seresco

Advanced Dehumidifiers
WebSentry® Technology

Installation, Operation & Maintenance Manual

NP Series Dehumidifiers

For the latest updated versions of this or other Seresco Installation, Operation & Maintenance Manuals contact Seresco Technologies Inc. Tel: (613) 741-3603
Visit: www.serescodehumidifiers.com

Issue Date : 2011-09-30

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Warnings, Cautions and Notices

Throughout this manual, warnings, cautions and notes appear when special care must be taken to avoid potential hazards that could result in mechanical or electrical damage, personal injury or death.

⚠ **WARNING** Indicates a potentially hazardous situation which could result in serious injury or death if handled improperly.

⚠ **CAUTION** Indicates a potentially hazardous situation which could result in moderate injury or equipment damage if handled improperly.

Note : Indicates a situation that could result in equipment damage if handled improperly.

Refrigerant Handling Practices

Refrigerants composed of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) have a catastrophic effect on the earth's protective ozone layer when released to the atmosphere. Seresco Technologies Inc. advocates the responsible handling of all refrigerants. Consult the appropriate Material Safety Data Sheets (MSDS) for further information. Follow all laws in your area that apply to the handling, reclaiming, recovering and recycling of refrigerants and associated equipment.

⚠ **WARNING** System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. Refer to the unit label to determine the refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives. Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death, serious injury or equipment damage.

⚠ **WARNING** Use only dry nitrogen with a pressure regulator for pressurizing the unit. Do not use acetylene, oxygen, compressed air or mixtures of the aforementioned for pressure testing. Do not use fixtures of a hydrogen-containing refrigerant and air above atmospheric pressure for pressure testing as they may become flammable and could result in an explosion. Refrigerant, when used as a trace gas should only be mixed with dry nitrogen for pressurizing units. Failure to follow these recommendations could result in death, serious injury or equipment damage.

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General Information

Use this manual to install, operate and maintain your Seresco Technologies Inc. (Seresco) NP Series dehumidification unit. Carefully review the procedures and instructions in this manual to minimize installation and operation difficulties. Every Seresco dehumidification unit is accompanied by a label that identifies the unit serial number, mechanical, refrigeration and electrical operating information. This information is required when ordering parts or requesting service for a Seresco dehumidification system. Seresco also publishes a comprehensive natatorium design guide which provides a wealth of information on how to design a pool. See www.serescodehumidifiers.com for more information.

Unit Description

Seresco's NP Series advanced dehumidifiers are designed for residential or commercial indoor pools and other various dehumidification requirements. The unit is comprised of components such as fans, compressors, refrigeration coils, filters, dampers and pumps. The NP Series units reject heat to a glycol-water loop through two flat plate heat exchangers instead of through a condenser coil. This allows for a system which requires substantially less refrigerant charge than a standard NE Series unit. The heat transferred to the glycol-water solution is then rejected through a condenser coil located in the unit and an outdoor air fluid cooler (OAFC).

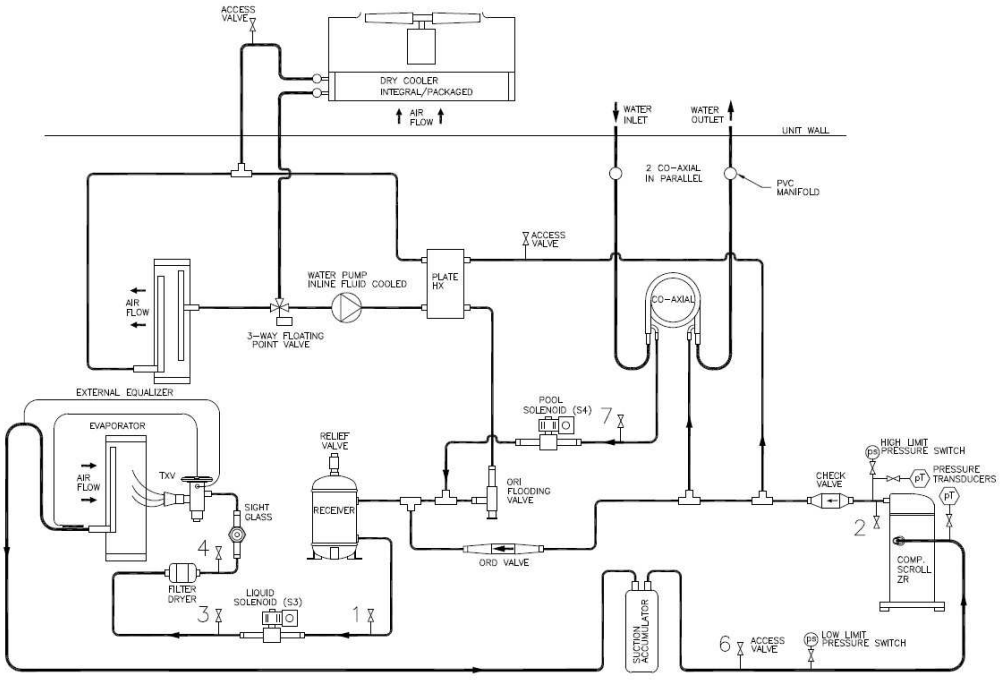

Figure B-1. Typical refrigeration circuit for NP Series units

Component Descriptions

The following components are commonly used on Seresco Technologies Inc.'s NP Series of dehumidifiers. Detailed technical information can be found in the annex and in the respective manufacturer's IOM manual(s).

Check Valves

A single direction flow valve, typically installed on the discharge line of the compressor and used to prevent back-flow of liquid refrigerant. Extends the life of the compressor.

ORD/ORI Valves (R-407C) or LAC Valve (R-410A)

Head pressure control valves, used as a means of controlling head pressure in the refrigeration system. Can either be fixed or manually adjustable. By keeping the head pressure at stable conditions, the efficiency of the system increases.

Solenoid Valves

Two-way valves used as a means of controlling refrigerant flow through the system depending on mode of operation (e.g. Air conditioning, or reheat).

Thermostatic Expansion Valve

Precisely selected to provide optimal refrigerant flow to the evaporator coils and factory adjusted to maintain superheat conditions within 18-20 °F.

Ball Valves (2-way and 3-way)

Manual two-way valves are used as shut-off valves, most commonly used to shut off refrigerant flow to allow field installation of remote condensers. Actuated three-way valves used to modulate flow when in different modes of operation.

Rotolock Valves

Manual shut-off valve used to isolate the compressor(s) and receiver to allow ease of serviceability and component replacement.

Plate Heat Exchanger

Plate heat exchangers are compact in size and efficient at exchanging waste refrigerant heat to a secondary fluid loop. This secondary fluid is then pumped to a fluid cooler or internal water coil.

Co-axial Heat Exchanger

Used as a condenser to exchange waste refrigerant heat to the pool water.

Receiver

Stores liquid portion of the refrigerant charge. They are equipped with external sight glasses to allow the refrigerant level to be monitored. If the bottom sight glass is not floating, the system is undercharged. If the top sight glass is floating high, the system is overcharged.

Suction Accumulator

Used to trap any potential liquid flood-back to the compressor, prolonging system life.

Filter Drier

Keeps moisture out of the system and contains potential contaminants that have entered the refrigeration system. Larger units are equipped with removable filter-drier cores for ease of serviceability.

High / Low Pressure Switches

Hi/Lo pressure switches are installed as a safety mechanism to prevent the system pressures from leaving the normal operating range.

Figure B-2. Pressure transducer (3-wire) and switch (2-wire)

Oil Safeties

Safety device to monitor oil levels in the system. Proper oil levels in the compressor are vital to its proper operation and life.

Figure B-3. Example oil safety, actual model may vary

Relief Valve

Installed on liquid receivers and used as an emergency pressure release. Opens if component's maximum allowable pressure is reached in the system to prevent damage.

Flow Switch

Safety device used to trigger a no water flow fault if no fluid flow is detected.

Sensors

Sensors mounted within the unit are key to Seresco's control systems which are capable of running the system without human intervention.

Relative Humidity

Located between the filters and evaporator coil(s), measures the relative humidity of air entering the unit from the pool space.

Temperature

Stainless steel sensors mounted throughout the unit to provide temperature data to the automated controls system. Sensors measure the temperature of air leaving the evaporator coil(s), air being exhausted from the unit, air brought in from the outdoors, and air returning to the pool space.

Figure B-4. Pool water sensor

Figure B-5. Sensor in well

Figure B-6. Evap coil sensor

Additionally, sensors mounted in copper wells determine the suction and discharge refrigerant line temperatures. On units with pool water heating, pool water temperature is recorded both when entering and leaving the co-axial heat exchanger.

Pressure Transducers

Figure B-7. Pressure switch (2-wire) and transducer (3-wire)

A low pressure transducer measures pressure on the suction line, while a high pressure transducer measures the pressure on the (compressor) discharge line.

Product Nomenclature

The product nomenclature is a 27 character alpha-numeric sequence that completely describes the options present on the dehumidification unit.

Table B-1. Seresco Technologies Inc. Nomenclature Definition		Version 3.2
Series	Natatorium Environmental Control Series	NE
	Natatorium Protocol Series	NP
	Natatorium Ventilation Series	NV
Dash	**Dash**	**-**
Tonnage	2 ton	002
	...16 ton	016
	18 ton	018
	...80 ton	080
	10 ton "double decker"	210
	...32 ton "double decker"	232
Dash	**Dash**	**-**
Pool Heater	No Pool Water Heater	N
	Pool Water Heater	P
Cabinet Configurations	Double walled - Return plenum - Bottom	B
	Double walled - Horizontal Return	C
	Horizontal -single wall Standard	H

	Horizontal - single wall - Mirrored	M
	Vertical - single wall Mirrored	N
	Double walled - Return plenum - Right Side	R
	Double walled - Return plenum - Left Side	S
	Double walled - Return plenum - Top	T
	Vertical - single wall Standard	V
	Special	Z
Dash	**Dash**	**-**
Indoor/Outdoor	Indoor Unit	I
	Exterior Unit	X
Dash	**Dash**	**-**
AC Options	Outdoor Air Cooled Condenser	A
	Glycol Cooled By a Fluid Cooler	G
	Air Handler (Chilled Water Coil)	H
	Water Cooled - Variable Flow (< 65F Water Loop)	M
	No Air Conditioning (All AC components removed)	N
	Packaged/Integral Air Cooled Condenser	P
	Water Cooled - Variable Flow (70-85F Water Loop)	V
Outdoor Air Options	None	0
	Duct Connection Collar Only	1
	Duct Collar c/w Manual Damper & Filter	2
	OA Inlet Motorized Damper & Filter	3
	Purge/Economizer Motorized Damper (In addition to OA Motorized Damper Option)	4
	Heat Recovery Package with Motorized Damper and Time Clock	5
	Heat Recovery Package Option on OA with Additional Purge/Economizer Option	6
Exhaust Fan	Unit mounted Exhaust fan (Required with HR)	E
	Unit mounted Exhaust fan and Purge/Economizer Fan	F
	None	N
	Unit mounted Purge/Economizer Fan	P
Supply Air Orientation	Bottom Supply	B
	Top Right Supply	D
	Horizontal - Loopback	E
	Top Loopback End Supply	F
	Top Left Supply	G
	Horizontal (Straight Through)	H
	Top Horizontal End Supply	J
	Left (oriented with airflow air turns left out of unit)	L
	Right (oriented with airflow air turns right out of unit)	R
	Top Supply	T
External Static Pressure	0.5"	0
	0.75"	4

	1.0"	1
	1.5"	5
	2.0"	2
	Other	3
Supply Air CFM		X
	XY times 10 to the N	Y
		N
Space Heating Type	Unit mounted electric Heater - Separate power connection	D
	Unit mounted electric heater - Single point power connection	E
	Unit mounted gas heating	G
	Remote by others	N
	Unit mounted steam coil	S
	Remote electric heater supplied by Seresco	T
	Unit mounted hot water coil	W
	Remote electric modulating heater supplied by Seresco	X
	Remote hot water coil supplied by Seresco	Y
	Remote steam coil supplied by Seresco	Z
Heating Control Details	Standard control signals: Valve and power supply by others	0
	2 stages factory wired electric heating control	1
	Modulating - factory supplied and wired valve	2
	On/Off - factory supplied and wired Valve	3
	Supply isolated 50 VA power for remote valve (valve by others)	4
	Modulating factory wired electric heating control	5
	Supply On/Off Valve & 50 VA power for remote valve installation	6
	Supply Modulating Valve & 50 VA power for remote valve installation	7
Unit Supply Voltage	208/1	A
	230-240/1	B
	208/3	C
	230-240/3	D
	460-480/3	E
	575-600/3	G
Unit Controls	Electro-mechanical	0
	Command Touch Screen	1
	Command Center	2
	Command Center c/w Building Communication	3
	Command Center c/w Remote Panel	4
	Command Center c/w Building Communications & Remote Panel	5
Refrigerant	R410A	A
	R407C	C
	R22	R
	Non fused Disconnect	D

Disconnect	Fused Disconnect	F
	No Disconnect	N
Warranties	Standard - 2yrs on driveline, coils, and compressor	0
	2 yrs on driveline and compresor, 5 yrs on coils	1
	2 yrs on driveline and compressor, 10 yrs on electrofined coils	2
	2 yrs on driveline and coils, 5 years on compressor	3
	2 yrs on driveline, 5 yrs on compressor and coils	4
	2yrs on driveline, 5 yrs on compressor, 10 yrs on electrofined coils	5
	2yrs on driveline and coils, 10 yrs on compressor	6
	2yrs on driveline, 10 yrs on compressor, 5 years on coils	7
	2yrs on driveline 10 yrs on compressor and electrofined coils	8
	5yrs on driveline, 2 yrs on compressor and coils	9
	5yrs on driveline and coils, 2 yrs on compressor	A
	5yrs on driveline, 2 yrs on compressor, 10 years on electrofined coils	B
	5yrs on driveline and compressor, 2 yrs on coils	C
	5yrs on driveline, compressor and coils	D
	5 yrs on driveline and compressor, 10 yrs on electrofined coils	E
	5 yrs on driveline, 10 years on compressor, 2 yrs on coils	F
	5 yrs on driveline and coils, 10 yrs on compressor	G
	5 yrs on driveline, 10 years on compressor and electrofined coils	H

Unit Label

seresco				Description
Serial #: **11061821** Unit Model: NE-020-PR-X-P6FT4123G2E4AD3				Unit serial number and model nomenclature
Electrical Data:	Voltage:	460/3/60		Supply power
	MCA:	70.0	A	
(Use copper conductors only)	Max Fuse or CKT BKR:	80.0	(HACR type NEC)	Fusing information
Wiring Diagram:	NEWD-SpringHill-11061821			Wiring diagram version
Supply Airflow:	12000	CFM		Design airflow
Main Blower Motor:	HP:	11.5	FLA: 15.4	Component electrical data (as applicable)
Exhaust Blower Motor:	HP:	1.0	FLA: 1.3	
Purge Blower Motor:	HP:	2.0	FLA: 3.1	
Main Glycol Pump Motor:	HP:	0.6	FLA: 1.5	
Heat Recovery Pump Motor:	HP:	0.3	FLA: 1.3	
Compressor 1:	RLA:	17.9	LRA: 125.0	
Compressor 2:	RLA:	17.9	LRA: 125.0	
Factory Charge 1:	46	lbs R410A	Max.of 50 ft	Refrigerant charge for NE series with ``split`` OACCs (circuit 1 and 2)
System Field Charge 1:	48	lbs R410A	of line length	
Ref. OACC Customer Line Sizes 1:		Hot Gas:	1 1/8 in	
		Liquid:	3/4 in	
Factory Charge 2:	46	lbs R410A	Max.of 50 ft	
System Field Charge 2:	48	lbs R410A	of line length	
Ref. OACC Customer Line Sizes 2:		Hot Gas:	1 1/8 in	
		Liquid:	3/4 in	
Factory Charge 1:	35	lbs R410A		Refrigerant charge for NP series and packaged NE series
Factory Charge 2:	35	lbs R410A		
Water Connections Sizes (per circuit):		Water In:	7/8 in	For units with water-cooled air conditioning option
		Water Out:	7/8 in	
Water Flow & Pressure Drop (per circuit):		Water Flow:	12.0 GPM	
		P.D.:	1.8 psi	
Pool Heating (total):	36.0 GPM		5.0 psi	For units with pool water heating option
Pool Water Connection Size:	2.0 inch			
Factory Added Oil 1:	10 oz POE			Oil added
Factory Added Oil 2:	10 oz POE			
High Design Pressure:	550 psig (max.)			Max / min refrigerant operating pressure
Low Operating Pressure:	150 psig (max.)			
Application:	OUTDOOR USE			Indoor / outdoor design
Electric Heater:	kW: 100		Amp: 30	Electric auxiliary heating option
Hot Water Coil:	MBH: 1600		GPM: 120	Hot water coil heating option
	EWT: 160		LWT: 130	
	PD: 5.3		ft-H2O	
	Connection: 2.0		inch	
Gas Heater Capacity:	320 MBH output			Gas heating option
Gas Line Connection:	0.75 inch			
Seresco Technologies Inc. www.serescodehumidifiers.com MADE IN CANADA				

Further Information

For further information, please visit our website at www.serescodehumidifiers.com. Feel free to browse our website and watch informative videos on every aspect of our products.

Pre-installation Requirements

Seresco Technologies Inc. inspects and fully tests each dehumidifier in all operating modes before it ships from the factory. The unit can suffer damage in transit. Check the equipment thoroughly for both visible and concealed damage before you sign the receiving papers. Document any damage in writing on the carrier's bill of lading to ensure that damage claims are handled promptly. If the unit has been damaged, obtain a claim form from the carrier. Promptly fill out and return the form, and notify Seresco Technologies Inc. of any damage.

Note : Damage claims or missing parts must be filed with the freight carrier.

Receiving Checklist

Note : The shipping protection provided by the factory is for transport purposes only and should not be relied on to protect the unit in storage or on the job site.

Note : Seresco is not responsible for any shipping damages. Should your unit arrive damaged, please follow the instructions in *Shipping Damage Instructions* to resolve the situation. Delivery cannot be refused on the basis of shipping damages.

Upon receipt, please check the following components for damage:

- Verify the proper operation of latches and hinges on all access doors
- Inspect all coils for damage to the fin surface coating, headers or coil connections
- Manually rotate the fan wheel to ensure free movement of the shaft, bearings and drive
- Inspect the fan housings for any foreign objects
- Inspect and test all piping for possible shipping damage
- Check the tightness of bolts on the fan structure and coils
- Inspect fan isolator shipping brackets

Shipping Damage Instructions

Seresco Technologies Inc. ships freight on board (FOB), meaning that the unit belongs to the customer as soon as the delivery truck leaves the factory. If damage has occurred to the unit during shipment, follow these instructions:

1. Specifically note the extent of the damage in detail on the freight bill. Clear photographs of the damaged

components are required.

2. Report all claims of shipping damage to the delivering carrier immediately and coordinate a carrier inspection if necessary.
3. Contact Seresco Technologies Inc. by email at service@serescodehumidifiers.com or by phone at (613)-741-3603 and dial 2 for the soonest available tech support technician. Have the unit serial number (8-digit) and nomenclature designation (23 digit alpha-numeric sequence starting with the series designation) on hand. These may be found on the unit label along with other performance and electrical information.
4. Do not attempt to repair the unit without consulting the Seresco Technologies Inc. Service and Tech Support Department. It is the receiver's responsibility to provide reasonable evidence that damage was not incurred after delivery.

Storage

Protection from the elements is required for any unit that will be stored on the job site or a holding area before installation. For long term storage, a controlled indoor environment is highly recommended. All factory-applied shipping protection should be removed before the unit is put into storage. Shipping protection material is not suitable protection for short or long-term storage.

Note :	Standard Seresco warranties expire 24 months from the date of shipment. See section *Y – Warranties* for further information.

Mechanical Installation

⚠ **WARNING** Heavy objects ! Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for an even unit lift. Other lifting arrangements may cause damage to equipment, serious injury or death of personnel. Always place, assemble, and suspend single sections. Do not lift units in windy conditions. Do not raise units overhead with personnel below unit.

⚠ **WARNING** Improper lifting procedure ! Test lift the unit 24 inches to verify proper operation of lifting equipment and positioning of lift points such that the unit is level. Failure to properly lift the unit could result in equipment damage, serious injury or death. Seresco Technologies Inc. is not responsible for the improper use of lifting equipment.

⚠ **WARNING** When lifting unit, appropriate personal protection equipment (PPE) such as steel-toed boots and hard hats must be worn to avoid potentially serious injury.

Lifting and Rigging Procedures

- Determine the approximate centre of gravity before lifting the unit. Consult unit design drawings provided in the submittal documents to determine total weight and weight distribution.
- Never assemble split sections before lifting them to the installation location. Always lift sections as received from the factory.
- Lift sections using the provided lifting lugs
- To avoid damage, do not attach intake or exhaust hoods prior to lifting the unit into place.

Unit Assembly (Split Units Only)

Under special conditions, the unit may be split into two or more sections to ease the installation process. Base angles are attached using 3/8" bolts, and inside angles are bolted using 5/16" bolts. Ensure that all provided holes are used. Caulk seams on the outside of the unit to make the join air-tight. Install the standing seam roof rib.

Duct Connections

All duct connections should be installed in accordance with local and national standards. To ensure the highest fan efficiency, duct turns and transitions should be made to minimize air friction losses and turbulence. See supplied unit drawing from the submittal for location and size of unit duct connections. Use only flexible duct connectors to connect to the unit.

Piping and Unit Connections

See the unit label for unit connection line sizes. The installer must endeavour to ensure that all industry standards for refrigeration component installation are met. This includes but is not limited to; proper line sizing, materials, nitrogen purging, brazing with Silfos 5 or better (NO SOFT SOLDER), evacuation, cleanliness, traps, long radius elbows and system charging.

Drain Pans - Condensate Drain

The dehumidifier is a draw through configuration as a result the entire cabinet is under negative pressure. Without a P-trap, condensate will not drain and the unit will overflow into your mechanical room.

- Per Figure 5 pitch the condensate drain line a minimum of 1/8" per linear foot, and support the pipe with code-approved hangers at least every 5 feet.
- If the drain line passes through an unconditioned space, heat tracing is required to prevent the condensate in the drain from freezing.

When gravity disposal is not possible, a condensate pump can be used. Follow the pump manufacturer's installation instructions.

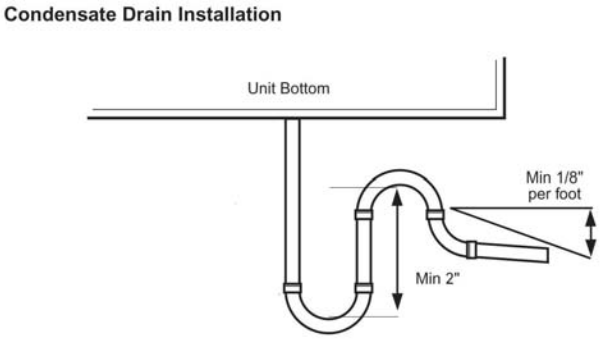

Figure D-1. P Trap

Blower Motor Brace

Upon installation remove ONLY lower bolt from all four corners shown in **Figure D-2** (Detail A). The top of the bolt will be spray-painted yellow for easy identification. The plug fan sits on spring dampers to minimize vibration translated to the unit from the fan motor. During shipping, the fan assembly is fixed such that the springs are compressed and cannot oscillate. Removing these bolts on installation ensures that the the fan vibrations will be dampened correctly.

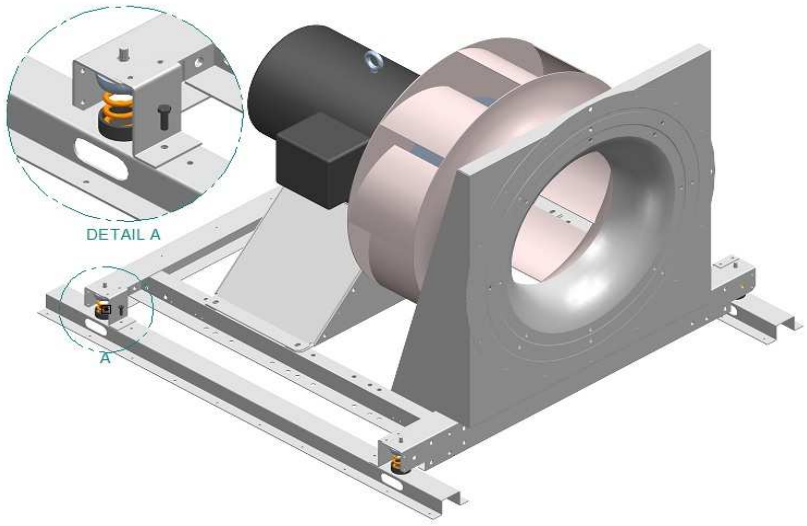

Figure D-2. Blower Motor Brace

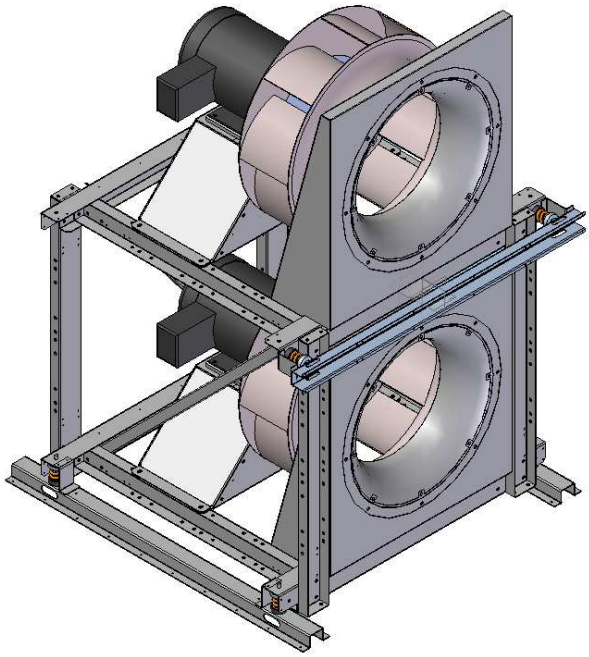

Figure D-3. Double motor assembly – remove horizontal brace on front wall

Field Installed Outdoor Air Cooled Condensers and Fluid Coolers

This condenser is used in air conditioning mode where it rejects unneeded heat from the space to outdoors. Proper installation is essential to ensure it can function as intended. Proper airflow and refrigerant piping are paramount. Ensure an appropriate maximum ambient air temperature has been specified. Ensure the unit has proper airflow per **Figure D-4**. A perimeter of free area equal to its width must be provided. Use line sizes as specified by Seresco. To avoid potential seasonal system charge problems, ensure the installed line lengths are never longer than indicated on the plans and specifications. If the condenser is installed above the dehumidifier, ensure the hot gas line has proper oil traps. Contact Seresco if the condenser is installed more than eight (8) feet below the dehumidifier. The installer must endeavour to ensure that all industry standards for refrigeration component installation are met. This includes but is not limited to; proper line sizing, materials, nitrogen purging, brazing with Silfos 5 or better (NO SOFT SOLDER), evacuation, cleanliness, traps, long radius elbows and system charging. Install the remote condenser on a level, hard surface. Bolt the condenser in place.

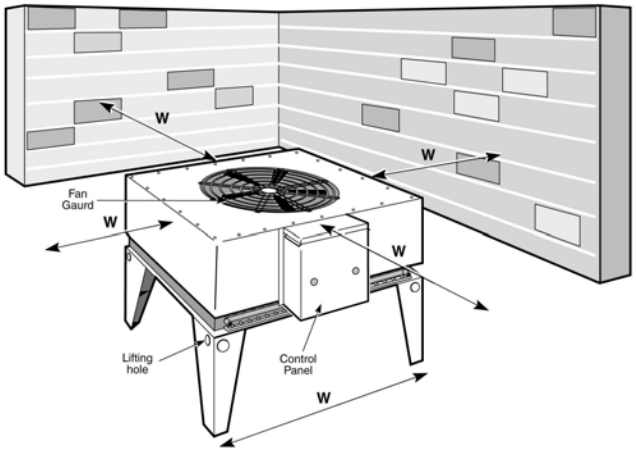

Figure D-4. Typical Outdoor Condenser Installation

Refrigerant Piping of Remote Condensers

NE and NP series dehumidifiers are equipped with isolation valves and access valves located in the blower compartment. Do not open the isolation valves until all exterior piping is leak checked and evacuated. The last outdoor condenser vacuum can be broken with liquid refrigerant (R-407C or R-410A as applicable). Monitor the exact amount of refrigerant added, as the total system charge must be per the unit nameplate. The NE and NP series dehumidifiers have refrigerant pipe stubs for the line set connection inside the cabinet. Use standard commercial refrigeration piping practices when installing the refrigeration piping between the dehumidifier and the remote air-cooled condenser.

- Hot Gas and Liquid line sizes should be per unit nameplate. The stubs inside the unit will be the correct sizes

for line lengths up to 50'

- Do not exceed 50' total line length or install the condenser more than 8' below the unit. Consult Seresco before installing the outdoor air-cooled condenser more then 8 feet below or more than 50 feet away from the dehumidifier.
- Per Figure 2, install an oil trap at the start of and at every 15 feet of vertical lift in the hot gas discharge line as shown. Pitch horizontal lines a minimum of 1/2" every 5 feet in the direction of flow. All piping must be clean and de-burred. Keep copper chips and foreign materials out of the tubing. A nitrogen purge while brazing is paramount to reduce the chances of oxidation in the pipes.
- Keep the Hot Gas and Liquid lines a minimum of 2" apart to prevent heat transfer. Insulate the hot gas line in all areas where a person may come in contact with the line and be in danger of a burn.
- When all piping work is complete, check for leaks by pressurizing the remote condenser and line set with dry nitrogen. If no leaks are detected, the circuit is ready to be evacuated. Evacuate the condenser and piping to a minimum 250 microns. Isolate the piping for ONE HOUR to verify that the system is free from leaks, moisture, and non-condensables. For further details on proper vacuum and evacuation procedures, see section *H – Routine Maintenance*.

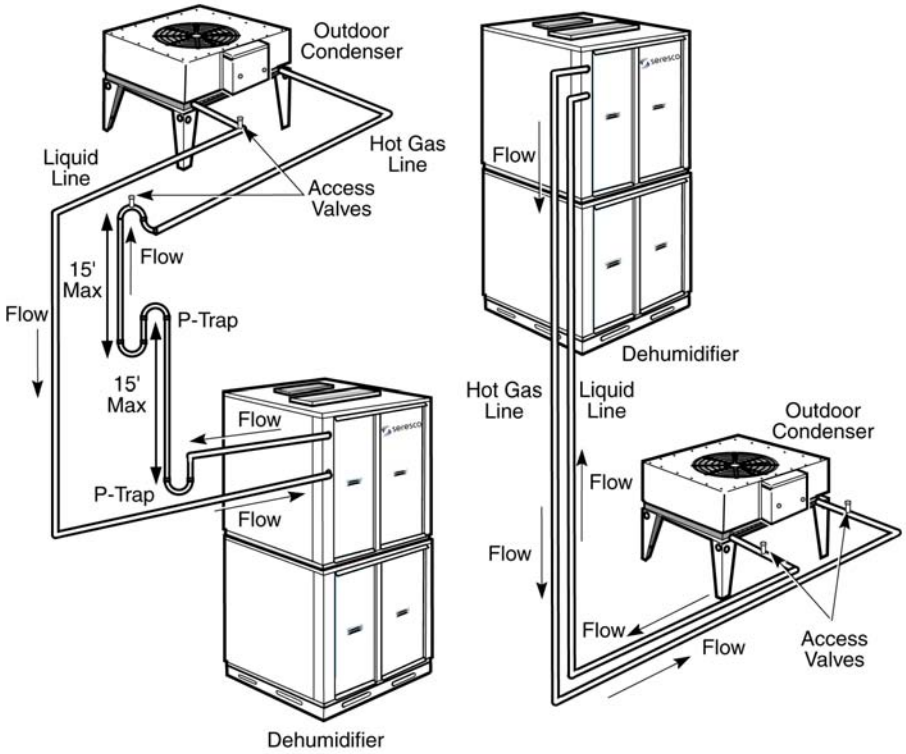

Figure D-5. Typical Outdoor Condenser Installation

Charging of Remote Condensers

Once a proper evacuation has been accomplished the system is ready for charging. The outdoor air-cooled condenser requires a field charge by the installing contractor. The field charge required depends on the size of the condenser and the length of the piping. The unit nameplate will show the exact field charge required. The last vacuum can be broken with liquid refrigerant. Monitor the exact amount of refrigerant added, as the total system charge must be per the unit nameplate. Connect the control wiring to the terminals provided inside the electrical compartment of the dehumidifier and outdoor condenser. Refer to the low voltage wiring schematic for details. The condenser fan(s) will not operate until this is complete. Once you have charged and checked the condenser and line set for leaks, open the service valves located in the compressor compartment of the dehumidifier. There is an access valve in the liquid line after the pump down valve. The pump down valve can be manually closed during start-up mode via the controller. Add only as much refrigerant as is needed to get to the total charge indicated on the nameplate. Never charge liquid into the suction line access valve! The receiver has 2 sight glasses with float balls to help ensure the maximum and minimum refrigerant levels are easily met.

Fluid Cooler Installation

Fluid cooled units come with a separate pump for the fluid loop. NP Series units have an internal pump and expansion tank for the glycol loop. PVC piping is highly recommended for fluid cooler installation.

Factory Start-up Supervision

Seresco Technologies Inc. factory start-up supervision can be purchased with the equipment. A factory start-up includes several key services:

- The expertise of a factory-trained technician who will supervise the commissioning of the equipment.
- This Seresco representative will assist the installing contractor with filling out the Start-Up Report.
- They will also inspect the installation to make sure that the dehumidifier has been properly integrated with the rest of the equipment on the job site.
- Finally, they can train the maintenance personnel to operate and service the equipment if necessary.

A factory start-up does not include installation assistance. The installing contractor is responsible for ensuring that the system is ready for start-up when the Seresco representative arrives. If the system is not ready, Seresco reserves the right to bill the contractor for a second visit. When the installing contractor is confident the system will be ready, contact the Seresco Sales representative to schedule the start-up. Please call at least two weeks before the desired start-up date to prevent scheduling conflicts.

Items required for Start-Up

- A service technician and a fully stocked service vehicle.
- A set of refrigerant manifold gauges.
- Air balancing equipment (magnehelic differential pressure gauge).
- Volt/Amp/Ohm meters.
- A digital thermometer w/clamp on sensors.
- A halogen leak detector, R410a or R407c and a scale.

Items to be Completed Before Start-up

- Refrigerant leak-check (with halogen leak detector) and inspect the unit for internal concealed damage.
- Level and support the dehumidifier properly.
- Install the outdoor air duct filters and damper (if applicable).
- Install the condensate P- trap and drain lines and prime P-trap.
- Pipe the remote condenser fan pressure controls to the condenser hot gas lines (if applicable).
- Evacuate and leak-check the remote condenser line set (if applicable).
- Tighten all electrical connections and verify that the line voltage is correct for the unit.
- Install all controls and verify that all field wiring matches the schematic.
- Fill and heat the pool and room to design conditions.
- Install the pool water piping and a flow meter (if applicable). Purge all air from pool lines.
- A complete system air balancing.

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Electrical Installation

⚠ **WARNING** Disconnect all electric power, including remote disconnects, before servicing. Follow proper lockout procedures to ensure that the unit is not accidentally powered. For variable frequency drives, refer to the appropriate section of the manual. Verify with a voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in serious injury or death.

Note : Use copper conductors only ! Unit terminals are not designed to accept other types of conductors. Use of aluminium or other wiring may result in galvanic corrosion or overheating.

Note : Properly seal all penetrations made in the outer walls. Failure to due so may result in unconditioned air entering the unit, water infiltrating the insulation or serious equipment damage. Ensure that all metal shards and filings are swept to avoid possible corrosion or damage to electrical components.

Main Panel Power Connection

The field-installed power supply wires and over current devices must be sized to handle the minimum ampacity of the dehumidifier without exceeding the maximum fuse size rating. Both the MCA and MOP are indicated on the unit nameplate. Figure E-1 shows typical power wiring connections. Single-phase units require 3 wires, 2 power and one ground. Three-phase units require 3 power wires and one ground wire. Connect the power supply wires to the main power distribution block located inside the unit main electrical panel. For units with electric heaters and single-point power connections, the power distribution block is located in the heater. For units with electric heaters and dual-point power connections, the unit and heater must be powered independently. For units with mounted disconnects, ensure that the power is brought first to the disconnect and then the power distribution block. Always verify the nameplate voltage before connecting to the unit.

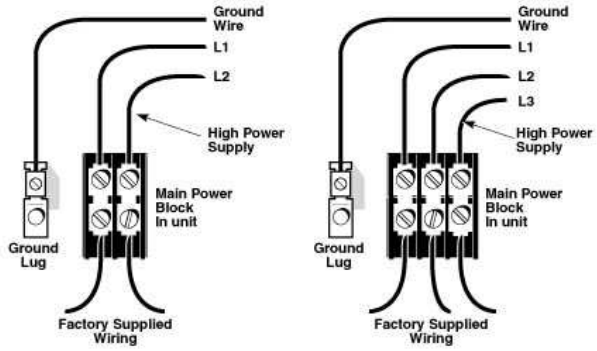

Figure E-1. Main power distribution block

Control Wiring

Seresco Technologies Inc.'s dehumidifiers have all necessary sensors unit mounted and setpoints pre-programmed at the factory. Remote duct heaters, outdoor air-cooled condensers, auxiliary pool water heaters and remote exhaust fans all require interfacing with the dehumidifier. The common connection terminals are identified in **Table E-1**. For a complete list of terminal connections and functions, refer to section *Z – Annex*.

Table E-1. Control Terminals

Pin	I/O's	Description
Connector J7		
6	DI14	Freezestat
7	DI15	Firestat
Connector J8		
7	AO01	Modulated Heat
Connector J9		
1 , 2	DO24	Space Heater, Stage 2
3 , 4	DO23	Space Heater, Stage 1
5 , 6	DO22	Exhaust Fan 2
7 , 8	DO21	Exhaust Fan 1
9 , 10	DO20	Outdoor Air Damper
Connector J10		
1 , 2	DI19	Outdoor Air Condenser 1
3 , 4	DI18	Outdoor Air Condenser 2 (Ver. 5.x only)
5 , 6	DI17	Auxiliary Pool Heater, Pool 2
7 , 8	DI16	Auxiliary Pool Heater, Pool 1

WebSentry Connection

Requires RJ45 ethernet connection to the unit.

To get access to WebSentry® you need to register a user id with Seresco. Follow these instructions.

1) Go to the Seresco web page at http://www.serescodehumidifiers.com.
2) Select the Login link in the upper right corner.
3) Select the 'Click here to register' link in the WebSentry® login box.
4) Fill in the registration form and submit it. The email address will be your user id.

Follow these instructions to login to WebSentry® and view your Seresco unit.

1) Go to the Seresco web page at http://www. serescodehumidifiers.com.
2) Select the Login link in the upper right corner.
3) Enter login credentials in the WebSentry® login box and click Submit button.
4) Once you have logged in you will see a list of all Seresco units you have access to. The very first time you login the list is empty since you do not yet have permission to see any unit (see Gain Access to Unit).
5) Too see more detailed information for a unit, click the job name link.
6) The main Conditions page shows you the current conditions including a trend graph showing the room temperature, humidity and optionally the pool water temperature over the past 4 hours.

You can also see current setpoints, logs and some basic unit configuration by selecting the appropriate menu link.

Gain Access to Unit

To gain access to a Seresco unit you need to know the serial number of the unit and the last 6 characters of the MAC address. The latter is printed on a bar code label on the control board where the network cable is plugged in. You can also find this information from the System Info page from the key pad (accessible from User Settings). If you are not able to get to this information you can also contact Seresco and someone will be able to help you get access to the unit.

Controlling Unit

To gain control of unit so that you can change setpoint, restart unit or modify some factory settings, you first have to Connect to unit and have it maintain a live connection. By default the unit connects once a minute to upload latest sensors readings and log entries and then disconnects again. Typically this does not take more than one second.

To get a live connection, click the Connect button on any page that has a Connect button. Keep pressing Connect button or Web browser refresh button until Connect button changes to a Save and Refresh button.

Another indication that unit is live is that the time stamp in the header under the job name changes to Live. Normally the time stamp tells you the last time the unit connected to the WebSentry® server.

Once a live connection has been established you can change any unit parameter like setpoints and factory settings. From the conditions page you can also start and stop the main blower and restart the unit. If unit is equipped with a purge feature, you can also initiate purge from the conditions page.

Remote Operator Panel (ROP)

The Remote Operator Panel (ROP) looks identical to the local keypad but instead of being connected to the main control board using a data ribbon cable, it uses a RS-485 serial port communication interface. Cat3 or Cat5 twisted pair cables must be used between the ROP and the main CommandCenter control board.

The other difference between the local keypad and the ROP is that the ROP has its own processor and memory where the menu system is stored opposed to the local keypad which just a "dumb" terminal displaying the menu system as controlled by the main control board.

When installing or replacing the ROP you can run into several issues that will prevent the ROP from working properly. This document covers all steps you need to take to ensure a good communication between ROP and main control board.

Testing Remote Operator Panel at the unit

To rule out any type of problem with the wiring between the unit and the ROP location, use a 3'-5' wire and connect the ROP to the main board right at the unit. All troubleshooting guides in this document applies to both testing ROP at the unit and at its final location.

NOTE! When doing any rewiring like moving wires from J8 to JCOM or moving ROP between final location and testing it at the unit, make sure the dip switches are in the off position (towards the 1 & 2 label on the dip switch socket). Do not move to on position until powered up and red LED (L1) is lit up.

Using proper cable

We recommend using a twisted pair Cat3 or Cat5 cable. What is important is that the two signal wires are twisted together. Twisting the signal wires together acts as a noise filter. If not using this type of cable you can run into communication issues.

Especially if the ROP is far away from the unit. For easier troubleshooting, use the following coloured wires.

Table E-2. ROP Connections

Cat3/Cat5 Wire	Remote Keypad	J8	JCOM
Orange	J8-1 (+24V)	Pin 1	Pin 5
White/Orange	J8-2 (GND)	Pin 2	Pin 4
Blue	J8-5 (+ 485)	Pin 5	Pin 6
White/Blue	J8-6 (- 485)	Pin 6	Pin 7

Connecting wires

Before doing any wiring, ensure there is no power over the wires. Either power unit off or unplug terminal (J8 or JCOM) to where the ROP is connected. Connect wires to main control board terminal as listed in Table 1. By default you should be using terminal J8. JCOM is only used as a backup RS-485 port or when more than one RS-485 port is needed. Open up the back of the ROP and feed wires through the hole of the back plate and connect wires to terminals as listed in **Table E-2**.

Check communication

Power up unit or plug in terminal block again. If the two power wires are wired correctly you should now see the red L1 LED light lit up in the ROP. If there is power you can now safely activate the signal wires. You do this by moving the two dip switches (SW1) next to the green terminal block towards the top of the ROP. This is easiest done by using a small flat head screw driver.

If signal wires are wired up correctly you should see the main sensor screen within a few seconds (possibly the system startup screen).

If the screen is blank, you see the Welcome screen for more than 10 seconds, or see other messages indicating the ROP is trying to establish communication, continue reading this document to help you troubleshoot the problem.

No power to ROP (LED L1 not lit up)

First make sure unit is powered up and that the terminal block (J8 or JCOM) is plugged into the main control board. Make sure wires are wired as listed in Table 1. Make sure that the terminal in the ROP is grabbing onto the copper and not the insulation. Check this at the main control board as well. There could possible be a kink in the cable causing a broken wire. Test ROP at unit using a short cable. Try both J8 and JCOM in case there still is no power connecting to J8. If still no power you most likely have a failed ROP terminal board.

Power to ROP but showing a blank screen

There should never be a blank screen when there is power to the ROP. At the minimum the ROP should show that it is trying to connect to the main control board. There are only two reasons why there is a blank screen. The ROP has a contrast dial. It might have been moved so that there is no contrast at all resulting in a blank screen. The contrast dial is a white dial in the upper left corner next to the terminal board. Use a small screw driver to adjust it. If you see no change at all on the screen when adjusting the dial, then this is not the problem. The second reason for a blank screen is if the menu program has been erased from memory. A static chock could possible cause this. All ROP's are tested at the factory so there should have been a program installed when the ROP was shipped from factory. Once again, to really rule out a wiring issue, test the ROP using a short cable right at the unit.

Power to ROP but not establishing a connection

First thing to check is that the two dip switches has been moved up to activate the signal wires. Make sure wires are wired as listed in Table E-1. Make sure that the terminal in the ROP is grabbing onto the copper and not the insulation. Check this at the main control board as well. There could possible be a kink in the cable causing a broken wire. Test ROP at unit using a short cable. Try both J8 and JCOM in case there still is no communication when wired to J8. If still no communication, read the next section to do one more last test.

Check for communication attempt

From the main control board you are able to look at data streams for anyone of the 3 serial ports. We can use this to determine if the ROP at least is getting some message through to the main control board. Start up the unit in Service Mode. Go to the Main Menu (1) and then Service (6) – Network (3) – Console (2). Use arrow keys to select port. Port D is RS-485 on J8 and Port C is RS-485 on JCOM. Select 1 to start serial port monitor console. If there is communication you should see a bunch of characters within a few seconds. You should also see them changing every few seconds. Stop by pressing 2 or the Back key. If there is no character stream them most likely the RS-485 communication chip on either the ROP or the main controller board has failed. There is no way to check which one so if you do not have a second ROP a second board to test with, there is no way to know. With our newer boards (4.1 and later) we have two RS-485 ports as discussed in this document so the chances that both communication chips have failed are very small. For these boards we will replace the ROP with a new one. For older units using a 3.1 board or older, there was only one RS-485 port so for these units we have to replace both the main controller board and the ROP.

If there is a character stream but still no communication at the ROP, check the serial port communication settings to make sure they have not been changed. See next section. Check serial port configuration settings. From the Main Menu, go to

Factory Settings (5) – Network (5) – Serial Ports (2). Then select either Port C (JCOM) or Port D (J8) depending on which terminal you are testing. User should be set to Seresco, Baud Rate to 57600, Databits to 8, Parity to None. The timer Reply Delay should be at least 500 but new recommendation is 750. The timer Invalid Data should be set to 1000.

Echo Test is by default set to Yes but you can try setting this to No to see if this will establish a connection. By default a RS-485 is echoing back every sent message back to the sender. Our controller is using this to test for a robust connection. We have however seen cases where the RS-485 communication chip partially has failed where it no longer echoes back sent messages but otherwise functions just fine. By setting the Echo Test to No we can test for this fault.

If you did any configuration change but still no communication you can try doing a System Restart to see if it this will help. Either power off unit in between or unplug ROP terminal from board to cycle the ROP. If you still are not being able to establish communication after doing these steps, we have an unknown fault and the ROP needs to be replaced. If this already is a new ROP, we need to replace the board.

ROP shows Version Mismatch

If the ROP display show Version Mismatch it means you are connecting a ROP to a unit running a software version with which the ROP is not compatible. Get a new ROP with a version compatible with the software version on the unit.

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Start-Up

⚠ **WARNING** Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout procedures to endure the unit cannot accidentally be powered. For variable frequency drives or other energy storing components, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in serious injury or death.

⚠ **WARNING** Rotating components ! During installation, testing, servicing and troubleshooting of this product it may be necessary to measure the speed of rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components perform these tasks. Failure to follow all safety precautions when exposed to rotating components could result in serious injury or death.

⚠ **WARNING** Live electrical components ! During installation, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a licensed electrician or other qualified individual perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in serious injury or death.

Pre-Startup Checklist

A complete start-up is required to ensure that all systems have been configured to ensure optimal and reliable unit operation. Final adjustments should be made when all space and water temperatures are at design conditions. The use of auxiliary or portable air heaters may be required to heat the room. Read this section thoroughly before attempting to commission the Seresco Technologies Inc. dehumidifier. Ensure that the unit installation conforms to all recommendations made by Seresco Technologies Inc. in this manual. Complete the pre start-up section of the warranty registration / start-up form provided in section *Z – Annex*.

Note : Do not use the unit as a construction site heater. Construction material will infiltrate the unit and can significantly deteriorate unit performance and lifespan.

General Checks

- Ensure that the unit has been installed on a level location
- Check to ensure all packing materials and shipping brackets have been removed from the unit
- Verify that any remote space heating coil is installed in the supply air duct (after the unit) and not in the return air duct (before the unit)
- Ensure supply and return air ducts have been connected
- Verify damper operation and alignment, as damper blade position may change in shipment
- Check that air filters are clean, in place and positioned properly
- Remove any debris from the unit interior
- Close and secure all unit access door in the airstream
- Inspect electrical connections to the unit and unit controllers
    - Connections should be clean and secure
    - Compare the actual wiring with provided wiring diagrams
    - Reference the controls section of this manual for more details on factory mounted controls
- Leave this manual with the unit

Fan/Motor-Related Checks

- Ensure that fan assembly braces have been removed
- Rotate all fan wheels manually to confirm they turn freely in the proper direction
- Inspect fan motor and bearings for proper lubrication

Coil-Related Checks

- Ensure coil and condensate drain piping connections are complete
- Check the piping and valves for leaks. Open and close the valves to check operation
- Remove all foreign material from the drain pan
- Test the drainage and prime the P-trap by pouring water into the drain pan

Note : For units with water cooled air conditioning. The use of untreated or improperly treated water in coils may result in scaling, corrosion, erosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required.

Electrical Checks

- Check nameplate for power requirements and confirm that it matches the available power supply
- Voltage must be within ±10% of nameplate voltage. Verify that all field wiring matches provided wiring schematics. Inspect and tighten all field and factory wiring
- Leave power on and allow 24 hours of crankcase heater operation before attempting start-up.
- Ensure that the control wiring has been installed to the outdoor condenser / cooler if applicable
- Ensure all peripheral controls and sensors are connected and wired correctly

Pool Water Checks

- For units with pool water heaters only. Energize the circulating pump and establish water flow. Inspect the piping and repair any water leaks. Ensure that control wiring has been installed between the unit and the auxiliary pool water heater

Refrigerant Line Checks

- Verify that all service valves in the refrigeration lines are open
- Leak test (with halogen leak detector) all factory and field piping. Shipping and handling may have caused refrigerant leaks inside the dehumidifier

Start-up Procedure

All appropriate fields and sections of the warranty registration / start-up form should be completed. A proper start-up requires that the unit be run and monitored in all modes of operation at design conditions with the operating data recorded on the forms provided in section *Z – Annex*. Seresco's service technicians review every report to ensure all aspects of the system are functioning within normal operating parameters. Carefully follow the process detailed in the start-up report. If the space is not at design conditions at the time of start-up, a follow-up visit for final adjustment and balancing is required.

Mail or fax the completed warranty registration / start-up form back to Seresco to validate your unit's warranty See section *Y – Warranty* for further information. If you do not have a start-up report, call Seresco for a new copy or download a PDF version from www.serescodehumidifiers.com.

Note : Warranty is void unless, upon start-up of the unit, the "Warranty Registration and Start-up Report" is completed and sent to the factory within one week of initial start-up. This report will also register the compressor warranty with the compressor manufacturer.

Power Turned ON (or after power failure)

When powered, the blower begins to operate immediately and will do so continuously. The microprocessor initiates a self-test and runs systems diagnostics algorithms. If all systems check out, the microprocessor used sensor feedback to resume normal unit operation. The microprocessor will confirm that the compressor has been off for at least five minutes using its internal clock.

The CommandCenter keypad display should show current sensor readings and the main menu. For keypad layout and function refer to section *G – Nx Series Unit Operation*, under CommandCenter operation.

Check time and set-points by doing the following:

- Current Time: **1-Main Menu, 4-User Settings, 2-Date&Time**
- Set-points: **1-Main Menu, 1-Setpoints**

Check remote operator panel response, if applicable, and record all data on the start-up forms.

Check Component Operation

To force component operation, do the following:

- **1-Main Menu, 6-Service, 2-Forced Contacts**
- To activate, switch component status from **OFF/No** to **ON/Yes**, to switch off do the reverse

Ventilation components (under **2-Ventilation**) to check include (as applicable) the main blower, condenser fan(s), damper(s), exhaust fan(s) and purge fan(s) (also known as exhaust 2). Ensure proper, uninhibited rotation of the fans, check and record amperage readings on the start-up forms.

For heating components (**3-Heating**), first check whether the space heating option is staged or modulating. To activate modulated heating, select the **modulated** option, then use the **up** and **down** arrows followed by **Enter** to select the desired

heating load. To activate **Staged heating**, enable stage 1 (and stage 2 if applicable).

> **Note :** for units equipped with a gas water boiler and modulated valve, activate stage 1 first to start the circulating pump(s), then activate modulated heating as described above.

> ⚠ **CAUTION** Ensure that the main blower is on while testing the heating system or compressor.

Enabling the Compressor(s)

Compressors are disabled after testing at the factory to prevent their accidental non-supervised start-up. To start the compressor(s):

- **1-Main Menu, 5-Factory Settings, 4-Compressor, 1-Enabled** and switch to **Yes** to enable the compressor

Ensure that design conditions (return air temperature and relative humidity) are established, the main blower is running, and a gauge set is attached to verify compressor rotation and performance. Make sure that gauge readings correspond to unit pressure sensor readings shown on the keypad.

Forced Modes

Check unit condition under different modes of operation by doing the following:

- Set forced demands: **1-Main Menu, 6-Service, 1-Forced Demands, 1-Compressor 1**

To run the unit in dehumidification mode, choose **Dehumidify** and check pressure, temperature readings. Allow the compressor to run for 20-30 minutes and ensure that the superheat is within 19-22°F, making adjustments if required. Record all data.

To run the unit in dehumidification and pool heat modes, select **Pool Heat** while the compressor is still running. Make sure that design water flow is provided to the unit. Record actual water flow GPM and pressure.

Confirm and record superheat data. Deselect dehumidification and pool heat modes by selecting **OFF/No** and allow the

compressor to pump down.

To run the unit in air conditioning mode, select **2-A/C**, then air conditioning and pool heat modes. Follow procedure outline above, recording all data on the start-up forms.

For units with two or more compressors, complete the process for each compressor individually, and finally both together.

To restart the unit in normal mode, do the following:

- **1-Main Menu, 6-Service, 6-Commission, 2-Commissioned** and switch to **ON/Yes**
- **1-Main Menu, 3-System, 3-System Restart, 1-Yes**
- After the system shuts down and restarts, select **Normal Mode**

Submit the completed start-up report by Fax: **1-613-741-3375** or e-mail: service@serescodehumidifiers.com.

Factory Start-up Supervision

Seresco Technologies Inc. factory start-up supervision can be purchased with the equipment. A factory start-up includes several key services:

- The expertise of a factory-trained technician who will supervise the commissioning of the equipment.
- This Seresco representative will assist the installing contractor with filling out the Start-Up Report.
- They will also inspect the installation to make sure that the dehumidifier has been properly integrated with the rest of the equipment on the job site.
- Finally, they can train the maintenance personnel to operate and service the equipment if necessary.

A factory start-up does not include installation assistance. The installing contractor is responsible for ensuring that the system is ready for start-up when the Seresco representative arrives. If the system is not ready, Seresco reserves the right to bill the contractor for a second visit. When the installing contractor is confident the system will be ready, contact the Seresco Sales representative to schedule the start-up. Please call at least two weeks before the desired start-up date to prevent scheduling conflicts.

Items required for Start-Up

- A service technician and a fully stocked service vehicle.
- A set of refrigerant manifold gauges.
- Air balancing equipment (magnehelic differential pressure gauge).
- Volt/Amp/Ohm meters.
- A digital thermometer w/clamp on sensors.
- A halogen leak detector, R410a or R407c and a scale.

Items to be Completed Before Start-up

- Refrigerant leak-check (with halogen leak detector) and inspect the unit for internal concealed damage.
- Level and support the dehumidifier properly.
- Install the outdoor air duct filters and damper (if applicable).
- Install the condensate P- trap and drain lines and prime P-trap.
- Pipe the remote condenser fan pressure controls to the condenser hot gas lines (if applicable).
- Evacuate and leak-check the remote condenser line set (if applicable).
- Tighten all electrical connections and verify that the line voltage is correct for the unit.
- Install all controls and verify that all field wiring matches the schematic.
- Fill and heat the pool and room to design conditions.
- Install the pool water piping and a flow meter (if applicable). Purge all air from pool lines.
- A complete system air balancing.

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NP Series Unit Operation

Sequence of Operation

The standard sequence of operation for a Seresco dehumidifier is relatively simple. Whenever the compressor operates, the evaporator is always dehumidifying and cooling the return air. The heat removed from the air at the evaporator, as well as the heat from the compressor's action, must be rejected to one of three heat sinks; room air, pool water (if applicable) or outdoors. The microprocessor will direct the heat to where it is needed based on room conditions.

Dehumidification Mode

Dehumidification Mode occurs when the space requires dehumidification. The air discharged from the unit is drier and approximately 20°F warmer than when it entered. This mode engages when the return air relative humidity is above the set-point. The hot gas is condensed in the reheat coil, returning heat to the room air.

Air Conditioning Mode

Air Conditioning Mode occurs when the room air requires only cooling, all of the refrigerant hot gas is directed outdoors, either directly (outdoor air cooled condenser, etc) or indirectly (water cooled, outdoor air fluid cooler, etc). The air discharged from the unit has been dehumidified and is about 15°F cooler than when it entered. In stage one air conditioning, the compressor starts (if not already operating in dehumidification mode), the evaporator sees nominal air flow, and the hot gas condenses at the outdoor air cooled condenser or equivalent. In stage two air conditioning, the system performs as in stage one air conditioning, except the evaporator bypass damper closes to maximize air moving across the evaporator coil.

Pool Heating Mode

If the unit is in dehumidification or air conditioning mode, there is free heat available in the system to heat the pool water. This pool water heating mode engages if the pool water drops below the set-point. Water heating alone will not start the compressor, thus there must be a pre-existing demand for this mode to operate. When in pool water heating mode, the pool water control valve directs hot refrigerant through the coaxial heat exchangers. This system also acts as a refrigerant subcooler, increasing system efficiency and capacity. If there is no other demand for the compressor to operate, the microprocessor sends a signal to the external auxiliary pool water heater (provided by others). No additional controls are required to operate the auxiliary water heater.

Continuous Blower Operation

Units have been factory wired for continuous blower operation. This helps prevent air stratification and stagnation. This is also required to ensure that the sensors produce accurate data.

Compressor Start Sequence

All Seresco NE/NP Series units have a pump down sequence and anti-short cycle timer. When a demand requires the compressor to operate, the following sequence occurs: blower operation is confirmed by the microprocessor and anti short cycling timer (ASCT) sequence completes, the pump down solenoid valve opens, the low pressure safety switch will activates at 25psig, and the compressor starts.

Space Heating Option

The microprocessor control is designed to control a space-heating coil mounted locally or remotely. When the room temperature drops below the set point, the microprocessor will send a signal to start the heating coil.

Purge

Used for complete air changeover in pool environment after super-chlorination. Return air damper is completely closed, resulting in all air from the pool space being exhausted, while fresh air is brought in from the outdoors. Also used for economizer cooling when conditions warrant.

Heat Recovery

The energy a room loses from the exhaust air, as a result of the fresh air requirements, can represent up to 50 % of the room's heating requirements. Approximately 50-60 % of this exhaust heat can be recaptured with a heat recovery loop. By doing so it supplies heat to warm the cold outside air and can provide generous energy savings to the room to reduce heating costs. During freezing weather conditions the outdoor air can provide much of the dehumidification required, and minimizing the time the compressors run offsetting some of the running electrical costs.

Our typical energy recovery loop consists of two glycol coils: one in the outside air intake and the other in the exhaust air-stream. The coils are connected in counter-flow closed loop piping system. The system comprises an inline fluid cooled pump, an air separator, and in some larger systems a pressure tank and pressure gauge. By circulating a glycol mixture,

typically 30%, we can extract enough heat from exhaust air stream to preheat the outside air intake to about 50-60% of the room temperature. Extracting more heat from the exhaust air stream is possible but would also lead to possibly freezing of the exhaust air and would require a more complex and costly system of frost prevention. Keeping our effectiveness down to 50-60% reduces initial cost and keeps things simple.

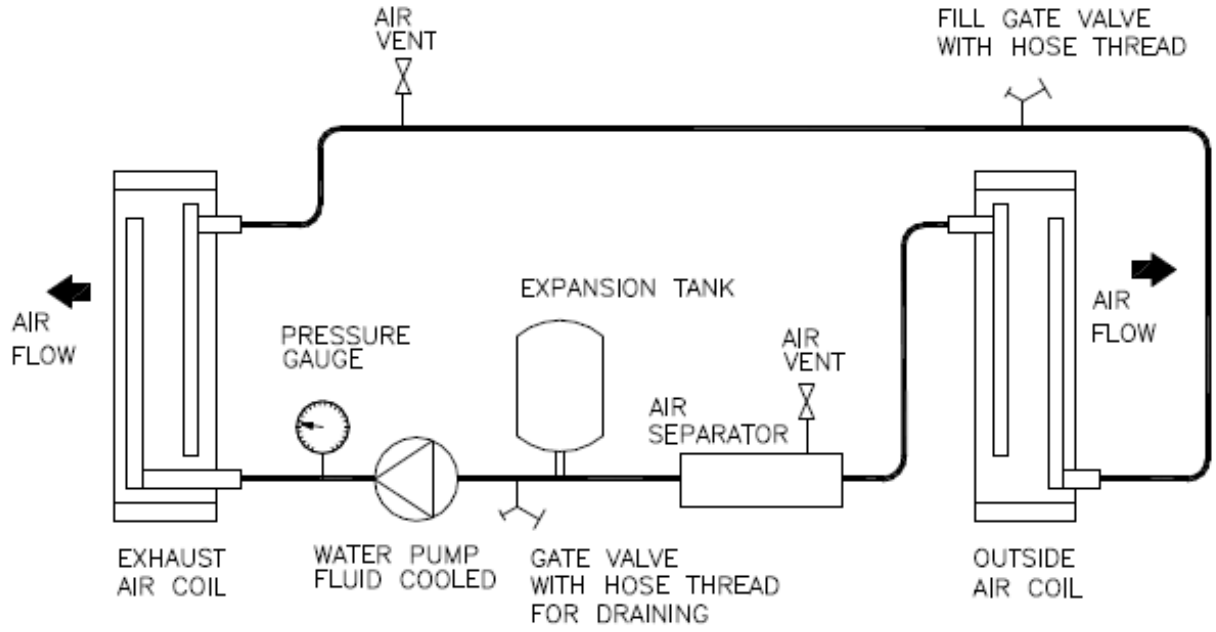

Figure G-1. Heat recovery loop

Types of Solutions

We recommend and typically use ethylene glycol in our systems but local codes or building requirements may specify propylene glycol mixtures. The higher viscosity of propylene means a stronger pump is required or a lower circulating water flow will occur. So it is best to contact the factory if a switch from one glycol to another is preferred. It is important to use corrosion inhibitors and in the correct amount. When adding the corrosion inhibitor solution please followed the suggested instructions for the required quantity of fluid. Seresco strongly recommends that the glycol, if not already mixed, be mixed with distilled water. Topping up and pressurizing the system can be done with clean tap water. In municipalities where local tap water has a high mineral content, Seresco strongly advises the use of distilled water to prevent "sludging" and premature failure.

Annual testing should be made of the fluid solution to ensure the adequate glycol concentrations and corrosion inhibitor protection. Freeze point and PH test strips are available from your local plumbing supply house. It is important to ensure the solution will not freeze in the case of a power failure or that it is not acidic and will corrode the system. The glycol mix should be replaced after 5 years or when quality is deem unsatisfactory and cannot be restored.

Filling or Refilling the Glycol Loop

When filling the system please insure all air has been removed. Air in the system will cause corrosion and improper functioning of the pump. Do not run the pump for any extent time with air in the system it will foam up the glycol and this will make it difficult to remove the air. If this happens pressurize the system with some water to about 15 PSI and let stand overnight. Before restarting vent as much air as possible running the pump for very short burst to move the water and any possible air bubbles around slowly to the vents. For systems with a pressure tank keep the system under a 10-15 PSI positive pressure to ensure no air get into the system. If the system is left dry for any period of time electrically disable the pump to avoid it possible coming on without fluid in the system. Please keep record, near the unit, the type of glycol used; ethylene or propylene, the two types should not be mixed. Keep careful track of what percentage by volume was used and when it was changed. And the last time it was checked.

CommandCenter Operator Panel – Software Version 5.3.2

Introduction

This document describes the different features of the Operator Panel (installed locally or remotely) that is used with the NP Series of dehumidification units.

Startup Screens

When the unit start up you will see the following menu screen. A 60 second timer is started and if no selection is made before timer expires, Normal Mode will automatically be selected.

1. Normal Mode
2. Service Mode

Selecting Normal Mode will take you to the main sensor screen. If the voltage monitor fault signal is not active, blower will start right away. If voltage monitor fault signal is active, 60 second timer will continue running. When timer expires, the voltage monitor fault signal will be checked again. If signal now is cleared, the blower will start, otherwise blower will remain off and there will be a voltage monitor fault alarm.

Navigation Mode and Edit Mode

The menu system implements two different modes where the keys have different meanings. Navigation mode is used to navigate the menu system and Edit mode is used when changing data.

The following keys are used in Navigation mode:

- Keys 1-3 (and 4-6) are used to select a menu item. If there are more than 6 menu items, menu items will be listed 1-3 on every screen.
- Up and Down arrows are used to scroll up or down a page. Arrows at the top right corner indicates which direction you can scroll. If no more than 6 items either down or up arrow will be displayed (no scrolling "around corner"). If more than 6 menu items, both arrows will be displayed and you can scroll "around the corner". Obviously no arrows when 3 or less menu items.
- Back key takes you back to previous menu level.

- Enter key has a special meaning. From any menu screen it will take you directly back to the main screen (the sensor screen). If you now press the Back key it will take you back to the screen where you were before pressing Enter. On the sensor screen you can still use the Up and Down arrows to scroll up and down a page and the Back key will still take you back to where you were before pressing Enter. If you press 1 however (Main Menu) the back shortcut is lost (it's not a true history list yet).
- Key 3 on the sensor screen is another hidden feature. It will toggle sensor readings between displaying values with a one decimal prevision and no precision. Default is no precision. This applies to all temperatures and the humidity level.

To enter Edit mode you select the number key corresponding to the data item you want to edit on a navigation screen with data items. To indicate that you are in edit mode, the data value is highlighted.

The following keys are used in Edit mode:

- Keys 1-3 are not used.
- Up and Down arrows are used to scroll up and down in the value list. More info about different types of data items later in this document.
- Back key takes you back to navigation mode and cancel any changed data. Data is with other words not saved when you press the Back key.
- Enter key will save the data and most of the time take you directly back to navigation mode (covered under data types).

Data Types

Most of the data (properties) you can change are changed using values in a selection list. You use the Up and Down arrows to scroll up and down in the selection list. You can scroll "around the corner". For data items with only two selection items (e.g. Yes/No), you can use either the up or down key to toggle between the two values.

Most Integer values are edited as lists with a min and max range. The value might also be restricted to be changed in specific increments (e.g. 5, 10, 15, 20, …). In a few rare cases integer values are entered one digit a time. When entering edit mode, the integer value will be displayed as a five digit zero padded number. To enter a number less than 5 digits, leave the first digits at 0. Press Enter until all digits are set.

Date and Time values are edited in a special way. Using date as an example, when entering edit mode, the year (or last two digits of the year) will be highlighted. Use Up and Down arrows to change year. When done, press Enter. Now the month

will be highlighted and you change it in the same way. Press Enter again and the day is highlighted. Pressing Enter a final time will save the new date. Pressing Back at any time when editing the date will cancel the change operation and take you back to navigation mode.

A time value is entered in the same way as a date. An IP address is entered the same way as date and time except that you edit one digit at a time. Passwords are entered one digit at a time pressing Enter after each digit.

Information Messages

Certain actions and certain conditions will generate information messages. Information messages will popup over current menu screen. The message can be cleared by pressing either key 1 or 2. Key 1 will clear current message and key 2 will clear all queued messages. Messages can be of three different types. Short, Long or Confirmed. A short message will be cleared automatically after 3 seconds (default). A long message will be cleared after 5 minutes (default). A confirmed message will never be cleared (unless there is a system restart) and have to be cleared by pressing key 1 or 2.

Menu Structure Quick Reference

The root menu screen is where you see all the sensors and one menu option that takes you to the Main Menu. Some menu selections are dependent on current unit configuration and will not always be displayed. These menu selections are marked as Optional. For data menu items, the default value is displayed in the summary.

1. User Settings
    - 1.1. Setpoints
        - 1.1.1. Temperature
        - 1.1.2. Humidity
        - 1.1.3. Pool Temp
        - 1.1.4. Pool 2 Temp
        - 1.1.5. Freezestat
        - 1.1.6. Purge Temp
        - 1.1.7. Economizer
        - 1.1.8. Disable A/C
        - 1.1.9. Heat Recovery
    - 1.2. Date & Time
        - 1.2.1. Date

1.2.2. Time
1.2.3. Zone
1.2.4. Date Format
1.2.5. Time Format
1.3. System Info
1.4. Occupied Schedule
1.4.1. Empty
1.4.1.1. Day(s)
1.4.1.2. On
1.4.1.3. Off
* 1.3.2 – 1.3.3 same as 1.3.1
1.5. Filter Schedule
1.5.1. Date
1.5.2. Interval
1.6. Display
1.6.1. Backlight
1.6.2. Temp Unit
1.6.3. Reset Display
1.7. User Password
1.7.1. Enabled
1.7.2. Password
1.7.3. Retention
1.8. Remote OP * Only visible on Remote OP
1.8.1. Version Info
1.8.2. Port Configuration
2. Alarms
2.1. Current Alarms
2.2. Alarm Log
3. System Control
3.1. Start/Stop Blower
3.2. System Restart
3.3. System Status
3.3.1. Environment
3.3.2. Compressor
3.3.3. Ventilation

- 3.3.4. Network
- 3.3.5. Serial Ports
- 3.3.6. Control Status
- 3.4. Purge

4. Factory Settings

- 4.1. Ventilation
  - 4.1.1. Options
    - 4.1.1.1. Purging
    - 4.1.1.2. Economizer
    - 4.1.1.3. Eco Offset OA
    - 4.1.1.4. Eco Offset DP
    - 4.1.1.5. Fire Reset
  - 4.1.2. Blower
    - 4.1.2.1. Normal Speed
    - 4.1.2.2. Max Speed
  - 4.1.3. Timers
    - 4.1.3.1. Stabilize
    - 4.1.3.2. Freezestat 1
    - 4.1.3.3. Freezestat 2
    - 4.1.3.4. No Airflow
    - 4.1.3.5. Purge Time
    - 4.1.3.6. Dirt Filt Dly
- 4.2. Compressors
  - 4.2.1. Configuration
    - 4.2.1.1. Compressor 1
      - 4.2.1.1.1. Available
      - 4.2.1.1.2. Resource ID
    - 4.2.1.2. Compressor 2
      - 4.2.1.2.1. Available
      - 4.2.1.2.2. Resource ID
  - 4.2.2. Options
    - 4.2.2.1. Enabled
    - 4.2.2.2. Design
    - 4.2.2.3. Refrigerant
    - 4.2.2.4. OACC Type

- 4.2.4.13. OACC Deadband

4.3. Space Control

- 4.3.1. Room Temperature
  - 4.3.1.1. Deg*Min On
  - 4.3.1.2. Deg*Min Off
  - 4.3.1.3. Setpoint Adj
- 4.3.2. A/C
  - 4.3.2.1. Operation
  - 4.3.2.2. Deg*Min On
  - 4.3.2.3. Deg*Min Off
  - 4.3.2.4. Sensor
- 4.3.3. Heating
  - 4.3.3.1. Type
  - 4.3.3.2. Deg*Min On
  - 4.3.3.3. Deg*Min Off
  - 4.3.3.4. Sensor
  - 4.3.3.5. Mod Step Size
  - 4.3.3.6. Stage 2 On
- 4.3.4. Humidity
  - 4.3.4.1. Deg*Min On
  - 4.3.4.2. Deg*Min Off
  - 4.3.4.3. Temp Offset
  - 4.3.4.4. High Humidity
- 4.3.5. Deadbands
  - 4.3.5.1. Air Temp Low
  - 4.3.5.2. Air Temp High
  - 4.3.5.3. Humidity Low
  - 4.3.5.4. Humidity High
  - 4.3.5.5. Heat Rec High
  - 4.3.5.6. SA Temp Low
  - 4.3.5.7. SA Temp High

4.4. Pool Control

- 4.4.1. Pool 1
- 4.4.2. Pool 2
- 4.4.3. Contact 2

4.4.4. 100% Heating
4.4.5. Heat Sink
4.4.6. Min Out Temp
4.4.7. High Flow Dly
4.4.8. HP Pool Fault
4.4.9. HP Relief
4.4.10. Waterflow Rec
4.4.11. Max Trips Time

4.5. Network
4.5.1. TCP/IP
4.5.1.1. DHCP
4.5.1.2. IP
4.5.1.3. Mask
4.5.1.4. GW
4.5.1.5. DNS
4.5.1.6. Link Monitor
4.5.1.7. Start Device
4.5.1.8. Reboot Device
4.5.1.9. Reboot Delay
4.5.2. Serial Ports
4.5.2.1. Port B (RS-232)
4.5.2.1.1. User
4.5.2.1.2. Baud Rate
4.5.2.1.3. Databits
4.5.2.1.4. Parity
4.5.2.1.5. Flow Control
4.5.2.1.6. Reply Delay
4.5.2.2. Port C (RS-485)
4.5.2.2.1. User
4.5.2.2.2. Baud Rate
4.5.2.2.3. Databits
4.5.2.2.4. Parity
4.5.2.2.5. Echo Test
4.5.2.3. Port D (RS-485)
4.5.2.3.1. User

4.5.2.3.2. Baud Rate
4.5.2.3.3. Databits
4.5.2.3.4. Parity
4.5.2.3.5. Echo Test

4.5.3. WebSentry
4.5.3.1. Enabled
4.5.3.2. Use DNS
4.5.3.3. IP
4.5.3.4. Port
4.5.3.5. Comm Interval
4.5.3.6. Comm Segment
4.5.3.7. Stay Alive

4.5.4. BACnet [Optional]
4.5.4.1. Enabled
4.5.4.2. Interface
4.5.4.3. Device ID
4.5.4.4. Port
4.5.4.5. Heartbeat

4.5.5. Modbus [Optional]
4.5.5.1. Device ID

4.5.6. LON [Optional]
4.5.6.1. Enabled
4.5.6.2. Interface
4.5.6.3. Refresh Rate

4.6. Inputs/Outputs
4.6.1. Sensor Type
4.6.1.1. HP
4.6.1.2. LP
4.6.1.3. Superheat
4.6.1.4. HP 2
4.6.1.5. LP 2
4.6.1.6. Superheat 2
4.6.1.7. Return Air
4.6.1.8. RA Humidity
4.6.1.9. Outdoor Air

4.6.3.8. LP 2
4.6.3.9. Superheat 2
4.6.3.10. Suct Temp 2
4.6.3.11. Discharge 2
4.6.3.12. Evap Temp 2
4.6.3.13. Return Air
4.6.3.14. RA Humidity
4.6.3.15. Outdoor Air
4.6.3.16. OA Humidity
4.6.3.17. OA Dew Point
4.6.3.18. Supply Air
4.6.3.19. Exhaust Air
4.6.3.20. Reheat Temp
4.6.3.21. Pool In
4.6.3.22. Pool Out
4.6.3.23. Pool 2 In
4.6.3.24. Pool 2 Out

4.6.4. AO Polarity
4.6.4.1. Modulated Heat
4.6.4.2. Blower Speed
4.6.4.3. Head Press 1

4.6.5. Digital Inputs
4.6.5.1. Blower On/Off
4.6.5.2. Compressors
4.6.5.3. Space Heater
4.6.5.4. Occupied
4.6.5.5. Pool 1 On/Off
4.6.5.6. Pool 2 On/Off
4.6.5.7. A/C Enabled
4.6.5.8. Emergency Heat
4.6.5.9. A/C Override
4.6.5.10. Heat Override
4.6.5.11. Freezestat
4.6.5.12. HP 1
4.6.5.13. HP 2

4.6.7.3.2. Compressors
4.6.7.3.3. Space Heater
4.6.7.3.4. Occupied
4.6.7.3.5. Pool 1 On/Off
4.6.7.3.6. Pool 2 On/Off
4.6.7.3.7. A/C Enabled
4.6.7.3.8. Emergency Heat
4.6.7.3.9. A/C Override
4.6.7.3.10. Heat Override
4.6.7.3.11. Freezestat
4.6.7.3.12. No Airflow
4.6.7.3.13. Dirty Filter
4.6.7.3.14. Pump Fault
4.6.7.3.15. Exhaust 2 OL
4.6.7.3.16. Heat Rec OL
4.6.7.4. Digital Outputs
4.6.7.4.1. Heat Recovery
4.6.7.4.2. OACC
4.6.7.4.3. OACC 2
4.6.7.4.4. Pool 2 Compr
4.6.7.4.5. Pool 2 Aux
4.6.7.4.6. System Status
4.6.7.4.7. Network Dev

5. Service [Optional]
5.1. Force Contacts
5.1.1. Reset All
5.1.2. Ventilation
5.1.2.1. Blower
5.1.2.2. Blower Speed
5.1.2.3. OA Damper
5.1.2.4. Exhaust Fan 1
5.1.2.5. Exhaust Fan 2
5.1.2.6. Heat Recovery
5.1.3. Space Heating
5.1.3.1. Heat Stage 1

5.1.3.2. Heat Stage 2
5.1.3.3. Modulated Heat
5.1.4. Pool Heating
5.1.4.1. Pool 1 Compr
5.1.4.2. Pool 2 Compr
5.1.4.3. Pool 1 Aux
5.1.4.4. Pool 2 Aux
5.1.5. Compressor 1
5.1.5.1. Contactor
5.1.5.2. Pump Down
5.1.5.3. Compr Pump
5.1.5.4. OACC
5.1.5.5. OACC2
5.1.5.6. Head Pressure
5.1.5.7. More Reheat
5.1.5.8. Less Reheat
5.1.5.9. Bypass Open
5.1.5.10. Bypass Close
5.1.6. Compressor 2
5.1.6.1. Contactor
5.1.6.2. Pump Down
5.1.6.3. Compr Pump
5.1.6.4. OACC
5.1.6.5. OACC2
5.1.6.6. Head Pressure
5.1.6.7. More Reheat
5.1.6.8. Less Reheat
5.1.6.9. Bypass Open
5.1.6.10. Bypass Close
5.2. Network
5.2.1. Ping
5.2.2. Console
5.3. Clear Alarm Log
5.4. Clear All Logs
5.5. Commission

5.5.1. Tested

5.5.2. Commissioned

Menu Structure Description

This is a more detailed description of each menu item.

1. User Settings

1.1. Setpoints : If user password has been enabled, you will need to enter the password before you can change any setpoint.

1.2. Date & Time : In this section you set system time properties. You can set the date, time and time zone. You can also set what date time format that should be used. Date is always edited in Year-Month-Day syntax and the time is always edited in 24-hour clock format not matter what the format settings are. Time zone can be set to -3:30, -4:00 to -10:00 and GMT time. The following date formats are supported: Y-M-D, D/M/Y, M/D/Y and Full. The last format will be spelled out as Jan 1, 2006. Clock is either a 12 or 24-hour clock. Note that if the unit is connected to the Internet, you do not need to set the clock. The clock will automatically be synchronized with a time server. Time zone and date/time formats still needs to be set.

1.3. System Info : The System Info screen lists some useful information when troubleshooting the system like Software and Board version, current IP and MAC address and optional configuration settings.

1.4. Occupied Schedule : If user password has been enabled, you will need to enter the password before you can change the schedule. You can enter up to 3 scheduled items. Each item determines when the room is Occupied by specifying a start time and a stop time. You also specify which day of the week the scheduled item applies (Monday-Sunday, Workdays, Weekends or All). If there are conflicting items then the priority goes to day items (Monday-Sunday) followed by Workday and Weekends and last All. Use this to your advantage by specifying a default schedule using All and then add a schedule item for days where the default does not apply (e.g. Weekends, Sunday).

1.5. Filter Schedule : Use the filter schedule to determine how often there will be a Dirty Filter alarm reminding you that all filters should be replaced. Date shows the next date a Dirty Filter alarm will be tripped. You can manually change this date to any date you like. Interval specifies number of months until next Dirty Filter alarm after the alarm has been cleared. Note that the alarm will not be cleared on a system restart. You have to clear the alarm from the

active alarms list. When cleared, the date for next alarm will automatically be changed to a date using this interval and the current date.

1.6. Display : Use Backlight to enable/disable the keypad backlight. Use Temp Unit property to set temperature unit to be used in the system (Celsius or Fahrenheit). Reset Display controls how long the operator panel will stay idle at a menu screen before being returned to the main sensor screen.

1.7. User Password : Here you can enable user passwords (disabled by default). You can also change the user password and set for how long the user password protected menu items should stay open after they have been unlocked (retention time).

1.8. Remote OP : This menu selection is only visible on a remote OP (operator panel connected to the board using a serial port). Under version info you can see the software version of the remote OP as well as the minimum main board software version required to be able to communicate with a main board. Port Configuration is used to configure the remote OP end of the serial port interface. Baud Rate sets the speed of the connection. Echo Test defines if we will do an echo test every time we transmit data over the port. Normally all data should be echoed back and therefore adding the echo test enable us to have one more test to ensure data was transmitted with no errors. However, if there is a minor hardware problem with the port chip, this will cause the port not to work at all. Disabling the echo test might enable us to still use the port even with the hardware error. Reply Delay defines for how long we will wait for a reply message before considering it a communication fault.

2. Alarms

2.1. Current Alarms : The current alarm lists shows all alarms that have not been cleared. You can clear an alarm by selecting the alarm using number key and then pressing the Enter key to clear the alarm. Note that some alarms are tied to a physical device that automatically will clear the alarm when device clear the fault condition. You can still clear this alarm from the alarm list but the alarm will trip right away if the device has not cleared the fault.

2.2. Alarm Log : The alarm log lists all alarms since the alarm log last was cleared (from the Service menu). Most recent alarm at the top. The top line shows the date for selected alarm. Use arrow keys to select an alarm. Selected alarm is indicated by an arrow in the left margin. The alarm log will scroll one alarm at a time rather than a page at a time. If pressing the up key when the first alarm is selected, alarm log will be refreshed.

3. System Control

3.1. Start/Stop Blower: Start and stop main blower. Note that the blower might not come when turning it on. There can be an alarm condition preventing it from starting (e.g. blower overload, voltage monitor fault or firestat). When selecting Normal Mode at startup, the blower will automatically be started. To not run the blower you will have to go to this menu and turn blower off. There might be up to a minute delay before blower starts due to the voltage monitor fault signal not being cleared. When selecting Service Mode at startup, the blower will not be started.

3.2. System Restart : When selecting System Restart you will see a confirmation screen where you have to confirm that you want to restart the system. Pressing 2 or the Back button will cancel this request.

3.3. System Status : The status screen shows the status for different internal system components. Its main purpose is for troubleshooting a running system where the information here can be passed back to tech support. The status feature has been grouped into 6 areas. Environment shows status for the environment control (Air Temp, Humidity and Pool Heat) including air heater and pool heater. The compressor area shows the status for all compressors in the system. The ventilation area shows the status of the different ventilation related components (including heat recovery). The network area shows the status for network related components. The serial ports area show serial port status. The control status area shows internal control parameters.

3.4. Purge : By selecting the Purge menu item you will get to the Purge activation screen. At this screen you can set the length of time the system will purge and start/stop purging. At the bottom of the screen you can see the current status. It can show Off, PendingPurge or number of minutes remaining of ongoing purge. PendingPurge means that we are waiting for the compressor(s) to stop before we can start purging. The compressors have been notified that they need to stop. Note that you only can start purge if Purge has been enabled under Factory Settings.

4. Factory Settings : To reach these settings you need to enter a service password.

4.1. Ventilation

4.1.1. Options : Purging enables and disables the purging feature. The Economizer property determines how the economizer feature will be used. Setting it to None disables the feature, setting it to A/C enables it for cooling only, setting it to Dehum enables it for dehumidification only and sertting it to Full enables it for bot cooling and dehumidification. Eco Offset OA is an offset below return air setpoint. The return air setpoint minus this offset is the highest outdoor air temperature at which the economizer will start. The minimum outdoor air temperature is

controlled by the economizer setpoint. Eco Offset DP is an offset below return air dew point. The return air dew point minus this offset is the highest outdoor air dew point at which the economizer will start. Fire Reset property controls how the system will recover after a Fire Alarm. When set to auto, system will automatically go back to normal once the alarm is cleared. When set to Manual, a System Restart is required to make the system operational again.

4.1.2. Blower : Normal Speed sets the normal main blower running speed as a percentage of full capacity. Max Speed sets the max main blower running speed as a percentage of full capacity. Blower will only switch to max speed if unit is equipped with a high speed override input.

4.1.3. Timers : Stabilize is how long time system will wait for sensors to stabilize after blower has started. No other components will start until sensors are stable. Freezestat 1 is the Freezestat 1 alarm debounce timer. Freezestat 1 is tripped when supply air drops below the freezestat setpoint. Freezestat 2 is the Freezestat 2 alarm debounce timer. Freezestat 2 is tripped if supply air drops stays below the freezestat setpoint after Freezestat 1 has been tripped. No Airflow property is the No Airflow debounce timer. Purge Time is for how long time purge will run when started. Setting it to 0 means purge will run until manually stopped. Dirt Filt Dly property is the Dirty Filter debounce timer if the dirty filter switch has been enabled.

4.2. Compressors

4.2.1. Configuration : Up to two compressors can be configured. The following parameters can be set for each one. Use Available property to make compressor available as a resource. Use Resource ID to determine in which order compressors will be used.

4.2.2. Options : Use Enabled property to enable or disable usage of compressors. Compressors are disabled by default when unit is shipped and still in Commission mode. The Design property defines what type of compressor circuit design is used in this unit. Classic design uses Reheat and A/C valves to control reheat temperature. Protocol design uses a modulating reheat valve. Refrigerant sets the type of Refrigerant used in the system. This will affect some of the pressure levels used to control the compressors. OACC Type sets the type of OACC used in the system. The LowHigh option is a 2 stage configuration where the two stage contacts are exclusive of each other (i.e. for stage 2, stage 1 contact is off and stage 2 contact is on). Compare this with the stage 2 option where both contacts are on for stage 2 fan speed. Emergency Heat determines if compressor can be used has a space heater. When set to Yes, compressor will start on a heating demand. Note that the space heater will be disabled when this options is enabled. The Superheat property defines the minimum superheat level. Reheat Steps defines the number of steps it takes to move reheat valve from fully closed to fully opened. Divide reheat time with reheat steps to see how many seconds the valve

will move every time there is a demand for more or less reheat. Reheat Time is the time it takes the reheat valve to move from fully closed to fully opened. Reheat Calib timer controls how long the reheat valve will continue moving after it reaches either fully closed or fully opened. This is used to calibrate valve position to avoid any drifting. BPD Steps defines the number of steps it takes to move bypass damper from fully closed to fully opened. BPD Turn Time is the number of seconds the bypass damper will move in one step. Number of steps times this timer is the total time it takes the bypass damper to move from fully closed to fully open. BPD Stabilize is the number of seconds the bypass damper will wait after moving one step before allowing another request to move damper. Use the Partial Mode property to control if unit will be using partial heating mode for compressors in a classic design unit. Partial heating mode is when both the reheat and the A/C valves are open. The Partial Transit property should only be changed after talking to a Seresco engineer. It is used to solve a problem where both the A/C and Reheat solenoids are open and one of them closing but not closing properly. Set this property to 0 to disable this feature. PD At Start determines if compressor will do an initial pump down at startup if LP is above start level. PSI Monitor is a timer used for monitoring low and high pressure. Low pressure is monitored to not rise too high and high pressure is monitored to not drop too low. A check is made every time this timer expires. If either low or high pressure indicates a bad pressure 7 times in a row, a compressor fault alarm will be tripped.

4.2.3. Timers : Min Startup timer controls the minimum time compressor will wait before starting compressor even if minimum Low Pressure level is met. Stabilize timer controls for how long time the compressor will run before we enable the Low Pressure alarm. During this time the system will still monitor for a low pressure level reaching vacuum levels using the low pressure transducer. Min Run Time timer controls the minimum time the compressor has to run before it can be stopped. Min Stop Time control the minimum time the compressor has to be stopped before being started again after a normal stop. Alarm Stop control the minimum time the compressor has to be stopped before being started again after an alarm. The Anti Block timer is used when deciding if the compressor should be started even if the low pressure has not reached minimum level. It is also used decide for how long we will wait for the low pressure to reach its shutoff level before stopping the compressor anyway. Superheat Dly timer is the superheat debounce timer. Superheat alarm condition must persist for this amount of time before an alarm is tripped. SucTemp Dly timer is the suction temperature debounce timer. High suction temperature alarm condition must persist for this amount of time before an alarm is tripped. Oil Fault timer is the time after compressor startup before oil alarm detection is enabled.

4.2.4. Pressures : LP Vacuum pressure setting controls at what Low Pressure level compressor will trip on Low Pressure alarm while compressor is in stabilizing mode. LP Alarm pressure setting controls at what Low Pressure level compressor will trip on Low Pressure alarm once it is past Stabilize state. LP Start pressure setting controls at what minimum Low Pressure level compressor will start. Note that there also are some timers controlling when compressor can start (Min Startup and Anti Block). LP Normal pressure is the normal low pressure runtime level.

This pressure in conjunction with the LP Deadband is used to determine when bypass damper will open or close. LP Deadband defines the deadband around the LP Normal pressure. When LP drops below deadband, bypass damper will close, when rising above deadband, bypass damper will open. LP Max pressure setting controls the maximum Low Pressure level we allow the compressor to run at. Pressure has to stay above this level for a short while and the trend not showing any tendency to recover. HP Min pressure setting controls the minimum High Pressure level we allow the compressor to run at. Pressure has to stay below this level for a short while and the trend not showing any tendency to recover. HP Alarm pressure setting controls at what High Pressure level compressor will trip on High Pressure alarm. HP Relief pressure setting controls at what High Pressure level compressor will engage HP relief mode. HP OACC Min pressure setting controls at what High Pressure level Outdoor Air Condenser will start (minimum capacity or stage 1). HP OACC Max pressure setting controls at what High Pressure level Outdoor Air Condenser will run at maximum capacity (max capacity or stage 2). OACC HP Change determines the sensitivity of the OACC head pressure control valve. Valve will only be adjusted if HP has changed at least as much as specified with this property since the last adjustment. OACC Deadband is used to determine when to turn off an OACC stage. OACC Min or Max pressure level minus deadband is when OACC stage will be turned off.

4.3. Space Control

4.3.1. Room Temperature : The Deg*Min On/Deg*Min Off properties controls for how long the control logic will wait until increasing or decreasing the supply air setpoint. Setpoint Adj determines number of degrees to increase or decrease the supply air setpoint every time setpoint is changed.

4.3.2. A/C : The Operation property determines when A/C mode will be used throughout the year. Default is All Year. Set it to Disabled to completely disable the A/C feature. Set it to Summer Only to only use A/C mode in summer time. Summer time is determined by the Disable A/C setpoint. Outside air temperature has to be above this temperature for it to be considered summer. The Deg*Min On/Deg*Min Off properties controls for how long the control logic will wait until adding or removing a Cooling stage after a stage has been added/removed. The Sensor property determines how cooling will be controlled. Supply means that space temperature will be controlled by using supply air sensor only. Return means that the space temperature will be controlled by the Room Temperature controller using the return air sensor.

4.3.3. Heating : Type sets heating type. The Deg*Min On/Deg*Min Off properties controls for how long the control logic will wait until adding or removing a Heating stage after a stage has been added/removed. The Sensor property determines how heating will be controlled. Supply means that space temperature will be controlled by using supply air sensor only. Return means that the space temperature will be controlled by the Room Temperature controller using the return air sensor. Mod Step Size defines the increments for the modulated signal when heater is configured as

modulated heater. Stage 2 On controls when the second stage digital output will be turned on for a modulated heater. First stage is turned on when heating is started.

4.3.4. Humidity : The Deg*Min On/Deg*Min Off properties controls for how long the control logic will wait until adding or removing a Dehumidification stage after a stage has been added/removed. Temp Offset property is the offset from the return air temperature where dehumidification will not operate. If temperature is outside this range, dehumidification ill not come on even the humidity is above the high deadband. However, if dehumidification already is running, the will keep on running even if the temperature moves outside the range. High Humidity property is the offset above setpoint at which dehumidification will start no matter what the return air temperature is.

4.3.5. Deadbands : This section is used to configure setpoint deadbands. Space temperature setpoints can be set in 1/10th of a degree.

4.4. Pool Control : Use Pool 1 and Pool 2 properties to enable pool heating. Pool heating can be enabled for compressor heating only, auxiliary heating only or to use both resources for heating. Contact 2 defines how the pool 2 heating contact will be used. Default means it will be used for pool 2 heating. Stage 2 means it will be used for units where pool heating coil has been divided into two stages. Use bypass if this software version is used on an older unit where a bypass valve was used. 100% Heating defines how pool heating can use compressor. Set it to Yes to let pool heating run compressor with only pool heating valve open. Heat Sink determines at what reheat level pool heating can be used as a heat sink feature. This property only applies to protocol design units. Min Out Temp defines the minimum pool out temperature offset above pool in temperature when pool is heated using compressor pool heating coil. If below this level, a high water flow alert will be tripped but pool heating will continue. High Flow Dly is a high water flow alarm debounce timer. Pool out temperature has to be below minimum temperature level for this amount of time before alarm is tripped. HP Pool Fault is a timer used in determining if a HP trip was caused by turning compressor pool water heating. If HP trip occurs within this time frame, HP trip will be tagged as being caused by pool water heating. There will also be a water flow fault alarm. HP Relief is a timer that defines for how long pool heating will run in HP relief mode before going back to normal mode. Waterflow Rec property controls for how long a waterflow alarm will stay active and pool heating will remain in recovery mode. After this time, the pool heating control will go back trying to heat pool again if there still is a demand for it and compressor is running. Note that auxiliary pool heater will still be used when recovering from a waterflow alarm. Max Trips Time determines in what time frame you are allowed to have 3 water flow fault alarm trips without locking out pool water heating.

4.5. Network

4.5.1. TCP/IP : Set DHCP to use Dynamic IP and set it to No to use Static IP. In the first case, the IP, Mask, GW and DNS property will be set automatically and you will be able to see what they are set to (as soon as a network connection has been detected and a DHCP server has been found). IP is the systems IP address. Mask is the network mask. GW is the IP address for the gateway. DNS is the IP address for the Domain Name Server. Link Monitor is how often the system will check that there still is a physical network link. If you unplug the Ethernet cable, it can take up to this time before it is detected. Start Device is a timer that is used at startup of a network device. The Network Device digital output has to be assigned to a terminal. Regular network setup will not start until this timer expires. Reboot Device is the number of minutes the network can be down until unit will reboot the network device (if assigned to a terminal). Reboot means turning off Network Device output and then turning it back on. Reboot Delay is how long the network device will stay off on a reboot request before turning it back on again.

4.5.2. Serial Ports : Port properties are the same for all ports except where noted. User defines the user of the port. Default is Seresco which means the port is opened for inbound traffic using the Seresco protocol. Other users are other protocols like LON and Modbus as well as 3&4 compressor slave board communication. Baud Rate, Databits and Parity defines your common serial port configuration parameters. Flow Control defines if hardware flow control should be used. Can only be configured for the RS-232 port (port B). Echo Test defines if we will do an echo test every time we transmit data over the port. Normally all data should be echoed back and therefore adding the echo test enable us to have one more test to ensure data was transmitted with no errors. However, if there is a minor hardware problem with the port chip, this will cause the port not to work at all. Disabling the echo test might enable us to still use the port even with the hardware error. Reply Delay defines for how long we will wait for a reply message before considering it a communication fault.

4.5.3. WebSentry : These properties controls WebSentry connection. Set Enabled to No to disable WebSentry. You can do this if you temporarily want to disable WebSentry connections. Also you should do this if a unit is not connected to the Internet to avoid unnecessary attempts trying to detect a physical network link. Use DNS controls if DNS should be used to resolve the IP address associated with the hard coded WebSentry server name. You should set this to No if there seems to be a problem resolving the IP address and instead use the IP property to define the IP address. IP is the WebSentry server IP address. Use this property to configure the IP address or to see what it is if DNS is enabled. Port is the WebSentry port to connect to. This is configurable in case the port will change in the future. Comm Interval is how often the system will try to connect to the WebSentry server between disconnects. Comm Segment is how often the system will try to connect to the WebSentry server between disconnects when we can not transmit all non-sent data in one session. Stay Alive is how long the TCP connection will stay active from the last time a message was received from the WebSentry server. Normally the WebSentry server should disconnect before this time.

4.5.4. BACnet : These properties controls BACnet connections and are only available if the CommandCenter has been loaded with BACnet support. Set Enabled to ReadWrite to enable BACnet for read and write support. Set it to ReadOnly to only let BACnet interface read data from unit (no changes allowed). Set Interface to BACnet interface type. Currently only Ehernet and IP is supported. Use Device ID to set a unique device ID for unit on the BACnet network. Port can be used to change the default port setting. The Heartbeat timer is used when BACnet interface is controlling some sensors. If no message is received within this time, unit will rollback to system installed sensors. Setting timer to 0 means that timer will not be used.

4.5.5. Modbus : Use these properties to configure Modbus communication.

4.5.6. LON : Use these properties to configure LON-Modbus gateway communication. Set Enabled to ReadWrite to enable LON for read and write support. Set it to ReadOnly to only let LON interface read data from unit (no changes allowed). Use Interface to define which serial port to use for gateway communication. Refresh Rate defines how often unit will check gateway for changed data.

4.6. Inputs/Outputs

4.6.1. Sensor Type : The sensor types controls how an input signal is translated into a value. Note that some sensors that are available under sensor calibration are not available under sensor types. These are temperature sensors that never should be disabled and for which there are no other sensor type that can be used except Thrm. The following sensor types are available:

Thrm, thermistor sensor to be used for all temperature sensors.
GSRA, Greystone return air sensor.
GSRH, Greystone RH sensor.
RH, General RH sensor.
SG145, Saginomiya transducer, max 145 psi.
SG200, Saginomiya transducer, max 200 psi.
SG435, Saginomiya transducer, max 435 psi.
SG500, Saginomiya transducer, max 500 psi.
JC100, Johnson Controls transducer, max 100 psi.
JC500, Johnson Controls transducer, max 500 psi.
BMS, Building Management System controlled sensor.
Calc, Calculated sensor.

4.6.2. Sensor Usage : The sensor usage option determines how a sensor is being used. There are four values that can

be set. None will disable sensor. It will not be used for control and will not be displayed on sensor screen. Dflt is the default setting for most sensors. It means that that sensor will be used as determined by the system. For sensors used for control, sensor will used both for control and it will also be displayed on sensor screen. Set sensor to View to disable sensor for control but still have it displayed on sensor screen. Set sensor to Ctrl to not show it on sensor screen but still have it enabled for control.

4.6.3. Sensor Calibration : All sensor calibration values are changed the same way. You use the up and down arrow to change the value to a few steps above or below 0.

4.6.4. AO Polarity : These options are used to set the polarity of the analog outputs. 0V means that device is off or closed at 0 volts. 10V means that device is off or closed at 10 volts.

4.6.5. Digital Inputs : These options are used to enable/disable some digital inputs. Several of them are optional inputs that can be used to control certain components and features of the system.

4.6.6. Sample Rates : The AI Samples, AI Samples 2 and AI Sample Rate properties are used to fine tune the way analog inputs are read and translated into sensor readings. A sensor reading is the average of all read samples. AI Samples 2 is used for all compressor related sensors and AI Samples 1 is used for all other sensors. The Refresh Sens and Refresh Sens2 properties determines how often sensors will be read. Sensor reading will also be generated when there is a change in the sensor reading. Refreshing sensors on a regular basis prevents us from getting stuck with no sensor readings for a long time when the system is stable. Refresh Sens2 is used for pool water related sensors and Refresh Sens is used for room conditions sensors. The DI Samples and DI Sample Rate properties are used to fine tune the way digital inputs are read and translated into alarms or other inputs. A digital input will signal a state change when all samples are the same and are different from current saved state.

4.6.7. Assignments : These settings are used to assign an input or output signal to a physical input/output on the board. The internal input/output id is being used to reference the physical input/output. A wiring diagram is needed to determine the board terminal.

5. Service : To reach these settings you need to enter a service password.

5.1. Force Contacts : Force Contacts is used to test all the Analog and Digital Outputs. This overrides any internal control of corresponding features and is just a way to physically test that a contact is working. Selecting Reset All will reset all contacts back to the Off position.

5.2. Network

5.2.1. Ping : The ping feature is used to test the IP network. To use ping, set the ping address and then select start. The first result line shows the IP addresses you are pinging from (units IP address) and the second line will show 4 time values in milliseconds. Ping will send 4 messages to specified address and measure in milliseconds how long it will take to get a reply. If no reply within 5 seconds the result will show Fail for that particular ping request.

5.2.2. Console : The console is currently only used to monitor serial port messages. Select the serial port to monitor by using the arrows keys. Select 1 to start monitoring. To stop/pause messages, you can press key 2 anytime. Press Enter to clear the screen. Select back top stop console or to go back and select another serial port.

5.3. Clear Alarm Log : Selecting Clear Alarm Log will display a confirmation screen where you have to confirm that you want to clear the alarm log. Pressing 2 or the Back button will cancel this request.

5.4. Clear All Logs : Even though you only can look at the alarm log from the control panel, there are several other logs used as well. These logs can be read using WebSentry if the unit is connected to Internet. Use Clear All Logs to clear all the logs and not just the alarm log.

5.5. Commission : When control board initially is configured loaded with the latest control software, unit is prepared to make it safe and easy to use when testing unit before delivery to customer. When test completed, the Tested option is changed to Yes and can never be changed back again. When unit has been tested, the compressor Enabled property will be changed to No. When Commissioned option still is set to No, unit will start up in service mode. It is not possible to start the unit in Normal Mode. The blower can be started anytime but to enable the compressors and to be able to change the Commissioned option, a factory password is required. When changing Commissioned to Yes, all the logs will be cleared and the unit will do a system restart. Now at startup you will see the normal startup screen with 2 selections, Normal Mode and Service Mode. The Commissioned option can be changed back to No if needed.

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Routine Maintenance

⚠ **WARNING** Disconnect all electrical power, including remote disconnect, and discharge all energy storing devices before servicing. Follow proper lockout procedures to ensure the power cannot be accidentally energized. Failure to follow provided safety warnings and labels could result in serious injury or death.

⚠ **WARNING** When it is necessary to work with live electrical components, have a licenced electrician or other qualified persons perform the required maintenance.

⚠ **WARNING** Danger or moving mechanical parts, high voltage power, elevated pressure and temperature ! When performing maintenance activities, lock out the unit to prevent accidental start-up. When service is required, call a qualified refrigeration mechanic.

Routine Maintenance Checklist

Seresco Technologies Inc.'s products are built for dependable and safe operation with minimum maintenance. Periodic maintenance is required, however, to ensure continuous safety and maximum operating efficiency. Suggested maintenance operations are listed in the table below with the recommended service intervals. Please note that these are general guidelines and should be adjusted accordingly to match facility operating conditions.

Table 1. Routine Maintenance Requirements

Frequency	Maintenance Operation
Weekly	Observe unit weekly for any change in running condition and unusual noise
Monthly	Clean or replace air filters if clogged or dirty
	Verify that all set-points are correctly programmed as specified by the facility operator
Quarterly	Inspect and clean drain pans
	Tighten electrical connections if required
	Check and tighten, if requires, pool water hose clamps and sensor mounts
	Inspect coils for dirt build-up
	Check that the P-trap is primed (filled with water). It is good practice to to pour some water into the drain pan to ensure that the P-trap is primed and operational
	Check and lubricate motor bearings. Refer to the motor manufacturer's instructions
	Check outdoor air louvres for accumulation of dust and clean as required

Yearly	Inspect the unit casing for corrosion. If damage is found, clean and repaint the affected surface with a rust-resistant primer
	Clean the fan wheel(s) and motor shaft(s)
	Inspect and clean drain pans
	Check damper operation
	Inspect electrical components, wiring and insulation
	Rotate the fan wheel(s) and check for obstructions and rubbing
	Lubricate motors as directed by motor manufacturer
	Check gasket condition on all doors to ensure an airtight seal
	Check for loose external or internal parts, paying careful attention external components
	Check bolts on compressors, motor mounts, unit bases and coils and tighten if required
	Verify that the airflow around the remote condenser or dry cooler is unobstructed

Component Maintenance

Filters

Replace filters when dirty. Check filters located in main filter wall, outside air intake and exhaust fan opening. Filters should slide out of their tracks without difficulty. Replace with filters of equivalent size and rating. See section *Z - Annex* for filter sizes and quantities.

Drain Pans

⚠ **WARNING** Hazardous chemicals ! Cleaning agents can be highly acidic or alkaline. Handle all chemicals carefully and use appropriate personal protective equipment (PPE). Refer to the cleaning agent manufacturer's Materials Safety Data Sheet (MSDS) for safety and handling information. Failure to follow all safety instructions could result in serious injury or death.

Note : Do not walk on the drain pans. Doing so will cause damage and impair drainage.

To clean drain pans:

1. Disconnect all electrical power to the unit
2. Remove any standing water
3. Scrape solid foreign material off of the drain pan and vacuum to remove particulate matter

4. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA approved sanitizer designed for HVAC use. Immediately rinse with fresh water to prevent corrosion
5. Allow to dry completely before putting the unit back into service. Dispose of all contaminated materials

Impellers / Fans

To clean fan blades:

1. Disconnect all electrical power to the unit
2. Scrape solid foreign material off of the fan blades and vacuum to remove particulate matter
3. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA approved sanitizer designed for HVAC use. Immediately rinse with fresh water to prevent corrosion
4. Allow to dry completely before putting the unit back into service. Dispose of all contaminated materials

Motors

Inspect fan motors periodically for excessive vibration or temperature. For bearing lubrication and other maintenance activities, see manufacturer's literature provided in the appendix.

Coils

⚠ **WARNING** Hazardous pressures ! Coils containing refrigerant under pressure must not be cleaned using a solution over 150 °F. Failure to follow these safety precautions could result in coil bursting, which could result in serious injury or death.

To clean coils:

1. Disconnect all electrical power to the unit
2. Wearing the appropriate personal protective equipment (PPE), use a soft brush to remove loose debris from the coil
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and / or system ductwork
4. Mix a high quality coil cleaning detergent with water according to the manufacturer's instructions
5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high-pressure

sprayer is to be used:

a) Maintain minimum nozzle spray angle of 15 degrees
b) Spray perpendicular to the coil face
c) keep the nozzle at least 6 inches from the coil
d) Do not exceed 60 psi

6. Spray the leaving side of the coil first, then the entering air side
7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water
8. Straighten any coil fins that have been bent during the cleaning process
9. Confirm the drain line is clear
10. Replace all panels and parts and restore electrical power to the unit
11. Dispose of all contaminated materials

Insulation

Note : Microbial growth ! Wet interior insulation can become an amplification site for microbial growth (mold), which may cause odours and damage to the equipment and building materials. If there is evidence of microbial growth on the interior insulation, the insulation should be removed and replaced prior to operating the system.

Accumulated dirt and other organic matter exposed to water or extended periods of high relative humidity (60 percent or higher) can support microbial growth, which must be removed to prevent the unit from becoming a contaminant source. If evidence of contamination exists, determine and eliminate the cause, remove the contamination and sanitize the affected area.

Refrigerant Charging Procedure

Repairs or maintenance on refrigerant containing components or pipes will require reclaiming and then charging the unit. The procedure outlined below demonstrates the correct method for charging refrigerant loops on Seresco Technologies Inc.'s dehumidifiers.

Pressure Testing Procedure

Perform a pressure test before vacuuming and charging the system to ensure that there are no leaks.

- Pressure test the pipes for at least four hours using nitrogen at 350 psi when using R-407C refrigerant or

500 psi when using R-410A refrigerant

- Perform soap tests at all joints
- If the pressure drops by more than 10 psi over the four-hours, then the test has failed
- Evacuate the nitrogen

Vacuuming Procedure

It is crucial to vacuum the system to ensure that there will be no contamination when the unit is charged with refrigerant. The whole system or only a portion can be put under vacuum. Make sure to replace the oil in the vacuum pump before every use.

- Fasten hoses as shown in the attached diagram
- Attach a Micron gauge to monitor vacuum levels in the system.
- The vacuum should be below 500 microns. Check the gauge after 15 minutes, it should not have increased by more than 15 – 20%.
- If 500 microns is not reached after 1 hour, redo the pressure test. Soap test everything including the hose connections.
- Break the vacuum by opening the rotolock valve on the receiver or by charging the receiver using 5 – 10 lb of refrigerant.
- Close the tank, all solenoid and ball valves before removing the vacuum gauge and vacuum hose.

Units 8 tons and larger feature a removable core filter drier. In order to clean the core only a portion of the system needs to be evacuated.

- Close the rotolock valve on the receiver outlet and pump down all the refrigerant in to the receiver
- Remove, clean and replace the filter dryer core
- Draw vacuum from the line as shown in the diagram.

Repeat the bullet points listed above, but note that vacuum may only reach 600 – 800 Microns due to small refrigerant leaks through the rotolock valve at the receiver. There are several possible causes which could prevent the vacuum pump from reaching 500 Microns. Ensure that all hose connections are tight. Contaminants in the lines could cause the vacuum pump to reach full vacuum very slowly. Traces of refrigerant could also be impeding the vacuum.

Charging Procedure

- Check the unit label for the proper refrigerant type (R-407C or R-410A)
- Turn the stem on the receiver rotolock counter-clockwise to "back-seat" the stem (close the rotolock)

- Partially connect the charging hose and purge the line before fully connecting the hose

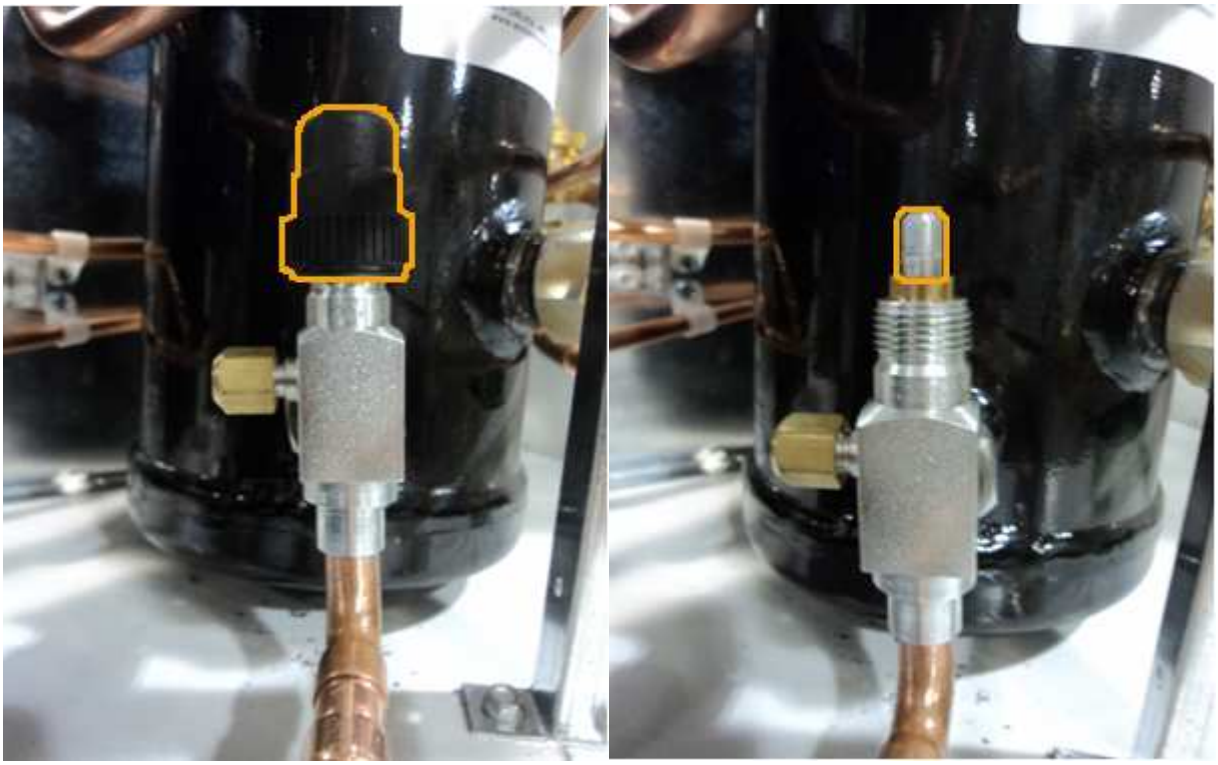

Figure H-1. Rotolock valve with cap (left, highlighted) and without the cap exposing the stem (right)

If charging the unit:

- "Front seat" the stem by turning clockwise.
- Charge the system with the required amount of refrigerant. Watch the pressure closely because the system will charge quickly.
- Back seat the stem again before disconnecting disconnect the hose.

If only charging 5-10lb to break the vacuum:

- Turn the stem counter-clockwise to the halfway position.
- Charge the required amount of refrigerant. This will be very quick.
- Back seat the stem again before disconnecting the hose.

Outdoor Air Balancing

The amount of outdoor air introduced into the unit varies by season. Seresco Technologies Inc. provides manual balancing dampers with all outdoor air equipped units. Even if a unit mounted motorized air damper is installed, the manual damper will also be installed. There are two types of manual dampers depending on the size of the unit.

NE/NP-004 to -016 and NE/NP-2xx Series

Note that the Outdoor Air filter box contains two perforated sliding plates as shown in **Figure H-1**. Adjust the manual damper by turning the black knob to slide one plate along the other. Align the holes for maximum air flow or misalign the holes to block or dampen the airflow.

Figure H-2. Outdoor Air Filter Box

For NE/NP/NV-018 to NE/NP/NV-120

To adjust the outdoor air balance, first remove the filters. The manual damper consists of two perforated plates, one of which slides on top of the other. To adjust the air balance loosen all the screws and slide the plate to obtain the desired setting. Re-tighten all the screws.

Figure H-3. Outdoor Air Filter Box

Figure H-4. Outdoor Air Tightening Screw (highlighted)

Mechanical Vestibule Access Steps

The service steps displayed in **Figure H-5** act as a step ladder giving easy access to the mechanical vestibule. The best place to store the steps is on right of the vestibule between the compressor stand and the unit wall. Place them into the slots at the front of the vestibule stand as shown and make sure they are secure before stepping on or placing any weight on them.

Figure H-5. Compressor stand step

Note that for unit models NE-018 to NE030 there is a lower step placement available on the outside of the unit as shown below.

Figure H-6. Mechanical vestibule step on base rail

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Troubleshooting

This section is intended to be used as a diagnostic aid only. For detailed repair procedures, contact Seresco Technologies Inc.'s service department.

Two user-friendly service tools are critical in troubleshooting any issues with Seresco's dehumidification systems: the WebSentry remote monitoring software and automated system alarm logs. WebSentry remote monitoring software allows the collection of comprehensive unit performance data and space conditions via the Internet. This option is default on all units with CommandCenter controls and has proven to be an extremely effective service tool. To function correctly, this requires the unit to be connected to a local network with Internet access. System Alarm Logs detail information on alarm situations, including the type of alarm, faults and time to help service technicians narrow down possible cause(s) of the problem(s).

Troubleshooting Steps

1. Collect information from unit owner/maintenance team about problem(s)
2. Refer to the provided Installation, Operation and Maintenance manual and the unit label for additional information
3. Perform a basic visual inspection of the unit
4. Check the System Alarm Log for the latest alarm(s)

> ⚠ **CAUTION** If the unit is powered down: before powering up the system again, ensure that it is safe to do so.

5. Refer to the list of common problems provided below for probable causes and suggested solutions
6. If you require further assistance, please feel free to contact Seresco's Service and Technical Support (STS) department

Contacting Seresco Service and Technical Support (STS)

The next availible service technician can be reached by phone at (613)-741-3603, followed by 2, or by e-mail at service@serescodehumidifiers.com. When contacting Seresco STS, please have the following information on hand:

- Your name
- Service company name
- Phone number
- Seresco unit serial number (8 digit number on the unit label i.e. 11011800)

WebSentry Connection Troubleshooting Guide

Ethernet cable connected and operating

First thing to check is that the Ethernet cable has been hooked up properly and is operating normally. Use the LED's by the Ethernet socket to verify this. The LED's are the two white square components on the mini board with the Ethernet socket.

The one closest to the socket should be solid green and indicates a solid physical connection. Unplug cable at the unit or at the other end and this LED will go blank.

If cable is connected at both end and the LED still does not lit up, it is very possible the Ethernet socket itself is faulty. Connecting a network cable between a laptop and unit can determine that indeed the Ethernet socket is faulty and that there is not a faulty router port or faulty cable.

The second LED is yellow and will blink when there is communication.

Firewall settings

The unit will try to connect to the WebSentry server once a minute using port 1030. Server name is websentry.seresco.net. Use ping to determine IP address associated with this IP address if this is needed for any firewall settings.

If network has a firewall, port 1030 must be open for communication or at least for the IP assigned to unit or the MAC address for the unit or to/from the Seresco domain name or server IP.

The MAC address can be found under System Info using the local keypad. '*' translates to 00:90:C2 so that if MAC shows *:D1:2A:49 the full MAC address is 00:90:C2:D1:2A:49.

Checking network communication status

Check status of network communication from the local keypad. From main screen select Main Menu (1) - System (3) - System Status (5) - Network (4).

TCP/IP should be saying Up. If it says PendingUp, there is a problem with establishing a physical connection. Network cables and router/switch needs to be checked. Ensure light over port where unit is connected is lit up.

WebSentry will say Idle when waiting to connect to server (connects once a minute). When connected you will either see Receive or Send. If it shows Connecting for several seconds it means there is a problem establishing a connection to the server. Usually it will toggle between Idle and Connecting when a proper connection is not established. Check TCP/IP and WebSentry configuration settings.

Checking TCP/IP configuration settings

Unit can be configured for dynamic or static IP. From main screen select Main Menu (1) - Factory Settings (5) - Network (5) - TCP/IP (1). If asked for a password at Factory Settings selection, enter 813.

DHCP set to Yes is for dynamic IP and if set to no, unit is configured for Static IP.

Dynamic IP

You should see an IP and Mask assigned (* means 255). This is assigned by the router to which the unit is connected. On second page you should also see IP's assigned to GW (Gateway) and DNS.

If any of these IP's are not assigned properly (showing 0.0.0.0 for instance), there is a problem with the router assigning IP info to the unit.

Static IP

IP, Mask, GW and DNS all have to be configured correctly or unit will not be able to communicate with the WebSentry server. This information should be known by the IT group managing the local network.

Check WebSentry configuration settings

By default the unit is configured to use DNS (Domain Name Server) to translate the Seresco domain name to the appropriate WebSentry IP address. Before software version 4.8.0, domain name www.seresco.net was used. Starting from version 4.8.0, domain name websentry.seresco.net is used.

If the IP is changing between an IP address and 0.0.0.0, there is a problem with the domain name lookup. In this case you can try to configure a static IP for the WebSentry server.

Change Use DNS to No and then change the IP address to IP of websentry.seresco.net (currently 97.74.200.218).

Testing Internet access from unit

Unit has a Ping feature that can be used to test that unit can connect to any IP address on the local network as well as to any IP over Internet.

To use the Ping feature you have to start the unit in Service Mode. From main screen select Main Menu (1) - System (3) - System Restart (3) and then press Yes (1) to confirm.

When unit starts up you will have a selection menu. Select Service (2).

To access the Ping feature, select Main Menu (1) – Service (6) – Network (3) – Ping (1). If asked for a password at Service selection, enter 813.

To test connection to WebSentry server, make sure IP (selection 1) is set to 97.74.200.218. Press 2 to start Ping request.

The 3rd line shows the current IP address assigned to the unit. The 4th line will either have 4 time values or the text Fail (up to 4 times). The time values indicate number of milliseconds for Ping message to go to WebSentry server and back.

Testing Internet access and WebSentry access from unit Ethernet cable

A simple test you can do to make sure there is Internet access from the Ethernet cable connected to our unit is to connect this cable into a laptop and accessing any web site using a web browser.

If unit is configured for static IP, you should configure the laptop with the exact same TCP/IP configuration. How this is done is not covered in this document.

IMPORTANT! Make sure WiFi connection is disabled when testing Ethernet cable.

A secondary test to ensure you can communicate with the Seresco WebSentry server is to use the Telnet command to establish a connection to the server.

Open up the Command Prompt window. Enter the command:

telnet 97.74.200.218 1030

You should now see a blank screen with a prompt. Hit any two characters. The text Seresco WebSentry should now be displayed followed by Connection to host lost. This verifies that you can open up a connection to the port used by the WebSentry server and that this port is not blocked by any firewall.

If the connection failed it most likely is a firewall issue. Port 1030 must be open for communication or at least for the IP assigned to the Seresco unit.

Contact Factory

If everything in this document has been tested and everything indicates that the communication should be working, we are dealing with an unknown fault. Contact Seresco for further advice.

Warranty

General Policy

This warranty applies to the original equipment owner and is not transferable. Seresco Technologies Inc. warrants as set forth and for the time periods shown below that it will furnish, through a Seresco Technologies Inc. authorized installing contractor or service organization, a new or rebuilt part for a factory installed part which has failed because of defect in workmanship or material.

Warranty Void Unless Registered

Warranty is void unless, upon start-up of the unit, the "Warranty Registration and Start-up Report" is completed and sent to the factory within one week of initial start-up. This report will also register the compressor warranty with the compressor manufacturer.

Initial 90-day Warranty

During the first 90 days from initial start-up and prior to the completion of the 24th month from date of shipment, whichever comes first and subject to prior written approval from the factory, Seresco Technologies Inc. will provide and/or reimburse the required labour, materials, and shipping and handling costs incurred in the replacement or repair of a factory installed defective part. Only the labour required to replace the defective part is warrantied – travel time, diagnostic time, per diems, truck charges, etc. are not covered under this warranty.

WebSentry Conditional One Year Extended Labour Warranty

The factory labour warranty shall be extended for a total of 12 months from initial start-up and prior to the completion of the 24th month from date of shipment, whichever comes first and subject to prior written approval from the factory. The provided equipment must be connected and communicating to Seresco's WebSentry online control and monitoring service for the entire term of the warranty extension. Seresco Technologies Inc. will provide and/or reimburse the required labour, materials, and shipping and handling costs incurred in the replacement or repair of a factory installed defective part. Only the labour required to replace the defective part is warrantied – travel time, diagnostic time, per diems, truck charges, etc. are not covered under this warranty.

Two Year Parts Warranty

If any factory installed part supplied by Seresco Technologies Inc. fails because of a defect in workmanship or material prior to the completion of the 24th month from date of shipment, Seresco Technologies Inc. will

furnish a new or rebuilt part F.O.B. factory. No labour reimbursement will be made for expenses incurred in making field adjustments or parts replacement outside the *Initial 90-day Warranty*. Seresco Technologies Inc. reserves the right to have the defective part returned to the factory in order to determine the warranty applicability. Parts shipping and handling costs (to and from the factory) are not covered outside of the *Initial 90-day Warranty*.

Replacement Part Warranty

If a replacement part provided by Seresco Technologies Inc. under this warranty fails due to a material defect prior to the end of the *Two Year Parts Warranty* (or the end of the extended warranty period if applicable) or 12 months from date of the replacement part shipment, whichever comes first, Seresco Technologies Inc. will furnish a new or rebuilt part F.O.B. factory.

Applicability

This warranty is applicable only to products that are purchased and installed in the United States and Canada. This warranty is NOT applicable to :

1. Products that have become defective or damaged as a result of the use of a contaminated water circuit or operation at abnormal water temperatures and/or flow rates
2. Parts that wear out due to normal usage, such as air filters, belts and fuses. 2. Refrigerant lost during the parts warranty will be reimbursed in accordance to the current market price of refrigerant at the time of repair. Seresco Technologies Inc. will not be responsible for refrigerant lost from the system due to improperly installed contractor piping to the remote outdoor air cooled condenser.
3. Refrigerant coils that corrode due to improperly balanced pool chemistry or corrosive air quality.
4. Components that have been relocated from their original placement at the factory.
5. Any portion of the system not supplied by Seresco Technologies Inc.
6. Products on which the model and/or serial number plates have been removed or defaced.
7. Products which have become defective or damaged as a result of unauthorized opening of refrigeration circuit, improper wiring, electrical supply characteristics, poor maintenance, accidents, transportation, misuse, abuse, fire, flood, alteration and/or misapplication of the product.
8. Products not installed, operated and maintained as per Seresco Technologies Inc. Owner's Manual.
9. Products on which payment is in default.

Limitations

This warranty is given in lieu of all other warranties. Anything in the warranty notwithstanding, any implied warranties of fitness for particular purpose and merchantability shall be limited to the duration of the express warranty. Manufacturer expressly disclaims and excludes any liability for consequential or incidental damage

for breach of any express or implied warranty.

Where a jurisdiction does not allow limitations or exclusions in a warranty, the foregoing limitations and exclusions shall not apply to the extent of the legislation, however, in such case the balance of the above warranty shall remain in full force and effect.

This warranty gives specific legal rights. Other rights may vary according to local legislation.

Force Majeure

Seresco Technologies Inc. will not be liable for delay or failure to provide warranty service due to government restrictions or restraints, war, strikes, material shortages, acts of God or other causes beyond Seresco Technologies Inc. control.

Optional Five Year Compressor Warranty

This extended warranty must be purchased before the shipment of the unit.

Seresco Technologies Inc. will provide a replacement compressor for 60 months from the date of shipment provided the factory installed compressor fails as a result of manufacturing defect and is returned to the factory with transportation prepaid. This extended compressor warranty is subject to all the terms of the standard Seresco Technologies Inc. warranty but applied to the compressor only.

No charges attributed to the replacement of a component, except as detailed in above Initial 90-day Warranty, will be allowed unless specifically granted in writing beforehand by Seresco Technologies Inc.

Optional Five Year Airside Coil Warranty

This extended warranty must be purchased before the shipment of the unit.

Seresco Technologies Inc. will provide a replacement Airside Coil for 60 months from the date of shipment provided the failed coil is returned to the factory with transportation prepaid. This extended coil warranty is subject to all the terms of the standard NE Series warranty but applied to the coil only.

No charges attributed to the replacement of a component, except as detailed in above Initial 90-day Warranty, will be allowed unless specifically granted in writing beforehand by Seresco Technologies Inc.

This warranty is contingent to the proper maintenance of pool water chemistry including a pH of between 7.2 and 7.6 free chlorine not exceeding 2.0 ppm and combined chlorine maintained at less than 0.3 ppm. These

parameters are to be measured and recorded daily and be available for review upon request.

Optional 10 Year Airside Coil Warranty

This extended warranty must be purchased before the shipment of the unit.

Seresco Technologies Inc. will provide a replacement Airside Coil for 120 months from the date of shipment provided the failed coil is returned to the factory with transportation prepaid. This extended coil warranty is subject to all the terms of the standard NE Series warranty but applied to the coil only.

No charges attributed to the replacement of a component, except as detailed in above Initial 90-day Warranty, will be allowed unless specifically granted in writing beforehand by Seresco Technologies Inc.

This warranty is contingent to the proper maintenance of pool water chemistry including a pH of between 7.2 and 7.6 free chlorine not exceeding 2.0 ppm and combined chlorine maintained at less than 0.3 ppm. These parameters are to be measured and recorded daily and be available for review upon request.

Optional Five Year Driveline Warranty

This extended warranty must be purchased before the shipment of the unit.

Seresco Technologies Inc. will provide a replacement part for the following components:

- Supply fan motor
- Supply fan motor starter
- Exhaust fan motor
- Exhaust fan motor starter
- Pool water heater solenoid valves & valve coils
- Liquid expansion solenoid valves & valve coils
- Air-cooled condenser solenoid valves & valve coils
- Blowers

Driveline warranty exists for 60 months from the date of shipment provided the factory installed component fails as a result of manufacturing defect and is returned to the factory with transportation prepaid. This extended driveline warranty is subject to all the terms of the standard Seresco Technologies Inc. warranty but applied to the listed parts only.

No charges attributed to the replacement of a component will be allowed unless specifically granted in writing beforehand by Seresco Technologies Inc.

Unit Component Specifications

&

Component Service Sheets

Installation Instructions
NEMA - IEC
W Range

Totally enclosed fan-cooled (TEFC)
three-phase motors with squirrel cage
for low voltage, with antifriction bearings.

BROOK
CROMPTON

Introduction

All ac induction motors are designed for long life and low running costs. Careful installation and maintenance will ensure that you achieve reliable operation and optimum efficiency. For motors with specific duties, such as brake motors, single phase motors and motors installed within hazardous areas, please refer to your supplier.

Pre-installation requirements

Warning

Handling and lifting of electric motors must only be undertaken by authorised personnel. Full product documentation and operating instruction must be available together with tools and equipment necessary for safe working practice. If there are any safety concerns, do not install or attempt to operate the motor. Please contact your supplier for advice or assistance.

Receipt

Before any motor is accepted on site, it should be inspected carefully against the following checklist:

a) Check that the description on the consignment note agrees with your order specification.

b) Check that the rating, speed etc are in accordance with your requirements.

c) Check for any damage, rust, dirt, foreign substance etc. Where an instance of droppage or loss is evident or suspected, it may be necessary to unpack the goods to establish the full extent of the problem. Wherever possible, damage should be recorded, photographed and witnessed.

Report any damage to the carriers and your supplier as soon as possible, quoting the motor and/or order number and shipping reference.

d) Check that the direction of rotation, if specified, is correct. Manually turn the shaft and check for smooth, quiet rotation.

Electric motors should not be transported by rail, as vibration from this method of transport has been known to cause brinelling of bearings.

Lifting

Eyebolts, lifting lugs and lifting trunnions supplied with the motor are designed to support only the weight of the motor, not the weight of the motor and any ancillary equipment attached to it. Be absolutely sure that cranes, jacks, slings and lifting beams are capable of carrying the weight of equipment to be lifted safely.

Where an eyebolt is provided with the motor, this should be screwed down until its shoulder is firmly seated against the face of the stator frame to be lifted. Eyebolts are normally designed for a vertical lift. For lifting lug or trunnion torques, see table below:

Lifting lug bolt torques

Type			Torque	
Metric	NEMA /CSA	Bolt dia*	Nm	Lbf.FT
63	**-**	-	-	-
71	**-**	-	-	-
80	**56**	-	-	-
90	**143/5T**	-	-	-
100L	**-**	-	-	-
112M	**182/4T**	M12*	-	-
132S/M	**213/5T**	M12*	-	-
160M/L	**254/6T**	M12*	-	-
180M/L	**284/6T**	M16*	-	-
200L	**324T**	M10*	52	38
225S	**326T**	M10*	52	38
225M	**364T**	M10*	52	38
250S	**365T**	M10*	52	38
250M	**404T**	M16*	220	162
280S	**405T**	M16*	220	162
280M	**444T**	M16*	220	162
315S	**445T**	M16*	220	162
315M	**504Z**	M20*	400	295
315L	**505Z**	M20*	400	295
355S/M/L	**585/6/7Z**	M20*	400	295

* Lifting lugs secured with bolts and nuts. High tensile socket headed bolts and special square nuts must be used. Aluminum frame motors should have eyebolt firmly screwed down (without overtightening), to ensure that the collar is fully seated.

Where two eyebolts/lifting lugs are used with inclined loading, the maximum safe working load quoted on the lifting arrangement must not be exceeded.

Storage

If motors have to be stored before installation, precautions should be taken to prevent deterioration:

Environment

Depending on the site conditions, it may be necessary to create a suitable stores area to hold the motor prior to installation. Packing cases are not waterproof.

Motors should be stored in a dry, vibration free and clean area at normal ambients (-20°C to 40°C), unless other arrangements have been agreed.

Where low temperature ambient storage is anticipated, special precautions should be taken with the type of grease, no plastic parts etc to ensure trouble-free start-up.

Motors must be stored away from corrosive or chemically damaging fumes. Before placing motors into storage, machined components should be carefully inspected. Bearings and shafts are normally covered with a corrosion resistive barrier. If this coating is damaged, it should be made good. The component should be cleaned and the protective coating reapplied. Under no circumstances should rust be merely covered over.

Drain holes

Motors of frame size 160 /254T and above have drain holes fitted with drain plugs as standard. Alternatively, the drain plugs can be provided loose in the terminal box if specifically requested.

Bearings

To avoid static indentation, the storage area should be vibration free. if this is not possible, it is strongly recommended that the motors be stood on thick blocks of rubber or other soft material.

Where the exposure to some vibration is unavoidable, the shaft should be locked in position to avoid static indentation of the bearings.

Shafts should be rotated by hand one quarter of a revolution weekly.

Roller bearings may be fitted with a shaft locking device. This should be kept in place during storage.

Grease

Factory-fitted bearings use a grease with a recommended shelf life of two years. If stored for a longer period the grease may need to be replaced*. Shielded bearings have a storage life of five years and a further two years operational life following installation.

**Wash all bearing parts with a non-contaminating solvent. Lightly pack the bearings with grease applying a 25% fill by volume into the bearing and housings. Run the motor on no-load to distribute grease and reduce losses.*

Heaters

Where heaters are fitted, and the storage environment has wide humidity and temperature variations, it is strongly recommended they be energised.

Warnings should be placed on the motors to make operatives aware of the live heaters.

Insulation resistance

During extended storage, a three-monthly insulation test is recommended to avoid possible lengthy drying out periods when installing.

The insulation resistance between phases and between the phase and earth should be checked and maintained above 10 Megohm.

If a lower reading is measured, use one of the recommended drying out methods until an acceptable reading is obtained. If heaters are fitted but not energised, they should be used in future.

Installation

It is the users or certified electricians reponsibility to ensure correct earthing and protection in accordance with applicable national and local requirements and standards.

Location

Motors must be installed with adequate access for routine maintenance. A minimum of 0.75m of working space around the motor is recommended, particular attention at the fan inlet (50mm) is necessary to facilitate airflow. Ensure that there is sufficient free area in front of the air intake.

Where several motors are installed in close proximity, care must be taken to ensure that there is no recirculation of exhausted warm air, as this will reduce the effectiveness of the cooling system.

Foundations must be solid, rigid, level and where possible free from any external vibration.

Mechanical

Drain holes

Prior to installation, remove drain plugs if fitted. If any water has accumulated, the integrity of all gaskets, sealants etc should be checked. Drain plugs should be put back into place after draining.

Alignment

When the application calls for direct coupling, the shafts must be correctly aligned in all three planes. Bad alignment can be a major source of noise and vibration.

Allowance must be made for shaft end-float and thermal expansion in both axial and vertical planes. It is preferable to use flexible drive couplings.

Motors fitted with angular contact or duplex bearings, must always be run loaded.

Slide rails and slide bases

Slide rails and bases are available for all motors in the product range to provide adjustable mounting. Fabricated steel rails and bases are the standard offer as they are suitable for all relevant mounting arrangements.

Installation:

1) They must be installed on a flat surface.
2) They must have a secure location.
3) Drive and driven shaft must be parallel.

Electrical connection

Connection diagrams

The connection diagram is shown on the leaflet enclosed in the motor terminal box or diagram inside the terminal box lid and provides supply details and the required winding connection. The cables used should be capable of carrying the full load current of the motor (see motor nameplate), without overheating or undue voltage drop.

Cable terminations

All cable terminations should be tightly secured. Mains lead terminal lugs should be in face-to-face contact with the motor lead lugs and securing nuts and lockwashers screwed firmly over the connection. There should be no nuts or lockwashers fitted between the mains and motor lugs.

Wiring should be carried out or checked by a qualified electrician and equipment must be earthed in accordance with current regulations. The equipment must be correctly fused and isolated. All covers must be in position prior to running.

All fixing bolts and electrical connections should be checked and tightened if necessary after 100-200 hours of operation.

Warning

Isolate power supply to motor before commencing any routine cleaning or maintenance work.

Drying out procedures

It is preferable to dismantle the motor to the point where the rotor is removed. This is not essential but the drying out process will take longer in the assembled state. The temperature of the windings and the insulation resistance should be monitored at regular intervals. On initial application of heat, the insulation resistance will drop quickly and then start to rise slowly until level. On discontinuation of the drying process, a further rise in resistance will occur.

There are several methods which can be used:

1) Place the motor in a warm (typically 40°C), dry airstream (fan or convector heater) or in a warm oven with a temperature not exceeding 80°C. This method is preferred if the motor is dismantled.
2) Connect the motor to a low voltage* three phase supply and inject a current not exceeding 50% of the full load current into the stator winding (*approximately 10% of the line voltage). If this is carried out on an assembled motor, it is possible though unlikely that the motor will turn. If so, the rotor should be locked in position.
3) Connect two phases in parallel, and the third in series. Apply a low voltage ac or dc suply up to a maximum of 50% of full load current. The stator winding temperature must not be allowed to exceed 80°C. In practice, the frame should not be hot to the touch, to guard against internal overheating and consequent damage to the insulation.
4) Where heaters are fitted, these can be energised.

Supply

It is important that a motor is operated within the limits of its design voltage and frequency. Standard motors will operate without damage on any voltage within the range of the nameplate voltage.

The supply cables must be capable of carrying the full load current of the motor (see motor nameplate) without overheating or excessive voltage drop under starting conditions.

Grounding

All motors fitted with an grounding terminal, in or adjacent to the terminal box to enable connection to an effective earthing bond. The terminal is designed for connecting the correct size of copper earth connector. If a different material is to be used, please refer to your supplier.

An earthing bond should not be terminated under the motor fixture bolts or terminal cover screws. The ground lead could be overlooked on reconnection after maintenance.

Auxiliary electrical items

Where auxiliaries are fitted, the characteristics should be checked. Example: RTDs (Resistance Temperature Detectors), should have their resistances checked against manufacturer's figures.

Auxiliaries should be checked for continuity prior to connection to the control circuitry.

Do not apply more than 6V across the thermistor for continuity check.

Control gear

Ensure all control gear and associated metering/protection circuits have been checked fully.

It is imperative that any overload trip and emergency shutdown circuits are working correctly before the motor is energised. All covers must be in position.

Where a motor is fitted with a separately driven fan unit, the interlocks and thermal overload protection circuits must be operative.

Rotation

Before coupling the motor to the drive, run the motor briefly to check rotation.

All covers must be in place.

To reverse the direction of rotation, interchange any two incoming supply leads.

Starting

Motors are rated by the output required, the number of starts per hour, the load curve/inertia and environmental considerations.

Operating outside the contractual parameters may thermally overload the motor, eg too many starts per hour, or mechanically stress components, eg overspeeding.

Refer to starter literature for methods of start and safety precautions to be taken.

Running

After one hour of running, check the general vibration levels. If these are excessive, check alignment (and belt tensioning if belt driven).

Some initial bearing noise may be present during the running-in period. This is normal because the grease has to settle down within the bearing. This noise should disappear after a few hours of operation.

Check that the motor runs up smoothly and within the permitted run-up time. Note that repeated starting in quick succession may lead to a thermal overload of the motor.

Fitting couplings and alignment

Extreme care must be exercised in lining up couplings as misalignment can be detrimental to the shaft and bearings. For direct drives, we recommend that flexible couplings are used. Please ensure that the alignment instructions given by the coupling manufacturer are followed.

Do not at any time force in the fitting of couplings, pulleys etc. All motors are provided with a threaded hole in the drive end shaft to assist fitting and removal. A bolt should be used in this hole and a nut with a large washer used to press the coupling or pulley against the shoulder of the shaft. Care must also be taken to ensure that the motor bearings are not subjected to end-thrust caused by the two halves of the couplings being squeezed too tightly together.

Please ensure that all couplings, belts, pulleys etc are properly and permanently guarded against accidental contact while the motor is running.

Care should be taken to ensure fixing bolts are correctly tightened.

Belts drives

Please ensure that the V-belts are of the same manufacture and have the same dimensions. Also ensure that the belts are correctly tensioned in accordance with the manufacturer's recommendations. If the V-belts are not tensioned correctly, it can cause belt and pulley wear and/or shaft and bearing damage. When replacing belts, it is recommended that all belts be replaced at the same time. It is also not generally recommended to use two pole motors for belt drive applications.

Motor modifications

Warning

All modifications should be carried out by a trained operative. Do not work under suspended load and use correct lifting equipment.

Changing terminal box position (on multi-mount motors)

1) Lift motor, using eyebolt or lifting lugs provided
2) Slacken / remove the foot fixing bolts on one foot
3) Pull the foot away from the frame
4) Repeat stages 2 to 3 on the other foot
5) Lower the motor onto two pieces of timber
6) Remove the eyebolt or lifting lugs
7) Rotate the motor until the terminal box is in the correct position.
8) Refit the eyebolt or lifting lugs on the machined pads at the top of the motor (diagonally opposite corners for lifting lugs). Ensure that lifting lugs are in contact with all machined faces and that the correct bolts and nuts are used. Tighten the bolts to the correct torque.
9) Remove fan cover
10) Remove the endshield bolts at both ends of the motor.
11) Slacken drive end bearing cap or clamping screws to allow endshield spigot to disengage.
12) If grease nipples are fitted, disengage both endshield spigots and rotate the endshields through 90° until the grease nipples are at the top, or the desired position.
13) Refit endshield bolts and tighten to the correct torque.
14) Retighten the bearing cap screws at the drive end, replacing the washers under the bolt heads. Tighten screws to the correct torque.
15) Lift motor using the eyebolt hooks or the lifting lugs.
16) Strip paint from the pads where the feet are to be fitted and apply a thin film of grease for corrosion protection on bare surfaces.
17) Refit the feet in the reverse order of dismantling (steps 2 and 3).
18) Ensure the feet are fully in contact with the machined faces. Tighten all bolts to the correct torque.
19) Repeat stages 18 to 19 on the other foot.
20) Prime and paint all machined surfaces left exposed by the changes.
21) Refit fan cover with the greasing hole in the correct position (if in doubt, contact your supplier).

Note:

If drain holes were present they may now be positioned at the top of the motor.

Bearings, grease, bearing change

Grease

Regreasable bearings are pre-packed with a lithium or lithium complex based grease.

Other lithium based greases of a similar consistency would be compatible. See table below for some alternatives:

Alternative lithium complex greases

Grease	Reference	Manufacturer
Energrease	N2	Shell
Castrol	LS	Texaco
Luplex	HP	Shell
Unirex	EP2	SKF
Sovereign	EP2	
Mobilgrease	LX	
Liplex	-	
Hytex	BP	
Retinax	Castrol	
LGHT3	Century	
LC2	Esso	
LMX	Gulf	
M2	Mobil	

Where a special grease has been supplied, this will be indicated on the motor nameplate.

Regreasing

Standard regreasing facilities, where provided, are situated on the periphery of the drive end and non-drive endshields.

Grease relief is via a:

a) Diaphragm relief valve.
b) Rotating grease relief flinger.
c) Plugged grease chute.

For motors with open bearings and without grease relief facilities, the old grease must be cleaned out from time to time by removing the bearing cap and/or endshield. The bearing and housing must then be re-packed with grease and reassembled. Do not overfill the bearing housing - it should not be more than a quarter full of grease after reassembly.

Motors with sealed for life bearings usually employ a polyurea EA6 grease. These should be fitted with new bearings based on the bearing life stated in the product catalogue.

An overgreased bearing will cause overheating of the bearing with the possible escape of the grease, loss of lubrication qualities, leading to ultimate bearing failure.

Standard regreasing facilities

Type		Regreasing facility
Metric	NEMA	
63-180*	56-286	on request
200-355	324-587	standard

** Bearings are double shielded and pre-packed with grease for life*

Lubrication procedure

The following procedure should be adopted:

1) Wipe clean the grease gun fitting and the regions around the motor grease fittings.
2) Remove the grease relief plug if fitted. Some motors will have one way grease valves which should be left in place.
3) Add a small quantity of grease, approximately 4 to 10 shots depending on frame size.
4) Allow motor to run for approximately 10 minutes in order that excess grease may be expelled before refitting the relief plug. Bearings fitted with rotating grease relief or through grease valves will relieve automatically. Grease may not be expelled from the motor during filling due to internal cavities/pipes filling or relief via seals.
5) On initial start up or after relubrication, 'bearing noise' may result from the new grease moving around the bearing. This noise is normal and will disappear after a few hours of running.

Bearing change

When fitting new bearings, the parts should be lightly lubricated with grease.

The bearing should be driven onto the shaft by pressure on the inner race only using a short length of tube placed over the motor shaft.

On larger motors, it is easier to raise the temperature of the bearing using an oil bath, oven or induction heating. The temperature must be controlled to 120°C maximum. Suitable handling precautions should be taken.

The bearing should then be quickly slipped into place, ensuring that the bearing is in contact with the shaft shoulder.

When cool, ensure that the bearing is clean and charge the bearing with the recommended quantity of grease. Bearings and housings should be approximately a quarter full.

Fitting flange adaptor (where applicable)

1) If required, remove foot as detailed in terminal box position change.
2) If required, reposition terminal box and lifting lugs.
3) Clean paint off the drive end endshield spigot and remove all the plastic bolt-hole cover caps. Apply a film of non-setting jointing compound on bare machined surfaces for sealing and corrosion protection.
4) Fit flange ring onto spigot positioning fixing holes, where applicable, to provide either BS or DIN flange hole positions.
5) Bolt ring into position, using the same size socket head bolts as used on the feet. These are supplied with the flange ring kit.
6) Tighten the bolts to correct torque.

Change from ball/ball to roller/ball construction 200 - 355 ~ 324T - 586 frame

1) Isolate motor before commencing work.
2) Remove fan cover and fan.
3) Remove bearing cap screws.
4) Remove endshield at both ends.
5) Remove bearing circlips at both ends.
6) Remove preload washer at non-drive end.
7) Replace drive end ball bearing with new roller bearing and refit circlip.
8) Remove non-drive end ball bearing and inner bearing cap.
9) Fit new non-drive end inner bearing cap with shallow recess (identical to existing drive end inner bearing cap.
10) Examine existing non-drive end ball bearing and either refit or replace.
11) Refit non-drive end bearing circlip.
12) Re-pack bearings with new grease in accordance with recommendations.
13) Ensure the lip on both oilseals is greased.
14) Refit both endshields and check that:
    a) spacer O/D is the same as the bearing O/D
    b) bearing spacer supplied is fitted into the non-drive end and endshield bearing recess
    c) slots in inner bearing caps are aligned with endshield grease chutes
    d) correct location for bearing cap by the use of a stud
    e) bolts are torqued up to recommended figures

Maintenance

Ongoing maintenance

Induction motors by their very nature require very little maintenance. However a regular regime of inspection is recommended to ensure minor problems do not escalate to breakdowns. Typical intervals would be 2000 hours of operation or 3 months, whichever is the sooner.

Checklist:

- No visible damage, ie fans cracked, fan cowls bent, foot cracked etc
- No accumulation of dust or fibres on the frame or around the fan inlet
- No significant corrosion of the lifting lugs/eyebolts
- No excessive vibration
- No loose fasteners
- Cables and earth are sound
- Sealing of the motor and gland plate in good condition
- Insulation resistance adequate, imperative this is checked after a prolonged shut-down
- Regrease required, particularly large output 2 pole motors
- Bearing condition

Note:

Smoke extraction motors or motors on safety critical applications should be rewound, to the original specification, after 40,000 hours of operation. If variable speed employing unipolar switching the period is reduced to 30,000 hours and reduced again to 20,000 hours for bipolar switching. In all cases refer to your supplier.

Periodic maintenance

Remove the fan cover and the fan which is keyed, clamped, pinned or knurl located to the shaft extension. Loosen and remove bearing cover screws and endshield bolts/studs. The endshields should then be eased off their spigots.

The rotor can now be carefully withdrawn from the stator, taking care not to damage the stator bore and both stator and rotor windings.

Having dismantled the motor, maintenance can be carried out to remove all dirt. For this purpose, the use of an air line supplying dry compressed air under comparatively low pressure is best, as a high velocity airstream can force dirt into the spaces between the windings and insulation etc. Grease-removing solvents should only be used very sparingly to avoid damage to impregnating varnish or insulation.

Motors should be re-assembled in the reverse order from dismantling, remembering to ease endshields onto bearings and spigots. Do not use force. On re-assembly oilseals to mating faces should be lubricated. If oilseals are worn or damaged during dismantling then they should be replaced before continuing.

Before starting the motor, check that the rotor revolves freely. Ensure that the electrical connections are correct and terminal nuts tight (see section - *Electrical Connection*).

Spares and repairs

When ordering spares, it is important to state the motor serial number to ensure that the correct spares will be supplied.

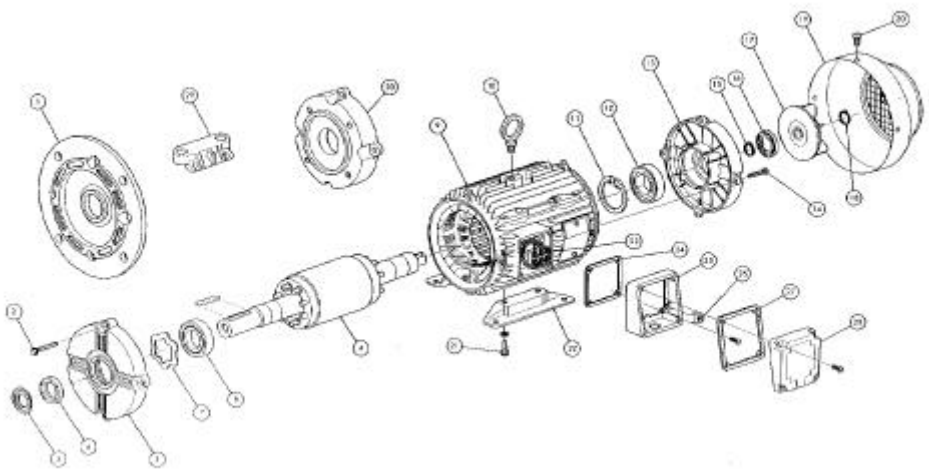
Notes

Fixing bolts, nuts, studs, screws, spacers or washers are not included with these parts and, if required, should be clearly specified on the order in addition to the part description number. The fixing duty and part description reference number for which they are required, should also be clearly stated.

Contact must be made prior to any remedial action being taken under warrantee

Please quote the motor serial number in all such cases with full details of the problem.

Exploded view of a typical standard ac motor



Ref	Part description
1	Flange endshield
2	Endshield fixing bolt
3	Drive end endshield
4	Rotor assembly
5	Flinger (when fitted)
6	Drive end oil seal (when fitted)
7	Preload washer
8	Drive end bearing
9	Stator assembly with or without feet
10	Eyebolt (when fitted) or dual lifting lug
11	Bearing retention circlip
12	Non-drive end bearing
13	Non-drive end endshield
14	Endshield fixing bolt
15	Bearing circlip

Ref	Part description
16	Non-drive end oilseal (when fitted)
17	Fan
18	Fan circlip
19	Fan cover
20	Fan cover screw and washer
21	Foot fixing bolts and washer (where applicable)
22	Feet
23	Terminal board (when fitted)
24	Terminal box to frame gasket
25	Terminal box
26	Internal earth terminal
27	Terminal box lid gasket
28	Terminal box lid
29	Pad mounting bracket
30	Face endshield

Bearing references and oil seals for horizontally-mounted motors only

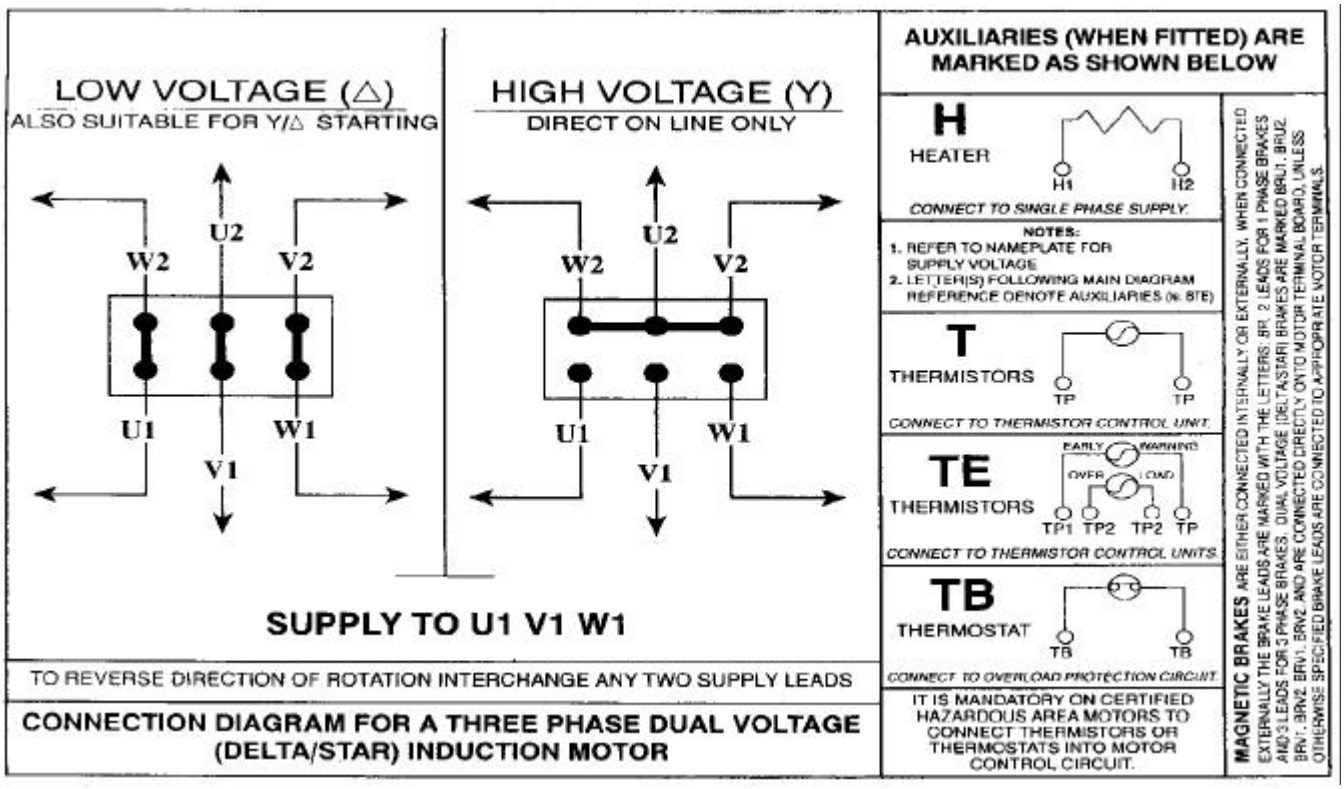
IEC Type			Bearings(1)		Oil seals(2)	
European	BS	Polarity	Drive end	Non-drive end	Drive end	Non-drive end
63	**63**	All	62022Z	62022Z	15 x 24 x 5(3)	15 x 24 x 5(3)
71	**71**	All	60032Z	60032Z	17 x 28 x 6(3)	17 x 28 x 6(3)
80M	**80M**	All	62042Z	60032Z	20 x 30 x 7(3)	15 x 24 x 5(3)
90S/L	**90S/L**	All	62052Z	62032Z	25 x 35 x 7(3)	17 x 28 x 6(3)
100L	**100L**	All	62062Z	62052Z	30 x 42 x 7(3)	25 x 37 x 7(3)
112M	**112M**	All	62062Z	62052Z	30 x 42 x 7(3)	25 x 37 x 7(3)
132S/M	**132S/M**	All	62082Z	63052Z	40 x 52 x 7(3)	25 x 37 x 7(3)
160M/L	**160M/L**	All	63092Z	63072Z	45 x 60 x 8(3)	35 x 47 x 7(3)
180M/L	**180M/L**	All	63102Z	63082Z	50 x 65 x 8(3)	40 x 52 x 7(3)
200LX	**200LX**	All	6312	6312	60 x 80 x 8(3)	60 x 80 x 8(3)
225S	**225S**	All	6313	6313	65 x 90 x 10(4)	65 x 90 x 10(4)
225M	**225M**	All	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
250ME	**250S**	2	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6316	6316	80 x 110 x 10(3)	80 x 110 x 10(3)
280SE	**250M**	2	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6318	6318	90 x 120 x 12(3)	90 x 120 x 12(3)
280ME	**280S**	2	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6318	6318	90 x 120 x 12(3)	90 x 120 x 12(3)
315SE	**280M**	2	6316	6316	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6319	6319	90 x 120 x 12(3)	90 x 120 x 12(3)
315ME	**315S**	2	6316	6316	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6319	6319	90 x 120 x 12(3)	90 x 120 x 12(3)
315M	**315M**	2	6316	6316	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6319	6319	90 x 120 x 12(3)	90 x 120 x 12(3)
315L	**315L**	2	6316	6316	70 x 90 x 10(4)	70 x 90 x 10(4)
		4 up	6319	6319	90 x 120 x 12(3)	90 x 120 x 12(3)
355S/M/L	**355S/M/L**	2	N316	6316	75 x 100 x 10(4)	75 x 100 x 10(4)
		4 up	N324	6324	115 x 145 x 14(3)	115 x 145 x 14(3)

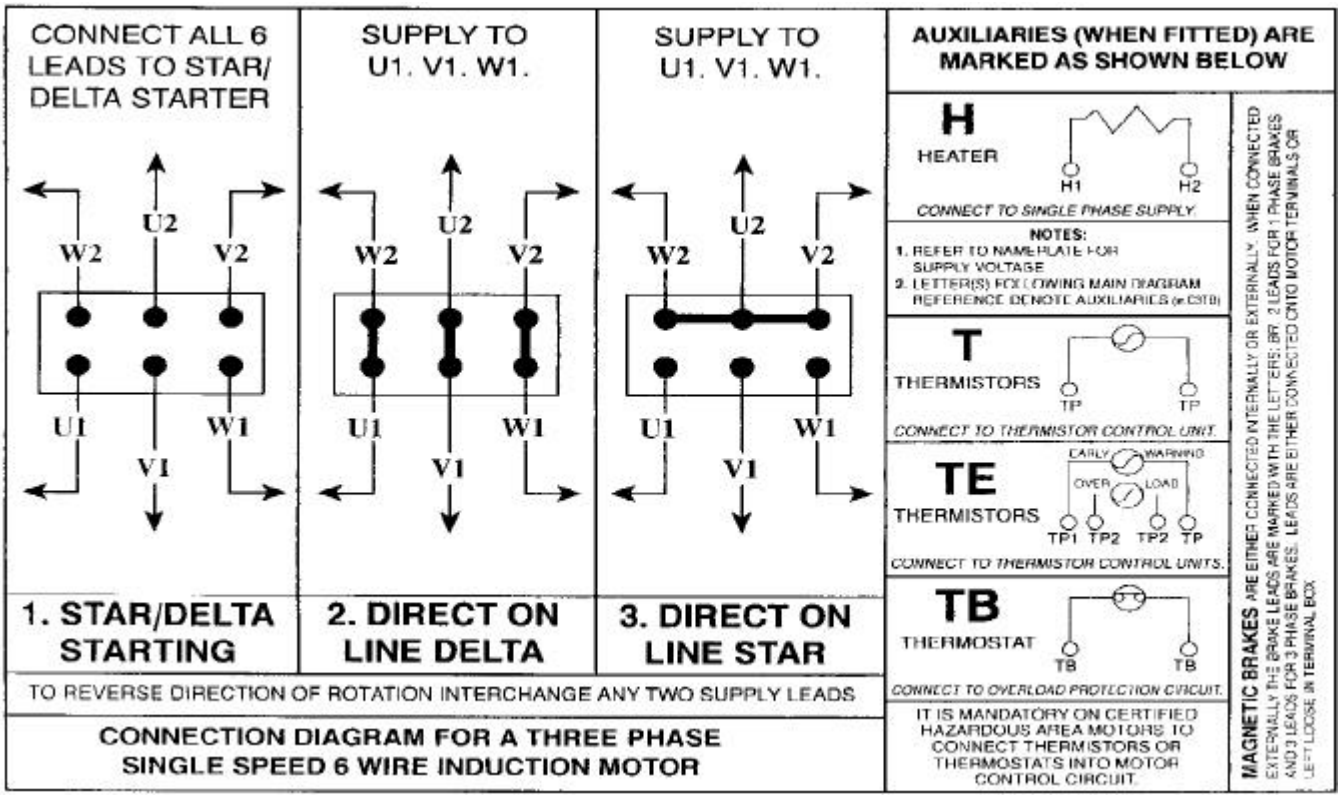
(1) Frame sizes 80 and 90 have bearings with CN clearances, frame sizes 100 to 355 have bearings with C3 clearance 'medium' series
(2) Sizes given are in mm, and represent bore x outside diameter x width
Material: (3) Nitrile rubber (4) Silicon rubber

Bearing references and oil seals for horizontally-mounted motors only

NEMA Type		Bearings(1)		Oil seals(2)	
Frame	Polarity	Drive end	Non-drive end	Drive end	Non-drive end
56	All	62042Z	60032Z	15 x 24 x 5(3)	15 x 24 x 5(3)
143/5T	All	62052Z	62032Z	17 x 28 x 6(3)	17 x 28 x 6(3)
182/4T	All	62062Z	62052Z	30 x 42 x 7(3)	25 x 37 x 7(3)
213/5T	All	62082Z	63052Z	40 x 52 x 7(3)	25 x 37 x 7(3)
254/6T	All	63092Z	63072Z	45 x 60 x 8(3)	35 x 47 x 7(3)
284/6T	All	63102Z	63082Z	50 x 65 x 8(3)	40 x 52 x 7(3)
324T	All	6312	6312	60 x 80 x 8(3)	60 x 80 x 8(3)
326T	All	6313	6313	65 x 90 x 10(4)	65 x 90 x 10(4)
364T	All	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
365T	2	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
	4 up	6316	6316	70 x 90 x 10(4)	70 x 90 x 10(4)
404/5T	2	6314	6314	70 x 90 x 10(4)	70 x 90 x 10(4)
	4 up	6318	6318	90 x 120 x 12(3)	90 x 120 x 12(3)
444/7T	2	6316	6316	70 x 90 x 10(4)	70 x 90 x 10(4)
	4 up	6319	6319	90 x 120 x 12(3)	90 x 120 x 12(3)
504/5	2	6316	6316	90 x 120 x 12(3)	90 x 120 x 12(3)
	4 up	6319	6319	90 x 120 x 12(3)	90 x 120 x 12(3)

(1) Frame sizes 56 to143/5T have bearings with CN clearances, frame sizes 182T to 505 have bearings with C3 clearance 'medium' series
(2) Sizes given are in mm, and represent bore x outside diameter x width
Material: (3) Nitrile rubber (4) Silicon rubber

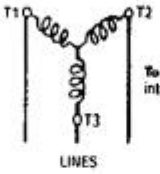

LOW VOLTAGE (△)
ALSO SUITABLE FOR Y/△ STARTING
HIGH VOLTAGE (Y)
DIRECT ON LINE ONLY
U2
W2
V2
U1
W1
V1
SUPPLY TO U1 V1 W1
TO REVERSE DIRECTION OF ROTATION INTERCHANGE ANY TWO SUPPLY LEADS
CONNECTION DIAGRAM FOR A THREE PHASE DUAL VOLTAGE (DELTA/STAR) INDUCTION MOTOR
AUXILIARIES (WHEN FITTED) ARE MARKED AS SHOWN BELOW
H
HEATER
H1
H2
CONNECT TO SINGLE PHASE SUPPLY.
NOTES:
1. REFER TO NAMEPLATE FOR SUPPLY VOLTAGE.
2. LETTER(S) FOLLOWING MAIN DIAGRAM REFERENCE DENOTE AUXILIARIES (ie. BTE)
T
THERMISTORS
TP
TP
CONNECT TO THERMISTOR CONTROL UNIT.
TE
THERMISTORS
EARLY WARNING
OVER LOAD
TP1 TP2 TP2 TP
CONNECT TO THERMISTOR CONTROL UNITS.
TB
THERMOSTAT
TB
TB
CONNECT TO OVERLOAD PROTECTION CIRCUIT.
IT IS MANDATORY ON CERTIFIED HAZARDOUS AREA MOTORS TO CONNECT THERMISTORS OR THERMOSTATS INTO MOTOR CONTROL CIRCUIT.
MAGNETIC BRAKES ARE EITHER CONNECTED INTERNALLY OR EXTERNALLY. WHEN CONNECTED EXTERNALLY THE BRAKE LEADS ARE MARKED WITH THE LETTERS: BR, 2 LEADS FOR 1 PHASE BRAKES AND 3 LEADS FOR 3 PHASE BRAKES. DUAL VOLTAGE (DELTA/STAR) BRAKES ARE MARKED BR1, BR2, BR1, BR2, BR1, BR2, AND ARE CONNECTED DIRECTLY ONTO MOTOR TERMINAL BOARD, UNLESS OTHERWISE SPECIFIED BRAKE LEADS ARE CONNECTED TO APPROPRIATE MOTOR TERMINALS.


CONNECT ALL 6 LEADS TO STAR/ DELTA STARTER
SUPPLY TO U1. V1. W1.
SUPPLY TO U1. V1. W1.
U2
W2
V2
U1
W1
V1
1. STAR/DELTA STARTING
2. DIRECT ON LINE DELTA
3. DIRECT ON LINE STAR
TO REVERSE DIRECTION OF ROTATION INTERCHANGE ANY TWO SUPPLY LEADS
CONNECTION DIAGRAM FOR A THREE PHASE SINGLE SPEED 6 WIRE INDUCTION MOTOR
AUXILIARIES (WHEN FITTED) ARE MARKED AS SHOWN BELOW
H
HEATER
H1
H2
CONNECT TO SINGLE PHASE SUPPLY.
NOTES:
1. REFER TO NAMEPLATE FOR SUPPLY VOLTAGE.
2. LETTER(S) FOLLOWING MAIN DIAGRAM REFERENCE DENOTE AUXILIARIES (ie. BTE)
T
THERMISTORS
TP
TP
CONNECT TO THERMISTOR CONTROL UNIT.
TE
THERMISTORS
EARLY WARNING
OVER LOAD
TP1 TP2 TP2 TP
CONNECT TO THERMISTOR CONTROL UNITS.
TB
THERMOSTAT
TB
TB
CONNECT TO OVERLOAD PROTECTION CIRCUIT.
IT IS MANDATORY ON CERTIFIED HAZARDOUS AREA MOTORS TO CONNECT THERMISTORS OR THERMOSTATS INTO MOTOR CONTROL CIRCUIT.
MAGNETIC BRAKES ARE EITHER CONNECTED INTERNALLY OR EXTERNALLY. WHEN CONNECTED EXTERNALLY THE BRAKE LEADS ARE MARKED WITH THE LETTERS: BR, 2 LEADS FOR 1 PHASE BRAKES AND 3 LEADS FOR 3 PHASE BRAKES. LEADS ARE EITHER CONNECTED ONTO MOTOR TERMINALS OR LEFT LOOSE IN TERMINAL BOX.

CONNECTION DIAGRAMS
3 PHASE

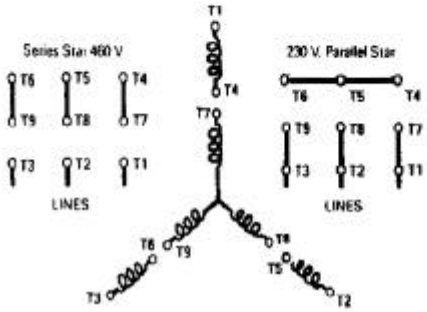
A POLYPHASE SINGLE VOLTAGE ACROSS-THE-LINE STARTING

STATOR WINDING
3 wires out



To reverse rotation interchange any 2 lines

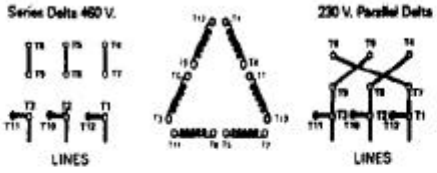
B POLYPHASE DUAL VOLTAGE – Series Parallel
Star for motors up to and including 20 h.p.



To reverse rotation . . . interchange any 2 lines

208 volts – connect as for 230 volts
416 volts – connect as for 460 volts
This applies to diagrams B and C

C POLYPHASE DUAL VOLTAGE – Series Parallel Delta for motors above 20 h.p. 12 leads out to 9 terminals.



To reverse rotation . . . interchange any 2 lines

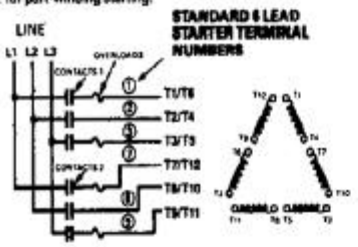
For Across-the-Line starting connect as below –

Voltage	Line Connections			Link together
	L1	L2	L3	
460	T1	T2	T3	T4-T7, T5-T8, T6-T9
230	T1	T2	T3	T1-T6-T7, T2-T4-T8 T3-T5-T9

For Wye-Delta starting, remove leads T10, T11 and T12 from terminals T2, T3 and T1 respectively and connect as below –

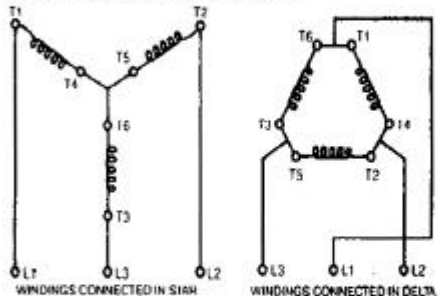
Voltage	Connect to Starter	Link together
460	T1, T2, T3, T10, T11, T12	T4-T7, T5-T8, T6-T9
230	T1, T2, T3, T10, T11, T12	T1-T7, T2-T8, T3-T9 T10-T4, T11-T5, T12-T6

For Part-Winding starting (on 230 V. only) remove leads T10, T11 and T12 from T2, T3 and T1 respectively and connect as below –
NOTE – The current rating of the overload heaters should be half the motor F.L.C. for part-winding starting.



Contacts 1 are closed first, followed shortly by contacts 2

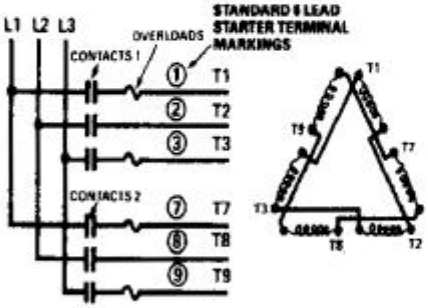
D SINGLE VOLTAGE STAR DELTA STARTING



To reverse rotation interchange any 2 lines

E POLYPHASE
Part Winding Start Motor with 6 leads from Stator Winding.

NOTE – The current rating of the overload heaters should be half the motor F.L.C. for part winding starting. (Full Load Current)



Contacts 1 are closed first, followed shortly by contacts 2.

For Auto-Transformer or Across-the-Line starting connects
L1 – (T1, T7)
L2 – (T2, T8)
L3 – (T3, T9)

AUXILIARIES (WHEN FITTED) ARE MARKED AS SHOWN BELOW

H HEATER — H1, H2
CONNECT TO SINGLE PHASE SUPPLY

P THERMISTORS — P1, P2
CONNECT TO THERMISTOR CONTROL UNITS

ON CERTIFIED HAZARDOUS AREA MOTORS, HEATERS (IF FITTED) MUST BE INTERLOCKED TO PREVENT OPERATION WHEN WINDINGS ARE ENERGIZED.

PE THERMISTORS — EARTH, WINDING, DRIVE, LOAD — P1, P2, P4, P3
CONNECT TO THERMISTOR CONTROL UNITS

PB THERMOSTAT — PB1, PB2
CONNECT TO OVERLOAD PROTECTION CIRCUIT

IT IS MANDATORY ON CERTIFIED HAZARDOUS AREA MOTORS TO CONNECT THERMISTORS OR THERMOSTATS INTO MOTOR CONTROL CIRCUIT.

MAGNETIC BRAKES

ARE MARKED B1 & B2 FOR SINGLE PHASE BRAKES AND B1, B2 & B3 FOR THREE PHASE BRAKES. BRAKE LEADS CONNECTED AS DIAGRAM UNLESS BRAKE IS EXCITED FROM SEPARATE SUPPLY.

Motor will not start	1. Fault with supply.	1. Check for correct voltage at motor terminals.	1.. Fit new fuses, reset circuit breakers, etc.
	2. Motor or load locked up.	2. Make sure motor and load are free to turn.	2. Remove clamps, locks etc.
	3. Wrong connection in control circuit.	3. Check to ensure contactors operate.	3. Sort out control circuit.
Supply or starter trips out at start	1. Wrong or loose connections.	1. Check all lugs are properly crimped or soldered, and connections are tight.	1. Fix up connections.
	2. Motor overloaded.	2. Check load performance data against motor performance data.	2. Change motor for correct size.
	3. Inertia of load too high.	3. Measure voltage at motor terminals while motor starting.	3. Change cables for correct size.
	4. Low voltage due to volt drop in cables. 5. Overload or circuit breaker incorrectly set or sized.	4. Check settings of overload and circuit breaker and allow for starting current.	4. Correct setting of overload or breaker or change.
Motor starts but has no torque. Motor does not reach full speed or takes a long time to accelerate	1. Incorrect connection.	1. Check connection diagram and nameplate data.	1. Sort out and correct connections.
	2. Delta wound motor connected in star.	2. Check load performance data against motor performance data.	2. Check timer and starter control circuit.
	3. Star/Delta starter staying in star.	3. Measure voltage at motor terminals while motor starting.	3. Change motor for correct size.
	4. Inertia of load too high.		
	5. Motor overloaded.		
	6. Low voltage due to drop in cables.		4. Change cables for correct size.
Motor overheating	1. Motor overloaded.	1. Check load performance data.	1. Fix problem with load or fit a larger motor.
	2. Ineffective cooling. Temperature of air. Look for build up of dirt	2. Check fan and air flow.	2. Clean motor. Sort out cool ing of air temp. and flow.
	3. Excessiive ambient.	3. Check connection diagram and nameplate data.	3. Sort out connections.
	4. Wrong connections.	4. Check volts and amps on all three phases.	4. Restore supply to all phases
	5. Delta wound motor in star.	5. Check nameplate	5. Correct voltage or frequency
	6. Motor ‘Single Phasing”.	6. Check phase to phase voltage accurately.	6. Balance supply or accept unbalance
	7. Wrong voltage or frequency. 8. Supply voltage unbalanced.		
No load amps in excess of full load amps.	1. Incorrect connection.	1&2. Check connection diagram	1&2. Sort out and correct connections at motor terminals.
	2. Star wound motor connected Delta.		
	3. Voltage in excess of nameplate.	3. Measure voltage at motor terminals.	3. Connect supply voltage.
	4. Motor supplied for a different voltage or frequency.	4. Compare supply voltage and frequency to nameplate.	4. Change motor for correct voltage and frequency.

Mechanical noise or vibration. Noisy bearings. Bearings overheating	1. Thrust from load or misalignment..	1. Check gaps between coupling halves and alignment.	1. Re-align couplings.
	2. Damaged bearings, too much grease, no grease, or foreign matter in grease.	2&3. Turn shaft slowly by hand and feel for roughness or stiffness. Check for bent shaft or fan rubbing.	2&3. Clean bearing housing, change bearings and repack with fresh grease.
	3. Rotor pulling or foreign matter in air gap.		
	4. Out of balance load, coupling or pulley.	4. Run motor disconnected from load and then with pulley or coupling removed.	4. Fix up out of balance items.
	5. Excessive belt pull.	5. Run motor without belts.	5. Loosen belt tension.
	6. Motor foundations not ridgid	6. Check design and construction foundations. performance data.	6. Increase strength of foundations.
Motor amps in excess of nameplate full load amps on load.	1. Motor overloaded	1. Check load and performance data.	1. Fix problem with load or fit larger motor.
	2. Low voltage supply	2. Measure voltage at motor terminals.	2. Fix problem, maybe with larger cables.
	3. Wrong voltage and frequency.	3. Check nameplate data.	3. Correct voltage or frequency
	4. Wrong connections.	4. Check nameplate data..	4. Sort out and correct.
	5. Motor “Single Phasing”.	5&6 Check volts and amps in all three phases.	5&6 Resore balanced supply to all three phases.
	6. Supply voltage unbalanced		
	7. Motor speed not matched to load.	7. Measure motor speed and check load requirements.	7. Change motor for correct motor speed.
Excessive electrical noise	1. Wrong connections	1. Check connections.	1. Fix connections.
	2. Wrong voltage.	2. Check voltage with nameplate.	2. Correct voltage.
	3. Motor “Single Phasing”	3. Check volts and amps on all three phases.	3. Restore supply to all phases
Unbalanced amps in different phases when motor loaded	1. Unbalanced power supply.	1. Measure phase to phase voltage accurately.	1. Balance supply or accept unbalance
Motor runs in wrong direction	1. Wrong connections.	1. Watch shaft rotation.	1. Swap any two phases of supply.

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Printed in Canada
15/09/04 - 2004.W.OI Issue 1

Electric Space Heaters

Electric space heaters can be mounted in one of two ways. Unit-mounted heaters are mounted inside the unit or on the supply air opening. Remotely mounted heaters are mounted in the duct-work and are not supplied by Seresco Technologies Inc. Electric heaters are offered in single or dual point power connection options. Single point power means that a single power line is feeding both the electric heater and the unit. Power is brought to the a power distributor block in the heater from which the unit is powered. This configuration is standard for unit-mounted residential installations. A dual point power configuration means that the unit and electric heater are powered from different sources. This is standard for larger installations. Refer to the unit nomenclature located on the label to see which configuration is used for your unit.

The heater is controlled by an external signal, typically either dry contact, 24VAC power or 0-10 VDC signal, but this may vary depending on the installation. Each heater is equipped with two bi-metal thermal switches to protect heating elements from overheating (See Wiring Diagram). During installation, connection or servicing exercise caution. Refer to local electrical codes and manufacturer's instructions when working with electric heaters.

Staged Electric Heaters

Electric heaters can come in either single stage or two stage configurations. Single stage electric heaters energize an external (closed contact) electric heater contactor, providing full output. These heaters are typically used for small kW applications. Two stage electric heaters split the signal into two separate contacts which each energize separate stage contactors. This gives better control over heater output (i.e. 50% or 100%) based on temperature requirements.

Modulating Electric Heaters

Modulating electric heaters use both the modulating (SCR) and the fixed step controller to ensure precise temperature control and high efficiency. Heater total output is divided between up to nine stages, including an SCR modulating stage. The modulating heating stage, usually 25% larger than the other heating stages, is proportionally controlled by CRISTAL CONTROLS SCR and the other heating stages are controlled by the electronic step controller.

Based on an external control signal (usually 0 – 10 VDC), the step controller activates step controlled stages one after another as needed. The SCR stage automatically fills the gaps between step controlled stages providing fully proportional control over the heaters entire kW range.

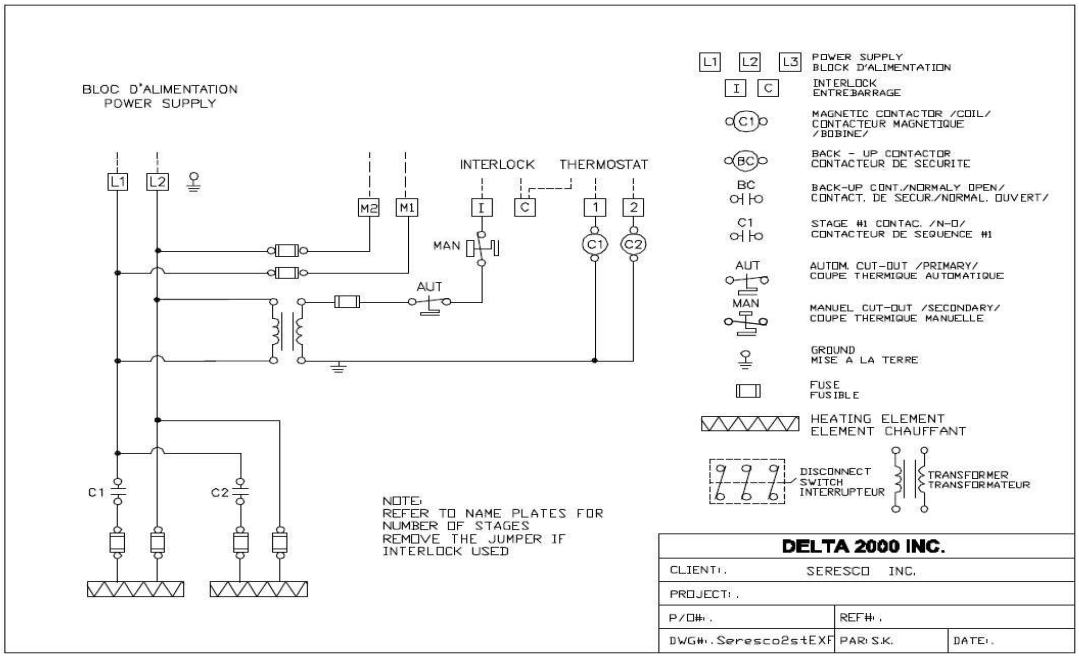


Figure 1 : Single Phase 2 Stage Electric Heater

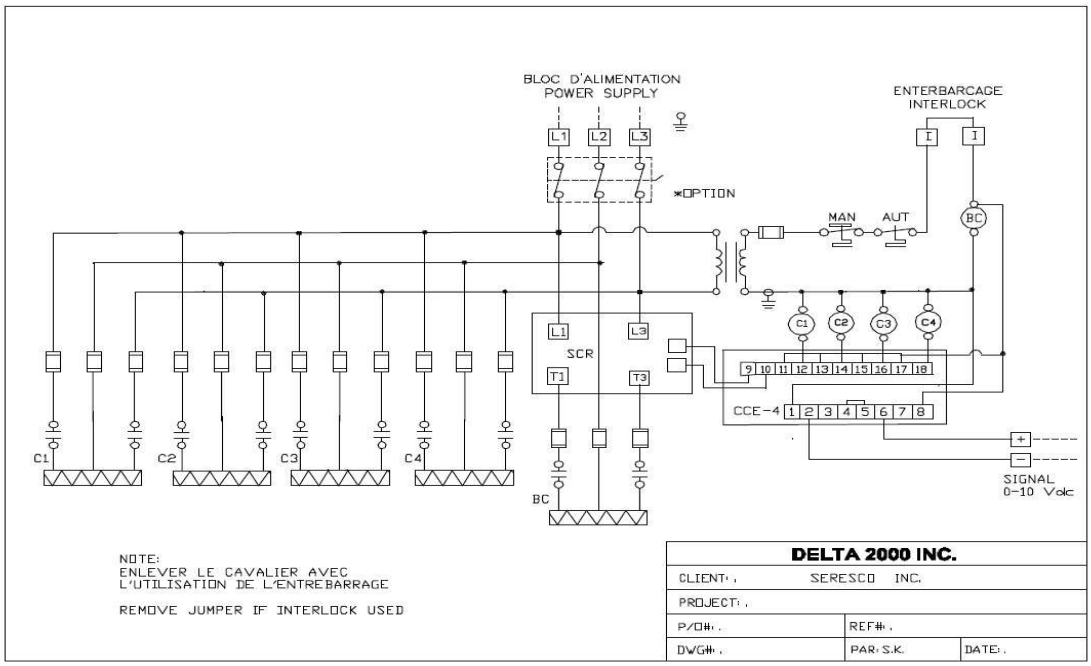


Figure 2 : Three Phase 2 Stage Electric Heater

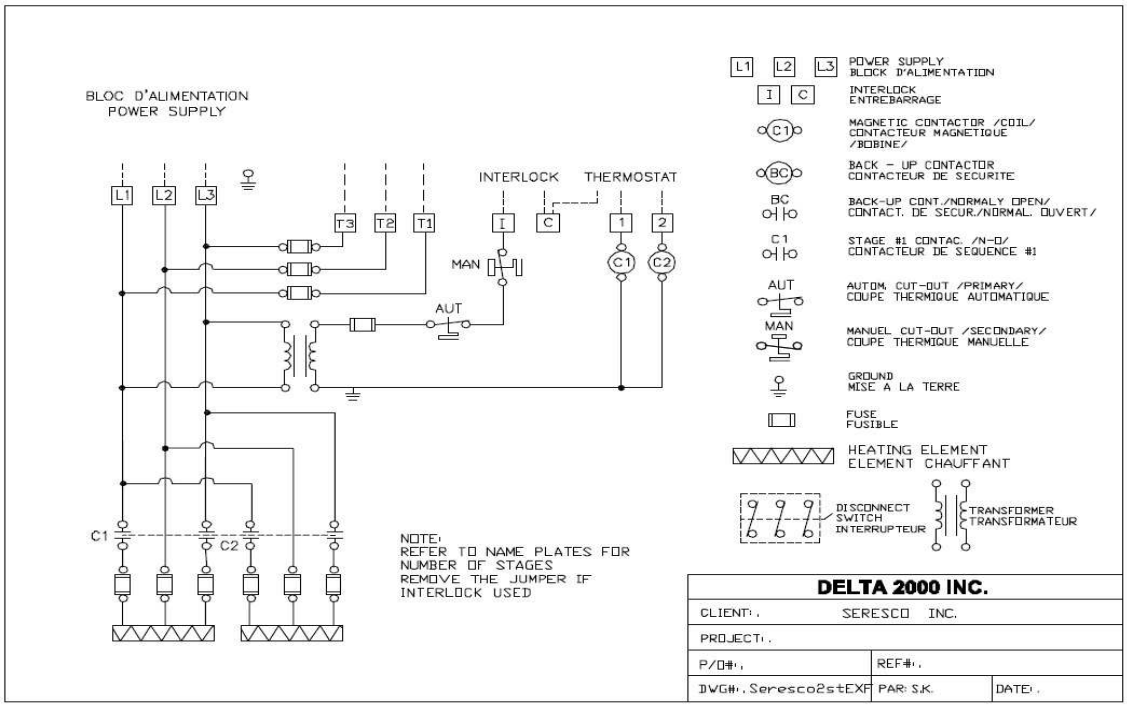


Figure 3 : Modulating Electric Heater

Technical Sheet – Steps Controller

Models: CCE-4 : 4 ON/OFF stages + 1 SCR stage

CCE-8 : 8 ON/OFF stages + 1 SCR stage

Power supply	24 Vac, 1 VA
Outputs (ON-OFF stages)	1 Amp max., 120Vac max.
Zero SCR	Adjustable
Span SCR	Adjustable
Span input	Adjustable (Min 2 ON/OFF + 1 SCR)
Input signal	0-135 Ohms, 0-10 Vdc, 0-5 Vdc, 4@20mA
Operation temperature	- 40 to +160 □ (- 40 @ +72 □)
Storage temperature	- 40 to +160 □ (- 40 @ +72 □)
Dimensions : CCE-4	210 mm X 56 mm X 30 mm 8 1/4" X 2 3/16'' X 1 3/16''
Dimensions : CCE-8	210 mm X 108 mm X 30 mm 8 1/4" X 4 1/4" X 1 3/16"

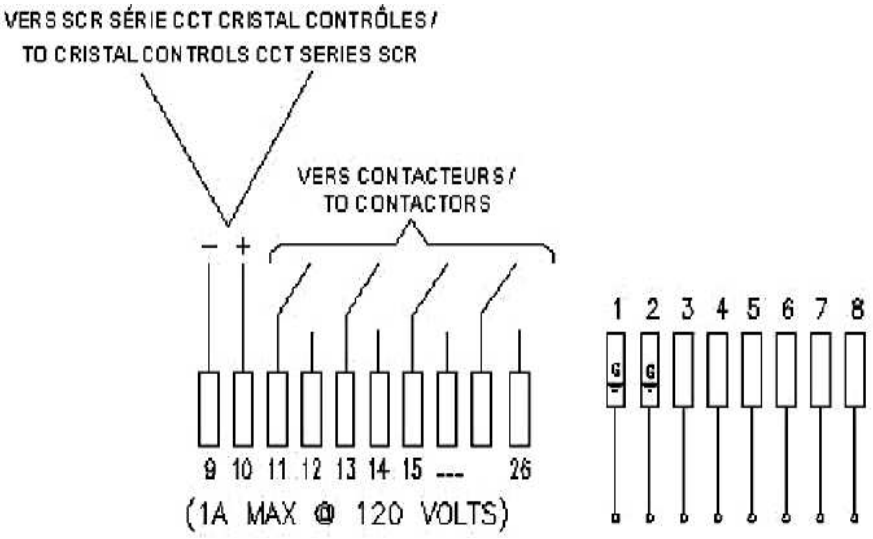


Figure 4 : CCE Control Wiring

Control signal:

0 – 10 VDC: put a jumper between pins 4 and 5,

bring control signal to pins 2 and 6 (pin 2 must be a ground, DCC, pin 6 is a 0-10 VDC signal)

4-20 mA: put a jumper between pins 2 and 5,

bring control signal to pins 2 and 5 (pin 2 must be a ground)

24 VAC power supply:

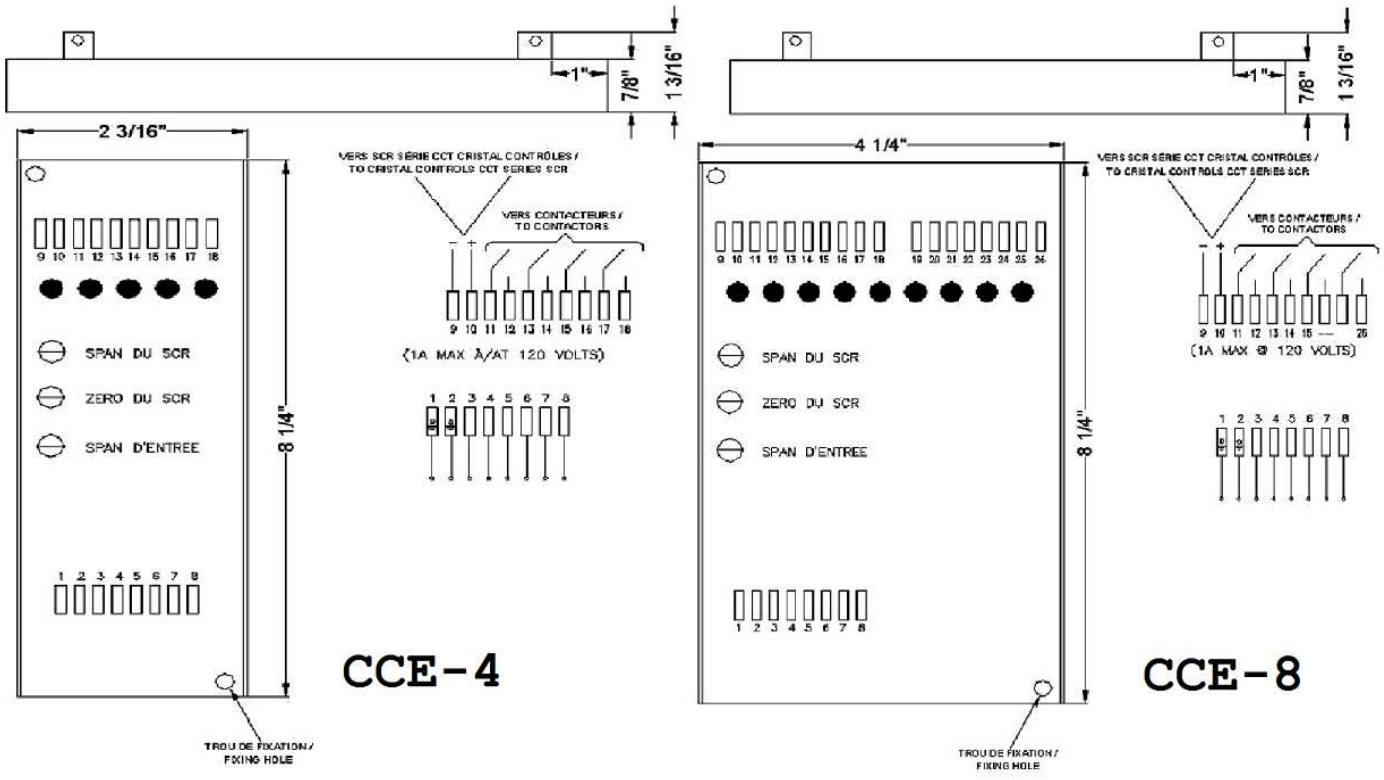
24 power: Pin 8

24 com: Pin 1 (pin 1 must be grounded)

Stages control:

SCR (modulating): Pins 9 and 10 (see diagram)

ON/OFF (steps): Respective pairs 11-12, 13-14 etc



Adjustment Procedure

Note that CCE step controllers are adjusted upon installation. If it is determined that an adjustment is necessary, follow the following procedure.

Potentiometers' functions:

"SPAN D'ENTREE" - Used to adjust/enable number of stages/steps

"SPAN DU SCR" - Used to adjust the SCR's span between two stages. To adjust, turn clockwise

"ZERO DU SCR" - Used to set the starting (zero) point of the SCR

1. Set the step controller to the desired mode (0-10 VDC or 4-20mA).
2. Set the control signal to 50%.
3. Adjust the "Span d'entrée" until half the stages are lit.
4. Set the control signal at 100% and ensure all stages are lit, readjusting the "Span d'entrée" if needed.
5. If adjustments were necessary at point 4, repeat points 3 and 4 until no further adjustment is needed.
6. Set the control signal at 50% and, if necessary, adjust the "Zéro du SCR" to obtain a 50% modulation output.
7. Set the control signal at 0% and make sure that all stages and the modulating output are off. If the modulating output does not turn off decrease "Span du SCR" and bring back the control signal to 50%. If needed adjust the "Zéro du SCR" to obtain a 50% modulation output.
8. Set the control signal at 100% and make sure all stages and the modulating output are open (without modulation). If the modulating output is still modulating, increase the "Span du SCR" , bring back the control signal to 50% and if needed, re-adjust the "Zéro du scr" to obtain a 50% modulation on the modulating output.
9. If adjustments were necessary at point 8, repeat points 7 and 8 until no further adjustment is required.
10. Finally, set the control signal at 0% and make sure all stages are off. Set the control signal at 100% and make sure all stages gradually turn on. Between each stage, the modulating output should be modulating from 0% to 100%. Also make sure that the modulating output does not take too long to begin after a stage kicked in or reaches the 100% too quickly before the next stage kicks in. In the event that the modulating output is not acting progressively (too long to begin or reaches 100% too quickly), increase the "Span du SCR" and repeat procedure from point 6.

Technical Data/Submittal

Three-way Threaded Equal Percentage Ball Valves with Fail-safe Actuators

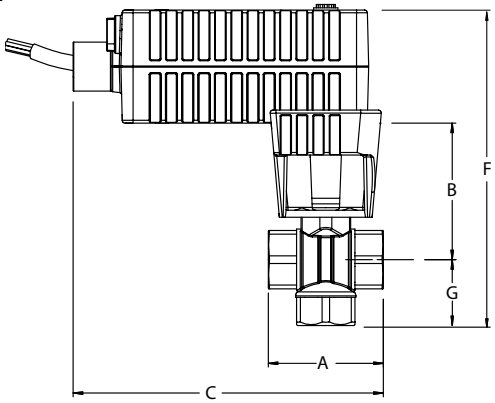
NEMA 4

ELODRIVE

Valve Specifications	
Static Pressure/Temp:	360 PSI / 250°F (600 WOG)
Service:	Chilled water, hot water, up to 50% Glycol
Flow Characterizing Disc:	Glass Filled Polymer
Body Material:	Forged Brass ASTM B283
End Connections:	Brass NPT
Stem:	Brass
Stem Seals:	EPDM O-Rings
Ball:	Nickel-plated brass
Ball Seals:	Teflon Seals with EPDM O-Rings
Angle of Rotation:	0–90°

Dimensions (nominal)

(measured in inches unless noted)



SIZE	A: Length	B:HEIGHT	C:LENGTH	D:DEPTH (NOT SHOWN)	F:HEIGHT	G:HEIGHT
	FNPT	FNPT	FNPT		FNPT	FNPT
0.5	2.6	2.9	6.5	3.0	7.5	2.4
0.75	2.8	2.9	6.6	3.0	7.5	2.0
1	2.8	3.3	6.6	3.0	7.5	2.0
1	3.0	3.4	6.7	3.0	8.0	2.6
1	4.2	3.6	7.3	3.0	9.0	3.3
1.25	3.0	3.4	6.7	3.0	8.0	2.5
1.25	3.6	3.6	7.0	3.0	8.6	2.8
1.5	3.5	3.6	7.0	3.0	8.8	2.8
1.5	4.0	4.1	7.2	3.0	9.6	3.3
2	4.0	4.1	7.2	3.0	9.7	3.3
2	5.0	4.5	7.7	3.0	10.8	3.8
2.5	5.3	4.8	7.8	3.0	11.0	4.0

Three-way valve coil and bypass streams flow simultaneously through the ball. Bypass Cv is always 80% of coil Cv so there is always enough pressure drop in bypass mode. Three-way over-flow problems are eliminated.

Flow characterizing disc:

- Equal percentage flow mirrors equal percentage coil characteristic.
- Molded from GE NORYL, a blend of a polymide with reinforced modified polymer PPE for retention of mechanical properties, chemical resistance, and dimensional stability.
- Because the disc is press fit into the ball where flow exits, the valve is able to modulate where differential pressure is over 160 psi without affecting the disc.
- Tapered shape means the back of the disc is too large to be forced through the ball's port.
- Good chemical resistance to: alcohol, alkalis (base), cooling and heating system liquids (ethylene and propylene glycol), chlorinated water, detergents/ cleaners. Poor chemical resistance to acids (high concentration), hydrocarbons, ketones, phenol.

Technical Data/Submittal

Three-way Threaded Equal Percentage Ball Valves with Fail-safe Actuators

NEMA 4

ELODRIVE

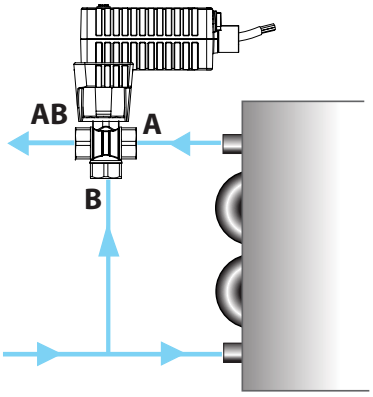
Select valve body (B3B.5-0.33N), then actuator (BSP-35A1U). Part no.: **B3B.5-0.33N+BSP-35A1U**.

3-Way Valve	Cv (1ΔP)	Full Port	Size	Close-off	Fail-safe Actuator, 24 VAC		
					On/off	Floating Point	0/2-10 VDC
					BSP-35A1U	BSP-35F1U	BSP-35P1U
					✓ Please check valve/actuator choice below		
B3B.5-0.33N	0.33		1/2″	50 psi			
B3B.5-0.59N	0.59		1/2″	50 psi			
B3B.5-1.0N	1.0		1/2″	50 psi			
B3B.5-2.4N	2.4		1/2″	50 psi			
B3B.5-4.3N	4.3		1/2″	50 psi			
B3B.5-8.0N	8.0		1/2″	50 psi			
B3B.75-0.40N	0.40		3/4″	50 psi			
B3B.75-0.66N	0.66		3/4″	50 psi			
B3B.75-1.4N	1.3		3/4″	50 psi			
B3B.75-2.4N	2.4		3/4″	50 psi			
B3B.75-3.8N	3.8		3/4″	50 psi			
B3B.75-11N	11	X	3/4″	50 psi			
B3B1-0.40N	0.40		1″	50 psi			
B3B1-0.65N	0.65		1″	50 psi			
B3B1-1.3N	1.3		1″	50 psi			
B3B1-2.3N	2.3		1″	50 psi			
B3B1-3.5N	3.5		1″	50 psi			
B3B1-10N	10		1″	50 psi			
B3B1-8.6N	8.6		1″	50 psi			
B3B1-22.3N	22.3		1″	50 psi			
B3B1-14.9N	14.9		1″	50 psi			
B3B1-4.5N	4.5		1″	50 psi			
B3B1-30.8N	30.8		1″	50 psi			
B3B1.25-19.4N	19.4	X	1-1/4″	40 psi			
B3B1.25-12.7N	12.7		1-1/4″	40 psi			
B3B1.25-4.1N	4.1		1-1/4″	40 psi			
B3B1.25-8.7N	8.7		1-1/4″	40 psi			
B3B1.25-34.1N	34.1	X	1-1/4″	40 psi			
B3B1.25-26.8N	26.8		1-1/4″	40 psi			
B3B1.5-13.4N	13.4		1-1/2″	40 psi			
B3B1.5-4.0N	4.0		1-1/2″	40 psi			
B3B1.5-8.3N	8.3		1-1/2″	40 psi			
B3B1.5-32.0N	32.0	X	1-1/2″	40 psi			
B3B1.5-23.5N	23.5		1-1/2″	40 psi			
B3B1.5-61.1N	61.1		1-1/2″	40 psi			
B3B2-23.9N	23.9		2″	40 psi			
B3B2-56.7N	56.7		2″	40 psi			
B3B2-38.2N	38.2		2″	40 psi			
B3B2-108.5N	108.5		2″	40 psi			
B3B2-82.6N	82.6		2″	40 psi			
B3B2.5-38.1N	38.1		2-1/2″	40 psi			
B3B2.5-74.1N	74.1		2-1/2″	40 psi			
B3B2.5-99.5N	99.5	X	2-1/2″	40 psi			
Accessories. Add to list price (part no. example).							
Single aux. switch (B3B3-49N+BSP-35P1U+AB-AS1)							
Double aux. switch (B3B3-49N+BSP-35P1U+AB-AS2)							
1,000 Ohm Potentiometer (B3B3-49N+BSP-35P1U+AB-P1K)							
10,000 Ohm Potentiometer (B3B3-49N+BSP-35P1U+AB-P10K)							
Options. Add to list price (part no. example). *Call for delivery.*							
120/230 VAC power supply (B3B3-49N+BSP-35P2U)							
Stainless steel stem (B3S3-49N+BSP-35P1U)							
Integrated 5,000 Ohm pot. (B3B3-49N+BSP-35P1U-P5K)							
Integrated 4-20 mA working range (B3B3-49N+BSP-35P1U-I20)							
10-ft cable (B3B3-49N+BSP-35P1U-C3M)							

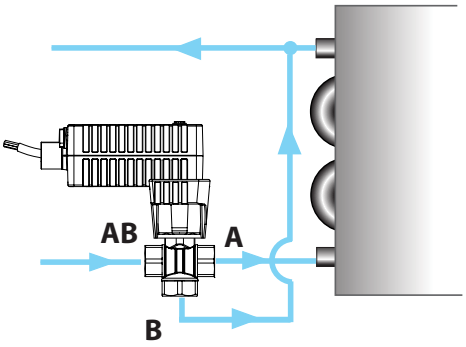
Note: For Actuator Detail, See Fail-Safe Actuator Product Data, Tab #4

NEMA 4

Piping Configurations



Mixing - fluid enters through two inlets (A,B) and exits through one outlet (AB)



Diverting - fluid enters through one inlet (AB) and exits through two outlets (A,B)

Flow Rates

Three-way Threaded

1 These valves are full port and do not have the linearizing insert.
2 Close-off pressures measured with 35 in-lb. actuator. The close-off pressure is the maximum allowable pressure drop across the valve body when the valve is fully closed.
3 C_v is defined as the quantity of water in GPM at 60°F that will flow through a given valve with a pressure drop of 1PSI. The 1.0 PSI pressure differential column in the table below is equivalent to the C_v value.

LINE SIZE	✓	MODEL NO.	FULL[1] PORT	CLOSE-OFF ΔP[2]	FLOWRATE (GPM) @ DIFFERENTIAL PRESSURE (PSI)											
					2-Position HVAC Apps		HVAC Modulating Applications									
					Cv[3]											
					0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	7.0	10.0
1/2"		B3B.5-0.33N		50 PSI	0.2	0.33	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.9	1.0
		B3B.5-0.59N			0.4	0.59	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.6	1.9
		B3B.5-1.0N			0.7	1.0	1.2	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.6	3.2
		B3B.5-2.4N			1.7	2.4	2.9	3.4	3.8	4.2	4.5	4.8	5.1	5.4	6.3	7.6
		B3B.5-4.3N			3.0	4.3	5.3	6.1	6.8	7.4	8.0	8.6	9.1	9.6	11.4	13.6
		B3B.5-8.0N			5.7	8.0	9.8	11.3	12.6	13.9	15.0	16.0	17.0	17.9	21.2	25.3
3/4"		B3B.75-0.40N		50 PSI	0.3	0.40	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.1	1.3
		B3B.75-0.66N			0.5	0.66	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.7	2.1
		B3B.75-1.4N			0.9	1.3	1.6	1.8	2.1	2.3	2.4	2.6	2.8	2.9	3.4	4.1
		B3B.75-2.4N			1.7	2.4	2.9	3.4	3.8	4.2	4.5	4.8	5.1	5.4	6.3	7.6
		B3B.75-3.8N			2.7	3.8	4.7	5.4	6.0	6.6	7.1	7.6	8.1	8.5	10.1	12.0
		B3B.75-11N	•		7.8	11.0	13.5	15.6	17.4	19.1	20.6	22.0	23.3	24.6	29.1	34.8
1"		B3B1-0.40N		50 PSI	0.3	0.40	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.1	1.3
		B3B1-0.65N			0.5	0.65	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.7	2.1
		B3B1-1.3N			0.9	1.3	1.6	1.8	2.1	2.3	2.4	2.6	2.8	2.9	3.4	4.1
		B3B1-2.3N			1.6	2.3	2.8	3.3	3.6	4.0	4.3	4.6	4.9	5.1	6.1	7.3
		B3B1-3.5N			2.5	3.5	4.3	4.9	5.5	6.1	6.5	7.0	7.4	7.8	9.3	11.1
		B3B1-10N			7.1	10.0	12.2	14.1	15.8	17.3	18.7	20.0	21.2	22.4	26.5	31.6
		B3B1-8.6N			6.1	8.6	10.5	12.1	13.6	14.9	16.1	17.2	18.2	19.2	22.7	27.2
		B3B1-22.3N			15.8	22.3	27.3	31.5	35.3	38.6	41.7	44.6	47.3	49.9	59.0	70.5
		B3B1-14.9N			10.5	14.9	18.2	21.1	23.6	25.8	27.9	29.8	31.6	33.3	39.4	47.1
		B3B1-4.5N			3.2	4.5	5.5	6.4	7.1	7.8	8.4	9.0	9.5	10.1	11.9	14.2
		B3B1-30.8N			21.8	30.8	37.7	43.6	48.7	53.3	57.6	61.6	65.3	68.9	81.5	97.4
1-1/4"		B3B1.25-19.4N	•	40 PSI	13.7	19.4	23.8	27.4	30.7	33.6	36.3	38.8	41.2	43.4	51.3	61.3
		B3B1.25-12.7N			9.0	12.7	15.6	18.0	20.1	22.0	23.8	25.4	26.9	28.4	33.6	40.2
		B3B1.25-4.1N			2.9	4.1	5.0	5.7	6.4	7.0	7.6	8.1	8.6	9.1	10.7	12.8
		B3B1.25-8.7N			6.1	8.7	10.6	12.3	13.7	15.0	16.2	17.3	18.4	19.4	22.9	27.4
		B3B1.25-34.1N	•		24.1	34.1	41.8	48.2	53.9	59.1	63.8	68.2	72.3	76.2	90.2	107.8
		B3B1.25-26.8N			19.0	26.8	32.8	37.9	42.4	46.4	50.1	53.6	56.9	59.9	70.9	84.7
1-1/2"		B3B1.5-13.4N		40 PSI	9.5	13.4	16.4	18.9	21.1	23.2	25.0	26.7	28.4	29.9	35.4	42.3
		B3B1.5-4.0N			2.8	4.0	4.9	5.7	6.4	7.0	7.5	8.1	8.5	9.0	10.7	12.7
		B3B1.5-8.3N			5.8	8.3	10.1	11.7	13.1	14.3	15.5	16.5	17.5	18.5	21.9	26.1
		B3B1.5-32.0N	•		22.6	32.0	39.2	45.3	50.6	55.5	59.9	64.0	67.9	71.6	84.7	101.3
		B3B1.5-23.5N			16.6	23.5	28.8	33.3	37.2	40.8	44.0	47.1	49.9	52.6	62.3	74.4
		B3B1.5-61.1N			43.2	61.1	74.8	86.4	96.6	105.8	114.3	122.2	129.6	136.6	161.6	193.2
2"		B3B2-23.9N		40 PSI	16.9	23.9	29.3	33.8	37.8	41.4	44.7	47.8	50.7	53.4	63.2	75.6
		B3B2-56.7N			40.1	56.7	69.4	80.2	89.7	98.2	106.1	113.4	120.3	126.8	150.0	179.3
		B3B2-38.2N			27.0	38.2	46.8	54.0	60.4	66.2	71.5	76.4	81.0	85.4	101.1	120.8
		B3B2-108.5N			76.7	108.5	132.9	153.4	171.6	187.9	203	217	230	243	287	343
		B3B2-82.6N			58.4	82.6	101.2	116.8	130.6	143.1	154.5	165.2	175.2	184.7	219	261
2-1/2"		B3B2.5-38.1N		40 PSI	26.9	38.1	46.7	53.9	60.2	66.0	71.3	76.2	80.8	85.2	100.8	120.5
		B3B2.5-74.1N			52.4	74.1	90.8	104.8	117.2	128.3	138.6	148.2	157.2	165.7	196.1	234
		B3B2.5-99.5N	•		70.4	99.5	121.9	140.7	157.3	172.3	186.1	199.0	211	223	263	315

Flow Rates Adjusted for Piping Geometry

Three-way Threaded

Valve		Line Size								
Size	Through C_v	0.5	0.75	1	1.25	1.5	2	2.5	3	4
1/2"	0.33	--	0.3	0.3						
	0.59	--	0.6	0.6						
	1.0	--	1.0	1.0						
	2.4	--	2.3	2.3						
	4.3	--	4.0	3.8	--					
	8.0	--	7.9	5.7	--					
3/4"	0.40	--	--	0.4	0.4	0.4				
	0.66		--	0.66	0.66	0.66				
	1.3		--	1.3	1.3	1.3				
	2.4		--	2.4	2.39	2.38				
	3.8		--	3.8	3.74	3.7				
	11.0		--	10.4	9.78	9.4				
1"	0.40			--	0.40	0.40	0.40	0.40	0.40	
	0.65			--	0.65	0.65	0.65	0.65	0.65	
	1.3			--	1.3	1.3	1.3	1.3	1.3	
	2.3			--	2.3	2.3	2.3	2.3	2.3	
	3.5			--	3.5	3.5	3.5	3.5	3.5	
	4.5			--	4.5	4.5	4.5	4.4	4.4	
	8.6			--	8.5	8.4	8.3	8.2	8.2	
	10.0			--	9.9	9.7	9.6	9.5	9.4	
	14.9			--	14.6	14.1	13.5	13.3	13.1	
	22.3			--	21.2	19.9	18.4	17.7	17.3	
	30.8			--	28.0	25.2	22.3	21.1	20.5	
1-1/4"	4.1				--	4.4	4.4	4.4	4.4	4.4
	7.7				--	8.3	8.2	8.2	8.2	8.1
	8.7				--	14.8	14.5	14.3	14.2	14.0
	12.7				--	35.0	31.5	29.6	28.6	27.6
	19.4				--	39.0	34.3	31.9	30.7	29.4
	34.1				--	79.1	53.3	45.5	42.0	39.0
1-1/2"	4.0					--	4.0	4.0	4.0	4.0
	8.3					--	8.2	8.2	8.2	8.2
	13.4					--	13.3	13.2	13.2	13.1
	23.5					--	23.1	22.7	22.4	22.1
	32.0						31.0	30.0	29.3	28.6
	61.1						54.9	49.7	46.9	44.1
2"	23.9						--	23.8	23.7	23.5
	38.2						--	37.8	37.3	36.62
	56.7						--	55.5	54.0	52.0
	108.5						--	100.7	92.3	83.3

Electric Actuator Type BE(P)

Electronic Fail-Safe, 88/132 in-lb Minimum Torque, BE NEMA 2 / BEP NEMA 4

ELODRIVE

✓	Model	Protection Degree	Min. Torque (in-lb)	Power Supply 24VDC, 120/230VAC	Power Consumption Max.	Power Consumption	Damper Area approx. sq-ft
BE Series							
On/Off Control, 90 Second Running Time Drive, 60 Second Running Time Fail-safe							
	BE-88A1U	NEMA 2	88	24	20.0VA	9.0VA	22
	BE-88A2U	NEMA 2	88	120/230	20.0VA	12.0VA	22
	BEP-88A1U	NEMA 4	88	24	20.0VA	9.0VA	22
	BEP-88A2U	NEMA 4	88	120/230	20.0VA	12.0VA	22
	BE-132A1U	NEMA 2	132	24	20.0VA	9.0VA	33
	BE-132A2U	NEMA 2	132	120/230	20.0VA	12.0VA	33
	BEP-132A1U	NEMA 4	132	24	20.0VA	9.0VA	33
	BEP-132A2U	NEMA 4	132	120/230	20.0VA	12.0VA	33
Directional Control, 90 Second Running Time Drive, 30 Second Running Time Fail-safe							
	BE-88D1U	NEMA 2	88	24	20.0VA	9.0VA	22
	BE-88D2U	NEMA 2	88	120/230	20.0VA	12.0VA	22
	BEP-88D1U	NEMA 4	88	24	20.0VA	9.0VA	22
	BEP-88D2U	NEMA 4	88	120/230	20.0VA	12.0VA	22
	BE-132D1U	NEMA 2	132	24	20.0VA	9.0VA	33
	BE-132D2U	NEMA 2	132	120/230	20.0VA	12.0VA	33
	BEP-132D1U	NEMA 4	132	24	20.0VA	9.0VA	33
	BEP-132D2U	NEMA 4	132	120/230	20.0VA	12.0VA	33
Floating Point Control, 90 Second Running Time Drive, 30 Second Running Time Fail-safe							
	BE-88F1U	NEMA 2	88	24	20.0VA	9.0VA	22
	BE-88F2U	NEMA 2	88	120/230	20.0VA	12.0VA	22
	BEP-88F1U	NEMA 4	88	24	20.0VA	9.0VA	22
	BEP-88F2U	NEMA 4	88	120/230	20.0VA	12.0VA	22
	BE-132F1U	NEMA 2	132	24	20.0VA	9.0VA	33
	BE-132F2U	NEMA 2	132	120/230	20.0VA	12.0VA	33
	BEP-132F1U	NEMA 4	132	24	20.0VA	9.0VA	33
	BEP-132F2U	NEMA 4	132	120/230	20.0VA	12.0VA	33
Proportional Control 0/2-10VDC, 90 Second Running Time Drive, 30 Second Running Time Fail-safe							
	BE-88P1U	NEMA 2	88	24	20.0VA	9.0VA	22
	BE-88P2U	NEMA 2	88	120/230	20.0VA	12.0VA	22
	BEP-88P1U	NEMA 4	88	24	20.0VA	9.0VA	22
	BEP-88P2U	NEMA 4	88	120/230	20.0VA	12.0VA	22
	BE-132P1U	NEMA 2	132	24	20.0VA	9.0VA	33
	BE-132P2U	NEMA 2	132	120/230	20.0VA	12.0VA	33
	BEP-132P1U	NEMA 4	132	24	20.0VA	9.0VA	33
	BEP-132P2U	NEMA 4	132	120/230	20.0VA	12.0VA	33

Note: See binder tab no. 5 for actuator accessories/options product data.

Technical Data Electric Actuator Type BE(P)		
Characteristic	**24 V**	**120/230 V**
Nominal voltage	AC 24V +/-20%, 50/60 Hz, DC 24 to 36V +/-10%	AC 90-264 V, 50/60 Hz
Electrical connection	3-ft plenum rated cable, 1/2-inch conduit fitting	
Starting current	.5 A for approx. 40 Sec	
Synchronization	+/- 5%	
Rotation direction	Selectable via switch L/R (CCW/CW) or by L/R mounting	
Angle of rotation	Max. 95°	
Manual adjustment	Standard allen key positioning without disengaging gears	
Shaft mounting	Centered, Ø 0.3in [8mm]-0.8in [20mm]; ◊ 0.2in [6mm]-0.6in [14mm]	
Running time	90 sec (+/- 5%), during normal operation; independent of load; Fail-safe operation approx. 30 sec	
Position indicator	Mechanical	
Noise emission level	< 35 dB (A), Fail-safe operation < 60 dB (A)	
Ambient temperature	-22 to +122°F [-30 to +50°C]	
Storage temperature	-40 to +176°F [-40 to +80°C]	
Humidity	5 to 95% RH non-condensing (excludes NEMA 4 models)	
Quality Standard	ISO - 9001	
Agency listings	c UL us (Listing for all 120/230 V power supply models is pending)	
Weight	2.1 lb [950 g]	
Maintenance	Maintenance free	

Elodrive type BE(P) actuators are designed and produced for long lasting, reliable and quiet operation of air control dampers and temperature control valves. BE(P) type actuators feature **EloSafe**™ electronic fail-safe technology which uses goldcap capacitors to drive the actuator to the fail-safe position in the event of an interruption of power. EloSafe capacitors store six times the energy required to drive the actuator to the fail-safe position under full torque load. Thermal compensation allows **EloSafe** actuators to deliver the full rated torque even at the lowest ambient temperature rating. A universal self-centering mounting clamp and anti-rotation strap are included with all models. All Elodrive models feature durable Elodrive brushless DC motor technology and easy manual positioning.

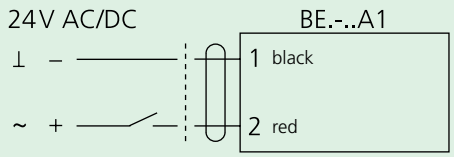
Highlights of the EloSafe series of actuators:

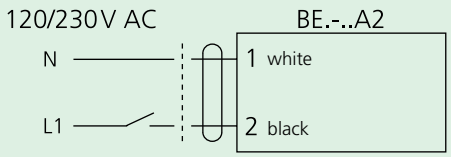
- 100% self-locking even without voltage.
- Full specified torque through out the entire 90° fail-safe function
- Remains in a defined fail-safe position with 100% self-locking
- Fail-safe function also possible when control signal (2-10 V) is missing

Technical Data Electric Actuator Type BE(P)

On/Off

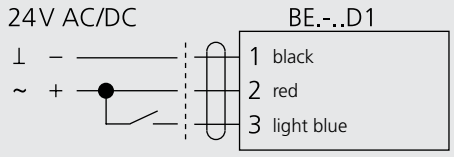
Wiring schematics On/Off

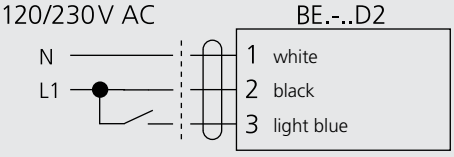




Directional

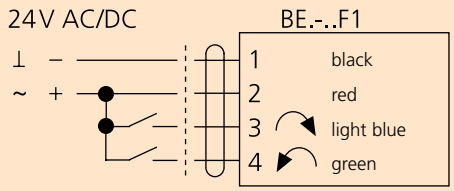
Wiring schematics Directional

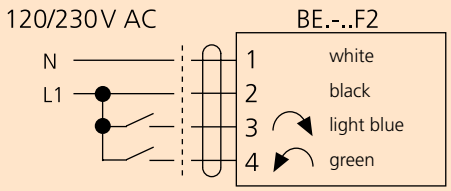




Floating Point

Wiring schematics Floating Point

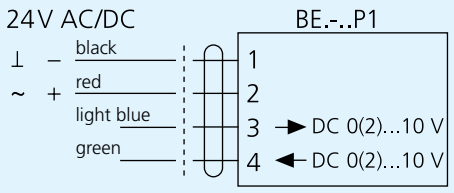


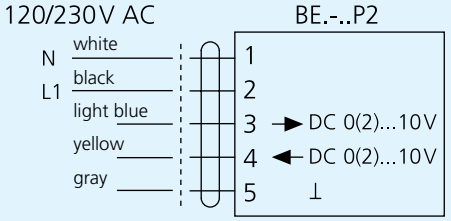


Proportional 0/2-10 V

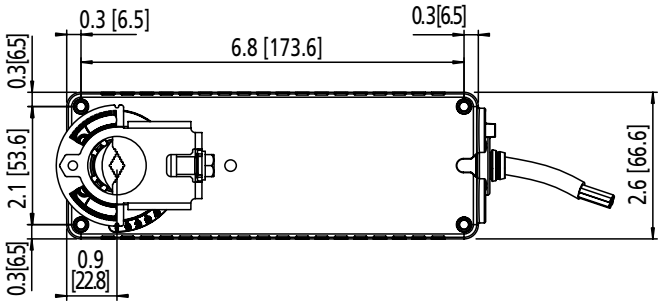
Input signal	0-10 V or 2-10 V selectable via switch
Input impedance	>100 kΩ
Output signal	DC 0/2-10 V for 0-100%

Wiring schematics Proportional 0/2-10 V



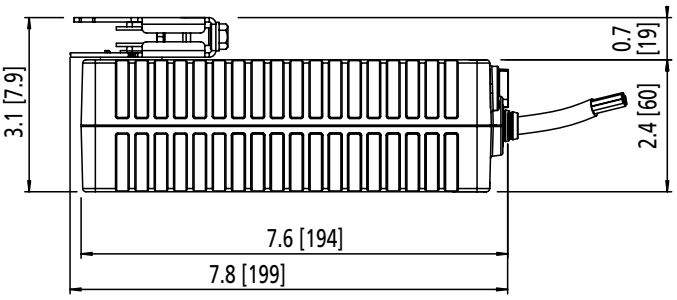


All Dimensions in inches and metric [mm]

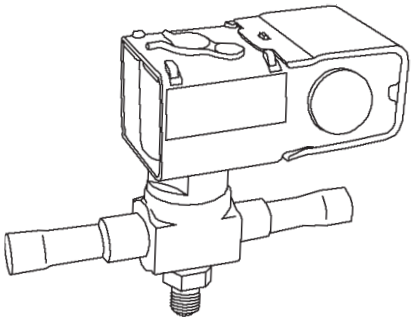


Standard delivery includes:

- Anti-rotation strap
- Centric clamp adaptor
- Allen key
- Position indicator
- Mechanical rotation limit stops
- Operation manual



Solenoid Valves
200RD Model



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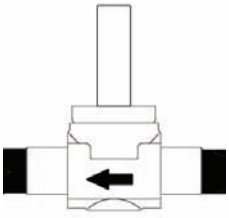
① Refrigerant Compatibility



R-11, R-12, R-22, R-113, R-114, R-115, R-123, R-124, R-125, R-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-407A, R-407B, R-407C, R-410A, R-500, R-502, R-507

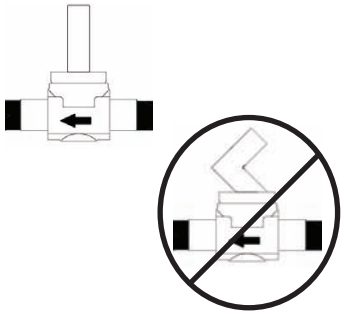
Compatibilidad con Refrigerantes
Compatibilidade do Refrigerante
Compatibilité du réfrigérant
冷媒適合性
냉매 호환성
冷媒兼容性

② Verify Coil

Model	Coil				
	AM	AH	DM	MM	ASC2
100RB	✓	✓	✓	✓	✓
200RB	✓	✓	✓	✓	✓
240RA	✓	✓	✓	✓	✓
500RB			✓	✓	✓
540RA	✓	✓	✓	✓	✓

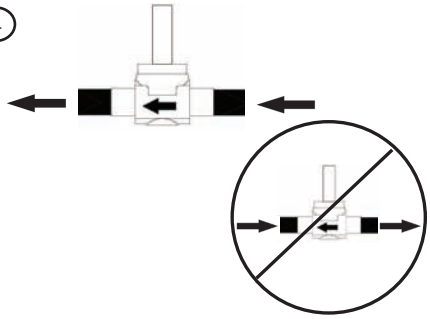
Verifique la Bobina
Verifique a bobina
Vérifier la bobine
コイルの確認
코일 대조 확인 하시오
确认线圈型号

③ Do Not Bend Enclosing Tube



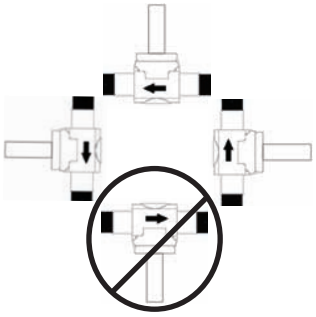
No doble el casquillo del Embolo de la Aguja
Não danifique o tubo de apoio da bobina
Ne pas plier le tube
エンクロージングチューブを曲げることは禁止
연결관을 구부리지 마시오
不要压弯阀杆

④ Flow Follows Arrow



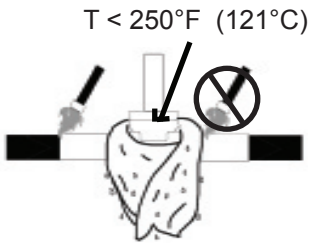
El Flujo sigue la Flecha
Barra Indica Posição do Fluido
L'écoulement doit suivre la flèche
矢印方向に冷媒流
화살표방향으로 흐름
流向箭头

⑤ Valve Orientation



Orientación de Válvulas
Orientação da Válvula
Orientation de la valve
バルブの向き
밸브 방향
阀的安装角度

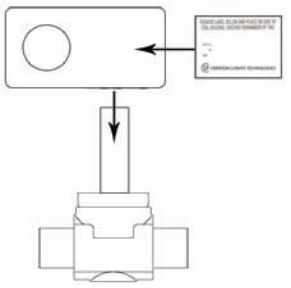
⑥ Solder Techniques



Type T

Técnicas para Soldar
Técnicas de Soldagem
Technique de soudure
溶接方法
용접 기술
焊接技术

⑦ Coil Installation



Instalación de la Bobina
Instalação da bobina
l'installation de la bobine
コイルの取付
코일 설치
安装线圈

9

AM Coil Electrical Data			
VAC/Hz	Maximum Amps		VA Holding
	Inrush	Holding	
24/50	2.0	0.96	23
24/60	1.6	0.74	18
120/50	0.45	0.21	25
120/60	0.36	0.16	19
208/50	0.19	0.08	17
208/60	0.15	0.06	12
220/50	0.24	0.10	24
240/60	0.19	0.08	19
480/50	0.11	0.05	24
480/60	0.09	0.04	19

Transformer Selection

Selección del Transformador

Selecione transformador capacidade suficiente

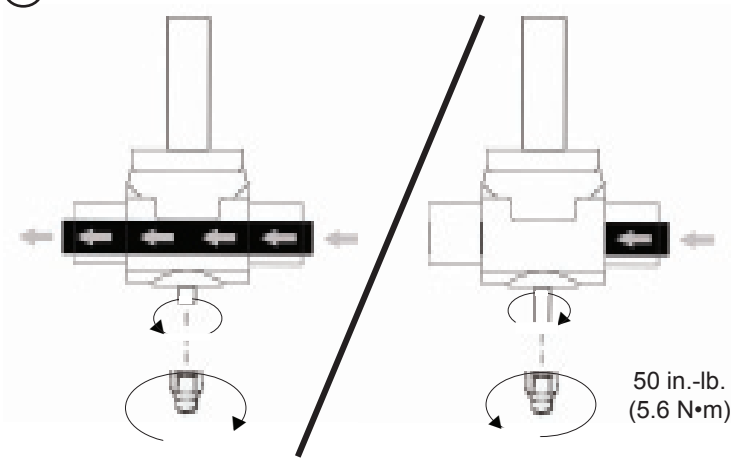
Sélection du transformateur

トランスフォーマの選択

변압기

选择变压器

10



Manual Override

Vástago de Operación Manual

Acionamento manual

Ouverture manuel de la tige

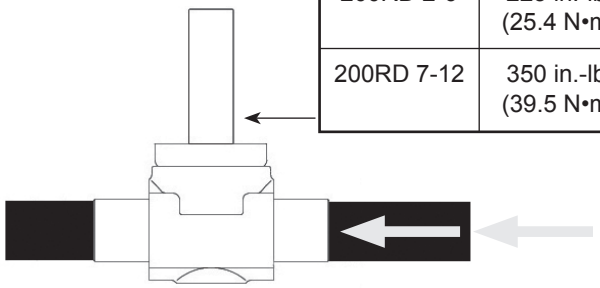
マニュアルオーバーライド

수동으로 변경

手动开阀

11

200RD 2-6	225 in.-lb. (25.4 N•m)
200RD 7-12	350 in.-lb. (39.5 N•m)



Disassembly - must use new gasket when reassembling - retorque per table above

Desmontaje - cuando este remontando usar una nueva empaquetadora - reajuste utilizando la tabla encima

Desmontagem - quando for remontar é necessário usar uma nova gaxeta - reaperte utilizando a tabela acima

Désassemblé - doit utiliser un nouveau segment lors du réassemblage - rétorqué selon la table si dessus

分解 – 再度組み立てる際には、新しいガスケットを使用する必要があります。上記表のトルクで締め付けます。

분리 시 – 재 조립할 때 반드시 새 가스켓을 사용 – 위 테이블 표에 의해 재 조인 다.

拆解 – 在重新组装时必须安装新的密封垫片 – 按上表内的扭矩要求拧紧

EMERSON
Climate Technologies

PA-00326 Apr 2009

R-410A

The 200RD is a pilot-operated, 2-way, normally closed, R-410A valve. 200RD valves are used for liquid, discharge, or suction gas refrigerant service.

Features

- One coil fits all valve sizes
- Extended ends for easy installation (standard)
- Long-life molded coils
- PTFE O-ring for superior external sealing

Options

- Available in 5 orifice sizes
- Manual stem or mounting stud
- Bi-Flow operation-conversion either factory assembled or with kit except 200RD 7,9 & 12

Specifications

- Maximum fluid temperature: 250°F
- Maximum working pressure: 680 psig
- Minimum operating pressure drop: 2 psi
- MOPD: 550 psig
- UL/CUL file number: MP604

NOTE: Mounting enclosing tube more than 90° off vertical up position is not recommended.

Nomenclature example: 200RD 4T3M VLC

200R	D	4	T	3	M	VLC
Valve Series	**Design Series**	**Port Size** (in 1/16")	**Connection Type** T = Copper Extended Ends	**Connection Size** (In 1/8")	M = manual stem T = mounting stud (optional)	**Coil***

*NOTE: Valves are shipped without the solenoid coils (VLC = Valve Less Coil). See available coil assemblies.

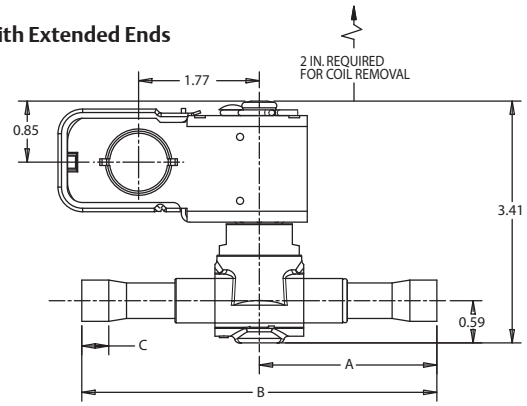
Ordering Information and Nominal * Liquid Capacity - Tons (kW)

PCN			Description	Connection Size	R-410A
Standard Valve	Mounting Stud[1]	Manual Stem[2]			
066158	066179	–	200RD 2 T 2	1/4 ODF	3.2 (11.3)
066159	066180	–	200RD 2 T 3	3/8 ODF	
066160	–	–	200RD 3 T 2	1/4 ODF	4.5 (15.8)
066161	066182	066203	200RD 3 T 3	3/8 ODF	
066162	066183	066204	200RD 3 T 4	1/2 ODF	
066163	066184	066205	200RD 4 T 3	3/8 ODF	7.3 (25.7)
066164	066185	066206	200RD 4 T 4	1/2 ODF	
066165	066186	006207	200RD 4 T 5	5/8 ODF	
066166	066187	066208	200RD 5 T 3	3/8 ODF	7.7 (27.1)
066167	066188	066209	200RD 5 T 4	1/2 ODF	
066168	066189	066210	200RD 5 T 5	5/8 ODF	
066169	066190	066211	200RD 6 T 4	1/2 ODF	8.8 (30.9)
066170	066191	066212	200RD 6 T 5	5/8 ODF	

[1] Add "T" to the end of description for Mounting Stud
[2] Add "M" to the end of the description for Manual Stem

Capacities based on ARI standard.
*See Extended Capacity Tables for ratings at a wide range of conditions.

With Extended Ends



With Extended Ends

Valve	Port Size	Conn. Size & Style	A	B	C
200RD 2T2	1/8	1/4 ODF	2.42	4.62	0.25
200RD 2T3		3/8 ODF			0.31
200RD 3T2	3/16	1/4 ODF			0.25
200RD 3T3		3/8 ODF			0.31
200RD 3T4		1/2 ODF			0.38
200RD 4T4	1/4		2.50	5.00	
200RD 4T5		5/8 ODF	3.25	6.50	0.50
200RD 5T3	5/16	3/8 ODF	2.31	4.62	0.31
200RD 5T4		1/2 ODF	2.50	5.00	0.38
200RD 5T5		5/8 ODF	3.25	6.50	0.50
200RD 6T3	3/8	3/8 ODF	2.31	4.62	0.31
200RD 6T4		1/2 ODF	2.50	5.00	0.38
200RD 6T5		5/8 ODF	3.25	6.50	0.50

Valve Repair Kit

"K" indicates part is supplied in valve repair kit KS30386. (PCN 066223)

Gasket Kit

Gasket Kit KG10025 (PCN 049190) (contains 12 pieces - each of PTFE and neoprene O-rings)

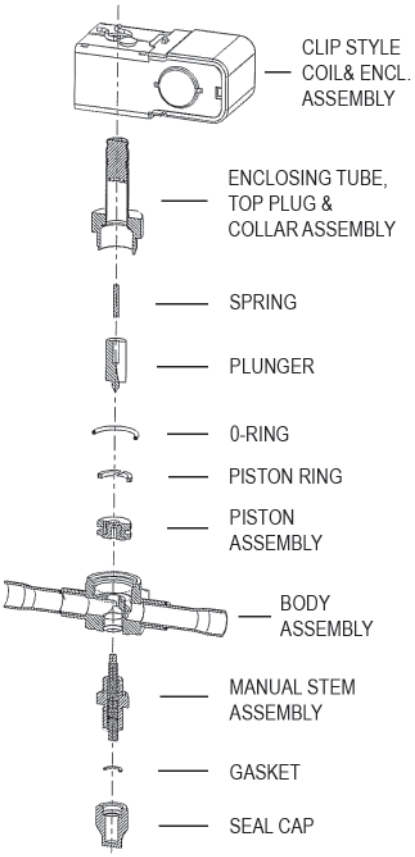
Coil Assembly

See coil assemblies for availability.

Bi-Flow Conversion Kit

KS30387 (PCN 066224)

Exploded View & Parts Kit Data



Technical Help Guide

Thermal Expansion Valves
Solenoid Valves
System Protectors
Regulators
Oil Controls
Temperature Pressure Controls
Basic Rules of Good Practice
Troubleshooting Guide

2008

EMERSON
Climate Technologies

Introduction

This Technical Guide from Emerson Climate Technologies provides a detailed explanation on the operation of common refrigeration system components such as thermal expansion valves, solenoid valves, system protectors, regulators, oil controls and temperature pressure controls. Also included in this guide is a listing of the basic rules of good practice and a detailed troubleshooting guide. This guide is designed to fill a need which exists for a concise, elementary text to aid servicemen, salesmen, students and others interested in refrigeration and air conditioning. It is intended to cover only the fundamentals of refrigeration and air conditioning theory and practice. Detailed information for specific products is available from manufacturers of complete units and accessories. Used to supplement such literature, and to improve general knowledge of refrigeration and air conditioning, this guide should prove to be very helpful.

Emerson Climate Technologies, a business of Emerson, is the world's leading provider of heating, ventilation, air conditioning and refrigeration solutions for residential, industrial and commercial applications. The group combines best-in-class technology with proven engineering, design, distribution, educational and monitoring services to provide customized, integrated climate-control solutions for customers worldwide. Emerson Climate Technologies' innovative solutions, which include industry-leading brands such as Copeland Scroll and White-Rodgers, improve human comfort, safeguard food and protect the environment.

Emerson Climate Technologies - Flow Controls Division is a leading manufacturer of valves, controls and system protectors commonly applied in air conditioning and refrigeration systems worldwide. The company continues to pioneer the control of refrigerant flow through innovative, high performance components, such as thermal expansion valves and filter driers.

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Thermal Expansion Valves

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Thermal Expansion Valves

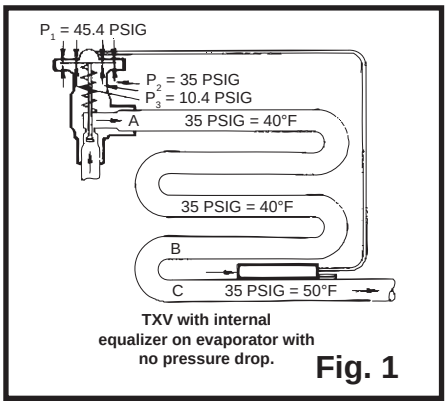
The most commonly used device for controlling the flow of liquid refrigerant into the evaporator is the thermostatic expansion valve (TXV). Also known as thermal expansion valves, TXVs are precision devices designed to regulate refrigerant liquid flow into the evaporator in exact proportion to evaporation of refrigerant liquid in the evaporator.

Refrigerant gas leaving the evaporator can be regulated since the TXV responds to the temperature of the refrigerant gas leaving the evaporator and the pressure in the evaporator. This controlled flow prevents the return of refrigerant liquid to the compressor. The TXV controls the flow of refrigerant by maintaining a pre-determined superheat.

An orifice in the TXV meters the flow into the evaporator. Flow is modulated as required by a needle type plunger and seat, which varies the orifice opening. The needle is controlled by a diaphragm subject to three forces:

1. The power element and remote bulb pressure (P1)
2. The evaporator pressure (P2)
3. The superheat spring equivalent pressure (P3)

These forces are shown in Figure 1.



TXV with internal equalizer on evaporator with no pressure drop.

Fig. 1

The following sections describe the operation and application of single-outlet TXVs in two general categories: internally equalized and externally equalized.

Internal Equalizer

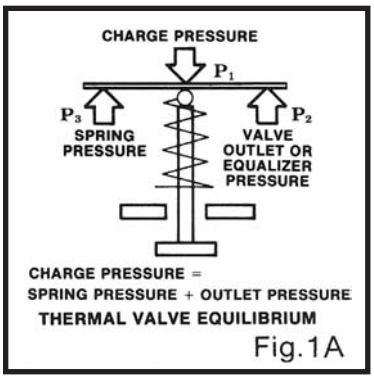
Three conditions are present in the operation of a TXV:

1. The balanced forces
2. An increase in superheat
3. A decrease in superheat

The remote bulb and power element make up a closed system (power assembly), and in the following discussion, it's assumed that the power assembly is charged with the same refrigerant as that in the system.

The power assembly pressure (P1), which corresponds to the saturation pressure of the refrigerant gas temperature leaving the evaporator, moves the TXV pin in the opening direction.

Opposed to this opening force on the underneath side of the diaphragm and acting in the closing direction are two forces: the force exerted by the evaporator pressure (P2) and that exerted by the superheat spring (P3). In the first condition, the TXV will assume a stable control position when these three forces are in balance (P1 = P2 + P3). See figure 1A.



If the temperature of the refrigerant gas at the evaporator outlet (remote bulb location) rises above the saturation temperature corresponding to the evaporator pressure as it becomes superheated (P1 greater than P2 + P3), the TXV pin moves in an opening direction.

When the temperature of the refrigerant gas leaving the evaporator decreases, the pressure in the remote bulb and power assembly also decreases and the combined evaporator and spring pressure cause the TXV pin to move in a closing direction (P1 less than P2 + P3).

For example, when the evaporator is operating with R-134a at a temperature of 40°F or a pressure of 35 psig and the refrigerant gas leaving the evaporator at the remote bulb location is 45°F a condition of 10°F superheat exists. Since the remote bulb and power assembly are charged with the same refrigerant as that used in the system R-134a, its pressure (P1) will follow its saturation pressure-temperature characteristics. With the liquid in the remote bulb at 45°F, the pressure inside the remote bulb and power assembly will be 40 psig acting in an opening direction. Beneath the diaphragm and acting in a closing direction are the evaporator pressure (P2) of 35 psig and the spring pressure (P3) for a 10°F superheat setting of 5 psig (35 psi + 5 psi = 40 psi) making a total of 40 psig. The TXV is balanced, 40 psig above and 40 psig below the diaphragm.

Changes in load cause the TXV pin to move:

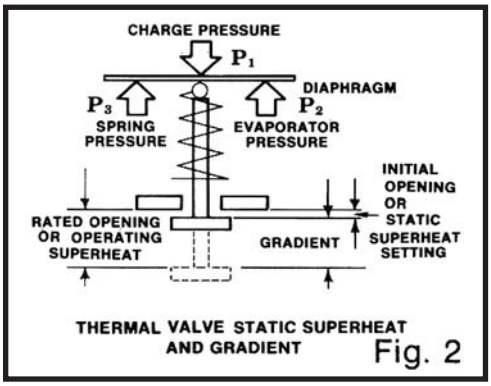
- Increasing the superheat will cause the TXV to open
- Decreasing the superheat will cause the TXV to close

Factory Settings of TXVs

The factory superheat setting of TXVs is made with the TXV pin just starting to move away from the seat. The superheat necessary to get the pin ready to move is called static superheat.

TXVs are designed so that an increase in superheat of refrigerant gas leaving the evaporator is needed for the TXV pin to open to its rated position.

This added superheat is known as gradient. For example, if the factory static is 6°F superheat, the operating superheat at the rated stroke or pin position (full load rating of TXV) will be 10°F to 14°F superheat (See fig. 2).



THERMAL VALVE STATIC SUPERHEAT AND GRADIENT Fig. 2

Manufacturers usually furnish the adjustable type TXV with a factory static superheat setting of 6°F to 10°F unless otherwise specified.

When using non-adjustable TXVs, it's important that they are ordered with the correct factory superheat setting. For manufacturer's production lines it is recommended that an adjustable TXV be used in a pilot model lab test to determine the correct factory superheat setting before ordering the non-adjustable type TXV.

If the operating superheat is raised unnecessarily high, the evaporator capacity decreases, since more of the evaporator surface is required to produce the superheat needed to operate the TXV.

A minimum change of superheat to open the TXV is important because it provides savings in first cost of the evaporator and cost of operation.

The TXV described so far is internally equalized, where the evaporator pressure at the TXV outlet is admitted internally and allowed to exert its force beneath the diaphragm. In the next section the externally equalized TXV will be discussed.

External Equalizer

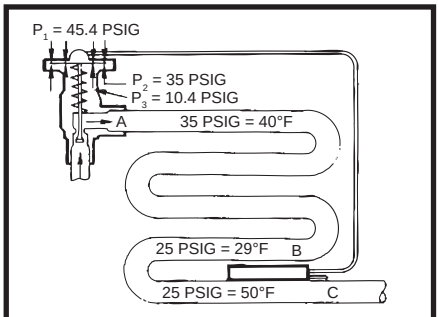
A TXV with an external equalizer is required when the pressure drop through the evaporator is substantial:

- 3°F for residential air conditioning
- 2°F for commercial air conditioning
- 1°F for refrigeration low temperature range

This is because the pressure drop will hold the TXV in a fairly "restricted" position and reduce system capacity. The evaporator should be designed or selected for the operating conditions and the TXV selected and applied accordingly.

For example, an evaporator is fed by a TXV with an internal equalizer, where a sizable pressure drop of 10 psi is present (See fig. 3). The pressure at point "C" is 25 psig or 10 psi lower than at the TXV outlet, point "A", however, the pressure of 35 psig at point "A" is the pressure acting on the lower side of the diaphragm in a closing direction. With the TXV spring set at a compression equivalent to 10°F superheat or a pressure of 10.4 psig, the required pressure above the diaphragm to equalize the forces is (35 + 10.4) or 45.4 psig. This pressure corresponds to a saturation temperature of 50°F. The refrigerant temperature at point "C" must be 50°F if the TXV is to be in equilibrium. Since the pressure at this point is only 25 psig and the corresponding saturation temperature is 28°F, a superheat of (50°F - 29°F) or 21°F is required to open the TXV.

This increase in superheat, from 10°F to 21°F means that more of the evaporator surface needs to be used to produce this higher superheated refrigerant gas. The evaporator surface available for absorption of heat is reduced and the evaporator is starved before the required superheat is reached.

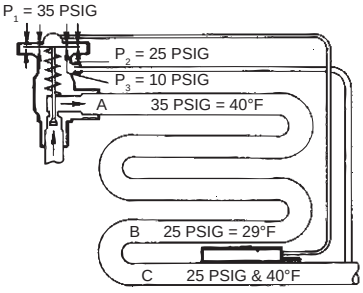


TXV with internal equalizer on evaporator with 10 PSI drop. Fig. 3

Since the pressure drop across the evaporator increases with load, the restricting effect becomes worse when the demand on the TXV capacity is greatest.

To compensate for an excessive pressure drop through an evaporator, the TXV must be externally equalized. The equalizer line should be connected to the suction line at the evaporator outlet, past the remote bulb location so that the true evaporator outlet pressure is exerted beneath the TXV diaphragm. The operating pressure on the TXV diaphragm is now free from any effect of the pressure drop through the evaporator, and the TXV will respond to the superheat of the refrigerant gas leaving the evaporator.

When the same conditions of pressure drop exist in a system with an externally equalized TXV (see fig. 4), the same pressure drop still exists through the evaporator, however, the pressure under the diaphragm is now the same as the pressure at the end of the evaporator, point "C", or 25 psig.

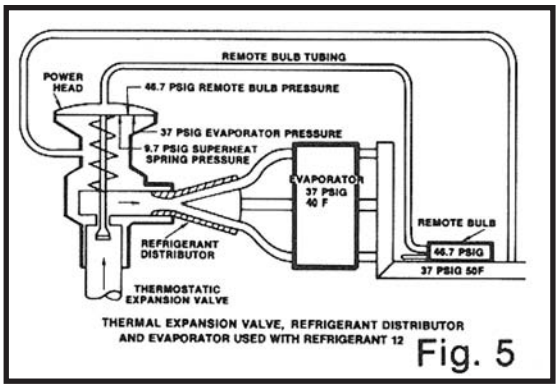


TXV with external equalizer on evaporator with 10 PSI pressure drop. **Fig. 4**

The required pressure above the diaphragm for equilibrium is (25 + 10) or 35 psig. This pressure, 35 psig, corresponds to a saturation temperature of 40°F and the superheat required is now (40°F minus 29°F) 11°F. The external equalizer has lowered superheat from 22°F to 11°F. The capacity of a system having an evaporator with a sizable pressure drop will be increased by a TXV with the external equalizer when compared to an internally equalized TXV.

When the pressure drop through an evaporator is substantial, or when a refrigerant distributor is used at the evaporator inlet, the TXV must have the external equalizer feature for best performance.

An externally equalized TXV is required when a liquid distributor is used. Although a multi-circuit evaporator may not have an excessive pressure drop, the liquid distributor will introduce a pressure drop, because the distributor is installed between the TXV outlet and the evaporator inlet (See fig. 5).



THERMAL EXPANSION VALVE, REFRIGERANT DISTRIBUTOR AND EVAPORATOR USED WITH REFRIGERANT 12 **Fig. 5**

This change from 10°F to 11°F in the operating superheat is caused by the change in the pressure-temperature characteristic of R-134a at the lower suction pressure of 25 psig.

Location of External Equalizer

The external equalizer line must be installed beyond the point of greatest pressure drop. Since it may be difficult to determinate this point, it is best to connect the equalizer line to the suction line at the evaporator outlet on the compressor side of the remote bulb location. (See fig. 4 & 5). When the external equalizer is connected to a horizontal line, always make the connection at the top of the line to avoid oil logging in the equalizer line.

On a multi-evaporator system including two or more evaporators each fed by a separate TXV, the external equalizer lines must be installed so that they will be free from the effect of pressure changes in the evaporators fed by other TXVs. At no time should the equalizer lines be joined in a common line to the main suction line.

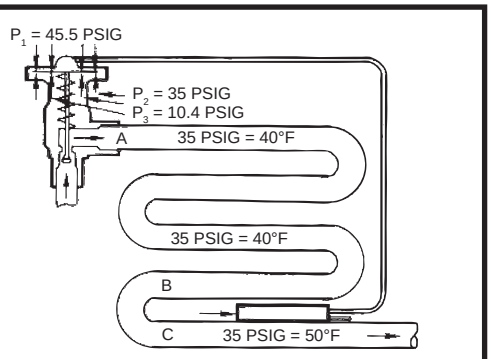
If individual suction lines from the separate evaporator outlets to the common suction line are short, then install the external equalizer lines into the separate evaporator suction headers, or as described in the preceding paragraph.

When the pressure drop through the evaporator is not substantial, install the external equalizer connection at one of the return bends midway through the evaporator. This equalizer location will provide smoother TXV control when used in conjunction with an Evaporator Pressure Regulator. Anytime a control valve is installed in the suction line, the external equalizer line for the TXV must be connected on the evaporator side of the control valve or regulator.

Never cap or plug the external equalizer connection on a TXV, as it will not operate. If the TXV is furnished with an external equalizer feature, the external equalizer line must be connected.

Superheat

A vapor is said to be superheated whenever its temperature is higher than the saturation temperature corresponding to its pressure. The superheat equals the temperature increase above the saturation temperature at that pressure. For example, a refrigeration evaporator is operating with R-134a at 35 psig suction pressure (See fig. 6). The R-134a saturation temperature at 35 psig is 40°F. As long as any liquid exists at this pressure, the refrigerant temperature will remain 40°F as it evaporates or boils off in the evaporator.



TXV with internal equalizer on evaporator with no pressure drop.

Fig. 6

As the refrigerant moves along in the coil, the liquid boils off into a vapor. The liquid is completely evaporated at point B because it has absorbed enough heat to change the refrigerant liquid to a vapor. The refrigerant gas continues along the coil and remains at the same pressure (35 psig); however, its temperature increases due to continued absorption of heat. When the refrigerant gas reaches the end of the evaporator (point "C") its temperature is 50°F. This refrigerant gas is now superheated and the superheat is 10°F. (50°F minus 40°F).

The amount of superheat depends on how much refrigerant is being fed into the evaporator by the TXV and the heat load to which the evaporator is exposed.

Superheat Adjustment

The function of a TXV is to control the superheat of the suction gas leaving the evaporator. If superheat is within reasonable limits, the TXV is operating in a satisfactory way. If superheat cannot be checked directly, it is important to know the size and direction of whatever error is present.

The pressure and temperature of the refrigerant suction gas passing the TXV remote bulb are required for an accurate determination of superheat. When measuring superheat, install a calibrated pressure gauge in a gauge connection at the evaporator outlet. In the absence of a gauge connection, a tee installed in the TXV external equalizer line can be used just as effectively.

A refrigeration type pocket thermometer with appropriate bulb clamp or an electric thermometer with thermocouples may be used to measure gas temperature.

The temperature element from the thermometer should be taped to the suction line at the point of remote bulb location and must be insulated. Thermometers will give an average reading of suction line and ambient if not insulated. Assuming an accurate gauge and thermometer, this method will provide accurate superheat readings.

Approximate Methods of Reading Superheat

When a gauge connection is not available and the TXV is internally equalized there are two ways of estimating superheat. *Neither of these methods will yield an exact superheat reading.*

The first is the two-temperature method, which uses the difference in temperature between the evaporator inlet and outlet as the superheat. The error is caused by the pressure drop in the evaporator. When the pressure drop between the evaporator inlet and outlet is 1 psi or less, the two-temperature method will yield fairly accurate results. But evaporator pressure drop is usually not known and will vary with load. For this reason, the two-temperature method cannot be relied on for absolute superheat readings. The error in this method is negative and always shows a lower superheat.

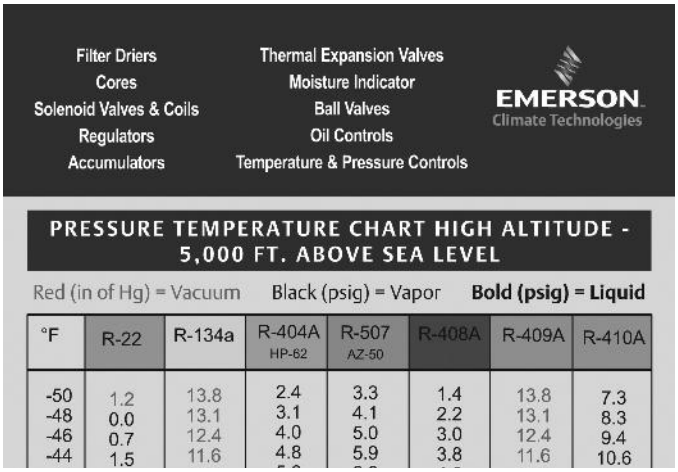
The second method involves taking the temperature at the evaporator outlet and using the compressor suction pressure as the evaporator saturation pressure. The error is caused by the pressure drop in the suction line between the evaporator outlet and the compressor suction gauge. On packaged equipment and close-coupled installations, the pressure drop and resulting error are usually small. But on large built-up systems or systems with long runs of suction lines, considerable error can result. Since estimates of suction line pressure drop are usually not accurate enough to give a true picture of the superheat, this method cannot be relied on for absolute values. The error in this method is positive and always shows a higher superheat.

The only method for checking superheat that will yield an absolute value involves a pressure and temperature reading at the evaporator outlet.

By realizing the limitations of these approximate methods and the direction of the error, it is often pos-

sible to determine that the cause of the trouble call is because of improper methods of instrumentation rather than any malfunction of the TXV.

When troubleshooting in mountain areas (such as Denver, Colorado or Salt Lake City, Utah) use a Pressure-Temperature chart that has correct readings such as Emerson Climate Technologies' 5,000 ft. pocket chart. Gauge pressures will read lower than they would at sea level.



PRESSURE TEMPERATURE CHART HIGH ALTITUDE - 5,000 FT. ABOVE SEA LEVEL

Red (in of Hg) = Vacuum Black (psig) = Vapor **Bold (psig) = Liquid**

°F	R-22	R-134a	R-404A HP-62	R-507 AZ-50	R-408A	R-409A	R-410A
-50	1.2	13.8	2.4	3.3	1.4	13.8	7.3
-48	0.0	13.1	3.1	4.1	2.2	13.1	8.3
-46	0.7	12.4	4.0	5.0	3.0	12.4	9.4
-44	1.5	11.6	4.8	5.9	3.8	11.6	10.6

TXV Selection

Proper TXV size is determined by the BTU/HR or tons load requirement, the pressure drop across the TXV, and the evaporator temperature. Do not assume that the pressure drop across the TXV is equal to the difference between discharge and suction pressures at the compressor. This assumption could lead to incorrect sizing of the TXV.

The pressure at the TXV outlet will be higher than the suction pressure at the compressor because of the frictional losses through the distribution header, evaporator tubes, suction lines, fittings, and hand valves. On rack systems, the EPR valve also adds substantial pressure drop.

The pressure at the TXV inlet will be lower than the discharge pressure at the compressor because of frictional losses created by the length of liquid line, valves and fittings, and vertical lift. The only exception is if the TXV is installed considerably below the receiver and static head built up is more than enough to offset frictional loses. The liquid line should be properly sized for its actual length plus equivalent length due to fitting and hand valves. Vertical lift in the liquid line adds pressure drop and thus static head must be included.

The pressure drop across the TXV will be the difference between the discharge and suction pressures at the compressor less the pressure drops in the liquid line, through the distributor, evaporator, and suction line. ASHRAE tables should be consulted for determining pressure drops in liquid and suction line.

Here is the procedure for properly selecting a TXV:

1. Determine pressure drop across TXV: using the maximum and minimum condensing pressures, subtract the evaporating pressure from each to get the total high-to-low side pressure drop. From these values subtract the other possible pressure losses– piping and heat exchanger losses; pressure drop thru accessories; vertical lift pressure drop; and the pressure drop across the refrigerant distributor.

2. Consider the maximum and minimum liquid temperatures of the refrigerant entering the TXV and select the correction factors for those temperatures from the table below the capacity ratings. Determine the corrected capacity requirement by dividing the maximum evaporator load in tons by the liquid correction factors.

3. Select the TXV size from the proper capacity table for the evaporator temperature, pressure drop available, and corrected capacity requirement.

4. Select the proper thermostatic charge based on the evaporator temperature, refrigerant, and whether a Maximum Operating Pressure (see MOP section) type charge is needed.

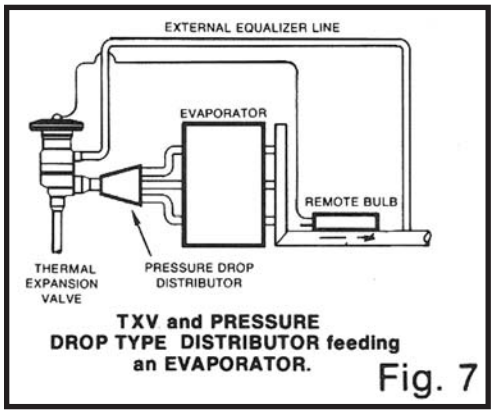
5. Determine connections and whether an externally equalized model is required. Always use an externally equalized TXV when a distributor is used.

A solid column of liquid refrigerant is required for proper TXV operation. Calculate the pressure drop in the liquid line to determine if there will be enough subcooling to prevent flash gas. If the subcooling of the liquid refrigerant from the condenser is not adequate, then a heat exchanger, liquid subcooler, or some other means must be used to get enough subcooling to ensure solid liquid entering the TXV at all times.

Emerson Climate Technologies has prepared extended TXV capacity tables. These tables can be found in the Emerson catalog. Always select a TXV based on operating conditions rather than nominal TXV capacities.

Application Tips

For best evaporator performance, the TXV should be installed as close to the evaporator as possible and in an easily-accessible location for adjustment and servicing. On pressure drop and centrifugal type distributors, apply the TXV as close to the distributor as possible. (See fig.7)



TXV and PRESSURE DROP TYPE DISTRIBUTOR feeding an EVAPORATOR. Fig. 7

Remote Bulb Location

Since evaporator performance depends on good TXV control, and TXVs respond to the temperature change of the refrigerant gas leaving the evaporator, care must be given to types of remote bulbs and their locations. The external remote bulb meets the requirements of most installations. The bulb should be clamped to the suction line near the evaporator outlet on a horizontal run. If more than one TXV is used on adjacent evaporators or evaporator sections, make sure that remote bulb of each TXV is applied to the suction line of the evaporator fed by that TXV.

Clean the suction line thoroughly before clamping the remote bulb in place. When a steel suction line is used, paint the line with aluminum paint to reduce future corrosion and faulty remote bulb contact with the line.

On lines smaller than 7/8" OD the remote bulb may be installed on top of the line. With 7/8" OD and over, the remote bulb should be installed at the position of about 4 or 8 o'clock. (See fig. 8)

It is good practice to insulate the bulb with a material which will not absorb moisture.

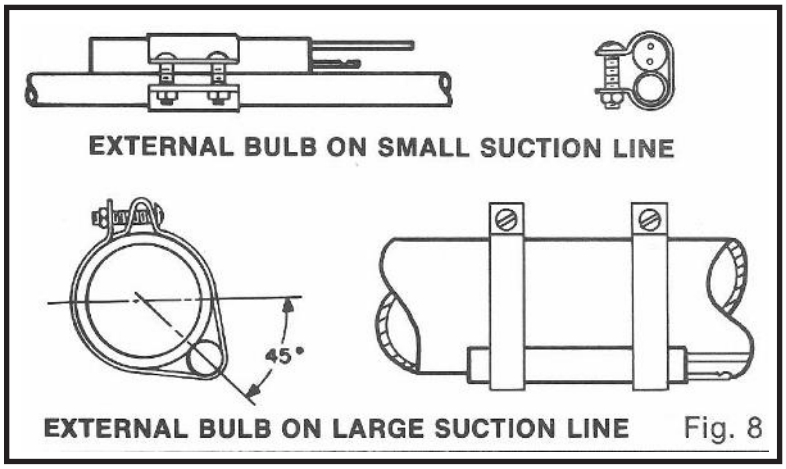


Fig. 8

Remote Bulb Well

A remote bulb well will improve the sensitivity of the remote bulb. This occurs with short coupled installations and installations with large suction lines (2-1/8" OD or larger). Remote bulb wells should be used when low superheat is desired or where converted heat from warm rooms can influence the remote bulb. (See fig. 9).

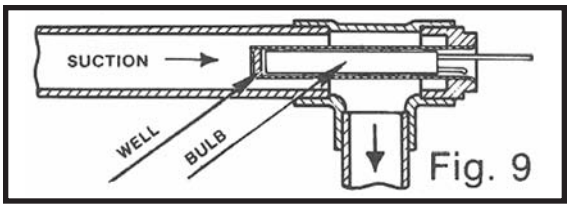


Fig. 9

Never install a remote bulb in a location where the suction line is trapped (See fig. 10). If the liquid refrigerant collects at the point of remote bulb location the TXV operation will be erratic.

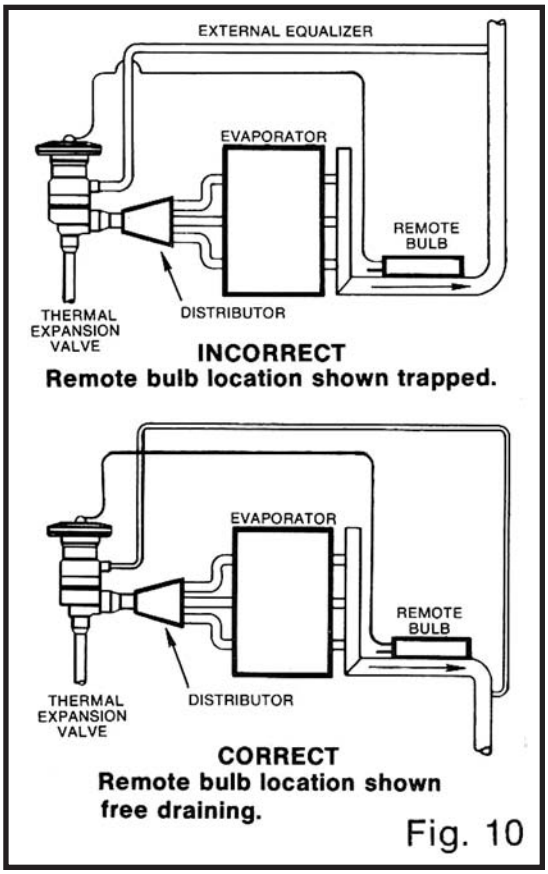


Fig. 10

Large fluctuations in superheat in the suction gas are usually the result of trapped liquid at the remote bulb location. Even on properly designed suction lines, it is sometimes necessary to move the remote bulb a few inches from the original location to improve TXV performance.

On multi-circuit evaporators fed by one TXV, install the remote bulb at a point where the suction gas has had an opportunity to mix in the suction header. Tighten clamps so that the remote bulb makes good contact with the suction line. **NEVER APPLY HEAT NEAR THE REMOTE BULB LOCATION WITHOUT FIRST REMOVING THE REMOTE BULB**.

Hunting

"Hunting" of TXVs is defined as the alternate overfeeding and starving of the refrigerant flow to the evaporator. Hunting is characterized by extreme cyclic changes in the superheat of the refrigerant gas leaving the evaporator and the evaporator or suction pressure.

Hunting is a function of the evaporator design, length and diameter of tubing in each circuit, load per circuit, refrigerant velocity in each circuit, temperature difference (TD) under which the evaporator is operated, arrangements of suction piping and application of the TXV remote bulb. "Hunting" can be reduced or eliminated by the correct rearrangement of the suction piping, relocation of the bulb and use of the recommended remote bulb and power assembly charge for the TXV.

Operation at Reduced Capacity

The conventional TXV is a self-contained direct operated regulator which is inherently susceptible to hunting because of its design and the design of the system to which it is applied.

The ideal flow rate would require a TXV with perfect dynamic balance, capable of instantaneous response to any change in evaporation (anticipation) and with a means of preventing the TXV from over shooting the control point because of inertia (compensation). With these features a TXV would be in phase with the system demand at all times and hunting would not occur.

A conventional TXV does not have built in anticipating or compensating factors. A time lag will exist between demand and response, along with the tendency to over shoot the control point. The conventional TXV may get out of phase with the system and hunt. An example of overshooting occurs when the load increases, causing the superheat of the suction gas to increase. The time interval between the instant the remote bulb senses the increase and causes the TXV pin to move into opening direction allows the superheat of the gas to increase still further.

In response to the rising superheat during the time lags, the TXV has moved further in the opening direction, overshooting the control point and allowing more refrigerant to flow to the evaporator than can be boiled off by load.

When the TXV finally responds to the over-feeding of the evaporator coil, it closes and will tend to again overshoot the control point and remain overly throttled until most of the liquid refrigerant has left the evaporator.

The ensuing time delay before the TXV moves in the opening direction allows superheat of the suction gas to again rise beyond the control point. This cycle, being self-propagating, continues to repeat.

Experience has shown that a TXV is more likely to hunt at low load conditions when the TXV pin is close to the valve seat. This is because of an unbalance between the forces which operate the TXV.

Besides the three main forces that operate the TXV, the pressure difference across the TXV port also acts against the port area and depending on TXV construction, tends to force the TXV either open or closed.

When operating with the pin close to seat, the following will occur:

With the TXV closed, there is liquid pressure on the inlet side of the pin and evaporator pressure on the outlet.

When the TXV starts to open allowing flow to take place, the velocity through the TXV throat will cause a point of lower pressure at the throat, raising the pressure difference across the pin and seat.

This sudden rise in pressure differential while acting on the port area will tend to force the TXV pin back into the seat. When the TXV again opens, the same type of action occurs and the pin bounces off the seat with a rapid frequency. This phenomenon is more frequently encountered with the larger conventional ported TXVs as compared to balance ported TXVs as the force caused by the pressure differential is magnified by the larger port area.

Most TXVs, when properly selected and applied, will overcome these factors and operate with virtual no hunting over a fairly wide load range.

Conventional ported TXVs will operate satisfactory to somewhat below 50% of nominal capacity depending on evaporator design, refrigerant piping, size and length of evaporator, and rapid changes in loading.

Nothing will cause a TXV to hunt quicker than unequal feeding of the parallel circuits by a distributor or unequal air loading across the evaporator circuits.

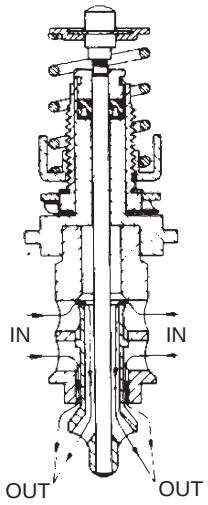
Balanced Port TXV Operation

In conventional TXVs, as the pressure drop across the TXV port changes due to changes in head pressure or suction pressure, the operating superheat of the TXV will vary.

Depending on the operating conditions under which the superheat was originally set, this "unbalance" can sometimes result in compressor flooding or evaporator starvation. A unique design concept called "Balanced Port" cancels the effect of this pressure unbalance, permitting the TXV to operate at a fairly constant superheat over a wide range of operating conditions.

There are 2 fundamental Balanced Port designs:
Double Ported Design (Figure 11a) – In this design, there are 2 paths for the refrigerant to flow. One path creates a force that tends to push the pin in the "open" direction; whereas the other path creates a force pushing the pin in the "closed" position. These paths are designed in such a way that the forces generated in each path are equal to one another, resulting in a "balanced" design.
Single Ported Design (Figure 11b) – In this design, the valve pin has a shoulder added that is on the inlet side of the valve. The high pressure times the area of the shoulder results in an upward (closing) force. The pressure differential across the pin results in a "downward" force. By designing the shoulder carefully, the downward force is negated or "balanced".

Any refrigeration system which experiences changes in operating pressures because of varying ambient, gas defrost, heat reclaim, or swings in evaporator load will benefit from using a balanced port TXV.



BALANCED CAGE ASSEMBLY

Fig. 11a

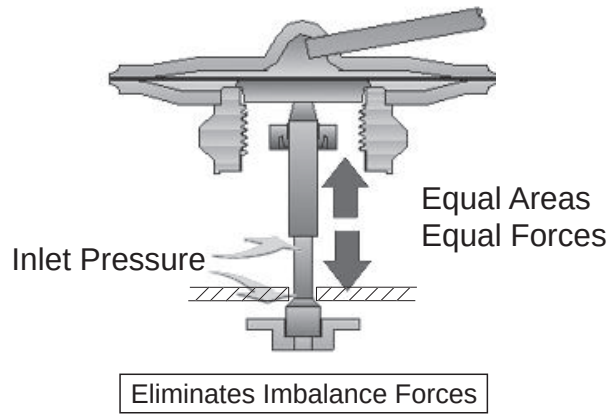


Fig. 11b

M.O.P.

Maximum Operating Pressure (sometimes referred to as Motor Overload Protection) is the ability of a TXV to close down, starve, or shut off if the suction pressure should approach a dangerously high predetermined limit condition. These conditions could overheat a suction cooled compressor or load the crankcase with too dense a vapor pressure. With the TXV in a closed condition the compressor has a chance to gain pull the suction back down to satisfactory operating conditions. Once below the MOP, the TXV will re-open and feed normally or until there is an overload again.

Power Element Charges

There are several basic types of charges in use today. Most common are the: liquid charge; gas charge; liquid cross-charge; gas cross-charge; and the adsorption charge.

Liquid Charges

The power element contains the *same* refrigerant as the system in which the TXV is used. When manufactured, it is put into the remote bulb in a liquid state. Volume is controlled so that within the design temperature range some liquid always remains in the bulb. Therefore, the power element pressure is always the saturation pressure corresponding to the temperature of the remote bulb.

Liquid charges have the following properties:

- Not subject to cross-ambient control loss
- Little or no superheat at start-up
- Superheat increase at lower evaporator temperatures
- Slow suction pressure pulldown after start-up

REFRIGERANT CODE NAMES

ARI Standard 750-2007 recommends the following color coding of the TXVs:

R-12	White
R-22	Green
R-502	Orchid
R-134a	Light Blue
R-410A	Rose
R-404A	Orange
R-507A	Blue Green (Teal)

Liquid Cross-Charges

Liquid cross-charges means that the power element contains a liquid refrigerant *different* from the system refrigerant in which the TXV is used. The pressure temperature curve of the charge *crosses* the curve of the system refrigerant.

Liquid cross-charge advantages are:

- Moderately slow pull down
- Insensitive to cross-ambient conditions.
- Damped response to suction line temperature changes (reduces tendency for TXV hunting)
- Superheat characteristics can be tailored for special applications

Gas & Gas Cross-Charges

Using a gas charge in place of a liquid alters the operational characteristics, because gas is compressible. At some predetermined temperature, the gas in the remote bulb becomes superheated, limiting the force it exerts. This produces higher superheats at higher evaporator pressures and is labeled the Maximum Operating Pressure (MOP) effect.

Any MOP point temperature depends on how that bulb was charged and where it will be used. All gas charges are susceptible to cross-ambient control loss when the power element is colder than the remote bulb. They respond faster, but tend to hunt for the proper operating level, so a ballast is often added to the remote bulb to reduce that tendency.

As in liquid charges, the remote bulb can be filled with the same refrigerant as the system refrigerant (producing a gas charge). Or, it can be filled with a different refrigerant, producing a gas cross-charge.

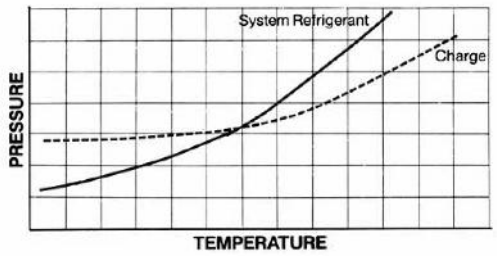
Adsorption Charges

The final type of charge is adsorption. In adsorption, solids hold large quantities of gas, not by taking them into the body of the solid, as in absorption, but by gathering them and holding them on the surface of the solid without chemical reaction.

The vapor penetrates into the cracks and furrows of the solid, allowing far greater capacity than possible with absorption.

The advantage of an adsorption charge is that in a fixed volume, the quantity of vapor adsorbed varies with the temperature and the system. So it can be used to exert operating pressure as a function of temperature.

Typical adsorbents include: charcoal, silica gel, activated alumina.



What happens with an adsorption charge

Which Charge to Use?

Here are some typical examples of applications by refrigerant charge:

Liquid Charge
Ice makers, pilots, liquid injection valves

Liquid Cross-Charges
Commercial refrigeration (low & medium temp.), ice makers, transport refrigeration and air conditioning

Gas Charge
Air conditioning (including mobile), water chillers

Gas Cross-Charge
Heat pumps and air conditioning

MOP
Maximum Operating Pressure

Other TXV Considerations

Solenoid Liquid Stop Valves

The TXV is produced as a tight seating device. But if the TXV is exposed to dirt, moisture, corrosion, and erosion the TXV will not be able to positively shut off. If the remote bulb is installed in a location where during the "off' cycle it is influenced by a higher ambient temperature than the evaporator, the valve will open and admit liquid to the evaporator. Installing a Solenoid Liquid Stop Valve ahead of any TXV is highly recommended.

Filter-Driers for System Protection

To protect the precision working parts of control valves from dirt and chips which can damage them and make them inoperative, and to protect the entire system from the damaging affects of moisture, sludge and acids, a filter-drier should be installed on every system.

Pressure Switch Setting

On TXVs with M.O.P., a Pressure Switch must be set to cut in at a pressure lower than M.O.P. rating of the TXV.

Emerson TXVs

Emerson's TXVs are designed for a wide range of air conditioning, refrigeration, heat pump, and chiller applications. Emerson uses stainless steel power elements that will not corrode.

Emerson's integral TXV line includes valves for commercial and refrigeration applications, and heat pump and residential applications. The "Take-A-Part Series" TXVs are available for almost any type of application, temperature range, or refrigerant. Emerson also offers a complete line of specialty TXVs.

Factory Superheat Setting

Unless otherwise specified, all Emerson TXVs will be preset at the factory at a bath temperature which is pre- determined by the charge symbol or the MOP rating. The bath temperature at which the TXV superheat is set is coded alphabetically in the superheat block on the TXV nameplate, as shown in Fig. 15.

TXV SUPERHEAT ADJUSTMENT

Valve Family	"Total Turns"	Degrees of SH Per Turn					
		R-22		R-134a	R-404A/507A		R-410A
		+20°F	-20°F	+20°F	+20°F	-20°F	+40°F
TCLE	32	0.8	1.5	1.0	0.5	1.0	N/A
HF	10	2.2	4.2	3.8	1.8	3.2	N/A
A	8	3.0	5.0	4.5	2.0	4.0	2
TRAE	10	2.2	4.2	3.8	1.8	3.2	N/A
C	12	–	–	–	–	–	4

Turn adjustment clockwise to increase superheat, counterclockwise to decrease superheat. To return to approximate original factory setting, turn adjustment stem counterclockwise until the spring is completely unloaded (reaches stop or starts to "ratchet"). Then, turn it back in one half of the "Total Turns" shown on the chart.

Fig. 15

For example, a TXV with "10A" stamped in the nameplate superheat block is set for 10°F static superheat with a 32°F bath. A TXV stamped "10C" is set for 10° of static superheat with a 0°F bath.

When ordering a TXV for an exact replacement, specify the code letter and the superheat setting desired. When ordering for general stock, it is not necessary to specify either the superheat or the code letter, since the standard setting will cover most applications and minor superheat adjustments may be made in the field.

Emerson "T" Series TXVs [except "W"-(MOP), G-(MOP) or GS-(MOP) gas charged types] may be installed in any location in the system. The gas charged type must always be installed so that the power assembly will be warmer than the remote bulb. The remote bulb tubing must not be allowed to touch a surface colder than the remote bulb location. If the power assembly or remote bulb tubing becomes colder than remote bulb, the vapor charge will condense at the coldest point and remote bulb will lose control.

For exact TXV selection (i.e., refrigerant tonnage, connections, equalizer style, cap tube length, adjustment and proper application, air conditioning, commercial, low temperature) refer to Emerson catalog.

Emerson MOP

The Emerson "W" charge can be supplied with the MOP feature if needed for system protection. This need rarely occurs in modern day refrigeration except such conditions as immediately after defrost or on gasoline driven compressors such as truck refrigeration.

For special applications, other charges may be used from time to time. For help in selecting a charge with Motor Overload Protection (if required by compressor manufacturer) see the table below and the TXV Charge Selector on page 13.

APPLICATION	R134a	R22	R404A/R507A
COMMERCIAL	MW35	HW65	*W65
LOW TEMP.	MW15	HW35	*W45

* Add refrigerant code as follows: S = R404A, P = R507A

NOTE: MOP **not** available with Rapid Response Bulb.

Superheat adjustment of "W–MOP" charged TXVs will change the MOP point. An increase in superheat setting will lower the MOP point and a decrease in superheat setting will raise the MOP.

TABLE 1 – Maximum Dehydration Temperature (in °F)

	THERMOSTATIC CHARGE					
REFRIGERANT	L	C	Z	G	WMOP/CA	X
R134a	195	190	250	250	250	N/A
R22	160	160	185	250	250	N/A
R404A/R507A	150	150	170	250	250	N/A
R717	N/A	N/A	150	N/A	N/A	200

The table above refers to the maximum dehydration temperatures when the bulb and TXV body are subjected to the same temperature. On **A, L, C, Z,** and **X** charges, 250°F maximum TXV body temperature is permissible **(if the bulb temperature)** does not exceed those shown in the table.

NOTE: Emerson charges "A", "C" and "Z" are liquid cross-charges.

To help you match the correct charge to your specific application, see the TXV Charge Code Selector on the next page. Also provided here are some typical examples of applications by refrigerant charge.

Liquid Charge – L
Ice makers, pilots, liquid injection valves

Liquid Cross-Charges – C, Z
Commercial refrigeration (low & medium temp.), ice makers, transport refrigeration and air conditioning

Gas Charge – G
Air conditioning (including mobile), water chillers

Gas Cross-Charge – CA, AA
Heat pumps and air conditioning

Gas Cross-Charge – HAA
Heat pumps and air conditioning

W(MOP)
Maximum Operating Pressure

Refrigerant Code Names

ARI Standard 750-2007 recommends the following color coding of thermostatic expansion valves: R-12 White; R-22 Green; R-502 Orchid; R-40 Red; R-500 Orange. Uncommon refrigerants with no designated color should use Blue.

ASHRAE REF. NO.	TRADE OR CHEMICAL NAME	EMERSON CODE COLOR	EMERSON CODE LETTER
R-12	Dichlorodifluoromethane	WHITE	F
R-22	Chlorodifluoromethane	GREEN	H
R-502	22/115	PURPLE	R
R-134a	Tetrafluoroethane	LIGHT BLUE	M
R-404A	125/134a/143A	ORANGE	S
R-401A	22/152A/124	CORAL	X
R-507A	125/143A	TEAL	P
R-410A	32/125	ROSE	Z

TXV Charge Code Selector

Applications	Operating Ranges
R-134a/R-12 Domestic Refrigerators and Freezers, Ice Makers,Dehumidifiers, Transport Refrigeration, Medium Temperature Supermarket Equipment,Medium Temperature Commercial Equipment	MC/FC MZ/FZ MW15/FW15 (MOP) MW35/FW35 (MOP) MW55
R-22 Residential Air Conditioners &Heat Pumps, Commercial and Industrial Chillers, Medium Temperature Supermarket Equipment, Commercial Air Handlers	HCA/HAA AIR COND. & HEAT PUMP HW/HW100 HC HW65 (MOP) HZ
R-404A/R-507A/R-502 Low Temperature Cases, Ice Makers, Commercial Air Handlers, Conditioners, Soft Ice Cream Machines, Environmental Chambers	SC/RC SZ/RZ SW45/RW45 (MOP)
R-410A	ZW195

-50 -40 -30 -20 -10 0 +10 +20 +30 +40 +50

TXV Replacement Charge Symbols Cross Reference

Old Bulb Charges vs. New Replacement Bulb Charge

AIR CONDITIONING		COMMERCIAL REFRIGERATION		LOW TEMPERATURE	
OLD CHARGE	REPLACEMENT	OLD CHARGE	REPLACEMENT	OLD CHARGE	REPLACEMENT
REFRIGERANT R12/R134a					
	FC	F OR FL	FC	—	—
		FC		—	FZ
FW		FW		FWZ	
FG55		FG35	FW35	—	—
FW55		FW35		FW15	FW15/MW15
FQ55		FQ35		FW15	
FGA		—	—	—	—
FLA					
FGS	FWS	FGS35	FGS35		
FWS		FWS	FWS	FWS	FWS
				FZ/MZ	FZ/MZ
				FX	FX
REFRIGERANT R22					
	HC	H OR HL	HC	—	—
		HC		—	HZ
HW	HCA	HW		HWZ	
HG100	HC	HG65	HW65	—	—
HW100		HW65		HW35	HW35
HQ100		HQ65		HQ35	
HGA		—	—	—	—
HLA					
HW85	HW85				
HGS	HWS	HGS65	HGS65		
HWS		HWS	HWS	HWS	HWS
				HZ	HZ
				HX	HX
REFRIGERANT R502/R404A/R507A					
	RC/SC/PC	RL	RC/SC/PC	—	—
RW		RW		RWZ	RZ
RW110		RW65	RW65	RW35	RW45/SW45
RWS	RWS	RWS	RWS	RWS	RWS
				RZ	RZ/SZ/PZ

NOTE: ALL OTHER CHARGE SYMBOLS MUST BE REPLACED WITH AN IDENTICAL MODEL OR AT THE OPTION OF THE EMERSON TECHNICAL SERVICE DEPARTMENT WHO MAY MAKE ENGINEERING AUTHORIZED SUBSTITUTION OF EQUIVALENT TYPE TO PROVIDE EQUIVALENT OPERATION AND PERFORMANCE.
NOTE: FOR FIELD REPLACEMENT PURPOSES, HC CAN BE USED TO REPLACE HCA.

Solenoid Valves

2008

Solenoid Valves

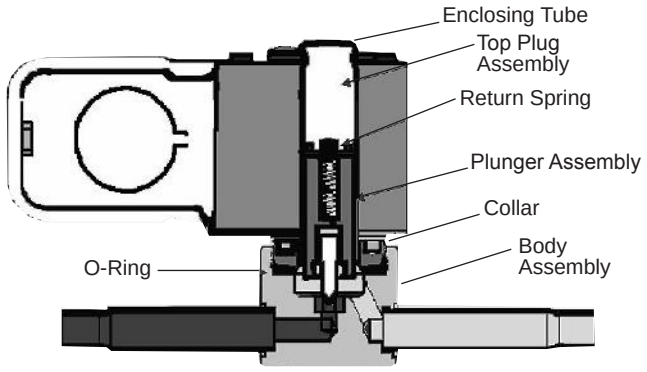
In most refrigeration applications, it is necessary to start or stop the flow in a refrigerant circuit to automatically control the fluids in the system. An electrically operated solenoid valve is usually used for this purpose. Its basic function is the same as a manually operated shut off valve, but by being solenoid actuated, it can be positioned in remote locations and may be conveniently controlled by simple electrical switches.

Solenoid valves can be operated by a thermostatic switch, float switches, low pressure switches, high pressure switches or any other device for making or breaking an electric circuit, with the thermostatic switch being the most common device used in refrigeration systems.

What Are Solenoid Valves?

A solenoid valve consists of two distinct but integral acting parts, a coil and a valve. See drawing below for complete valve anatomy.

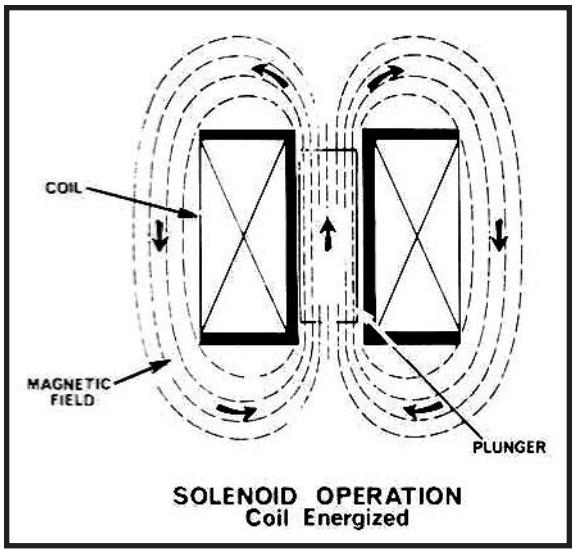
Direct Acting Solenoid Anatomy



The coil is nothing more than electrical wire wound around the surface of a cylindrical form usually of circular cross section. When an electric current is sent thru the windings, they act as an electromagnet. The force field that is created in the center of the solenoid is the driving force for opening the valve. Inside is a moveable magnetic steel plunger that is drawn toward the center of the coil when energized.

The valve contains an orifice through which fluid flows when open. A needle or rod is seated on or in the orifice and is attached directly to the lower part of the plunger.

When the coil is energized, the plunger is forced toward the center of the coil, lifting the needle valve off of the orifice and allowing flow. With a normally-closed valve, when the coil is de-energized, the weight of the plunger and in some designs, a spring, causes it to fall and close off the orifice, thus stopping the flow through the valve. Less common are normally-open valves which are open when the coil is de-energized.



Principles of Solenoid Operation

Solenoids are either direct acting or pilot operated. The application determines the need for either of these types. The direct acting valve is used on valves with low capacities and small port sizes. The pilot operated type is used on the larger valves, eliminating the need for larger coils and plungers.

1. Direct Acting

In the direct acting type valve, as discussed under Solenoid Valve operation, the plunger is mechanically connected to the needle valve. When the coil is energized, the plunger pulling the needle off the orifice is raised into the center of the coil. A direct acting valve will operate from zero pressure differential to its maximum rated pressure differential, regardless of the line pressure.

The direct acting type valve is only used on small capacity circuits because of the increased coil size that would be required to counter the large pressure differential of large capacities. The required coil would be large, uneconomical, and not feasible for large capacity circuits. To overcome this problem on large systems, pilot operated solenoid valves are used.

2. Pilot Operated Valve

The pilot operated solenoid valve uses a combination of the solenoid coil and the line pressure to operate. In this type valve the plunger is attached to a needle valve covering a pilot orifice rather than the main port. The line pressure holds an independent piston or diaphragm closed against the main port. See figures 2a and 2b. When the coil is energized, the plunger is pulled into the center of the coil, opening the pilot orifice. Once the pilot port is opened, the line pressure above the diaphragm is allowed to bleed off to the low side or outlet of the valve, thus relieving the pressure on the top of the diaphragm. The inlet pressure then pushes the diaphragm up and off of the main valve port and holds it there allowing full fluid flow. When the coil is de-energized, the plunger drops and closes the pilot orifice. Pressure starts to build up above the diaphragm by means of a bleed hole in the piston diaphragm until it and the diaphragm's weight and spring cause it to close on the main valve port. A pilot operated solenoid valve requires a minimum pressure difference of several pounds between inlet and outlet to operate.

Types of Solenoids

There are different types of solenoid valves for different applications. The three main types of valves are the 2-way, 3-way, and 4-way valves. The 2-way valve is the most common.

2-Way Valves

The 2-way valve controls fluid flow in one line. It has an inlet and an outlet connection. This valve can be of the direct acting or pilot operated type of valve depending on the need. When the coil is de-energized, the 2-way valve is normally closed. Although normally closed is the most widely used, two-way and three-way valves are manufactured to be normally open when the coil is de-energized. See Figure 3 for an example of a 2-way valve.

Figure 3

NOTE: 2-way valves are usually designed to have flow in one direction only. Some valves may be modified to have flow in both directions. A "bi-flow" kit must be used.

Figures 1A and 1B show a simple schematic of a Direct Acting Solenoid Valve in operation.

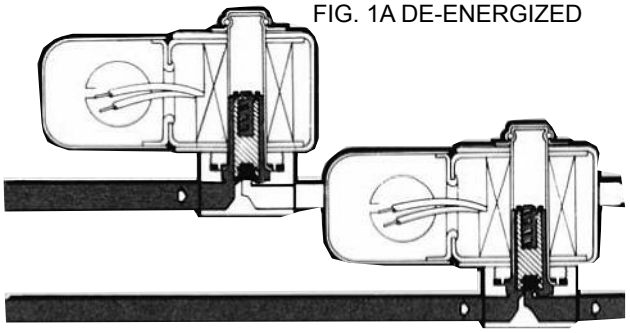


FIG. 1A DE-ENERGIZED

FIG. 1B ENERGIZED

Figures 2A and 2B show a simple schematic of a Pilot Operated Solenoid Valve in operation.

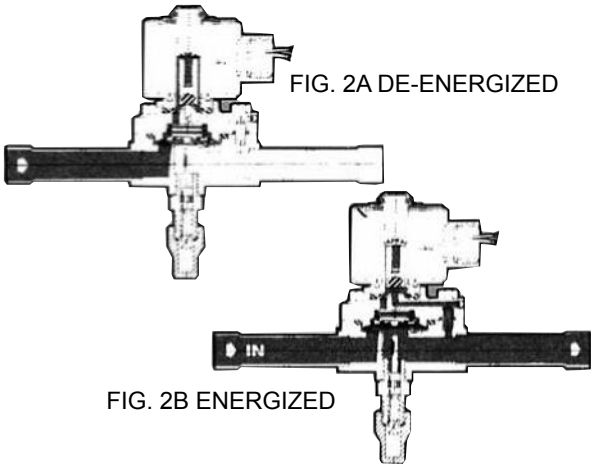


FIG. 2A DE-ENERGIZED

FIG. 2B ENERGIZED

Solenoid Valve Selection

The selection of a Solenoid Valve for a control application requires the following information:

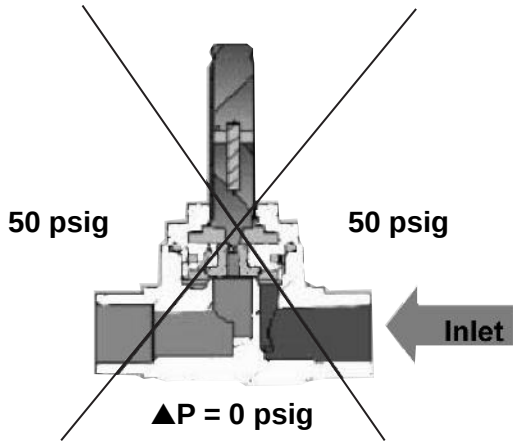
1. Fluid to be controlled
2. Capacity required
3. Maximum operating pressure differential (MOPD)
4. Electrical characteristics
5. Maximum working pressure required (MWP)

The capacities of Solenoid Valves for normal liquid or suction gas refrigerant service are given in tons of refrigeration at some nominal pressure drop and standard conditions. Manufacturers' catalogs provide extended tables to cover nearly all operating conditions for common refrigerants. Follow the manufacturer's sizing recommendations. Do not select a valve based on line size. Pilot operated valves require a pressure drop to operate and selecting an oversize valve will result in the valve failing to open. Undersized valves result in excessive pressure drops.

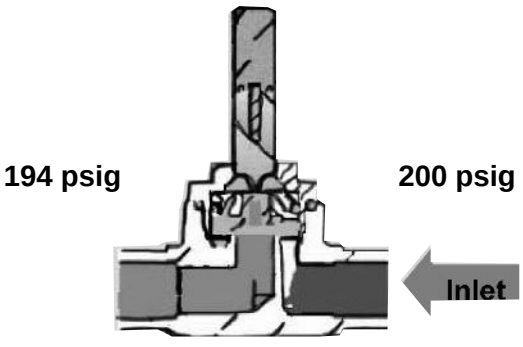
The solenoid valve selected must have a MOPD rating equal to or greater than the maximum possible differential against which the valve must open. The MOPD or Maximum Operating Pressure Differential considers the inlet and outlet valve pressures. If a valve has a 500 psi inlet pressure and a 250 outlet pressure, and a MOPD rating of 300 psi it will operate, since the pressure difference (or 500-250) is less than the 300 MOPD rating. If the pressure difference is larger than the MOPD, the valve will not open.

Minimum Operating Pressure Differential

Consideration of the maximum working pressure required is also important for proper and safe operation. A solenoid valve should not be used for an application when the pressure is higher than the valve maximum working pressure. Solenoid valves are designed for a given type of fluid so that the materials of construction will be compatible with that fluid. Special seat materials and synthetics may be used for high temperature or ultra-low temperature service. Special materials are required for corrosive fluids. Special attention to the electrical characteristics is also important. Required voltage and Hertz must be specified to ensure proper selection. Valves for DC service often have different internal construction than valves for AC applications, so it is important to study the manufacturer's catalog information. Solenoid valves should never be used as a Safety Shut Off unless specifically designed and rated for that service.



NOTE: No minimum pressure differential – valve will not operate.



NOTE: Pressure differential greater than minimum – valve will operate.

Installation

Solenoid Valves having a spring loaded piston or diaphragm may be installed and operated in any position, but installing more than 90° from vertical is not recommended since dirt or debris may collect in the solenoid area and prevent it from operating. An adequate strainer or filter drier should be installed ahead of each solenoid valve to keep scale, pipe dope, solder, and other foreign matter out of the valve.

When installing a solenoid valve, be sure the arrow on the valve body points in the direction of refrigerant flow.

When brazing valves with extended solder type connections do not use too hot a torch and point the flow away from the valve. These valves do not normally need to be disassembled before installation; if the valve does not have extended connections, disassemble the valve before brazing. Wet rags or chill blocks are recommended during brazing. They are needed to keep the valve body cool so that body distortion on close-coupled valves will not occur. Allow the valve body to cool before replacing the valve's operating insides to ensure that the seat material and gaskets are not damaged by the heat. When reassembling, do not over torque.

Emerson Solenoid Valves

Emerson offers a complete line of refrigerant solenoid valves for refrigeration and air-conditioning applications. As part of Emerson's commitment to the industry, each valve undergoes stringent Emerson testing to ensure fail-safe operation. And, with the lowest external leak rates in the industry, Emerson solenoid valves ensure precise refrigerant flow, preventing system failures and aiding in environmental protection.

Application Overview

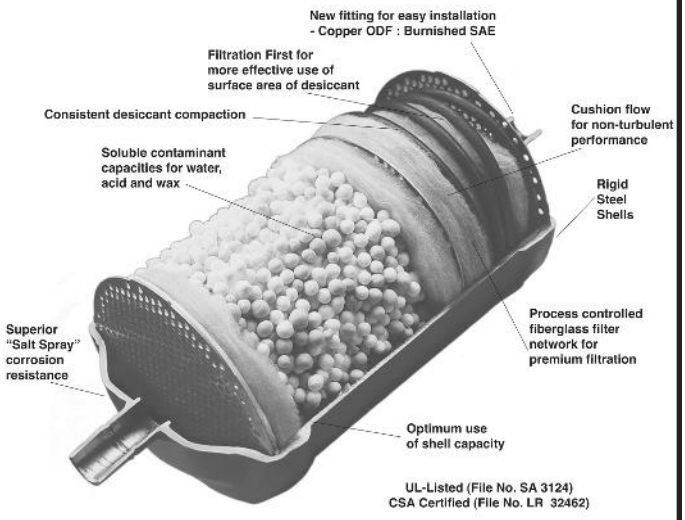
Application	Product Family
Liquid, Suction Line Service or Hot Gas By-Pass	**240RA/540RA 50RB 100RB 200RB/500RB**
Pressure Differential Valve for Gas Defrost	**710RA 713RA**

System Protectors

Liquid line and suction line filter-driers are often referred to as System Protectors because they remove harmful elements from the circulating refrigerant before serious damage results.

Keeping the system clean and free of foreign contaminants that can restrict the operation of valves, block capillary tubes or damage compressors is the best way to assure trouble-free operation. These contaminants can be solids, such as metal filings, flux, dust and dirt. Other equally menacing contaminants are solubles, such as acid, water, resins and wax.

No matter how many precautions are taken during assembly and installation or servicing of a system, contaminants can find a way into the system. Filter-driers are designed to protect a system during operation. It is the function of this all important unit to remove those residual elements that can attack and eventually destroy the system components.



MWP-680

Filtration Capacity

Solid particles or semi-solids such as sludges circulating in a refrigerant system can destroy valve seats, plug control valves, and score cylinder walls or compressor bearings. These contaminants can be the result of manufacturing, servicing, or can be generated during normal system operation.

It is important to remove these contaminants as quickly as possible and prevent them from returning to the system. Properly specified filter-driers are designed to trap and hold large quantities of these contaminants while maintaining low pressure drop during their service life.

Moisture Capability

Moisture in a refrigeration system can cause frozen valves, copper plating, damaged motor insulation, corrosion, and sludges. Filter-driers remove and retain moisture through one or more desiccants. The most popular and effective desiccant in use today for the removal of moisture is molecular sieve which can hold three to four times the water of other commercial absorbents.

Moisture capacity of a filter-drier is normally given in drops of water per ARI Standard 710. These rated capacities are in addition to any residual moisture that might be absorbed during manufacturing.

Acid Pick-Up Capability

Various organic acids result during the decomposition of the refrigerant and oil in a system. This decomposition can be the result of moisture in the system, excessive temperatures, air, or exposure to foreign substances in the system. It is important that acid in a system is absorbed as soon as it is formed to prevent the acid from causing system damage. Activated alumina is the most popular of the desiccants used to remove acid.

Tests have shown that the amount of acid and resin pick-up of an adsorbing agent is almost proportional to the weight of the desiccant. Size or granulation makes little difference.

There is no industry-approved method for rating acid removal. So weight of the desiccant provides the handiest measure.

Wax Removal

The ability of a filter-drier to remove wax and resins is important in low temperature applications that use R-22. Wax when present in a system tends to solidify on valve seats and pins, resulting in system malfunctions.

Flow Rate

Published flow rates for filter-driers are established in accord with ARI Standard 710 for liquid line driers, and ARI Standard 730 for suction line driers.

Absorption vs. Adsorption

One factor to consider in selection is ab- vs. adsorption. Absorption means a material's ability to take another substance into its inner molecular structure.

An adsorbed substance doesn't penetrate the molecular structure. It simply starts building up on the surface of the adsorbent. Walls, cracks, crevices are part of the surface area and are able to hold other substances, greatly increasing capacity.

Modern desiccants are extremely porous and have a large surface area and internal pore volume of a size and shape to adsorb and retain water molecules.

Types of Filter-Driers

All the liquid line filter-driers on the market today are a variation of one of two types: the molded core type or the bead type.

Molded core type filter-driers are manufactured by mixing desiccants (which remove the soluble contaminants) with a bonding agent, then baking them to give them permanent shape and to activate the drying ingredients. The results is a porous core which acts as filter and drying agent.

Compacted bead style filter-driers are manufactured with the active desiccant in bead or pellet form; no bonding material is used. Rather, compacting comes from mechanical pressure exerted by a spring. Compacted bead-style filter-driers usually include an additional filter network to trap solid contaminants from the refrigerant, unlike most core styles.

The separate and distinctive filter media can take various forms that permit depth filtration with greater solid contaminant capacity and contaminant retention during start-up and shut- down when turbulent conditions exist.

Compacted bead filter-driers offer the maximum volume of desiccant because filtering and drying is done in one mass. But, because the core is porous, it does not hold all solid contaminants; often particles are washed through channels within in the core when pressures surge. Better holding power is possible with a more compacted core. But pressure drops increase inversely.

Compacted bead style filter-drier, Emerson's EK-Plus

Dirt, Waxes, Acid

Every system has contaminants in it as soon as it is opened. These contaminants may be insoluble, such as metal filings not removed in manufacturing, or airborne dirt that entered when the system was opened. Or they may be soluble, such as waxes, acids, water and resins that develop through reactions between air, the refrigerant, or lubricant.

Any of these can cause system failure. Installing an all-purpose filter-drier can lessen chances for trouble.

There are basic differences to consider: type of filter, how it filters, and its true capacity.

Most manufacturers rate their filters to ARI Standard 710. But even though two clean filter-driers may be rated the same, there can be a vast difference in flow as the quantity of solids picked up increases.

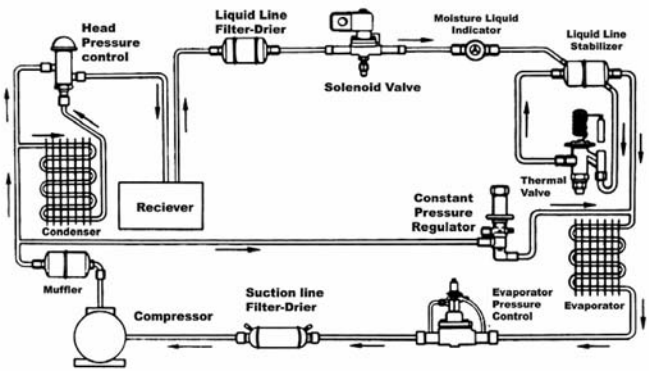
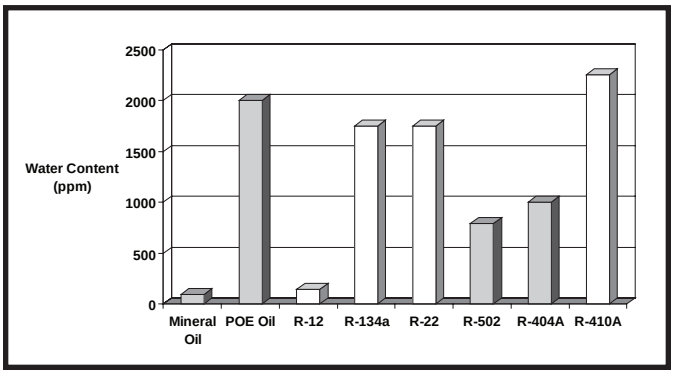


Fig 1. Proper placement of filter-drier in the system

HFC Refrigerants and POE Lubricants

The use of HFC refrigerants and Polyolester (POE) lubricants for air-conditioning and refrigeration has generated new system chemistry related problems. New and redesigned system protectors have been developed to counter these problems and provide a long, reliable life for the operating refrigeration system.

Moisture is the major problem causing contaminate for HFC/POE oil systems just as it was for CFC and HCFC systems using Mineral oil. Many HFCs can hold much more water than their CFC counterparts but the oil differences are much worse than those of the refrigerant. POE oil can hold as much as 10 times more water than Mineral oils. Evacuation alone has proved ineffective at removing this moisture so a filter-drier is required to perform this function.



Water poses a new problem for POE oils above and beyond those experienced with Mineral oil. POE oil will react with water to form organic acids at normal operating conditions in refrigerating and air-conditioning systems. This reaction starts at water levels as low as 75 ppm. These acids attack system components including motor insulation and metallic parts, reducing system life.

To combat the detrimental effects of water in HFC and POE oil systems it is imperative to hold moisture levels as low as possible. Water level must be maintained less than 50 ppm in the refrigerant and the same for the oil.

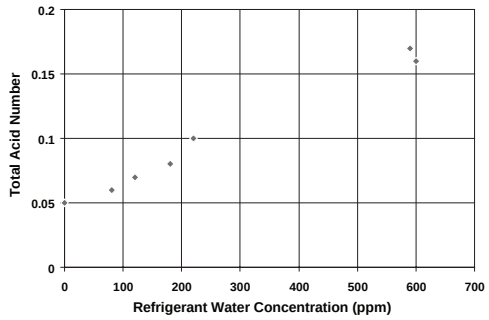


Figure 2

Acid Generation in a 1.5 Ton POE Oil Containing System

Another aspect of POE oil is the ability to keep more solid particles in suspension than Mineral oil. This is important in retrofitted systems where pockets of solid contamination are now flushed from low flow areas and need to be removed before moving parts in the system are damaged. The filter-drier for POE oils needs to have higher solid particle holding capacity with little impact to refrigerant flow capacity or pressure drop.

The filter-drier should also have improved contaminate removal efficiency as well to ensure that all particles are captured the first time they enter the filter-drier. The ability to remove smaller particles is also advantageous. The Emerson EK series filter-driers provide a unique combination of these characteristics to provide outstanding filtration as shown in Figure 4.

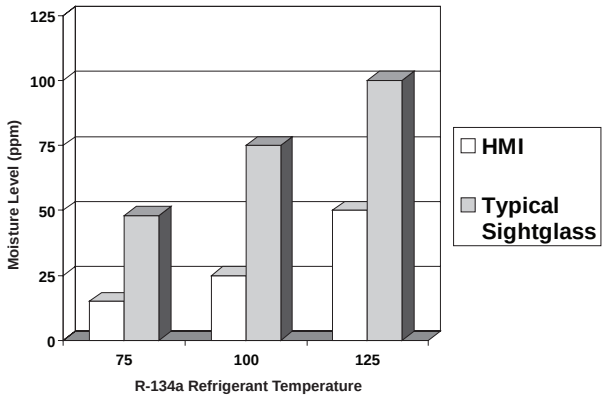


Figure 3
Dry Indication Water Level

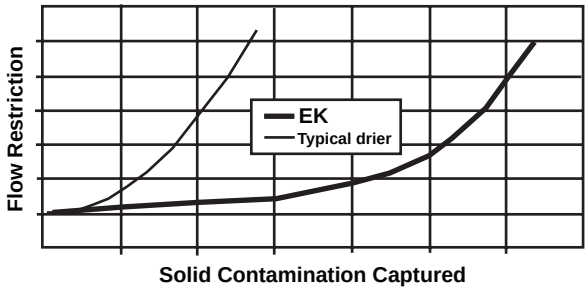


Figure 4
Filtration Capability of Filter-driers

The filter-driers for use in HFC and POE oil systems must maintain the system dry and free of any acids generated. However, since water capacity is of primary importance the filter-drier should contain a higher percentage of molecular sieve than was required for CFC and HCFC systems. But molecular sieve alone is not enough since it has almost no organic acid capacity. An organic acid removal desiccant must be used such as activated alumina to ensure low acid levels are maintained. The filter-drier should also have higher filtration capacity and efficiency. The EK series of filter-driers provides the best combination of these properties to ensure the long, trouble-free life of any air-conditioning or refrigeration system.

The moisture indicating sightglass must also indicate moisture levels less than 50 ppm moisture. Also, it must be able to perform this function at the temperature of the liquid line on which it is placed. Many sightglasses cannot perform this function at all liquid line temperatures. This low level indication ability is needed to ensure that the system moisture never exceeds the level at which organic acid formation starts. The Emerson HMI moisture indicating sightglass provides this low level detection ability.

Suction Filter-Driers

The function of filter-driers in refrigeration and air conditioning systems is to trap moisture and harmful contaminants. But their use in the **liquid** line still tends to be thought of as the “standard” application; including them also in the **suction** line hasn’t yet become standard practice to the same degree.

A filter-drier in the liquid line essentially protects the system controls – solenoid valves, expansion valves, and pressure regulators. The function of the filter or filter-drier in the suction line is specifically to protect the compressor against contaminants.

Such protection is encouraged by compressor manufacturers in any case, but there are two circumstances that make suction line filters or filter-driers advisable.

Emerson ASD suction line filter-drier

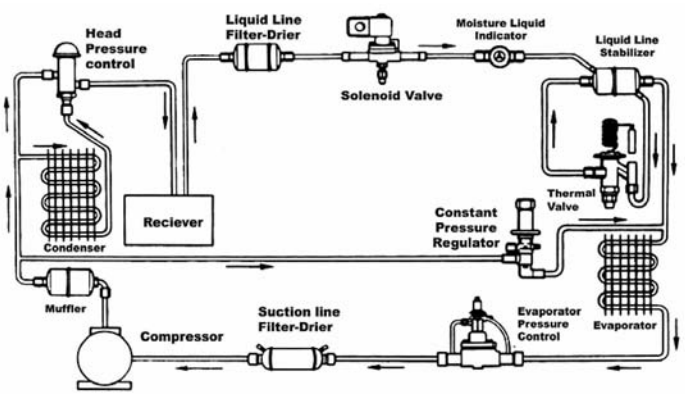
Field Built-up Systems

It is practically impossible to avoid contamination when assembling a refrigeration system in the field. Dirt, moisture, metal particles, and copper oxide from brazing all can be present in the system despite the greatest care, and all can damage are reduce the service life of the compressor.

In large and complex systems, such as a single system serving several food cases throughout a supermarket, it is a generally accepted practice to install a cartridge-type filter in the suction line. Then, because of the virtual certainty of contamination during assembly of the system, the initial cartridge is removed and replaced after the first few days of system operation.

When considering the price of a compressor, the cost of protecting it with a suction line filter is insignificant.

Cross-section shows desiccant beads surrounding accordion-type filter element



Typical system arrangements show suction line filter-drier installed ahead of the compressor.

Internal Design

Internally, suction line filter-driers employ the same types of elements as liquid line units. One is the core type, in which the filter-drier consists of a rigid, cylindrical, porous core that may perform both the filter and drier functions, or be used in combination with a separate accordion-type filter element.

The core type filter-drier is available either in a hermetically sealed configuration or in take-apart designs with a replaceable element.

The latest advancement is the bead-type unit, in which the desiccant is compacted into the shell. This design offers several advantages over older types, including lower pressure drop, more desiccant surface area, and greater capacity.

Application Tips

Using a liquid line filter-drier as a suction line filter-drier is not recommended. A suction line filter-drier should provide for greater capacity than a liquid line unit, for better compressor protection and for less pressure drop. Two access valves are required to measure pressure drop across the suction line filter-drier.

Compressor Burnout

A compressor burnout can be expected to release a variety of pollutants into the system, including acids. The clean-up procedure below describes the use of system protectors in cleaning up a system.

Clean-Up Procedure for Compressor Motor Burnout

1. Determine the extent of the burnout. For mild burnouts where contamination has not spread thru the system it may be economical to save the refrigerant charge, if the system has service valves on the compressor. A severe burnout exists if the oil is discolored, an acid odor is present, and contamination products are found on the high and low side. In this condition, caution should be exercised to avoid breathing the acid vapors. Also, avoid skin contact with the contaminated liquid.

2. Thoroughly clean and replace all system controls such as TXVs, solenoids, check valves, and reversing valves. Remove all strainers and filter-driers.

3. Install replacement compressor and make a complete electrical check.

4. Make sure that the suction line near the compressor is clean. Install an over-sized liquid line filter-drier and a suction line filter-drier.

5. Pressure and leak-test the system according to unit manufacturer's recommendations.

6. Triple evacuate to at least 200 microns. Break the vacuum with clean, dry refrigerant at 0 psig.

7. Charge the system through an Emerson EK filter-drier to equipment manufacturer's recommendations.

8. Start the compressor and put the system in operation. Record the pressure drop across the suction line filter-drier on the enclosed label and apply label to the side of the shell.

9. Replace the suction line filter-drier if the pressure drop becomes excessive.

10. Observe the system during the first 4 hours. Repeat step 9 as often as required, until no further change in pressure drop is observed.

11. After the system has been in operation for 48 hours, check the condition of the oil with an acid test kit. If the oil test indicates an acid condition, replace the liquid and suction line filter-driers.

12. Check the system again after 2 weeks of operation. If the oil is still discolored, replace the liquid and suction line filter-drier.

13. Clean-up is finished when the oil is clean and odor-free, and is determined to be acceptable with the acid test kit.

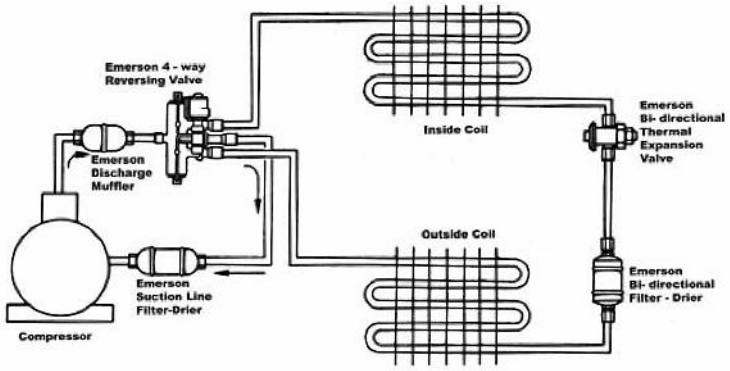
For detailed burnout clean-up procedure and recommendations, consult the RSES Service Manual, Section 91.

Filter-Driers for Heat Pumps

A heat pump is essentially a refrigeration system that can flow in either direction. The key to its operation is a four-way reversing valve that routes the discharge gas from the compressor.

Depending on whether the system is cooling or heating, the indoor and outdoor coils swap roles, taking turns serving as the condenser and evaporator.

Since conventional refrigerant control components are designed for unidirectional operation, their use in heat pumps requires installation in pairs, one for each direction, with check valves routing the flow through or around them. Today, because of the growing use of heat pumps, components such as thermostatic expansion valves are available in bi-directional versions, as are filter-driers.



Schematic of a basic heat pump system.

Emerson BKF bi-directional pump filter-drier

Removing Contaminants

Just like any other refrigeration system, heat pump system components need filter-drier protection to remove solid and soluble contaminants. This may be handled several ways.

First, in systems with one-way expansion valves and check valves, a one-way filter-drier might be installed in series with a check valve. This would be a “part-time” arrangement, in that filtration would be provided in only one direction.

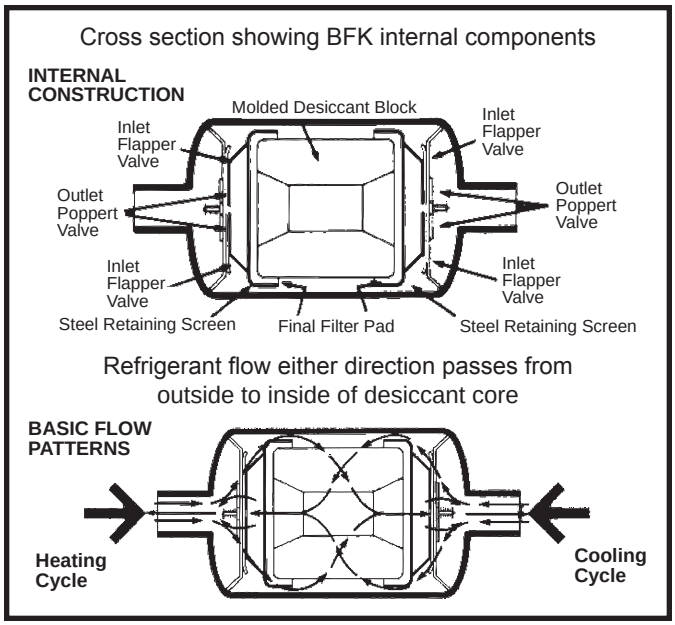
Second, a one-way filter-drier might be installed with each of the check valves, so that one provides filtration in each direction.

Third, the simplest arrangement is to install a bi-directional filter-drier in the common liquid line. Used in combination with a bi-directional thermostatic expansion valve such as Emerson’s HF series, the complexity of multiple expansion valves, check valves, and filter-driers can be completely eliminated.

One-Way Flow, Both Ways

Inside a bi-directional filter-drier the refrigerant always flows the same direction regardless of which way the refrigerant is flowing through the system. The internal flow in this case is controlled by an inlet flapper valve and an outlet poppet valve on each side of the desiccant core. As the liquid enters the filter-drier from either direction, the inlet flapper valve routes it to the outside of the desiccant core. After it flows through to the inside of the desiccant core, it exits through the opposite poppet valve.

The purpose of the arrangement shown below is to prevent contaminants collected in one direction from being flushed back out when the flow reverses.

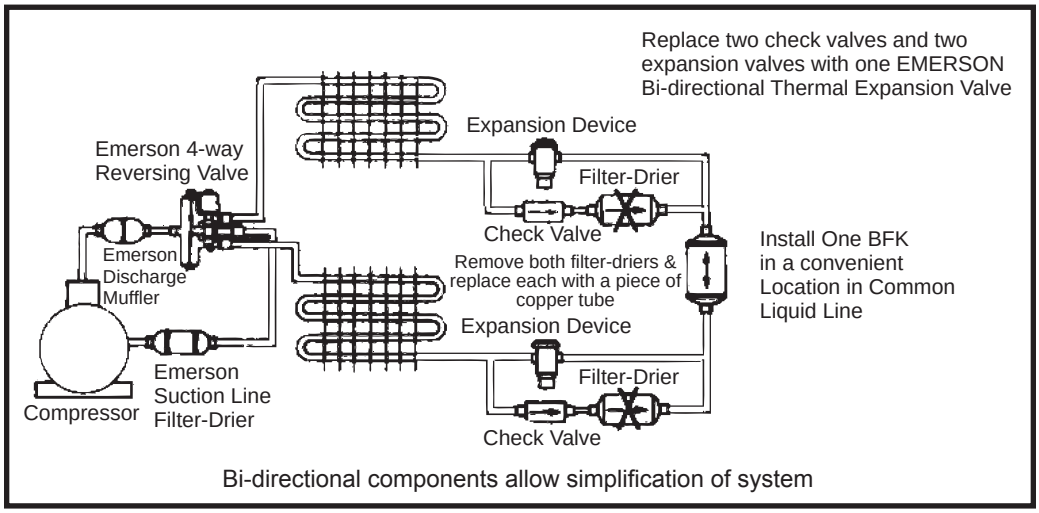


Simplifying While Servicing

When servicing or repairing heat pump systems, especially older units, it's a good idea to simplify them by replacing unidirectional driers and check valves with bi-directional driers. When a bi-directional filter-drier is installed, check valves, and filter-driers can all be replaced at once with copper tubing.

Emerson System Protectors

Emerson filter-driers were redesigned for increased water removal capacity to reach these low moisture levels. However, since no system is entirely without water on startup some organic acids will be generated and must be removed. The desiccant formulation for the Emerson EK series of filter-driers was designed to provide the best mix of water capacity and acid capacity to ensure that harmful contaminates are removed. This desiccant mixture contains molecular sieve and activated alumina. The molecular sieve is specifically designed to provide maximum drying in today's systems. The activated alumina is ideal for capturing the large organic acids that the molecular sieve cannot.



Regulators

Types of Regulators: Suction Line Regulators

Suction line regulators provide a wide variety of refrigerant control functions, but are mainly used for regulating suction gas pressures. These regulators provide a method of balancing the output of the refrigeration system with the load requirements. Two basic types are covered here:

1) Upstream pressure regulators, which control from an inlet pressure signal.
2) Downstream pressure regulators, which control from an outlet pressure signal.

Application of Evaporator Pressure Regulators

Evaporator Pressure Regulators are normally used on multiple-compressor refrigeration systems fed by TXVs, low side floats or solenoid liquid valve and float switch combination. They are used whenever a minimum evaporator pressure or temperature is desired. Controlling from an inlet side pressure signal, they prevent upstream pressure from going below a pre-set point.

EPR valves are used on brine or water chillers to prevent freeze-up during low load periods, by keeping the refrigerant saturation pressure above the fluid freezing temperature. Similarly, they may be used to prevent frost formation on fan coil evaporators. They may also be used to provide a given evaporator saturation pressure to produce the required evaporation/room temperature difference, (especially useful where humidity control is required). On multiple evaporator systems where different evaporator temperatures are required, EPR valves will hold the saturation pressure at the required set point above the common system suction pressure. Here, the EPRs prevent lowering of the desired temperature in the warmer evaporators, while the compressor continues operating to satisfy the coldest evaporators. See figure 1.

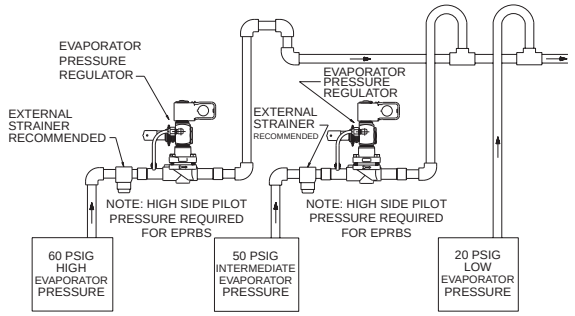


Figure 1: Evaporator Pressure Regulators used in multiple system.

EPR Installation

EPRs may be installed at the compressor rack or close to the evaporator.

Suction line regulators can be direct acting or internally piloted such as an Emerson IPR regulator. These are hermetically sealed, non-repairable valves for use on low capacity systems.

For higher sensitivity and accurate control, an externally piloted EPRB regulator will provide control of larger units. These are repairable in the line. The EPRB valve is a lightweight, brass body valve which eliminates the need for normal system pressure drop needed to make the valve move through the full stroke. This is accomplished by using compressor discharge gas to pilot the regulator.

Combining an EPRB with a suction stop or shut off is done with the EPRBS models. When the pilot solenoid is de-energized, the valve closes. This eliminates the cost of a separate suction solenoid and offers a tight shut off.

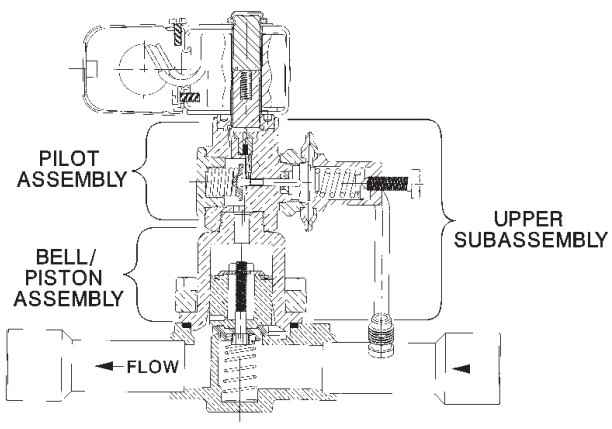


Figure 2: Cutaway view of an EPRBS.

Upstream Regulators

The sole function of the Evaporator Pressure Regulator is to prevent the evaporator pressure from falling below a predetermined pressure setting. This enables the system to meet certain load requirements over a wide range of conditions and offers improvement over the simple “on-off” compressor control usually provided by thermostats or pressure switches.

Downstream Pressure Regulators

Suction pressure regulators are used to prevent compressor motor overload. By throttling the suction gas flow during high load conditions, the compressor motor is permitted to remain within current draw limitations. Often referred to as holdback valves, crankcase pressure regulators or suction pressure regulators, they also serve many other useful applications.

A downstream pressure regulator can be direct acting such as an OPR valve. These are hermetically sealed, non-repairable outlet pressure regulators for use on low capacity systems.

Adjustable Range Table

Valve	Adjustable Range
EPRB(S)-12 thru -20	0 to 110 psig
IPR-6, -10	0 to 50 psig 30 to 100 psig 65 to 225 psig
OPR-6, -10	0 to 60 psig 50 to 130 psig 100 to 225 psig

Standard Voltage & Frequencies Table

Voltage	Cycles
24	50-60 Hz, AC
120	
208-240	

Series EPRB & IPR

These are all upstream regulators which can be selected from the capacity charts available. Combining the regulator with a suction stop or shutoff solenoid will cause the regulator to act as a suction stop valve. Certain basic design operating condition data must be determined to properly apply the regulator. For best results, follow the simple procedure outlined below.

To select the proper regulator port size, the following information is required:

1. System refrigerant (R134a, R22, R404A/R507A).
2. The required pressure setting (lowest allowable evaporator pressure and corresponding refrigerant saturation temperature).
3. The system suction pressure at the regulator outlet (suction pressure where compressor capacity balances with system load) making allowance for any common suction line pressure drop.
4. Pressure drop across regulator port. Subtract suction pressure (3) from regulator set point (2).
5. Evaporator load in tons at regulator setting (required minimum evaporator saturation temperature).

With the above information, select the proper regulator as follows:

1. Select the valve extended capacity table from that page which covers the system refrigerant.
2. Find the required evaporator saturation temperature column.
3. For the available regulator pressure drop, find the rated capacity for each regulator port size.
4. Select the proper port size from the capacity which matches the evaporator load.

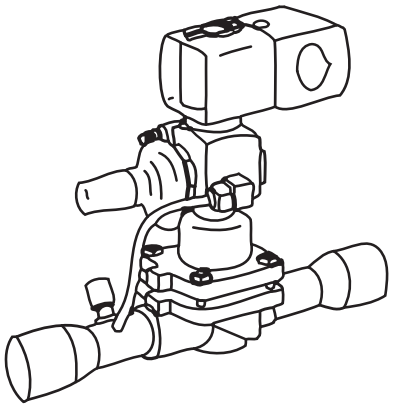


Figure 3: EPRB(S) Brass Body
Upstream Pressure Regulator with Suction Stop Option

Crankcase Regulators

Normally open, the CPR (Fig. 4) closes when compressor pressure rises above the pre-set maximum, forcing the valve back onto its seat. As suction pressure drops, the valve starts to reopen, maintaining a balance.

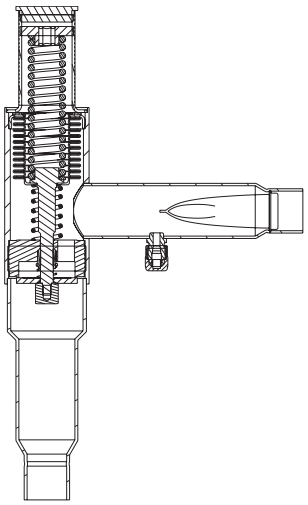


Fig 4. Cutaway of crankcase pressure regulator (Emerson OPR)

How to Apply Regulators

It isn't normally necessary to apply both an EPR and a crankcase regulator. Most installations only utilize an EPR.

Typical installations of EPRs are in supermarket systems, large chillers, and industrial processes where large amounts of heat must be absorbed. Smaller (including residential) systems of less than 5 tons are usually equipped with compressors designed to operate well within 30°-40°F variations.

One of the advantages of suction line regulators in supermarkets is that by adding EPRs you can control the operating temperatures of the individual cases in a single loop system.

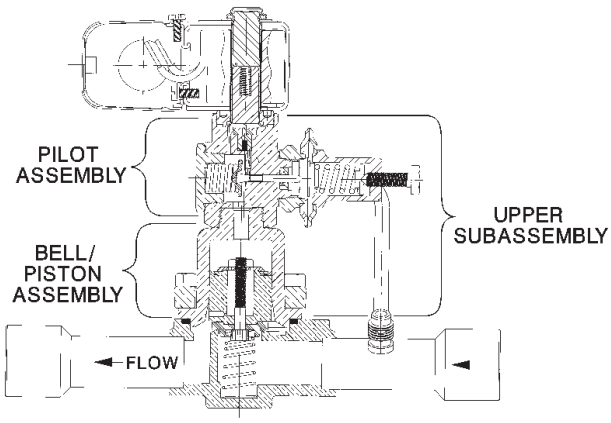


Fig 5. Cutaway of evaporator pressure regulator (Emerson EPRB).

Where to Apply Regulators

EPRs are most commonly used on multiple evaporator systems, installed in the branch lines close to the required control source. They are used for indirect temperature control. They also maintain evaporator pressure during defrost, conserving power, expediting the defrost and reducing flood back.

CPRs are usually only applied if the system is being continually "over-pressured," causing the compressor to be overloaded. If you suspect that's the case, check the amp draw on the compressor while it's running. If it's higher than the plate rating, the system may be a CPR candidate.

HeadMaster Head Pressure Controls

The application of air-cooled condensers for year-round operation, or during periods of low ambient temperature, requires some means of control to maintain adequate condensing pressures that ensure proper system performance. It is essential that proper liquid refrigerant pressure be controlled to:

1) Maintain liquid subcooling and prevent liquid line flash gas.
2) Provide adequate pressure at the inlet side of the Thermostatic Expansion Valve to get enough pressure drop across the valve port.
3) Properly operate systems with hot gas defrost or hot gas bypass.
4) Provide adequate temperature for operation of heat reclaim systems.

Without proper control of condensing pressure a refrigeration system might not perform properly and components can be damaged. Emerson's HeadMaster Control offers an efficient and economical approach to this common industry problem on air cooled condensers.

The HeadMaster 3-Way Head Pressure Control eliminates the need for special piping or multiple control valves. As a single unit it simplifies piping and cuts installation costs.

HeadMaster HP Operation

The HP control is a three-way modulating valve controlled by the discharge pressure. The charged dome exerts a constant pressure on top of the diaphragm. At high ambient air temperature, bypass gas entering Port B is allowed under the diaphragm where it counters the pressure of the dome charge. This upward push on the diaphragm allows the seat disc to seal against the top seat, preventing flow from Port B (discharge gas) while flow from Port C is unrestricted (see figure 6).

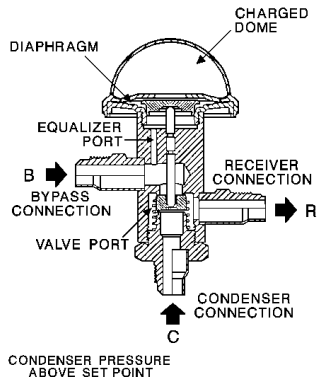


Figure 6: HeadMaster HP Valve CutAway View

As ambient air temperature falls, an uncontrolled air cooled condenser will exhibit a corresponding decrease in head pressure. As the discharge (bypass) pressure falls, it no longer counters the dome charge pressure and the diaphragm moves downward, moving the push-rod and seat disc toward the bottom seat. This allows discharge (bypass) gas to be metered into the receiver, creating a higher pressure at the condenser outlet. The higher pressure at the condenser outlet reduces the flow from Port C and causes the level of condensed liquid to rise in the condenser.

The flooding of the condenser with liquid cuts the available condensing surface. The result is to raise the pressure in the condenser and maintain an adequate high side pressure. Figure 7 illustrates a typical application of the 3-way control valve. This system is perhaps the most economical and reliable way to control discharge pressure. The three-way valve as shown in figure 6 is a fixed, non-adjustable valve. The wholesaler replacement setting is normally furnished for a pressure corresponding to 95° to 98°F condensing temperature for the given system refrigerant.

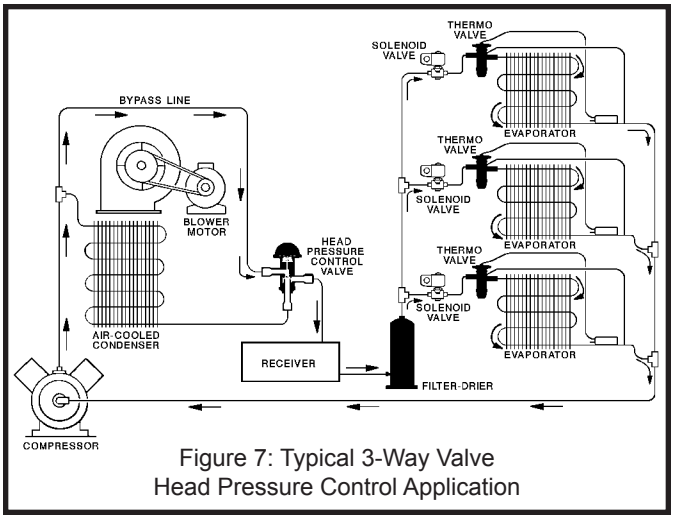


Figure 7: Typical 3-Way Valve Head Pressure Control Application

As with all head pressure control applications, additional liquid receiver capacity is required to prevent loss of a liquid seal in the receiver when the condenser is flooded. The receiver must be large enough to hold the total system charge. The total system charge consists of the following:

1. An operating charge which is the amount of refrigerant needed to operate the system during summer (high ambient temperature) conditions.
2. An additional charge equaling the amount of refrigerant required to flood the condenser with liquid. The condenser must be filled with liquid to a point where a minimum head pressure is created for cold weather (low ambient temperature) conditions.

NOTE: Should the outdoor temperature fall below design conditions, more refrigerant will be required.

The total above is the total charge needed for satisfactory system performance during the lowest expected ambient air temperature conditions. During summer operation the receiver must be sized to safely hold the total system charge. Good refrigeration practice states that the total system charge should not exceed 80% of the receiver capacity.

CAUTION:

1. The HP control should not be used on a system which does not have a liquid receiver or on one with a receiver which is too small. If the receiver does not have adequate storage space, the refrigerant will back up in the condenser to produce excessively high discharge pressures during high ambient air temperatures, with could cause system damage or personal injury.
2. The HP control should be used only on systems which employ a Thermostatic Expansion Valve.

Installation of HP HeadMaster Series

Head pressure control systems are used on refrigeration systems that are temperature operated. The compressor is started by a thermostat or the system operates on a pump down cycle, where the thermostat controls the liquid line solenoid valve and the compressor starts on a rise in suction pressure with a low pressure switch.

On systems that are pressure operated, migration of the refrigerant to the cold condenser on the “off” cycle should be prevented. If the system does not operate on a pump down cycle, migration can take place through some compressors, from the suction line to the condenser. Crankcase heaters will prevent liquid from condensing in the crankcase, but will not stop migration to the cold condenser. If the system is properly charged, the filled condenser will permit the excess to remain in the receiver and low side.

Under some conditions where the receiver is located in a warm ambient, a check valve in the liquid drain line between the HeadMaster control and the receiver may be required to prevent the liquid receiver pressure from equalizing to that of the condenser during the “off” cycle. This enables the system to start on a pressure switch. Some systems may require a time delay on the low pressure switch. Condenser fans should not be cycled when using the HeadMaster control. The sudden changes in high side pressure caused by fan cycling will result in erratic Thermostatic Expansion Valve performance, and shortened head pressure control life. To prevent this from happening, make sure fan controls are set to operate at pressures above the HP valve setting.

HP Series Capacity & Selection

The nominal HP control capacity in tons for various refrigerants is shown in Table 1 for R134a, R22 and R404A/R507A. The nominal capacity is based on 100°F liquid, 40°F evaporator and the pressure drop shown. To get capacities in tons at other liquid and evaporator conditions, multiply the nominal capacity at the desired pressure drop by the correction factor given in the catalog for the liquid temperature and evaporator temperature.

Table 1 – Nominal Capacity (tons)

Valve	Refrigerant	Pressure Drop – PSI				
		1	2	3	4	5
HP-5	R-134a	2.0	2.9	3.6	4.1	4.6
HP-8		5.5	7.8	9.6	11.0	12.4
HP-14		14.0	19.8	24.2	28.3	31.7
HP-5	R-22	2.2	3.2	3.9	4.5	5.0
HP-8		6.0	8.5	10.5	12.0	13.5
HP-14		14.7	20.8	25.6	29.7	33.8
HP-5	R-404A R-507A	1.5	2.1	2.6	3.0	3.3
HP-8		3.9	5.5	6.7	7.8	8.7
HP-14		10.1	14.3	17.6	20.5	23.0
Based on 100°F liquid and 40°F evaporator						

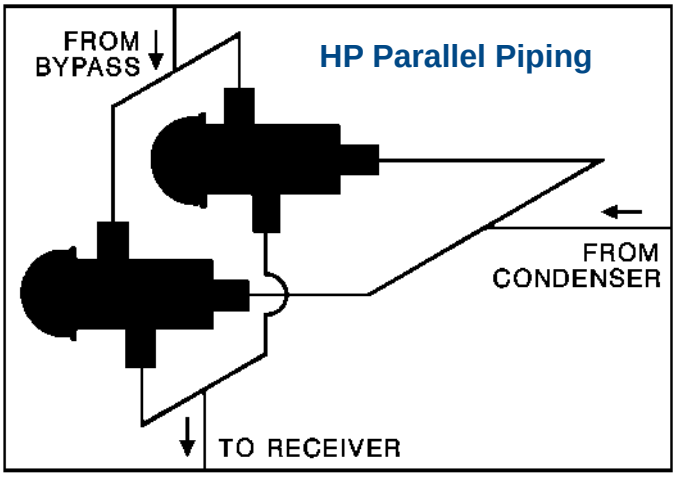
NOTE: Not recommended for systems utilizing patented subcooling coils in conjunction with low head pressure systems or on sytems where the condensate line bypassses the receiver in order to maintain subcooling effect in the liquid line.

NOTE: Do not select a valve for a capacity rating exceeding 5 psi pressure drop from Port C to Port B or for a system with more than 20 psi pressure drop across the condenser.

During normal ambient conditions, the available liquid subcooling in the condenser will be adequate to cover the pressure drop through the HeadMaster control.

If a valve is selected for a given flow rate, the resulting pressure drop must not cause the liquid pressure to drop below saturation and produce flash gas. If enough sub-cooling is not available to cover this pressure drop, it is suggested that more than one valve be installed in parallel to lower the pressure drop to tolerable limits.

Do not parallel valves of different capacities. Liquid drain lines from the condenser to receiver are sized for a velocity of 150 ft./min. or less.



Additional Refrigerant

On most systems, an added refrigerant will be required. It is essential to have enough to completely fill the condenser for the lowest ambient condition. To accurately determine the added refrigerant charge required to fill the condenser, find the total length of condenser tubing in feet, and multiply by pounds of refrigerant per foot for a given size tubing.

Factory Settings

The HeadMaster Control is factory-set to provide an average condensing temperature consistent with good system performance. The complete type number includes the service reference code, port size, connection size and style. When ordering, be sure to specify the complete type number.

UL File No. SA5312
CSA File No. LR44005

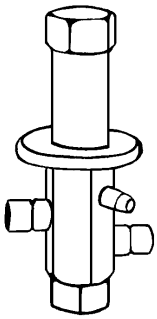


Figure 3: DGRE adjustable hot gas bypass regulator.

Hot Gas Bypass

Demand continues to mount for improved comfort conditioning combined with lower operating costs. New architectural designs have created real problems for contractors and engineers to maintain humidity control at reduced loads, and to control load variations. Refrigeration and air conditioning systems are usually designed to provide a given capacity at maximum conditions. These operate with little fluctuation throughout a narrow load range. However, only the larger size machines make any provisions for operation at reduced capacity. In some systems, integral cylinder unloading, gas engine drives with variable speed control, or even several smaller systems, provide a logical solution.

Function – Hot Gas Bypass Method

Many manufacturers now recommend use of a modulating control valve to provide a metered flow of compressor discharge gas to the system low side, in a proportion that will balance the system capacity to the load demand. This is commonly known as the hot gas bypass method. It permits full modulation of capacity on all types of reciprocating compressors, and extends capacity reduction below the last step of cylinder unloading.

The system must provide a means of bypassing high pressure refrigerant to the system low pressure side, to maintain operation at a given minimum suction pressure. Proper bypass control can be accomplished by a modulating type pressure regulator, which opens on a decrease in valve outlet pressure.

Operation of Bypass Valves

Bypass pressure regulators are grouped into the following categories:

1. Direct acting conventional port valves (figure 3)
2. Direct acting balanced port valves (figure 4). Any of these regulators are available with either an adjustable setting, or a fixed, non adjustable setting.

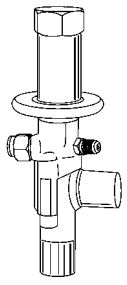


Figure 4: Balance port CPHE adjustable field-serviceable hot gas bypass regulator.

Applications: Hot Gas Bypass to Compressor Suction Line

Figure 6 shows the most common hot gas bypass system. In this system, the bypass line is taken directly from the compressor discharge line, through a bypass regulator, and into the suction line at the compressor. Although the hot gas bypass regulator is considered a downstream control, there is a big difference in function between a Crankcase Regulator and a hot gas regulator.

Pilot operated bypass valve main regulators have a long stroke stem with a restrictor plug characterized by either a parabolic or vee port restrictor plug design. This prevents the valve from operating close to the seat where pressure differential unbalance may occur, eliminating the need for a balanced port design.

The characterized port will provide smooth bypass flow modulation. Pilot operated valves usually have the extra features of a manual opening stem for testing or emergency operation, flanged connections, synthetic tight seating seats, and replaceable parts. Hot gas bypass valves can be applied to a system in several ways, differing only in the point to which the hot gas is to be bypassed. Several mixing methods are available. The one recommended is piped so that discharge gas is admitted to the suction line to flow against the direction of the suction gas as in figure 6.

Applications: Bypass to Evaporator Inlet

Another method is to bypass the hot discharge gas to the evaporator inlet, usually between the Thermal Valve and the refrigerant distributor (see figure 7). This provides distinct advantages. The artificial load imposed on the evaporator causes the Thermal Valve to respond to the rise in superheat, eliminating the need for the liquid injection valve. The evaporator serves as an excellent chamber to provide homogeneous mixing of the gases before reaching the compressor.

Hot gas bypass into the evaporator is suggested when the evaporator elevation is below the compressor, to prevent oil trapping caused by low velocity at low loads. This assures proper oil return. Although there are many advantages to this system, it is not used on a multiple coil system, or where the evaporator sections may be located a distance from the compressor. The coil should be a free draining circuiting design to prevent the increase in velocity, due to forcing a large quantity of trapped liquid out of the low side, which in some cases may have enough volume to flood the compressor crankcase. Separate regulators must be used for each evaporator when bypassing to multiple evaporators located below the compressor to help oil return.

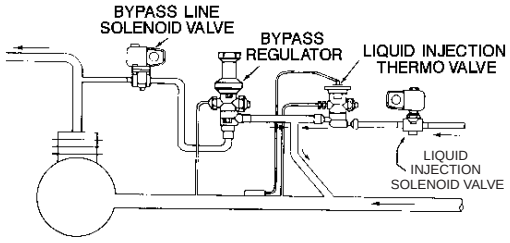


Figure 6: Hot gas bypass using type LCL liquid injection valve.

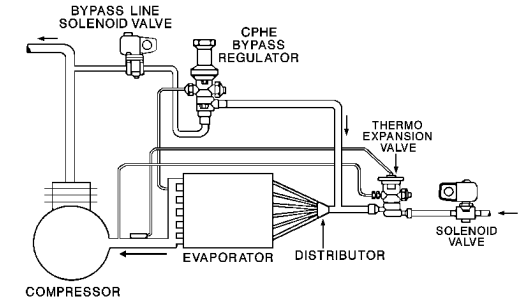


Figure 7: Direct acting hot gas regulator admitting flow between TEV and venturi distributor.

Bypass to flooded evaporators and suction line accumulators also present special cases. Contact the equipment manufacturer or the bypass control valve manufacturer for specific, detailed information.

Solenoid Valve for Positive Shut-off & Pump-down Cycle

It is recommended that a solenoid valve be installed ahead of the bypass regulator. This permits the system to operate on an automatic pump-down cycle.

Thermal Valves for Liquid Injection

When hot gas is bypassed directly into the suction line, it is necessary to make some provision for desuperheating the gas returning to the compressor. Without a small Thermal valve to lower suction gas temperature to tolerable limits, compressor damage may occur. Standard Thermal Valves cannot be adjusted for control over 20°F superheat and, therefore, are not recommended. Liquid Injection Thermal Valves with special adjustment ranges are used to conform to compressor manufacturer temperature recommendations.

To simplify selection, Emerson has developed Liquid Injection Thermal Valves with four basic adjustment ranges. These are designated as models A, B, C and D. The adjustable superheat range chart (page 11) shows the proper power assembly charge symbol suffix for a given saturated suction temperature and a given superheated suction gas temperature entering the compressor.

Nearly all Thermal valves for liquid injection may be internally equalized. However, if pressure drop occurs at the valve outlet due to a distributor, spray nozzle or other restrictive device, externally equalized valves may be needed.

Model LER and LIR valves are furnished with a 1/4" SAE male flare external equalizer as standard. Other models must include the code letter "E" to specify the 1/4" SAE male flare external equalizer connection. Example: LCLE and LJLE.

Application and Installation

Liquid injected into a gas to be desuperheated should be injected in a way which provides a homogeneous mixing of the liquid and superheated gas. Desuperheating hot gas bypass in the suction line may be accomplished in several ways.

The preferred method is to bullhead the hot gas and liquid injection in a tee to permit good mixing before it enters the suction line. A good mix with the suction gas may be gained by injecting the liquid/hot gas mixture into the suction line at a 45° angle against the flow of suction gas to the compressor. See figure 6.

For suction lines 7/8" OD and smaller, the bypass mixture may be introduced into a tee rather than an angle connection. For lines larger than 2-5/8" OD, introduce the desuperheated bypass mixture into a 90° ell inserted against the flow of suction gas to the compressor.

Arranging a bypass directly into a suction accumulator is often a convenient way to get proper desuperheating of suction gas.

Introducing the hot gas and liquid into the suction line with separate connections is not recommended.

NOTE: Excessive suction gas superheat can cause serious damage to the compressor. As a safety precaution, the bypass line solenoid valve should be wired in series with a discharge line thermostat.

Special Applications

On systems where evaporator pressure regulators are used, better control can be reached by installing the bypass regulator equalizer line on the downstream (outlet) side of the EPR so it responds to compressor suction pressure, not evaporator pressure. This results in nearly constant evaporator load balance. See figure 8.

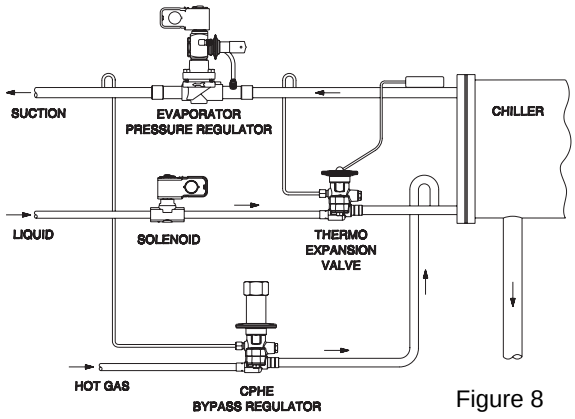


Figure 8

Adjusting the Set Point

The suction pressure at which the valve opens is selectable by increasing or decreasing the load on the spring by turning an adjusting screw. To set it, the evaporator must be cooled down by shutting off the fans, blocking off the airflow, or some other means, until the suction pressure drops to at least five pounds below the desired set point. Then, by allowing the pressure to be raised by the bypass gas, the spring load can be varied until the valve closes at precisely the desired set point.

The pressure is set to maintain an evaporator temperature just above that at which frost forms.

Application Tips

- In systems that use a Venturi type distributor, the bypass gas should be fed into the system between the outlet of the expansion valve and the inlet to the distributor. For pressure drop distributors that use an orifice, the inlet must be between the orifice and the inlet to the distributor.
- The hot gas bypass line should be insulated to minimize system heat loss.
- In systems with sequential compressor unloading, the valve should be set to start opening at two to three pounds below the last stage of unloading, because compressor unloading is considerably more efficient and should be used before resorting to bypassing.
- For oil return considerations, the bypass line must feed in ahead of the evaporator when the evaporator is installed below the compressor.
- The hot gas bypass valve should be installed as close as practical to the condensing unit, to reduce condensing ahead of it.
- In systems that operate on a pump down cycle, there must be a solenoid valve or some other means of shutoff in the bypass line.

Oil Controls

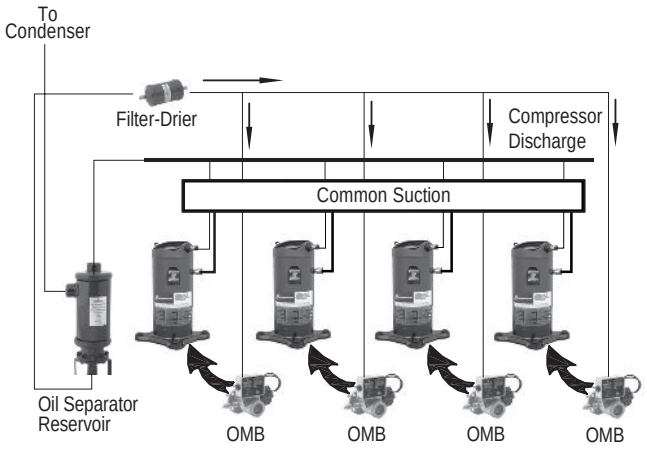
2008

Oil Controls

Any time that compressors are operated in a parallel operation (Suction and Discharge lines manifolded together), an oil control system in needed to ensure that each compressor has enough oil to operate properly.

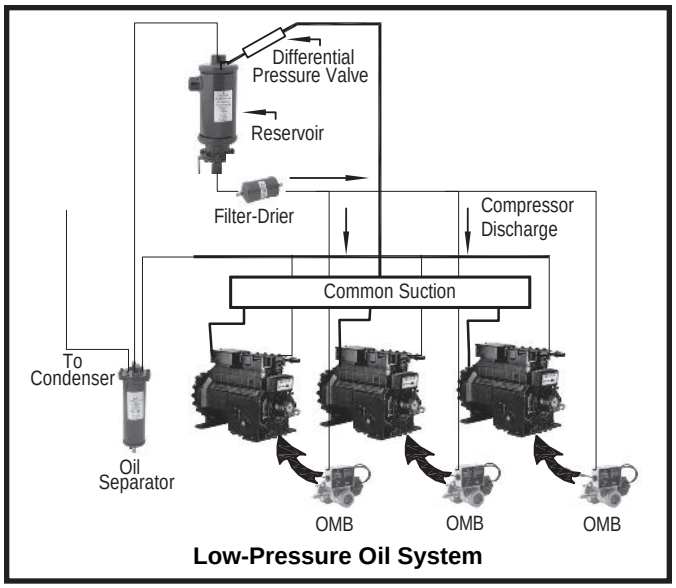
Oil control systems are sometimes as basic as a common line connected between compressors to allow oil and gas equalization. This is usually referred to as a "passive" oil system. Although this may suffice on two-compressor systems, compressor racks of three or more compressors almost always have an "active" system since even small differences in crankcase pressures can cause oil starving. This system uses an oil separator to capture most of the oil from the compressor discharge gas since some oil is carried out of the compressor with the refrigerant. Several types of oil separators are commonly used in these applications. The older style is called an impingement type while newer, more efficient types are the centrifugal and coalescing types.

After the oil is separated from the refrigerant, it collects in the bottom of the oil separator where it is fed directly to the crankcase in a high-pressure oil system using oil controls on the compressor crankcases.



High-Pressure Oil System

A low-pressure oil system incorporates a separate oil reservoir which is downstream of the separator. Oil separators in low-pressure oil systems have a float valve in the bottom to allow excess oil to pass to the reservoir whenever the level is high enough in the separator to open the valve. The pressure in the oil reservoir is usually held 20-30 psi above the crankcase pressure through a differential check valve. This lower pressure allows mechanical oil floats, which use a float valve which opens when the crankcase oil level falls below 1/sight glass, to be used to feed oil into the compressor crankcases. The mechanical floats cannot be used on high-pressure oil systems because the oil pressure entering them would be too high and cause them to not be able to control the oil level.



Low-Pressure Oil System

On all oil systems, it is important to install an oil filter downstream of the oil separator to ensure a supply of clean oil to the compressors.

Emerson Oil Controls

A high-pressure oil system can use an Emerson OMB oil control mounted on the compressor crankcase. The OMB is a device which uses a reverse Hall-effect magnetic float to activate a solenoid to allow oil to flow into the crankcase whenever the level falls below 1/2sight glass level. It is designed to operate at oil pressures up to 350 psid.

OMB

Temperature Pressure Controls

2008

Temperature Pressure Controls

Temperature pressure controls serve a number of purposes in refrigeration systems, including the control of compressor cycling, pump-down, defrost control, pressure limiting, loss of charge freeze protection and fan speed control.

TS1 Introduction

The TS1 Series is Emerson's adjustable thermostats for application in refrigeration and heat pump systems. In these systems, thermostats provide space temperature control, high/low temperature alarming or defrost termination. By operating an electrical contact, a temperature value is kept inside a certain limit.

Housing Variants

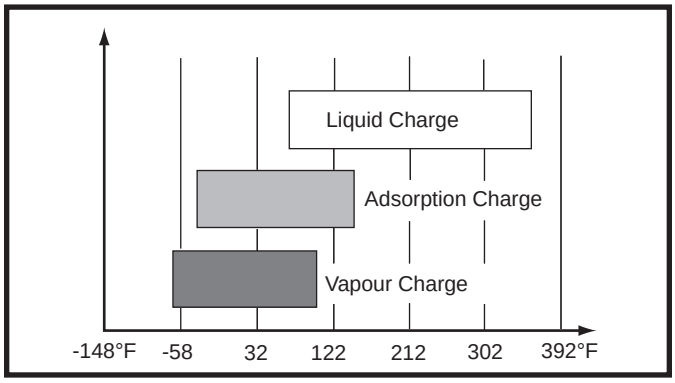
TS1 controls are top operated. Top operated controls have adjustment spindles at the top and a display scale, showing temperature setpoint and differential, at the front. A knob which may be permanently plugged onto one of the adjustment spindles comes with every control. Frost monitors and room thermostats are derivatives of top operated thermostats. They differ by their sensors and other features to suit their target applications.

TS1 Top Operated

Temperature Sensing

TS1 thermostats sense temperature by a thermal system, consisting of temperature charge, bulb, capillary and bellows. The temperature charge changes its pressure based on the refrigerant temperature to be sensed. The sensor is the part of the system which is in thermal contact with the refrigerant. The capillary connects the sensor with the bellows and the bellows contracts or expands depending on the temperature, causing the thermostat to operate the electrical contacts. An exception are capillary type of sensors, which do not have a bulb, instead, their capillary serves as the bulb directly.

Charges and sensor types are matched to temperature ranges and other application specific characteristics. TS1 thermostats come with one of three charge types: vapor charges, adsorption charges or liquid charges. The application temperature range covered by each charge type is shown below:



Vapor Charge – Sensor Type A, E, P

These sensing elements always sense from the coldest point on the capillary, coil, bulb or power element head. For proper operation, the coldest point must be at the part of the sensor which is exposed to the medium temperature to be sensed. The sensing location should be at least 4 degrees F colder than the other parts of the thermal system.

To avoid unwanted effects of heat transfer, for example from a cold wall, vapor charged thermostats come with an integrated bellows heater (not for frost monitors), which is rated for 230V applications. For other applications, the heater must be disabled or a bellows heater with a different rating should be used.

Besides the bellows heater, room thermostats are supplied with an insulation console for the same reason.

Sensor type 'A' is a coiled bulb sensor with two meter capillary, which may be used with or without a bulb well. Style 'E' is a coil sensor for space temperature sensing, and type 'P' is a capillary type of sensor which can be wrapped around a heat exchanger's surface to sense the coldest point on the heat exchanger for frost protection applications.

Vapor charges respond faster to temperature changes than adsorption and liquid charges.

Adsorption Charge – Sensor Type F

Adsorption charged sensor types operate on a temperature dependent adsorption material, which is inside the bulb only. These sensor types always respond to temperature changes at the bulb only. This makes them suitable to applications where it is not always defined which part of the thermal system the coldest point is (cross ambient applications). An example for such applications is defrost control.
Adsorption charges are slower in response to temperature changes than vapor charges.

Liquid Charge – Sensor Type C

Liquid charge sensors of type 'C' always sense from the warmest point of the thermal system. The sensing location must always be 4 degrees F warmer than other parts of the thermal system.

Setpoints

TS1 are adjustable controls with adjustment spindles for range and differential. Note that manual reset controls and some other controls have a fixed differential and no differential spindle. By turning the range spindle, the upper setpoint is defined and by adjusting the differential spindle, the differential and the lower setpoint is defined.

The dependency between upper and lower setpoint is always as follows:

lower setpoint = upper setpoint – differential

The following two rules should be kept in mind:

⇨ an adjustment of the range spindle always affects both upper and lower setpoint.

⇨ an adjustment of the differential spindle affects the lower setpoint only.

The controls are equipped with display scale and pointers to show the approximate settings.

Top operated controls have display scales in units °C and °F, front operated controls have a display scale in units °C.

For precise setting of the controls, external thermometers must be used.

Electrical Contacts

TS1 temperature controls are equipped with high rated double snap action contacts for shatter-free and reliable operation.

All contacts in these controls are designed as Single Pole Double Throw (SPDT) contacts. One contact may be used for control and the other contact for alarm/status indication or auxiliary control.

Gold plated contacts are available on request for low electrical loads, for example in electronic signaling applications.

For applications using a supply voltage other than 230V and for applications using gold plated contacts, the bellows heater of vapor charged thermostats (sensor style A, E or P – not for frost monitors function C or D) must be disabled.

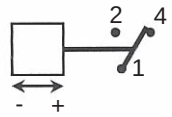
Contact Function

Thermostat contacts TS1 are labeled 1-2-4 where '1' refers to the common pole, '2' refers to the lower setpoint and '4' refers to the upper setpoint.

The contact function for automatic and manual reset versions is as described below.

Automatic Reset

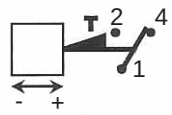
On temperature rise above the upper setpoint, contacts 1-open and contacts 4 close. On decreasing temperature lower setpoint contacts 4 open and contacts close.



Automatic reset contact function

Manual Reset Low Temperature

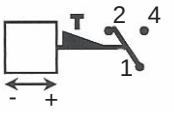
On decreasing temperature below the lower setpoint, contacts 1-4 open, contacts close and latch. Only on temperature rise above upper setpoint and after pressing the manual reset button contacts will open and contacts 4 will close again.



Manual reset low temperature contact function

Manual Reset High Temperature

On increasing temperature above the upper setpoint, contacts 1-open, contacts 4 close and latch. Only on falling temperature below lower setpoint and after pressing the manual reset button, contacts 4 will open and contacts 1-will close again.

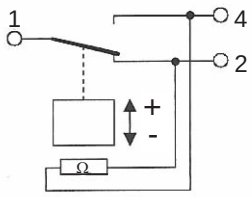


Manual reset high temperature contact function

For operational safety, all TS1 with manual reset are designed as trip-free controls, i.e. pressing the manual reset button while the temperature has not reached its reset threshold will not operate the electrical contacts.

Bellows Heater

TS1 with vapor charges, i.e. sensor types A, E, P (not frost monitors function C or D) have a bellows heater wired across the contacts in the following way.



Bellows heater

PS1/PS2 Introduction

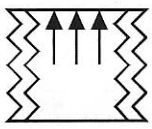
The PS1/PS2 Series is Emerson's adjustable pressostats for application in refrigeration and heat pump systems.

In these systems, pressure controls serve control and protection functions. Examples of control are compressor cycling, pump-down or defrost control. Protection includes pressure limiting and cut out against excessive pressures, against loss of charge or for freeze protection.

Pressure Sensing

All pressures mentioned in this document are understood as gauge pressures. PS1/PS2 controls sense pressure by bellows which expand or contract when exposed to medium pressure.

High pressure limiters and pressure cut outs with type approval according to EN 12263 feature a double bellows design. The inner bellows serves as the operating bellows and is enclosed by the outer bellows featuring a larger surface area.



Should the inner bellows leak, then the larger surface area of the outer bellows creates a larger force and causes the pressostat to a pre-empted cut out. This represents a fail-safe function. Standard controls for refrigeration applications are equipped with a bronze bellows and can be used with all common HFC, HCFC and CFC refrigerants.

Single Pressostat PS1

Dual Pressostat PS2

Pressure Connectors

A variety of pressure connectors, including male and female flare type connectors, capillary and solder connectors are available. The standard connector is a 7-16"-20 UNF male flare connector, which, in its high pressure versions, is equipped with a snubber to protect against pressure pulsations.

Electrical Contacts

PS1/PS2 pressure controls are equipped with high rated double snap action contacts for shatter-free and reliable operation.

All contacts in these controls are designed as Single Pole Double Throw (SPDT) contacts. One contact may be used for control and the other contact for alarm/status indication or auxiliary control. Dual Pressostats PS2 come with two independently actuated SPDT contacts, providing for even further application flexibility by allowing for a variety of wiring options.

Setpoints

PS1/PS2 are adjustable controls with external adjustment spindles for range and differential. Note that manual reset controls have a fixed differential and no differential spindle. By turning the range spindle, the upper setpoint is defined and by adjusting the differential spindle, the differential and the lower setpoint is defined.

The dependency between upper and lower setpoint is always as follows:

lower setpoint = upper setpoint – differential

The following two rules should be kept in mind:

⇨ an adjustment of the range spindle always affects both upper and lower setpoint.

⇨ an adjustment of the differential spindle affects the lower setpoint, only.

The controls are equipped with display scale and pointers to show the approximate settings. The display scales are printed in relative pressure units “bar” and “psi”. For precise setting of the controls, external gauges must be used.

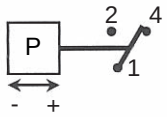
Contact Function

Contacts on Dingle Pressostats, PS1 are labeled 1-2-4 where ‘1’ refers to the common pole, ‘2’ refers to the lower setpoint and ‘4’ refers to the upper setpoint. This is true for all types of controls, irrespective whether they are low pressure controls, high pressure controls, manual or automatic reset types.

The contact function for automatic and manual reset versions is as described below.

Automatic Reset

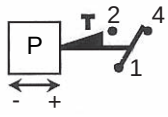
When pressure rises above the upper setpoint, contacts 1-2 open and contacts 1-4 close. On decreasing temperature lower setpoint contacts 1-4 open and contacts 1-2 close.



Automatic reset contact function

Manual Reset Low Pressure

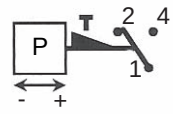
When pressure drops below the lower setpoint, contacts 1-4 open, contacts 1-2 close and latch. Only on pressure rise above upper setpoint and after pressing the manual reset button contacts 1-2 will open and contacts 1-4 will close again.



Manual reset low pressure contact function

Manual Reset High Pressure

When pressure rises above the upper setpoint, contacts 1-2 open, contacts 1-4 close and latch. Only on falling pressure below lower setpoint and after pressing the manual reset button, contacts 1-4 will open and contacts 1-2 will close again.



Manual reset high pressure contact function

For operational safety, all PS1/PS2 with manual reset are designed as trip-free controls, i.e. pressing the manual reset button while the pressure has not reached its reset threshold will not operate the electrical contacts.

As Dual Pressostats PS2 have two sets of contacts, their function is the same as on Single Pressostats PS1 with the only difference that the contact labels are preceded by an additional index. One side of the control is labeled 11-12-14 and the second side is 21-22-24.

The contact function of controls with convertible reset is as described above but depends on the position of the convertible reset toggle, i.e. automatic or manual reset position.

PSC Pressure Switch

The Flow PSC is a Pressure Switch with fixed switch-point settings.

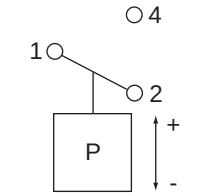
Features

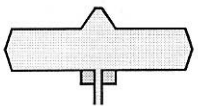
- Maximum Operating Pressure up to 623 psig Test Pressure up to 696 psig
- Standard factory settings from stock in small volumes
- High and low pressure switches
- High temperature version with snubber for direct compressor mounting (Range 6)
- Direct mounting reduces the number of joints and thus avoiding potential leakage
- Precise setting and repeatability
- IP 65 protection if used with the cables with plug

PSC

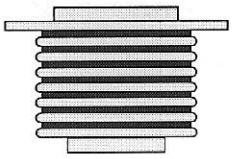
Options

- For direct mounting on a pressure connection (free standing) or with a capillary tube
- Direct compressor head mounting with high temperature bellows and snubber
  - reduces the number of joints
  - avoids potential leakage
  - saves high cost of flexible hose
- TÜV approved versions for high and low pressure
- Micro-switch for narrow pressure differentials
- Gold plated contacts for low voltage/current applications
- Cables with plug ordered separately





Single Diaphragm



Bellows (Pressure Range 6)

PSC Introduction

PSC is equipped with a SPDT snap action contact, switching from 1-2 to 1-4 on rising pressure and from 4 to on falling pressure (see diagram). Several models are available:

- Low pressure switch, with automatic or manual reset
- High pressure switch, with automatic or manual reset
- DIN/TÜV approved safety high pressure limiter with automatic reset
- DIN/TÜV approved safety high pressure cut-out, with internal or external manual reset

TÜV approval for pressure switches can be reached either by using a double diaphragm (Pressure range 1-5) which acts in a fail-safe mode or by a single pressure element (Bellows, Pressure range 6) which is able to resist to >Mio. cycles between 50% and 100% of the maximum operating pressure (see 4.6.1 of EN 12263).

FSX Introduction

FSX electronic speed controllers are designed to control the speed of fan motors in commercial refrigeration system depending on condensing pressure changes. It is suitable for single phase. FSX can be used in air-cooled condensers, air-cooled condensing units and air-conditioning units.

Using variable fan speed controllers offers the following benefits in commercial refrigeration or air-conditioning applications:

• Head pressure can be kept high enough to ensure proper operation of the expansion valve, and sufficient mass flow through the expansion valve to feed the evaporator. This maintains the required cooling capacity.

• Efficiency increase of the compressor by controlling the head pressure, improved performance and energy saving for the complete system.

• The noise fan motors can be kept at a minimum by avoiding permanent on/off cycling.

FSX-43S

Description of control behavior

FSX control behavior can be easily described by looking at the function of output voltage versus input pressure (see figure 1) and by dividing it into maximum, proportional and minimum range.

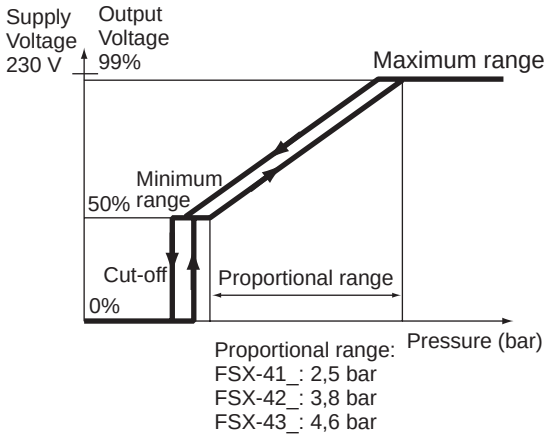


Figure 1 – FSX Output Voltage Versus Input Pressure

In the maximum range, the FSX provides a constant output voltage of about 1% below the supply voltage. The fan runs at maximum speed.

Along the proportional range the output voltage varies between maximum and minimum voltage of approximately 50% of the supply voltage. This causes the fan speed to slow down from maximum speed to minimum speed.

Further decrease of pressure in the minimum range leads to cut-off of the fan motor. Increase of input pressure will start the motor with a hysteresis of approximately 10 psig to avoid cycling (Fig. 1).

The pressure from which motor is cut off (FSX), see column “pressure range” in the selection chart. The proportional range is fixed at:

36 psig for FSX-41_/FSM-41_
55 psig for FSX-42_/FSM-42_
66 psig for FSX-43_/FSM-43_

Basic Rules of Good Practice

2008

Basic Rules of Good Practice

Doing a good job in any line of work almost always involves following some basic "good practice" rules, and servicing refrigeration systems is no exception. Knowing and observing such basic rules, to the point that it becomes automatic, can prevent a lot of problems by cutting them off at the pass before they have a chance to happen.

A list of DO's, procedures that should be followed, and a list of DON'Ts representing pitfalls that should be avoided are presented here to promote the general adoption of good servicing practices and a better understanding of the WHYs behind them. An occasional quick review may serve to reinforce awareness and help make their application second nature.

DOs

***DO* maintain test instruments in good working order and periodically check them against accurately calibrated instruments.**

Good diagnoses can't be made with faulty inputs.

***DO* familiarize yourself with the operation of a control before attempting to make adjustments or repairs.**

If you don't understand how a control is supposed to function, you can't be sure if it's defective or not. When you know what you're doing, you achieve good results on purpose; when you don't know what you're doing, you achieve good results only by accident.

***DO* make it a practice to check suction gas superheat at the compressor.**

Too low superheat may result in liquid flood-back, while high superheats cause high discharge temperatures. Always follow equipment manufacturers' instructions.

***DO* replace filter-driers or replaceable cartridges whenever it's necessary to open a system for service.**

Regardless of how careful you are, it's virtually impossible to prevent the entry of moisture and other contaminants while the system is open. Driers or cartridges cannot be successfully activated in the field for reuse. A new filter drier or cartridge is cheap insurance for a compressor.

***DO* use an accurate moisture indicator in the liquid line to watch out for moisture contamination.**

It is the single most common contaminant, and it can lead to a variety of problems including acid, sludge, and freeze-ups.

***DO* check expansion valve superheat by using the temperature-pressure method.**

This involves measuring the suction line pressure at the evaporator outlet and then referring to the appropriate temperature-pressure chart to determine the saturation temperature. Subtracting this temperature from the suction line temperature measured at the remote bulb gives you the operating superheat, which should be adjusted to the equipment manufacturer's specifications.

DON'Ts

***DON'T* be a "parts-changer."**

Analyze problems based on the symptoms, and determine the specific cause before making any changes or repairs. Emerson's Troubleshooting Guide describes a wide variety of problems that may be encountered, and their probable causes.

***DON'T* think of a TXV as a temperature or pressure control.**

Thinking of it as a superheat control is basic to achieving optimum system performance.

***DON'T* attempt to use any control for any application other than the one it was designed for.**

Using a pressure regulator for a pressure relief valve, or any similar substitution, is not good practice and almost certainly won't deliver proper performance. Misapplications can lead to equipment damage and even injury. When doubt exists, check with the manufacturer.

***DON'T* energize a solenoid coil while it is removed from the valve.**

Without the magnetic effect of the solenoid core, the coil will burn out in a matter of seconds.

***DON'T* install a previously used filter-drier or replaceable cartridge.**

It could introduce contaminants that it has picked up since its removal from a system.

***DON'T* select solenoid valves by line size or port size, but by valve capacity.**

They must also be compatible with the intended application with regard to the specific refrigerant used, the maximum opening pressure differential (MOPD), the maximum working pressure (MWP), and the electrical characteristics. Never apply a valve outside of its design limits or for uses not specifically catalogued.

***DON'T* rely on sight or touch for temperature measurements.**

Use an accurate thermometer. Once again, you can't get accurate diagnoses with faulty inputs.

Troubleshooting Guide

2008

SYSTEM TROUBLESHOOTING GUIDE

System Problem	Discharge Pressure	Suction Pressure	Superheat	Subcooling	Amps
Overcharge	↑	↑	↓	↑	↑
Undercharge	↓	↓	↑	↓	↓
Liquid Restriction (Drier)	↓	↓	↑	↑	↓
Low Evaporator Airflow	↓	↓	↓	↑	↓
Dirty Condenser	↑	↑	↑	↑	↑
Low Outside Ambient Temperature	↓	↓	↓	↑	↓
Inefficient Compressor	↓	↑	↑	↑	↓
TXV Bulb Loose Mounted	↑	↑	↓	↓	↑
TXV Bulb Lost Charge	↓	↓	↑	↑	↓
Poorly Insulated Bulb	↑	↑	↓	↓	↑

Troubleshooting Expansion Valves

Superheat Is Too Low -- TXV Feeds Too Much

Problem	Symptoms	Causes	Corrective Action
Valve Feeds Too Much	1) Liquid Slugging 2) Low Superheat 3) Suction Pressure Normal or High	Oversized Valve	Replace with correct size valve
		Incorrect Superheat Setting	Adjust the superheat to correct setting
		Moisture	Replace the filter-driers; evacuate the system and replace the refrigerant
		Dirt or Foreign Material	Clean out the material or replace the valve
		Incorrect Charge Selection	Select proper charge based on refrigerant type
		Incorrect Bulb Location	Relocate the bulb to proper location
		Incorrect Equalizer Location	Relocate the equalizer to proper location
		Plugged Equalizer (Balanced Port Valve)	Remove any restriction in the equalizer tube

Superheat Is Too High -- TXV Doesn't Feed or Doesn't Feed Enough

Problem	Symptoms	Causes	Corrective Action
Valve Doesn't Feed or Doesn't Feed Enough	1) Evaporator Temperature Too High 2) High Superheat 3) Low Suction Pressure	Short of Refrigerant	Add correct amount of refrigerant
		High Superheat	Change superheat setting
		Flash Gas In Liquid Line	Remove source of restriction
		Low or Lost Bulb Charge	Replace power element or valve
		Moisture	Replace driers or evacuate the system and replace refrigerant
		Plugged Equalizer (Conventional Valve)	Remove restriction in equalizer tube
		Insufficient Pressure Drop or Valve Too Small	Replace existing valve with properly sized valve
		Dirt or Foreign Material	Clean out material or replace valve
		Incorrect Charge Selection	Select correct charge
		Incorrect Bulb Location	Move bulb to correct location
		Incorrect Equalizer Location	Move equalizer to correct location
		Charge Migration (MOP Only, Vapor Charges)	Move valve to a warmer location or apply heat tape to powerhead
		Wax	Use charcoal drier
		Wrong equalizer Type Valve	Use externally equalized valve
		Rod Leakage (Balanced Port Valve)	Replace valve
		Heat Damaged Powerhead	Replace powerhead or valve

No Superheat At Start Up Only

Problem	Symptoms	Causes	Corrective Action
Valve Feeds Too Much At Start Up	1) Liquid Slugging 2) Zero Superheat 3) Suction Pressure Too High	Refrigerant Drainage	Use pump down control; Install trap at the top of the evaporator
		Compressor or Suction Line in a Cold Location	Install crankcase heater; Install suction solenoid
		Partially Restricted or Plugged External Equalizer (Balanced Port Valve)	Remove restriction
		Liquid Line Solenoid Won't Shut	Replace powerhead or valve

Superheat Is Erratic Or Hunts

Problem	Symptoms	Causes	Corrective Action
System Hunts or Cycles	1) Suction Pressure Hunts 2) Superheat Hunts 3) Erratic Valve Feeding	Bulb Location Incorrect	Reposition Bulb
		Valve Too Large	Replace with correctly sized valve
		Incorrect Superheat Setting	Adjust superheat to correct setting
		System Design	Redesign system

Superheat Appears Normal -- System Performs Poorly			
Problem	**Symptoms**	**Causes**	**Corrective Action**
Valve Doesn't Feed Properly	1) Poor System Performance 2) Low or Normal Superheat 3) Low Suction Pressure	Unequal Circuit Loading	Make modification to balance load
		Flow From One Coil Affecting Another Coil	Correct piping
		Low Load	Correct conditions causing low load
		Mismatched Coil/Compressor	Correct match
		Incorrect Distributor	Install correct distributor
		Evaporator Oil-Logged	Increase gas velocity through coil

TROUBLESHOOTING SOLENOID VALVES		
Problem	**Causes**	**Corrective Action**
Normally Closed Valve Will Not Open -or- Normally Open Valve Will Not Close	Movement of plunger or diaphragm restricted a) Corroded parts b) Foreign material lodged in valve c) Dented or bent enclosing tube d) Warped or distorted body due to improper brazing or crushing in vice	Clean affected parts and replace parts as required. Correct the cause of corrosion or source of foreign materials in the system.
	Improper wiring	Check electrical circuit for loose or broken connections. Attach voltmeter to coil leads and check voltage, inrush and holding currents
	Faulty contacts on relays or thermostats	Check contacts in relays and thermostats. clean or replace as required.
	Voltage and frequency rating or solenoid coil not matched to electrical supply: a) low voltage b) high voltage c) incorrect frequency	Check voltage and frequency stamped on coil assembly to make certain it matches electrical source. If it does not, obtain new coil assembly with proper voltage and frequency rating: a) Locate cause of voltage drop and correct. Install proper transformer, wire size as needed. Be sure all connections are tight and that relays function properly. b) Excessively high voltage will cause coil burnout. Obtain new coil assembly with proper voltage rating. c) Obtain new coil assembly with proper frequency rating.
	Oversized Valve	Install correct sized valve. Consult extended capacities tables.
	Valve improperly assembled.	Assemble parts in proper position making certain none are missing from valve assembly.
	Coil Burnout a) Supply voltage at coil too low (below 85% of rated coil voltage) b) Supply voltage at valve too high (more than 10% above coil voltage rating) c) Valve located at high ambient d) Plunger restricted due to: corroded parts, foreign materials lodged in valve, dented or bent enclosing tube or warped or distorted body due to improper brazing or curshing in vise e) With valve closed, pressure difference across valve is too high preventing valve from opening f) Improper wiring. Inrush voltage drop causing plunger to fail to pull magnetic field due to: - Wiring the valve to the load side of the motor starter - Wiring the valve in parallel with another appliance with high inrush current draw - Poor connetions, especially on low voltage, where connections should be soldered - Wire size of electrical supply too small g) Electrical supply (voltage and frequency) not matched to solenoid coil rating	a) Locate cause of low voltage and correct (check transformer, wire size, and control rating) b) Locate cause of high voltage and correct (install proper transformer or service) c) Ventilate the area from high ambient. Remove covering from coil housing d) Clean affected parts and replace as required. Connect cause of corrosion or source of foreign material in the system e) Reduce pressure differential to less than 300psi f) Correct wiring according to valve manufacturers' instructions. Solder all low voltage connections. Use correct wire size. g) Check coil voltage and frequency to ensure match to electrical service rating. Install new coil with proper voltage and frequency rating.

Problem	Causes	Corrective Action
Normally Closed Valve Will Not Close -or- Normally Open Valve Will Not Open	Diaphragm or plunger restricted due to: corroded parts, foreign material lodged in valve, dented or bent closing tube, or warped body due to improper brazing or crushing in vise	Clean affected parts and replace parts as required. Correct the cause of corrosion or source of foreign materials in the system. Install a filter-drier upstream of solenoid valve
	Manual opening stem holding valve open	With coil de-energized, turn manual stem in counter clockwise direction until valve closes
	Closing spring missing or inoperative	Re-assemble with spring in proper position
	Electrical feedback keeping coil energized, or switch contacts not breaking circuit to coil	Attach voltmeter at coil leads and check for feedack or closed circuit. Correct faulty contacts or wiring
	Reverse pressures (outlet pressure greater than inlet pressure), or valve installed backwards	Install check valve at valve outlet, or install with flow arrow in proper direction
Problem	**Causes**	**Corrective Action**
Valve Closes, But Flow Continues (Seat Leakage)	Foreign material lodged under seat	Clean internal parts and remove foreign material
	Valve seat damaged	Replace valve or affected parts
	Synthetic seat materials chipped	Replace valve or affected parts
	Valve improperly applied or assembled	Replace valve with proper valve or re-assemble

Special Considerations For Industrial Solenoid Valves		
Symptoms	**Causes**	**Corrective Action**
High Internal Seat Leakage (high temperature steam up to 400°)	Wrong Seat Elastomer Used (Buna N)	Use Valve with Teflon Seat Elastomer
External Leakage (high temperature steam up to 400°)	Wrong Gasket Material Used (Neoprene)	Use Ethylene Propylene Gasket
High Internal Seat Leakage (high temperature steam up to 250° or water up to 210°)	Wrong Seat Elastomer Used (Buna N)	Use Valve with Ethylene Propylene Seat Elastomer
External leakage (high temperature steam up to 250° or water up to 210°)	Wrong Gasket Material Used (Neoprene)	Use Ethylene Propylene Gasket

Troubleshooting Ball Valves

Symptoms	Causes	Corrective Action
Doesn't Flow	Valve Isn't Open	Turn Stem
Leak at Access Schrader Valve	Schrader Valve Isn't Tight	Tighten Schrader Valve
Leak at Stem	Valve Stem is Leaking	Replace Valve
Excessive Pressure Drop	Valve Isn't Fully Open	Turn Stem to Open Valve

Troubleshooting System Protectors

Allowable Pressure Drop -- Permanent Installation

Refrigerant	Evaporator Temperature				
	40°F	20°F	0°F	-20°F	-40°F
R12, R134a	2.0	1.5	1.0	0.5	-
R22, R410A	3.0	2.0	1.5	1.0	0.5
R502, R404A/507	3.0	2.0	1.5	1.0	0.5

Troubleshooting Storage Devices

Suction Line Accumulators

Problem	Causes	Corrective Action
Oil Not Returning to Compressor	Bleed Hole in U-Tube Plugged	Replace Accumulator; Install Filter Ahead of Accumulator
	U-Tube Broken Off	Replace Accumulator
	Accumulator Too Large for Application	Replace with Smaller Accumulator
	Accumulator Installed Incorrectly	Re-Install with Correct Inlet & Outlet Connections

Liquid Refrigerant Receivers		
Problem	**Causes**	**Corrective Action**
Flashing In Liquid Sight Glass Downstream Of Receiver	Receiver Outlet Not Fully Open	Open Valve Fully
	On Receivers with Top Outlet Connections, the Dip Tube may be Broken Off Or Plugged	Replace Receiver
	Receiver Installed Upside Down	Re-Install Receiver Correctly

Troubleshooting Oil Controls - OMB

Problem	**Causes**	**Corrective Action**
Oil Level Too High In Sight Glass	OMB out of calibration	Replace OMB
	Too much oil in system	Remove oil from oil separator or reservoir until proper level is maintained
	Too much oil coming back from evaporator	Check system piping design for: - Proper velocities - P-traps at the bottom of all suction risers - Piping pitched to compressor - Overlapping or defrosts that are not staggered
	Debris under solenoid valve seat	Unscrew solenoid valve, clean & replace
Problem	**Causes**	**Corrective Action**
Oil Level Too Low In Sight Glass	Oil separator or reservoir empty	Add oil to maintain a liquid seal in the bottom of the separator or reservoir
	Plugged oil line filter	Replace filter
	Plugged inlet strainer(s) on OMB	Remove and clean strainer on all affected OMB
	Solenoid coil defective	Replace coil
	Power loss to OMB	Check power to OMB. Green light should be lit.
Problem	**Causes**	**Corrective Action**
Foaming In Sight Glass	Liquid refrigerant in oil	Flood back through suction; Increase superheat on expansion valve; Refrigerant condensing in oil separator - add heater to oil separator and/or adjust system setting to eliminate flood back
	If so equipped, liquid injection overfeeding	Correct liquid injection overfeed
	Excess quantity of oil in crankcase	Remove excess oil
Problem	**Causes**	**Corrective Action**
Nuisance Oil Alarms	"Filling" light remains on even though level is 1/2 above sight glass	Replace OMB
	Alarm light on all the time	Replace OMB
	Intermittent oil return from system	Check system piping design for: - Proper veloicties - P-traps at the bottom of all suction risers - Piping pitched to compressor - Overlapping or defrosts that are not staggered

Troubleshooting Oil Separators

Problem	**Causes**	**Corrective Action**
Reduced or No Oil Feed to Compressor	Oil outlet valve closed or partially closed	Open oil outlet valve
	Inadequate oil charge in system	Add oil in system
	Oil float defective or dirty (will not open)	Disassemble and clean or replace defective float component (flanged versions); Replace oil separator (welded version).
	Separator too small for application	Replace separator with larger size
Hot Gas Entering Compressor	Oil float defective or dirty (will not close)	Disassemble and clean or replace defective float component (flanged versions); Replace oil separator (welded version).

Troubleshooting Regulators

Problem	Causes	Corrective Action
Erratic Pressure Control	Pilot inlet filter screen obstructed	Clean or replace.
	Piston bleed hole restriction	Disassemble valve and clean. Replace if necessary.
Regulator Will Not Open (EPRBS Version)	Excessive dirt in pilot/solenoid	
	Piston bleed hole restriction	
	Coil is damaged or not energized	Verify coil is energized. Replace if necessary.
Excessive Pressure Drop Across the Regulator	Piston bleed partially obstructed	Disassemble and clean regulator.
	Pilot or solenoid leaking internally	Replace pilot assembly.
	Regulator undersized	Refer to extended capacities table. Install correct sized regulator.
Regulator Hunting (Fluctuations in Controlled Pressure)	Piston bleed port obstructed	Clean or replace.
	Pilot inlet filter screen obstructed	
	Regulator oversized	Refer to extended capacities table. Install correct sized regulator.
	Regulator and TXV have control interaction	Turn off pilot pressure. Ensure regulator is wide open. Adjust superheat to required setting. Turn pilot pressure back on.
	Regulator and cylinder unloaders have control interaction	The unloader should be set to control at least 5 psig lower than regulator.
Regulator Will Not Provide Pressure Control	Pilot inlet filter screen obstructed	Clean or replace.
	Pilot inlet pressure is too low	Increase pressure to a minimum of 25 psi higher than the main valve outlet pressure.
	Piston jammed due to excessive dirt; Inoperative pilot or broken diaphragm	Locate and remove the stoppage or dirt. Replace pilot. A broken diaphragm can be detected by checking for leaks around the adjusting stem.
Regulator Will Not Close (EPRBS Version)	Dirt under seat	Disassemble and clean.
	Excessive piston seal leakage	Replace bell piston assembly.
	Plugged pilot filter	Clean or replace.
	Pilot supply turned off or restricted	Verify pilot inlet pressure is at least 25 psig greater than valve outlet.
	Excessive dirt in pilot/solenoid	Replace pilot assembly.

Troubleshooting Hot Gas Regulators

Problem	Causes	Corrective Action
Low Suction Pressure - Valve Open	Valve undersized	Replace valve with correct size
Will Not Bypass - Valve Not Open	1. Solenoid (if present) not energized 2. Valve sticking closed 3. Not set properly 4. Bad pilot	1. Repair (replace solenoid coil) 2. Replace 3. Recalibrate 4. Replace
Suction Pressure Swings Erratically	Oversized valve	Replace valve with correct size
Bypass Continuously - Suction Pressure High	1. Manual stem screwed down 2. Valve sticking open 3. Bad pilot	1. Back stem out 2. Repair/replace valve 3. Replace pilot
Setpoint Drifts	Bad pilot	Replace pilot

Troubleshooting Crankcase Regulators

Problem	Causes	Corrective Action
Valve Won't Adjust or Is Erratic	Dirt under seat	With system running, open the valve adjustment to open the valve and flush away the contaminant. If this fails, replace valve.
Valve Throttles Constantly	On system equipped with Hot Gas Bypas Valves, the bypass valve setting is higher than CPR	Re-adjust bypass and/or CPR valve so that the CPR setting is higher than the discharge bypass valve
Temperature Pull-Down After Defrost is Too Long	TXV with MOP feature used with the CPR	To improve pull-down time, replace TXV with equivalent without MOP feature
	Valve setting is too low	Re-adjust the CPR to a higher setting - see adjustment procedure

Problem	Causes	Corrective Action
Compressor tripping on Internal Thermal Protector - Fails to Start-Up and Run Long Enough to Pull Down Temperature	CPR setting too high	Re-adjust the CPR to a lower setting - see adjustment procedure
Valve Fails to Open	CPR setting is too low	
	Valve defective - bellows leak, pressurizing the upper adjustment assembly	Replace valve

Troubleshooting Head Pressure Controls

Problem	Causes	Corrective Action
Low Head Pressure During Operation	Valve unable to throttle "C" port 1. Foreign material wedged between "C" port seat and seat disc 2. Power element lost its charge 3. Insufficient winter-time system charge	1. Artificially raise head pressure and tap valve body to dislodge foreign material 2. Change valve 3. Add refrigerant per Table 3
	Wrong charge pressure in valve for refrigerant	Change valve
	Receiver exposed to low ambient conditions is acting as condenser	Insulate the receiver
	Hot gas bypass line restricted or shut off	Clear obstruction or open valve
System Runs High Head Pressure -or- Cycles on High Pressure Cut-Out	Compressor not pumping, restriction in liquid line, low side causing very low suction pressure	Change or repair compressor; clear obstruction or other reason for low suction pressure
	Condenser fan not running or turning in wrong direction	Replace or repair fan motor, belts, wiring or controls as required
	Fan cycling	Run condenser fan continuously while system is running
	Pressure drop through condenser exceeds allowable 20 psi forcing "B" port partially open	Repipe, recircuit, or change condenser as required to reduce condenser pressure drop to less than 20 psi
	Condenser undersized or air flow restricted or short circuiting	Increase size of condenser or remove air flow restriction or short circuit as required
	"B" port wedged open due to foreign material between seat and seat disc	Artificially reduce head pressure below valve setpoint and tap valve body with system running to dislodge foreign material
	"B" port seat damaged due to foreign material	Change valve
	Wrong charge pressure in valve for refrigerant	
	Excessive system charge or air in system	Purge or bleed off refrigerant or non-condensables as system requires
	Obstruction or valve closed in discharge or condenser drain line	Clear obstruction or open valve
	Liquid line solenoid fails to open	Check solenoid

CHARGING THE SYSTEM - THEORETICAL METHOD

Weighing the Charge (Method has practical limitations)

Add refrigerant until the sight glass is clear and free of bubbles.

Determine refrigerant required to fill the condenser, see Table 3 below. Add this additional amount.

Table 3 - Refrigerant lbs. per ft.*

Refrigerant	Condenser Tube Size - O.D. (in inches)** and Ambient Temperature ° F											
	3/8"				1/2"				5/8"			
	40°	0°	-20°	-40°	40°	0°	-20°	-40°	40°	0°	-20°	-40°
R134a	.051	.054	.055	.057	.095	.099	.102	.105	.150	.157	.164	.167
R22	.051	.054	.055	.056	.094	.099	.102	.104	.150	.159	.163	.167
R404A/R507A	.053	.056	.058	.059	.098	.104	.107	.109	.157	.166	.171	.175

* Return bends: 3/8" O.D. - 20 ft; 1/2 O.D. - 25 ft.; 5/8 O.D. - 30 ft. (equivalent length of tubing/return bend)

** Wall thickness: 3/8" O.D. - .016"; 1/2 O.D. - .017"; 5/8 O.D. - .018"

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Form No. 2004FC-141 R4 (4/08)

Made in USA

ICM 450

Programmable Three Phase Voltage Monitor with 25-Fault Memory

Protects motors from premature failure and burnouts

Installation, Operation & Application Guide

For more information on our complete range of American-made products – plus wiring diagrams, troubleshooting tips and more, visit us at **www.icmcontrols.com**

ICM CONTROLS

Specification

Input
- ***Line Voltage:*** Universal, 190-630 VAC
- ***Frequency:*** 50-60 Hz
- ***Load Side Monitoring:*** Optional
- ***Control Voltage:*** 18-240 VAC
- ***Frequency:*** 50-60 Hz

Output
- ***Type:*** Relay, SPDT
- ***Voltage Range:*** 240VAC @ 10A maximum
- ***Frequency:*** 50-60 Hz

Control Operating Temperature
- ***Operating Temperature:*** -40ºF to +167ºF (-40ºC to +75ºC)
- ***Storage Temperature:*** -40ºF to +185ºF (-40ºC to +80ºC)

LCD Operating Temperature
- ***Operating Temperature:*** -4ºF to +167ºF (-20ºC to +75ºC)

Mechanical
- ***Mounting:*** Surface mount using (2) #8 screws
- ***Terminations:*** Screw terminals
- ***Weight:*** 12 ounces (341 grams)

Dimensions
- 6 1/2" L, 4 1/4" W, 1 3/8" H (16.5 cm. L, 10.8 cm. W, 3.5 cm. H)

Parameters

Phase Unbalance Protection
- ***Voltage Unbalance:*** 2-20% adjustable

Over/Under Voltage Protection
- ***Under Voltage:*** 2-25% adjustable
- ***Over Voltage:*** 2-25% adjustable

Phase Loss Protection
- ***Phase Loss Condition:*** Equals 25% of nominal for any given phase; system will shut down and a fault will be recorded should this occur

Delay on Break Timer
- ***Control Voltage:*** 18-240 VAC
- ***Time Delay:*** 0 to 10 minutes adjustable

Fault Interrogation Delay
- ***Time Delay:*** 0 to 15 seconds adjustable
- Provides a delay between fault detection and system shutdown - helps to eliminate nuisance trips or unnecessary shutdowns

Caution

Installation of the ICM450 shall be performed by trained technicians only. Adhere to all local and national electric codes.

Disconnect all power to the system before making any connections.

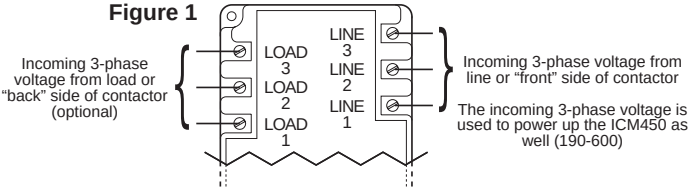
Installation

1. Using (2) #8 screws, mount the ICM450 in a cool, dry, easily accessible location in the control panel.
2. Connect voltage as shown in Figure 1 (below). Leave existing line and load side connections intact on the contactor.
3. Load side monitoring is optional (unit may be used to monitor line side only). Wire the contactor and optional control voltage monitoring as in Figures 2 and 3 (below).

   ⁂ **Note:** Load/line wire must be rated for 3-phase voltage rating, 20ga minimum.

4. Upon application of power, the ICM450 will be on line and will begin to monitor the system.

Figure 1



- Terminals 1 and 3 are the control signal input terminals
- "Control Mode" is turned ON or OFF in setup
- With "Control Mode" set to "ON," there must be a voltage present on terminals 1 and 3 for the relay output terminals 4 and 6 to close; this voltage can be supplied from a thermostat, pressure switch, etc.
- When the voltage on these terminals is re-applied, the unit will not re-energize until the delay on break (0-10 minutes) time has elapsed
- Use of terminals 1 and 3 is optional; they will be ignored if the "Control Mode" is set to "OFF"

Figure 2

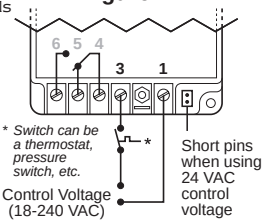
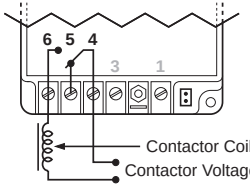
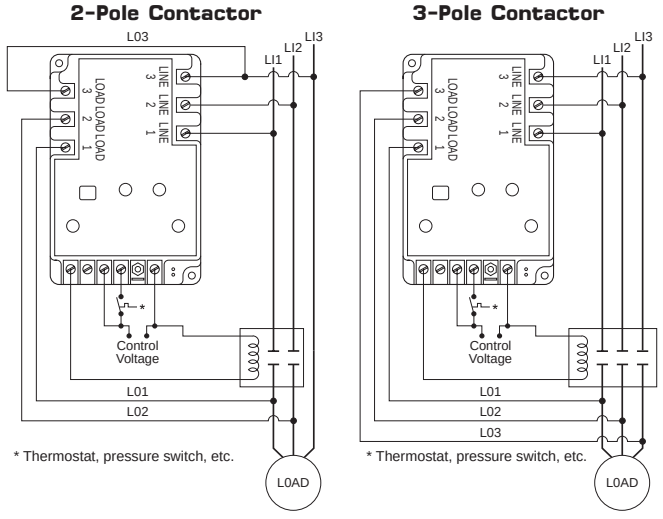


Figure 3



- Terminals 4 and 6 are "dry," normally open contacts
- Terminals 4 and 6 are closed when power is within specifications
- Terminals 4 and 6 open when there is a fault condition or loss of control signal

ICM450 Wiring Diagrams



Setting the Parameters

1. Press the green SETUP button to enter Setup mode. Setup LED will light.
2. Use the ∨ and ∧ arrows to change user parameters.
3. Scroll through setup by pressing and releasing the SETUP button.
4. When the last parameter has been set, the phase average will be displayed and the Setup LED will automatically turn OFF.

Button Functions

Press arrows to scroll through and select user parameter settings in Setup mode. HOLD down for fast edit.

Press to enter Setup mode and select user parameters.

Hold for voltage display a → b, b → c, a → c (simultaneously).

Press to read faults. Hold for 5 seconds to clear faults and reset memory.

Parameters

Parameter	Description	Range	Default	Recommended
Line Voltage	Average phase to phase line voltage	190-600	208	Nameplate Voltage
Delay On Break	Amount of time between the load de-energizing and re-energizing	0-10 minutes	.1 minute	4 minutes**
Fault Interrogation	Amount of time before the load de-energizes due to a non-critical fault*	0-15 seconds	15 seconds	7-8 seconds**
% Over/Under Voltage	Maximum/minimum phase to phase average voltage, respectively	2-25%	20%	12-15%**
% Phase Unbalance	Amount of allowable voltage unbalance	2-20%	20%	4-5%**
Reset Mode	AUTO or number of times the load can be re-energized after a load side fault before a manual reset is necessary ⁂ Note: When monitoring line side only, the reset mode will always be AUTO	AUTO, 0-10	AUTO	AUTO
Control Mode	With control mode set to OFF, the load will energize if no 3- phase fault conditions exist; with control mode ON, the load will energize if no fault conditions exist and control voltage is present at terminals 1 and 3 of the ICM450	ON or OFF	ON	Based on wiring

* Non-critical faults are faults such as High/Low Voltage and Phase Unbalance. Critical faults, such as Phase Loss and Phase Reversal, have a fault interrogation of under 2 seconds and it is not user adjustable.

** For best recommendations, consult manufacturer of equipment.

Fault Conditions

Press and release fault button to scroll through all saved faults.

⁂ **Note:** For initial setup, press and hold FAULT for 5 seconds to remove any previously stored faults.

Fault	Problem	Corrective Action
Back Phase Loss	Not all three of the phases on the load side are present	1. Re-energize the contactor. 2. If the fault reappears after the load energizes: a. Turn all power OFF b. Check all load side connections c. Check the contacts of the contactor for debris or excess carbon.
Back Phase Rev	Loads 1, 2, or 3 are not in sequence (not 120° phase shifted)	1. Turn OFF all power. 2. Swap any 2 phases on the load side of the ICM450 only (example: swap load 1 and load 2) * 3. Re-apply power.
Back Phase Unbal	A voltage unbalance between the three load phases exceeds the unbalance setpoint	1. Press the **READ** button to observe the present load voltages. Check system for unbalance cause. 2. Increase the fault interrogation time if necessary. 3. Increase the percent unbalance setting if necessary.
Front Over Volt	Average phase-phase voltage exceeds the maximum percentage	1. Check system for over-voltage cause. 2. Increase the percent over-voltage setting if necessary. 3. Increase the fault interrogation time if necessary.
Front Phase Loss	Not all three of the phases on the line side are present	1. Press and hold the **READ** button on the phase monitor or use an AC voltmeter to carefully measure all three phase-phase line voltages (example: Line 1 ➔ Line 2, Line 2 ➔ Line 3, Line 3 ➔ Line 1). 2. Repair the missing phase.
Front Phase Rev	Lines 1, 2, or 3 are not in sequence (not 120° phase shifted)	1. Turn OFF all power. 2. Swap any 2 phases on the line side of the ICM450 (example: swap load 1 and load 2)* 3. Re-apply power.
Front Phase Unbal	A voltage unbalance between the three line phases exceeds the unbalance setpoint	1. Press the **READ** button to observe the present load voltages. Check system for unbalance cause. 2. Increase the fault interrogation time if necessary. 3. Increase the percent unbalance setting if necessary.
Front Under Volt	Average phase-phase voltage is below the minimum percentage	1. Check system for under-voltage cause. 2. Increase the percent under-voltage setting if necessary. 3. Increase the fault interrogation time if necessary.

* **Only** swap phases during initial setup, **not** after the ICM450 has been in operation without errors.

Troubleshooting

Problem	LCD Readout	LED Status	Corrective Action
Load will not energize	Phase Avg.	All LEDs Off	Confirm that the control input (terminals 1 & 3) is properly connected and configured (see Pages 1 and 3)
Load will not energize	Phase Avg.	Load LED Off, Fault LED blinking	Press **FAULT** to observe the current fault; correct the condition of the first fault that appears (see Fault Conditions, Page 4 for a list of corrective actions)
Fault LED blinks repeatedly while load is energized	Phase Avg.	Fault LED Blinking, Load LED On	Indicates there are faults saved in the memory, press **FAULT** rapidly to scroll through saved faults; to clear the faults, press and hold **FAULT** for more than 5 seconds
Load will not de-energize when control voltage is OFF	Phase Avg.	Load LED On, Control LED Off	The control mode setting is OFF; press **SETUP** to get to the control mode. Press ^ to set the control mode ON
Setup LED is on while load is being energized	Anything Other Than Phase Avg.	Setup LED On, Load LED On	To exit the setup mode, press either **READ** or **FAULT**
Load will not energize	Reset	Fault LED Blinking	Unit in lockout; maximum number of retries in manual reset mode has been reached; to reset unit, press **FAULT** and hold for more than 5 seconds
Load turns ON and OFF repeatedly	Readout is Irrelevant	Fault LED Blinking	Fix load side fault; press **FAULT** to observe condition; the delay on break period may be too short; press **SETUP** to enter the delay on break mode; press ^ to lengthen the delay

ONE-YEAR LIMITED WARRANTY

The Seller warrants its products against defects in material or workmanship for a period of one (1) year from the date of manufacture. The liability of the Seller is limited, at its option, to repair, replace or issue a non-case credit for the purchase prices of the goods which are provided to be defective. The warranty and remedies set forth herein do not apply to any goods or parts thereof which have been subjected to misuse including any use or application in violation of the Seller's instructions, neglect, tampering, improper storage, incorrect installation or servicing not performed by the Seller. In order to permit the Seller to properly administer the warranty, the Buyer shall: 1) Notify the Seller promptly of any claim, submitting date code information or any other pertinent data as requested by the Seller. 2) Permit the Seller to inspect and test the product claimed to be defective. Items claimed to be defective and are determined by Seller to be non-defective are subject to a $30.00 per hour inspection fee. This warranty constitutes the Seller's sole liability hereunder and is in lieu of any other warranty expressed, implied or statutory. Unless otherwise stated in writing, Seller makes no warranty that the goods depicted or described herein are fit for any particular purpose.

ICM CONTROLS™

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ICM 450
Programmable Three Phase Voltage Monitor

Settings for Seresco NE series dehumidifiers

Parameters	**Default settings**	**Seresco Settings**
Line voltage	208 V	See Name Plate
Dealay on break	.1 minute	1 minute
Fault delay	15 sec	5 sec
Overvoltage	20%	5%
Undervoltage	20%	5%
Phase unbalance	20%	3%
Reset Mode	AUTO	AUTO
Control Mode	ON	OFF

Note: Please reffer to ICM 450 manual. Consult Seresco if settings' change is required

SPORLAN REF. & A/C PRODUCTS

Sporlan Refrigeration and Air Conditioning Products

Oil Level Controls

Suction Filters **Oil Filters**

See•All

Head Pressure Control Valves

Solenoids

Three-Way Heat Reclaim Valves

TEV

Crankcase Pressure Regulating Valves

Catch-All

Discharge Bypass Valves

Evaporator Pressure Regulating Valves

SPORLAN THERMOSTATIC EXPANSION VALVES

- **Selective Thermostat Charges —** Designed to provide optimum performance for all applications — air conditioning and heat pump, medium and Low temperature refrigeration.
- **Thermostatic Element Design —** Long lasting and field proven stainless steel diaphragm and welded element construction.
- **Diaphragm Design —** Large flat diaphragm permits precise valve control.
- **Replaceable Thermostatic Elements —** Field replaceable elements on all standard valves.
- **Balanced Port Design —** Provides perfect pin and port alignment, and prevents changes in pressure drop across the valve from influencing Valve operation. Provides excellent control on applications with widely varying operating conditions.
- **Pin Carrier Design (Conventional Valves) —** Provides precise pin and port alignment, and tighter seating.
- **Accessible Internal Parts —** Durable, leak proof body joint construction allows the valve to be disassembled, and the internal parts cleaned and inspected.
- **Materials of Construction —** Pin and port material offer maximum protection against corrosion and erosion.
- **Silver Soldered Connections —** For leak proof, high strength connection-to-body joints.
- **Adjustable Superheat Design —** All standard valves are externally adjustable.

VALVE NOMENCLATURE/ORDERING INSTRUCTIONS

Combine the letters and numbers in the following manner to obtain the complete valve designation. Also include all connection Sizes and the capillary tube length.

CONVENTIONAL VALVES:

S	V		E	-	8	-	GA	5/8"ODF Solder	X	7/8"ODF Solder	X	1/4" ODF Solder	X	5'
Body Type: FB,F, EF,G, EG, RI,RC, S, EBS*, O*, V**, W**	**Sporlan Code - REFRIGERANT - Element Label Color Code**		E" specifies external equalizer. Omission of letter "E" indicates valve with internal equalizer. e.g. EGV-1-C		Nominal Capacity in Tons		Thermostatic Charge	Inlet Connection Size and Style		Outlet Connection Size and Style		External Equalizer Connection Size and Style		Capillary Tubing Length (Inches or Feet)
	F - R-12 Yellow	V - R-407A – Green												
	E - R-13 - Blue	N - R-407 Lt. Brown												
	V - R-22 -Green	S - R-408A -Purple												
	G - R-23 - Blue	F - R-409A -Yellow												
	M - R124 - Blue	R - R-502 - Purple												
	J- R134a -Blue	W - R-503 - Blue												
	X - R-401A Pink	P - R-507 - Teal												
	L - R-402ASand	W - R-508B - Blue												
	S- R-404A Orange	A - R-717 – White												

BALANCE PORTED VALVES:

EBF	V	E	-	AA		-	C	3/8" Extended ODF Solder	X	1/2" Extended ODF Solder	X	1/4" Extended ODF Solder	X	30"
Body Type: BF,SBF, EBF	**22 (V)** 407C (N) 407A (V)	"E" specifies external equalizer. Omission of letter "E" indicates valve with internal equalizer.		Port Size	Nominal Capacity in Tons		Thermostatic Charge	Inlet Connection Size and Style		Outlet Connection Size and Style		External Equalizer Connection Size and Style		Capillary Tubing Length (Inches)
				AAA	1/8 thru 1/3									
				AA	1/2 thru 2/3									
				A	3/4 thru 1-1/2									
				B	1-3/4 thru 3									
				C	3-1/4 thru 5-1/2									
	134a (J) 12 (F) 401A (X) 409A (F)			**AAA**	1/8 thru 1/5									
				AA	1/4 thru 1/3									
				A	1/2 thru 1									
				B	1-1/4 thru 1-3/4									
				C	2 thru 3									
	404A (S) 502 (R) 408A (S)			**AAA**	1/8 thru 1/5									
				AA	1/4 thru 1/3									
				A	1/2 thru 1									
				B	1-1/4 thru 2									
				C	2-1/4 thru 3									
	507 (P) 402A (L)			**AAA**	1/8 thru 1/5									
				AA	1/4 thru 1/3									
				A	1/2 thru 1									
				B	1-1/4 thru 2									
				C	2-1/4 thru 3									

*EBS and O valves are balance ported valves, but follow conventional valve nomenclature.
**V and W valves have dual port semi-balance design.

SPORLAN SELECTIVE CHARGES ENGINEERED FOR PEAK PERFORMANCE FOR EACH SPECIFIC APPLICATION

RECOMMENDED THERMOSTATIC CHARGES*

APPLICATION	REFRIGERANT										ACTUAL THERMOSTATIC CHARGES
	12 409A	22 407A	134a	401A	402A	404A 408A	407C	502	507	717	
AIR CONDITIONING	FCP60	—	JCP60	XCP60	—	—	—	—	—	—	FCP60
	—	VCP100	—	—	—	—	NCP100	—	—	—	VCP100
	—	VGA	—	—	—	—	NGA	—	—	—	VGA
	—	—	—	—	—	SCP115	—	RCP115	—	—	SCP115
COMMERCIAL REFRIGERATION 50°F TO -10°F	FC	—	JC	XC	—	—	—	—	—	—	FC
	—	VC	—	—	—	—	NC	—	—	—	VC
	—	—	—	—	—	SC	—	RC	—	—	SC
	—	—	—	—	LC	—	—	—	PC	—	PC
	—	—	—	—	—	—	—	—	—	AC, AL	AC, AL
LOW TEMPERATURE REFRIGERATION 0°F TO -40°F	FZ	—	—	—	—	—	—	—	—	—	FZ
	FZP	—	—	—	—	—	—	—	—	—	FZP
	—	VZ	—	—	—	—	—	—	—	—	VZ
	—	VZP40	—	—	—	—	—	—	—	—	VZP40
	—	—	—	—	LZ	SZ	—	RZ	PZ	—	SZ
	—	—	—	—	LZP	SZP	—	RZP	PZP	—	SZP
	—	—	—	—	—	—	—	—	—	AZ, AL	AZ, AL
EXTREME LOW TEMP.REFRIGERATION -40°F TO -100°F	—	VX	—	—	—	—	—	—	—	—	VX
	—	—	—	—	LX	SX	—	RX	PX	—	SX

* APPLICATION FACTORS:

1. The Type ZP charges have essentially the same characteristics as the Type Z charge with one exception: they produce a pressure limit Maximum Operating Pressure (MOP). ZP charges are not intended as replacements for Z charges. Each should be selected for its own unique purpose.
2. All air conditioning and heat pump charges are intended for use with externally equalized valves.
3. Type L liquid charges are also available for most commonly used refrigerants in most element sizes.
4. If in doubt as to which charge to use, contact Sporlan Valve Company, Washington, Missouri with complete system data.
5. The Type X charges are not to be used with “EBS” and “O” valves.

IMPORTANT NOTES:

A. R-134a air conditioning and commercial refrigeration applications are using R-12 or R-409A or R-401A valves.

B. R-404A commercial refrigeration applications are using R-502 or R-408A valves.

C. R-404A and R-507 low temperature refrigeration applications are using R-502 or R-402A or R-408A valves.

QUICK REFERENCE GUIDE — REFRIGERATION VALVES

VALUE TYPE	NOMINAL CAPACITY RANGE (Tons)			CONNECTION TYPES	VALVE DESCRIPTION AND APPLICATION
	R-22	R-134a	R-404A & R-507		
F 	1/5 thru 3	1/8 thru 2	1/8 thru 2	SAE Flare	Small brass bar body, externally adjustable valve for small capacity refrigeration systems. SAE flare inlet connection has a removable 100 mesh strainer. Typical applications: Refrigerated cases, coolers, freezers.
EF 	1/5 thru 3	1/8 thru 2	1/8 thru 2	ODF Solder	Same as the Type F valve except it features ODF solder connections. The inlet connection has a 50 mesh strainer. Typical applications: Refrigerated cases, coolers, freezers.
G 	1/5 thru 3	1/8 thru 2	1/8 thru 2	SAE Flare	Forged brass bar body, externally adjustable valve for small capacity refrigeration systems. Inlet connection has a removable 100 mesh strainer. Typical applications: Refrigerated cases, coolers, freezers and small capacity air conditioners.
EG 	1/5 thru 3	1/8 thru 2	1/8 thru 2	ODF Solder	Same as the Type G valve except it features ODF solder connections and a forged brass inlet fitting with a removable 100 mesh strainer which can be cleaned and/or replaced without moving the valve from the line.
FB 	1/4 thru 8	1/4 thru 5	1/4 thru 6	SAE Flare or ODF Solder	Small brass body valve available only with straight through connections and external adjustment. Typical applications: Small capacity air conditioning and refrigeration applications where an external adjustment is desired
BF 	1/3 thru 5	1/4 thru 3	1/4 thru 3	SAE Flare	Same physical size as the Type F valve with SAE flare connection except it features a balanced port construction. Inlet connection has removable 100 mesh strainer. Typical applications: Small capacity refrigeration that operates over widely varying operating conditions.
SBF 	1/3 thru 5	1/4 thru 3	1/4 thru 3	Extended ODF Solder	Same as the Type BF valve except it features ODF solder connection and a forged brass inlet fitting with a removable 100 mesh strainer which can be cleaned and/or replaced without removing the valve from the line.
EBF 	1/3 thru 5	1/4 thru 3	1/4 thru 3	Extended ODF Solder	Same as the Type BF valve except it features ODF solder connections.
S 	2 thru 10	2 thru 6	2 thru 7	ODF Solder	Brass bar body, externally adjustable valve. General purpose valve for air conditioning and refrigeration applications.
EMC 	0.64 thru 2.34	0.46 thru 1.69	0.42 thru 1.51	ODF Solder	Multi-capacity two part valve designed to perform effectively over the range of load conditions inherent with most refrigeration systems. Large port is for pull down load and smaller port to control holding loads.

TYPE F

PART NO*	SPORLAN MODEL**
	FF-1-1/2-C 3X4 SAE 30"
	FF-1-C 3X4 SAE 30"
	FFE-1-C 3X4 SAE 30"
	FFE-2-C 3X4 SAE 30"
	FJ-1/2-C 2X4 SAE 30"
	FJ-1/4-C 2X4 SAE 30"
	FJ-1/4-Z 2X4 SAE 30"
	FR-1/4-Z 2X4 SAE 30"
	FRE-1/2-C 3X4 SAE 30"
	FRE-1/2-Z 3X4 SAE 30"
	FRE-1/2-ZP 3X4 SAE 30"
	FRE-1/4-Z 2X4 SAE 30"
	FRE-1-1/2-C 3X4 SAE 30"
	FRE-1-1/2-Z 3X4 SAE 30"
	FRE-1-1/2-ZP35 2X4 SAE 30"
	FRE-1-ZP 3X4 SAE 30"
	FRE-2-Z 3X4 SAE 30"
	FRE-2-ZP 3X4 SAE 30"
	FS-1/2-C 2X4 SAE 30"
	FS-1/4-C 2X4 SAE 30"
	FS-1/4-ZP 2X4 SAE 30"
	FSE-1/2-Z 2X4 SAE 30"
	FSE-1/2-ZP35 2X4 SAE 30"
	FSE-1/4-ZP 2X4 SAE 30"
	FSE-1/4-ZP30 2X4 SAE 30"
	FSE-1-C 3X4 SAE 30"
	FV-1/4-C 2X4 SAE 30"
	FVE-1/2-C 3X4 SAE 30"
	FVE-1/4-C 2X4 SAE 30"
	FVE-1-1/2-C 3X4 SAE 30"
	FVE-1-C 3X4 SAE 30"
	FVE-2-C 3X4 SAE 30"
	FVE-3-C 3X4 SAE 30"

TYPE EF

PART NO*	SPORLAN MODEL**
	EFF-1/4-Z 2SX3 ODF 30"
	EFJ-1/2-C 2SX3 ODF 30"
	EFJ-1/4-C 2SX4 ODF 30"
	EFS-1/4-C 2SX3 ODF 30"
	EFS-1/4-Z 2SX3 ODF 30"
	EFS-1-Z 3X4 ODF 30"
	EFSE-1/2-Z 3X4 ODF 30"
	EFSE-1/4-Z 3X4 ODF 30"
	EFSE-1/6-Z 2X4 ODF 30"
	EFVE-1/2-C 3X4 ODF 30"
	EFVE-1/2-L1 3X4 ODF 30"
	EFVE-1/3-C 2X4 ODF 30"
	EFVE-1/3-C 3X4 ODF 30"
	EFVE-1/3-L1 3X4 ODF 30"
	EFVE-1/5-C 2X4 ODF 30"
	EFVE-1-C 3X4 ODF 30"

TYPE BF

PART NO*	SPORLAN MODEL**
	BFF-A-C 3X4 SAE 30"
	BFJE-A-C 3X4 SAE 30"
	BFJE-B-C 3X4 SAE 30"
	BFR-A-C 3X4 SAE 30"
	BFRE-A-Z 3X4 SAE 30"
	BFRE-A-ZP 3X4 SAE 30"
	BFRE-B-C 3X4 SAE 30"
	BFRE-B-Z 3X4 SAE 60"
	BFRE-B-ZP 3X4 SAE 30"
	BFSE-AA-ZP 3X4 SAE 30"
	BFSE-A-C 3X4 SAE 30"
	BFSE-C-ZP 3X4 SAE 30"
	BFV-AA-C 3X4 SAE 30"
	BFV-A-C 3X4 SAE 30"
	BFVE-AAA-C 3X4 SAE 30"
	BFVE-AA-C 3X4 SAE 30"
	BFVE-A-C 3X4 SAE 30"
	BFVE-B-C 3X4 SAE 30"

TYPE G

PART NO*	SPORLAN MODEL**
	GRE-1-1/2-ZP 3X4 SAE 5'
	GRE-1-ZP 3X4 SAE 5'
	GVE-1-C 3X4 SAE 5'
	GVE-3/4-C 3X4 SAE 5'
	GVE-3/4-ZP 3X4 SAE 5'
	GVE-3-C 3X4 SAE 5'

TYPE FB

PART NO*	SPORLAN MODEL**
	FBFE-1-C 3SX4X2 ODF 30"
	FBJE-1/2-CP60 3X4X2 ODF 30"
	FBJE-1/2-Z 3X4X2 ODF 30"
	FBR-1/2-Z 2X4 SAE 30"
	FBR-1/4-Z 2X4 SAE 30"
	FBS-1/2-C 3SX4 ODF 30"
	FBS-1/2-Z 2SX4 ODF 30"
	FBS-1/2-ZP 3SX4 ODF 30"

IMPORTANT NOTE:

***S - with Insert Strainer**

Connection Sizes are in eighths of inch – (3x4 means 3/8" inlet x 1/2" outlet).

TYPE FB

PART NO*	SPORLAN MODEL**
	FBS-1/4-C 3SX4 ODF 30"
	FBS-1/4-Z 2SX4 ODF 30"
	FBS-1/4-ZP 3SX4 ODF 30"
	FBSE-1/2-C 3SX4X2 ODF 30"
	FBSE-1/4-C 3SX4X2 ODF 30"
	FBSE-1/4-ZP 3SX4X2 ODF 30"
	FBSE-1\2-ZP 3SX4 ODF 30"
	FBSE-1-1\2-C 3SX4 ODF 30"
	FBSE-1-1\2-ZP 3SX4 ODF 30"
	FBSE-1-C 3SX4 ODF 30"
	FBSE-1-Z 3X4X2 ODF 30"
	FBSE-1-ZP 3SX4 ODF 30"
	FBSE-2-C 3SX4X2 ODF 30"
	FBSE-2-Z 3X4X2 ODF 30"
	FBSE-2-ZP 3SX4X2 ODF 30"
	FBSE-3.5-C 4X7X2 ODF 60"
	FBSE-3.5-ZP 4X7X2 ODF 30"
	FBSE-3-C 4X7X2 ODF 60"
	FBSE-3-ZP 4X7X2 ODF 30"
	FBSE-4.5-C 4X7X2 ODF 60"
	FBSE-4.5-ZP 4X7X2 ODF 30"
	FBSE-6-C 5X7X2 ODF 60"
	FBSE-6-ZP 5X7X2 ODF 30"
	FBV-1/4-C 2*SX4 ODF 30"
	FBV-1/4-C 3*SX4 ODF 30"
	FBV-1/4-ZP40 3SX4 ODF 30"
	FBVE-1/2-ZP40 3*SX4X2 ODF 30"
	FBVE-1/4-C 3*SX4X2 ODF 30"
	FBVE-1/4-ZP40 3*SX4X2 ODF 30"
	FBVE-1\2-C 3*SX4 ODF 30"
	FBVE-1-1/2-ZP40 3*SX4X2 ODF 30"
	FBVE-1-1\2-C 3*SX4 ODF 30"
	FBVE-1-C 3*SX4 ODF 30"
	FBVE-1-ZP40 3*SX4X2 ODF 30"
	FBVE-2.5-C 4X5X2 ODF 60"
	FBVE-2.5-ZP40 4X5X2 ODF 30"
	FBVE-2-C 4X5X2 ODF 30"
	FBVE-2-ZP40 4X5X2 ODF 30"
	FBVE-3-C 4X5X2 ODF 60"
	FBVE-3-ZP40 4X5X2 ODF 60"
	FBVE-4-C 4X7X2 ODF 60"
	FBVE-4-ZP40 4X7X2 ODF 60"
	FBVE-5-C 4X7X2 ODF 60"
	FBVE-5-ZP40 4X7X2 ODF 60"
	FBVE-6-C 4X7X2 ODF 60"
	FBVE-6-GA 4X5X2 ODF 30"
	FBVE-6-ZP40 4X7X2 ODF 60"
	FBVE-8-C 5X7X2 ODF 60"
	FBVE-8-ZP40 5X7X2 ODF 60"

*( ) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service Center for part number and pricing.

TYPE EG

PART NO*	SPORLAN MODEL**
	EGFE-1/2-C 3X4 ODF 5'
	EGFE-1/4-C 3X4 ODF 5'
	EGFE-1-C 3X4 ODF 5'
	EGFE-2-C 3X4 ODF 5'
	EGJ-1/4-C 3X4 ODF 5'
	EGJ-1/6-C 3X4 ODF 5'
	EGJ-1/8-C 3X4 ODF 5'
	EGJE-1/6-C 3X4 ODF 5'
	EGJE-1/8-C 3X4 ODF 5'
	EGJE-1-1/2-C 3X4 ODF 5'
	EGP-1/2-C 3X4 ODF 5'
	EGP-1/4-C 3X4 ODF 5'
	EGP-1/6-C 3X4 ODF 5'
	EGP-1/8-C 3X4 ODF 5'
	EGPE-1/2-C 3X4 ODF 5'
	EGPE-1/4-C 3X4 ODF 5'
	EGPE-1/8-C 3X4 ODF 5'
	EGPE-1-1/2-C 3X4 ODF 5'
	EGPE-1-C 3X4 ODF 5'
	EGPE-2-C 3X4 ODF 5'
	EGR-1/2-C 3X4 ODF 5'
	EGR-1/2-Z 3X4 ODF 5'
	EGR-1/2-ZP 3X4 ODF 5'
	EGR-1/4-C 3X4 ODF 5'
	EGR-1/4-Z 3X4 ODF 5'
	EGR-1/6-C 3X4 ODF 5'
	EGR-1/8-C 3X4 ODF 5'
	EGR-1/8-Z 3X4 ODF 5'
	EGR-1-C 3X4 ODF 5'
	EGRE-1/4-Z 3X4 ODF 5'
	EGRE-1/6-C 3X4 ODF 5'
	EGRE-1/8-C 3X4 ODF 5'
	EGRE-1-ZP40 3X4 ODF 5'
	EGRE-2-C 3X4 ODF 5'
	EGRE-2-Z 3X4 ODF 5'
	EGSE-1/2-C 3X4 ODF 5'
	EGSE-1/2-Z 3X4 ODF 5'
	EGSE-1/2-ZP 3X4 ODF 5'
	EGSE-1/4-C 3X4 ODF 5'
	EGSE-1/4-ZP 3X4 ODF 5'
	EGSE-1-1/2-C 3X4 ODF 5'
	EGSE-1-1/2-Z 3X4 ODF 5'
	EGSE-1-1/2-ZP 3X4 ODF 5'
	EGSE-1-C 3X4 ODF 5'
	EGSE-1-X 3X4 ODF 5'
	EGSE-1-Z 3X4 ODF 5'
	EGSE-1-ZP 3X4 ODF 5'
	EGSE-2-C 3X4 ODF 5'
	EGSE-2-ZP 3X4 ODF 5'
	EGV-1/2-C 3X4 ODF 5'
	EGV-1/2-Z 3X4 ODF 5'
	EGV-1/2-ZP40 3X4 ODF 5'
	EGV-1/3-C 3X4 ODF 5'
	EGV-1/3-Z 3X4 ODF 5'
	EGV-1/5-C 3X4 ODF 5'
	EGV-1/5-Z 3X4 ODF 5'
	EGV-1-C 3X4 ODF 5'
	EGV-3/4-C 3X4 ODF 5'
	EGV-3/4-Z 3X4 ODF 5'
	EGV-3/4-ZP 3X4 ODF 5'
	EGV-3/4-ZP40 3X4 ODF 5'
	EGVE-1/2-C 3X4 ODF 5'
	EGVE-1/2-L1 3X4 ODF 5'
	EGVE-1/2-Z 3X4 ODF 5'
	EGVE-1/2-ZP40 3X4 ODF 5'
	EGVE-1/3-C 3X4 ODF 5'
	EGVE-1/5-C 3X4 ODF 5'
	EGVE-1-1/2-C 3X4 ODF 5'
	EGVE-1-1/2-Z 3X4 ODF 5'
	EGVE-1-1/2-ZP40 3X4 ODF 5'
	EGVE-1-C 3X4 ODF 5'
	EGVE-1-Z 3X4 ODF 5'
	EGVE-1-ZP40 3X4 ODF 5'
	EGVE-2-C 3X4 ODF 5'
	EGVE-2-Z 3X4 ODF 5'
	EGVE-2-ZP40 3X4 ODF 5'
	EGVE-3/4-C 3X4 ODF 5'
	EGVE-3/4-L1 3X4 ODF 5'
	EGVE-3/4-X 3X4 ODF 5'
	EGVE-3/4-Z 3X4 ODF 5'
	EGVE-3/4-ZP 3X4 ODF 5'
	EGVE-3/4-ZP40 3X4 ODF 5'
	EGVE-3-C 3X4 ODF 5'
	EGVE-3-Z 3X4 ODF 5'
	EGVE-3-ZP40 3X4 ODF 5'
	EGX-1/2-C 3X4 ODF 5'

TYPE SBF

PART NO*	SPORLAN MODEL**
	SBFF-AA-ZP 3X4 ODF 30"
	SBFF-A-ZP 3X4 ODF 30"
	SBFFE-AA-ZP 3X4 ODF 30"
	SBFFE-A-ZP 3X4 ODF 30"
	SBFFE-B-ZP 3X4 ODF 30"
	SBFJ-AAA-C 3X4 ODF 30"
	SBFJ-AA-C 3X4 ODF 30"
	SBFJ-A-C 3X4 ODF 30"
	SBFJ-B-C 3X4 ODF 30"
	SBFJE-AAA-C 3X4 ODF 30"
	SBFJE-AA-C 3X4 ODF 30"
	SBFJE-A-C 3X4 ODF 30"
	SBFJE-B-C 3X4 ODF 30"
	SBFJE-C-C 3X4 ODF 30"
	SBFP-AAA-C 3X4 ODF 30"
	SBFP-AAA-Z 3X4 ODF 30"
	SBFP-AA-C 3X4 ODF 30"
	SBFP-AA-Z 3X4 ODF 30"
	SBFP-A-C 3X4 ODF 30"
	SBFP-B-C 3X4 ODF 30"
	SBFPE-AAA-C 3X4 ODF 30"
	SBFPE-AA-C 3X4 ODF 30"
	SBFPE-AA-Z 3X4 ODF 30"
	SBFPE-B-C 3X4 ODF 30"
	SBFPE-C-C 3X4 ODF 30"
	SBFR-AAA-Z 3X4 ODF 30"
	SBFR-AAA-ZP 3X4 ODF 30"
	SBFR-AA-C 3X4 ODF 30"
	SBFR-AA-Z 3X4 ODF 30"
	SBFR-AA-ZP 3X4 ODF 30"
	SBFR-A-C 3X4 ODF 30"
	SBFR-A-ZP 3X4 ODF 30"
	SBFR-B-C 3X4 ODF 30"
	SBFRE-AAA-C 3X4 ODF 30"
	SBFRE-AAA-Z 3X4 ODF 30"
	SBFRE-AA-Z 3X4 ODF 30"
	SBFRE-A-Z 3X4 ODF 30"
	SBFRE-B-Z 3X4 ODF 30"
	SBFS-AAA-C 3X4 ODF 30"
	SBFSE-AAA-ZP 3X4 ODF 30"
	SBFSE-AA-C 3X4 ODF 30"
	SBFSE-AA-ZP 3X4 ODF 30"
	SBFSE-A-C 3X4 ODF 30"
	SBFSE-A-ZP 3X4 ODF 30"
	SBFSE-B-C 3X4 ODF 30"
	SBFSE-B-Z 3X4 ODF 30"
	SBFSE-B-ZP 3X4 ODF 30"
	SBFSE-C-C 3X4 ODF 30"
	SBFSE-C-Z 3X4 ODF 30"
	SBFSE-C-ZP 3X4 ODF 30"
	SBFV-AAA-C 3X4 ODF 30"
	SBFV-AAA-Z 3X4 ODF 30"
	SBFV-AA-C 3X4 ODF 30"
	SBFV-AA-Z 3X4 ODF 30"
	SBFV-AA-ZP40 3X4 ODF 30"
	SBFV-A-C 3X4 ODF 30"
	SBFV-B-C 3X4 ODF 30"
	SBFVE-AAA-C 3X4 ODF 30"
	SBFVE-AAA-ZP40 3X4 ODF 30"
	SBFVE-AA-C 3X4 ODF 30"
	SBFVE-AA-Z 3X4 ODF 30"
	SBFVE-AA-ZP40 3X4 ODF 30"
	SBFVE-A-C 3X4 ODF 30"
	SBFVE-A-Z 3X4 ODF 30"
	SBFVE-A-ZP 3X4 ODF 30"
	SBFVE-A-ZP40 3X4 ODF 30"
	SBFVE-B-C 3X4 ODF 30"
	SBFVE-B-Z 3X4 ODF 30"
	SBFVE-B-ZP40 3X4 ODF 30"
	SBFVE-C-C 3X4 ODF 30"
	SBFVE-C-Z 3X4 ODF 60"
	SBFVE-C-ZP40 3X4 ODF 30"

TYPE EBF

PART NO*	SPORLAN MODEL**
	EBFF-AAA-C 3X4 ODF 30"
	EBFF-A-C 3X4 ODF 30"
	EBFFE-A-C 3VX4 ODF 30"
	EBFFE-B-C 3X4 ODF 30"
	EBFLE-A-C 3X4 ODF 30"
	EBFLE-A-Z 3X4 ODF 30"
	EBFPE-C-C 3X4 ODF 30"
	EBFPE-C-Z 3X4 ODF 30"
	EBFR-A-C 3EX4 ODF 30"
	EBFRE-AA-Z 3VX4 ODF 30"
	EBFRE-AA-ZP 3VX4 ODF 30"
	EBFRE-A-Z 3EX4 ODF 30"
	EBFRE-A-Z 3X4 ODF 30"
	EBFRE-A-ZP 3EX4 ODF 30"
	EBFS-AAA-ZP 2X4 ODF 30"
	EBFSE-AAA-Z 2SX4 ODF 30"
	EBFSE-AAA-ZP 3VX4 ODF 30"
	EBFSE-AA-C 3X4 ODF 30"
	EBFSE-A-C 3VX4 ODF 30"
	EBFSE-A-Z 3VX4 ODF 30"
	EBFSE-B-C 3VX4 ODF 30"
	EBFSE-B-Z 3VX4 ODF 30"
	EBFSE-B-ZP 3X4 ODF 30"
	EBFSE-C-C 3X4 ODF 30"
	EBFSE-C-Z 3X4 ODF 30"
	EBFSE-C-ZP 3VX4 ODF 30"
	EBFV-AAA-C 3EX4 ODF 30"
	EBFV-AA-C 3EX4 ODF 30"
	EBFV-AA-Z 3EX4 ODF 30"
	EBFV-AA-ZP40 3EX4 ODF 30"
	EBFV-A-C 3EX4 ODF 30"
	EBFV-B-C 3X4 ODF 30"
	EBFVE-AAA-C 3X4 ODF 30"
	EBFVE-AA-C 3EX4 ODF 30"
	EBFVE-AA-CP100 3VX4 ODF 30"
	EBFVE-AA-Z 3EX4 ODF 30"
	EBFVE-AA-ZP40 3EX4 ODF 30"
	EBFVE-A-C 3EX4 ODF 30"
	EBFVE-A-Z 3X4 ODF 30"
	EBFVE-A-ZP40 3VX4 ODF 30"
	EBFVE-B-C 3X4 ODF 30"
	EBFVE-B-CP100 3X4 ODF 30"
	EBFVE-B-Z 3X4 ODF 30"
	EBFVE-B-ZP40 3X4 ODF 30"
	EBFVE-C-C 3X4 ODF 30"
	EBFVE-C-CP100 3X4 ODF 30"
	EBFVE-C-ZP40 3VX4 ODF 30"

IMPORTANT NOTES:

E – Elbow Inlet

V – 877 Series (100 Mesh) Strainer

*( ) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service Center for part number and pricing.

TYPE S

PART NO*	SPORLAN MODEL**
	SRE-1/2-C 4X5 ODF 5'
	SRE-1/2-ZP 4X5 ODF 5'
	SRE-1-1/2-C 4X5 ODF 5'
	SRE-1-1/2-Z 4X5 ODF 5'
	SRE-1-1/2-ZP 4X5 ODF 5'
	SRE-1-C 4X5 ODF 5'
	SRE-1-ZP 4X5 ODF 5'
	SRE-2-L1 4X5 ODF 5'
	SRE-4-Z 4X7 ODF 5'
	SSE-1/4-C 3X4 ODF 5'
	SSE-10-ZP 5X7 ODF 5'
	SSE-10-ZP 7X9 ODF 5'
	SSE-2-C 4X5 ODF 5'
	SSE-2-ZP 4X5 ODF 5'
	SSE-3-C 4X7 ODF 5'
	SSE-3-L1 4X7 ODF 5'
	SSE-3-ZP 4X7 ODF 5'
	SSE-3-ZP40 4X7 ODF 5'
	SSE-4-C 4X7 ODF 5'
	SSE-4-ZP 4X7 ODF 5'
	SSE-6-C 4X7 ODF 5'
	SSE-6-C 5X7 ODF 5'
	SSE-6-X 5X7 ODF 5'
	SSE-6-Z 5X7 ODF 5'
	SSE-6-ZP 5X7 ODF 5'
	SSE-7-C 5X7 ODF 5'
	SSE-7-ZP 5X7 ODF 5'
	SVE-1/2-C 4X5 ODF 5'
	SVE-10-C 5X7 ODF 5'
	SVE-1-1/2-C 4X5 ODF 5'
	SVE-1-1/2-L1 3X4 ODF 5'
	SVE-1-1/2-Z 3X4 ODF 5'
	SVE-1-1/2-ZP40 4X5 ODF 5'
	SVE-15-C 7X11 ODF 5'
	SVE-15-CP100 7X9 ODF 5'
	SVE-1-C 4X5 ODF 5'
	SVE-1-ZP40 4X5 ODF 5'
	SVE-2-C 4X5 ODF 5'
	SVE-2-L1 4X5 ODF 5'
	SVE-2-ZP40 4X5 ODF 5'
	SVE-3-C 4X5 ODF 5'
	SVE-3-L1 4X5 ODF 5'
	SVE-3-L2 4X5 ODF 5'
	SVE-3-ZP40 4X5 ODF 5'
	SVE-4-C 4X7 ODF 5'
	SVE-4-L1 4X7 ODF 5'
	SVE-4-X 4X7 ODF 5'
	SVE-4-ZP40 4X7 ODF 5'
	SVE-5-C 4X7 ODF 5'
	SVE-8-C 5X7 ODF 5'
	SVE-8-L1 5X7 ODF 5'
	SVE-8-Z 5X7 ODF 5'

TYPE EMC

PART NO*	SPORLAN MODEL**
	EMC-10-PC 3X4 ODF 5'
	EMC-10-SC 3X4 ODF 5'
	EMC-10-SZ 3X4 ODF 5'
	EMC-10-VC 3X4 ODF 5'
	EMC-10-VZ 3X4 ODF 5'
	EMC-11-SZ 3X4 ODF 5'
	EMC-20-PC 3X4 ODF 5'
	EMC-20-SC 3X4 ODF 5'
	EMC-20-VC 3X4 ODF 5'
	EMC-21-PC 3X4 ODF 5'
	EMC-21-SC 3X4 ODF 5'
	EMC-21-VC 3X4 ODF 5'
	EMCE-10-JC 3X4 ODF 5'
	EMCE-10-PC 3X4 ODF 5'
	EMCE-10-SC 3X4 ODF 5'
	EMCE-10-SZ 3X4 ODF 5'
	EMCE-10-VC 3X4 ODF 5'
	EMCE-10-VZ 3X4 ODF 5'
	EMCE-11-SZ 3X4 ODF 5'
	EMCE-11-VZ 3X4 ODF 5'
	EMCE-12-SC 3X4 ODF 5'
	EMCE-12-SZ 3X4 ODF 5'
	EMCE-12-VC 3X4 ODF 5'
	EMCE-12-VZ 3X4 ODF 5'
	EMCE-13-SZ 3X4 ODF 5'
	EMCE-13-VZ 3X4 ODF 5'
	EMCE-20-JC 3X4 ODF 5'
	EMCE-20-PC 3X4 ODF 5'
	EMCE-20-SC 3X4 ODF 5'
	EMCE-20-VC 3X4 ODF 5'
	EMCE-21-JC 3X4 ODF 5'
	EMCE-21-PC 3X4 ODF 5'
	EMCE-21-SC 3X4 ODF 5'
	EMCE-21-VC 3X4 ODF 5'
	EMCE-22-JC 3X4 ODF 5'
	EMCE-22-PC 3X4 ODF 5'
	EMCE-22-SC 3X4 ODF 5'
	EMCE-22-VC 3X4 ODF 5'
	EMCE-23-PC 3X4 ODF 5'
	EMCE-23-SC 3X4 ODF 5'
	EMCE-23-VC 3X4 ODF 5'

TYPE KT

PART NO*	SPORLAN MODEL**
	KT-43-FC 5'(1.5M) ELEMENT
	KT-43-FZ 5'(1.5M) ELEMENT
	KT-43-FZP 5'(1.5M) ELEMENT
	KT-43-PC 5' ELEMENT
	KT-43-RC 5'(1.5M) ELEMENT
	KT-43-RZ 30"(.75M) ELEMENT
	KT-43-RZP 5'(1.5M) ELEMENT
	KT-43-VC 5'(1.5M) ELEMENT
	KT-43-VZ 5'(1.5M) ELEMENT
	KT-43-VZP 5'(1.5M) ELEMENT
	KT-53-FC 5' ELEMENT
	KT-53-FZ 5'(1.5M) ELEMENT
	KT-53-FZP 5'(1.5M) ELEMENT
	KT-53-RC 5' ELEMENT
	KT-53-SZ 5' ELEMENT
	KT-53-SZP 5' ELEMENT
	KT-53-VC 5' ELEMENT
	KT-53-VZ 5'(1.5M) ELEMENT
	KT-53-VZP 5'(1.5M) ELEMENT
	KT-83-FC 5' ELEMENT
	KT-83-SC 5' ELEMENT
	KT-83-SZ 5' ELEMENT
	KT-83-SZP ELEMENT
	KT-83-VC 5' ELEMENT
	KT-45-ZGA, 30" ELEMENT

IMPORTANT NOTES:

A. R-134a air conditioning and commercial refrigeration applications are using R-12 or R-409A or R-401A elements.

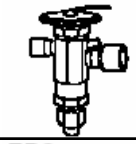
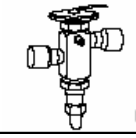
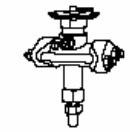
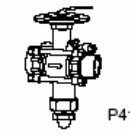
B. R-404A commercial refrigeration applications are using R-502 or R-408A elements.

C. R-404A and R-507 low temperature refrigeration applications are using R-502 or R-402A or R-408A elements.

*( ) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service Center for part number and pricing.

SPORLAN THERMOSTATIC EXPANSION VALVES

QUICK REFERENCE GUIDE — AIR CONDITIONING VALVES

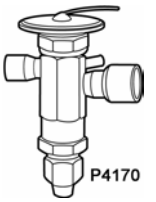
VALVE TYPE	NOMINAL CAPACITY RANGE (Tons)			CONNECTION TYPES	VALVE DESCRIPTION AND APPLICATION
	R-22	R-134a	R-404A & R-507		
RC  P4521	2 thru 6	—	—	ODF Solder	Compact and adjustable thermostatic expansion valve with an internal check valve to allow reverse flow on heat pump applications. Valve also can be used for refrigerant 410A applications.(2 ton through 6 ton) RC valve replaces RI valve.
S  P4170	2 thru 10	2 thru 6	2 thru 7	ODF Solder	Brass bar body, externally adjustable valve. Inlet has a permanent 12 mesh strainer. General purpose valve for air conditioning and refrigeration applications.
EBS  P4171	8 & 11	5 & 7	6 & 7-1/2	Extended ODF Solder	Same physical size as the Type S valve except it features extended ODF connections and a balanced port construction.
O  P4172	15 thru 70	9 thru 40	9 thru 45	ODF Solder	Brass bar body, externally adjustable valve. Inlet has a permanent 12 mesh strainer. General purpose valve for air conditioning and refrigeration applications.
V  P4174	52 thru 100	35 thru 55	38 thru 70	ODF Solder or FPT Flange	Cast bronze body, externally adjustable valve with flange connections. Inlet has a 12 mesh strainer. This valve type features a dual port semi-balanced design. This valve type provides valve capacities greater than the Type M, and is suitable for air conditioning and refrigeration applications. Flanges for the Type V are interchangeable with the Type M.
W  P4175	135 & 180	80 & 110	—	ODF Solder Flange	Cast bronze body, externally adjustable valve with flange connections. Inlet has a 12 mesh strainer. This valve type features a dual port semi-balanced design and it is primarily for large capacity chillers. This valve type provides the largest valve capacities available for flange connection TEVs.

• R-22 M Valves With GA & CP 100 Thermostatic chargers are also available

SPORLAN THERMOSTATIC EXPANSION VALVES

Type-S

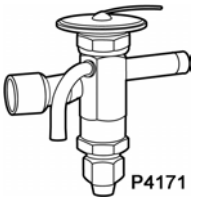
ELEMENT SIZE No. 83, Knife Edge Joint. Standard Tubing Length 5 Feet.



REFRIGERANT (Sporlan Code)	TYPE & CAPACITY	THERMOSTATIC CHARGES AVAILABLE	STANDARD CONNECTIONS (in. ODF Solder)	
			Inlet	Outlet
22 (V)	SVE-2	GA or CP100	1/2	5/8
	SVE-3			7/8
	SVE-4			
	SVE-5			
	SVE-8		5/8	
	SVE-10			

Type-EBS

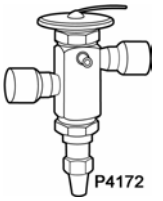
Balanced Port Construction ELEMENT SIZE No. 83, Knife Edge Joint, Standard Tubing Length 5 Feet



REFRIGERANT (SPORLAN CODE)	TYPE & CAPACITY	THERMOSTATIC CHARGES AVAILABLE	STANDARD CONNECTIONS (in. Extended ODF Solder)	
	External Equalizer Only		Inlet	Outlet
22 (V)	EBSVE-8	GA or CP100	5/8	7/8
	EBSVE-11			

Type-O

Balanced Port Construction ELEMENT SIZE No. 83 and 33, Knife Edge Joint, Standard Tubing Length 5 Feet



REFRIGERANT (Sporlan Code)	TYPE & CAPACITY	ELEMENT SIZE NUMBER	THERMOSTATIC CHARGES	STANDARD CONNECTIONS (in. ODF Solder)	
				Inlet	Outlet
22 (V)	OVE-15	83	GA or CP100	7/8	1-1/8
	OVE-20				1-3/8
	OVE-30				
	OVE-40	33		1-1/8	
	OVE-55				
	OVE-70				

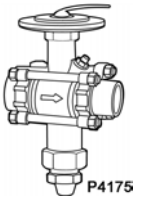
Type-RC

With internal check valve.
R-22 ELEMENT SIZE No. 43, Knife Edge Joint, Standard Tubing Length 30 Inches
R-410A ELEMENT SIZE No. 45, Knife Edge Joint, Standard Tubing Length 30 Inches

REFRIGERANT (Sporlan Code)	TYPE & CAPACITY	THERMOSTATIC CHARGES AVAILABLE	STANDARD CONNECTIONS (In. ODF Solder)	
	External Equalizer Only		Inlet	Outlet
22 (V)	RCVE-2	GA Only	3/8	1/2
	RCVE-3		1/2	5/8
	RCVE-4			
	RCVE-5			
	RCVE-6			
410A (Z)	RCZE-2		3/8	1/2
	RCZE-3		1/2	5/8
	RCZE-4			
	RCZE-5			
	RCZE-6			

Type-W

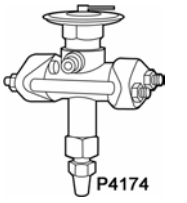
ELEMENT SIZE No. 63, Small Capacity No. 7 Large Capacity —Gasket Joint, Standard Tubing Length 10 Feet, Flange Ring Size —2-3/4" OD x 3-3/16" ID.



REFRIGERANT (Sporlan Code)	TYPE & CAPACITY	ELEMENT SIZE NUMBER	THERMOSTATIC CHARGES AVAILABLE	STANDARD CONNECTIONS (in. ODF Solder)	
	External Equalizer Only			Inlet	Outlet
22(V)	WVE-135	63	GA or CP100	1-5/8	2-1/8
	WVE-180	7	G only		

Type-V

ELEMENT SIZE No. 63, Gasket Joint, Standard Tubing Length 5 Feet Flange Ring Size — 1-3/4" OD x 1-1/2" ID.



REFRIGERANT (Sporlan Code)	Type & CAPACITY	THERMOSTATIC CHARGES AVAILABLE	STANDARD CONNECTIONS (In. Extended ODF Solder)	
	External Equalizer Only		Inlet	Outlet
22 (V)	VVE-52	GA or CP100	1-3/8	1-3/8
	VVE-70			
	VVE-100			

TEV REPLACEMENT ELEMENTS

Item Descriptions	
KT-43-VGA 30"	KT-43-VCP100 30"
KT-33-VGA 60"	KT-33-VCP100 60"
KT-53-VGA 60"	KT-53-VCP100 60"
KT-83-VGA 60"	KT-83-VCP100 60"
KT-63-VGA 10"	KT-63-VCP100 10"

THERMOSTATIC EXPANSION VALVE CAPACITIES FOR REFRIGERANTS (Tons of Refrigeration)

AIR CONDITIONING AND HEAT PUMP APPLICATIONS

VALVE TYPES	NOMINAL CAPACITY	REFRIGERANT	
		22	410A
		RECOMMENDED THERMOSTATIC CHARGES	
		VCP100, VGA	N, ZGA
		EVAPORATOR TEMPERATURE (°F)	
		40°	40°
RC	2	2.30	2.76
RC	3	3.20	3.83
RC	4	4.20	5.03
RC	5	5.00	5.99
RC	6	6.01	7.20
EBS	8	8.51	—
EBS	11	11.50	—
O	15	15.00	—
O	20	22.20	—
O	30	30.50	—
O	40	40.30	—
O	55	55.00	—
O	70	73.00	—
S	2	2.00	—
S	3	3.20	—
S	4	4.50	—
S	5	5.20	—
S	8	8.00	—
S	10	10.00	—
S	15	15.00	
V	52	52.00	—
V	70	73.00	—
V	100	100.00	—
W	135	143.00	—
W	180	180.00	—

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)								
	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE								
22	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76
410A	1.32	1.24	1.16	1.08	1.00	0.92	0.83	0.73	0.62

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 40° F.

REFRIGERANT	PRESSURE DROP ACROSS TEV (PSI)									
	75	100	125	150	160	175	200	225	250	275
	CORRECTION FACTOR, CF PRESSURE DROP									
	40°F EVAPORATOR TEMPERATURE									
22	0.87	1.00	1.12	1.22	—	1.32	1.41	1.50	1.58	1.66
410A	0.68	0.79	0.88	0.97	1.00	1.05	1.12	1.19	1.25	1.31

TEV CAPACITY = TEV RATING X CF LIQUID TEMPERATURE X CF PRESSURE DROP —

Example: Calculate the actual capacity of a nominal 2 ton, R-22, Type RC valve at 40° F evaporator, 80° F liquid temperature entering the TEV, and 75 psi pressure drop across the TEV:

TEV capacity = 2.30 (from rating chart) x 1.12 (CF liquid temperature) x 0.87 (CF pressure drop)
= 2.24 tons

SPORLAN THERMOSTATIC EXPANSION VALVE PART NUMBERS

Type S Series Valves

Part No	DESCRIPTION
SVE-10-GA5/8X7/8ODF	SVE-10-GA 5/8X7/8 ODF
SVE-15-GA7/8X1-1/8ODF	SVE-15-CP100 7/8X1-1/8 ODF
SVE-2-GA1/2/5/8ODF	SVE-2-GA 1/2X5/8 ODF
SVE-3-GA1/2X5/8ODF	SVE-3-GA 1/2X5/8 ODF
SVE-4-GA1/2X7/8ODF	SVE-4-GA 1/2X7/8 ODF
SVE-5-GA1/2X7/8ODF	SVE-5-GA 1/2X7/8 ODF
SVE-8-GA5/8X7/8ODF	SVE-8-GA 5/8X7/8 ODF
SVE10CP1005/8X7/8ODF	SVE-10-CP100 5/8X7/8 ODF
SVE15CP1007/8X11/8OD	SVE-15-CP100 7/8X1-1/8 ODF
SVE2-CP1001/2X5/8OD	SVE-2-CP100 1/2X5/8 ODF
SVE3-CP1001/2X5/8OD	SVE-3-CP100 1/2X5/8 ODF
SVE4-CP1001/2X7/8OD	SVE-4-CP100 1/2X5/8 ODF
SVE5-CP1001/2X7/8OD	SVE-5-CP100 1/2X5/8 ODF
SVE8CP1005/8X7/8ODF	SVE-8-CP100 5/8X7/8 ODF

Type RC Series Valves

Part No	DESCRIPTION
RCVE-2-GA3/8X1/2ODF	RCVE-2-GA 3/8X1/2 ODF
RCVE-3-GA3/8X1/2ODF	RCVE-3-GA 3/8X1/2 ODF
RCVE-4-GA1/2X1/2ODF	RCVE-4-GA 1/2X1/2 ODF
RCVE-4-GA1/2X5/8ODF	RCVE-4-GA 1/2X5/8 ODF
RCVE-5-GA1/2X1/2ODF	RCVE-5-GA 1/2X1/2 ODF
RCVE-5-GA1/2X5/8ODF	RCVE-5-GA 1/2X5/8 ODF
RCVE-6-GA1/2X1/2ODF	RCVE-6-GA 1/2X1/2 ODF
RCVE-6-GA1/2X5/8ODF	RCVE-6-GA 1/2X5/8 ODF
RCZE-2-GA3/8X1/2ODF	RCZE-2-GA 3/8X1/2 ODF
RCZE-3-GA3/8X1/2ODF	RCZE-3-GA 3/8X1/2 ODF
RCZE-4-GA1/2X1/2ODF	RCZE-4-GA 1/2X1/2 ODF
RCZE-5-GA1/2X5/8ODF	RCZE-5-GA 1/2X5/8 ODF
RCZE-6-GA1/2X5/8ODF	RCZE-6-GA 1/2X5/8 ODF

Type EBS Series Valves

Part No	DESCRIPTION
EBSVE-11-GA5/8X7/8OD	EBSVE-11-GA 5/8X7/8 ODF
EBSVE-8-CP1005/8X7/8	EBSVE-8-C100 5/8X7/8 ODF
EBSVE-8-GA5/8X7/8ODF	EBSVE-8-GA 5/8X7/8 ODF
EBSVE11CP1005/8X7/8O	EBSVE-11-CP100 5/8X7/8 ODF

Type O Series Valves

Part No	DESCRIPTION
OVE-20-GA7/8X7/8ODF	TXV, VALVE 7/8X7/8 ODF
OVE15CP1007/8X11/8O	OVE-15-CP100 7/8X1-1/8 ODF
OVE15GA7/8X1-1/8ODF	OVE-15-GA 7/8X1-1/8 ODF
OVE20CP1007/8X1-3/8OD	OVE-20-CP100 7/8X1-3/8 ODF
OVE20GA7/8X1-1/8ODF	OVE-20-GA 7/8X1-1/8 ODF
OVE30CP1001-1/8X1-3/8O	OVE-30-CP100 1-1/8X1-3/8 ODF
OVE30GA1-1/8X1-3/8OD	OVE-30-GA 1-1/8X1-3/8 ODF
OVE40CP10011/8X13/8O	OVE-40-CP100 1-1/8X1-3/8 ODF
OVE40CP10011/8X15/8O	OVE-40-CP100 1-1/8X1-5/8 ODF
OVE40GA1-1/8X1-3/8OD	OVE-40-GA 1-1/8X1-3/8 ODF
OVE40GA1-1/8X1-5/8OD	OVE-40-GA 1-1/8X1-5/8 ODF
OVE55CP10011/8X13/8O	OVE-55-CP100 1-1/8X1-3/8 ODF
OVE55CP10011/8X15/8O	OVE-55-CP100 1-1/8X1-5/8 O
OVE55GA1-1/8X1-3/8OD	OVE-55-GA 1-1/8X1-3/8 ODF
OVE55GA1-1/8X1-5/8OD	OVE-55-GA 1-1/8X1-5/8 ODF
OVE70CP10011/8X13/8O	OVE-70-CP100 1-1/8X1-3/8 ODF
OVE70CP10011/8X15/8O	OVE-70-CP100 1-1/8X1-5/8 ODF
OVE70GA1-1/8X1-3/8OD	OVE-70-GA 1-1/8X1-3/8 ODF
OVE70GA1-1/8X1-5/8OD	OVE-70-GA 1-1/8X1-5/8 ODF

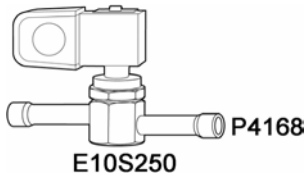
Type V Series Valves

Part No	DESCRIPTION
VVE-100-GA13/8X13/8	VVE-100-GA 1-3/8X1-3/8 ODF
VVE-52-GA13/8X138OD	VVE-52-GA 1-3/8X1-3/8 ODF
VVE-70-GA13/8X13/8OD	VVE-70-GA 1-3/8X1-3/8 ODF
VVE100CP10013/8X13/8	VVE-100-CP100 1-3/8X1-3/8 ODF
VVE52CP10013/8X13/8	VVE-52-CP100 1-3/8X1-3/8 ODF
VVE70CP10013/8X13/8O	VVE-70-CP100 1-3/8X1-3/8 ODF

Type W Series Valves

Part No	DESCRIPTION
WVE-135-GA15/8X21/8	WVE-135GA 1-5/8X2-1/8 ODF
WVE135CP10015/8X21/8	WVE-135-CP100 1-5/8X2-1/8 ODF

SPORLAN SOLENOID VALVES



Refrigerants 22, 134a, 402A, 404A, 407C, 502, 507

SPECIFICATIONS

6 Proven Benefits of Sporlan Solenoid Valves

- Molded coil for most sizes.
- Class “F” temperature rating – Coil types MKC-1, OMKC-1, MKC-2, and OMKC-2.
- Extremely rugged, simple design – few parts.
- “E” Series may be brazed without disassembly.
- Tight closing through use of synthetic seating material.
- Can be used on Refrigerants 22, 134a, 401A, 402A, 404A, 407C, 502 and 507 because of high MOPD ratings.

Sporlan Solenoid Valves are made in two general types, normally closed and normally open. The normally closed types may be further sub-divided into direct acting and pilot operated types.

The Sporlan “E” series solenoid valves feature extended solder type connections as standard. One important benefit to the user is that all valves in the “E” series can be installed without disassembly using either low or no silver content brazing alloy. The “E” series is interchangeable with the “B” series; solder type valves, providing the overall length can be accommodated.

All valves in the “E” series have the same capacities as the “B” series with the exception of the E42. Its capacity is approximately 15% greater than the MA42.

All Sporlan solenoid valves are designed for liquid, suction and discharge gas applications.

Most Sporlan Solenoid Valves are listed by Underwriters’ Laboratories, Inc. –Guide No. Y10Z – File No.MH4576 and Canadian Standards Association –Guide 440-A-O, Class 3221, File 19953 and CE provisions of the LVD 73/23/EEC.

LIQUID CAPACITY SELECTION TABLE

PART NO “E” SERIES VALVE	TONS OF REFRIGERATION**																			
	R-22					R-134a					R-401A					R-402A				
	PRESSURE DROP – psi*																			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
E3	0.9	1.3	**1.6**	1.9	2.1	0.8	**1.2**	1.5	1.8	2.0	0.9	**1.3**	1.6	1.9	2.1	0.6	0.9	**1.1**	1.2	1.4
E5	1.6	2.3	**2.8**	3.3	3.6	1.5	**2.1**	2.6	3.0	3.4	1.6	**2.3**	2.8	3.3	3.7	1.1	1.5	**1.9**	2.1	2.4
E6	2.9	4.0	**4.9**	5.7	6.4	2.7	**3.8**	4.6	5.3	5.9	2.9	**4.1**	4.9	5.7	6.4	1.9	2.7	**3.3**	3.8	4.2
E9	4.7	6.6	**8.1**	9.3	10.4	4.4	**6.2**	7.5	8.7	9.7	4.7	**6.6**	8.1	9.3	10.4	3.1	4.4	**5.3**	6.2	6.9
E10	6.4	9.1	**11.1**	12.8	14.3	6.0	**8.5**	10.4	12.0	13.4	6.4	**9.1**	11.1	12.8	14.4	4.2	6.0	**7.3**	8.5	9.4
E14	9.1	12.9	**15.8**	18.2	20.3	8.5	**12.0**	14.7	17.0	18.9	9.1	**12.9**	15.8	18.2	20.4	6.0	8.5	**10.4**	12.0	13.4
E19	13.9	19.8	**24.2**	28.0	31.4	13.0	**18.4**	22.6	26.1	29.2	14.0	**19.8**	24.3	28.1	31.4	9.2	13.0	**16.0**	18.5	20.7
E25	23.8	33.8	**41.4**	47.8	53.5	22.2	**31.5**	38.6	44.6	49.9	23.9	**33.8**	41.4	47.9	53.6	15.7	22.2	**27.3**	31.5	35.3
E34	33.2	47.0	**57.6**	66.5	74.4	31.0	**43.8**	53.7	62.0	69.4	33.3	**47.1**	57.7	66.6	74.5	21.9	31.0	**38.0**	43.9	49.0
—	60.9	82.3	**98.2**	111	123	56.7	**76.7**	91.5	104	114	61.0	**82.5**	98.0	112	123	40.4	54.6	**65.1**	73.8	81.4
E42	73.5	104	**127**	147	164	68.6	**96.9**	119	137	153	73.6	**104**	127	147	165	48.5	68.5	**83.9**	96.9	108
—	109	147	**175**	199	219	101	**137**	163	185	204	109	**147**	176	199	220	72.1	97.5	**116**	132	145

PART NO “E” SERIES VALVES	TONS OF REFRIGERATION**																			
	404A					407C					502					507				
	PRESSURE DROP – psi*																			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
E3	0.6	0.9	**1.1**	1.2	1.4	0.8	1.2	**1.5**	1.7	1.9	0.6	0.8	**1.0**	1.2	1.4	0.6	0.8	**1.0**	1.2	1.4
E5	1.1	1.5	**1.9**	2.1	2.4	1.5	2.1	**2.6**	3.0	3.4	1.0	1.5	**1.8**	2.1	2.4	1.0	1.5	**1.8**	2.1	2.4
E6	1.9	2.7	**3.3**	3.8	4.2	2.6	3.7	**4.5**	5.2	5.8	1.9	2.6	**3.2**	3.7	4.1	1.9	2.6	**3.2**	3.7	4.1
E9	3.1	4.4	**5.4**	6.2	6.9	4.3	6.1	**7.4**	8.6	9.6	3.0	4.3	**5.2**	6.0	6.8	3.0	4.3	**5.2**	6.0	6.7
E10	4.2	6.0	**7.3**	8.5	9.5	5.9	8.3	**10.2**	11.8	13.2	4.2	5.9	**7.2**	8.3	9.3	4.2	5.9	**7.2**	8.3	9.3
E14	6.0	8.5	**10.4**	12.0	13.4	8.4	11.8	**14.5**	16.7	18.7	5.9	8.4	**10.2**	11.8	13.2	5.9	8.3	**10.2**	11.8	13.2
E19	9.2	13.1	**16.0**	18.5	20.7	12.8	18.2	**22.3**	25.8	28.8	9.0	12.8	**15.7**	18.2	20.3	9.0	12.8	**15.7**	18.1	20.3
E25	15.7	22.3	**27.4**	31.6	35.4	21.9	31.0	**38.0**	44.0	49.2	15.5	21.9	**26.8**	31.0	34.7	15.4	21.8	**26.8**	30.9	34.6
E34	22.0	31.1	**38.1**	44.0	49.2	30.5	43.2	**53.0**	61.2	68.4	21.5	30.5	**37.4**	43.2	48.3	21.5	30.4	**37.3**	43.1	48.2
—	40.8	55.2	**65.8**	74.6	82.2	56.4	76.3	**91.1**	103	114	39.5	53.4	**63.7**	72.2	79.5	39.8	53.8	**64.2**	72.8	80.2
E42	48.6	68.8	**84.2**	97.2	109	67.6	95.6	**117**	135	151	47.7	67.4	**82.5**	95.3	107	47.6	67.3	**82.4**	95.1	106
—	72.8	98.5	**118**	133	147	101	136	**163**	184	203	70.4	95.3	**114**	129	142	71.0	96.1	**115**	130	143

*Do not use below 1 psi pressure drop, except Types E3 and A3 valves.

**Capacities are based on 40° F evaporator and 100° F liquid. Valve types whether Normally Closed or Normally Open have the same capacities, i.e., B10 or OB10, E10 or OE10.

Solenoid valves for brine applications – consult Sporlan Valve Company, Washington, MO.

SPORLAN SOLENOID VALVES

SPECIFICATIONS

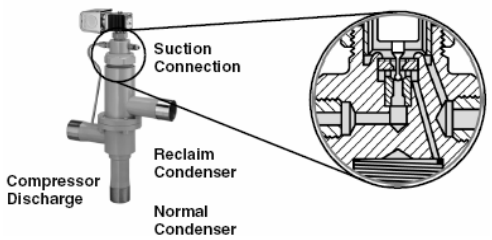
Refrigerants 22, 134a, 402A, 404A, 407C, 502, 507

PART NOE Series Extended Connections					
Without Manual Lift Stem	With Manual Lift Stem Normally Closed	CONNECTIONS (in)	PORT SIZE (in)	MOPD psi AC	WATTS
E3S120	—	—	.101	300	10
E3S130	—	3/8 ODF Solder	.101	300	10
E5S120	—	1/4 ODF Solder	.150	300	10
E5S130	—	3/8 ODF Solder	.150	300	10
E6S130	ME6S130	3/8 ODF Solder	3/16	300	10
E6S140	ME6S140	1/2 ODF Solder	3/16	300	10
E9S240	ME9S240	1/2 ODF Solder	9/32	300	15
E10S240	ME10S240	1/2 ODF Solder	5/16	300	15
E10S250	ME10S250	5/8 ODF Solder	5/16	300	15
E14S250	ME14S250	5/8 ODF Solder	7/16	300	15
E19S250	ME19S250	5/8 ODF Solder	19/32	300	15
E19S270	ME19S270	7/8 ODF Solder	19/32	300	15
E25S270	ME25S270	7/8 ODF Solder	25/32	300	15
E25S290	ME25S290	1-1/8 ODF Solder	25/32	300	15
E34S290	ME34S290	1-1/8 ODF Solder	1	300	15
E34S2110	ME34S2110	1-3/8 ODF Solder	1	300	15
E42S2130	ME42S2130	1-5/8 ODF Solder	1-5/16	300	15
E42S2170	ME42S2170	2-1/8 ODF Solder	1-5/16	300	15

SOLENOID PARTS KITS Part No.	
KS-B6/E6	**KS-B19/E19**
KS-B9/E9	**KS-B25/E25**
KS-B10/E10	**KS-B34/E34**
KS-B14/E14	**KS-B42/E42**

SOLENOID COILS Coil Type and Voltage
MKC-1 and MKC-2 – 24 JAQ and CAQ
MKC-1 and MKC-2 – 120 JAM and CAM
MKC-1 and MKC-2 – 208-240 JAN and CAN
MKC-1 and MKC-2 – Dual JAU and CAU

THREE WAY HEAT RECLAIM VALVES



Sporlan Heat Reclaim Valves are tight synthetic seating three way valves designed specifically to divert hot gas from the normal to auxiliary condenser.

OPERATION

"B" TYPE

Normal (Outdoor) Condenser – De-energized – With the pilot valve de-energized, high side pressure is prevented from entering the cavity above the piston-seat assembly. At the same time the upper pilot port is opened to suction pressure. The resulting pressure differential across the piston moves the piston-seat assembly to close the reclaim (upper) main port. When the upper pilot port is open, the cavity above the piston is open to suction. Pump out of the reclaim condenser is controlled by the bleed rate through the piston. After the reclaim condenser has been pumped out, and the valve continues to operate in the normal condenser mode, all flow ceases, thus eliminating high to low side bleed and the resulting capacity loss.

"C" TYPE

Normal (Outdoor) Condenser – De-energized – With the pilot valve de-energized, high side pressure is prevented from entering cavity above the piston-seat assembly. At the same time the upper pilot port is opened to suction pressure. The resulting pressure differential across the piston moves the piston-seat assembly to close the reclaim (upper) main port. The non bleed piston prevents high to low side bleed with the system operating in the normal condenser mode.

"B" AND "C" TYPE

Reclaim (Reheat) Condenser – Energized – When the pilot valve is energized, high side pressure is permitted to flow thru the lower pilot port. At the same time the upper pilot port is closed to suction. High side pressure on top of the piston moves the piston-seat assembly to close the normal condenser port and open the reclaim (upper) main port. With the upper pilot port closed there is no high to low side bleed loss with the system operating in the reclaim mode.

HEAT RECLAIM SYSTEMS

- **With Head Pressure Control**
- **With Split Condenser Control**
- **With Integral Check Valve**

When employing heat reclaim on a refrigeration system, the addition of head pressure controls is important not only to maintain liquid pressure at the expansion valve inlet, but also to assure availability of quality hot gas at the reclaim heat exchanger. Split condenser controls are important to minimize the required refrigerant charge for wintertime operation. And, integral check valves are important to minimize installation costs.

PART NO*	Sporlan Model
☎	10G711B 120/50-60 JAM
☎	10G79B 120/50-60 JAM
☎	12D11B LESS COIL
☎	12D11C LESS COIL
☎	12D13B LESS COIL
☎	12D13B-SC LESS COIL
☎	12D13C LESS COIL
☎	16D17B LESS COIL
☎	16D17B-SC LESS COIL
☎	16D17C LESS COIL
☎	8D7B 208-240/50-60 JAN
☎	8D7B DUAL JAU
☎	8D7C LESS COIL
☎	8D9B DUAL JAU
☎	8D9B LESS COIL
☎	8D9B-CV 24/50-60 LAQ
☎	8D9C LESS COIL

Note: SC - split condenser; CV - check valve.

*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

SPORLAN CATCH-ALL SEALED TYPE

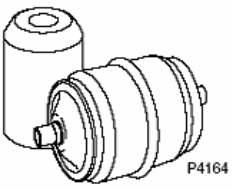
The universal acceptance of the **Catch-All Filter Drier** is due to its unique molded porous core, consisting of a blend of highly effective desiccants. The quality features built into it assure years of service on any refrigeration system.

MOISTURE — The **Catch-All Filter Drier** removes moisture from the refrigerant by adsorbing and retaining it deep within the desiccant granules.

FOREIGN MATTER — The **Catch-All Filter Drier** will filter out scale, solder particles, carbon, sludge, dirt, or any other foreign matter with negligible pressure drop. Fine particles that would go through an ordinary strainer are removed down to a minimum size in one pass filtration. The large filtering area of the **Catch-All Filter Drier** core permits it to collect a large amount of dirt without plug up.

OIL SLUDGE AND VARNISH — Even the best refrigeration oils break down to produce varnish, sludge, and organic acids. Only the **Catch-All Filter Drier** is capable of removing these products of oil decomposition.

ACID — The **Catch-All Filter Drier** is unexcelled in acid removal ability. The hydrochloric, hydrofluoric, and various organic acids are adsorbed and held by the desiccant in a manner similar to the adsorption of moisture. Tests have demonstrated that the **Catch-All Filter Drier** will remove over 10 times as much acid as the desiccant used in most driers. This ability, along with its excellent ability to clean up the oil, is responsible for the excellent field performance in cleaning up severely contaminated systems.**SPECIAL APPLICATIONS —** A special "HH" core **Catch-All Filter Drier** is available to remove wax which frequently causes difficulty on low temperature Refrigerant 22 and 502 systems. For cap tube systems, use the C-032-CAP or CW-032-CAP Catch-All which has fittings suitable for attaching to any size capillary tube.



Remember…It's not how much moisture you remove from a refrigeration system that counts, it's how little moisture is left

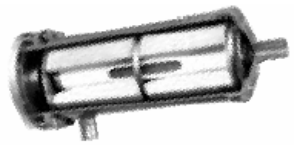
SEALED TYPE – Liquid Line and Suction Line

SPECIFICATIONS

LIQUID LINE TYPE		SUCTION LINE TYPE	CONNECTION SIZE (in.)	VOLUME OF DESICCANT (cu in.)	OVERALL LENGTH (in.)		SOLDER SOCKET DEPTH (in.)	DIAMETER of BODY (in.)
SAE Flare	ODF Solder	ODF Solder			SAE Flare	ODF Solder		
C-032	C-032-S	—	1/4	3	4.19	3.81	0.38	1.75
C-033	C-033-S	—	3/8		4.69	3.88	0.44	
C-052	C-052-S	—	1/4	5	4.75	4.19	0.38	2.44
—	C-0525-S		5/16		—	4.38	0.44	
C-053	C-053-S		3/8		5.19	4.31	0.44	
C-082	C-082-S	—	1/4	9	5.62	5.12	0.38	2.62
—	C-0825-S	—	5/16		—	5.31	0.44	
C-083	C-083-S	—	3/8		6.06	5.25	0.44	
C-084	C-084-S	C-084-S-T-HH	1/2		6.31	5.44	0.50	
C-162	C-162-S	—	1/4	16	6.25	5.75	0.38	3.00
—	C-1625-S	—	5/16		—	5.94	0.44	
C-163	C-163-S	—	3/8		6.75	5.88	0.44	
C-164	C-164-S	C-164-S-T-HH	1/2		6.94	6.00	0.50	
C-165	C-165-S	C-165-S-T-HH	5/8		7.25	6.31	0.62	
—	—	C-166-S-T-HH	3/4		—	6.75	0.62	
—	C-167-S	C-167-S-T-HH	7/8		—	6.93	0.75	
C-303	C-303-S	—	3/8	30	9.69	8.88	0.44	3.00
C-304	C-304-S	—	1/2		9.88	9.00	0.50	
C-305	C-305-S	C-305-S-T-HH	5/8		10.19	9.25	0.62	
—	C-306-S	C-306-S-T-HH	3/4		—	9.65	0.62	
—	C-307-S	C-307-S-T-HH	7/8		—	9.80	0.75	
—	C-309-S	C-309-S-T-HH	1-1/8		—	9.75	0.96	
C-413	—	—	3/8	41	9.56	—	—	3.50
C-414	C-414-S	—	1/2		9.94	9.05	0.50	
C-415	C-415-S	—	5/8		10.25	9.35	0.62	
—	C-417-S	C-417-S-T-HH	7/8		—	9.81	0.75	
—	C-419-S	C-419-S-T-HH	1-1/8		—	9.75	0.90	
—	—	C-437-S-T-HH	7/8	48	—	10.34	0.75	4.75
		C-439-S-T-HH	1-1/8			10.62	0.94	
		C-4311-S-T-HH	1-3/8			10.94	1.00	
		C-4313-S-T-HH	1-5/8			10.94	1.06	
—	C-607-S	C-607-S-T-HH	7/8	60	—	16.00	0.75	3.00
	C-609-S	C-609-S-T-HH	1-1/8			16.00	0.90	
COMPACT STYLE		C-144-S-TT-HH	1/2	14	—	4.14	0.50	4.44
		C-145-S-TT-HH	5/8			4.38	0.66	
		C-146-S-TT-HH	3/4			4.83	0.66	
		C-147-S-TT-HH	7/8			4.97	0.75	
		C-149-S-TT-HH	1-1/8			4.93	0.96	

Listed by Underwriters Laboratories Inc. – Guide SMGT-File No. SA-1756A& B. Maximum Rated Pressure of 650 psi, except for the C-140 Series which has a maximum pressure of 450 psi.

SPORLAN CATCH-ALL REPLACEABLE CORE TYPE



Catch-All THE PERFECT FILTER-DRIER

The rugged construction of the Replaceable Core Catch-All has proven itself in the field for many years. The design features include:

1. The famous **molded porous core** for maximum contaminant removal. The core cannot swell, powder, or pack—assuring ease of installation and removal;
2. The **bolt and nut attachment** of the end plate provides simple and trouble free installation;
3. The **internal** construction gives a one piece assembly and assures proper core alignment;
4. A **complete line** of fitting sizes — all with copper fittings;
5. **No plastic parts** are used — all internal parts are plated steel;
6. A **corrosion resistant powder paint** protects the exterior of the shell.

REPLACEABLE CORE TYPE

TYPE	CONNECTIONS (in) ODF Solder	NUMBER OF CORES	CORE PART NO	VOLUME OF DESICCANT (cu in)	MOUNTING BRACKETS	OVERALL LENGTH (in)
C-485,C-485-G	5/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.15
C-485-T	5/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.15
C-487,C-487-G	7/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.30
C-487-T	7/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.30
C-489-T,C-489-G	1-1/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.50
C-4811-T,C-4811-G	1-3/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.60
C-4813-T,C-4813-G	1-5/8	1	RCW-48, RC-4864, or RC-4864-HH	48	A-685	9.60
C-967,C-967-G	7/8	2	RCW-48, RC-4864, or RC-4864-HH	96	A-685	14.84
C-967-T	7/8	2	RCW-48, RC-4864, or RC-4864-HH	96	A-685	14.84
C-969,C-969-G	1-1/8	2	RCW-48, RC-4864, or RC-4864-HH	96	A-685	15.04
C-969-T	1-1/8	2	RCW-48, RC-4864, or RC-4864-HH	96	A-685	15.04
C-9611-T,C-9611-G	1-3/8	2	RCW-48, RC-4864, or RC-4864-HH	96	A-685	15.14
C-9613-T,C-9613-G	1-5/8	2	RCW-48, RC-4864, or RC-4864-HH	96	A-685	15.14
C-1449,C-1449-G	1-1/8	3	RCW-48, RC-4864, or RC-4864-HH	144	A-685	20.58
C-1449-T	1-1/8	3	RCW-48, RC-4864, or RC-4864-HH	144	A-685	20.58
C-14411,C-14411-G	1-3/8	3	RCW-48, RC-4864, or RC-4864-HH	144	A-685	20.68
C-14411-T	1-3/8	3	RCW-48, RC-4864, or RC-4864-HH	144	A-685	20.68
C-14413-T,C-14413-G	1-5/8	3	RCW-48, RC-4864, or RC-4864-HH	144	A-685	20.68
C-19211,C-19211-G	1-3/8	4	RCW-48, RC-4864, or RC-4864-HH	192	A-685	26.22
C-19211-T	1-3/8	4	RCW-48, RC-4864, or RC-4864-HH	192	A-685	26.22
C-19213,C-19213-G	1-5/8	4	RCW-48, RC-4864, or RC-4864-HH	192	A-685	26.22
C-19213-T	1-5/8	4	RCW-48, RC-4864, or RC-4864-HH	192	A-685	26.22
C-30013,C-30013-G	1-5/8	3	RCW-100, RC-10098, or RC-10098-HH	300	A-175-2	26.22
C-30013-T	1-5/8	3	RCW-100, RC-10098, or RC-10098-HH	300	A-175-2	27.94
C-30017-T,C-30017-G	2-1/8	3	RCW-100, RC-10098, or RC-10098-HH	300	A-175-2	28.06
C-40017,C-40017-G	2-1/8	4	RCW-100, RC-10098, or RC-10098-HH	400	A-175-2	28.06
C-40017-T	2-1/8	4	RCW-100, RC-10098, or RC-10098-HH	400	A-175-2	34.56
C-40021-T,C-40021-G	2-5/8	4	RCW-100, RC-10098, or RC-10098-HH	400	A-175-2	34.57
C-40025-T,C-40025-G	3-1/8	4	RCW-100, RC-10098, or RC-10098-HH	400	A-175-2	34.44
C-40029-T,C-40029-G	3-5/8	4	RCW-100, RC-10098, or RC-10098-HH	400	A-175-2	34.81
C-40033-T,-C-40033-G	4-1/8	4	RCW-100, RC-10098, or RC-10098-HH	400	A-175-2	35.12

OPTIONAL SECONDARY FILTER – ORDER SEPARATELY		
Filter Part No.	Description	Quantity Required
FS-480 FS-960 FS-1440 FS-19200	Filter for C-480 Series Shell	1

SPORLAN CATCH-ALL FILTER DRIERS

LIQUID LINE RATINGS AND SELECTION RECOMMENDATIONS

TYPE	SURFACE FILTERING AREA	RATINGS AT ARI STANDARD CONDITIONS															SELECTION RECOMMENDATIONS (Tons)				
		Water Capacity-Drops										Refrigerant Flow Capacity** (Tons at 1 psi ΔP)					Refrigeration			Air Conditioning	
		Refrigerant 22 60 PPM		Refrigerant 134a 50PPM		Refrigerant 404A/507 50 PPM		Refrigerant 407C 50 PPM		Refrigerant 410A 50 PPM							Commercial & Low Temperature Equipment			Field Replacement or Field Built Up Systems	
		75°F	125° F	75° F	125° F	75° F	125° F	75° F	125° F	75° F	125° F	22	134a	404A 507	407C	410A	12 & 134a	22	404A, 502 & 507	12 & 134a	22, 407C & 410A
C-032	9	61	50	67	48	71	58	52	17	27	20	1.5	1.3	1.0	1.3	1.4	1/4	1/4	1/4	1/2	1/2
C-032-CAP																					
C-032-S																					
C-032-F																					
C-032-FM																					
C-033												3.5	3.2	2.3	3.2	3.4					
C-033-S												3.8	3.5	2.6	3.5	3.7					
C-052	15	146	119	158	114	169	138	123	40	63	48	2.1	1.9	1.4	1.9	2.0	1/3	1/3	1/3	3/4 thru 1	3/4 thru 2
C-052-S																					
C-052-F																					
C-052-FM																					
C-0525-S												3.4	3.1	2.3	3.1	3.3					
C-053												4.1	3.8	2.7	3.8	4.0					
C-053-S												4.7	4.3	3.1	4.3	4.5					
C-082	21	240	196	261	188	279	227	202	65	104	78	2.1	1.9	1.4	1.9	2.0	1/2 thru 1-1/2	1/2 thru 1-1/2	1/2 thru 1	3/4 thru 2	1 thru 2
C-082-S																					
C-0825-S												3.7	3.3	2.4	3.3	3.5					
C-083												4.5	4.2	3.0	4.2	4.4					
C-083-S												5.2	4.7	3.4	4.7	5.0					
C-084												8.7	7.9	5.9	8.0	8.5					
C-084-S												9.6	8.8	6.4	8.8	9.4					
C-162	33	346	297	396	285	424	345	307	100	158	119	2.1	1.9	1.4	1.9	2.0	1 thru 2	1-1/2 thru 3	3/4 thru 2	1 thru 5	1-1/2 thru 5
C-162-S																					
C-1625-S												3.7	3.3	2.4	3.3	3.5					
C-163												4.5	4.2	3.0	4.2	4.4					
C-163-S												5.2	4.7	3.4	4.7	5.0					
C-164												10.1	9.3	6.8	9.3	9.8					
C-164-S												11.0	10.1	7.3	10.1	10.7					
C-165												13.8	12.6	9.2	12.7	13.4					
C-165-S												15.9	14.5	10.6	14.6	15.5					
C-303	53	696	567	756	545	809	658	586	189	302	227	4.6	4.2	3.0	4.2	4.4	3 thru 5	3 thru 5	2 thru 5	3 thru 7-1/2	4 thru 10
C-303-S												5.3	4.7	3.4	4.7	5.0					
C-304												10.1	9.3	6.8	9.3	9.8					
C-304-S												11.0	10.1	7.3	10.1	10.7					
C-305												14.9	13.6	9.9	13.7	14.5					
C-305-S												16.9	15.5	11.3	15.5	16.4					
C-307-S												21.6	19.8	14.4	19.9	21.0					
C-414	67	936	713	1017	733	1088	885	788	254	407	305	11.5	10.5	7.6	10.5	11.1	5 thru 10	5 thru 12	5 thru 10	5 thru 12	7-1/2 thru 15
C-414-S												12.4	11.4	8.3	11.4	12.1					
C-415												15.8	14.5	10.6	14.6	15.4					
C-415-S												17.5	16.1	11.8	16.2	17.1					
C-417-S												22.1	20.3	14.8	20.4	21.5					
C-419-S												24.3	22.3	16.3	22.4	23.7					
C-607-S	106	1392	1134	1512	1090	1618	1316	1172	378	604	454	29.1	26.6	19.5	26.8	28.4	15	15	10	15	20
C-609-S												33.2	30.4	22.3	30.7	32.4					

*The filtration area is equal to the core surface area plus the large internal surface available for depth filtration.

†20 drops = 1 gram = 1cc.

**Based on 86 F liquid line temperature and a refrigerant flow of 3.1 pounds per minute per ton of Refrigerant 134a; 2.9 pounds per minute per ton of Refrigerant 22; 3.9 pounds per minute per ton for Refrigerant 404A; 2.9 pounds per minute per ton for Refrigerant 407C; 2.8 pounds per minute per ton for Refrigerant 410A and 4.1 pounds per minute per ton for Refrigerant 507. Ratings in accordance to ARI Standard 710.

NOTES:

1. R-12 water capacity values are approximately 15 percent greater than R-134a. R-502 water capacities are similar to R-404A and R-507.
2. The variation in flow ratings of filter-driers having the same size core and shell is caused by the difference in connection sizes used.

SPORLAN CATCH-ALL SUCTION LINE FILTER DRIER RECOMMENDATIONS

FOR CLEAN-UP AFTER BURNOUT AND NEW SYSTEMS

TYPE NUMBER		CONNECTIONS (in.) ODF Solder	Number of Cores	CORE PART NO	LENGTH (in.)	SOLDER SOCKET DEPTH (in.)	WIDTH (in.)	SYSTEM CAPACITY IN HORSEPOWER			
								Refrigerant 22 & 407C		Refrigerant 12, 134a, 404A, 502 & 507	
								Permanent Installation with Cores	Temporary Installation Cores for Cleanup; Filter Elements after Cleanup	Permanent Installation with Cores	Temporary Installation Cores for Cleanup; Filter Elements after Cleanup
SEALED TYPE	C-084-S-T-HH	1/2	Sealed Type Filter Driers	Sealed Type Filter Driers	5.44	0.50	2.62	1	Select these types on basis of permanent installation	1/2	Select these types on basis of permanent installation
	C-164-S-T-HH	1/2			6.00	0.50	3.00	2		1	
	C-165-S-T-HH	5/8			6.31	0.62					
	C-166-S-T-HH	3/4			6.75	0.62					
	C-167-S-T-HH	7/8			6.93	0.75		3		2	
	C-305-S-T-HH	5/8			9.25	0.62	3.00				
	C-306-S-T-HH	3/4			9.65	0.62					
	C-307-S-T-HH	7/8			9.80	0.75		5		3	
	C-309-S-T-HH	1-1/8			9.75	0.96					
	C-417-S-T-HH	7/8			9.81	0.75	3.50				
	C-419-S-T-HH	1-1/8			9.75	0.96		7-1/2		4	
	C-437-S-T-HH	7/8			10.34	0.75	4.75				
	C-439-S-T-HH	1-1/8			10.74	0.96					
	C-4311-S-T-HH	1-3/8			10.94	1.00		10		5	
	C-4313-S-T-HH	1-5/8			10.94	1.06					
	C-607-S-T-HH	7/8			16.00	0.75	3.00	5		3	
	C-609-S-T-HH	1-1/8			16.00	0.96					
SEALED TYPE COMPACT STYLE	C-144-S-TT-HH	1/2			4.14	0.50	4.44	2		1	
	C-145-S-TT-HH	5/8			4.38	0.62		3		2	
	C-146-S-TT-HH	3/4			4.83	0.69					
	C-147-S-TT-HH	7/8			4.97	0.75		5		3	
	C-149-S-TT-HH	1-1/8			4.93	0.96					
REPLACEABLE CORE TYPE*	C-30013-G	1-5/8	3	RC-10098-HH or RC-10098				25	50	15	25
	C-30017-G	2-1/8									
	C-40017-G	2-1/8	4					30	60	20	30
	C-40021-G	2-5/8									
	C-40025-G	3-1/8									
	C-40029-G	3-5/8									
	C-40033-G	4-1/8									

*See page for RSF shells.

CATCH-ALL SUCTION LINE FILTER DRIER SELECTION INSTRUCTIONS

Selection of the proper Catch-All Suction Line Filter Drier will depend upon the intended usage. Either the “Permanent Installation with Cores” or “Temporary Installation Cores for Cleanup; Filter Elements after Cleanup” column may be used. When the **best possible system protection** is desired, the “Permanent with Cores” column should be used for selection. These recommendations are made on the basis of a low pressure drop, and as a result the cores can be left in the shell for maximum drying and acid removal when the system returns to normal operation delivering its full rated capacity.

An alternate **selection that is satisfactory and less expensive** is to install cores temporarily for cleanup, and then remove these cores and install filter elements after cleanup. Because of the larger system capacity, the pressure drop through the temporarily installed cores will be somewhat larger than normal, but still within the limits. After cleanup, the use of filter elements will assure a minimum pressure drop when the system is in normal operation. The low pressure drop through the filter elements assures maximum energy savings during normal operation. Cleanup of the system can be accomplished with either the standard core (RC-10098) or the charcoal core (RC-10098-HH).

SIGNIFICANCE OF THE PART NUMBER

The letters and numerals in the Catch-All part number each have a significance. The **“C”** indicates Catch-All, and **“CW”** indicates the High Water Capacity Catch-All. The **FIRST TWO OR THREE DIGITS** indicate cubic inches of desiccant. The **LAST ONE OR TWO DIGITS** indicate fitting size in eighths. For sealed models, a **“-S”** following the last digit indicates solder fittings, and **NO LETTER** indicates a flare fitting. Replaceable core models (C-420 and larger) only have solder connections and the “-S” is omitted.

Examples: C-083 is 8 cu. in. and 3/8 in. flare, C-309-S is 30 cu. in. and 1-1/8 in. solder, C-19213 is 192 cu. in. and 1-5/8 in. solder.

Other suffix letters indicate special qualities. For example:

“-T” indicates a pressure tap consisting of a Schrader type access valve on the inlet end of the Catch-All.

“-HH” indicates a charcoal style core for wax removal and cleanup after a hermetic motor burnout.

REPLACEABLE CORES AND PLEATED FILTER ELEMENTS

Cores for replaceable core type filter-driers are molded with the same desiccants that are used in the popular sealed filter-driers.

Cores are individually packed in metal cans, fully activated and hermetically sealed against moisture and dirt.

Filter elements are dried and packed in individuals sealed metal cans. This method of packaging prevents the element from picking up moisture from the atmosphere

Each can contains a **"triple gasket"** consisting of a new end plate gasket, an end plate gasket for certain competitive filter-driers, and a core gasket where desired. See the specifications on Page * for the number of cores required for each type drier.

RC-4864 — Activated Core — Order as separate item — Fits types C-480 thru C-19200 Series Shells. This is the standard core suitable for most installations in the liquid or suction line.

RCW-48 — High Water Capacity Core — Order as separate item — Fits types C-480 thru C-19200 Series shell. **Designed specially for use with POE lubricants.** This core should be used on systems that have a ruptured water cooled condenser, or that have been exposed to the atmosphere, or for some reason have a high amount of moisture in the system.

RC-4864-HH— Activated Charcoal Core— Order as separate item — Fits types C-480 thru C-19200 Series Shells. This core should be used for wax removal, and for clean-up of systems that have had a hermetic motor burnout.

RPE-48-BD — Filter Element — Order as separate item — Fits types C-480 thru C-19200 Series Shells and **Replaceable Suction Filter (RSF) Shells**. This element should be used in RSF shells installed in the suction line to obtain the lowest possible pressure drop. In cleaning up a system after a hermetic motor burnout, cores should be used first. After clean-up, the filter element should be installed.

RC-10098 —Activated Core — Order as a separate item — Fits types C-30,000 and C-40,000 Series Shells. This is the standard core suitable for liquid and suction line applications.

RCW-100 — High Water Capacity Core — Order as separate item — Fits types C-30,000 and C-40,000 Series Shells. **Designed specially for use with POE lubricants.** This core should be used on systems that have a ruptured water cooled condenser, or that have been exposed to the atmosphere, or for some reason have a high amount of moisture in the system.

RC-10098-HH — Activated Charcoal Core — Order as separate item — Fits types C-30,000 and C-40,000 Series Shells. This core should be used for wax removal, and for clean-up of systems that have had a hermetic motor burnout.

RPE-100 — Filter Element — Order as separate item — Fits types C-30,000 and C-40,000 Series Shells. This filter element should be used in the suction line to obtain the lowest possible pressure drop after cores were used for system clean-up.

HH STYLE CATCH-ALL FOR WAX REMOVAL

U.S. PATENT NUMBER 3,407,617

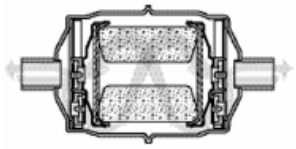
Small amounts of wax are often a problem on **low temperature systems.** Even well engineered systems frequently contain minute quantities of wax which are sufficient to clog expansion valve screens or cause sticking of the valve. Sporlan has developed a special blend of desiccants including activated charcoal which removes small amounts of wax in the liquid line before this wax can cause trouble at the expansion valve. These Catch-All Filter Driers have been very successful in correcting trouble jobs in the field.

By installing HH Style Catch-All Filter Driers in the liquid line of all low temperature systems these wax problems can be entirely prevented. In addition to their wax removal ability, these filter driers will remove all of the other harmful contaminants that the standard filter driers remove.

The following **Catch-All Filter Driers** are available with the HH core to meet the needs of low temperature systems. **For dimensions, refer to the specifications for standard filter driers or consult Bulletin 40-10.**

PART NO.	CONNECTIONS (in.)	PART NO.	CONNECTIONS (in.)
C-052-HH	1/4 SAE Flare	C-303-HH	3/8 SAE Flare
C-082-HH	1/4 SAE Flare	C-304-HH	1/2 SAE Flare
C-083-HH	3/8 SAE Flare	C-304-S-HH	1/2 ODF Solder
C-162-HH	1/4 SAE Flare	C-305-HH	5/8 SAE Flare
C-163-HH	3/8 SAE Flare	C-305-S-HH	5/8 ODF Solder
C-163-S-HH	3/8 ODF Solder	C-414-HH	1/2 SAE Flare
C-164-HH	1/2 SAE Flare	C-415-HH	5/8 SAE Flare
C-164-S-HH	1/2 ODF Solder	C-417-S-HH	7/8 ODF Solder
C-165-HH	5/8 SAE Flare	RC-4864-HH	Replaceable Core
C-165-S-HH	5/8 ODF Solder	RC-10098-HH	

REVERSIBLE HEAT PUMP FILTER-DRIER



DESIGN BENEFITS

- A short overall length for easy installation.
- Drier operates in either flow direction with low pressure drop.
- Proven metal check valves used in construction — no synthetic materials.
- The Sporlan dependable molded core used for maximum filtration ability. When the flow direction reverses, dirt already collected remains in the filter-drier.
- A carefully engineered blend of desiccants for maximum water capacity and acid removal ability. The HPC-160-HH Series also has the HH style core with activated charcoal which offers maximum ability to remove oleoresin and other reactive chemical constituents in the oil.
- Same rugged construction as used in the Catch-All.

SPECIFICATIONS -FOR NEW INSTALLATIONS AND HFC SYSTEM USE

Part No	Connection Size Inches	Selection Recommendations Tons	Dimensions		Flow Capacity Tons at 1 psi ΔP		Water Capacity				Liquid Capacity Ounces (Wt.) @100°F	
					Refrigerant							
			Overall Length Inches	Diameter Inches	R-22	R-410A	R-22 Drops at 60 ppm		R-410A Drops at 80 ppm*		R-22	R-410A
							75°F	125°F	75°F	125°F		
HPC-103	3/8 Flare	1 thru 5	6.75	3.00	3.4	3.3	215	176	171	105	12.2	10.6
HPC-103-S	3/8 Solder		5.88									
HPC-104	1/2 Flare		6.94		4.5	4.4						
HPC-104-S	1/2 Solder		6.00									

FOR CLEAN-UP AFTER BURNOUT

Part No	Connection Size Inches	Selection Recommendations Tons	Dimensions		Flow Capacity R-22 Tons at 1 psi ΔP	Water Capacity Refrigerant 22 Drops at 60 ppm		Liquid Capacity Ounces (Wt.) R-22 @ 100°F
			Overall Length Inches	Diameter Inches		75°F	125°F	
HPC-163-HH	3/8 Flare	1 thru 5	7.78	3.00	3.7	93	81	14.5
HPC-163-S-HH	3/8 Solder	1 thru 5	6.92	3.00	3.7	93	81	14.5
HPC-164-HH	1/2 Flare	1 thru 5	7.95	3.00	4.0	93	81	14.5
HPC-164-S-HH	1/2 Solder	1 thru 5	7.07	3.00	4.0	93	81	14.5
HPC-165-HH	5/8 Flare	1 thru 5	8.28	3.00	4.9	93	81	14.5
HPC-165-S-HH	5/8 Solder	1 thru 5	7.35	3.00	4.9	93	81	14.5

UL and ULc Listed — Guide-SMGT-File No. SA-1756A & B. Core volume is 10 cubic inches for HPC-100 Series and 14 cubic inches for the HPC-160-HH Series. Core surface filtering area is 18 sq. in. for the HPC-100 Series and 26 sq. in. for the HPC-160-HH Series. HPC-100 Series are rated for 650 psig; HPC-160-HH have a 500 psig rating.
*As of this printing, ARI has not established an EPD for R-410A.

SUCTION FILTER WITH THE EXCLUSIVE BI-DIRECTIONAL FEATURE

DESIGN BENEFITS

- Protects the compressor from dirt
- A relief device opens if the filter plugs
- Suitable for use with all brazing alloys
- Maximum corrosion resistance
- Full flow design for low pressure drop
- Complete line of sizes

Sporlan offers an exclusive concept in Suction Filter design — a filter which is Bi-directional. When flow is in **one direction,** the bypass relief feature is active. If the pressure drop across the element becomes excessive the bypass relief will open slightly to maintain sufficient gas flow and assure proper cooling of the hermetic motor.

When the Suction Filter is installed with flow in the **opposite direction,** the bypass relief feature is inactive and will never open, regardless of the increase in pressure drop.

The "-T" in the part number indicates that these models are equipped with an access valve to permit pressure drop readings. The access valve will be operational provided the Suction Filters are installed with the bypass feature inactive.

SPECIFICATIONS

Types with bypass relief feature (Bi-directional Flow)

Part No				Dimensions		
WITHOUT Access Valve	WITH Access Valve	CONNECTIONS (in)	FILTER AREA Sq In	Overall Length Inches	SOCKET DEPTH Inches	SHELL DIAMETER Inches
SF-283-F	—	3/8 SAE Flare	28	8.78	—	3.00
—	SF-285-T	5/8 ODF Solder	28	8.34	0.62	3.00
—	SF-286-T	3/4 ODF Solder	28	8.79	0.69	3.00
—	SF-287-T	7/8 ODF Solder	28	8.93	0.75	3.00
—	SF-289-T	1-1/8 ODF Solder	28	9.51	0.91	3.00
—	SF-489-T	1-1/8 ODF Solder	48	12.42	0.91	3.00
—	SF-4811-T	1-3/8 ODF Solder	48	13.10	0.97	3.00
—	SF-4813-T	1-5/8 ODF Solder	48	13.44	1.09	3.00

Types without bypass relief feature (Single Flow Direction)

Part No				Dimensions		
WITHOUT Access Valve	WITH Access Valve	CONNECTIONS (in)	FILTER AREA Sq In	Overall Length Inches	SOCKET DEPTH Inches	SHELL DIAMETER Inches
SF-114	—	1/2 ODF Solder	11	4.36	0.50	2.00
SF-114-F	—	1/2 ODF Flare	11	5.25	—	2.00
SF-115	—	5/8 ODF Solder	11	4.60	0.62	2.00
SF-115-F	—	5/8 ODF Flare	11	5.56	—	2.00
—	SF-6417-T	2-1/8 ODF Solder	388	1094	1.24	4.75
—	SF-6421-T	2-5/8 ODF Solder	388	1094	1.38	4.75

SELECTION RECOMMENDATIONS

Part No			NOMINAL SYSTEM HORSEPOWER* Refrigerant	
WITHOUT Access Valve	WITH Access Valve	CONNECTIONS (in)	12, 134a, 404A, 502, 507	22, 407C
SF-114	—	1/2 ODF	1/2	1
SF-114-F	—	1/2 SAE	1/2	1
SF-115	—	5/8 ODF	1	2
SF-115-F	—	5/8 SAE	1	2
SF-283-F	—	3/8 SAE	1/2	1
—	SF-285-T	5/8 ODF	1-1/2	4
—	SF-286-T	3/4 ODF	1-1/2	5
—	SF-287-T	7/8 ODF	3	7-1/2
—	SF-289-T	1-1/8 ODF	5	7-1/2
—	SF-489-T	1-1/8 ODF	5	10
—	SF-4811-T	1-3/8 ODF	5	12
—	SF-4813-T	1-5/8 ODF	7	15
—	SF-6417-T	2-1/8 ODF	20	55
—	SF-6421-T	2-5/8 ODF	30	60

*Use R-502 horsepower recommendations for R-502A & B and R-508A.
Use R-12 horsepower recommendations for R-501A & B and R-509A. Ratings are in accordance with ARI Standard 730.

REPLACEMENT SUCTION FILTER

The Replaceable Suction Filter shell, used with RPE-48-BD pleated filter element, is designed to be installed in the suction line of new systems to remove resident contaminants.

DESIGN BENEFITS:

- Low pressure drop
- Can be used with desiccant cores for clean-up after burnout
- Various fitting sizes up to 3-1/89line size
- Access valve supplied for pressure drop measurement or charging

HOW IT'S USED – Sporlan Replaceable Suction Filters are installed in the suction line of air conditioning systems to remove contaminants that may be in the system at start-up. The Replaceable Suction Filter has large fittings permitting the use of a small shell on a system with a large line size, resulting in considerable economy. The angle construction is suitable for flow in either direction, which results in easy installation even on compact racks. The Replaceable Suction Filters should be used with cores for cleaning up a system after a hermetic motor burnout. Select the RC-4864, RC-4864-HH or RCW-48 replaceable cores. After clean-up, install RPE-48-D elements in the shells.

SELECTION – The table below gives information for choosing the proper model for a given system. The filter elements are supplied in hermetically sealed metal cans.

SELECTION RECOMMENDATIONS WITH FILTER ELEMENTS

PART NO	CONNECTIONS Inches ODF Solder	NOMINAL SYSTEM HORSEPOWER Refrigerant			NO. OF FILTER ELEMENTS	NO. OF CORES	OVERALL LENGTH Inches
		12 & 134a	22 & 407C	404A, 502 & 507			
RSF-487-T	7/8	7	10	10	**One** RPE-48-BD	**One** RC-4864 or RC-4864-HH	9.30
RSF-489-T	1-1/8	8	15	12			9.37
RSF-4811-T	1-3/8	10	20	15			9.60
RSF-4813-T	1-5/8	12	25	20			9.60
RSF-4817-T	2-1/8	20	35	25			9.37
RSF-4821-T	2-5/8	25	50	35			9.75
RSF-9617-T	2-1/8	20	40	30	**Two** RPE-48-BD	**Two** RC-4864 or RC-4864-HH	14.96
RSF-9621-T	2-5/8	30	50	40			15.43
RSF-9625-T	3-1/8	40	80	55			15.12

Safety screen Part No.: 6171-S is required when cores are used in the RSF shell. Remove the screen when RPE-48-BD elements are used. UL and ULc Listed — Guide-SMGT-File No. SA-1756A & B.

ACID TEST KIT

PART NO
TA-1 One Time Acid Test Kit

See -All Moisture and Liquid Indicators offers these 8 outstanding benefits


P4536

1. The **See•All Moisture and Liquid Indicator** provides a true moisture indication for Refrigerants 12, 134a, 22, 404A, 407C, 410A, 502 and 507. The See All is also suitable for Refrigerants 401A & B, 402A & B, 408A and 409A. The dark green indicates dry and a bright yellow indicates wet. The one indicator avoids the confusion found in models with two elements. You **cannot** pick the wrong element when checking the moisture content of the system.

2. RELIABLE and ACCURATELY CALIBRATED COLOR CHANGE POINTS. The **See•All Moisture and Liquid Indicator** is accurately calibrated in parts per million of moisture for each refrigerant. All moisture indicators change color on the basis of relative saturation of the refrigerant. Therefore, liquid line temperature must be considered if an accurate calibration is to be obtained. A color chart is part of the label, for easy comparison.

3. COLOR CHANGES ARE EASILY DISTINGUISHED and REVERSIBLE. The indicator's color differs so widely between WET and DRY conditions that there is no possibility of confusion between the two. Colors will reverse as often as moisture concentration in the system changes.

4. LARGE FULL VIEW SIGHT GLASS. The **See•All Moisture and Liquid Indicator** has an extra large crystal clear sight glass for viewing the refrigerant. Bubbles indicate a shortage of refrigerant or a restriction in the liquid line.

5. INDICATOR PROTECTED from DISCOLORATION and DIRT. The indicator is protected by a filter pad and screen. This prevents washing of the indicator by the refrigerant and protects it from system contamination and turbulence.

6. REPLACEABLE INDICATOR ELEMENT. The color indicator paper can be changed on the new fused glass models without removing the **See•All** from the line. Replacement is thru the bottom (see SA-14SU below). Request the K-SA-4 kit.

7. DISASSEMBLY OF THE SMALLER SIZES NOT REQUIRED. The extended steel fittings on solder models in the smaller sizes make it unnecessary to disassemble for installation since steel conducts onl one eighth as much heat as copper.

8. A DOUBLE DUTY PLASTIC CAP is supplied to keep the glass free from dust, dirt, and grease. It also permits the service engineer to use his own discretion concerning instructions to his customers on observing the **See•All Moisture and Liquid Indicator.**


SA-12FM SA-14U SA-13UU SA-13FU SA-14SU SA-17S SA-217

Specifications

CONNEC -TION SIZES Inches	MALE FLARE		FEMALE & MALE FLARE		MALE FLARE X SWIVEL NUT		SWIVEL NUT X SWIVEL NUT		FEMALE FLARE X SWIVEL NUT		SWIVEL NUT X ODF SOLDER		ODF SOLDER	
	Part No	Overall Length Inches	Part No	Overall Length Inches	Part No	Overall Length Inches	Part No	Overall Length Inches	Part No	Overall Length Inches	Part No	Overall Length Inches	Part No	Overall Length Inches
1/4	SA-12	2.87	SA-12FM	2.56	—	—	—	—	—	—	—	—	SA-12S	4.62
3/8	SA-13	3.37	SA-13FM	2.97	SA-13U	3.64	SA-13UU	3.95	SA-13UU	3.19	SA-13SU	4.19	SA-13S	
1/2	SA-14	3.81	SA-14FM	3.44	SA-14U	4.13	SA-14UU	4.50	SA-14UU	3.75	SA-14SU	4.62	SA-14S	4.87
5/8	SA-15	4.13	—	—	SA-15U	4.44	SA-15UU	4.75	—	—	SA-15SU	4.89	SA-15S	
7/8	—	—	—	—	—	—	—	—	—	—	—	—	SA-17S	6.31
1-1/8	—	—	—	—	—	—	—	—	—	—	—	—	SA-19S	
1-3/8	—	—	—	—	—	—	—	—	—	—	—	—	SA-211	7.97
1-5/8	—	—	—	—	—	—	—	—	—	—	—	—	SA-213	
2-1/8	—	—	—	—	—	—	—	—	—	—	—	—	SA-217	

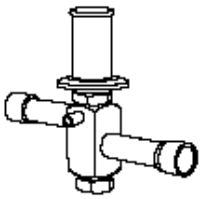
Listed by Underwriters' Laboratories, Inc. - Guide SEYW - File No. SA3182
Maximum Rated Pressure – 650 psi. Overall width is: 1.31 in. for 1/4 in. and 3/8 in. sizes, 1.58 in. for 1/2 in. and 5/8 in. sizes, and 1.38 in. for 7/8 in. and 1-1/8 in. sizes. Most solder connections can be used as male fittings as well as female fittings. The 1/4 in. ODF is 3/8 in. ODM, the 3/8 in. ODF is 1/2 in. ODM, the 1/2 in. ODF is 5/8 in. ODM, and the 5/8 in. ODF is 3/4 in. ODM. Models with female flare and/or swivel nut connections are supplied with a copper gasket in the fitting.

Moisture Content PPM

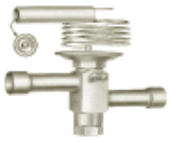
SEE•ALL SHOWS	LIQUID LINE TEMP	REFRIGERANT											
		12		22		134a		502		404A & 507		407C	410A
		75° F	100° F	75° F	100° F	75° F	100° F	75° F	100° F	75° F	100° F	75° F	75° F
Green Dry		Below 5	Below **10**	Below 30	Below **45**	Below 50	Below **80**	Below 10	Below **20**	Below 15	Below **30**	Below 120	Below 75
Chartreuse CAUTION		5-15	**10-30**	30-90	**45-130**	50-200	**80-225**	10-45	**20-65**	15-90	**30-140**	120-280	75-150
Yellow WET		Above 15	Above **30**	Above 90	Above **130**	Above 200	Above **225**	Above 45	Above **65**	Above 90	Above **140**	Above 280	Above 150

NOTE: Change or add Catch-All Filter-Drier when paper turns from green to chartreuse.

SPORLAN DISCHARGE BYPASS VALVES


ADRHE-6


ADRI


DRHE-6


SHGB-8


SHGB-15

The Sporlan line of discharge bypass valves are designed to provide an economical method of compressor capacity control in place of cylinder Unloader or to handle unloading requirements below the last step of cylinder unloading. These modulating control valves automatically bypass the required amount of discharge gas to the low side to maintain the desired minimum evaporator pressure. The valves are applicable on any refrigeration or air conditioning system that operates during periods of low load, which can result in coil icing or short cycling. These valves respond to downstream pressure changes and open when the evaporator pressure falls below the valve setting. At normal loads and evaporator conditions, the valve remains closed and the system operates in a conventional manner.

The DR line of valves consists of three basic types of valves: the adjustable models, the adjustable remote bulb models, and the non-adjustable models.

The SHGB valves are adjustable and pilot operated with a solenoid stop feature that eliminates the need for a hot gas solenoid valve. They were developed for use on larger capacity systems.

APPLICATION — The discharge bypass valve is normally applied in a branch line off the discharge line. To allow system pump down control, a solenoid valve or hand valve must be installed upstream of the discharge DR type bypass valves. The bypassed hot gas can enter the low side at several locations; however, two of the possible locations are preferred because of superior operating performance: into the side connection of a Sporlan side connection distributor or directly into the suction line. By using the side connection distributor method, the system TEV will act as a desuperheating valve to keep the compressor suction temperature below the recommended maximum temperature published by the compressor manufacturer. When the hot gas is bypassed directly into the suction line, an auxiliary desuperheating TEV may be required.

SELECTION and CAPACITY RATINGS —The capacities given in the table below are **valve** hot gas capacities and not the capacities of the system on which the valve is to be applied. To select a valve, first determine the compressor capacity at the minimum allowable evaporating temperature.

Then the discharge bypass valve must supply the difference between this compressor capacity and the minimum evaporator load at which the system is to be operated. The valve pressure setting will be that pressure at which the bypass valve must start to open.

Connections – (Standard Connections are in **BOLD** type).
ADRS(E)-2 – 3/8 in., **1/2** in.**,** 5/8 in. ODF Solder or 3/8 in., 1/2 in., 5/8 in. SAE Flare
ADRP(E)-3 – 1/2 in., **5/8** in. ODF Solder on 1/2 in., 5/8 in. SAE Flare
ADRHE-6 & DRHE-6 – 5/8 in., **7/8** in.**,** 1-1/8 in. ODF Solder
SHGB(E)-8 – 7/8 in. ODF, 1-1/8 in. ODF Solder
SHGB(E)-15 – 1-1/8 in., 1-3/8 in. ODF Solder

Valves with ODF solder connections are supplied standard with 1/4 in. ODF external equalizer, 1/4 in. SAE Flare external equalizer available on special order. Pilot operated models are supplied with 1/4 in. SAE external equalizer.

SPORLAN DISCHARGE BYPASS VALVES

DISCHARGE BYPASS VALVE CAPACITIES — Tons

Capacities based on 6° F evaporator temperature change from closed to rated opening (does not apply to pilot operated models), discharge temperature 30° F above isentropic compression, 100° F condensing temperature, 0° F subcooling, 25° F superheat at the compressor and includes both the hot gas bypassed and liquid refrigerant for desuperheating, regardless of whether the liquid is fed through the system thermostatic expansion valve or auxiliary desuperheating thermostatic expansion valve.

REFRIGERANT	MINIMUM ALLOWABLE EVAPORATOR TEMPERATURE	VALVE TYPE & ADJUSTMENT RANGE (psig)														
		ADRI-1-1/4 ADRIE-1-1/4			ADRS-2 ADRSE-2		ADRP-3 ADRPE-3		ADRHE-6		DRHE-6 (Adjustable "Remote Bulb" Model)*				SHGB-8 SHGBE-8	SHGB-15 SHGBE-15
		0/55	0/75	0/100	0/30	0/80	0/30	0/80	0/30	0/80	25/35	32/44	55/70	65/80	0/100	0/75
22	40	—	0.58	0.53	—	3.51	—	5.99	—	9.16	—	—	1 9.8	—	15.7	58
	26	0.44	0.64	0.54	—	3.57	—	6.26	—	9.90	—	—	1 6.9	—	15.9	62
	0	0.63	0.60	0.49	3.90	3.66	7.38	6.61	13.9	10.9	—	—	—	—	16.2	66
	–20	0.59	0.50	0.44	3.75	3.65	7.45	6.64	14.1	11.0	—	—	—	—	16.2	69
134a	40	0.40	0.43	0.34	—	2.67	—	4.94	—	9.34	9.64	—	—	—	10.9	41
	26	0.41	0.39	0.32	2.60	2.44	4.95	4.42	9.36	7.26	8.31	—	—	—	10.9	43
	0	0.38	0.31	0.28	2.46	—	4.89	—	9.41	—	—	—	—	—	11.0	46
401A	40	0.45	0.48	0.39	—	2.76	—	4.95	—	7.99	—	11.0	—	—	12.3	52
	26	0.47	0.45	0.37	2.97	2.79	5.66	5.04	10.7	8.26	—	9.49	—	—	1 .4	52
	0	0.44	0.36	0.32	2.83	2.74	5.62	5.01	10.8	8.32	—	—	—	—	12.5	56
402A	40	—	—	0.54	—	—	—	—	—	—	—	—	—	—	17.3	—
	26	—	0.65	0.60	—	3.91	—	6.66	—	10.3	—	—	—	—	17.7	63
	0	0.66	0.72	0.57	—	4.00	—	7.16	—	11.7	—	—	—	—	17.9	63
	–20	0.69	0.63	0.52	4.22	4.04	8.11	7.33	15.3	12.2	—	—	—	—	18.0	64
404A	40	—	—	0.55	—	—	—	—	—	—	—	—	—	—	17.5	—
	26	—	0.67	0.60	—	3.91	—	6.70	—	10.4	—	—	—	21.4	17.7	64
	0	0.67	0.71	0.56	—	4.00	—	7.16	—	11.7	—	—	—	—	17.9	65
	–20	0.68	0.61	0.51	4.17	4.02	8.08	7.28	15.3	12.1	—	—	—	—	17.9	65
407C	40	—	0.78	0.65	—	4.25	—	7.50	—	12.1	—	—	22.9	—	18.6	74
	26	0.61	0.78	0.63	—	4.25	—	7.50	—	12.1	—	19.3	—	—	18.7	75
	0	0.74	0.68	0.56	4.51	4.31	8.63	7.81	16.3	13.0	—	—	—	—	18.9	76
	–20	0.68	0.56	0.50	4.33	4.23	8.64	7.71	16.5	12.9	—	—	—	—	19.1	77
502	40	—	—	0.46	—	3.14	—	5.28	—	7.85	—	—	—	19.2	14.3	—
	26	—	0.56	0.49	—	3.19	—	5.51	—	8.55	—	—	—	16.6	14.5	55
	0	0.55	0.57	0.46	3.58	3.28	6.64	5.90	12.5	9.62	—	—	—	—	14.7	59
	–20	0.55	0.59	0.41	3.43	3.30	6.68	6.00	12.6	9.91	—	—	—	—	14.8	61
507	40	—	—	0.53	—	—	—	—	—	—	—	—	—	—	17.4	—
	26	—	0.65	0.59	—	3.87	—	6.60	—	10.2	—	—	—	—	17.7	64
	0	—	0.71	0.57	—	3.96	—	7.09	—	11.5	—	—	—	—	17.8	64
	–20	0.69	0.62	0.52	4.17	4.00	8.02	7.25	15.2	12.0	—	—	—	—	17.9	65

PART NO	DESCRIPTION
ADRS-20/30ODF	ADRS-2 0/30 4 ODF
ADRS-20/305ODF	ADRS-2 0/30 5 ODF
ADRSE-20/304ODF	ADRSE-20/304ODF
ADRSE-20/305ODF	ADRSE-20/305ODF
ADRS-20/804ODF	ADRS-2 0/80 4 ODF
ADRS-20/805ODF	ADRS-2 0/80 5 ODF
ADRSE-20/803ODF	ADRSE-20/803ODF
ADRSE-20/804ODF	ADRSE-20/804ODF
ADRSE-20/805ODF	ADRSE-20/805ODF
ADRP-30/304ODF	ADRP-3 0/30 4 ODF
ADRP-30/305ODF	ADRP-3 0/30 5 ODF
ADRPE-30/304ODF	ADRPE-30/304ODF
ADRPE-30/305ODF	ADRPE-30/305ODF
ADRP-30/804ODF	ADRP-3 0/80 4 ODF
ADRP-30/805ODF	ADRP-3 0/80 5 ODF
ADRPE-30/804ODF	ADRPE-30/804ODF
ADRPE-30/805ODF	ADRPE-30/805ODF
ADRHE-60/305ODF	ADRHE-60/305ODF

PART NO	DESCRIPTION
ADRHE-60/805ODF	ADRHE-6 0/80 5 ODF
ADRHE-60/807ODF	ADRHE-6 0/80 7 ODF
ADRHE-60/809ODF	ADRHE-6 0/80 9 ODF
DRHE-6-55/70AR7X7	DRHE-6-55/70AR 7 ODF
DRHE-6-55/70AR9X9	DRHE-6-55/70AR 9 ODF
SHGBE-8-0/1009ODF	SHGBE-8-0/100 9 ODF LESS COIL
SHGBE-8-0/1007ODF	SHGBE-8-0/100 7 ODF LESS COIL
SHGB-8-0/107ODF	SHGB-8-0/100 7 ODF LESS COIL
SHGB-8-0/1009ODF	SHGB-8-0/100 9 ODF LESS COIL
SHGB-15-0/759ODF	SHGB-15-0/75 9 ODF LESS COIL
SHGB-15-0/7511ODF	SHGB-15-0/75 11 ODF LESS COIL
SHGBE-15-0/759ODF	SHGBE-15-0/75 9 ODF LESS COIL
SHGBE-15-0/7511 ODF	SHGBE-15-0/75 11 ODF LESS COIL

CRANKCASE PRESSURE REGULATING VALVES

Crankcase Pressure Regulating Valves are designed to prevent overloading of the compressor motor by limiting the crankcase pressure to a predetermined maximum value during and after a defrost cycle or a normal shutdown period. These valves automatically throttle the vapor flow from the evaporator until the compressor can handle the load.

Sporlan manufactures five adjustable models… CRO-4, CRO-6, CROT-6, CRO-10 and CROT-10…all models respond only to their outlet pressure and modulate to prevent the suction pressure at the compressor from rising above the valve setting. Since these valves are adjustable, the setting may be altered to suit the specific system requirements.

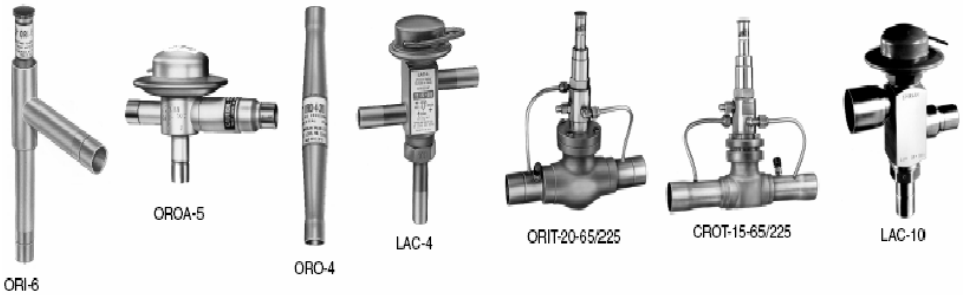
SELECTION and CAPACITY RATINGS

The ratings for these valves vary depending on three items: design suction pressure after pull down, maximum allowable suction pressure recommended by the compressor or unit manufacturer (this is the valve setting), and pressure drop across the valve. The difference between the design suction pressure and the valve setting determines how much of the valve stroke is used. Therefore, the valve setting should be kept as high as possible without exceeding the recommendation of the compressor or unit manufacturer.

PART NO*	SPORLAN MODEL
☎	CRO-4-0/20 4X4 ODF LS
☎	CROT-10 30/110 9 ODF WS
☎	CROT-10 30/110 11 ODF WS
☎	CROT-10 0/6011ODF WS
☎	CROT-10 0/60 1-1/8"ODF
☎	CROT-10 0/60 7 ODF WS
☎	CROT-10 30/110 7 ODF WS
☎	CROT-12-65/225 9 ODF
☎	CROT-15-65/225 11 ODF
☎	CROT-6 0/60 5 ODF WS
☎	CROT-6 0/60 1/2" SAE
☎	CROT-6 0/60 5/8" SAE
☎	CROT-6 0/60 7 ODF WS
☎	CROT-6 30/110 5 ODF WS
☎	CROT-6 30/110 7 ODF WS

*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

HEAD PRESSURE CONTROL VALVES



Sporlan Head Pressure Control for systems with air cooled condensers can be accomplished with several valve types or combinations. The valve types are: LAC-4, OROA-5, LAC-5, LAC-10, ORI/ORD combination and the ORIT/CROT combination.

The LAC, OROA, ORI and ORIT are designed for application in the liquid line and should not be applied in the discharge line for any reason. Compressor pulsations can greatly shorten the life of the valves. If any of the valves are applied in any manner other than described here, the Sporlan warranty is void.

PART NO*	SPORLAN MODEL
☎	ORD-4-20 5/8 ODF
☎	ORD-4-20 7/8 ODF
☎	ORD-4-25 5/8 ODF
☎	ORD-4-30 5/8 ODF
☎	ORD-4-35 5/8 ODF
☎	ORI-10 65/225 1-1/8"
☎	ORI-10 65/225 1-3/8"
☎	ORI-10 65/225H 7ODF WS
☎	ORI-10 65/225H 11 ODF WS
☎	ORI-6 65/225 5/8" WS
☎	ORI-6 0/50 5 ODF WS
☎	ORI-6 65/225 7/8" WS
☎	ORI-6 65/225H 9ODF WS
☎	ORIT-15-65/225 11 ODF
☎	ORIT-20-65/225 13 ODF

PART NO*	SPORLAN MODEL
☎	OROA-5-100 5/8 ODF WS
☎	OROA-5-100 7/8 ODF WS
☎	OROA-5-150 7/8 ODF WS
☎	OROA-5-180 5/8 ODF WS
☎	OROA-5-180 7/8 ODF WS
☎	OROA-5-220 5/8 ODF WS

IMPORTANT NOTES: WS - With Strainer
LS - Less Strainer

PART NO*	SPORLAN MODEL
☎	LAC-10-100 11X7 ODF LS
☎	LAC-10-100 11X9 ODF LS
☎	LAC-4-100 1/2 ODF LS
☎	LAC-4-180 3/8 0DF LS
☎	LAC-4-190 1/2 ODF LS
☎	LAC-4-210 1/2 ODF LS
☎	LAC-4-240 1/2 ODF LS
☎	LAC-5-100 1-1/8 ODF LS
☎	LAC-5-210 5/8 ODF WS
☎	LAC-5-75 1/2 ODF LS

PART NO*	SPORLAN MODEL
☎	CROT-12-65/225 9 ODF
☎	CROT-15-65/225 11ODF

*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

DEFROST DIFFERENTIAL PRESSURE REGULATING VALVES

DDR-20 VALVE OPERATION

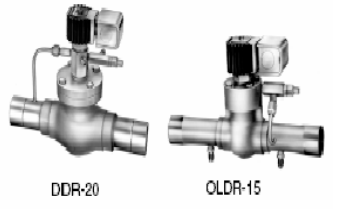
The DDR-20 is designed to create a differential pressure between its inlet (discharge) pressure and the receiver pressure.
A solenoid bypass feature is incorporated in the valve so that the valve can be made to go full open when there is no need for a differential to be created. Energizing the solenoid coil opens the valve fully.

LOCATION

The (O)LDR valve is located between the receiver and the liquid header. The DDR-20 is located in the discharge line before the condenser.

ADJUSTMENT RANGE AND PRESSURE SETTINGS

All defrost differential valves are set by turning the adjusting stem located under the cap on the pilot differential valve.
The adjustment range is 5 to 50 psig. The (O)LDR has a factory setting of 18 psid and the DDR-20 has a factory setting of 30 psid. Turning the stem clockwise increases the setting, counterclockwise decreases the setting.



PART NO*	SPORLAN MODEL
☎	OLDR-15 11ODF LESS COIL
☎	OLDR-15 9ODF LESS COIL
☎	OLDR-20 13ODF LESS COIL
☎	OLDR-20 17ODF LESS COIL
☎	DDR-20 13 ODF LESS COIL

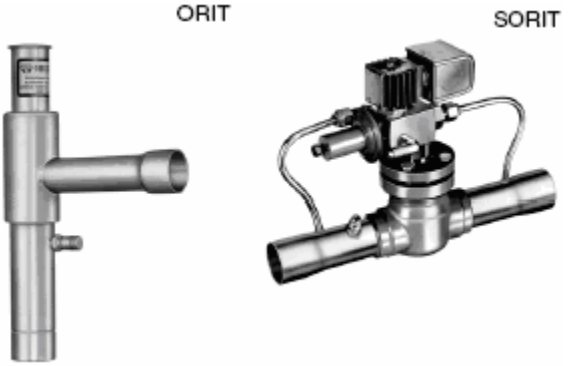
*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

EVAPORATOR PRESSURE REGULATING VALVES

The Sporlan line of evaporator pressure regulating (EPR) valves are designed to provide an accurate and economical means of balancing system capacity and load requirements during “low” loads and/or while maintaining different evaporator conditions on multi-temperature evaporator systems. These valves control evaporator temperature by maintaining evaporator pressure. As the evaporator load increases the **ORI** valves will **O**pen on **R**ise of **I** nlet pressure above the valve’s setting to provide more flow capacity to meet the evaporator load. When the evaporator load decreases the valves will modulate closed to maintain the pressure setting of the valve.
Sporlan offers a number of EPR valve types in various sizes, and with optional features to accommodate almost any industry requirement. For more complete information on any of the EPR valve types see your Sporlan Wholesaler or contact your Sporlan Sales Engineer.

APPLICATIONS

- Maintain minimum evaporator temperature to avoid frost on air coils and provide improved humidity control
- Evaporator temperature control for food merchandisers (single and multiple evaporator systems)
- Evaporator temperature control on water chilling units



PART NO*	SPORLAN MODEL
☎	ORI-6 0/50 5 ODF WS
☎	ORIT-10 0/50 7 ODF WS
☎	ORIT-10 0/50 11 ODF WS
☎	ORIT-10 0/50 9 ODF WS
☎	ORIT-10 30/100 7 ODF WS
☎	ORIT-10 30/100 9 ODF WS
☎	ORIT-10 30/100 11 ODF WS
☎	ORIT-12 0/100 9 ODF
☎	ORIT-15 0/100 11 ODF
☎	ORIT-20 0/100 13 ODF
☎	ORIT-6 0/50 5/8" SAE
☎	ORIT-6 0/50 1/2" SAE
☎	ORIT-6 0/50 5 ODF WS
☎	ORIT-6 0/50 7 ODF WS
☎	ORIT-6 30/100 5 ODF WS
☎	ORIT-6 30/100 7 ODF WS
☎	ORIT-PI-25-0/100
☎	ORIT-PI-27-0/100
☎	ORIT-PI-29-0/100
☎	ORIT-PI-311-0/100
☎	ORIT-PI-39-0/100
☎	ORIT-PI-411-0/100
☎	ORIT-PI-413-0/100
☎	ORIT-PI-513-0/100

PART NO*	SPORLAN MODEL
☎	SORIT-12 0/100 208-240VAC 9ODF
☎	SORIT-12-0/100 LC 9ODF
☎	SORIT-15-0/100 LC 11ODF
☎	SORIT-20-0/100 LC 13ODF
☎	SORIT-PI-211S-0/100 LC
☎	SORIT-PI-25S-0/100 LESS COIL
☎	SORIT-PI-25SE-0/100 LESS COIL
☎	SORIT-PI-27S-0/100 LESS COIL
☎	SORIT-PI-27SE-0/100 LESS COIL
☎	SORIT-PI-29S-0/100 LESS COIL
☎	SORIT-PI-29SE-0/100 LESS COIL
☎	SORIT-PI-311S-0/100 LESS COIL
☎	SORIT-PI-313S-0/100 LESS COIL
☎	SORIT-PI-37S-0/100 LESS COIL
☎	SORIT-PI-39S-0/100 LESS COIL
☎	SORIT-PI-411S-0/100 LESS COIL
☎	SORIT-PI-413S-0/100 LESS COIL
☎	SORIT-PI-417S-0/100 LESS COIL
☎	SORIT-PI-49S-0/100 LESS COIL
☎	SORIT-PI-511S-0/100 LESS COIL
☎	SORIT-PI-513S-0/100 LESS COIL
☎	SORIT-PI-517S-0/100 LESS COIL

IMPORTANT NOTES:WS - With Strainer

*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

ELECTRONIC TEMPERATURE CONTROL SYSTEMS


CDS

Type CDS-9 and CDS-16

PART NO*	SPORLAN MODEL
☎	CDS-16 11ODF 10'-S ST
☎	CDS-16 11ODF 20'-S ST
☎	CDS-9 7ODF 20'-H
☎	CDS-9 9ODF 20'-S

*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

SERIES OIL FILTER

DESIGN BENEFITS

- Virtually eliminates the need for oil changes due to suspended particulate in circulation
- Unsurpassed filtering efficiency
  99% removal of 3 micron sized particles
  98% removal of 2 micron sized particles
- Element utilizes a pleated design for maximum surface area
- Unsurpassed filtration capacities
- High flow capacities with low pressure drop
- Filter element utilizes an O-ring seal
- Inert micro glass filter material insures lubricant compatibility
- Dimensions allow for easy replacement of current filter

The Sporlan Catch-All or SF-283-F Suction Filter has been used for many years as an oil filter in refrigeration rack systems with mineral or alkylbenzene as the lubricant of choice.

With the use of the new polyolester (POE) oils, system chemistry has changed. Unlike mineral and alkylbenzene oils, POE oil has solvent like tendencies. POE oil has the ability to suspend and recirculate small, solid contaminants left from system installation or retrofit. Analysis of POE oil samples taken from actual systems have shown the oil to suspend and recirculate a high concentration of 2-20 micron sized particles, with the largest percentage between 2-10 microns. Although some particles are smaller than bearing tolerances, studies have shown bearing life can still be affected.

Bearing wear depends upon the size, hardness, and concentration of particles in circulation. To effectively remove these small particles, Sporlan developed a new type of oil filter.

The OF Series Oil Filters are designed to be 99% efficient in removing 3 micron sized particles and yet have sufficient flow capacity at a low pressure drop. The unsurpassed filtration ability of the oil filters will assure clean POE, mineral, or alkylbenzene oil is returned to the compressors. Clean oil insures proper operation of the oil level control and minimizes compressor wear. The Sporlan OF Series Oil Filters were designed to virtually eliminate the need for oil changes resulting from suspended solid contaminants in circulation.

PART NO*	SPORLAN MODEL
☎	OF-303 OIL FILTER
☎	OF-303-T OIL FILTER
☎	OF-303-BP OIL FILTER
☎	ROF-413-T REPLACEABLE FILTER
☎	OFE-1 OIL FILTER ELEMENT

*(☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

OIL LEVEL CONTROL SYSTEM

Sporran's Oil Level Control System Components were developed to offer the refrigeration industry an oil level control system of the highest quality. The heart of the system is the Oil Level Control which when matched with the Oil Reservoir and Oil Differential Check Valve maintains a minimum oil level in the compressor crankcase during all phases of system operation.

OIL RESERVOIR Type OR-1-1/2

The Sporlan Oil Reservoir (OR-1-1/2) is a holding vessel to contain the oil that is not within the crankcase, the oil separator, or in circulation. The OR-1-1/2 has an inlet and an outlet service valve so it may be isolated from the rest of the system, or the oil supply from the oil reservoir to the Oil Level Control can be eliminated for service. The OR-1-1/2 also contains two sight glasses so the maximum and minimum oil level can be observed. The sight glasses are placed on the shell symmetrically so 1/4 gallon of oil is contained between the lower sight glass and the bottom of the shell; 1 gallon is contained between the sight glasses; and 1/4 gallon is contained between the upper sight glass and the top of the shell. This allows the shell to be mounted vertically with either service valve on top. Depending on which end of the OR-1-1/2 Oil Reservoir is mounted to the top, the oil service valves will be pointing either right or left for piping convenience.

OIL DIFFERENTIAL CHECK VALVE Types OCV-5, OCV-10, OCV-20

The Sporlan Oil Level Differential Check Valve (OCV) is installed on the 3/8 SAE fitting on top of the OR-1-1/2, and allows pressure to be relieved from the reservoir to the suction as required to maintain a pressure in the reservoir at a preset level above the suction pressure. The pressure differential created by the OCV assures oil flow from the reservoir to the Oil Level Control providing there is adequate oil in the reservoir.

NOTE: OL-60CH replaces OL-1CH and OL-2CH; OL-60FH replaces OL-1FH and OL-2FH models.

The OCV will only relieve pressure from the reservoir in excess of its fixed set point. Systems with fluctuating suction pressure as a result of compressor unlades, staging or other suction line controls must be fitted with an OCV with a differential greater than the suction pressure fluctuation to assure oil flow from the OR-1-1/2 through the oil level control to the compressor crankcase.

Sporlan offers OCV's with a 5, 10, and 20 psi fixed differential setting. However, Sporlan recommends the use of an OCV-20 on all field built up applications.

OIL LEVEL CONTROLS

The purpose of the Sporlan Oil Level Control is to regulate the flow of oil to the compressor crankcase to maintain a minimum oil level as specified by the compressor manufacturer for any given application.

PART NO*	SPORLAN MODEL
	OL-60CH OIL LEVEL CONTROL
	OL-60FH OIL LEVEL CONTROL
	OL-60XH OIL LEVEL CONTROL
	OR-1-1/2 OIL RESERVOIR
	OCV-10 CHECK VALVE
	OCV-20 CHECK VALVE
	OCV-30 CHECK VALVE
	OCV-5 CHECK VALVE
	S-OL OIL LEVEL SIGHT GLASS KIT
	AOL-A COPELAND ADAPTOR
	AOL-K-1 ADAPTOR KIT -OM-1
	AOL-R-1 KIT

*( ) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

TEMPERATURE RESPONSIVE **MISCELLANEOUS** VALVES, REPLACEMENT PARTS, PARTS KITS, SOLENOID COILS, AND STRAINER

PART NO*	SPORLAN MODEL
	ADRHE-60/307 ODF
	ADRHE-60/309 ODF
	ADRIE-1-1/4-0/55 3X3 ODF ST
	ADRIE-1-1/4-0/75 3X3 ODF ST
	825-005 INLET STRAINER 5/8 ODF
	825-007 INLET STRAINER 7/8 ODF
	825-009 INLET STR 1-1/8 ODF
	825-011 INLET STR 1-3/8 ODF
	877-003 INLET STRAINER 3/8 ODF
	877-004 INLET STRAINER 1/2 ODF
	6034 Y-TYPE 1/2 FPT STRAINER

PART NO*	SPORLAN MODEL
	K-PI-E KIT
	RK-SORIT-PI-2 0/100
	RK-SORIT-PI-3 0/100
	RK-SORIT-PI-4 0/100
	KS-12DB
	KS-12DC
	KS-16DB
	KS-ORI/CDA-15 INT PARTS KIT
	KS-ORI/CDA-20 INT PARTS KIT
	K-SORIT-PI KIT
	K-Y1005-1 0/100 PILOT ASSY KIT
	OMKC-2 120/50-60 JAM
	OMKC-2 208-240/50-60 JAN

PART NO*	SPORLAN MODEL
	Y 1037-FV-1-1/2-190 3VX3 ODF 5'
	Y 1037-FV-1-190 3VX3 ODF 30'
	Y 1037-FV-2-190 3VX3 ODF 5'
	Y 1037-FV-3-190 3VX3 ODF 5'
	Y 1037-FV-5-190 3VX3 ODF 5'
	Y 1037-FV-1/2-190 3VX3 ODF 5'
	Y 1037-FV-1/2-220 3VX3 ODF 5'
	Y 1037-FV-1/2-230 3VX3 ODF 5'
	Y 1037-FV-1/2-250 3VX3 ODF 5'
	Y 1037-FV-1/3-190 3VX3 ODF 5'
	Y 1037-FV-1-1/2-220 3VX3 ODF 5'
	Y 1037-FV-1-1/2-230 3VX3 ODF 5'
	Y 1037-FV-1-1/2-250 3VX3 ODF 5'
	Y 1037-FV-1-220 3VX3 ODF 5'
	Y 1037-FV-1-230 3VX3 ODF 5'
	Y 1037-FV-1-250 3VX3 ODF 5'

* ( ) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

PART NO*	SPORLAN MODEL
☎	ADRHE-60/307 ODF
☎	ADRHE-60/309 ODF
☎	ADRIE-1-1/4-0/55 3X3 ODF ST
☎	ADRIE-1-1/4-0/75 3X3 ODF ST
☎	825-005 INLET STRAINER 5/8 ODF
☎	825-007 INLET STRAINER 7/8 ODF
☎	825-009 INLET STR 1-1/8 ODF
☎	825-011 INLET STR 1-3/8 ODF
☎	877-003 INLET STRAINER 3/8 ODF
☎	877-004 INLET STRAINER 1/2 ODF

PART NO*	SPORLAN MODEL
☎	K-PI-E KIT
☎	RK-SORIT-PI-2 0/100
☎	RK-SORIT-PI-3 0/100
☎	RK-SORIT-PI-4 0/100
☎	KS-12DB
☎	KS-12DC
☎	KS-16DB
☎	KS-ORI/CDA-15 INT PARTS KIT
☎	KS-ORI/CDA-20 INT PARTS KIT
☎	K-SORIT-PI KIT
☎	K-Y1005-1 0/100 PILOT ASSY KIT

PART NO*	SPORLAN MODEL
☎	MKC-1 120/50-60 JAM
☎	MKC-1 208-240/50-60 JAN
☎	MKC-1 24/50-60 JAQ
☎	MKC-1-DUAL/50-60 JAU
☎	MKC-2 24/50-60 JAQ
☎	MKC-2 120/50-60 JAM
☎	MKC-2 208-240/50-60 JAN
☎	MKC-2-DUAL/50-60 JAU
☎	OMKC-2 120/50-60 JAM
☎	OMKC-2 208-240/50-60 JAN
☎	6034 Y-TYPE 1/2 FPT STRAINER

* (☎) Please contact your local Carlyle Certified Refrigeration Partner or RCD Customer Service for P/N and Pricing.

Variable Frequency Drives

As variable frequency drives (VFDs) from multiple manufacturers are used in Seresco Technologies Inc.'s products, please ensure that you are aware which model is used in your unit before consulting this guide.

Siemens MicroMaster VFDs

⚠ **WARNING** This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with Warnings failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property. Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.

⚠ **WARNING** The DC link of all MICROMASTER modules remains at a hazardous voltage level for 5 minutes after all voltages have been disconnected. Therefore always wait for 5 minutes after disconnecting the inverter from the power supply before carrying out work on any modules. The drive unit discharges itself during this time.

This equipment is capable of providing internal motor overload protection in accordance with UL508C section 42. Refer to P0610 (level 3) and P0335. Motor overload protection can also be provided using an external PTC via a digital input. This equipment is suitable for use in a circuit capable of delivering not more than 10,000 symmetrical amperes (rms), for a maximum voltage of 230/460 V when protected by an H or K type fuse, a circuit breaker or self-protected combination motor controller controller (for more details see Operating Instructions Appendix F). Use Class 1 60/75 °C copper wire only with the cross-sections as specified in the Operating Instructions.

Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Table 1. Maximum permissible ambient temperature	
Frame Sizes A-F	50 °C at constant torque (CT) and 100 % 40 °C at variable torque (VT) and 100 %

Frame Sizes FX and GX	40 °C at 100 % permissible output current

MM420

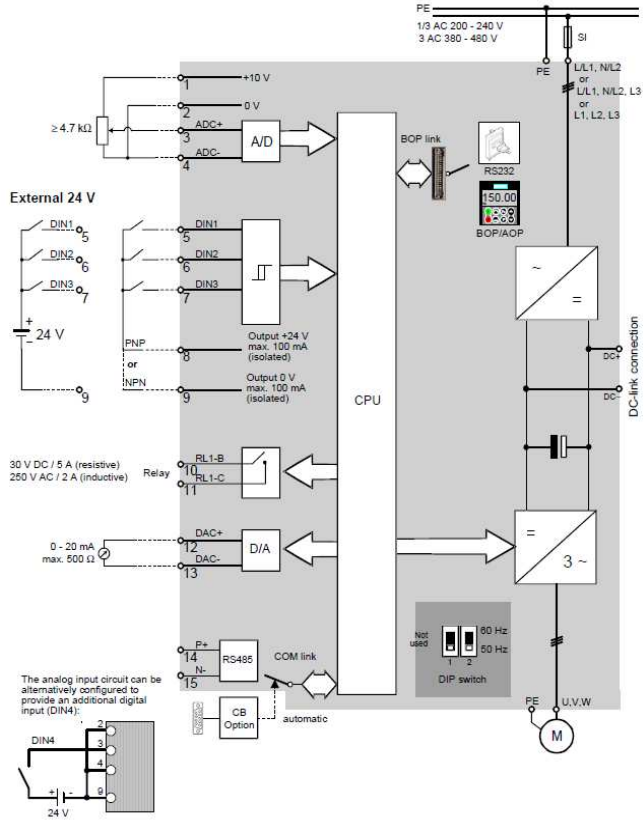


Figure 1. MM420 Block Diagram

MM440

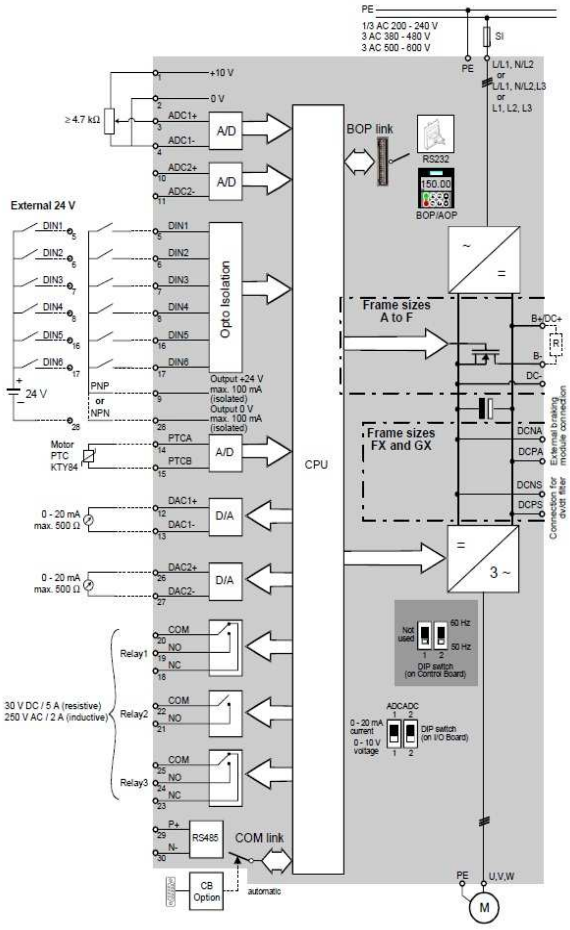


Figure 2. MM440 Block Diagram

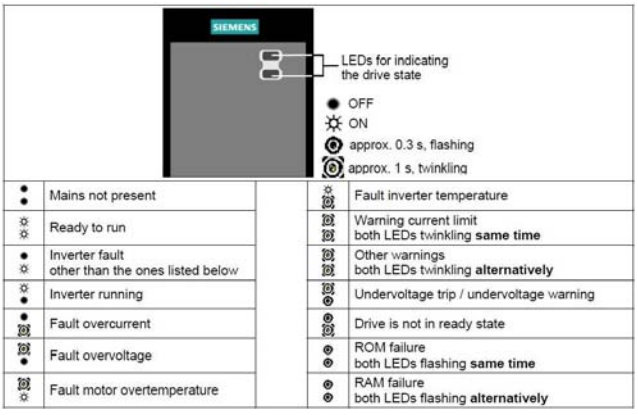


Figure 3. MM420 LED Status Display

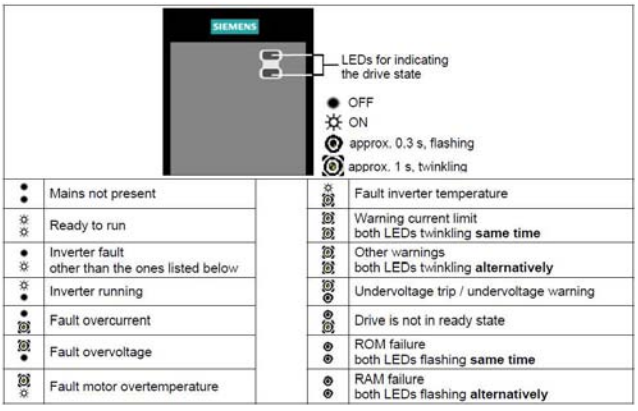


Figure 4. MM440 LED Status Display

Table 2. Fault Messages

MM420		MM440	
Fault	**Significance**	**Fault**	**Significance**
		F0001	Overcurrent
F0002	Overvoltage	F0002	Overvoltage
F0003	Undervoltage	F0003	Undervoltage
F0004	Inverter Overtemperature	F0004	Inverter Overtemperature
F0005	Inverter I2t	F0005	Inverter I2t
F0011	Motor Overtemperature I2t	F0011	Motor Overtemperature I2t
		F0012	Inverter temp. Signal lost
		F0015	Motor temp. Signal lost
		F0010	Mains Phase Missing
		F0021	Earth Fault
		F0022	HW Monitoring Active
		F0023	Output Fault
		F0024	Rectifier Overtemperature
		F0030	Fan Has Failed
		F0035	Auto Restart after n
		F0040	Automatic Calibration Failure
F0041	Stator resistance measurement failure	F0041	Motor Data Identification Failure
		F0042	Speed Control Optimization Failure
F0051	Parameter EEPROM Fault	F0051	Parameter EEPROM Fault
F0052	Powerstack Fault	F0052	Powerstack Fault
		F0053	IO EEPROM Fault
		F0054	Wrong IO Board
F0060	Asic Timeout	F0060	Asic Timeout
F0070	Communications board setpoint error	F0070	Communications board setpoint error
F0071	No Data for USS (RS232 link) during Telegram Off Time	F0071	USS (BOP Link) setpoint fault
F0072	No Data from USS (RS485 link) during Telegram Off Time	F0072	USS (COM Link) setpoint fault
F0080	Analogue input - lost input signal	F0080	Analogue input - lost input signal
F0085	External Fault	F0085	External Fault
		F0090	Encoder Feedback Loss
F0101	Stack Overflow	F0101	Stack Overflow
F0221	PI Feedback below minimum value	F0221	PI Feedback below minimum value
F0222	PI Feedback above maximum value	F0222	PI Feedback above maximum value
F0450	BIST Tests Failure	F0450	BIST Tests Failure
		F0452	Belt Failure Detected

Table 3. Alarm Messages

MM420		**MM440**	
Alarms	**Significance**	**Alarms**	**Significance**
A0501	Current Limit	A0501	Current Limit
A0502	Overvoltage limit	A0502	Overvoltage limit
A0503	Undervoltage Limit	A0503	Undervoltage Limit
A0504	Inverter Overtemperature	A0504	Inverter Overtemperature
A0505	Inverter I2t	A0505	Inverter I2t
A0506	Inverter Duty Cycle	A0506	Inverter Duty Cycle
A0511	Motor Overtemperature I2t	A0511	Motor Overtemperature I2t

		A0520	Rectifier Overtemperature
		A0521	Ambient Overtemperature
		A0522	I2C read out timeout
		A0523	Output fault
		A0535	Braking Resistor Output
A0541	Motor Data Identification Active	A0541	Motor Data Identification Active
		A0542	Speed Control Optimization Active
		A0590	Encoder feedback loss warning
A0600	RTOS Overrun Warning	A0600	RTOS Overrun Warning
A0700 - AO709	CB warning	A0700 - AO709	CB warning
A0710	CB communication error	A0710	CB communication error
A0711	CB configuration error	A0711	CB configuration error
A0910	Vdc-max controller de-activated	A0910	Vdc-max controller de-activated
A0911	Vdc-max controller active	A0911	Vdc-max controller active
		A0912	Vdc-min controller active
A0920	ADC parameters not set properly	A0920	ADC parameters not set properly
A0921	DAC parameters not set properly	A0921	DAC parameters not set properly
A0922	No load applied to inverter	A0922	No load applied to inverter
A0923	Both JOG Left and JOG Right are requested	A0923	Both JOG Left and JOG Right are requested
		A0952	Belt Failure Detected
		A0936	PID Autotuning Active

ABB VFDs

ACS 350

⚠ **WARNING** Ignoring the following instructions can cause physical injury or death, or damage to the equipment. Only qualified electricians are allowed to install and maintain the drive! Never work on the drive, motor cable or motor when input power is applied. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.

Before performing any maintenance activity, ensure by measuring with a multimeter (impedance at least 1 Mohm) that:

1. There is no voltage between the drive input phases U1, V1 and W1 and the ground.
2. There is no voltage between terminals BRK+ and BRK- and the ground.

- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may carry dangerous voltage even when the input power of the drive is switched off.
- Do not make any insulation or voltage withstand tests on the drive.
- If a drive whose EMC filter is not disconnected is installed on an IT system [an ungrounded power system or a high resistance-grounded (over 30 ohms) power system], the system will be connected to earth potential through the EMC filter capacitors of the drive. This may cause danger or damage the drive.
- If a drive whose EMC filter is not disconnected is installed on a corner grounded TN system, the drive will be damaged.

⚠ **WARNING** Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 and U2, V2, W2 and BRK+ and BRK-

⚠ **WARNING** The drive is not field repairable. Never attempt to repair a malfunctioning drive; contact your local ABB representative or Authorized Service Center for replacement. Make sure that dust from drilling does not enter the drive during the installation. Electrically conductive dust inside the drive may cause damage or lead to malfunction. Ensure sufficient cooling.

Operation and Start-up

- Do not activate automatic fault reset functions if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the motor with an AC contactor or disconnecting device (disconnecting means); use instead the control panel start and stop keys or external commands (I/O or fieldbus). The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is two per minute and the maximum total number of chargings is 15 000.
- If an external source for start command is selected and it is ON, the drive will start immediately after an input voltage break or fault reset unless the drive is configured for 3 wire (a pulse) start/stop.
- When the control location is not set to local (LOC not shown on the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the LOC/REM key LOC and then the stop key.

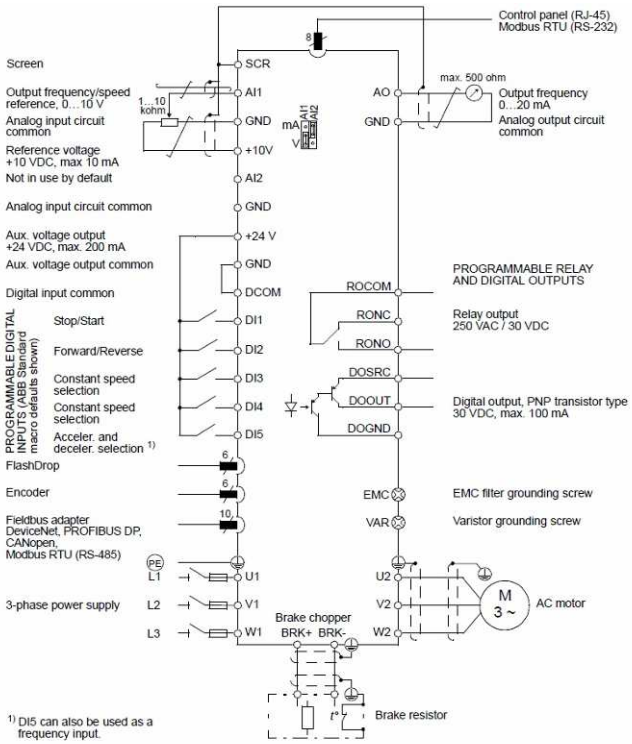


Figure 5. ACS 350 Block Diagram

Table 4. Alarm and Fault Codes

CODE	ALARM	CAUSE	WHAT TO DO
2001	OVERCURRENT (2310) *0308* bit 0 (programmable fault function *1610*)	Output current limit controller is active.	Check motor load. Check acceleration time (*2202* and *2205*). Check motor and motor cable (including phasing). Check ambient conditions. Load capacity decreases if installation site ambient temperature exceeds 40°C. See section *Derating* on page *291*.
2002	OVERVOLTAGE (3210) *0308* bit 1 (programmable fault function *1610*)	DC overvoltage controller is active.	Check deceleration time (*2203* and *2206*). Check input power line for static or transient overvoltage.
2003	UNDERVOLTAGE (3220) *0308* bit 2 (programmable fault function *1610*)	DC undervoltage controller is active.	Check input power supply.
2004	DIRLOCK *0308* bit 3	Change of direction is not allowed.	Check parameter *1003* DIRECTION settings.
2005	IO COMM (7510) *0308* bit 4 (programmable fault function *3018*, *3019*)	Fieldbus communication break	Check status of fieldbus communication. See chapter *Fieldbus control with fieldbus adapter*/*Fieldbus control with embedded fieldbus* or appropriate fieldbus adapter manual. Check fault function parameter settings. Check connections. Check if master can communicate.
2006	AI1 LOSS (8110) *0308* bit 5 (programmable fault function *3001*, *3021*)	Analog input AI1 signal has fallen below limit defined by parameter *3021* AI1 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
2007	AI2 LOSS (8110) *0308* bit 6 (programmable fault function *3001*,*3022*)	Analog input AI2 signal has fallen below limit defined by parameter *3022* AI2 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
2008	PANEL LOSS (5300) *0308* bit 7 (programmable fault function *3002*)	Control panel selected as active control location for drive has ceased communicating.	Check panel connection. Check fault function parameters. Check control panel connector. Refit control panel in mounting platform. If drive is external control mode (REM) and is set to accept start/stop, direction commands or references via control panel: Check group *10 START/STOP/DIR* and *11 REFERENCE SELECT* settings.

CODE	ALARM	CAUSE	WHAT TO DO
2009	DEVICE OVERTEMP (4210) *0308* bit 8	Drive IGBT temperature is excessive. Alarm limit is 120°C.	Check ambient conditions. See also section *Derating* on page *291*. Check air flow and fan operation. Check motor power against unit power.
2010	MOTOR TEMP (4310) *0305* bit 9 (programmable fault function *3005*...*3009* / *3503*)	Motor temperature is too high (or appears to be too high) due to excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings, load and cooling. Check start-up data. Check fault function parameters.
		Measured motor temperature has exceeded alarm limit set by parameter *3503* ALARM LIMIT.	Check value of alarm limit. Check that actual number of sensors corresponds to value set by parameter (*3501* SENSOR TYPE). Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
2011	UNDERLOAD (FF6A) *0308* bit 10 (programmable fault function *3013*...*3015*)	Motor load is too low due to e.g. release mechanism in driven equipment.	Check for problem in driven equipment. Check fault function parameters. Check motor power against unit power.
2012	MOTOR STALL (7121) *0308* bit 11 (programmable fault function *3010*...*3012*)	Motor is operating in stall region due to e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
2013	AUTORESET *0308* bit 12	Automatic reset alarm	Check parameter group *31 AUTOMATIC RESET* settings.
2018	PID SLEEP *0309* bit 1	Sleep function has entered sleeping mode.	See parameter groups *40 PROCESS PID SET 1*...*41 PROCESS PID SET 2*.
2019	ID RUN *0309* bit 2	Motor Identification Run is on.	This alarm belongs to normal start-up procedure. Wait until drive indicates that motor identification is completed.
2021	START ENABLE 1 MISSING *0309* bit 4	No Start Enable 1 signal received	Check parameter *1608* START ENABLE 1settings. Check digital input connections. Check fieldbus communication settings.
2022	START ENABLE 2 MISSING *0309* bit 5	No Start Enable 2 signal received	Check parameter *1609* START ENABLE 2 settings. Check digital input connections. Check fieldbus communication settings.
2023	EMERGENCY STOP *0309* bit 6	Drive has received emergency stop command and ramps to stop according to ramp time defined by parameter *2208* EMER DEC TIME.	Check that it is safe to continue operation. Return emergency stop push button to normal position.

CODE	ALARM	CAUSE	WHAT TO DO
2024	ENCODER ERR (7301) *0306* bit 6 (programmable fault function *5003*)	Communication fault between pulse encoder and pulse encoder interface module or between module and drive.	Check pulse encoder and its wiring, pulse encoder interface module and its wiring and parameter group *50 ENCODER* settings.
2025	FIRST START *0309* bit 8	Motor identification magnetisation is on. This alarm belongs to normal start-up procedure.	Wait until drive indicates that motor identification is completed.
2026	INPUT PHASE LOSS (3130) *0306* bit 5 (programmable fault function *3016*)	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse. Alarm is generated when DC voltage ripple exceeds 14% of nominal DC voltage.	Check input power line fuses. Check for input power supply imbalance. Check fault function parameters.

ALARM CODE	CAUSE	WHAT TO DO
5001	Drive is not responding.	Check panel connection.
5002	Incompatible communication profile	Contact your local ABB representative.
5010	Corrupted panel parameter backup file	Retry parameter upload. Retry parameter download.
5011	Drive is controlled from another source.	Change drive control to local control mode.
5012	Direction of rotation is locked.	Enable change of direction. See parameter *1003* DIRECTION.
5013	Panel control is disabled because start inhibit is active.	Deactivate start inhibit and retry. See parameter *2108* START INHIBIT.
5014	Panel control is disabled because of drive fault.	Reset drive fault and retry.
5015	Panel control is disabled because local control mode lock is active.	Deactivate local control mode lock and retry. See parameter *1606* LOCAL LOCK.
5018	Parameter default value is not found.	Contact your local ABB representative.
5019	Writing non-zero parameter value is prohibited.	Only parameter reset is allowed.
5020	Parameter or parameter group does not exist or parameter value is inconsistent.	Contact your local ABB representative.
5021	Parameter or parameter group is hidden.	Contact your local ABB representative.
5022	Parameter is write protected.	Parameter value is read-only and cannot be changed.
5023	Parameter change is not allowed, when drive is running.	Stop drive and change parameter value.
5024	Drive is executing task.	Wait until task is completed.
5025	Software is being uploaded or downloaded.	Wait until upload/download is complete.
5026	Value is at or below minimum limit.	Contact your local ABB representative.
5027	Value is at or above maximum limit.	Contact your local ABB representative.
5028	Invalid value	Contact your local ABB representative.

ALARM CODE	CAUSE	WHAT TO DO
5029	Memory is not ready.	Retry.
5030	Invalid request	Contact your local ABB representative.
5031	Drive is not ready for operation, e.g due to low DC voltage.	Check input power supply.
5032	Parameter error	Contact your local ABB representative.
5040	Parameter download error. Selected parameter set is not in current parameter backup file.	Perform upload function before download.
5041	Parameter backup file does not fit into memory.	Contact your local ABB representative.
5042	Parameter download error. Selected parameter set is not in current parameter backup file.	Perform upload function before download.
5043	No start inhibit	
5044	Parameter backup file restoring error	Check that file is compatible with drive.
5050	Parameter upload aborted	Retry parameter upload.
5051	File error	Contact your local ABB representative.
5052	Parameter upload has failed.	Retry parameter upload.
5060	Parameter download aborted	Retry parameter download.
5062	Parameter download has failed.	Retry parameter download.
5070	Panel backup memory write error	Contact your local ABB representative.
5071	Panel backup memory read error	Contact your local ABB representative.
5080	Operation is not allowed because drive is not in local control mode.	Switch to local control mode.
5081	Operation is not allowed because of active fault.	Check cause of fault and reset fault.
5082	Operation is not allowed because override mode is enabled.	
5083	Operation is not allowed because parameter lock is on.	Check parameter *1602* PARAMETER LOCK setting.
5084	Operation is not allowed because drive is performing task.	Wait until task is completed and retry.
5085	Parameter download from source to destination drive has failed.	Check that source and destination drive types are same, i.e. ACS350. See drive type designation label.
5086	Parameter download from source to destination drive has failed.	Check that source and destination drive type codes are same. See drive type designation label.
5087	Parameter download from source to destination drive has failed because parameter sets are incompatible.	Check that source and destination drive information are same. See parameters in group *33 INFORMATION*.
5088	Operation has failed because of drive memory error.	Contact your local ABB representative.
5089	Download has failed because of CRC error.	Contact your local ABB representative.
5090	Download has failed because of data processing error.	Contact your local ABB representative.
5091	Operation has failed because of parameter error.	Contact your local ABB representative.
5092	Parameter download from source to destination drive has failed because parameter sets are incompatible.	Check that source and destination drive information are same. See parameters in group *33 INFORMATION*.

Fault messages generated by the drive

CODE	FAULT	CAUSE	WHAT TO DO
0001	OVERCURRENT (2310) *0305* bit 0	Output current has exceeded trip level.	Check motor load. Check acceleration time (*2202* and *2205*). Check motor and motor cable (including phasing). Check ambient conditions. Load capacity decreases if installation site ambient temperature exceeds 40°C. See section *Derating* on page *291*.
0002	DC OVERVOLT (3210) *0305* bit 1	Excessive intermediate circuit DC voltage. DC overvoltage trip limit is 420 V for 200 V drives and 840 V for 400 V drives.	Check that overvoltage controller is on (parameter *2005* OVERVOLT CTRL). Check input power line for static or transient overvoltage. Check brake chopper and resistor (if used). DC overvoltage control must be deactivated when brake chopper and resistor is used. Check deceleration time (*2203*, *2206*). Retrofit frequency converter with brake chopper and brake resistor.
0003	DEV OVERTEMP (4210) *0305* bit 2	Drive IGBT temperature is excessive. Fault trip limit is 135°C.	Check ambient conditions. See also section *Derating* on page *291*. Check air flow and fan operation. Check motor power against unit power.
0004	SHORT CIRC (2340) *0305* bit 3	Short circuit in motor cable(s) or motor	Check motor and motor cable.
0006	DC UNDERVOLT (3220) *0305* bit 5	Intermediate circuit DC voltage is not sufficient due to missing input power line phase, blown fuse, rectifier bridge internal fault or too low input power.	Check that undervoltage controller is on (parameter *2006* UNDERVOLT CTRL). Check input power supply and fuses.
0007	AI1 LOSS (8110) *0305* bit 6 (programmable fault function *3001*, *3021*)	Analog input AI1 signal has fallen below limit defined by parameter *3021* AI1 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
0008	AI2 LOSS (8110) *0305* bit 7 (programmable fault function *3001*, *3022*)	Analog input AI2 signal has fallen below limit defined by parameter *3022* AI2 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.

CODE	FAULT	CAUSE	WHAT TO DO
0009	MOT OVERTEMP (4310) *0305* bit 8 (programmable fault function *3005*...*3009* / *3504*)	Motor temperature is too high (or appears to be too high) due to excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings, load and cooling. Check start-up data. Check fault function parameters.
		Measured motor temperature has exceeded fault limit set by parameter *3504* FAULT LIMIT.	Check value of fault limit. Check that actual number of sensors corresponds to value set by parameter (*3501* SENSOR TYPE). Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
0010	PANEL LOSS (5300) *0305* bit 9 (programmable fault function *3002*)	Control panel selected as active control location for drive has ceased communicating.	Check panel connection. Check fault function parameters. Check control panel connector. Refit control panel in mounting platform. If drive is external control mode (REM) and is set to accept start/stop, direction commands or references via control panel: Check group *10 START/STOP/DIR* and *11 REFERENCE SELECT* settings.
0011	ID RUN FAIL (FF84) *0305* bit 10	Motor ID Run is not completed successfully.	Check motor connection. Check start-up data (group *99 START-UP DATA*). Check maximum speed (parameter *2002*). It should be at least 80% of motor nominal speed (parameter *9908*). Ensure ID run has been performed according to instructions in section *How to perform the ID Run* on page *54*.
0012	MOTOR STALL (7121) *0305* bit 11 (programmable fault function *3010*...*3012*)	Motor is operating in stall region due to e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
0014	EXT FAULT 1 (9000) *0305* bit 13 (programmable fault function *3003*)	External fault 1	Check external devices for faults. Check parameter *3003* EXTERNAL FAULT 1 setting.
0015	EXT FAULT 2 (9001) *0305* bit 14 (programmable fault function *3004*)	External fault 2	Check external devices for faults. Check parameter *3004* EXTERNAL FAULT 2 setting.
0016	EARTH FAULT (2330) *0305* bit 15 (programmable fault function *3017*)	Drive has detected earth (ground) fault in motor or motor cable.	Check motor. Check fault function parameters. Check motor cable. Motor cable length must not exceed maximum specifications. See section *Motor connection* on page *296*.

CODE	FAULT	CAUSE	WHAT TO DO
0017	UNDERLOAD (FF6A) *0306* bit 0 (programmable fault function *3013*...*3015*)	Motor load is too low due to e.g. release mechanism in driven equipment.	Check for problem in driven equipment. Check fault function parameters. Check motor power against unit power.
0018	THERM FAIL (5210) *0306* bit 1	Drive internal fault. Thermistor used for drive internal temperature measurement is open or short-circuited.	Contact your local ABB representative.
0021	CURR MEAS (2211) *0306* bit 4	Drive internal fault. Current measurement is out of range.	Contact your local ABB representative.
0022	SUPPLY PHASE (3130) *0306* bit 5 (programmable fault function *3016*)	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse. Trip occurs when DC voltage ripple exceeds 14% of nominal DC voltage.	Check input power line fuses. Check for input power supply imbalance. Check fault function parameters.
0023	ENCODER ERR (7301) *0306* bit 6 (programmable fault function *5003*)	Communication fault between pulse encoder and pulse encoder interface module or between module and drive.	Check pulse encoder and its wiring, pulse encoder interface module and its wiring and parameter group *50 ENCODER* settings.
0024	OVERSPEED (7310) *0306* bit 7	Motor is turning faster than highest allowed speed due to incorrectly set minimum/ maximum speed, insufficient braking torque or changes in load when using torque reference. Operating range limits are set by parameters *2001* MINIMUM SPEED and *2002* MAXIMUM SPEED (with vector control) or *2007* MINIMUM FREQ and *2008* MAXIMUM FREQ (with scalar control).	Check minimum/maximum speed settings. Check adequacy of motor braking torque. Check applicability of torque control. Check need for brake chopper and resistor(s).
0026	DRIVE ID (5400) *0306* bit 9	Internal drive ID fault	Contact your local ABB representative.
0027	CONFIG FILE (630F) *0306* bit 10	Internal configuration file error	Contact your local ABB representative.

CODE	FAULT	CAUSE	WHAT TO DO
0028	SERIAL 1 ERR (7510) *0306* bit 11 (programmable fault function *3018*, *3019*)	Fieldbus communication break	Check status of fieldbus communication. See chapter *Fieldbus control with fieldbus adapter*/*Fieldbus control with embedded fieldbus* or appropriate fieldbus adapter manual. Check fault function parameter settings. Check connections. Check if master can communicate.
0030	FORCE TRIP (FF90) *0306* bit 13	Trip command received from fieldbus	See appropriate communication module manual.
0034	MOTOR PHASE (FF56) *0306* bit 14	Motor circuit fault due to missing motor phase or motor thermistor relay (used in motor temperature measurement) fault.	Check motor and motor cable. Check motor thermistor relay (if used).
0035	OUTP WIRING (FF95) *0306* bit 15 (programmable fault function *3023*)	Incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection).	Check input power connections. Check fault function parameters.
0036	INCOMPATIBLE SW (630F) *0307* bit 3	Loaded software is not compatible.	Contact your local ABB representative.
0101	SERF CORRUPT (FF55) *0307* bit 14	Drive internal error	Write down fault code and contact your local ABB representative.
0103	SERF MACRO (FF55) *0307* bit 14		
0201	DSP T1 OVERLOAD (6100) *0307* bit 13		
0202	DSP T2 OVERLOAD (6100) *0307* bit 13		
0203	DSP T3 OVERLOAD (6100) *0307* bit 13		
0204	DSP STACK ERROR (6100) *0307* bit 12		
0206	MMIO ID ERROR (5000) *0307* bit 11		

CODE	FAULT	CAUSE	WHAT TO DO
1000	PAR HZRPM (6320) *0307* bit 15	Incorrect speed/frequency limit parameter setting	Check parameter settings. Check that following applies: *2001* < *2002*, *2007* < *2008*, *2001*/*9908*, *2002*/*9908*, *2007*/*9907* and *2008*/*9907* are within range.
1003	PAR AI SCALE (6320) *0307* bit 15	Incorrect analog input AI signal scaling	Check parameter group *13 ANALOGUE INPUTS* settings. Check that following applies: *1301* < *1302*, *1304* < *1305*.
1004	PAR AO SCALE (6320) *0307* bit 15	Incorrect analog output AO signal scaling	Check parameter group *15 ANALOGUE OUTPUTS* settings. Check that following applies: *1504* < *1505*.
1005	PAR PCU 2 (6320) *0307* bit 15	Incorrect motor nominal power setting	Check parameter *9909* setting. Following must apply: 1.1 < (*9906* MOTOR NOM CURR · *9905* MOTOR NOM VOLT · 1.73 / P_N) < 3.0 Where P_N = 1000 · *9909* MOTOR NOM POWER (if units are in kW) or P_N = 746 · *9909* MOTOR NOM POWER (if units are in HP).
1007	PAR FBUSMISS (6320) *0307* bit 15	Fieldbus control has not been activated.	Check fieldbus parameter settings. See chapter *Fieldbus control with fieldbus adapter*.
1009	PAR PCU 1 (6320) *0307* bit 15	Incorrect motor nominal speed/ frequency setting	Check parameter settings. Following must apply: 1 < (60 · *9907* MOTOR NOM FREQ / *9908* MOTOR NOM SPEED) < 16 0.8 < *9908* MOTOR NOM SPEED / (120 · *9907* MOTOR NOM FREQ / Motor poles) < 0.992
1015	PAR CUSTOM U/F (6320) *0307* bit 15	Incorrect voltage to frequency (U/f) ratio voltage setting.	Check parameter *2610*...*2617* settings.
1017	PAR SETUP 1 (6320) *0307* bit 15	It is not allowed to use MTAC encoder module, frequency input signal and frequency output signal simultaneously.	Disable frequency output, frequency input or encoder: - change transistor output to digital mode (value of parameter *1804* = DIGITAL), or - change frequency input selection to other value in parameter groups *11 REFERENCE SELECT*, *40 PROCESS PID SET 1*, *41 PROCESS PID SET 2* and *42 EXT / TRIM PID*, or - disable (parameter *5002*) and remove MTAC encoder module.

ACH 550

⚠ **WARNING** The ACH550 adjustable speed AC drive should ONLY be installed by a qualified electrician.

⚠ **WARNING** Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 (L1, L2, L3) and U2, V2, W2 (T1, T2 T3) and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-

⚠ **WARNING** Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover. Even when power is switched off from the input terminals of the ACH550, there may be dangerous voltage (from external sources) on the terminals of the relay outputs.

⚠ **WARNING** When the control terminals of two or more drives are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the drives or an external supply. 1-4 ACH550-UH User's Manual Safety

⚠ **WARNING** Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system).

⚠ **WARNING** Do not attempt to install or remove EM1, EM3, F1 or F2 screws while power is applied to the drive's input terminals.

⚠ **WARNING** Do not control the motor with the disconnecting device (disconnecting means); instead, use the control panel keys or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

⚠ **WARNING** Never attempt to repair a malfunctioning ACH550; contact the factory or your local Authorized Service Center for repair or replacement.

⚠ **WARNING** The ACH550 will start up automatically after an input voltage interruption if the external run command is on.

Connection diagrams

The following diagrams show:

- The terminal layout for frame size R3, which, in general, applies to frame sizes R1...R6, except for the R5/R6 power and ground terminals.
- The R5/R6 power and ground terminals.
- The terminal layout for R7/R8.

R1...R4 (Diagram shows the R3 frame.)

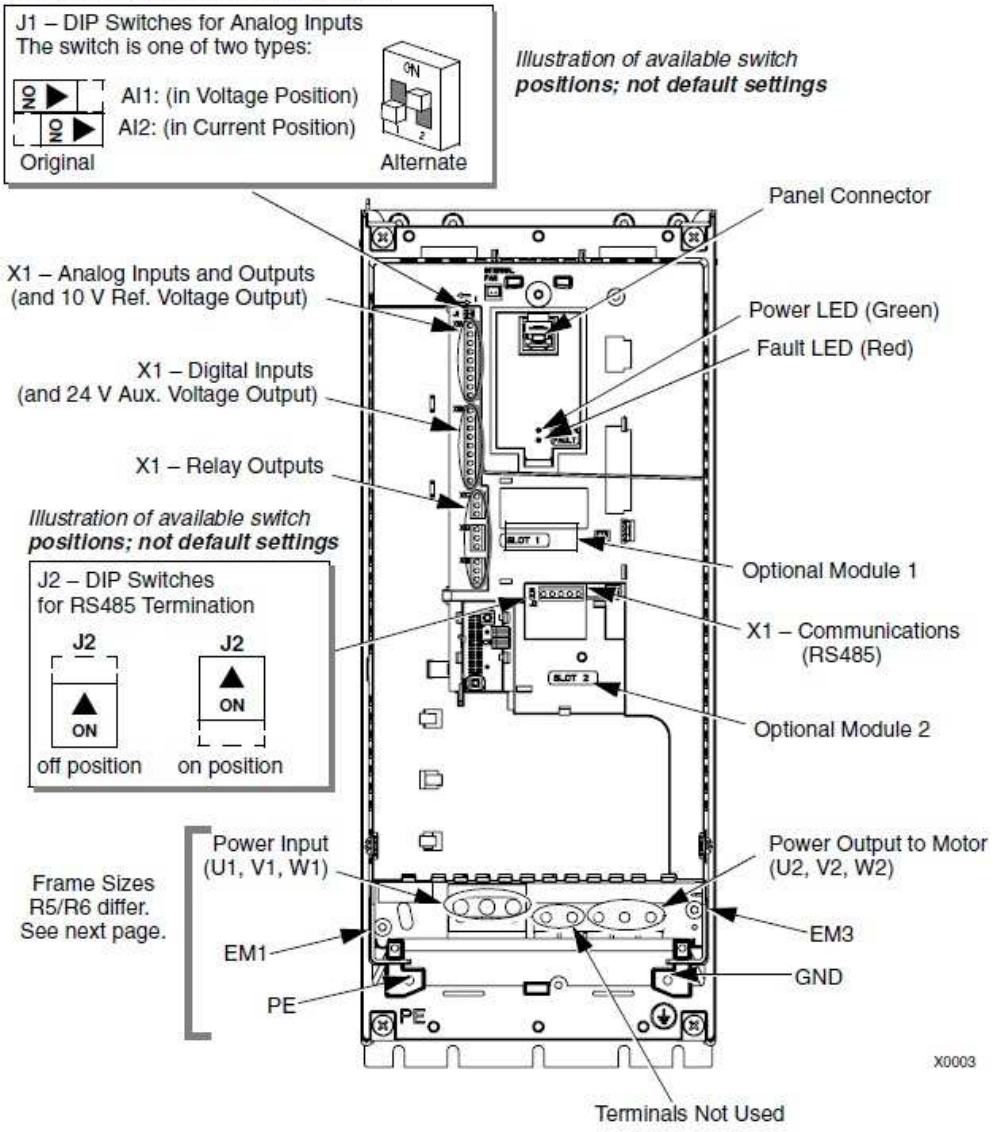


Figure 6. Wiring Diagram ACH 550

The following diagram shows the power and ground terminal layout for frame sizes R5 and R6.

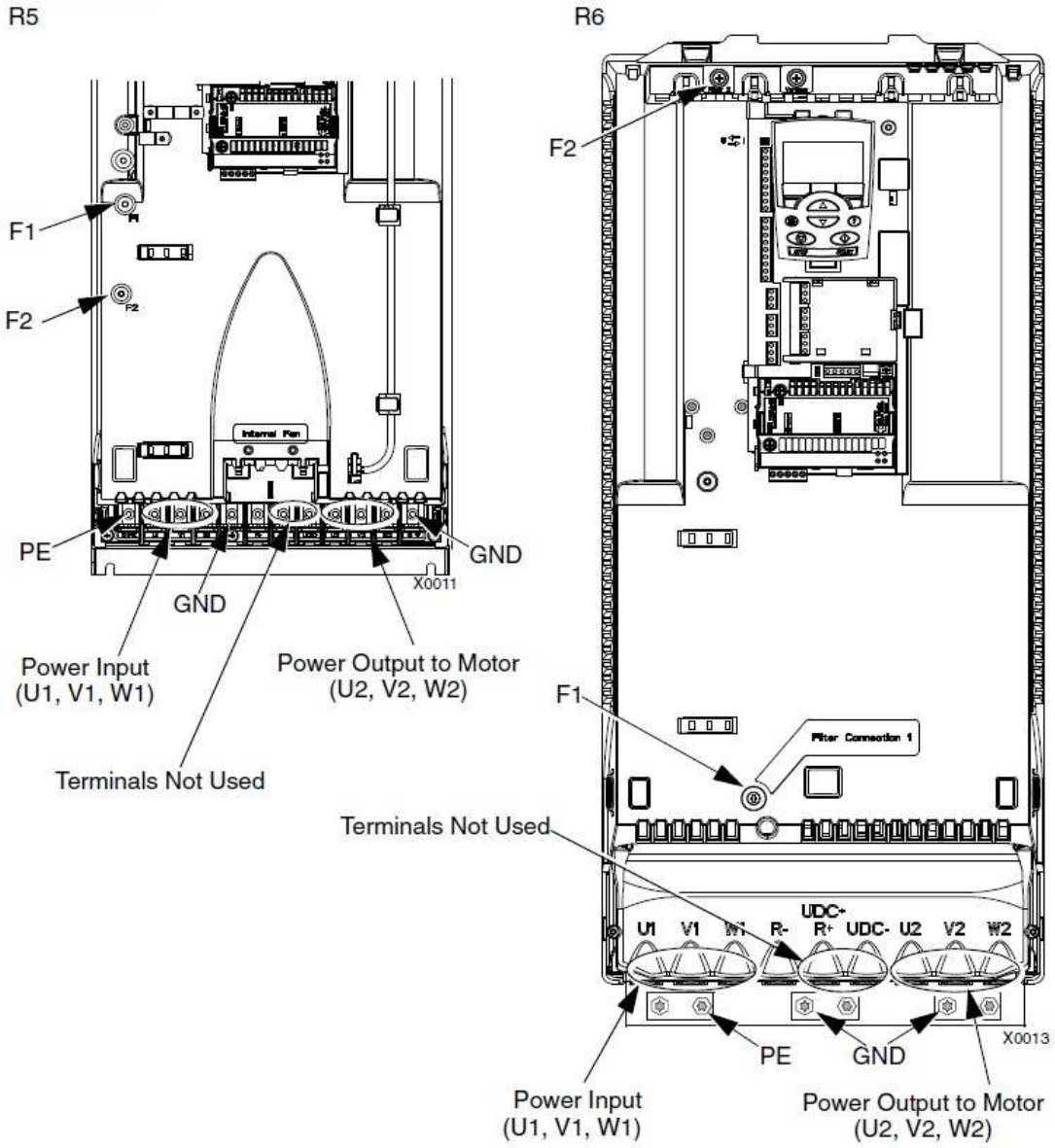
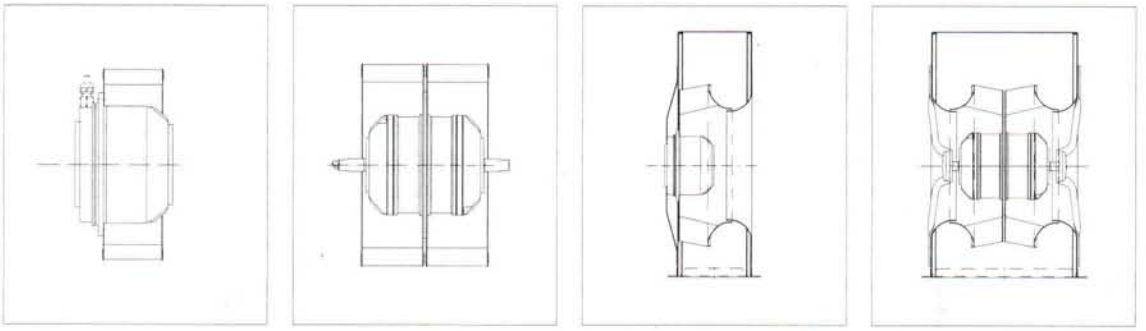


Figure 7. Wiring Diagram ACH 550

Operating Instruction

Centrifugal-/Cross-Flow Fans

RE, RH, RZ, RK, RG, RF, RD, RA, RM, RR



L-KL-2324

Content

Operating Instructions

To keep things manageable, these operating instructions do not contain all detailed information on all types of products and do not cover every conceivable installation, operation or maintenance situation. Please request this information from your dealer if you desire additional information or if special problems arise that are not covered in the operating instructions. Furthermore, we point out that the contents of these installation instructions are neither part of nor can they modify a previous or existing agreement, commitment or a legal relation. All Ziehl-Abegg obligations result from the respective bill of sale, which also contains the complete and solely valid warranty stipulations. These contractual warranty stipulations are neither expanded nor restricted through the explanations in these operating instructions. The right to technical changes is retained at all times.

L-BAL-005-08/07

Part.-No. 00407441

ZIEHL-ABEGG

Application

Ziehl-Abegg centrifugal series fans:

centrifugal:	**RE, RH**	**- motorized impellers single inlet**
	RZ, RK	**- motorized impellers double inlet**
	RG, RF	**- fans with scroll single inlet**
	RD, RA	**- fans with scroll double inlet**
cross-flow:	**RM**	**- motorized impellers single inlet**
	RR	**- tube or duct fans**

with integrated external rotor asynchronous-motors are not ready-for-use products but are conceived as components for air conditioning, ventilation, and exhaust air removal. A special motor design enables speed control through voltage reduction. When operating on frequency converters, please comply with the instructions in the operating conditions section. The fans may only be operated if they are installed in accordance with their intended use and safety has been secured through protective equipment in accordance with ISO 13852 (DIN EN ISO 12100) or other structural protective measures.

WARNING 	**Hazardous voltages and dangerous rotating machine parts** Death, severe injuries, property damage ► Any work on the fan whatsoever may only be carried out by qualified specialists ► Safety, installation and warning notices must be complied with ► Impeccable operation, proper transport, professional storage, erection and installation as well as conscientious operation and maintenance

Definitions

Qualified personnel
In the sense of the operating instructions and the warnings on the product itself, persons who are familiar with the erection, installation, commissioning and operation of the product, who comply with all relevant regulations / standards and who have the corresponding qualification for their job, such as:

- Apprenticeship or instruction and authorization to connect or disconnect electrical circuits, to ground them or to label them in accordance with safety engineering standards.
- Apprenticeship or instruction in accordance with safety engineering standards regarding care and use of suitable safety equipment.
- Training in First Aid.

DANGER 	means death or severe injury or significant property damage will occur if the corresponding precautions are not taken.

WARNING 	means death or severe injury or significant property damage can occur if the corresponding precautions are not taken.

CAUTION 	with a warning triangle means minor injuries can occur if the corresponding precautions are not taken

CAUTION	without a warning triangle means property damage can occur if the corresponding precautions are not taken.

ATTENTION	means an undesirable result or condition can arise if the corresponding warning is not heeded.

Safety information

WARNING 	**Explosive-prone areas** Death, severe injuries and/or property damage through explosion hazard ► Do not use in explosion endangered areas authorized to convey dusts, gasses, mist, vapours or mixtures thereof! This is not permissible. Explosion hazards, e.g. due to sparks, high temperatures.

WARNING 	**Solid matter or solids content in the carrier vehicle (air)** Danger of injury through the ejection of parts, damage to the fan is possible ► The fan is only intended for the conveyance of air or mixtures similar to air ► The conveyance of solid matter or solids content in the carrier vehicle is not permissible

- The fan is only to be operated within the ranges specified on the type plate! Use the fan only in the authorised fashion and only for the tasks and flow media specified in the order!
- The max. allowed operating specifications on the rating plate apply to an atmospheric density of $\rho = 1.2\ kg/m^3$.
- The thermostat switches (TB) integrated in the winding or PTC thermistors act as motor protection and must be connected!

CAUTION	**PTC test voltage not greater than 2.5V** The PTC can become defective, leading to damage to the fan through overheating possible ► permissible test voltage max. 2.5 V

- You must use a motor protection switch in motors without thermostat switches! When the motor is jammed / tight, the motor protection switch triggers, protecting it from a short-circuit and overloading.
- Compliance with the FCC EMC directives applies in connection with our closed loop controls and control devices. If the fans are complemented with components from other manufacturers, the manufacturer or operator of the entire system is responsible for compliance with these directives, especially with FCC / CFR 47. (EMC directive 89/336/EEC is to be complied with for re-import into the European economic area)

- Pay attention to the notes which concerning maintenance and service.
- These operating instructions are part of the product and, as such, are to be kept accessible at all times.
- A separate fault and performance monitoring-system with an alarm signal function is necessary in order to prevent personal injuries and material damages during malfunctions and in case the device fails. Substitute operation must be taken into consideration!

Transport, storage

- Care is imperative to ensure the fan arrives at its destination in first-class condition. If there are any signs of careless handling or transportation damage, immediately report this to the shipping company and to your Ziehl-Abegg sales office.
- Ziehl-Abegg axial fans are properly packed in the factory for the respectively agreed to form of transport.
- Transport the fan(s) either in the original packaging or, in the case of larger fans, on the dedicated transportation fixtures (housing flange, mounting bracket, holes on the motor housing to attach lifting eye-bolts), using a suitable means of transportation.

CAUTION 	**Suspended load** Death or crushing through falling loads ► Never walk under suspended loads

- Observe the weight data on the identification plate.

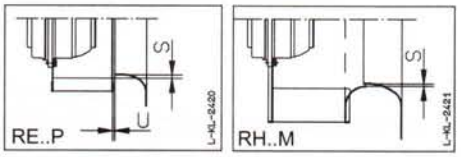
CAUTION 	**Transport on the connection cable** Damage to the fan or the electrical connection possible Death through electric shock possible ► Never transport the fan by the connection cable

- Avoid impacts and collisions including to fans installed on devices.
- Be on the alert for any damage to the packaging or the fan.
- Store the fan in its original packing dry and weather protected.
  - Cover the open pallet with tarpaulins and protect the fan from becoming soiled (e.g., shavings, stones, wires, etc.)
- Keep the storage temperature to between – 22F and + 104F
- Prevent excessively long storage periods (we recommend a maximum of one year). Before installing, check for the proper functioning of the motor bearing suspension. Corrosion and ageing of mechanical components, bearings, etc. can occur due to too long storage times (>1 year). That can lead to possible preliminary damage and a reduced useful life of the fans.

Installation

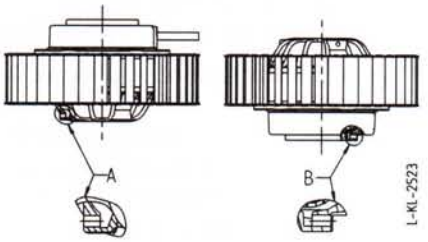
WARNING	**Death, severe injuries and/or damage to the fan are possible when working on the fan** ► Any kind of work installation, electrical connection, commissioning) is to be carried out by qualified personnel only.

- The system or plant manufacturer is responsible that the system related installation and safety notices are in accord with the applicable norms and regulations (DIN EN ISO 12100 / ISO 13852).
  - **Mounting types RE, RH, RM:** Use screws with a strength class of 8.8 to fasten to a stationary motor flange. Secure all threaded joints, e.g. with Loctite. Permissible torque: M6 = 9.5 Nm; M10 = 46 Nm; M12 = 79 Nm
  - **Design RZ, RK without add on parts:** attachment to axle ends according to manufacturers specifacions.
  - **Mounting types RA, RD, RF, RG, RR:** Fasten to the flange or mounting bracket, dependent on the housing construction. Secure all threaded joints, e.g. with Loctite.
- The following applies for all fans:
  - Do not install without adequat support. Flange and mounting bracket must be fixed flat on a level surface.
  - Ensure gap "U" or "S" is uniform according to illustration. Strain due to uneven support can lead to failure of the fan due to abrasion of the impeller.



  - In the case of a vertical motor axis, the respective lower condensation drain hole must be open.

drain hole



  - Electrical connection according to circuit diagram. The circuit diagram is located in the terminal box, for cable entry on the stator frame, respectively the cable or the fan housing.

DANGER	**Fatal electric shock from metal cable glands in the plastic terminal boxes possible if incorrectly connected** ► Do not use metal cable glands in plastic terminal boxes, as there is no potential equalization via the plastic terminal boxes.

  - Use filler plug seal for the cable glands also.
  - Depending on the layout, prepare the cable entry with water drainage conduits.
  - The terminal box must be tightly sealed.
  - The torque for the cover threading on the terminal box cover: plastic version 1.3 Nm, metal version 2.6 Nm

- Secure fan connection cable with cable fasteners or cable clips.
- Connect a thermostat switch (TB) or PTC with a triggering device so that no independent restarting is possible during excess temperature malfunctions.

WARNING 	**Independent restarting after cooling off is not permissible** Damage to the fan possible ► The temperature switch must be correctly inserted into the control circuit. ► We assume no liability for proper functioning when motor protection devices from external suppliers are used. ► Before restarting, analyze and repair the faults (e.g. storage damage, soiling, etc.)

- In Ziehl-Abegg speed controlled devices, the motor protection function is currently integrated, i.e., the thermostat switches (TB) or temperature sensors (TP) can be directly connected. When connecting multiple motors, the thermostat switch or temperature sensor must be connected in series! When doing so, be sure a temperature malfunction in one motor disconnects all motors together. In addition, we also offer separate circuit and motor protection devices. See catalogue E01 at www.ziehl-abegg.com in the "Download" section.

Operating Conditions

- Do not operate the fan in an explosive atmosphere.
- Switching frequency:
  - The fan is rated for continuous duty S1 (i.e. operation with a constant load that is applied as long as the machine can reach thermal equilibrium).

CAUTION	**Extreme switching frequency** Damage to the windings possible ► The controller must not permit extreme switching modes

- Ziehl-Abegg Centrifugal fans are suitable for operation with frequency converters if the following points are complied with:
  - All-pole effective sinusoidal filters are placed between the inverter and the motor (sinusoidal output voltage! Install phase to phase, phase to protective conductor) exactly as they are supplied by some inverter manufacturers. Please request our Technical Information L-TI-0510 regarding this. Frequency inverters from the Ziehl-Abegg Fcontrol series have an integrated all-pole effective sinusoidal filter!

CAUTION	**du/dt filters (also called motor or damping filters)** Damage to the winding and motor bearing is possible ► du/dt filters must not be used instead of sinusoidal filters.

  - When using sinusoidal filters, screened motor leads, metal terminal boxes and a second earth connection to the motor can, if necessary, be omitted. Check-back by the supplier of the sinusoidal filter.
- When operating via a frequency converter, you must reckon with increased leakage current (greater than 3.5 mA). Therefore, you must comply with locally prescribed protective measures, such as increased cross-section or a 2nd protective conductor for contact protection.

- During speed control using electronic voltage reduction (phase control), increased noise levels can occur due to resonances, depending on the installation situation. Here, we recommend additionally installing a type GFD noise filter.
- During speed control using voltage reduction, please observe a current increase in the partial load area can occur that is greater than the rated current. **ATTENTION: We assume no liability for proper functioning when voltage controllers and frequency converters from external suppliers are used.**
- Continuous sound levels greater than 70dB(A) are possible; see product catalogue. Continuous sound-level pressures larger than 85dB(A); wear hearing protection.
- IP55-fans with a seal which is rubbing may cause additional noise.

Start-up operation

WARNING 	**Contact protection (guard grille)** Danger of injury through body parts being pulled in or crushed! ► The guard grille must securely prevent reaching into rotating parts ► In case of an integrated, inaccessible installation, a suction-side guard grille in accordance with IP20 IEC 60529 is stipulated ► For accessible installations, a suction-side and pressure side guard grille according to IP20 EN60529 is prescribed ► Safety features, e.g. guard grilles, are not to be dismantled, circumvented or made inoperative!

- Before initial operation, check the following:
  - Installation and electrical connection have been properly completed.
  - All leftover installation materials and other foreign materials have been removed from the fan cavity.
  - Have all fastening elements been tightened to the prescribed torque?
  - Protective conductor has been connected.
  - Protective motor switch / PTC thermistor have been professionally connected and are functional.
  - Cable entry is sealed (see "Installation").
  - Installation position and the arrangement of condensation water drains correspond to each other.
  - Does the connection data comply with the specifications on the rating plate?
  - Motor operating capacitor data (1~ motors) complies with the specifications on the type plate.
- Commissioning may only take place if all safety instructions have been checked and danger can be excluded.
  - Check rotational direction/air feed direction: **Definition of the rotational direction according to pictures.**

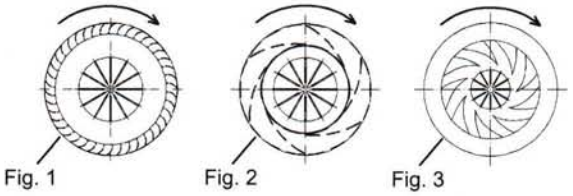


Fig. 1 Fig. 2 Fig. 3

Model	Fig.	
RE, RG..P/S/R, RF	1	looking at rotor
RZ, RD..P/S/R	1	looking at motor shaft and cabl
RH, RG..A, RG..M	2	looking at rotor
RD..A/K	2	looking at motor shaft and cabl
RM, RR	3	looking at rotor

– Watch out for smooth operation. Strong vibrations due to uneven motion (imbalance), e.g., caused by transportation damage or improver handing can lead to failure.

Repairs, maintenance

- The centrifugal fan is provided with "for-life" lubricated ball bearings. The fan is maintenance-free during the lubrication service-life period (30,000 – 40,000 operating hours for standard applications). Replace the bearings before the end of the lubrication service-life period or in case of damage. Ask for our service instructions about this or contact our repair department (special tools are needed!) When replacing the bearing, use genuine factory ball bearings only (special Ziehl-Abegg lubrication).
- In 1~ motors, the capacitor value decreases over time. The life expectancy is ca. 30,000 h based on IEC 60252
- Periodical servicing including cleaning is necessary in order to prevent imbalance caused by a build-up of dirt.

WARNING 	**Cleaning the fan** Death or severe injury can be caused by electric shock ► Never use a high-pressure cleaner (steam-jet), and in no case on a running fan ► Disconnect electricity from the fan before wet cleaning

– Watch out for vibration free motion!
– Service intervals in accordance with the degree of contamination of the impeller.

CAUTION	**During long down times in a humid atmosphere** Damage to the windings possible ► Run the fans for at least 2 hours per month in order to evaporate any moisture that may have entered ► Prevent long standstill times as far as possible

- Maintenance operation is only to be performed by trained service personnel.
- Observe the safety instructions and work regulations during all service and maintenance work

WARNING 	**Repair and maintenance of the fan** Death or severe injury can be caused by electric shock or by objects flying out ► Power supply is interrupted and secured against restoration! ► No maintenance work at running fan! ► Before reconnecting, free up the fan's airways - Danger due to objects flying out!

- Take note of abnormal operating noise!
- Please contact our service department about any other damage (e.g., winding damage).

DANGER 	**Imbalance after impeller installation and reinstallation** Death or severe injury can be caused by objects flying out Breakage under vibratory fan stress Damage to the fan and impeller ► after reinstallation, be sure to rebalance according to DIN ISO 1940, T1 ► Vibration severity less than 2.8 mm/s

Manufacturer / Service

Our products are manufactured in compliance with applicable international standards and regulations.
If you have any questions about how to use our products or if you are planning speical applications, please contact:

Ziehl-Abegg AG
Heinz-Ziehl-Straße
D-74653 Künzelsau (Germany)
Phone: +49(0)7940/16-0
Fax: +49(0)7940/16-30
info@ziehl-abegg.de
www.ziehl-abegg.com

Service address

USA / Kanada / Mexiko
Ziehl-Abegg Inc.
6348 Burnt Poplar Rd.
Greensboro, North Carolina 27409 (USA)
Phone: +1 (336) 834-9339, Fax: +1 (336) 834-9340
duncan.russell@ziehl-abegg.us, www.ziehl-abegg.com

Table 1. Pressure – Temperature Relation		
Temperature [F]	Pressure [psi g]	
	R-410a	R-407c
18	75.2	34.8
22	82.3	39.1
26	89.7	43.6
30	97.5	48.4
34	105.7	53.4
38	114.4	58.9
42	123.6	64.6
46	133.2	70.6
50	143.3	77.1
55	156.6	106.0
60	170.7	116.2
65	185.7	127.0
70	201.5	138.5
75	218.2	150.6
80	235.9	163.5
85	254.6	177.0
90	274.3	191.3
95	295.0	106.4
100	316.9	222.3
105	339.9	239.0
110	364.1	256.5
115	389.6	274.9
120	416.4	294.2
125	444.5	314.5
130	474.0	335.7
135	505.0	357.8
140	537.6	380.9
145	571.7	405.1
150	607.6	430.3
155	645.2	456.6

Startup Report - Seresco Technologies Inc.

Project Name		**NE Series Model**	
Location		**Serial Number**	
Site Contact/Tel:		**Seresco Rep.**	

Unit Visual Inspection

	Check	Comments
Supply air blowing on exterior doors and windows?		
No supply-return air short-circuiting?		
Outdoor air connected to Seresco unit?		
Exhaust fan installed and operating, away from intake?		
Vapor Barrier installed?		
Condensate P-Trap installed and filled?		
Condensate line tested?		
Pool Water piping properly installed?		
Auxiliary pool water circulating pump installed?		
Pool water flow to spec?		
OACC or Dry Cooler installed and wired properly?		
Nameplate voltages verified?		
Main disconnect installed?		
Wiring connections checked & tightened?		
Control wiring to aux pool heater installed?		
Floor drain in mechanical room?		
Chemicals stored in separate ventilated room?		
Air balance report on file?		
List other external controlled components		
WebSentry connected?		
Blowers, compressors rotation checked?		
Adequate service access provided?		
Unit's leveled and vibration isolated?		
Flex connectors used at both duct connections?		
What type of refrigerant is used?		

Unit Electrical Data

	L1 – L2	L1 – L3	L2 – L3	Nameplate
Unit Voltage (V)				
Transformer secondary voltage (V)				
Compressor 1 (A)				
Compressor 2 (A)				
Main Blower 1 (A)				
Main Blower 2 (A)				
Exhaust Blower 1 (A)				
Exhaust Blower2 (A)				
Purge Blower 1 (A)				
Purge Blower 2 (A)				
OACC Motor 1 (A)				
OACC Motor 2 (A)				
OACC Motor 3 (A)				
OACC Motor 4 (A)				
Heat Recovery Pump (A)				
Hot Water Pump (A)				
Hot Water Pump 2(A)				

NOTE: Put ALL additional info/comments into **Notes** section.

Outdoor Air Condensing / Cooling Unit inspection

	Check	Comments/Data
OACC or dry cooler located how feet above/below/level with Seresco Unit?		
Oil traps installed for OACC?		
Model number of condenser		
Field charge added in pounds and refrigerant type		
Fluid GPM		
Glycol %		
Glycol stabilizers added?		
Distance from Seresco Unit to OACC or dry cooler (one-way line length), ft		
Hot gas line size (in)		
Liquid line size (in)		
Pipe size to dry cooler (in)		

Fluid Temperature entering main unit (F)		
Fluid Temperature leaving main unit (F)		
Piping and valves installed per spec?		

Unit Operating Data and Configurations

Operating Data						Unit Configuration	
Sensor	**Reheat**	**Reheat + Pool heat**	**A/C**	**A/C + Pool heat**		**Setpoints**	**Value**
Return Air (F)						Return Air (F)	
Return Air (% RH)						Return Air (RH)	
Supply Air (F)						Pool 1 (F)	
Pool 1 In (F)						Pool 2 (F)	
Pool 1 Out (F)						Purge (F)	
Pool 2 In (F)						HR (F)	
Pool 2 Out (F)						Economizer (F)	
Outdoor Air (F)							
Comp 1 HP (psi)						Air Heating Type	
Comp 1 LP (psi)						Clock Set?	
Comp 1 Suction (F)						Board #	
Comp 1 Discharge (F)						MAC address	
Evap 1 (F)						IP address	
Superheat 1 (F)							
Comp 2 HP (psi)						BACNET?	
Comp 2 LP (psi)						LON?	
Comp 2 Suction (F)						MODBUS?	
Comp 2 Discharge (F)							
Evap 2 (F)							
Superheat 2 (F)						**NOTE**: Check/verify superheat is within 18 – 22 F margin; refer to Pressure -Temperature chart for proper refrigerant. Adjust if required.	
Exhaust (F)							
Reheat (F)							
T/B Sight Glasess1							
T/B Sight Glasses 2						**NOTE**: For Receiver Sight glasses: T(top)/B(bottom) make note whether ball is "UP" or "DOWN".	
Moisture Indicator 1							
Moisture Indicator 2							

Startup Date	
Startup Company Name	
Startup Company Contact #	
Startup Technician Name	
Startup Technician Contact #	

Notes/Comments/Info

For tech support call: 1-770-457-3392 ext.2# OR 1-613-741-3603 ext.4#

Startup Report - Seresco Technologies Inc.

Project Name		**NE Series Model**	
Location		**Serial Number**	
Site Contact/Tel:		**Seresco Rep.**	

Unit Visual Inspection

	Check	Comments
Supply air blowing on exterior doors and windows?		
No supply-return air short-circuiting?		
Outdoor air connected to Seresco unit?		
Exhaust fan installed and operating, away from intake?		
Vapor Barrier installed?		
Condensate P-Trap installed and filled?		
Condensate line tested?		
Pool Water piping properly installed?		
Auxiliary pool water circulating pump installed?		
Pool water flow to spec?		
OACC or Dry Cooler installed and wired properly?		
Nameplate voltages verified?		
Main disconnect installed?		
Wiring connections checked & tightened?		
Control wiring to aux pool heater installed?		
Floor drain in mechanical room?		
Chemicals stored in separate ventilated room?		
Air balance report on file?		
List other external controlled components		
WebSentry connected?		
Blowers, compressors rotation checked?		
Adequate service access provided?		
Unit's leveled and vibration isolated?		
Flex connectors used at both duct connections?		
What type of refrigerant is used?		

Unit Electrical Data

	L1 – L2	L1 – L3	L2 – L3	Nameplate
Unit Voltage (V)				
Transformer secondary voltage (V)				
Compressor 1 (A)				
Compressor 2 (A)				
Main Blower 1 (A)				
Main Blower 2 (A)				
Exhaust Blower 1 (A)				
Exhaust Blower2 (A)				
Purge Blower 1 (A)				
Purge Blower 2 (A)				
OACC Motor 1 (A)				
OACC Motor 2 (A)				
OACC Motor 3 (A)				
OACC Motor 4 (A)				
Heat Recovery Pump (A)				
Hot Water Pump (A)				
Hot Water Pump 2(A)				

NOTE: Put ALL additional info/comments into **Notes** section.

Outdoor Air Condensing / Cooling Unit inspection

	Check	Comments/Data
OACC or dry cooler located how feet above/below/level with Seresco Unit?		
Oil traps installed for OACC?		
Model number of condenser		
Field charge added in pounds and refrigerant type		
Fluid GPM		
Glycol %		
Glycol stabilizers added?		
Distance from Seresco Unit to OACC or dry cooler (one-way line length), ft		
Hot gas line size (in)		
Liquid line size (in)		
Pipe size to dry cooler (in)		

Fluid Temperature entering main unit (F)		
Fluid Temperature leaving main unit (F)		
Piping and valves installed per spec?		

Unit Operating Data and Configurations

Operating Data						Unit Configuration	
Sensor	**Reheat**	**Reheat + Pool heat**	**A/C**	**A/C + Pool heat**		**Setpoints**	**Value**
Return Air (F)						Return Air (F)	
Return Air (% RH)						Return Air (RH)	
Supply Air (F)						Pool 1 (F)	
Pool 1 In (F)						Pool 2 (F)	
Pool 1 Out (F)						Purge (F)	
Pool 2 In (F)						HR (F)	
Pool 2 Out (F)						Economizer (F)	
Outdoor Air (F)							
Comp 1 HP (psi)						Air Heating Type	
Comp 1 LP (psi)						Clock Set?	
Comp 1 Suction (F)						Board #	
Comp 1 Discharge (F)						MAC address	
Evap 1 (F)						IP address	
Superheat 1 (F)							
Comp 2 HP (psi)						BACNET?	
Comp 2 LP (psi)						LON?	
Comp 2 Suction (F)						MODBUS?	
Comp 2 Discharge (F)							
Evap 2 (F)							
Superheat 2 (F)						**NOTE**: Check/verify superheat is within 18 – 22 F margin; refer to Pressure -Temperature chart for proper refrigerant. Adjust if required.	
Exhaust (F)							
Reheat (F)							
T/B Sight Glasess1							
T/B Sight Glasses 2						**NOTE**: For Receiver Sight glasses: T(top)/B(bottom) make note whether ball is "UP" or "DOWN".	
Moisture Indicator 1							
Moisture Indicator 2							

Startup Date	
Startup Company Name	
Startup Company Contact #	
Startup Technician Name	
Startup Technician Contact #	

Notes/Comments/Info

For tech support call: 1-770-457-3392 ext.2# OR 1-613-741-3603 ext.4#

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www.serescodehumidifiers.com

Issue Date : 2011-09-30

Supersedes : 2011-09-20

Seresco Technologies Inc. has a policy of continuous product and product data improvement and reserves the right to change design and specifications at any time without prior notification. Only qualified technicians working within their area of competence should perform the installation and maintenance of equipment referred to in this literature.