Maintenance
Manual for

Standard Hydraulic Power Units

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Introduction

This manual provides descriptive information, operation and maintenance instructions for standard Hydraulic Power Units manufactured by the Power Unit Division of Parker Hannifin Corporation, Orrville, Ohio 44667. Any additional information may be obtained from the Power Unit Division by referencing to the Unit's Model Number and Serial Number stamped on the Reservoir Nameplate, or by contacting your authorized Parker Distributor.

Some of the information in this manual may not apply to your power unit, and information on more custom units may require obtaining service and application information from other sources.

Warning

It is imperative that personnel involved in the installation, service, and operation of the power unit be familiar with how the equipment is to be used, the limitations of the system and it's component parts, and have knowledge of good hydraulic practices in terms of safety, installation, and maintenance.

Description

The standard Hydraulic Power Unit usually consists of a JIC reservoir (see figure 1), or "L" shaped reservoir (see figure 2) both of which incorporate a baffle, clean-out access, 3/4 NPT sump drain, oil level gage, filter/breather assembly and spare return connections.

The pump will be coupled to the motor using a flexible shaft coupling and will be mounted using a bell housing (requires NEMA "C" Motor) or will be foot mounted requiring a pump foot bracket, coupling guard, and pump/motor mounting plate. Also included on most standard units is a Pump Suction Filter (or Suction Strainer), Relief Valve, and a Pressure Gauge with Shut-Off Valve.

More custom type power units may have heat exchangers for oil cooling; pressure or return filters, oil immersion heaters, directional valves, and other pressure and flow control valves, or monitoring instrumentation.

Preparation For Use

Unpacking and Checking

The Power Unit is mounted on skids and carefully packed for shipment. Do not remove it from skid until it has been carefully checked for damage that may have occurred in transit. Report all damage immediately to the carrier and send a copy

to the vendor. All open ports on the Power Unit were plugged at the factory to prevent the entry of contamination. These plugs must not be removed until just before piping connections are made to the unit.

Storage

If the Power Unit is not going to be installed immediately, it should be stored indoors, covered with plastic sheet, and all open ports plugged. If long term storage is expected (6 months or more) we recommend filling the reservoir completely with clean hydraulic fluid to prevent the entry of moisture.

Removing from Shipping Skids

Small JIC style Power Units should be moved with a fork-lift truck, with 2X4 boards under the reservoir belly, to distribute and steady the load. Larger JIC style Power Units have lifting holes in the reservoir end plates. Extra heavy 1 1/2 pipes can be inserted into the lifting holes for allowing movement with a fork-lift truck. L-shaped reservoirs are provided with clearance and cross braces under the base plate for movement with a fork-lift truck.

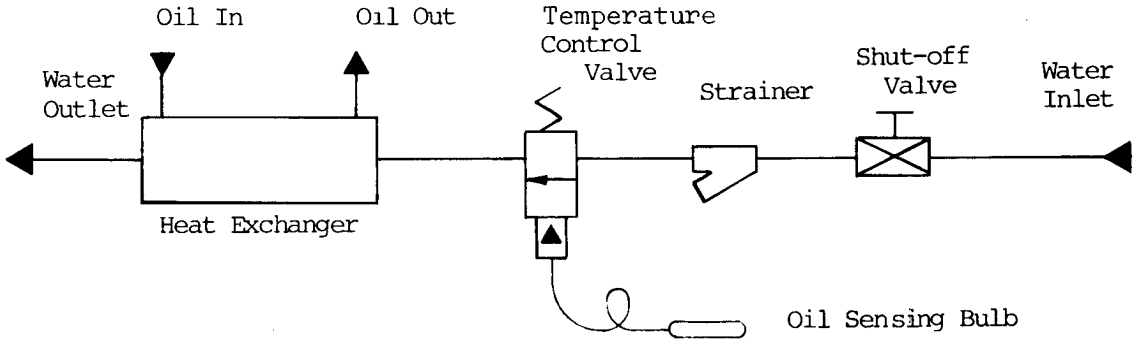
Installation

Locating Power Unit

The unit should be installed indoors, and preferably in a clean dry environment with an ambient temperature of 60 to 100°F. The unit can be installed outdoors if the reservoir was provided with optional weatherproof construction, and provisions were made for extreme temperature conditions. The reservoir can be secured to the floor or base using the four mounting holes located on the reservoir legs.

Service Connections

Water (If water cooled heat exchanger has been provided) Connect the water supply to the inlet of the heat exchanger, with a shut-off valve and strainer (if not supplied by Parker). If a Temperature Control Valve (Model WTC-**) has been provided, it also should be installed on the inlet side. The outlet of the hear exchanger should be connected directly to the facility drain system. On single pass heat exchangers the water connections should be installed as shown below. On multi-pass heat exchanger the water flow direction is not important.



Electrical Connect the pump motor to the facility power source following good practices as outlined in the National Electric Code and any local codes which may apply. Verify that the available voltage is the same as the voltage identified on the motor nameplate. Most motors have dual voltage ratings, so verify that the leads in the conduit box have been connected together as defined on the motor nameplate to match the facility power source available.

If Solenoid valves, pressure/temperature switches, or oil immersion heaters have been provided on the power unit, refer to the component nametag or other service information in this manual for operating voltage and ratings.

Supply and Return Connections

Complete all necessary interconnecting piping between the power unit and hydraulic actuators. The line sizes should be determined based on oil flow, operating pressure and allowable pressure drop between the power unit and actuator.

Warning
Check to insure that the proper rated hose or pipe is used on pressure lines.

One of the key ingredients for good service and long life from a hydraulic system is cleanliness, and since it has been our experience that most dirt infiltrates a hydraulic system during installation, we recommend the following rules be adhered to:

a) All open ports on the power unit, cylinders, etc. must remain plugged with tape or plastic plugs until just before the hydraulic connections are made.

b) All interconnecting tubing, pipe, or hose should be clean, and free of rust, scale and dirt. The ends of all connectors should be plugged until just before they are to be installed in the system.

c) All openings in the reservoir such as the filler breather or access end covers holes must remain closed during installation.

d) If Teflon tape, or pipe dope is used, be sure it doesn't extend beyond the first thread of the pipe fitting.

Reservoir Inspection

The reservoir has been thoroughly cleaned and sprayed with rust inhibitor at Parker prior to shipping. It is suggested, however, to remove the reservoir access covers and re-inspect the tank for cleanliness. JIC reservoirs are provided with a removable baffle for greater access for cleaning.

Note

On JIC reservoirs it is important for the baffle to be centered in the tank, and for the sealing gaskets to take a good set if the end covers are to seal properly. Reinstall end covers as follows:

a) Locate the baffle in the center of the tank.

b) Install end covers hand tight, being careful not to move the baffle.

c) Torque one cover a small amount, and then torque the opposite end cover a small amount more. Continue going back and forth between the covers until both are torqued equally. (See figure 1 for proper torque value.)

Reservoir Filling

The reservoir must be filled with clean fluid thru the filler cap on the reservoir. The type of fluid must be compatible with the seals used on the power unit, and must comply with the recommendations of the manufacturers of the component parts.

Refer to the component manufacturer's catalog for fluid requirements.
The cleanliness of the fluid going into the reservoir is very important, and in some cases, even new oil out of the drum is not adequate. We recommend that any fluid being transferred into the reservoir be done with a transfer pump with a 10 micron filter installed. A Parker filter cart is available for this purpose.

Coupling Alignment

It is possible for pump/motor shaft alignment to be incorrect because of shock incurred during shipping. The alignment should be re-checked before start-up.
If the pump/motor assembly has been foot mounted, the coupling alignment should be checked using the coupling installation instructions provided in the appendices of this manual. If re-aligning is required, the motor mounting bolts should be loosened, and shims inserted. Note, see figure 3 for Lovejoy or Magnaloy couplings.

If the pump/motor assembly has been mounted with a bell-housing, the only check required is to verify that the coupling halves have adequate clearance, and that the coupling set-screws are tight. A slot is provided in the bell housing for this purpose.

Start-Up Procedure

1) Open any ball or gate valve (if applicable) located in the pump suction line.

2) Back the system relief valve and/or pump pressure compensator adjustment knob out, so that the pressure will be near zero during the initial start.

Note

If the power unit has been provided with a variable displacement pump or any piston pump, the pump case should be filled with clean oil prior to priming. In most cases this can be accomplished by disconnecting the pump case drain line and pouring the oil into the pump case drain port.

3) If the system has been provided with an open center directional valve, the oil during start-up will flow directly back to tank. If the system has a closed centered valve, it may be necessary to loosen a fitting momentarily at the pump discharge, to bleed any air in the pump during the priming operation.

4) Jog the pump motor once, and verify that the pump is rotating in the same direction as the arrow tag on the pump case. If the direction is incorrect, reverse two (2) of the three (3) motor leads, and recheck the rotation.

5) Jog the pump motor (3) to (6) times to prime the pump and allow the pump to run for several minutes at zero pressure. Check the piping for any leaks and correct immediately. (Leaks in fittings and tubing can be the result of vibration during shipping.)

6) Begin adjusting the relief valve and/or pump compensator to increase the pressure gradually. Note; on systems with open center directional valves, it will be necessary to actuate the valve to build pressure.

7) Continue increasing pressure until normal operating pressure is obtained, and recheck system for leaks. Lock adjustment screws in place.

Note

If the system has been provided with a pressure compensated pump and a relief valve, adjust the relief valve approximately 10% higher than the compensator so that excessive heat is not generated by the relief valve.

8) During the start-up sequence, all filters should be monitored closely. Replace any filters element immediately, as soon as they begin to go into by-pass as indicated on the visual indicator.

9) After the entire system has been wetted with fluid, refill the reservoir to the normal operating level.

10) Verify that the cooling water to the hear exchanger (if applicable) is flowing. If the power unit has been provided with a water control valve (Model WTC-**), and the oil temperature is exceeding 135°F, adjust the valve to increase the water flow.

Special Tools

All normal service and maintenance on standard power units can be accomplished with standard handtools. No special tools are required.

General Maintenance

Electric Motors - Lubricate as recommended by the motor manufacturer.

Filters - Change or clean as required or as indicated on filters supplied with visual indicators.

Suction Strainers - Should be cleaned after 10 hours operation and 100 hours thereafter. See appendicies for cleaning instructions.

Reservoirs - Maintain oil level at all times. The oil should be checked after the first 100 hours and verify that the class of oil meet the requirements of the pump being used. Change the oil every 1000 to 2000 hours depending on the application and operation environment.

Components - See component literature in appedicies.

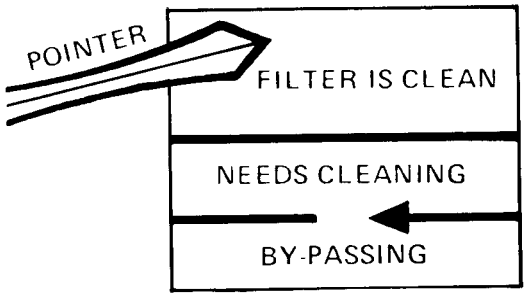
Recommended Spare Parts

Spare filter elements should be purchased with the power unit, and be available during the start-up operation. Other spare parts may be required, and are a function of the duty cycle of the hydraulic system, operation environment, and the acceptable down time of the equipment.

Preventive Maintenance

Filter Service

Filters must be maintained. The key to good filtration is filter maintenance. A machine may be equipped with the best filters available and they may be positioned in the system where they do the most good; but, if the filters are not taken care of and cleaned when dirty, the money spent fot the filters and their installation has been wasted. A filter which gets dirty after one day of service and is cleaned 29 days later gives 29 days of non-filtered fluid. A filter can be no better than the maintenance afforded it.



Maintenance Suggestions

1) Set up a filter maintenance schedule and follow it dilligently.
2) Inspect filter elements that have been removed from the system for signs of failure which may indicate that the service interval should be shortenend and of impending system problems.
3) Do not return to the system any fluid which has leaked out.
4) Always keep the supply of fresh fluid covered tightly.
5) Use clean containers hoses, and funnels when filling the reservoir. Use of a filter cart when adding oil is highly recommended.
6) Use common sense precautions to prevent entry of dirt into components that have been temporarily removed from the circuit.
7) Make sure that all clean-out holes, filler caps, and breather cap filters on the reservoir are properly fastened.
8) Do not run the system unless all normally provided filtration devices are in place.
9) Make certain that the fluid used in the system is of a type recommended by the manufacturers of the system or components.
10) Before changing from one type of fluid to another (e.g., from petroleum base oil to a fire resistant fluid), consult component and filter manufacturers in selection of the fluid and the filters that should be used. Also consult the publication **"Recommended Practice for the use of Fire Resistant Fluids for Fluid Power Systems"** published by the National Fluid Power Association.
11) Parker offers an oil sampling kit which can be used to ascertain the condition of the system fluid.

Maintaining Proper Oil Temperature

Hot oil in your equipment's hydraulic system is one of the primary causes of poor operation, component failure and downtime. Here are some pointers on maintaining proper oil temperature.

The oil in your hydraulic system was designed for operation within a specified temperature range. You may be able to run it at hotter temperatures for short periods of time, intermittently, without bad effects. If you run continuously with oil that's too hot, however, your equipment will operate poorly, and eventually key components will fail and halt your machine.

How Hot is "Too Hot"?

"Hot oil" is a relative term. In most cases, 120°F. at the reservoir is considered an ideal operating temperature. Always take an oil temperature reading at the reservoir, not at a component or any of the piping.

Some hydraulic systems are designed to operate at 130°F. or higher. If you don't know the maximum operating temperature for your equipment, check your component manual for temperature and viscosity limitations.

Measuring Oil Temperature

There are several ways to check the temperature of the oil. The best, most accurate method is by means of a thermometer. On some machines, this is mounted on the reservoir. Make it a habit to check the thermometer periodically, after the equipment has been running for more than an hour.

If your machine doesn't have a reservoir thermometer, use the "palm test." First check the tank with your fingertip; if it's not too hot to touch, place your palm on the tank. You'll be able to hold it there without discomfort if the oil temperature is about 130°F. or below.

Isolating Trouble-Spots

To determine which components are "running hot" and overheating the oil, feel the outlet fittings and lines at the valves, pumps and motors. If the oil is normal going into a component but hot coming out-that could be one of the trouble-makers.

A sticking valve can cause excessive heat. If a spool does not return promptly to the neutral position, the pump flow will be dumped continuously. This builds up heat rapidly.

If a relief valve is set too low, part of the oil will be dumped across the valve with every cycle. This too, generates excessive heat. Even when all valves are set properly, they may not be operating well because of worn orifices or seals.

Always remove and check the hot components first, before the others.

Look, Smell and Feel

Checking oil temperature periodically is good preventive maintenance. So too is the practice of periodically siphoning an oil sample from the reservoir, and comparing it with a sample of clean, new oil.

Oil that has been running too hot will look darker and feel thinner than new oil. It will also smell burned. Chances are, it will contain more contaminants, because hot oil leads to accelerated wear of component parts.

Preventive Measures

How can you keep your equipment's hydraulic system from running too hot?

1) Set up a regular schedule for checking the oil temperature, appearance, smell and feel. Change oil as recommended by the equipment manufacturer.
2) Be prompt about removing, checking and repairing or replacing valves, pumps or other components that are running hot.
3) If relief or flow-control valves are running hot, check and adjust their settings. Follow your equipment owner's manual.
4) Break in new components gradually. New, close-fittings parts expand at different rates, and are especially prone to seize when they get too hot.
5) Start a cold pump or motor on hot oil by jogging just enough to draw the hot oil into the component. Then wait a few minutes to allow the temperature to equalize in all the pump's parts. Repeat until the temperature on the outside of the pump is the same as that on the piping.
6) **Keep your equipment clean.** A thick layer of dirt acts as insulation. It will prevent the hydraulic system from getting rid of heat.
7) On hot days, and in hot climates, check and change the oil more frequently. Be sure to use an oil recommended for hot-weather operation by the equipment manufacturer or oil supplier.

Troubleshooting

Troubleshooting Areas

Dirty oil

1) Components not properly cleaned after servicing.
2) Inadequate screening in fill pipe.
3) Air breather left off. (No air breather provided... inadequate unit provided... insufficient protection of air breather.)
4) Tank not properly gasketed.
5) Pipe lines not properly covered while servicing machine.
6) Improper tank baffles not providing settling basin for heavy materials.
7) Filter dirty or ruptured.

Fire resistant fluids

1) Incorrect seals cause binding spools.
2) Paint, varnish or enamel in contact with fluids can cause sludge deposits on filters and around seal areas.

3) Electrolytic action is possible with some metals. Usually zinc or cadmium.
4) Improper mixtures can cause heavy sludge formations.
5) High temperatures adversely affect some of the fluids, particularly the water base fluids.
6) Adequate indentificaiton of tanks containing these fluids should be provided so that they will be refilled with the proper media.
7) As with mineral base oils, nuisance leaks should be remedied at once.
8) Make certain replacement parts are compatible with fluid media.

Foaming oil

1) Return of tank line not below fluid level. Broken pipe, line left out between a bulkhead coupling and the bottom of the tank after cleaning tank.
2) Inadequate baffles in reservoir.
3) Fluid contaminated with imcompatible foreign matter.
4) Suction leak to pump aerating oil.
5) Lack of anti-foaming additives.

Moisture in oils

1) Cooling coils not below fluid level.
2) Cold water lines fastened directly against hot tank causing condensation within tank.
3) Soluble oil solution splashing into poorly gasketed tanks or fill pipes left open.
4) Moisture in cans used to replace fluid in tanks.
5) Extreme temperature differential in certain geographical locations.
6) Drain not provided at lowest point in tank to remove water collected over possibly long operating periods.

Overheating of system

1) Water shut off or heat exchanger clogged.
2) Continuous operation at relief setting.
   a. Stalling under load, etc.
   b. Fluid viscosity too high or too low.
3) Excessive slippage or internal leakage.
   a. Check stall leakage past pump, motors and cylinders
   b. Fluid viscosity too low.
4) Reservoir sized too small.

5) Reservoir assembled without baffling or sufficient baffling.
6) Case drain line from pressure compensated pump returning oil too close to suction line.
   a. Repipe case drain line to opposite side of reservoir baffling.
7) Pipe, tube or hose I.D. too small causing high velocity.
8) Valving too small, causing high velocity.
9) Improper air circulation around reservoir.
10) System relief valve set too high.
11) Power unit operating in direct sunlight or ambient temperature is too high.

Foreign matter sources in the circuit

1) Pipe scale not properly removed.
2) Sealing compound (pipe dope, teflon tape allowed to get inside fittings.
3) Improperly screened fill pipes and air breathers.
4) Burrs inside piping.
5) Tag ends of packing coming loose.
6) Seal extrusions from pressure higher than compatible with the seal or gasket.
7) Human element... not protecting components while being repaired and open lines left unprotected.
8) Wipers or boots not provided on cylinders or rams where necessary.
9) Repair parts and replacement components not properly protected while stored in repair depot. (Rust and other contaminants.)

Troubleshooting Pumps

Pump makes excessive noise

1) Check for vacuum leaks in the suction line. (Such as leak in fitting or damaged suction line.
2) Check for vacuum leaks in the pump shaft seal if the pump is internally drained. Flooding connections with the fluid being pumped may cause the noise to stop or abate momentarily. This will locate the point of air entry.
3) Check alignment with drive mechanism. Misalignment will cause wear and subsequent high noise level in operation.
4) Check manufacturers specifications relative to wear possibilities and identification of indications of wear as high operating noise level, etc.

5) Check compatibility of fluid being pumped against manufacturers recommendations.
6) Relief or unloading valve set too high. Use reliable gauge to check operating pressure. Relief valve may have been set too high with a damaged pressure gauge. Check various unloading devices to see that they are properly controlling the pump delivery.
7) Aeration of fluid in reservoir (return lines above fluid level).
8) Worn or sticking vanes (vane type pump).
9) Worn cam ring (vane type pump).
10) Worn or damaged gears and housing (gear pump).
11) Worn or faulty bearing.
12) Reversed rotation.
13) Cartridge installed backwards or improperly.
14) Plugged or restricted suction line or suction strainer.
15) Plugged reservoir filter breather.
16) Oil viscosity too high or operating temperature too low.
17) Oil pour point too high.
18) Air leak in suction line or fittings also causing irregular movement of control circuit.
19) Loose or worn pump parts.
20) Pump being driven in excess of rated speed.
21) Air leak at pump shaft seal.
22) Oil level too low and drawing air in through inlet pipe opening.
23) Air bubbles in intake oil.
24) Suction filter too small or too dirty.
25) Suction line too small or too long.
26) Pump housing bolts loose or not properly torqued.

Pump failure to deliver fluid

1) Low fluid level in reservoir.
2) Oil intake pipe suction strainer plugged.
3) Air leak in suction line and preventing priming.
4) Pump shaft turning too slowly.
5) Oil viscosity too high.

6) Oil lift too high.
7) Wrong shaft rotation.
8) Pump shaft or parts broken.
9) Dirt in pump.
10) Variable delivery pumps. (Improper stroke.)

Oil leakage around pump.

1) Shaft seal worn.
2) Head of oil on suction pipe connection-connection leaking.
3) Pump housing bolts loose or improperly torqued.
4) Case drain line too small or restricted. (Shaft seal leaking.)

Excessive pump wear

1) Abrasive dirt in the hydraulic oil being circulated through the system.
2) Oil viscosity too low.
3) System pressure exceeds pump rating.
4) Pump misalignment or belt drive too tight.
5) Air being drawn in through inlet of pump.

Pump parts inside housing broken

1) Seizure due to lack of oil.
2) Excessive system pressure above maximum pump rating.
3) Excessive torquing of housing bolts.
4) Solid matter being drawn in from reservoir and wedged in pump.

Troubleshooting Solenoid Valves

Solenoid failures

1) Voltage too low. If voltage will not complete the stroke of alternating current (AC) solenoid it will burn out the coil.
2) Signal to both solenoids of a double solenoid valve simultaneously. One or both of the solenoids will be unable to complete their stroke and will burn out. (Make certain the electrical signal is interlocked so that this condition cannot exist.)
3) Mechanical damage to leads. (Short circuit, open connections, etc.)

4) Tight spool or other mechanical parts of the valve being actuated can prevent the solenoid from completing its stroke and subsequently burning out.
5) Replacement springs too heavy in valve. Overloads solenoid and shortens life.
6) Wrong voltage or frequency will either prevent operation because of inadequate capacity to handle the load with the lower voltage or burn out the coil because of improper winding and excessive voltage.
7) Dirty contacts may not supply sufficient current to solenoid to satisfy inrush demands.
8) Low voltage direct current solenoids may be affected by low battery capacity on cold mornings directly after starting cold engine.
9) Long feed lines to low voltage solenoids may cause sufficient voltage drop to cause erratic operation.

Solenoid valve fails to operate

1) Is there an electrical signal to the solenoid or operating device? Is the voltage too low? (Check with voltmeter... test light in emergency.)
2) If the supply to the pilot body is orificed, is the orifice restricted? (Remove orifice and check for foreign matter. Flushing is sometimes necessary because of floating impediment.)
3) Has foreign matter jammed the main spool? (Remove end caps and see that main spool is free in its movement... remember that there will be a quantity of fluid escaping when the cap is removed and provide a container to catch it.)
4) Is pilot pressure available? Is the pilot pressure adequate? (Check with gauge on main pressure input port for internally piloted types and in the supply line to the externally piloted type.)
5) Is pilot drain restricted? (Remove pilot drain and let the fluid pour into an open container while the machine is again tried for normal operation. Small lines are often crushed by machine parts banging against them causing a subsequent restriction to fluid flow.)
6) Is pilot tank port connected to main tank port where pressures are high enough to neutralize pilot input pressure? (Combine pilot drain and pilot tand port and check for operation with the combined flow draining into an open container... block line to main tank form pilot valve... if this corrects the situation, reroute pilot drain and tank line.)
7) Are solenoids improperly interlocked so that a signal is provided to both units simultaneously? (Put test light on each solenoid lead in parallel and watch for simultaneous lighting... check electrical interlock. This condition probably burns out more solenoids than any other factor.)

8) Has mounting pad been warped from external heating? (Loosen mounting bolts slightly and see if valve functions. End caps can also be removed and check for tight spool.)

9) Is fluid media excessively hot? (Check for localized heating which may indicate an internal leak... check reservoir temperature and see if it is within machine specifications.)

10) Is there foreign matter in the fluid media causing gummy deposits? (Check for contamination... make certain seals and plumbing are compatible with the type of fluid being used.)

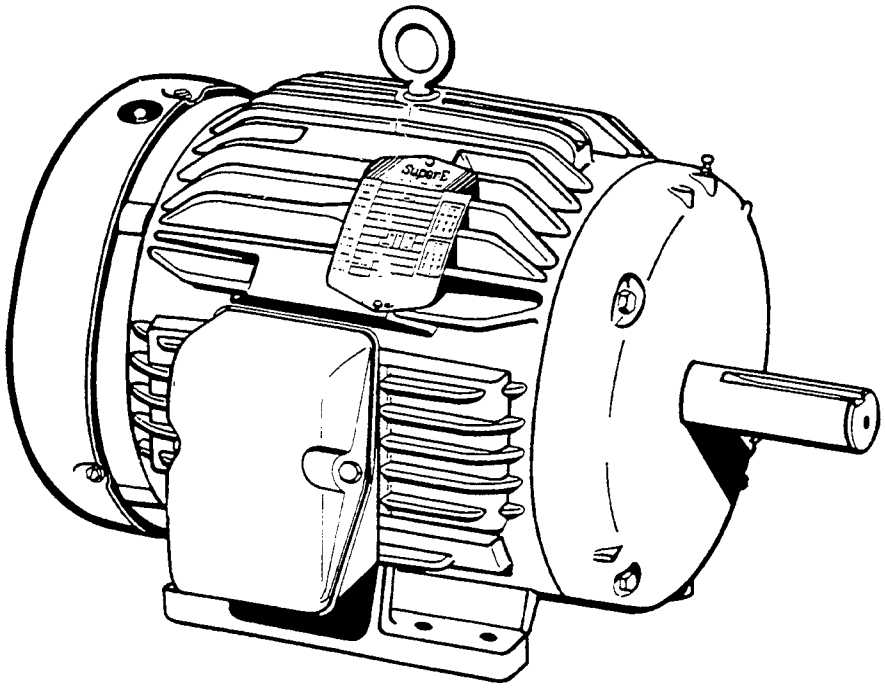
11) Is an adequate supply of fluid being delivered to actuate the load? (Many times there is sufficient pressure to shift the valve but not enough to actuate the work load. Check pump supply pressure and volume if necessary... physical measurement of flow through relief valve with units blocked may be necessary.)

12) Check circuit for possible interlocks on pressure sources to valve or to pilot.

MOTORS AND DRIVES

INSTRUCTION, OPERATION AND MAINTENANCE MANUAL

INTEGRAL HORSEPOWER AC INDUCTION MOTORS TEFC ENCLOSURE



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SAFETY PRECAUTIONS

☛ **WARNING:** High voltage and rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of electric machinery should be performed by qualified personnel.

Familiarization with NEMA publication MG-2, safety standard for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices is recommended.

For equipment covered by this instruction manual, it is important to observe the following safety precautions to avoid possible injury:

Avoid contact with energized circuits or rotating parts.

Avoid by-passing or rendering inoperative any safe guards or protective devices.

Avoid use of automatic reset devices where automatic restarting of equipment might be hazardous to the safety of personnel.

Failure to properly ground the frame of this machine can cause serious injury to personnel. Grounding should be in accordance with the National Electrical Code and consistent with pertinent local codes and practices.

Make sure that the shaft key is fully captive before the motor is energized.

Avoid extended exposure in close proximity to machinery with high noise levels.

Use proper care and procedures in handling, lifting, storing, installing, operating, and maintaining the equipment.

If eyebolts are used for lifting motor,they must be securely tightened. The lifting direction should not exceed a 20-degree angle with the shank of the eyebolt or the lifting lug for safe lifting.

Do not lift both the motor and the driven equipment with the motor lifting provisions. Motor lifting provisions are adequate for lifting the motor only.

Qualified maintenance personnel and safe maintenance practices are imperative. Be sure that the following precautions are taken before beginning maintenance:

The equipment connected to the shaft will not cause mechanical rotation.

Disconnect main machine windings and all accessory devices from the power source before disassembly of motor.

If a high potential insulation test is required, procedure and precautions as outlined in NEMA MG-1 and MG-2 standards should be followed.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently, consult your Baldor distributor or an authorized Baldor Service Center.

RECEIVING

Each shipment should be thoroughly inspected upon arrival. Any damage should be immediately reported to the carrier and a claim filed. For additional assistance,contact the Baldor distributor from whom you purchased the motor.

STORAGE

In the event that the motor will not be put into service immediately, certain precautions should be taken. The motor should be stored in a clean, dry, and warm location.

If the storage location is damp or severe humidity changes exist, the motor windings should be protected from excessive moisture by energizing the space heaters, when provided, during storage.

It is recommended that periodic inspections of the insulation integrity be performed by use of a megger, and a log kept of the pertinent information. Any significant drop in insulation resistance should be investigated.

Grease lubricated bearings are prepacked at the factory and no further preventative bearing maintenance on the bearings is required during storage. Rotate the shaft ten or more revolutions at least every two months during storage, more frequently if possible.

UNPACKING

All motors are packaged for ease of handling and to prevent entry of contaminants. To avoid condensation inside the motor, unpack only when motor temperature has reached the temperature of the room in which it will be unpacked. Motor installation should be completed before attempting to energize. All protective wrapping should be removed before starting.

HANDLING

The motor should be lifted using the provided lifting lugs or eyebolts. Motor lifting provisions are adequate for lifting the motor only.

They are not to be used to lift the motor plus additional equipment such as pumps, compressors or other driven equipment. In the case of assemblies on a common base, lugs or eyebolts provided on the motor are not to be used to lift the assembly and base. Rather, the assembly should be lifted by a sling around the base of the entire unit or by other lifting means provided on the base of the assembly. In the event of unbalanced loads (such as couplings or other attachments), additional slings or other effective means should be used to prevent tipping. A motor should never be lifted by the shaft of the motor. Contact your Baldor distributor or an authorized Baldor Service Center for further information.

Failure to observe these precautions may result in damage to the equipment, injury to personnel, or both.

INSTALLATION

☛ **WARNING:** Installation should be in accordance with the National Electrical Code and consistent with pertinent local codes and practices. Coupling, belt and chain guards should be installed to protect against accidental contact with moving parts. Machines accessible to personnel should be further guarded by screening, guard rails, etc.

Failure to observe these precautions may result in injury to personnel.

LOCATION: Install the motor in a well ventilated area. Make sure there is clearance for ventilation, cleaning, repair, and accessibility for inspection for all machines. It is important that the external provisions for ventilation are not obstructed in any manner that might limit the free passage of air.

TEFC motors are suitable for indoor or outdoor standard service applications.

These motors are not designed for atmospheric conditions requiring explosion proof operation, such as flammable or combustible vapors or dust.

Failure to observe these precautions may result in damage to the equipment, injury to personnel, or both.

MOUNTING: The motor must be securely mounted to a rigid foundation to minimize vibration and to maintain alignment between the motor and the driven equipment or vibration and bearing damage may result. Foundation caps and sole plates, when used, are designed to act as spacers between the true foundation and the machine and must be evenly supported by the foundation. After accurate alignment of the drive and load-machine shafts, the base should be grouted to the foundation.

Motors may, under certain conditions, be mounted other than horizontally. Consult your Baldor distributor or an authorized Baldor Service Center for further information.

The standard motor base is suitable for horizontal or vertical mounting. Adjustable bases or sliding rails are suitable for horizontal mounting.

ALIGNMENT

Direct Coupling - Align motor accurately with the driven unit. For direct drive, use flexible couplings if possible. For drive recommendations, consult drive or equipment manufacturers.

Accurate mechanical alignment is essential for successful operation. Mechanical vibration and roughness in running the motor may indicate poor alignment. It is recommended that the alignment be checked with dial indicators. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

End-Play Adjustment - The axial position of the motor frame with respect to the load is important. The bearings are not designed to take excessive external axial thrust loads.

Belt Drive - Refer to NEMA MG-1 section 14.07 for the application of pulleys, sheaves, sprockets, and gears. Align the sheaves carefully to minimize belt wear and axial load on bearings. Belt tension should be sufficient to prevent belt slippage at rated speed and load, however, slippage may occur during starting.

DO NOT OVER-TENSION BELTS

The pulley ratio should not exceed 8:1. For more information, contact your Baldor distributor or an authorized Baldor Service Center.

DOWELING & BOLTING

After alignment, dowel pins should be inserted through the motor feet into the foundation to maintain the position of the motor should removal be required. Baldor has made provisions on the frame for doweling. Dowel holes should be drilled in the provided location in diagonally opposite feet. These holes should be drilled and reamed together with corresponding holes in the foundation and properly fitting dowel pins inserted.

Mounting bolts must be carefully tightened to prevent changes in alignment and possible damage to equipment. It is recommended that a flat washer and a lock washer be used under each nut or bolt head to insure a secure hold on the motor feet. Flanged nuts or bolts may be used as an alternative to washers.

POWER SUPPLY & CONNECTION

☛ **WARNING:** Motor and control wiring, overload protection, accessories, and grounding should be in accordance with the National Electrical Codes and consistent with local codes and practices.

Failure to observe these precautions may result in damage to the equipment, injury to personnel, or both.

Motor lead connections should be made as shown on the connection diagram located on the nameplate or the inside cover of the conduit box.

The motor frame must be grounded by attaching a ground strap from a known, well established ground point to the grounding bolt provided inside the conduit box.

Conduit Box - For ease in connection, an oversized conduit box rotatable 360 degrees in 90 degree increments is provided. Auxiliary conduit boxes are provided for accessories such as space heaters, RTD's, etc., on some motors.

ALLOWABLE VOLTAGE AND FREQUENCY

Induction machines shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency up to the following:

1. Plus or minus 10 percent of rated voltage, with rated frequency.

2. Plus or minus 5 percent of rated frequency, with rated voltage.

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

Performance within these voltage and frequency variations will not necessarily be in acordance with the standards established for oepration at rated voltage and frequency.

OPERATION

PRE-OPERATION CHECK

Disconnect power before motor disassembly and touching any internal part. High voltage may be present even when the machine is not rotating.

Before starting the motor for the first time, the following steps should be followed:

1. Make sure all hold down bolts are tightened.

2. If motor has been idle or in storage for an extended period of time, check winding insulation integrity by using a "megger".

3. All electrical connections should be inspected for correct termination, clearance, mechanical strength, and electrical continuity.

4. Check to be sure all shipping and packaging braces (if used) are removed from the motor shaft.

5. Before connecting to driven equipment, manually turn shaft to make sure it rotates freely.

6. Replace all panels and covers removed during installation before operation.

7. Check to make sure that all coupling guards and other protective hardware are not blocking the ventilation of the motor and not in a position to cause damage or injury when the shaft begins to rotate.

INITIAL START-UP

◆ **CAUTION:** Read each of the following steps carefully before attempting to start motor.

IMPORTANT: If driven equipment can be damaged by rotating in the wrong direction, remove or uncouple motor from the load before checking for rotation.

If direction of rotation needs to be corrected, disconnect input power supply and interchange any two input power leads or refer to the connection diagram on the nameplate or inside of the conduit box cover.

1. Check direction of rotation by momentarily applying power to the motor.

2. It is preferred that the initial start and running of the motor be in an uncoupled no load state.

3. After starting the motor, check that the motor is running smoothly without excessive noise or vibration. If either is present, shut down the motor immediately and investigate. The motor should be run uncoupled for approximately 30 minutes to 1 hour.

COUPLED START-UP

1. After initial start-up procedures are performed successfully, stop motor, assemble the coupling.

2. Check to be sure that the coupling is properly aligned and not binding in any manner.

3. The first coupled start-up should be with no load. Check to see that the driven equipment is not transmitting any vibration back to the motor through the coupling or the base, and any vibration is within an acceptable level.

4. Run for a period of approximately 1 hour with driven equipment in an unloaded condition.

5. After successfully completing these steps, the equipment can now be loaded.

Do not exceed the value of nameplate amperes times the service factor under steady continuous load.

JOGGING AND REPEATED STARTS

Repeated starts and/or jogs of induction motors greatly reduce the life of the winding insulation. The heat produced by each acceleration or jog is much more than that dissipated by the motor under full load. If it is necessary to repeatedly start or jog a motor, it is advisable to check the application with the local Baldor distributor or an authorized Baldor Service Center or refer to NEMA MG1-12.50.1.

Heating - Duty and maximum ambient temperature are stated on the nameplate of the motor. If there is any question regarding safe operation, contact the local Baldor distributor or an authorized Baldor Service Center.

Overheating of the motor may be caused by improper ventilation, excessive ambient temperature, dirty conditions, excessive current due to overload or unbalanced AC voltage.

MAINTENANCE

GENERAL

Inspect the motor at regular intervals, approximately every 500 operating hours or every 3 months, whichever comes first. Keep the motor clean and the ventilation openings clear. Keep accurate maintenance records.

The following should always be observed during inspections:

CLEANLINESS

The interior and exterior of the motor should be kept free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc., can accumulate and block ventilation. If the motor is not properly ventilated, overheating can occur, causing early motor failure.

☛ **WARNING:** High voltage. Electric shock may cause serious or fatal injury. Disconnect power before touching any internal part of the motor. High voltage may be present even when the machine is not rotating.

INSULATION AND WINDINGS

Periodically the motor insulation integrity should be checked using a "megger". Check all electrical connections to be sure they are tight.

LUBRICATION AND BEARINGS

Anti friction bearing grease used in grease-lubricated anti-friction bearings does not lose its lubricating ability suddenly, but over a period of time. For a given bearing construction and assembly, 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 operating conditions. Good results can be obtained if the following recommendations are followed. (See Table I)

RELUBRICATION RECOMMENDATIONS

TYPE OF GREASE

A high grade ball and roller bearing grease. Recommended greases for standard service conditions are:

Shell Dolium R or Chevron SRI.

If other greases are preferred, check with a local Baldor Service Center for recommendations.

RELUBRICATION INTERVALS

Table I: Recommended relubrication intervals at standard service conditions.

NEMA/(IEC) FRAME SIZE	RATED SPEED - RPM			
	3600	1800	1200	900
Up to 210 incl. (132)	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 5000 incl. (300)	*2200 hrs	3500 hrs	7400 hrs	10500 hrs

* Bearings in 360 through 5000 frame, 2 pole motors are either 6313 or 6314 bearings. Stated relubrication interval reflects this selection. If roller bearings are used, the listed relubrication interval is to be divided by 2.

Table II - Service Conditions

SEVERITY OF SERVICE	AMBIENT TEMPERATURE MAX	ATMOSPHERIC CONTAMINATION	TYPE OF BEARING
STANDARD	40 DEGREES C	CLEAN, LITTLE CORROSION	DEEP GROOVE BALL BEARING
SEVERE	50 DEGREES C	MODERATE DIRT, CORROSION	BALL THRUST, ROLLER
EXTREME	>50 DEGREES C* or CLASS H INSULATION	SEVERE, DIRT, ABRASIVE DUST, CORROSION	ALL BEARINGS
LOW TEMPERATURE	<-30 DEGREES C**		

* Special high temperature grease is recommended.

** Special low temperature grease is recommended.

Table III - Lubrication Interval Multiplier

OPERATING CONDITION	MULTIPLIER
STANDARD	1.0
SEVERE	.5
EXTREME	.1

Table IV - Bearing Sizes and Types

FRAME SIZE	BEARING DESCRIPTION (THESE ARE THE "LARGE" BEARINGS IN EACH FRAME SIZE)					
NEMA/(IEC)	Largest Bearing in size category	OD D mm	Width B mm	Weight of Grease to be Added	Volume of grease to be added	
				GRAMS/OZ	IN^3	tsp
Up to 210 incl. (132)	6307	80	21	8.4/.30	0.6	2.0
Over 210 to 280 inc. (180)	6311	120	29	17.4/.61	1.2	3.9
Over 280 to 360 incl. (225)	6313	140	33	23.1/.81	1.5	5.2
Over 360 to 5000 incl. (300)	NU322	240	50	60.0/2.12	4.1	13.4

Weight in Grams = .005 DB

RELUBRICATION PROCEDURE

1. Clean grease fittings.
2. Remove grease outlet plug.
3. Add recommended amount of grease. Be sure grease to be added is compatible with grease already in motor. Consult your Baldor distributor or an authorized Baldor Service Center if grease other than recommended is to be used. If motor is to be greased while running, a somewhat larger quantity of grease will have to be used. Stop when new grease appears at shaft hole in the endplate or purge outlet plug.
4. Replace plug.

SAMPLE RELUBRICATION DETERMINATION

ASSUME - NEMA 286T/(IEC 180), 1750 RPM motor driving an exhauster fan in an ambient temperature of 43° C., atmosphere moderately corrosive.

1. Table I lists 9500 hours for standard conditions.
2. Table II classifies service conditions as "severe".
3. Table III lists a multiplier of .5 for severe conditions.
4. Relubrication interval should be 9500 X .5 = 4750 hours.
5. The amount of grease to be added is 1.2 in^3 or 3.9 tsp.

NOTE: Smaller bearings in size category may require reduced amounts of lubricant.

♦ **CAUTION:** To avoid damage to motor, bearings and grease must be kept free of dirt. In case of extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center.

Bearing removal - Contact an authorized Baldor Service Center or a District Office.

ACCESSORIES

The following accessories are available. Contact your Baldor distributor for pricing and lead-time information on each accessory listed below. (Note: Space heaters and/or winding RTD's are standard on some motors).

Space Heaters - Used to prevent condensation of moisture within the motor enclosure during periods of shut-down or storage.

Winding RTD - (Resistance Temperature Detector) Used to measure or monitor winding temperature during operation.

Winding Thermostat - Used to warn of excessive winding temperatures.

Winding Thermocouples - Used to measure or monitor winding temperature.

Bearing RTD - Used to measure or monitor bearing temperature during operation.

Bearing Thermostat - Used to warn of excessive bearing temperatures.

Bearing Thermocouples - Used to measure or monitor bearing temperatures during operation.

Roller Bearings - Recommended for belt drive applications with speed of 1800 RPM or below.

Conduit Boxes - Auxiliary conduit boxes available in smaller and larger sizes.

Drains and Breathers - Stainless steel drains and separate breathers are available.

Hardware - Stainless steel hardware is available. Standard hardware is corrosion resistant zinc plated steel.

Nameplates - Additional stainless steel nameplates are available.

Rotation Arrows - Rotation arrows are supplied on motors designed to operate in one direction only. Additional rotation arrows available.

Drip Covers - For use when motor is mounted in vertical position. Contact your Baldor distributor to confirm that motor is designed for vertical mounting.

• **NOTE:** On some motors, accessory device leads are brought out to a separate conduit box located on the side of the motor housing unless otherwise specified.

TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
Motor won't start	Usually line trouble, such as single phasing at the starter.	Check source of power supply. Check overloads, fuses, controls, etc.
Excessive humming	High voltage	Check input voltage and for proper connections.
	Eccentric air gap	Have motor checked at local service center.
Motor over-heating	Overload. Compare actual amps nameplate rating.	Check for excessive friction in motor or driven equipment. Reduce load or replace motor with unit of greater capacity.
	Single-phasing	Check current, all phases. Should be approximately equal.
	Improper ventilation	Check external cooling fan to be sure air is moving properly through cooling fins.
	Unbalanced voltage	Check voltage, all phases. Should be approximately equal.
	Rotor rubbing on stator	Check air gap clearance and bearings.
	Over voltage or under voltage	Check voltage.
	Open stator windings	Check stator resistance in all three phases for balance.
	Grounded winding	Dialectric test and repair.
	Improper connections	Recheck all connections in accordance with connection diagram.
Bearing over-heating	Misalignment	Realign motor and equipment
	Too much tension in belt drive	Reduce belt tension to a point adequate for load.
	Excessive end thrust	Reduce thrust from driven machine.
	Too much grease in bearing	Remove grease until cavity is approximately 3/4 filled.
	Insufficient grease in bearing	Add grease to bearing until approximately 3/4 filled.
	Dirt in bearing	Clean bearing and bearing cavity. Repack with correct grease.
Vibration	Misalignment	Realign motor and driven equipment.
	Rubbing between rotating and stationary parts	Eliminate cause of rub.
	Rotor out of balance	Have rotor balance check and repaired at local repair center.
	Resonance	Tune system or contact a local service center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Replace rotor. Check integrity of insulation. Check ventilation openings.
Growling or whining	Bad bearing	Replace bearing. Purge and replace grease.

Product Overview: VL5004A

Click for Larger Image

Catalog Number:	VL5004A
Description:	1/2HP | 1725RPM | 1PH | XPFC | 56C NEMA
Ship Weight:	36 lbs.
List Price:	$12
Multiplier Symbol:	K

View Specifications

FEATURES

- Corrosion resistant epoxy finish
- Positively locked drive end bearing
- U.L. approved cast conduit box standard
- 1.00 Service Factor
- U.L. and CSA approved for Class I, Group D or Class II, Group F &G

APPLICATIONS

Pumps, blowers, valves, etc.

Specifications: VL5004A

Catalog Number:	VL5004A
Specification Number:	34-5335W369
Horsepower:	1/2
Voltage:	115/208-230
Hertz:	60
Phase:	1
Full Load Amps:	7.4/3.9-3.7
Usable at 208 Volts:	3.9
RPM:	1725
Frame Size:	56C
Service Factor:	1.00
Rating:	40C AMB-CONT
Locked Rotor Code:	J
NEMA Design Code:	N
Insulation Class:	B
Full Load Efficiency:	64
Power Factor:	66
Enclosure:	N/A
Baldor Type:	X3424L
DE Bearing:	N/A
ODE Bearing:	N/A
Electrical Specification Number:	34WGW369
Mechanical Specification Number:	34-5335
Base:	N
Mounting:	F1

* For certified information, contact your local Baldor office.

Performance Data: VL5004A

Rating - Nominals

Rated Output	0.5
Volts	115/208-230
Full Load Amps	7.4/3.9-3.7
Speed	1725
Hertz	60
Phase	1
NEMA Design Code	N
LR KVA Code	J
Efficiency	64.0
Power Factor	66
Service Factor	1.00
Rating - Duty	40C AMB-CONT

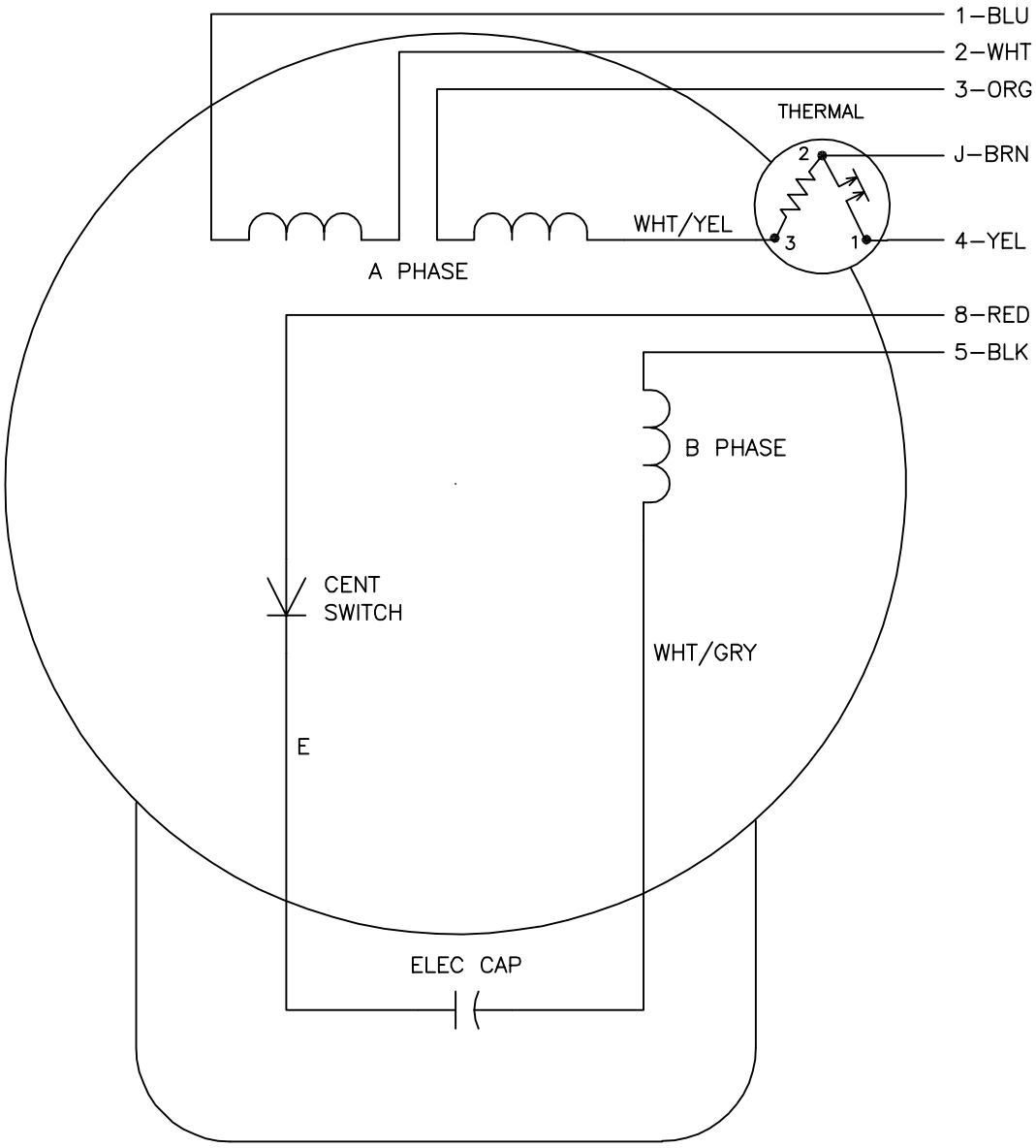
Characterstics

Full Load Torque	1.5 LB-FT
Break Down Torque	4.4 LB-FT 293 % of F.L. Torque
Locked-Roter Torque	5.1 LB-FT
Starting Current (Amps)	19.41
No-Load Current (Amps)	2.81
Line-line Resistance @ 25° C	3.94 A ph 2.93 B ph
Temperature Rise, C @ FL (in deg)	61

Load Characteristics - Tested

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	37	48	59	67	74	79	
Efficiency	38.8	55.2	62.0	64.9	65.1	63.8	
Speed (rpm)	1781	1768	1753	1736	1717	1696	
Line Amperes	2.89	3.06	3.31	3.69	4.13	4.69	

***** For certified information, contact your local Baldor office.

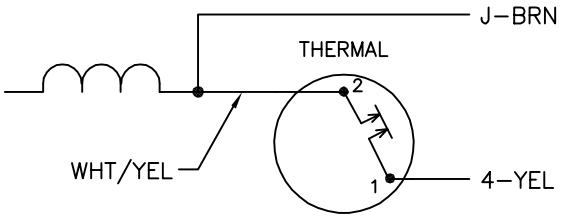


	LINE A	LINE B	JOIN	JOIN
HIGH STD	1	4	2,3,8	J,5
HIGH OPP	1	4	2,3,5	J,8
LOW STD	1,3,8	4	–	2,J,5
LOW OPP	1,3,5	4	–	2,J,8

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
3. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

INTERNAL CONNECTION FOR
TWO TERMINAL THERMAL



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REV. LTR: E	BY: JLP	REVISED: 04/09/99 8:12	TDR: 0178636
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		MTL: –	

BALDOR ELECTRIC Co.

TYPE L, DV, REV, THERMAL, 7 LEADS

CD0008

Product Detail

2510FR1
MANUAL STARTER 277VAC F +OPTIONS

Product Characteristics | Digest Information | Docs & Literature | Pricing & Ordering

Product Characteristics	
2510FR1	Manual Starter 277vac Type F +Options
Type of device	Single starter
Type of operator	Key
Number of poles	1 pole
Enclosure	NEMA 3R/7/9
Lockoff/Handle guard	Yes
Pilot light	None
Auto-Off-Hand Selector Switch	No
Additional pipe tap?	No