

MFP POWER UNITS

Custom Power Units Installation and Maintenance Manual

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WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from MFP Automation Engineering provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety, and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability, and pricing, are subject to change by MFP Automation Engineering at any time without notice.

Introduction

This manual provides descriptive operation and maintenance instructions for Hydraulic Power Units manufactured by MFP Automation Engineering. Any additional information may be obtained from MFP by referencing the Unit's Model Number and Serial Number stamped on the Reservoir Nameplate.

Some of the Information in this manual may not apply to your power unit. Information on custom units may require 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. They should be aware of the limitations of the system and its 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, "L" shaped, or vertical reservoir; all of which incorporate sump drain, oil level gauge, filler/breather assembly and spare return connections. The pump will be coupled to the motor using either an integral close coupled configuration or flexible shaft coupling.

Customer 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 the 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 waterproof 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

Vertical Power Units should be removed from the skid by wrapping a heavy-duty nylon strap around the base of the motor mounting feet. This strap should be firmly secured to the lift truck forks when unit is lifted. Small horizontal style Power Units should be moved with a fork-lift truck, with 2 x 4 boards under the reservoir belly, to distribute and steady the load. Larger horizontal 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 exchange 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 MFP). If a temperature Control Valve has been provided, it also should be installed on the inlet side. The outlet of the heat 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. (See fig. 1)

Electrical Connect the pump motor to the power source following the good practices as outlined in the National Electric Code and any local codes which may

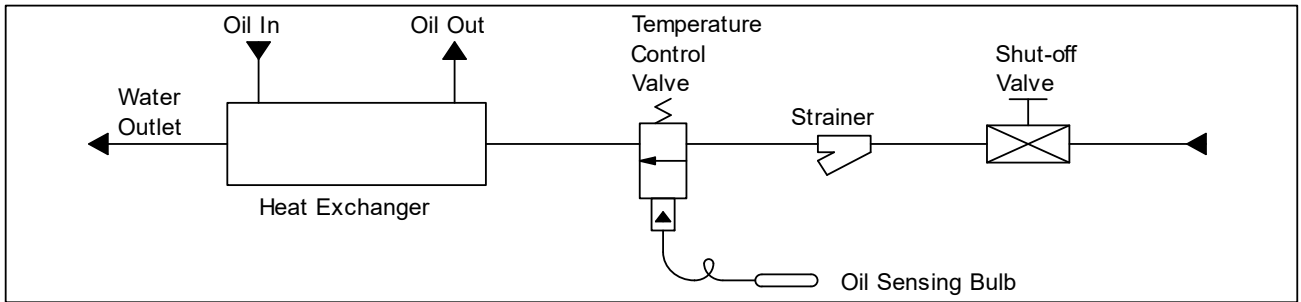


Figure 1

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 name tag or other service information in this manual for operating voltage and ratings. If part number 0111-650 or 0111-651 temp/level switch was provided with the power unit, refer to diagram below for wiring requirements (Figure 2). If TLS-100 series temp/level switch was provided, refer to wiring diagram below (Figure 3).

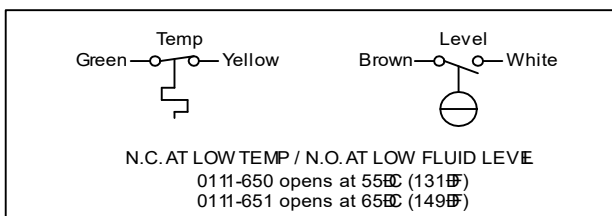


Figure 2

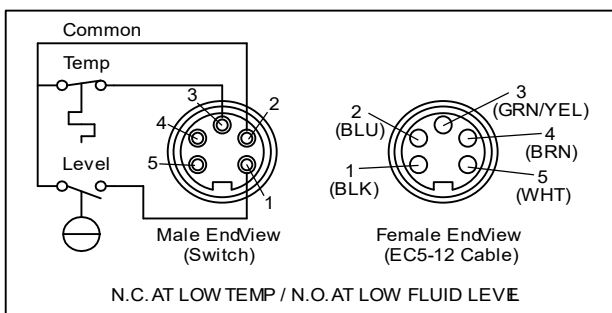


Figure 3

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 ensure 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 most dirt infiltrates a hydraulic system during installation, we recommend the following:

- 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 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 the transfer pump with a 10-micron filter installed.

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 center 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 compensator pump and a relief valve, adjust the relief valve approximately 300 PSI 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 heat exchanger (if applicable) is flowing. If the power unit has been provided with a water control valve, 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 hand tools. 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. Make sure to check indicators shortly after start-up.

Suction Strainers – Should be cleaned after 10 hours of operation initially and every 100 hours thereafter.

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

Recommended Spare Parts

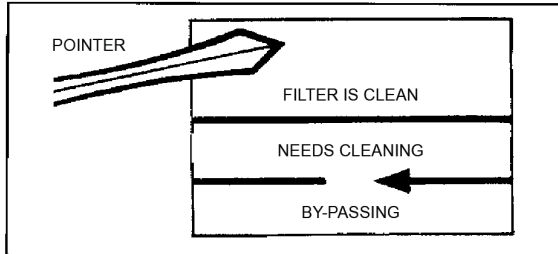
Spare filter elements should be purchased with the power unit and be available during the start-up operation. Other spare parts may be required and are a function of the duty cycle of the hydraulic system, operation environment, and the acceptable down time of the equipment.

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 aren't serviced and cleaned when dirty, the money spent for 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 provided.



Maintenance Suggestions

- 1) Set up a filter maintenance schedule and follow it diligently.
 - 2) Inspect filter elements that have been removed from the system for signs of failure which may indicate that the service interval should be shortened and of impending system problems.
 - 3) Never 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 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, filter 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) MFP 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 adverse effects. If you run continuously with oil that's too hot, your equipment will operate poorly causing key component failure and machine downtime.

"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.

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-fitting parts expand at different rates, and are especially prone to seize when they get too hot.
- 5) Start a cold pump 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.

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 temperature is normal going into a component but hot coming out, that could be one of the potential problem areas.

A sticking valve can cause excessive heat. If a spool does not return promptly to the neutral position, the pump flow will be dumping 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.

Check Oil Samples Periodically

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.

Normally it will contain more contaminants, because hot oil leads to accelerated wear of component parts.

General Troubleshooting

Dirty Oil

- 1) Components not properly cleaned after servicing.
- 2) Inadequate screening in fill pipe.
- 3) Air breather left off. (No air breather provided or insufficient protection of air breather).
- 4) Tank not properly sealed.
- 5) Pipelines 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) Improve mixtures can cause heavy sludge formations.
- 5) High temperatures adversely affect some of the fluids, particularly the water base fluids.
- 6) Adequate identification 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) Tank line not returned below fluid level.
- 2) Broken pipe.
- 3) Line left out between a bulkhead coupling and the bottom of the tank after cleaning.
- 4) Inadequate baffles in reservoir.
- 5) Fluid contaminated with incompatible foreign matter.
- 6) Suction leak to pump aerating oil.
- 7) Lack of anti-foaming additives.

Moisture in Oils

- 1) Cooling coils not below fluid levels.
- 2) Cold water lines fastened directly against hot tank causing condensation within the tank.
- 3) Soluble oil solution splashing into poorly sealed 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) Relief valve set too close to compensator pressure setting.
- 2) Water shut off or heat exchanger clogged.
- 3) Continuous operation at relief setting.
 - a. Stalling under load, etc.
 - b. Fluid viscosity too high or too low.
- 4) Excessive slippage or internal leakage.
 - a. Check stall leakage part pump, motors and cylinders.
 - b. Fluid viscosity too low.
- 5) Reservoir sized too small.
- 6) Case drain line from pressure compensated pump returning oil too close to suction line.
 - a. Re-pipe 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 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 premature wear and subsequent high noise level in the operation.
- 4) Check manufacturer's 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 manufacturer's 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 (van 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 filler breather.
- 16) Oil viscosity too high or operating temperature too low.

- 17) Air leak in suction line or fittings may cause irregular movement of hydraulic system.
- 18) Loose or worn pump parts.
- 19) Pump being driven in excess of rated speed.
- 20) Air leak at pump shaft seal.
- 21) Oil level too low and drawing air in through inlet.
- 22) Air bubbles in intake oil.
- 23) Suction filter too small or too dirty.
- 24) Suction line too small or too long.
- 25) Pump housing bolts loose or not properly torqued.

Pump failure to delivery 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 is not sufficient to complete the stroke of the solenoid, it will burn out the coil.
- 2) Voltage too high. Excessive voltage can also burn out coils.
- 3) 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).
- 4) Mechanical damage to leads. (Short circuit, open connections, etc.)
- 5) Tight spool or other mechanical parts of the valve being actuated can prevent the solenoid from completing its stroke and subsequently burning out.
- 6) Replacement springs too heavy in valve. Overloads solenoid and shortens life.
- 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. (DC)
- 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 tank port and check for operation with the combined flow draining into an open container...block line to main tank from 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 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.