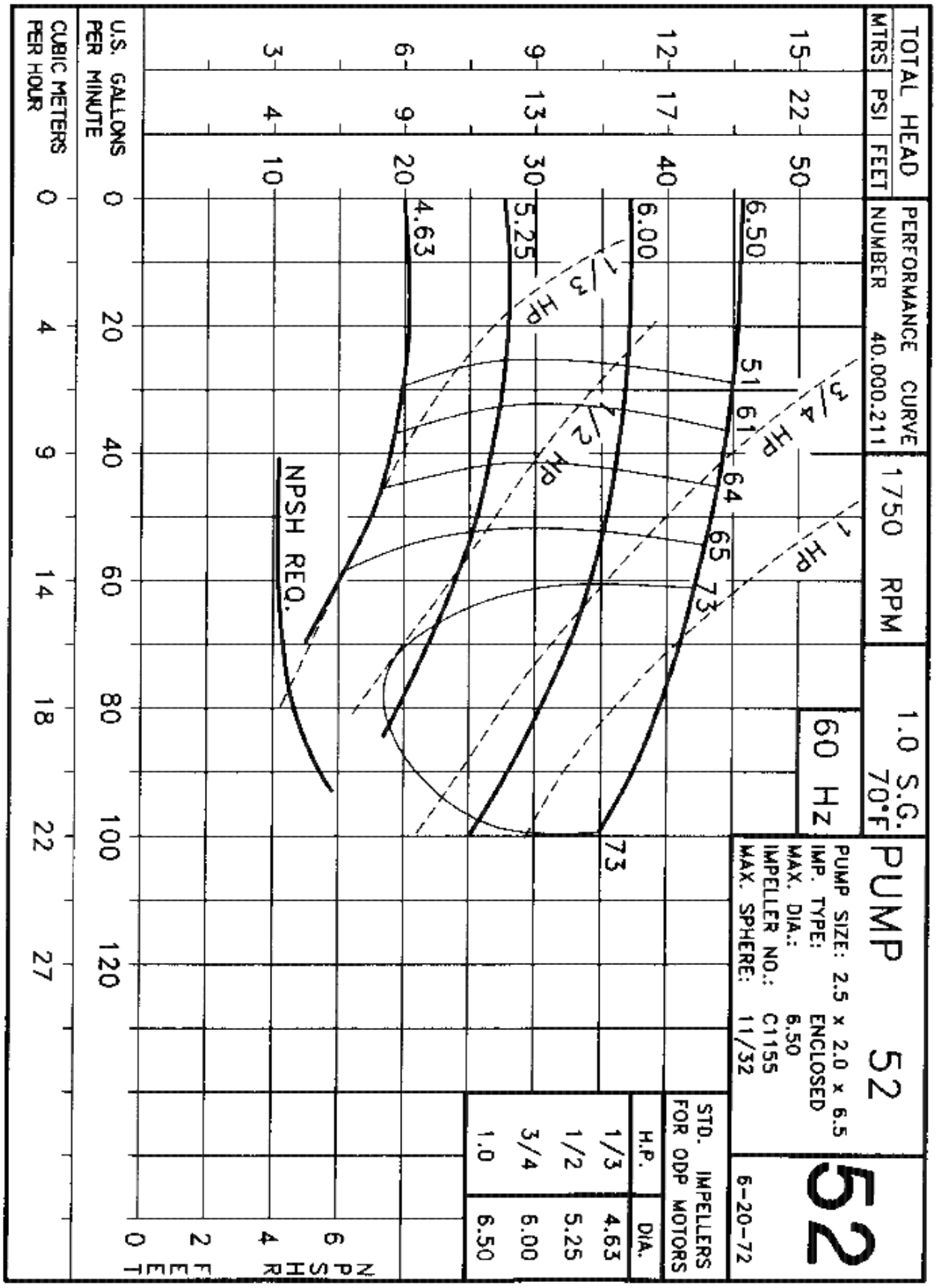
WE RECOMMEND STOCKING A SPARE MECHANICAL SEAL OR REPAIR KIT TO ELIMINATE DOWN TIME.

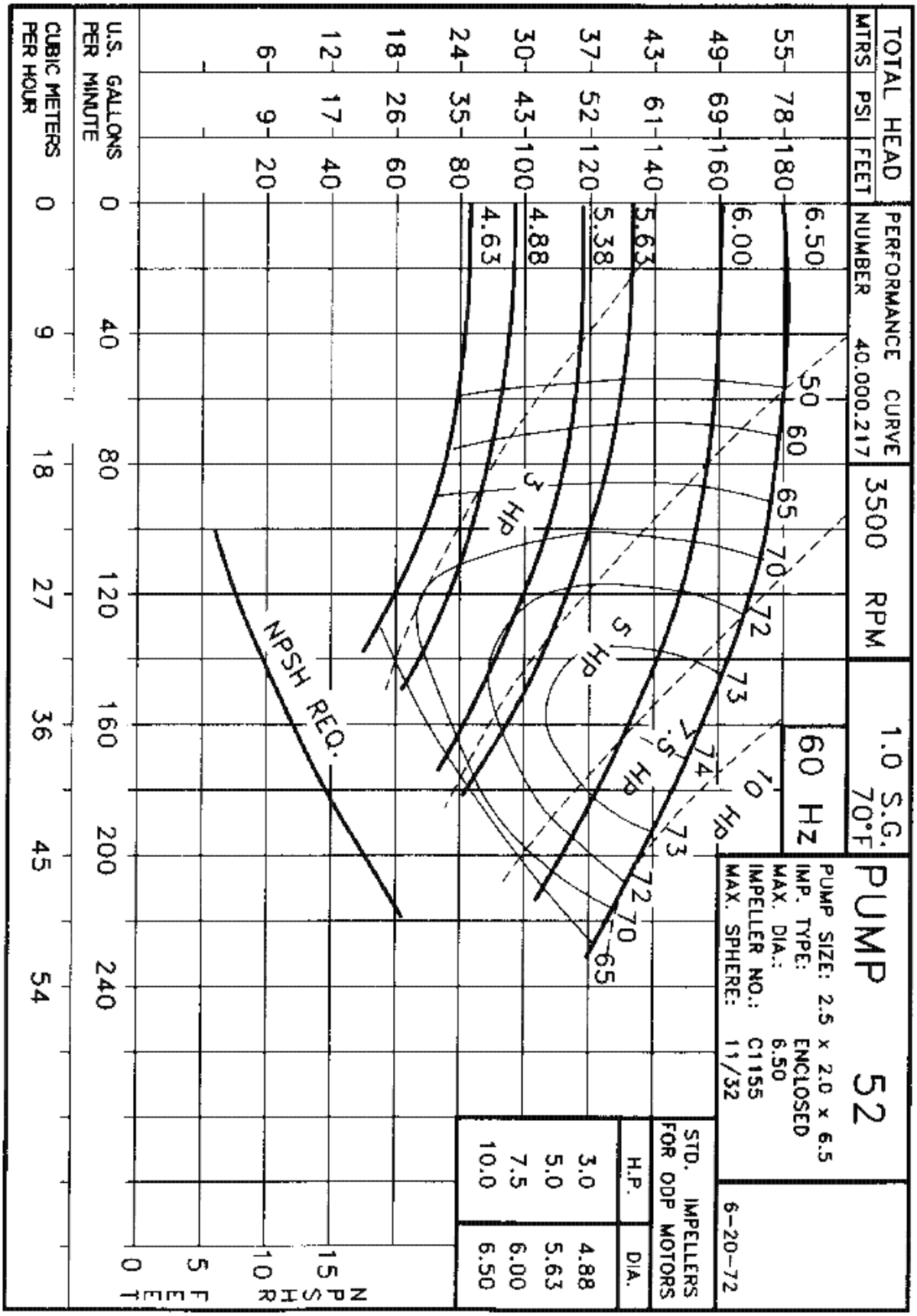
PRESSURE AND TEMPERATURE LIMITATION
STANDARD FITTED PUMPS

PUMP	PRESSURE		TEMPERATURE	
NO.	STANDARD	OPTIONAL	STANDARD	OPTIONAL
68, 69	75 PSI	N/A	220°F	275°F
51, 61, 74	75 PSI	150 PSI	220°F	275°F
71, 72, 77, 78, 79, 82	75 PSI	N/A	220°F	275°F
11, 13, 60	75 PSI	150 PSI	220°F	275°F
62	165 PSI	165 PSI	220°F	275°F
ALL OTHERS	175 PSI	175 PSI	220°F	275°F

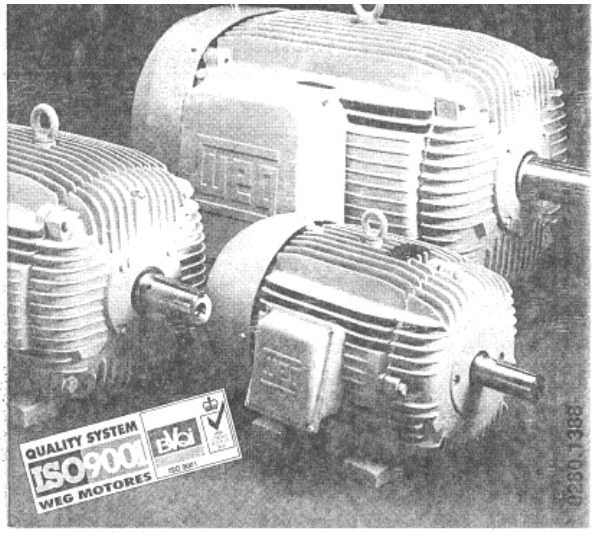
N/A - NOT AVAILABLE

CAUTION
DO NOT ALLOW EITHER THE DISCHARGE PRESSURE OR THE TEMPERATURE OF THE LIQUID TO EXCEED THE LIMITATIONS LISTED ABOVE.


PUMP 52
PUMP SIZE: 2.5 x 2.0 x 6.5
IMP. TYPE: ENCLOSED
MAX. DIA.: 6.50
IMPELLER NO.: C1155
MAX. SPHERE: 11/32
6-20-72
52
1.0 S.G. 70°F
60 Hz
1750 RPM
PERFORMANCE CURVE NUMBER 40.000.211
TOTAL HEAD
MTRS PSI FEET
U.S. GALLONS PER MINUTE
CUBIC METERS PER HOUR
NPSH REQ. FEET
STD. IMPELLERS FOR ODP MOTORS
H.P. DIA.
1/3 4.63
1/2 5.25
3/4 6.00
1.0 6.50
6.50
6.00
5.25
4.63
NPSH REQ.


PUMP 52
PUMP SIZE: 2.5 x 2.0 x 6.5
IMP. TYPE: ENCLOSED
MAX. DIA.: 6.50
IMPELLER NO.: C1155
MAX. SPHERE: 11/32
6-20-72
1.0 S.G. 70°F
60 Hz
3500 RPM
PERFORMANCE CURVE 40.000.217
NUMBER
TOTAL HEAD
MTRS PSI FEET
6.50
6.00
5.63
5.38
4.88
4.63
NPSH REQ.
3 H.P.
5 H.P.
7.5 H.P.
10 H.P.
STD. IMPELLERS FOR ODP MOTORS
H.P. DIA.
3.0 4.88
5.0 5.63
7.5 6.00
10.0 6.50
U.S. GALLONS PER MINUTE
CUBIC METERS PER HOUR
NPSH FEET

WEG
Installation & Maintenance Instruction for Electric Motors



Frames 143T – 586/7

READ CAREFULLY THIS MANUAL BEFORE INSTALLING THE MOTOR

RECEIVING CHECK

Check if any damage has occurred during transportation.
Check nameplate data.
Remove shaft locking device (if any) before operating the motor.
Turn the shaft with the hand to make sure if it is turning freely.

HANDLING AND TRANSPORTATION

1- General

Motors must not be lifted by the shaft, but by the eyebolts which are properly designed to support the motor weight.

Lifting devices, when supplied, are designed only to support the motor. If the motor has two lifting devices then a double chain must be used to lift it.
Lifting and lowering must be done gently without any shocks; otherwise the bearings can get damaged.

During transportation, motors fitted with roller or angular contact bearings are protected against bearing damages with a shaft-locking device.

This locking device must be used on any further transport of the motor, even when this means to uncouple the motor from the driven machine.

STORAGE

If motors are not immediately installed, they must be stored in dry places, free of dust, vibrations, gases, corrosive smokes, under constant temperature and in normal position free from other objects.

In case the motors are stored for more than two years, the bearings must be changed or the lubrication grease must be totally replaced after cleaning.
Single-phase motors when left in stock for 2 years or more must have their capacitors replaced(if any). We recommend to turn the shaft (by hands) at least once a month, and to measure the insulation resistance before installing it, in cases of motors stored for more than 6 months or when subject to high humidity areas.

If motor is fitted with space heaters, these should be switched on.

Insulation Resistance Check

Measure the insulation resistance before operating the motor and/ or when there is any sign of humidity in the winding.
The resistance measured at 25°C, must be:

Ri (20 x U) /(1000 + 2P) [Mohm] (measured with a MEGGER at 500 V c.c.)

where U = voltage (V) ; P = power (kW)

If the insulation resistance is less than 2 mega ohms, the winding must be dried according to the following:
Warm it up inside an oven at a minimum temperature of 80°C increasing 5°C every one hour until 105°C, remaining under this temperature for at least one hour. Check if the stator insulation resistance remains constant within the accepted values. If not, stator must be reimpregnated.

INSTALLATION

1- Safety

All personnel involved with electrical installations, either handling. lifting, operation or maintenance must be well informed and up-to-dated concerning the safety standard and principles that govern the work and carefully follow them.
We strongly recommend that these jobs are carried out by qualified personnel.

 Make sure that the electric motors are switched off before starting any maintenance service.

Motors must be protected against accidental starts.
When performing any maintenance service, disconnect the motor from the power supply. Make sure all accessories have been switched off and disconnected.
Do not change the regulation of the protecting devices to avoid damaging.

2- Operating Conditions

Electric motors, in general, are designed for operation at an altitude of 1000m above sea level for an ambient temperature between 25 and 40°C. Any variation is stated on the nameplate.

 Compare the current, voltage, frequency, speed, output and other values demanded by the application to the data given on the nameplate.

Motors supplied for hazardous locations must be installed in areas that comply with that specified on the motor nameplate.

 Keep air inlet and outlet free and clean. The air blown out by the motor shall not enter again. The distance between the air inlet and the wall must be around of the inlet opening diameter.

3- Foundation

Motors provided with feet must be installed on though foundations to avoid excessive vibrations.
The purchaser is fully responsible for the foundation.
Metal parts must be painted to avoid corrosion.
The foundation must be uniform and sufficiently tough to support any short circuit strengths. It must be designed in such a way to stop any vibration originated from resonance.

4- Drain Holes

Make sure the drains are placed in the lower part of the motor when the mounting configuration differs from that specified on the motor purchase order.

5- Balancing

WEG motors are dynamically balanced, with half key at no load and uncoupled.

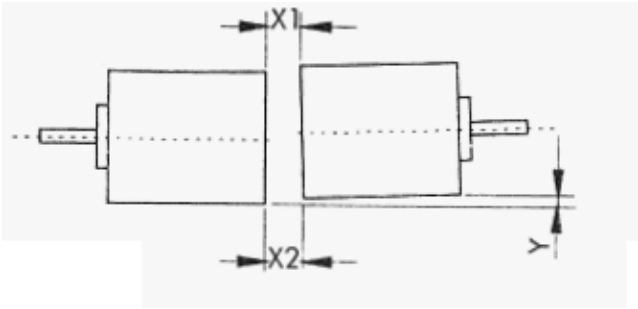
Transmission elements such as pulleys, couplings, etc must be dynamically balanced with half key before installation.
Use always appropriate tools for installation and removal.

6- Alignment

Align the shaft ends and use flexible coupling, whenever possible.

Ensure that the motor mounting devices do not allow modifications on the alignment and further damages to the bearings.
When assembling a half-coupling, be sure to use suitable equipment and tools to protect the bearings.
Suitable assembly of half-coupling:

Check that clearance Y is less than 0.05mm and that the difference X1 to X2 is less than 0.05m also.



7- Belt Drive

When using pulley or belt coupling the following must be observed:
Belts must be tightened just enough to avoid slippage when running, according to the specifications stated on the belt supplier recommendation.

WARNING:
Excessive tension on the pulleys will damage the bearings and lead to a probable shaft rupture.

8- Connection

WARNING:
Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

WARNING:
The capacitor on single-phase motors can retain a charge which appears across the motor terminals, even when the motor has reached standstill.

A wrong connection can burn the motor.

Voltage and connection are indicated on the nameplate. The acceptable voltage variation is ±10%, the acceptable frequency variation is ±5% and the total acceptable variation is ±10%.

9- Starting Methods

The motor is rather started through direct starting. In case this is not possible, use compatible methods to the motor load and voltage. -
The rotation direction is clockwise, if the motor is viewed from DE side and if the phases are connected according to the sequence L1, L2, L3.
To change the rotation direction, interchange two of the connecting leads..

 The connection to the power supply must be done by qualified personnel and with full attention to assure a safe and permanent connection. After connecting the motor, check for any strange body inside the terminal box. The cab/e inlets not in use must be closed.

Make sure to use the correct cable dimension, based on the rated current stamped on the motor nameplate.

 Before energizing the terminals, check if the earthing is made according to the actual standards. This is essential against accident risks.

When the motor is supplied with protective or monitor temperature device such as thermostats, thermistors, thermal protector, etc, connect their terminals to the corresponding devices on the control panel.

10- Start-Up

 The key must be fastened or removed before starting the motor.

a) The motor must start and operate smoothly. In case this does not occur, turn it off and check the connections and the mounting before starting it again.
b) If there is excessive vibration, check if the fastening screws are correctly fastened. Check also if the vibration comes from a neighbor machine. Periodical vibration checks must be done.
c) Run the motor with the rated load for a short period of time and compare if the running current is equal to the one stamped on the nameplate.

MAINTENANCE

1- General Inspection

Check the motor periodically.
Keep the motor clean and assure free airflow.
Check the seals or V Ring and replace them, if required.
Check the connections as well as supporting screws.
Check the bearings and observe: Any excessive noise. bearing temperature and grease condition.
When a changing, under normal conditions, is detected, check the motor and replace the required parts.

The frequency of the inspections depends on the motor type and on the application conditions.

Relubrification Recommendations

Frame size	Amdunt of grease g	3600 rpm	3000 rpm	1800 rpm	1500 rpm	1000 rpm	500/ 900 rpm
		Ball bearings Relubrication intervals in hours					
25416T 28416T	10	4300	5900	9500	10900	12700	14400
324/6T	15	3800	5400	9300	10300	12400	14300
36415T 404/5T 44415T	30 -	1100	2000	4100	4700	5700	6500
504/5	40	700	1600	3700	5400	5400	6100
586/7	50	-	800	3100	4000	5000	5700
		Roller bearings Relubrication intervals in hours					
324/6T	15	1600	2700	6800	8300	9600	10700
364/5T	30	700	1100	2800	3600	4400	5000
404/5T 444/5T 447/9T	30	1100	2000	4100	4700	5700	6500
504/5	40	700	1100	2800	3600	4400	5000
586/7	50	-	-	1900	2600	3900	4400

WARNING: The maximum operating temperature of the bearing or of the grease is 70°C and shall not be exceeded. For each 15°C over this temperature the regreasing interval must be reduced by 50%.

LUBRICATION

 Follow the regreasing intervals. This is fundamental for the motor operation.

1- Machines without Grease Nipples

Motors up to frame 200 are normally fitted, without grease nipples. In these cases the regreasing shall be done at the preventive maintenance job observing the following aspects:
disassemble carefully the motors
take all the grease out
wash the bearing with kerosene or diesel
regrease the bearing immediately

2- Machines Fitted with Grease Nipples

It is strongly recommended to grease the machine while running. This allows the grease renewal in the bearing housing. When this is not possible due to turning parts by the grease device (pulleys, gloves, etc) that offer some risk to the physical integrity of the operator, proceed as follows:
Clean the area near to the grease lubricator.
Put approximately half of the total grease and run the motor for 1 minute at full speed. Then turn off the motor and put the rest of the grease.
The injection of all the grease with the motor in standstill can make the grease penetrate into the motor, through the inner seal of the bearing housing,

3- Type of grease

When regreasing, use only special bearing grease with the following properties:
good quality lithium base or lithium complex grease
base oil viscosity 100 - 140 c St at 409C
consistency NLGI grade 2 or 3
Temperature range -30°C till +130°C, continuously

For special applications like high or low temperatures, speed variation, etc. the kind of grease and the regreasing interval are indicated on a special nameplate.

The use of standard motors in special areas or special applications must be preceded by consult to the grease manufacturer or WEG.

ASSEMBLY AND DISASSEMBLY

Disassembly and assembly must be done by qualified personnel using only suitable tools and appropriated methods. The stator grips must be applied over the side face of the inner ring to be disassembled or over an adjacent part.
It is essential that the bearings disassembly and assembly be done in cleaning conditions to ensure good operation and to avoid damages. New bearings shall only be taken out from their cases when assembling them.
Before installing a new bearing it is necessary to check the shaft fitting for any sharp edge or strike signals.
For bearing assembly warm their inner parts with suitable equipment - inductive process - or use suitable tools.

SPARE PARTS

When ordering spare parts, please specify the full type designation and product code as stated in the motor nameplate.
Please also inform the motor serial number stated on the nameplate.

MOTORS FOR HAZARDOUS LOCATIONS

Besides the recommendations given previously, these ones must be also followed:

The specification of the motor installation place is for customer's responsibility, who will also determine the environment characteristics.

Motors for hazardous locations are manufactured according to specific standards for such environments and they are certified by worldwide certifying entities.

1- Installation

The complete installation must follow procedures given by the local legislation in effect.

The installation of hazardous location motors must be carried out by skilled people, and the thermal protection must be always installed, either inside or outside the motor, operating at the rated current.

2- Maintenance

Maintenance must be carried out by repair shops authorized by Weg.
Repairs shops and people without Weg's authorization who will perform any service on hazardous location motors will be fully responsible for such service as well as for any consequential damage.

Any electrical or mechanical modification made on hazardous location motors will void the certification.

When performing maintenance, installation or relubrication, follow these instructions.

Check if all components are free of edges, knocks or dirt.
Make sure all parts are in perfect conditions.
Lubricate the surfaces of the endshield fittings with protective oil to make the assembly easier.
Use only rubber hammer to fit the parts.
Check for correct bolts tightening.
Use clearance calibrator for correct T-box fitting (smaller than 0.05mm).

Do not reuse damaged or worn parts. Replace them by new ones supplied by the factory.

WARRANTY TERMS
SERIES AND ENGINEERING PRODUCTS

WEG warrants its products against defects in workmanship and materials for 18 months from the invoice date issued by the factory, authorized distributor or agent limited to 24 months from manufacturing date independent of installation date as long as the following items are fulfilled accordingly:
Proper transportation, handling and storage;
Correct installation based on the specified ambient conditions and free of corrosive gases;
Operation under motor capacity limits;
Observation of the periodical maintenance services;
Repair and/or replacement effected only by personnel duly authorized in writing by WEG;
The failed product be available to the supplier and/or repair shop for a required period to detect the cause of the failure and corresponding repair;
Immediate notice by the purchaser about failures occurred and that these are accepted by WEG as manufacturing defects.

This warranty does not include disassembly services at the purchaser facilities, transportation costs with product, tickets, accommodation and meals for technical personnel when requested by the customer. The warranty service will be only carried out at WEG Authorized Repair Shops or at WEG's facilities.
Components whose useful life, under normal use, is shorter than the warranty period are not covered by these warranty terms.
The repair and/or replacement of parts or components, when effected by WEG and/or any WEG Authorized Repair Shop, will not give warranty extension.
This constitutes WEG's only warranty in connection with this sale and the company will have no obligation or liability whatsoever to people, third parties, other equipment or installations, including without limitation, any claims for consequential damages or labor costs.

WEG EXPORTADORA S.A.
RUA JOINVILLE, 3000
89256-900 - JARAGUÁ DO SUL - SC - BRASIL
PHONE (55) (47) 372-4000 - FAX (55) (47) 372-4060

For further information please contact your nearest Weg sales office.

We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

✎ **Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee.**

How to Contact Customer Service

To contact Customer Service personnel, call:

NOTE: Normal operating hours are 8:00 AM - 5:00 PM. After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

Before You Call...

If you do have a problem, please complete the following checklist before calling Conair:

- ❒ Make sure you have all model, serial and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- ❒ Make sure power is supplied to the equipment.
- ❒ Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- ❒ Check the troubleshooting guide of this manual for a solution.
- ❒ Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- ❒ Check that the equipment has been operated as described in this manual.
- ❒ Check accompanying schematic drawings for information on special considerations.

Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.