IMPORTANT:

READ THIS MANUAL THOROUGHLY BEFORE INSTALLING AND OPERATING UNIT. IT IS THE CUSTOMERS RESPONSIBILITY TO WIRE UNIT WITH THE APPLICABLE ELECTRICAL CORD AND PLUG FOR USE IN HAZARDOUS DUTY ENVIRONMENTS PER LOCAL LAWS AND REGULATIONS. WIRING SHOULD BE COMPLETED BY A LICENSED ELECTRICIAN WITH KNOWLEDGE ON HAZARDOUS DUTY WIRING.

Phoenix C4XE - Membrane Based Portable Lube and Hydraulic Oil Purifier Cart For use in Hazardous Duty Locations.

Rev 0-PHX-C4XE-OPSM-06082016-KB

INDEX

SECTION 1

PHOENIX SPECIFICATIONS

FLOW RATE:	4 GPM
MAX OPERATING VISCOSITY	3 cSt to 3000 cSt
FLUID/OIL COMPATIBILITY	MINERAL BASED, PAO AND POLYOLESTER (Phosphate Ester Membrane Optional)
MAX RECOMMENDED OPERATING PRESSURE	20 PSIG
MIN/MAX OPERATING AMBIENT TEMP	1 – 50 C
MIN/MAX STORAGE TEMP	- 20 – 60 C
MIN/MAX OPERATING FLUID TEMP	- 15C – 80 C
EMPTY WEIGHT	250 LBS
INLET/OUTLET CONNECTIONS	1” Male JIC
DIMENSIONS	20”W X 22”D X 51”H
VOLTAGE	110V STANDARD 220 V OPTIONAL
MAX AMPERAGE DRAW	12.5 AMPS/ 6 AMPS
FLUID PUMP AND VACUUM PUMP MOTOR ELECTRICAL	Class 1, Group C & D,
MOTOR ELECTRICAL CONTRO BOX SPECIFICATIONS	Class 1, Div 1 & 2, GR, C&D, Class II Div 1 & 2 GR, E, F, G

SECTION 2:

Phoenix Portable Lube and Hydraulic Membrane Oil Purifier

For use in Hazardous Locations.

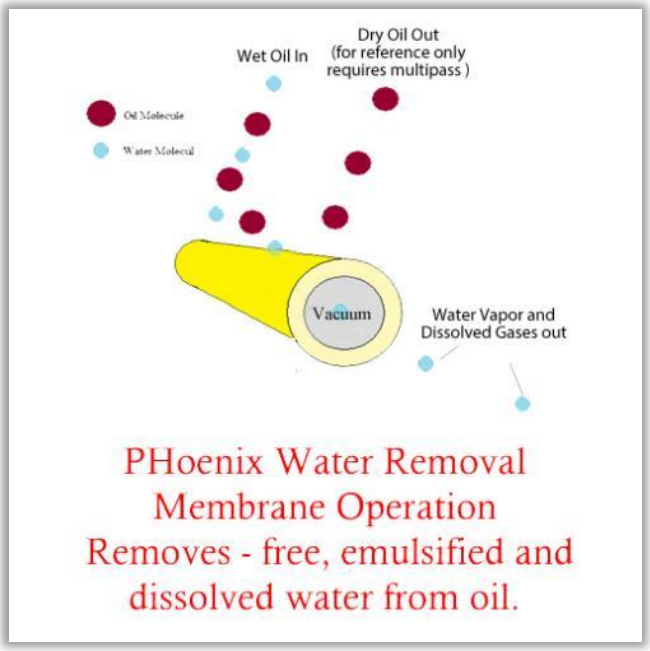
(Description and Operation)

The Phoenix oil purifier is a compact and portable 4 gpm oil dehydrator and filter cart with the capability to remove particulate along with free, emulsified and dissolved water from lube and hydraulic systems of between 20 and 1000 gallons (water ingression level and oil temp dependent).

The Phoenix utilizes a cutting edge hollow fiber membrane bundle to remove water from oil. Moisture is pulled out of the oil by a vacuum as wet oil passes across the outside of the membrane. A vacuum created by a supplied vacuum pump pulls moisture through the membrane where it is expelled as vapor from the vacuum pumps exhaust port. Water levels as low as 25 ppm are achievable depending on oil sump size and water ingression levels. This cutting edge technology has no limit to the quantity of water it can remove and requires minimal maintenance and operator attention. It should provide years of worry and trouble free operation before replacement.

IMPORTANT NOTE:

The membrane bundle is not serviceable in the field and should be returned for replacement when its useful life is complete. Never try to disassemble the membrane housing in the field or damage to the bundle may occur.



Disclaimer: Photo is illustrative. The membrane is not claimed as defect free and there may be very slight oil carryover to the vacuum side. This does not however effect the performance or many benefits of the Phoenix Purifier. Water Removal is multi-pass and requires several passes of oil across membrane to be fully effective.

Figure 1

(SECTION 2: Description and Operation - Continued)

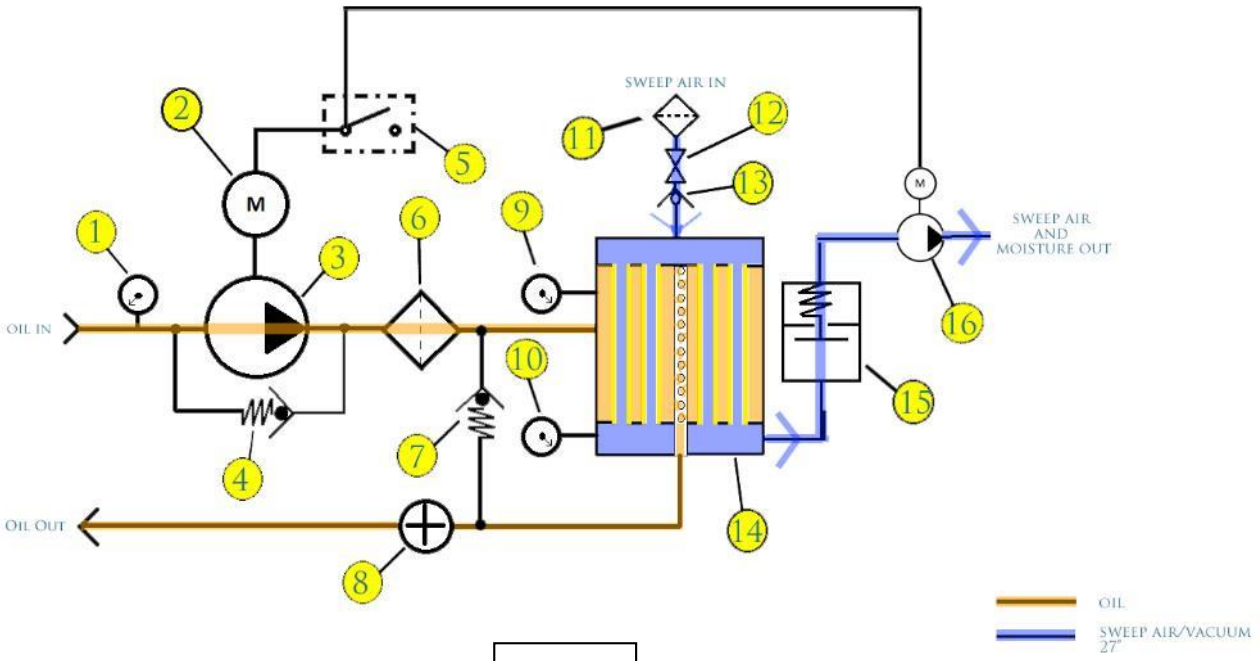


Figure 2

Oil is pumped into the Phoenix Cart by (item 3) a 4 gpm gear pump with a (item 4) integral 65 psid relief valve. The fluid pump motor and on off switch (items 2 and 5) are specified for use in Hazardous duty locations. Oil then flows into (item 6) particulate filter element and housing. There is a visual filter plugged indicator on the filter housing to tell when the filter element is plugged. (Item 1) is a vacuum gauge which shows the inlet vacuum that the fluid pump is pulling. A vacuum reading above 25” is an indication of restriction in the fluid line. To prevent cavitation and potential damage to the fluid pump never run the Phoenix for prolonged periods of time with a vacuum reading above 25” on (Item 1). Reference the trouble shooting guide included with this manual for tips on lowering the suction line vacuum reading.

Oil then passes into (item 14) the maintenance free and non-replaceable water removal membrane. A 10 psid spring loaded check valve (Item 7) is piped in parallel with the water removal membrane housing to provide pressure relief across the membrane bundle in the event of excess differential pressure. The membrane housing may handle up to 150 psig of total pressure however (Item 7) the relief limits the total pressure drop possible across the membrane bundle to about 10 psid. This total pressure may be read from the (item 9) 0-100 psig liquid filled pressure gauge installed on the back of the Phoenix purifier.

After oil enters the membrane housing it is forced across the water removal membrane and then exits the housing. Water is removed from the oil as it passes across the membrane. If the spring loaded bypass (item 7) is open, then partial flow from the membrane housing will recombine with partial non dewatered oil passing through the check valve. Both combined flows exit the purifier and return to the oil reservoir through (item 8) - a sight glass with a spinning oil flow indicator. A vacuum is generated by the (item 16) a vacuum pump with hazardous duty moto. This vacuum pump generates the vacuum and driving force to remove water from the oil. The Vacuum pump is designed to pull up to 27” of vacuum on the inside of the water removing hollow fibers while still pulling sweep air through (items 11,12 and 13) the (vent filter, vacuum control valve and leak prevention check valve) .

(Item 15) An air eliminator is installed between the membrane housing and vacuum pump in order to prevent any oil leakage to the vacuum side in the event that the membrane is compromised. The air eliminator (Item 15) and the check valve installed (Item 13) allow the Phoenix to automatically seal itself completely off in the unlikely event of a membrane break or rupture. See figures 3 through 5 below showing sweep air flow for further information.

The total vacuum generated by (Item 16) vacuum pump is controlled by manually throttling down on the control valve (item 12) and may be read in inches of mercury on the vacuum gauge (item 10). Vacuum is typically set between 25” and 27” of mercury but may vary as water levels in the oil rise and fall. There is a sight glass and drip leg located on the membrane in order to drain any potential condensation from the line.

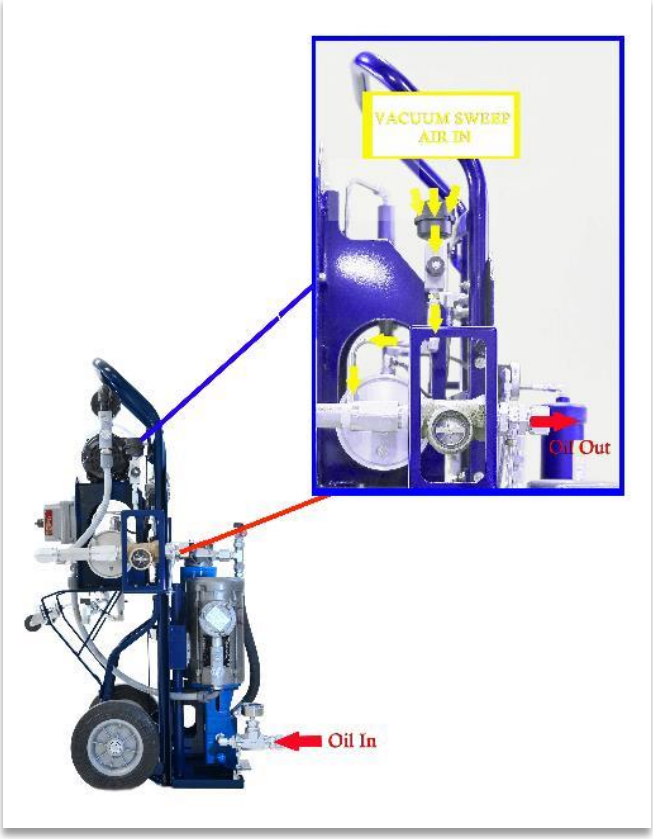


Figure 3

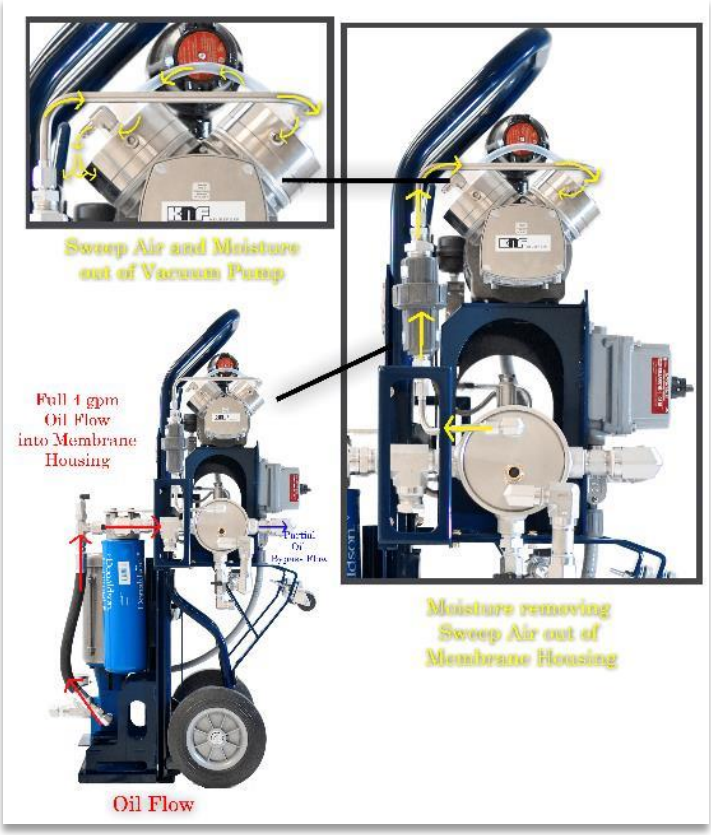


Figure 4

SECTION 3: COMPONENT LIST AND DESCRIPTION

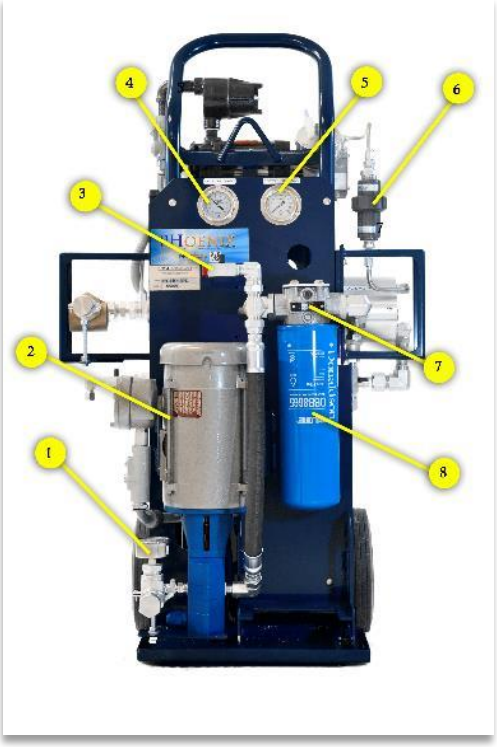


Figure 5

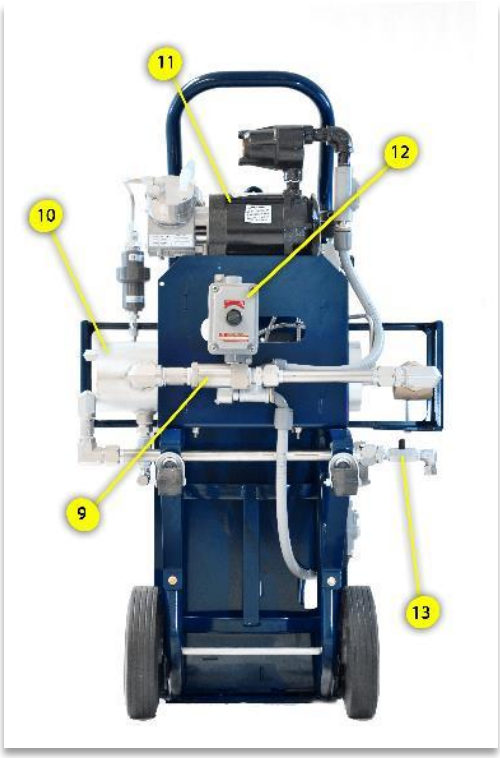


Figure 6

Figure 7

Figure 8

(SECTION: 3 Component List and Description – Continued)

See Figures 5-8 on page 5

Item	Qty	Description
1	1	Inlet Fluid Pump Compound Vacuum/Pressure Gauge
2	1	110/230 V Class 1, Group D, Class 2, Group F&G, T3C Fluid Pump Motor w 4 gpm Gear Pump 50 psid integral relief.
3	1	Inlet Oil Sample Valve
4	1	Membrane Vacuum Gauge
5	1	Membrane Pressure Gauge
6	1	Vacuum Air Eliminator Leak Protector
7	1	Particulate Filter Plugged Indicator
8	1	Particulate Filter Element (7 um Beta 2000) Do not substitute Larger Micron.
9	1	10 psid Membrane Bypass Check Valve
10	1	Water Removal Membrane Housing
9	1	Upstream Particulate Filter Oil Sample Valve and Filter Housing Drain Valve.
10	1	10 psid Differential Pressure Membrane Bypass Check Valve
11	1	115/230 UL/CUL Rated Class 1 Groups C&D Vacuum Pump
12	1	Class 1 Groups C&D On/Off Switch.
13	1	Oil and or Water Vacuum Line Condensation Drip Leg
14	1	Membrane Housing Drain Valve
16	1	Vacuum Line Vent Filter
17	1	Vacuum Adjustment Valve
18	1	Outlet Oil Flow Spinning Indicator

Section 4:

(RECOMMENDED INSTALLATION)

IMPORTANT

DO NOT CONNECT THE PHOENIX PURIFIER OUTLET LINE TO ANY POINT OR PRESSURE LINE WHERE THE BACK PRESSURE COULD EXCEED 20 PSIG OR DAMAGE TO THE MEMBRANE BUNDLE COULD OCCUR AND REPLACEMENT MAY BE NECESSARY. IT IS IDEAL TO CONNECT THE RETURN LINE OF THE PHOENIX TO A POINT OF LOWEST PRESSURE AS POSSIBLE SUCH AS ON A T DOWNSTREAM OF A BREATHER FILTER

There are several ways to connect the Phoenix membrane purifier to a reservoir with some being better than others. Figures 9 shows two ideal ways since they both allow suction from the bottom of the reservoir where water and particulate can collect and return to the top away from the suction. This provides the maximum turnover of oil while the siphon breaks provide a level of safety in the event of a hose or fitting break/leak preventing the possibility of accidentally completely draining the reservoir. For good practices the return pipe should be unobstructed and end below the oil line to prevent aeration of the oil upon return to the reservoir.

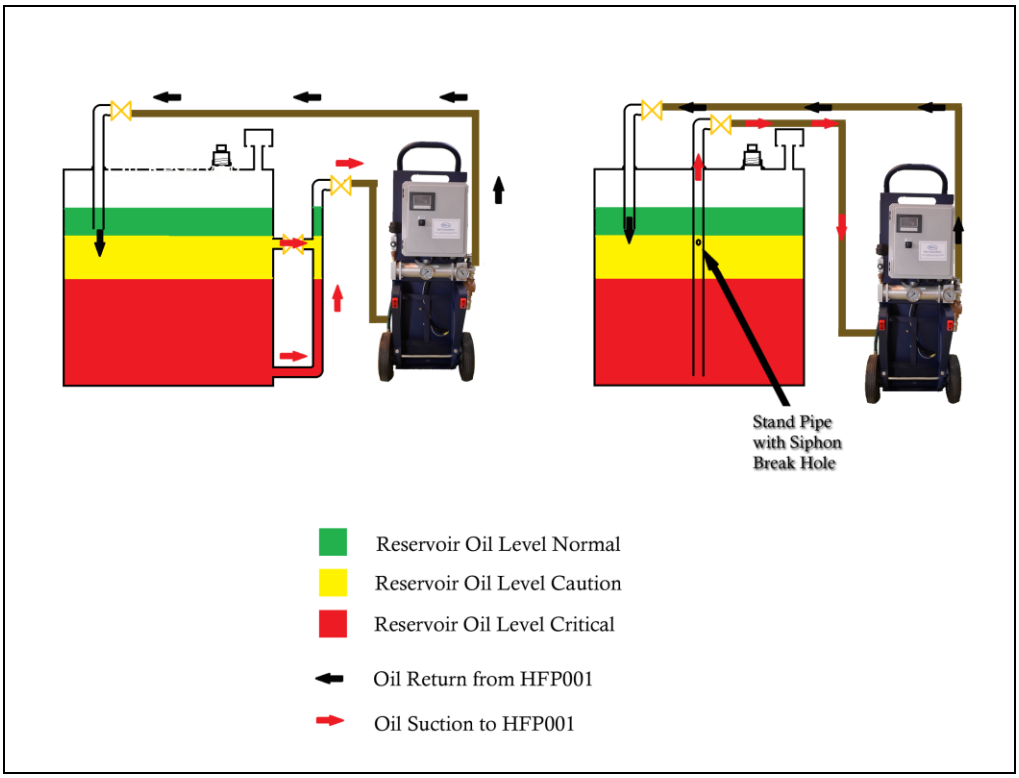


Figure 9

Section 5:

Unit Startup/Crane Rigging Instructions

CRANE RIGGING

If lifting and moving unit with a crane lift from this point figure 10 only!

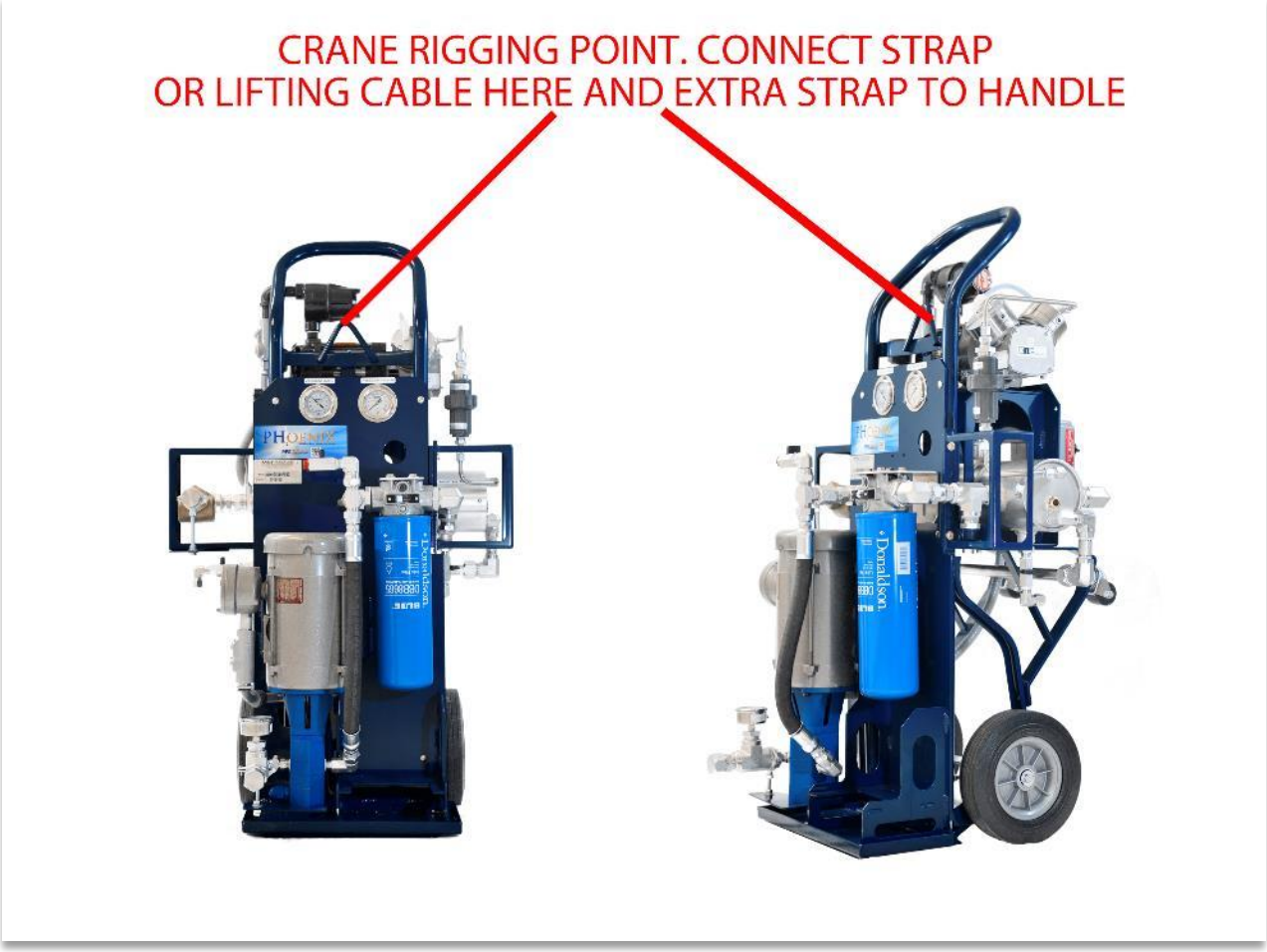


Figure 10

ϟ Connections ϟ

Electrical – See Figure 11 Below. Should be done by a licensed Electrician knowledgeable in Hazardous Duty Wiring and Recepticles. The PHX –C4XE is not shipped with a powercord or plug since there are too many available explosion proof plugs to standardize on. It is therefore the customers responsibility to pick and wire the correct plug and cord based on applicable voltage, amp draw and control box sealing along with local explosion proof codes and laws or catastrophic damage can occur to both people and property. Once Electrical is connected then plug Phoenix into Power Supply.

Inlet/Outlet hose connection – See Figure 13 Below. Use at minimum 1 " Hydraulic Full Vacuum Hose with 1" Jic Swivel Connections. Cases where oil viscosity is higher than 360 weight may require 1.5" Hydraulic Hose adapted down to 1" connections on the unit. Inlet Hose should be less than 8-10' if possible. Open all supply and return valves off of the oil supply system to make sure oil has an unobstructed flow path to and from Phoenix. Check for any leaks in hoses and connections before continuing.

Figure 11

Figure 12

1. AFTER FOLLOWING INSTRUCTIONS ON PREVIOUS PAGE MAKE SURE ALL CONNECTIONS AND SUPPLY VALVES TO PHOENIX ARE OPEN AND THEN ENERGIZE FLUID PUMP BY TURNING POWER KNOB

2. IMMEDIATELY CHECK SPINNER FLOW INDICATOR ON SIDE OF UNIT TO SEE IF OIL IS FLOWING OUT WHICH MAY TAKE A FEW SECONDS OR SO. IF OIL IS CONFIRMED CHECK INLET COMPOUND VACUUM GAUGE TO INSURE THAT READING IS BETWEEN 0 PSIG AND 25” HG. IF READING IS OUT OF SPECIFICATION OR IF OIL IS NOT SHOWING IN SPINNER FLOW INDICATOR – SHUT DOWN UNIT AND LOOK FOR OBSTRUCTION IN OIL LINES OR CHECK IN TROUBLE SHOOTING GUIDE OF THIS MANUAL.

3. CHECK MEMBRANE PRESSURE GAUGE ON BACK PANEL TO BE LESS THAN 25 PSIG. IF PRESSURE IS HIGHER THAN 40 PSIG SHUT UNIT DOWN AND LOOK FOR OBSTRUCTION IN UPSTREAM HOSES AND ALSO CHECK TO MAKE SURE ALL SUPPLY VALVES FROM OIL SUPPLY ARE COMPLETELY OPEN. IF ISSUE CONTINUES CHECK TROUBLE SHOOTING GUIDE IN THIS MANUAL.

IF UNIT IS FUNCTIONING NORMALLY CHECK ALL SUPPLY HOSES AND FITTINGS ON UNIT FOR ANY OIL LEAKAGE AND CORRECT OR TIGHTEN AS NECESSARY BEFORE GOING FORWARD.

6. CHECK VACUUM GAUGE ON BACK PANEL AND INSURE VACUUM IS BETWEEN 23 AND 27 HG OF MERCURY. IF VACUUM IS LOWER ADJUST THROTTLE VALVE UNDER VENT FILTER. IMPORTANT - DO NOT CLOSE ADJUSTMENT VALVE ALL THE WAY SINCE SOME SWEEP AIR IS REQUIRED. TURN KNOB JUST BETWEEN 23 AND 27” OF VACUUM IS REACHED ON GAUGE AND THEN LOCK DOWN KNOB. VACUUM MAY VARY DURING OPERATION DEPENDING ON HOW MUCH WATER IS IN OIL AND MAY LOWER DURING HIGH WATER CONTENT BUT WILL INCREASE ONCE OIL IS DRY. MONITOR VACUUM LEVEL REGULARLY

7. SPIN ON SUPPLIED PHOENIX ONLY - MONITOR PARTICULATE FILTER DIFFERENTIAL PRESSURE USING GREEN TO RED INDICATOR ON SIDE OF SPIN ON FILTER HOUSING HEAD.

   FILTER ELEMENT SHOULD BE REPLACED EVERY 6 MONTHS OR WHEN WHITE FILTER PLUGGED INDICATOR IS SHOWING IN THE RED. TURN PHOENIX OFF, DRAIN BY PUMPING OIL OUT OF UNIT (FOLLOW STEPS 1-7 ON PAGE 18 OF THIS MANUAL) AND USE STRAP WRENCH TO REMOVE FILTER. RUB A LITTLE OIL ON ORING OF NEW FILTER, INSTALL AND TIGHTEN SNUG. INSPECT FOR ANY LEAKS AFTER STARTING UNIT BACK UP.

   MONITOR FILTER INDICATOR REGULARLY AND ONLY RUN PHOENIX WITH MSC APPROVED PARTICULATE FILTER INSTALLED. RUNNING UNIT WITH A DIFFERENT FILTER TYPE WILL VOID WARRANTY AND MAY CAUSE PERMANENT DAMAGE TO THE WATER REMOVAL MEMBRANE

10. OCCASIONALY DURING VERY HIGH WATER IN OIL CONTAMINATION LEVELS - WATER CONDENSATION MAY BECOME PRESENT IN VACUUM LINE. DURING THOSE TIMES IT MAY BE NECESSARY ON OCCASION TO CHECK CONDENSATION DRAIN LINE FOR ACCUMULATED MOISTURE AND DRAIN. TO DO THIS DENERGIZE PHOENIX AND THEN OPEN DRAIN VALVE LOCATED UNDER MEMBRANE HOUSING. NO PRESENCE OF CONDENSATION DOES NOT MEAN THAT THE PHOENIX IS NOT WORKING, ONLY THAT WATER LEVELS ARE NOT HIGH ENOUGH IN OIL TO CAUSE CONDENSATION TO FORM.

NOTE: A SMALL AMOUNT OF OIL MAY PASS THROUGH THE MEMBRANE AND CONDENSE IN THIS LINE AS WELL WHICH IS NORMAL AND SHOULD BE DRAINED. HOWEVER, IF LARGE AMOUNTS OF OIL ARE PRESENT PLEASE CONTACT YOUR PHOENIX REPRESENTATIVE.

OPERATIONAL CHECK LIST

ITEM	DESCRIPTION	OPTIMUM READING	READING
1	Fluid Pump Suction Gauge	Less than 15” HG	
2	Oil Sample Valve	Sample Occasionally and Analyze	
3	Water Removal Vacuum Reading Gauge	23-27” If less see page 11 item 6 for how to adjust. Do not close valve all the way and if unable to adjust to desired level check trouble shooting guide on page 16	
4	Membrane Pressure Gauge	Less than 25 psid	
5	Particulate Filter Plugged Indicator	Green Normal – Red Plugged and requires changing	
6	Oil Flow Sight Glass	Check for Oil Flow Out of Phoenix	
7	Condensate Drip Leg	On Occasion weekly – de-energize Phoenix and open drip leg to drain out any condensed water or oil. A Slight amount of oil is normal – few ml per day. If higher check with your Phoenix Representative.	

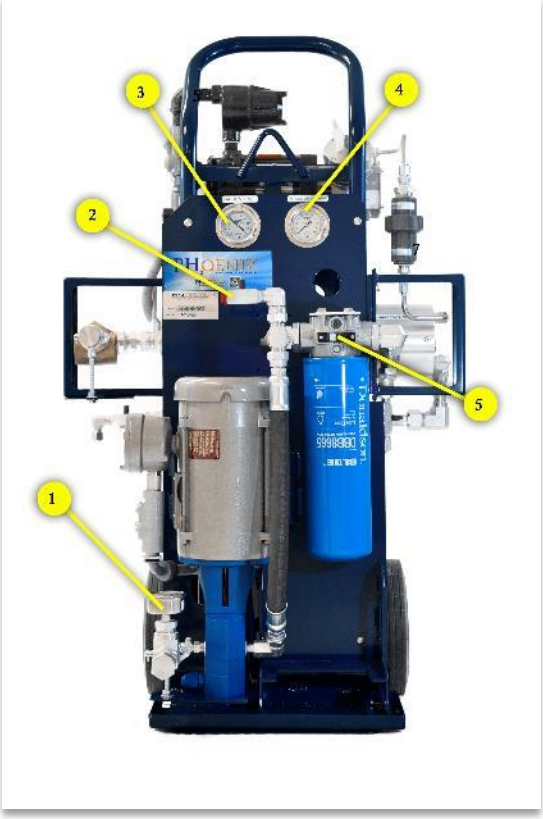


Figure 13

Figure 14

SECTION 6:

PHOENIX PREVENTATIVE MAINTENANCE AND RECOMMENDED SPARE PARTS

IMPORTANT NOTE: There is very little preventative maintenance required for the Hazardous Duty X Model Phoenix Purifier. The amount required is limited to replacement of the particulate filter and the inlet breather filter. There is no maintenance required on the water removal membrane which **is not field serviceable**. Always operate the Phoenix with an MSC approved Filter Element and also a breather filter per Figure 17 below or premature damage to the water removal membrane may occur

RECOMMENDED SPARE PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	REPLACEMENT INTERVAL
1	FS-05-25	Breather filter Element	6-12- Months of operation or when necessary.
2	MSCN726S/TT	Vacuum Pump Spares/PM Rebuild Kit	As needed – check vacuum pump maintenance manual in data sheets for reference.
3	MSCP568665	8 micron Beta 2000 Spin On Filter Element Supplied Phoenix Only. Replacement Element.	Every 6 Months or before dp indicator reaches red

Figure 15

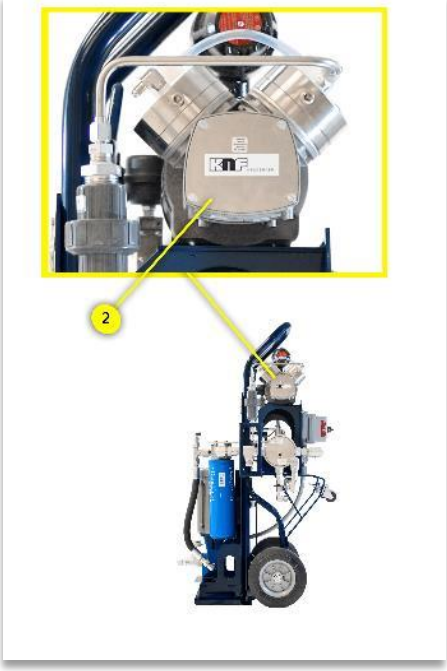


Figure 16

Figure 17

SECTION 7: TROUBLE SHOOTING GUIDE

This is only a guide. If these recommendations do not solve the problem, please contact your Sales representative for further help.

PROBLEM DESCRIPTION	POSSIBLE CAUSE/SOLUTION
NO POWER TO UNIT OR UNIT WILL NOT RUN	• Insure Phoenix-C4XE is plugged into specified power source and make sure there is power to that source. • If Problem continues have a licensed electrician investigate that explosion proof cord and plug are wired correctly and that there is power at the source.
POWER TO UNIT – AND PUMP RUNNING BUT NO FLOW OUT OF SPINNING INDICATOR	• Inspect filter element plugged indicator to make sure element is not plugged. If filter is plugged the pump will relieve through its 65 psig spring loaded relief valve and there will be no flow. Replace filter if necessary. • Inspect membrane pressure gauge on front of unit and if pressure is over 30 psig check for obstructions down stream of phoenix such as unopened return valve on system. Again pump is designed to relieve back to the inlet in the event of greater than 65 psig of backpressure.
LOW OR NO VACUUM ON FRONT RIGHT VACUUM GAUGE	• See page 11 Item 6 on adjusting vacuum control knob. • Check condensation drain valve per instructions on step 9 page 13 to see if high levels of water or oil condensation are present. If too much condensation builds up gray air eliminator on vacuum line is designed to isolate membrane from vacuum pump so no liquid can get through the pump and although vacuum pump is running vacuum will reduce to 0. • If above fails, there is a possibility vacuum pump seals require pm. See vacuum pump operations manual in data sheet section of this manual. IMPORTANT NOTE: IF HIGH AMOUNTS OF OIL IS PRESENT IN CONDENSATION DRAIN LINE THIS MAY INDICATE A COMPROMISED MEMBRANE. SHUT UNIT DOWN AND CONTACT YOUR SALES REPRESENTATIVE. SOME SMALL AMOUNT OF OIL IS NORMAL

(SECTION 7: Trouble Shooting Guide – Continued)

PRESSURE HIGHER THAN 20-30 PSIG ON PRESSURE GAUGE PAGE 11 ITEM 15.	• **Make sure Pressure Gauge is reading correctly and 0's out when unit is shut down. If not, then replace gauge.** • **Check for obstruction upstream in return line and remove any obstructions or blockage. See page 10 for recommended Phoenix installation procedure.**
VACUUM LEVEL HIGH ON VACUUM GAUGE BUT VACUUM LEVEL UNRESPONSIVE WHEN VACUUM CONTROL VALVE IS TURNED.	• **Breather Filter Plugged. See page 15 figure 15 for replacement part.** • **Check inlet check valve just below breather filter to insure it is not stuck shut.** • **Check that Vacuum Gauge is Reading Correctly and 0 outs when unit is shut down. Replace if necessary.**
VACUUM LEVEL READS ABOVE 25" ON INLET FLUID PUMP VACUUM GAUGE – PAGE 10 PAGE ITEM 2	• **Insure a minimum of 1 "diameter fittings and full vacuum rated hydraulic hose is used. 1.5" may be required for oils higher than 360 weight.** • **Decrease length of hose to reduce restriction into purifier.** • **Insure any supply or block valves to purifier located on lube and hydraulic system are open** **.**

SECTION 8: PHOENIX C4XE FLUSHING PROCEDURE

IT IS RECOMMENDED THAT WHEN USING THE PHOENIX CXE WITH MORE THAN ONE TYPE OF OIL THAT IT BE FLUSHED OUT BEFORE CHANGING TO ANOTHER OIL. THIS WILL PREVENT OIL CROSS CONTAMINATION IN RESERVOIRS.

STEP 1 – Turn Phoenix C4XE off

STEP 2 – Disconnect inlet suction hose from oil reservoir. Remove any quick disconnect hydraulic Coupling from end of hose if used so that air can be pumped through Phoenix.

STEP 3 - Leave outlet hose connected to oil reservoir so any oil in Phoenix can be pumped Back to reservoir without loss.

STEP 4 - Power on Phoenix and allow oil to pump out and back into reservoir. Watch outlet Oil flow sight glass (see page 10 – item 2) till there is no more oil coming out. Run for 2 minutes max.

STEP 5 - Place Bucket under membrane housing drain valve (Page 5, Figure 7 item 15). Open valve and let drain for 5 – 10 minutes. Close Valve when completely drained.

STEP 7 - To prevent cross contamination of oil it is recommended that the Particulate Element be changed each time a different oil is used. Install a new Particulate element into filter housing. See page 12 for filter element change out procedure.

STEP 8 - Empty approximately 2-3 gallons into a 5 Gallon bucket with whatever type of oil the Phoenix is to filter next.

STEP 9 - Close all valves on Phoenix, disconnect outlet hose from oil reservoir and now insert inlet and outlet hoses into bucket and flush new oil through Phoenix for About 5 minutes. Phoenix is now flushed out and ready to run on new oil.

SECTION 9: DATA SHEETS

KILLARK® Killark Electric Manufacturing Company,
A Subsidiary of Hubbell Incorporated,
Box 5325, St. Louis, MO 63115

INSTALLATION, OPERATION & MAINTENANCE DATA SHEET

SEAL-X® FXS/FXCS SERIES FACTORY-SEALED CONTROL STATION SUB-ASSEMBLIES.

FOR CLASS I, DIV. 1 & 2, GR. C & D, CLASS II, DIV. 1 & 2, GR. E, F & G AND CLASS III HAZARDOUS LOCATIONS.

DIRECTIONS FOR INSTALLATION

CAUTION: Before beginning installation, make sure that the supplying circuit is turned OFF.

CAUTION: For installations in extreme cold weather conditions nearing or exceeding -30 C (-22 F), avoid sharp wire bends. A sharp bend in the wire in these temperatures could result in insulation failure due to cracking.

Be sure to check the catalog number on the box or cover with the number on the carton(s) to be certain you have the correct components.

(1) Using the Installation Drawing below as a guide, install the FXB Splice Box using the cast-on mounting lugs (1/4" dia. bolts are recommended for secure mounting).

(2) Attach the conduit to the box.

(3) Pull the wires through the conduit and through the splice box.

(4) Make the wiring connections as shown on the wiring diagram on the back of the sealed cover.

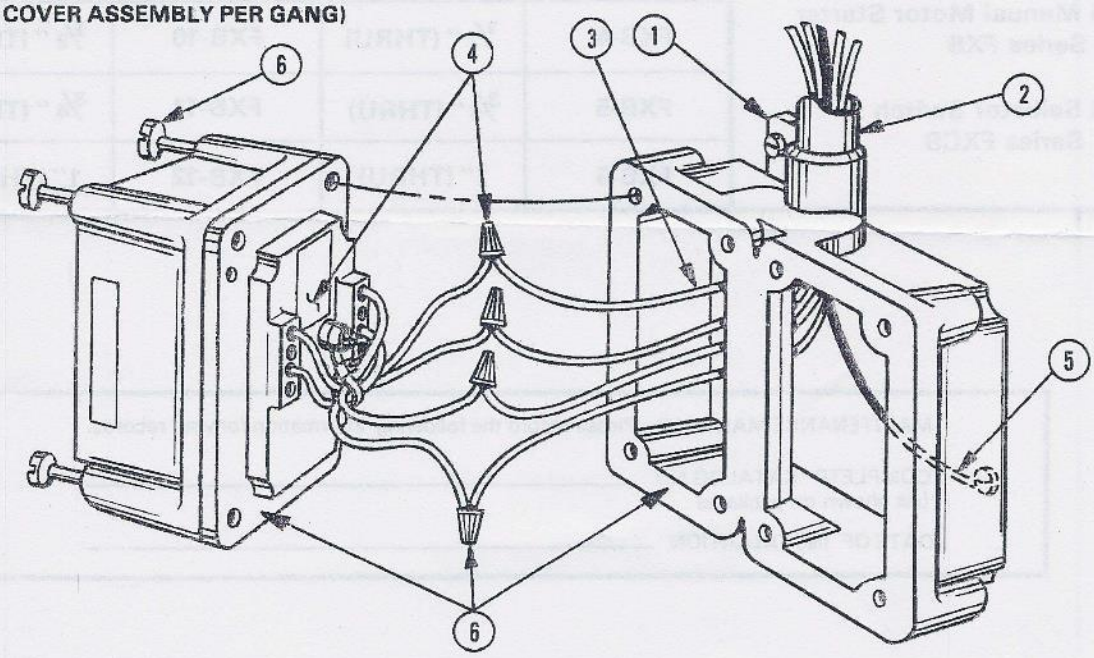
(5) Connect the ground wire to the ground screw in the splice box.

(6) To complete the installation, push the connected wires into the splice box, **check the flange surfaces to make sure they are clean and smooth**, and install the cover assembly. The four cover bolts should be tightened so a .0015" feeler guage will not enter more than 1/8" at any point around the flange joint.

TO INSTALL A NEW COVER ON AN EXISTING FXB SPLICE BOX: Remove and disconnect the old cover assembly, then follow Steps 4 thru 6 above for the new cover assembly.

NOTE: All installations must comply with applicable local and/or National Electrical Code.

TYPICAL INSTALLATION DRAWING
(ONE COVER ASSEMBLY PER GANG)



SEE REVERSE SIDE FOR OPERATION AND MAINTENANCE DATA.

OPERATIONAL DATA

This enclosure is made of cast copper-free aluminum alloy. It is suitable for Class I, Div. 1 & 2, Gr. C & D, Class II, Div. 1 & 2, Gr. E, F & G, and Class III hazardous locations. Like all electro-mechanical devices, these control stations require occasional maintenance. Parts may wear out or become defective due to adverse environmental conditions.

MAINTENANCE DATA

CAUTION - Disconnect this device from the supplying circuit before opening.
The flanges and operator shaft(s) should be lubricated occasionally to prevent corrosion, using Killark LUBG General Purpose lubricant. **Keep all flanges clean and free from scratches.** Many types of control station configurations are offered, and internal and external service parts are available. Consult the Killark factory for parts breakdowns.

REMEMBER TO SAVE ONE OF THESE SHEETS FOR MAINTENANCE PERSONNEL.

TYPICAL CONTROL STATION CONFIGURATIONS

COVER ASSEMBLIES (ONE REQUIRED PER GANG)	BOX IDENTIFICATION			
	SINGLE GANG		DOUBLE GANG	
	CAT. NO.	HUB SIZE	CAT. NO.	HUB SIZE
a) Pushbutton Series FXCS	FXB-1	½"	FXB-7	½"
b) Combination Pushbutton & Pilot Light Series FXCS	FXB-2	¾"	FXB-8	¾"
c) Pilot Light Series FXCS	FXB-3	1"	FXB-9	1"
d) Snap Switch Series FXS	FXB-4	½" (THRU)	FXB-10	½" (THRU)
e) Manual Motor Starter Series FXS	FXB-5	¾" (THRU)	FXB-11	¾" (THRU)
f) Selector Switch Series FXCS	FXB-6	1" (THRU)	FXB-12	1" (THRU)

MAINTENANCE MANAGER: Please record the following information for your records.

COMPLETE CATALOG NO. _____
(As shown on package)

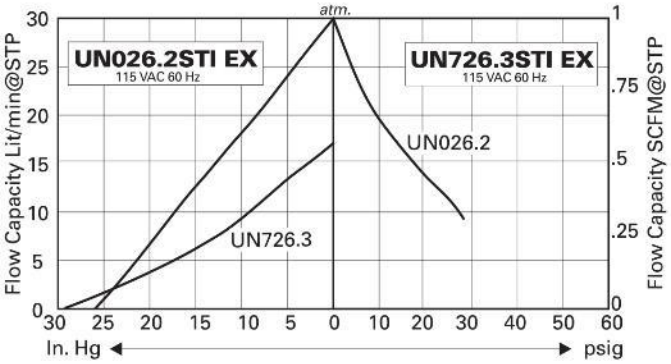
DATE OF INSTALLATION _____

UN026.2STI EX, UN726.3STI EX

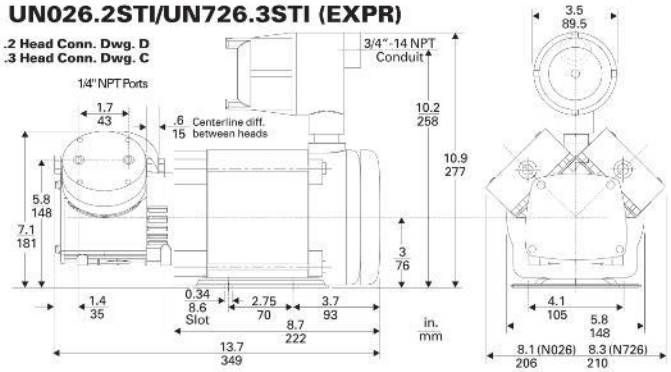
Type	UN026.2STI EX	UN726.3STI EX
Head Configuration	Parallel Head	Two-Stage
Max. Flow	31 LPM (1.1 SCFM)	17 LPM (0.6 SCFM)
Max. Vacuum	26.8 in. Hg	29.74 in. Hg
Max. Continuous Pressure	29 psig	Vacuum Only
Motor Specifications		
Motor Voltage (Hz)	115/230 VAC, 50/60 Hz	
Max. Oper. Current @ 115V 60Hz	2.1 Amps	2.3 Amps
Hazardous Location Rating	Class I, Division 1 Groups C & D	
Max. Surface Temp. Rating	T3C 320°F (160°C)	
Motor Protection	Thermal Reset	
Environmental		
Max. Ambient Temperature	40°C (105°F)	
Max. Medium Temperature	40°C (105°F)	
Net Weight	20.2 kg/45 lbs.	

Materials of Construction

Model Number	Head	Diaphragm	Valves
UN026.2STI EX	316 Stainless	PTFE	PTFE
UN726.3STI EX	316 Stainless	PTFE	PTFE



UN026.2STI/UN726.3STI (EXPR)

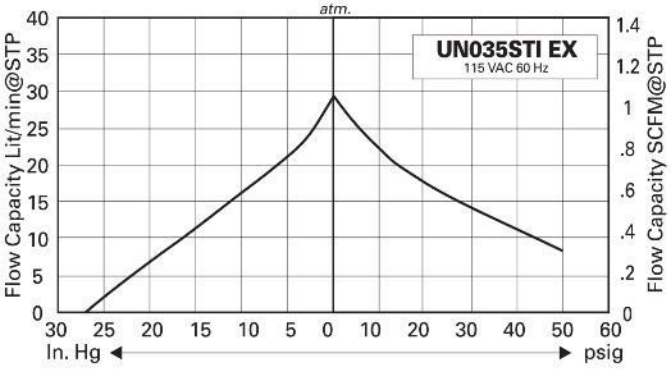


UN035STI EX

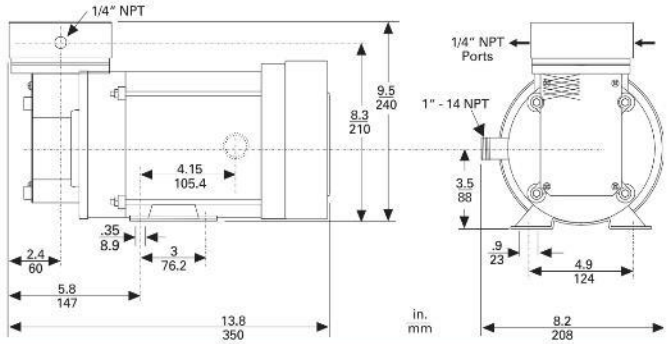
Type	UN035STI EX
Head Configuration	Single Head
Max. Flow	29.2 LPM (1.0 SCFM)
Max. Vacuum	27 in. Hg
Max. Continuous Pressure	50 psig
Motor Specifications	
Motor Voltage (Hz)	115/230 VAC, 60 Hz
Max. Operating Current @ 115V 60Hz	6.0 Amps
Hazardous Location Rating	Class I, Division 1 Groups C & D
Max. Surface Temp. Rating	T3B 329°F (165°C)
Motor Protection	Thermal Reset
Environmental	
Max. Ambient Temperature	40°C (105°F)
Max. Medium Temperature	40°C (105°F)
Net Weight	22 kg/48 lbs.

Materials of Construction

Model Number	Head	Diaphragm	Valves
UN035STI EX	316 Stainless	PTFE	PTFE



UN035STI EX



Operating and Maintenance Instructions

For Portable & Installation Models: UN726/.0/.1/.2/.1.2/.3
Diaphragm Vacuum Pump Using Head Materials: AN, AT

Operating Instructions

Note: The following guidelines should be observed to promote safe and reliable operation of your KNF pump.

1. KNF units are all 100% oil–free. No maintenance at all is necessary for the bearings and NO lubrication should be done. All bearings are sealed and permanently lubricated. For repair service, call KNF Customer Service.
2. Be sure that the available electric power matches specifications marked on the motor. Serious damage may occur to the motor if connected to an improper voltage. All KNF units should be grounded using the provided brass screw or grounded 3-prong plug. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current.
3. The pump should be placed where the surrounding temperature remains between 40°F and 104°F (5°C and 41°C). This is particularly important when the unit is installed in a confined space where heat may build up during operation.
4. Standard models are designed to *start against atmospheric pressure only, not under load (Pressure or vacuum)*. Care must be taken to eliminate load when pump is turned off for any reason. Optional modifications for the pump to start under load may be available for certain models.
5. Use this pump only to pump air or gas, not liquids or particulates. *Damage to the pump or loss of performance can occur if liquids or particulates enter the system.*
6. Always install the pump in such a location that it is protected from direct (or indirect) moisture contact.
7. Avoid operating the pump in very dusty conditions. If necessary, install an inlet filter and change it frequently.
8. If flow is throttled or restricted for any reason, care must be taken to avoid exceeding the maximum continuous operating design pressure of the unit.
9. Be sure that the pump is installed at the highest point within the system to prevent possible liquid condensate from entering the unit.
10. To avoid personal injury, remove any protective plastic plugs supplied prior to applying power to the motor.
11. Run the pump for a few minutes to warm it up before handling saturated or nearly saturated vapors.
12. After use, let the pump run for about 2 minutes in air before switching it off, to purge out droplets of liquid that may have formed on the inside of the pump. This prevents crystallization and/or absorption of liquids by the pump materials.
13. Do not thread metal fittings into Kynar-coated (TT) pump heads. Use plastic or nylon only.

Troubleshooting

Warning!: AC motors are thermally protected and will automatically restart unexpectedly when the overload device resets. - Don't pump flammable or explosive gases or operate this pump in an atmosphere containing flammable or explosive gases.

Your KNF Pump should perform to specifications for years if the simple operating instructions and precautions are observed. If you experience a problem and suspect the pump, try these simple checks prior to calling for assistance:

1. Check that all system interconnections are gas-tight and head screws are snug. Do not overtighten screws.
2. Remove the head assembly as described in "Changing the Diaphragm and Valves". Look for any foreign matter; usually bits of Teflon® tape or particulates carried into the valve system or crystallized material from previously pumped vapors. All of the above must be cleared out and reassembled with clean parts.
3. If pitting of the pump parts or tearing of the diaphragm is observed, it is possible that the gas/vapor being pumped is capable of dissolving the wetted parts of the pump.

Chemical resistance charts should be consulted for compatibility with wetted parts. Generally, replacement of the diaphragm and reed valves will restore the pump to operating specifications if there is no pitting or debris in the valve seat area.

4. Check that power is being supplied to the pump from the power source and the pump switch is in the on position.

Spare Parts Kits *(One kit per head)*

Kit consist of:

Qty	ID#	Description
1	G	Molded Diaphragm
2	Q	SS Reed Valve
1	P	SS Screw M3
2	P	SS Washer
1	P	SS Hexagon Nut
1	V	Head Gasket

For Model N726AN
Order Kit Number: K726-1ANA
For Model N726.3AN
Order Kit Number: K726-9ANA
For Model N726AT, N726.3AT
Order Kit Number: K726-1ATA
Note: Above kit is to renew one head only. Two kits are required to renew a twin-head pump (.1.2/.3 models).

Changing the Diaphragm and Reed Valves

Notes:

1. If your model Number begins with MPU, PU or PJ, contact KNF Customer Service for the proper Parts Kit, as the contents may differ from those kits listed above.
2. For twin-head pumps, always change the diaphragm and reed valves in both heads at the same time. Follow the below procedures for each head.

Materials needed:

Proper replacement kit(s)
Roll of Teflon® tape
(available at most hardware stores)
Felt marking pencil

Tools Required:

3 mm Allen key wrench

4 mm Allen key wrench
20 mm open-end wrench
Small slotted-head screwdriver
Medium slotted-head screwdriver

Changing the Diaphragm:

1. Disconnect the pump from electrical power. For parallel and two–stage models, make a sketch of the position of interconnecting tubes and fittings. Remove them by undoing nuts with the 20 mm wrench, or loosening hose clamps, and carefully pulling tubing from fittings.
2. Mark the relative positions of the head plate **A** and crankcase housing **B** with a line using a marker for ease of reassembly later.

KNF NEUBERGER, INC.
2 Black Forest Rd
Trenton, NJ 08691-1810

Phone: 609-890-8600
Fax: 609-890-8323

www.knf.com/usa.htm

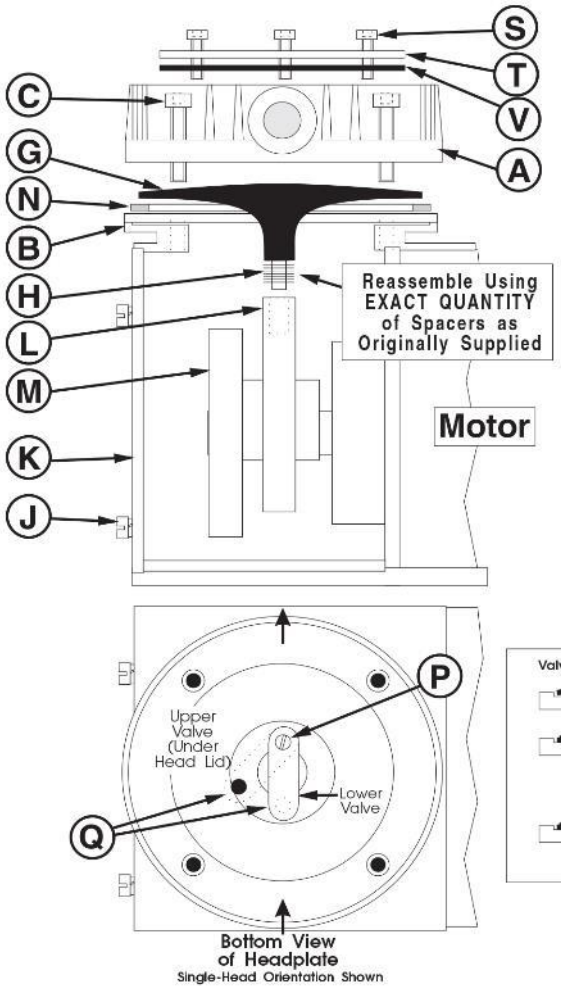
Ident# 211283-211285
Revision (06/12)

Note that .1.2 and .3 models head orientation is different from the single head model shown on the diagram.

3. Undo the 4 socket head cap screws **C** and lift off the head plate **A**.
4. Remove the 4 pan head screws **J** and remove the housing lid **K**.
5. Unscrew the old diaphragm **G** by turning it counterclockwise using both hands. Do not use tools. IMPORTANT — Take care not to lose any spacers **H** positioned between the diaphragm stud and connecting rod **L**, as the exact quantity must be reassembled later for proper pump operation.
6. Place *the same quantity of spacers* removed in step 5 above onto the threaded stud of the new diaphragm. Carefully screw the new diaphragm into the connecting rod **L**.
   NOTE: Tighten firmly using both hands only. DO NOT use tools.

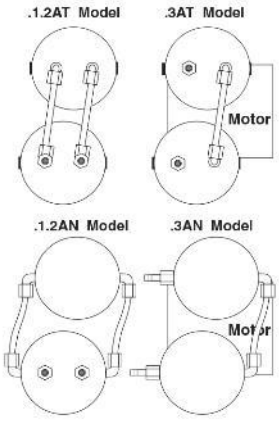
Changing the Reed Valves:

1. Dismantle the head **A** as outlined above. In addition, remove the socket head cap screws **S**, remove the head lid **T** and head gasket **V**.
2. Loosen the single stainless steel pan head screw **P**, washers and nut, and remove the two stainless steel reed valves **Q**.
3. Lightly clean the valve seat area on the headplate **A** of any debris or deposits with fine steel wool. This area must be clean and smooth, without pits or scratches. Do not scratch the head plate.
4. Lay the two replacement reed valves **Q** on a clean, flat surface to determine the direction of any slight bend.
5. Lay the replacement reed valves **Q** in place, center bowed out, (see inset: valve installation) and tighten the pan head screw **P**, both washers and nut. **NOTE:** Make sure that the reed valves lay straight and smooth with clearance from the recessed edge to prevent sticking. If a reed valve curves slightly away from the valve hole, remove the screw, flip the reed valve over and reinstall.
6. Turn the counterweight **M** until the diaphragm is in mid-position (flat across). Carefully center the diaphragm over the compressor housing **B**, or over the head spacer ring **N**. *Note: Only double-head pumps are supplied with a head spacer ring.*
7. Place the head plate **A** on top of the diaphragm, lining it up with the compressor housing markings you made in step 2. Note that .1.2 and .3 models head orientation is different from the single head model shown on the diagram.
8. Tighten the 4 socket head cap screws **C** uniformly in a crisscross pattern.
9. Reassemble lid **T** using a new gasket **V** and and the socket head cap screws **S**, tightening uniformly in a crisscross pattern.
10. Check that the pump runs freely by turning the counterweight **M** by hand.
11. Carefully apply two layers of Teflon® tape around each fitting thread. *Do not hang tape over edge of fitting.* Reinstall the head connecting tubing and fittings as previously sketched in step 1 above. *Do not use excess tape or substitute any other type of tape. Excess tape may get carried into the valves.*

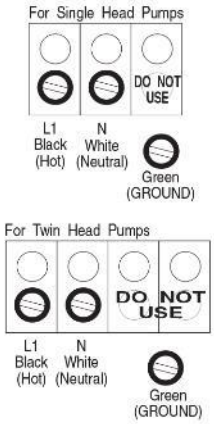


UN726AN, AT

Head Interconnections



Wiring Diagrams



Ensure that the compression rings (ferrules) are correctly positioned under the union nuts before tightening the interconnection fittings.

Note: Should you need to send a KNF pump to our factory for repairs, please be sure to read the instructions in the Limited Warranty section with regard to obtaining an RMA (Return Materials Authorization) number prior to shipment.

Individual Parts: *(per head)*

ID#	Description
A	Headplate
C	Socket Screw (4 per head)
G	Diaphragm
H	Diaphragm Spacers (Note 1)
S	Socket Screw (8 per head)
T	Head Lid
V	Head Gasket
Q	Reed Valves (2 per head)

Notes:

1. Use same quantity as originally supplied.
2. Contact KNF Customer Service for ordering information.

Returns:

KNF provides warranty and non-warranty repair services for all products.

1. A Return Material Authorization (RMA) number is required for all product returns.
2. To receive an RMA number, submit a completed De-contamination Declaration form to rma@knf.com
3. The Decontamination Declaration form can obtained from our website or by contacting KNF Technical Services. www.knf.com/pdfs/decontamdec.doc
4. Product return instructions will be provided when the RMA is issued.

For Service or Parts, CONTACT:

KNF NEUBERGER, INC.
Two Black Forest Road
Trenton, New Jersey 08691-1810
Fax: 609-890-8323 · Phone: 609-890-8600

BALDOR • RELIANCE

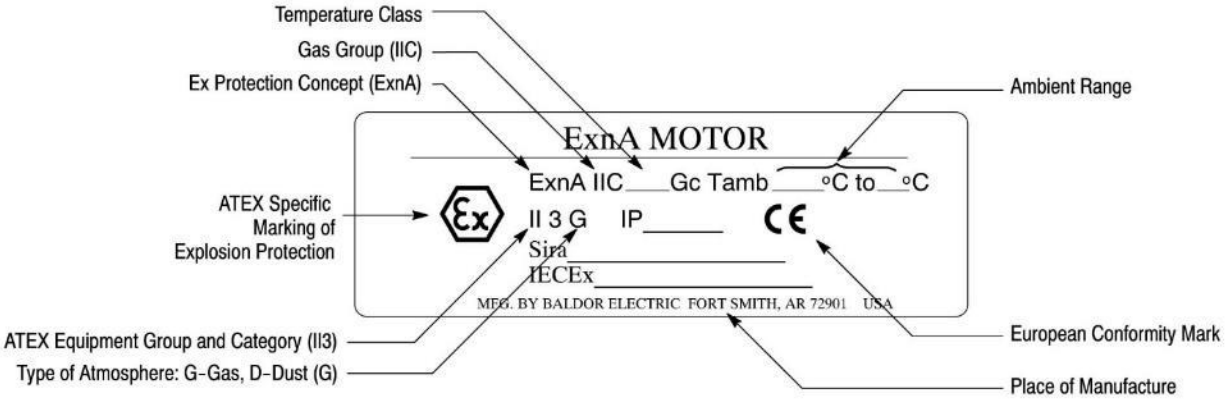
Integral Horsepower
AC Induction Motors
ODP, WPI Enclosures
TENV, TEAO, TEFC Enclosure
Explosion Proof

10/14 Installation & Operating Manual MN408

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 1-1.

Figure 1-1 IEC Certified Product Markings



Specific Conditions of Use:

If the motor certificate number is followed by the symbol "X", this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification certificate in conjunction with this instruction manual.

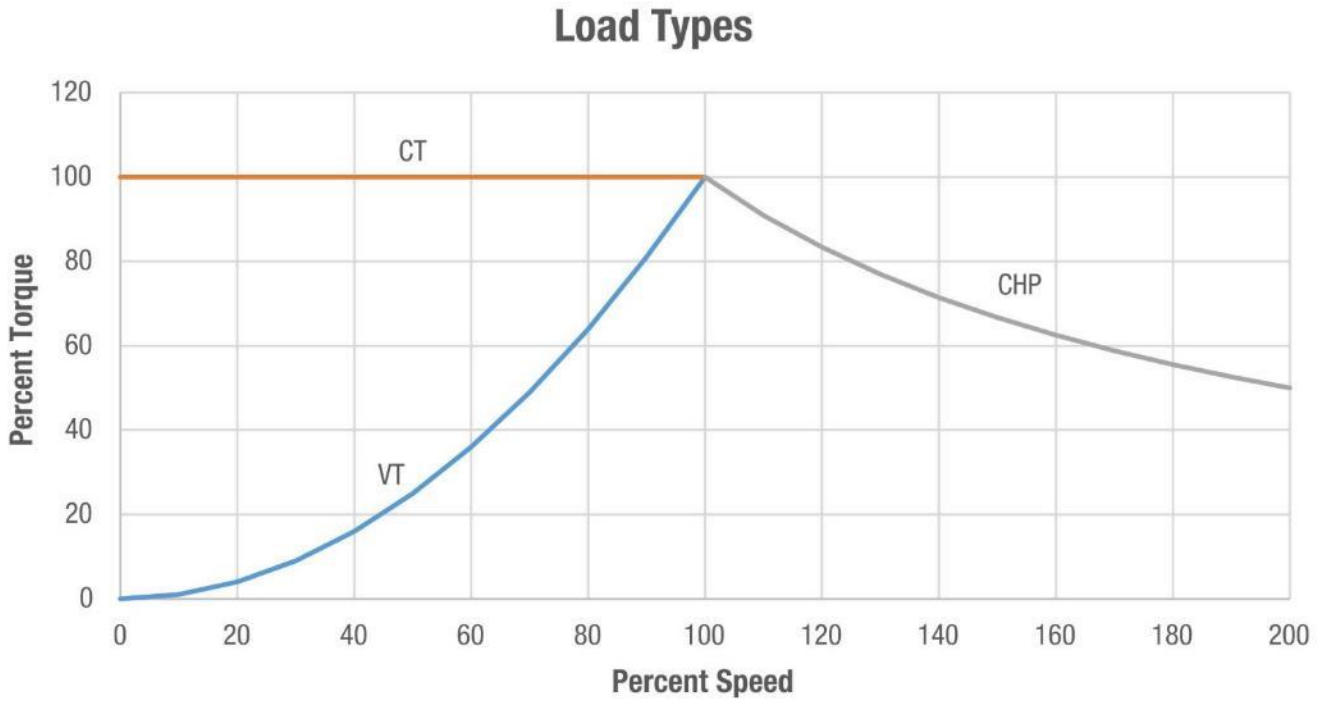
Operation On Frequency Converters:

If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed ranges (for example 0- 120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive manual for proper set up. IECEx Certificates are available online at www.iecex.com

Unit Conversions	
Inches to Millimeters	Inches x 25.4 = mm
Millimeters to Inches	mm x .03937 = Inches
Horsepower to Kilowatts	Hp x .746 = Kw
Kilowatts to Horsepower	Kw x 1.341 = Hp
Pounds to Kilograms	Lbs x .454 = Kg
Kilograms to Pounds	Kg x 2.205 = Lbs

Typical Speed vs Torque Curves are shown in Figure 1-2. For values relative to your specific motor, consult the motor nameplate marking.

Figure 1-2 Typical Speed vs Torque Curves



EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use. When used with converters, please consult converter manufacturers literature regarding recommendations on cable types, cable shielding, cable shielding termination, connection recommendations and any filters which may be recommended for EMC compliance. For additional information, consult Baldor MN1383.

Section 2

Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip–Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non–corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service. IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use.

Mounting Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1" (25mm)
Fan Cover Air Intake	250 – 449T Frame 4" (100mm)
	IEC 112 – 132 1" (25mm)
	IEC 160 – 280 4" (100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2" (50mm) Exhaust out the end same as intake.

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

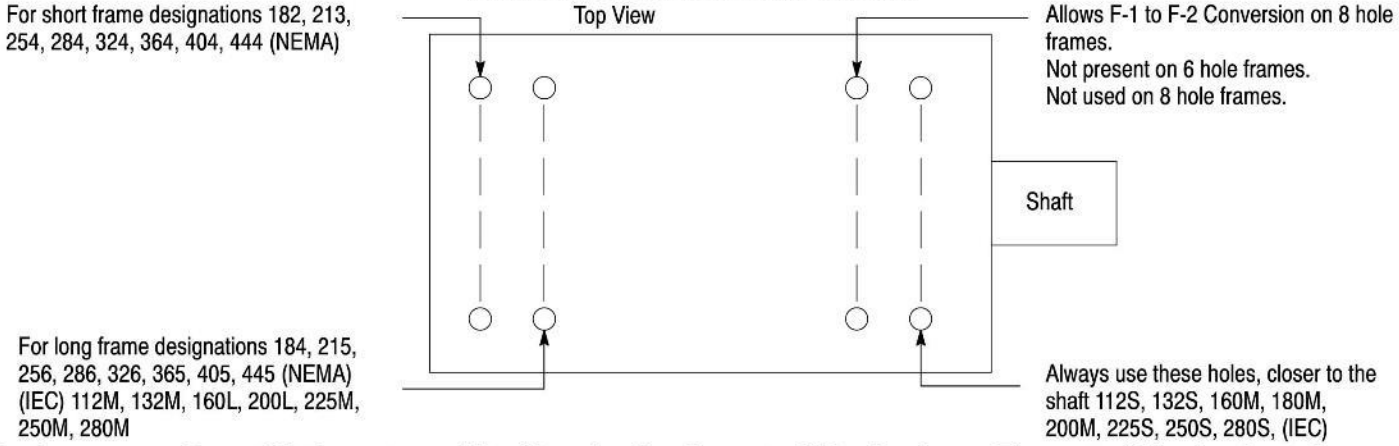
When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Frame Mounting Holes

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F–1 to F–2, etc. Figure 2-1 indicates the proper mounting holes to use.

Figure 2-1 6 & 8 Hole Motor Frame Mounting



Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

In the case of assemblies on a common base, any lifting means provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. Assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. Direct Coupling
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. End-Play Adjustment
   The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. Pulley Ratio
   The best practice is to not exceed an 8:1 pulley ratio.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. Belt Drive
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor•Reliance motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment.

Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure.

Flanged nuts or bolts may be used as an alternative to washers.

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Guarding

Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Grounding

In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non–USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Crosssectional area of phase conductors, S	Minimum crosssectional area of the corresponding protective conductor, S_p
mm^2	mm^2
$S < 16$	S
$16 < S \leq 35$	16
$S > 35$	$0{,}5\ S$

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm^2.

Conduit Box

For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360 ° in 90 ° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power

Motors with flying lead construction must be properly terminated and insulated.

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).

OR

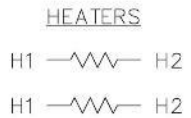
2. AC power is within ±5% of rated frequency with rated voltage.

OR

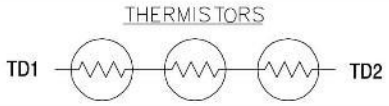
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-3.

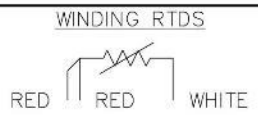
Figure 2-2 Accessory Connections



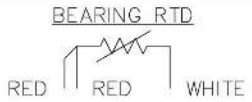
One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).



Three thermistors are installed in windings and tied in series.
Leads are labeled TD1 & TD2.



Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.



* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
* One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.
* Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Rotation

All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn–to–turn, phase–to–phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

AC Motor Connection Diagram

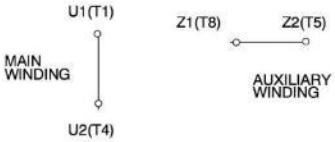
IEC VERSUS NEMA LEAD MARKING

EXAMPLE COMPARISIONS OF IEC AND NEMA LEADING MARKINGS FOR COMMON CONNECTION TYPES ARE SHOWN BELOW.

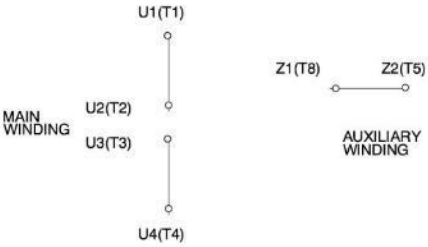
SINGLE PHASE MOTORS

SINGLE VOLTAGE NON REVERSIBLE

SINGLE VOLTAGE REVERSIBLE



DUAL VOLTAGE REVERSIBLE



AC Motor Connection Diagram

THREE PHASE

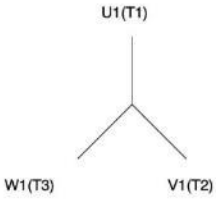
FOR SINGLE WINDING 3 PHASE MOTORS, LEAD MARKINGS CAN BE DIRECTLY TRANSLATED BETWEEN IEC AND NEMA DESIGNATIONS. FOR THESE MOTORS, THE LEAD MARKINGS ARE EQUIVALENT AS FOLLOWS:

U1=T1	U2=T4	U5=T7	U6=T10
V1=T2	V2=T5	V5=T8	V6=T11
W1=T3	W2=T6	W5=T9	W6=T12

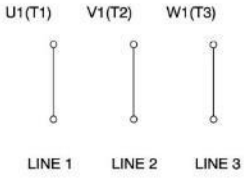
EXAMPLES OF COMMON CONNECTIONS ARE GIVEN BELOW.

THREE LEADS

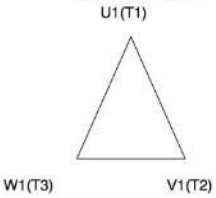
WYE CONNECT



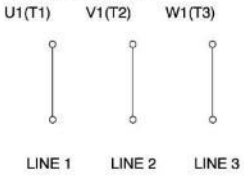
WIRING DIAGRAM



DELTA CONNECT



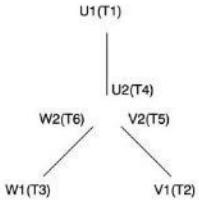
WIRING DIAGRAM



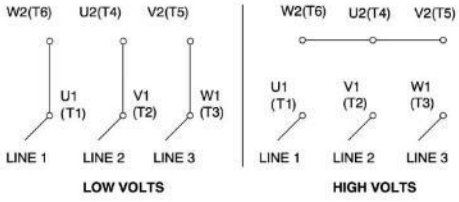
AC Motor Connection Diagram

SIX LEADS

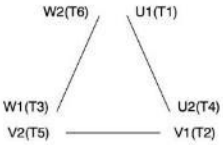
DELTA-WYE CONNECT



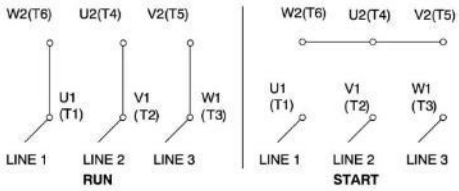
DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 1.73:1



WYE-DELTA CONNECT



WYE START-DELTA RUN
SINGLE VOLTAGE

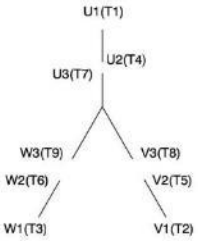


AC Motor Connection Diagram

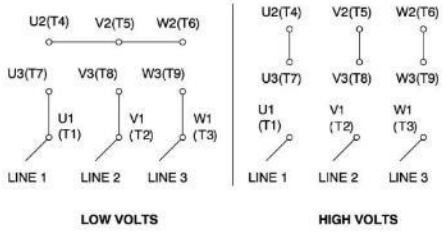
NINE LEADS

DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 2:1

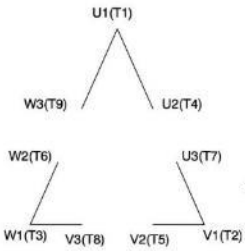
WYE CONNECT



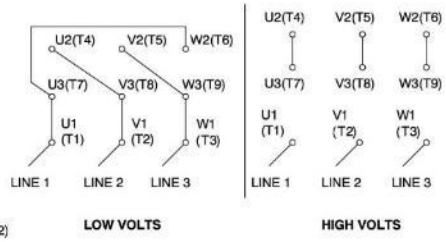
WIRING DIAGRAM



DELTA CONNECT



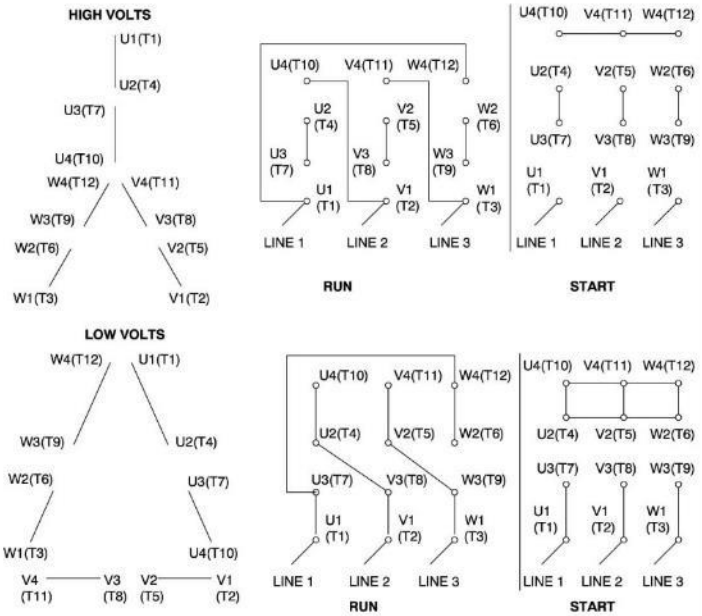
WIRING DIAGRAM



AC Motor Connection Diagram

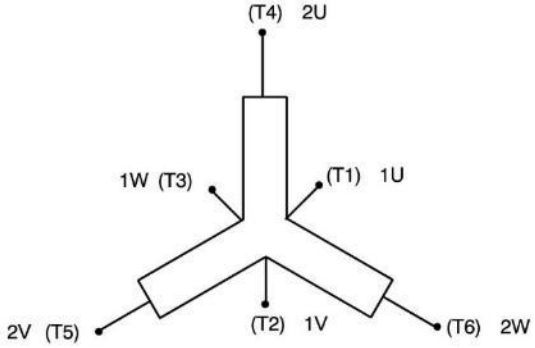
TWELVE LEADS

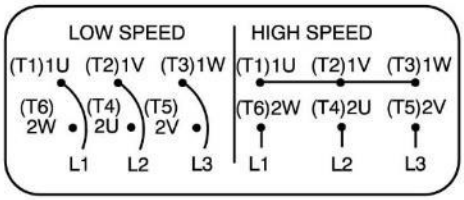
DUAL VOLTAGE WYE START - DELTA - RUN



AC Motor Connection Diagram

SINGLE WINDING MULTI-SPEEDS CONSTANT TORQUE

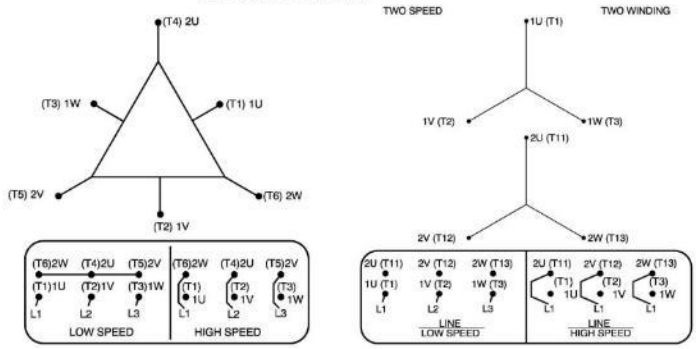


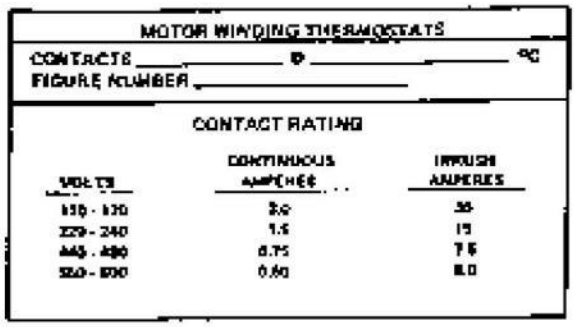


(N.P. 1634-DE)

AC Motor Connection Diagram

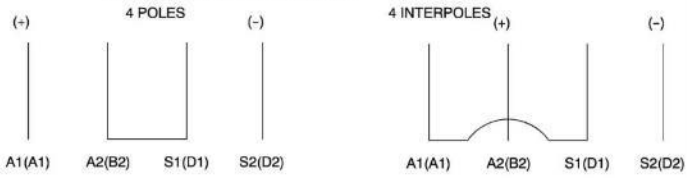
SINGLE WINDING MULTI-SPEEDS CONSTANT HP.





DC Motor Connection Diagram

WIRING DIAGRAM TYPE "T" MOTOR



COUNTERCLOCKWISE ROTATION CLOCKWISE ROTATION

ROTATION - FACING COMMUTATOR END

COMPARISON OF IEC AND NEMA LEAD MARKINGS
FOR DIRECT CURRENT MOTORS

A1--A1
A2--B2
S1--D1

S2--D2

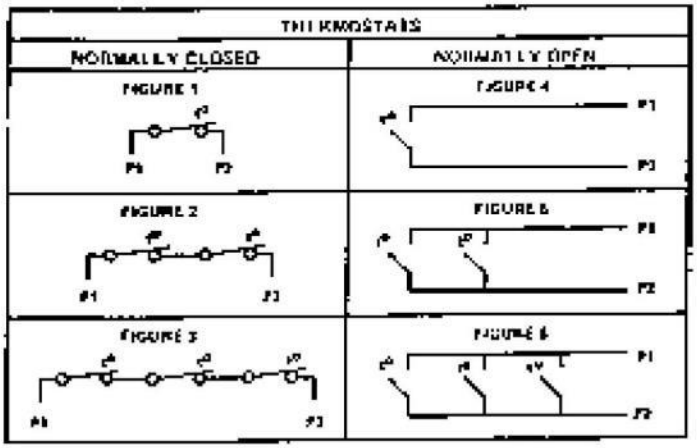
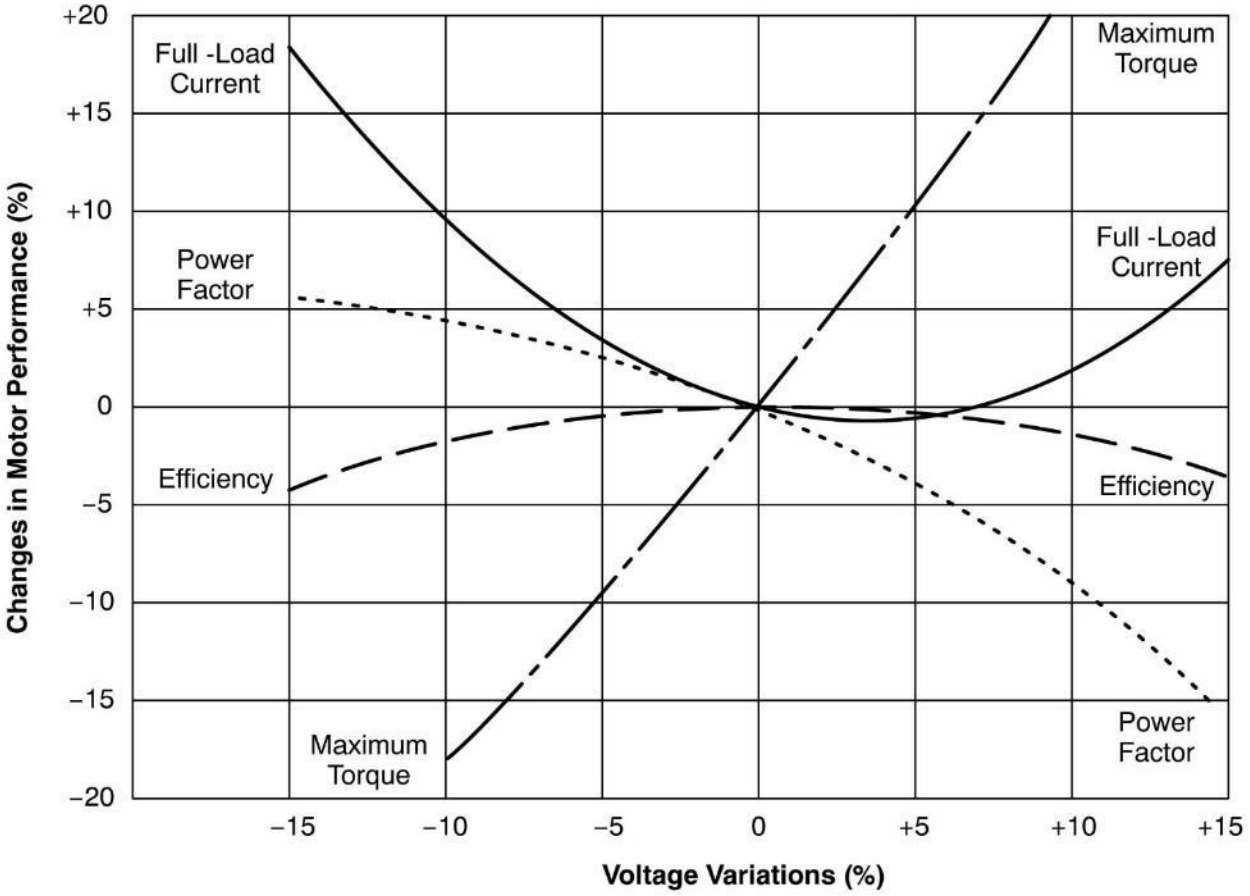


Figure 2-3 Typical Motor Performance VS Voltage Variations



Initial Lubrication

Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.

10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.
11. If motor is totally enclosed fan–cooled or non–ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end–shields. Totally enclosed fan–cooled "XT" motors are normally equipped with automatic drains which may be left in place as received.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts

Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

Hazardous locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers or flyings.

Selection

Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079–14, or for dust in IEC61241–14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required. It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof. Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries. The fit of these flameproof joints are designed to contain the combustion or quench the flame of an explosive gas atmosphere prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor•Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA 70–2008) – according to Article 500.8(C) Marking, sub clause (2) in the fine print note, it is noted that Equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since flameproof or explosion proof motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 94/9/EC, and shall be covered by an appropriate EC Type Examination Certificate.

Flameproof motors, internationally referred to as Ex d use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs. Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Hazardous location motors equipped with NPT pipe nipples are designed and built such that the pipe nipple is securely attached to the motor frame. This is accomplished externally by interference between the threads as well as tack welding. The conduit box is securely attached to the pipe nipple at the factory per:

1. Standard Commercial NPT & Explosion Proof IEC/ATEX parts : L-1 gauging notch +/- 1 thread (ref. ANSI/ASME B1.20.1 and Clarification Sheet ExNB/98/06/010/CS) Note: Clarification Sheet ExNB/98/06/010/CS provides inspection criteria to meet (6 threads minimum per engineering part drawing for ATEX parts).
2. Explosion Proof UL conduit boxes & MSHA parts: L-1 gauging notch "+1 min to + 3 1/2 max threads. Note: Provides inspection criteria to meet (5 threads minimum per engineering part drawing for MSHA parts and meet UL 1203 requirement for L-1 gauging notch flush to + 3 1/2 max threads).

This allows the end user to position the conduit box according to the application then secure when in place. For obvious reasons having the conduit box snug prior to affixing to the pipe nipple is preferable. However, the guidance in numbers 1 and 2 above can be used in determining thread engagement.

Note: In the United States most non-mining applications have rigid conduit for cabling, therefore not tack welding the conduit box to the pipe nipple is standard. In markets outside the United States, flexible conduit/cabling are common and end users should take note to secure the conduit box to the pipe nipple once in position. Further, the flexible leads should be secured to inhibit forces acting on the conduit box.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]

This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]

This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings.
In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]

This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T–Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Altitude above 3300 feet / 1000 meters
7. Severe duty cycles of repeated starts
8. Motor stall
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Variable frequency operation

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22

Hazardous Location (motors with maximum surface temperature listed on the nameplate).
Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T–Code) stated on the nameplate.
Failure to operate the motor properly can cause this maximum surface temperature to be exceeded.

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting
Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction
Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified. Bearing currents can exist in some motors for both line–fed and inverter–fed applications. Larger line–fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line–fed or inverter–fed applications. Inverter–fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079–19 Explosive Atmospheres–Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEX Repair Scheme at http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction – flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details.
Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts.
Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors – Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Section 3

Maintenance & Troubleshooting

WARNING: **UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil) or as stated on the nameplate.
Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

Operating Temperature –25 °C (–15 °F) to 50 °C (120 °F)

EXXON	POLYREX EM (Standard on Baldor motors)
EXXON	UNIREX N2
EXXON	BEACON 325
CHEVRON OIL	SRI NO. 2 (Compatible with Polyrex EM)
CHEVRON OIL	BLACK PEARL
TEXACO, INC.	PREMIUM RB
TEXACO, INC.	POLYSTAR
AMOCO	RYKON # 2
PENNZOIL	PENNZLUBE EM–2
DARMEX	DARMEX 707
DARMEX	DARMEX 711
PETRO–CANADA	PEERLESS LLG
SHELL OIL	DOLIUM BRB

Minimum Starting Temperature –60 °C (–76 °F)

SHELL OIL CO.	AEROSHELL 7 (Standard on Baldor motors)
MOBIL	MOBIL 28
MOBIL	MOBILITH SHC 100 (Low Temperature – Arctic Duty)

Roller Bearing Motors

Operating Temperature –25 °C (–15 °F) to 50 °C (120 °F)

TEXACO, INC.	PREMIUM RB
MOBIL	MOBILITH SHC 220 (Standard on Baldor motors)
CHEVRON OIL	BLACK PEARL

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40 °C	Clean, Little Corrosion
Severe	16 Plus	50 °C	Moderate dirt, Corrosion
Extreme	16 Plus	>50 °C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<–29 °C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: **To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.**

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: **Over–lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.**

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43 °C and the atmosphere is moderately corrosive.

1. Table 3-2 list 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as "Severe".
3. Table 3-5 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Shaker Duty Motors only

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Table 3-6.**

Lubrication should be performed before Start Up and at regular maintenance intervals.
Follow these recommendations to ensure proper lubrication.

Recommended Lubricant

For ambient temperatures between –15 °F to 120 °F the following lubricants are recommended:
Mobil PolyrexEM, Texaco Premium RB, Exxon Unirex N–2.

Do not mix greases unless compatibility has been checked and verified.

Table 3-5 Lubrication Volume

NEMA Frame Size	Volume in Cubic Inches					
	Normal Duty		Severe Duty		Extreme Duty	
	Start Up	Relub	Start Up	Relub	Start Up	Relub
184TY	1.4	0.5	1.4	0.5	2.7	0.5
215TY	1.6	0.5	1.6	0.5	4.5	1
256TY	7	1			11	2
286TY	9	1			15	3

Lubrication Frequency

Normal Duty 8 hours per day (16 hours per day in a clean environment). Lubricate every 2 months.

Severe Duty 16 hours per day or more in a dirty environment (corrosive atmosphere, chemical fumes, acids, alkalies or extreme high humidity). Lubricate every month or 700 hours of operation.

Extreme Duty operation in extremely dirty or dusty environments and high ambient temperatures exceeding 104 °F (40 °C). Lubricate twice a month or 350 hours of operation.

Lubrication Procedure

1. Locate the grease inlet and outlet. Clean the areas.
2. Remove the plug(s) and install a grease fitting in the inlet if grease fitting is not already installed.
3. Add the recommended amount of lubricant.
4. Run the motor for two hours with the outlet plug removed.
5. Install outlet plug.

Note: To loosen hardened grease it may be necessary to insert a rod or wire into the grease inlet and outlet holes.

Table 3-6 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage. Eccentric air gap.	Check input line connections. Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings. Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately 3/4 filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately 3/4 filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately 3/4 filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately 3/4 filled.

Suggested bearing and winding RTD setting guidelines for Non–Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80 °C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Table 3-7 Winding RTDs – Temperature Limit In °C (40 °C Maximum Ambient)

Motor Load (Typical Design)	Class B Temp Rise ≤ 80 °C		Class F Temp Rise ≤ 105 °C		Class H Temp Rise ≤ 125 °C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod–Express.

When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Table 3-8 Bearing RTDs – Temperature Limit In oC (40 °C Maximum Ambient)

Bearing Type Oil or Grease	Anti–Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Notes: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants include the following:

- Texaco Polystar
- Mobilith SHC–100
- Darmex 707
- Rykon Premium #2
- Pennzoil Pennzlube EM–2
- Darmex 711
- Chevron SRI #2
- Chevron Black Pearl
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.

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