MODEL 506.71/.81
HYDRAULIC
POWER SUPPLIES

006-205M

MTS

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INTRODUCTION

1.1 FUNCTIONAL DESCRIPTION

The Model 506.71 and Model 506.81 Hydraulic Power Supplies (HPS) use two independent variable volume pumps to provide the power source for hydraulic systems having flow requirements up to 110 gpm (416 ℓ/min) or 140 gpm (530 ℓ/min), respectively. Hydraulic fluid is supplied to the main pumps by a supercharge pump. The HPS is specifically designed to meet the requirements of systems using servovalves. Hydraulic fluid passes through a 3-micron low-pressure fine filter before entering the main pumps. Output fluid is filtered to 10 microns. Figure 1-1 shows the Model 506.81 Hydraulic Power Supply. The appearance of the Model 506.71 Hydraulic Power Supply is identical.

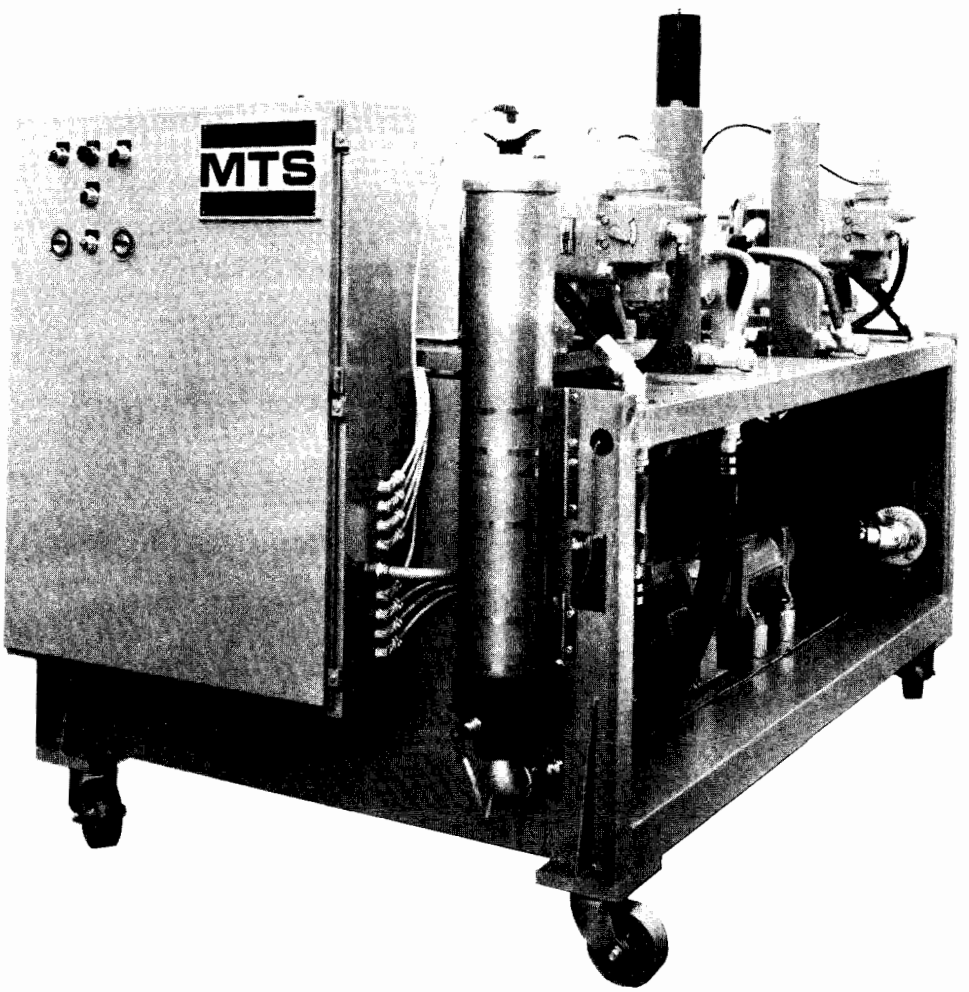


Figure 1-1. Model 506.81 Hydraulic Power Supply

The HPS may be operated locally through the use of controls mounted on the pump motor starter box assembly, or it may be operated from a remote control device located in the system electronics console. Both high-pressure and low-pressure (bypass) operation may be selected in either local or remote control. Output pressure during high-pressure operation is adjustable up to a maximum recommended continuous pressure of 3000 psi (20.7 MPa). Output pressure during low-pressure operation is approximately 150 psi (1.03 MPa). A pressure gage indicates output pressure during operation. The hydraulic system is protected by a back-up relief valve which prevents excessive output pressure. An under-pressure switch protects the main pumps by turning off the HPS if supercharge pump pressure drops below a minimum level.

The hydraulic fluid is temperature controlled by the use of a fluid-to-water heat exchanger. If fluid temperature exceeds the preset limit, a temperature-sensitive switch turns off the HPS. A temperature gage indicates fluid temperature.

A transparent fluid-level gage indicates both the level of hydraulic fluid in the reservoir and the relative contamination of the fluid. A low-level switch automatically turns off the HPS when the level of hydraulic fluid drops below a preset level.

A pump motor starter box assembly includes operator controls, a running time meter for each main pump, protective devices for the HPS electrical circuits, and a dirty-filter indicator and interlock for the low-pressure fine filter.

1.2 SPECIFICATIONS

Table 1-1 lists the specifications for the Model 506.71 and Model 506.81 Hydraulic Power Supplies. Specifications are listed in both U.S. customary and SI metric units of measurement.

NOTE

Specifications are subject to change without notice. Contact MTS Systems Corporation for verification of critical specifications.

Table 1-1. Model 506.71/506.81 HPS Specifications

Specification	Model	
	506.71	506.81
HYDRAULIC		
Flow capacity at 3000 psi (20.7 MPa)	110 gpm (416 ℓ/min)	140 gpm (530 ℓ/min)[1]
Reservoir capacity	350 gal (1330 ℓ)	350 gal (1330 ℓ)
Hydraulic fluid filtration		
Low-Pressure filter	3 micron absolute	3 micron absolute
High-Pressure filter	10 micron	10 micron
Hydraulic fluid hose connections[2]		
Pressure (37° flare)	-20(2)	-20(2)
Pressure (SAE 4-bolt flange)	-32(1)	-32(1)
Return (37° flare)	-24(2)	-24(2)
Return (SAE 4-bolt flange)	-32(1)	-32(1)
Drain (37° flare)	-8(3), -24(1)	-8(3), -24(1)
ELECTRICAL		
Main pump motor power rating	100 hp (74.6 kW)	125 hp (93.25 kW)
3-phase current at 460 Vac, 60 Hz[3]		
Inrush	670 A	805 A
Continuous	285 A	350 A
3-phase current at 380 Vac, 50 Hz (optional)[3]		
Inrush	530 A	600 A
Continuous	340 A	380 A
Starter type		
460 V, 60 Hz	part winding	part winding
380 V, 50 Hz	Wye-delta	Wye-delta

[1] The flow capacity for the Model 506.81 HPS is less when operated with 50 Hz power.

[2] The quantity is in parentheses. Flanged connections are per SAE J518, code 61.

[3] Current listings are typical maximum values. Actual maximum values may be as much as 15% higher.

Table 1-1. Model 506.71/506.81 HPS Specifications (Continued)

Specification	Model	
	506.71	506.81
COOLING WATER		
Maximum cooling water heat load	509,000 Btu/hr (130,000 kcal/hr)	636,000 Btu/hr (160,000 kcal/hr)
Required water flow Water pressure required Max. allowable water pressure	Refer to table 1-2 30-45 psid 120 psig	Refer to table 1-2 30-45 psid 120 psig
Water hose required (I.D.)	2 in. (51 mm)	2 in. (51 mm)
ENVIRONMENTAL		
Atmospheric heat load[4]	56,000 Btu/hr 14,000 kcal/hr	70,000 Btu/hr 16,000 kcal/hr
Maximum ambient operating temp	104°F (40°C)	104°F (40°C)
Minimum ambient operating temp	40°F (4.4°C)	40°F (4.4°C)
Noise rating at 3 ft. (0.9 M)[5]	100 dBA	100 dBA
PHYSICAL		
Height	73 in. (1854 mm)	73 in. (1854 mm)
Length	108 in. (2743 mm)	108 in. (2743 mm)
Width	60 in. (1524 mm)	60 in. (1524 mm)
Weight with fluid (uncrated)	10000 lb (4536 kg)	10500 lb (4763 kg)

[4] If the HPS is operated in a room without adequate ventilation, a fan is necessary for removal of the atmospheric heat load.

[5] Measured noise levels can be up to 10 dBA greater than the free field value.

Table 1-2. Required Water Flow

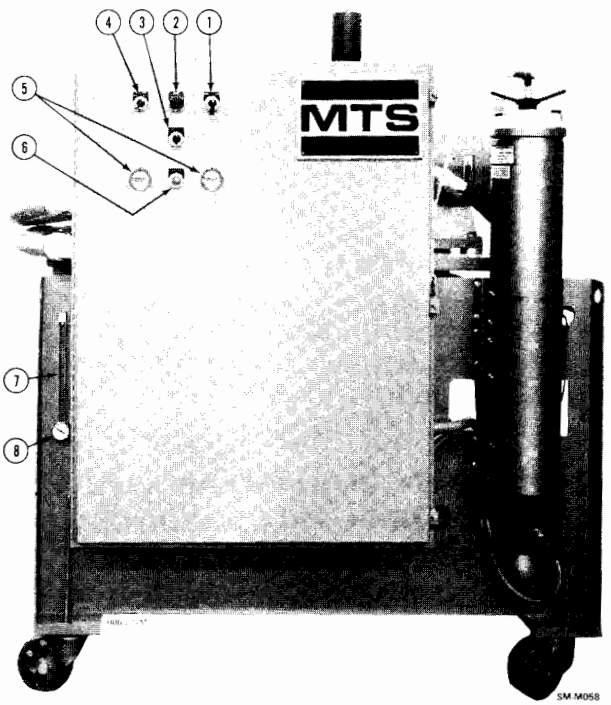
Cooling Water Inlet Temperature	HPS Model[1]			
	506.71-S	506.71-O	506.81-S	506.81-O
60°F (16°C)	30 gpm (114 ℓ/min)	30 gpm (114 ℓ/min)	30 gpm (114 ℓ/min)	30 gpm (114 ℓ/min)
65°F (18°C)	35 gpm (133 ℓ/min)	30 gpm (114 ℓ/min)	48 gpm (182 ℓ/min)	30 gpm (114 ℓ/min)
70°F (21°C)	53 gpm (201 ℓ/min)	30 gpm (114 ℓ/min)	100 gpm (380 ℓ/min)	30 gpm (114 ℓ/min)
75°F (24°C)	120 gpm (456 ℓ/min)	30 gpm (114 ℓ/min)	180 gpm (684 ℓ/min)	32 gpm (121 ℓ/min)
80°F (27°C)	--	36 gpm (137 ℓ/min)	--	45 gpm (171 ℓ/min)
85°F (30°C)	--	52 gpm (198 ℓ/min)	--	69 gpm (262 ℓ/min)
90°F (32°C)	--	74 gpm (281 ℓ/min)	--	100 gpm (380 ℓ/min)

[1] "S" denotes a standard-size heat exchanger; "O" denotes an over-size heat exchanger.

SECTION II
OPERATION

2.1 OPERATOR CONTROLS AND INDICATORS

Table 2-1 briefly explains the operator controls and indicators of the Model 506.71 and Model 506.81 Hydraulic Power Supplies (HPS) as shown in figure 2-1. The use of the service-related controls and indicators is described in detail in section III (Service) of this manual.



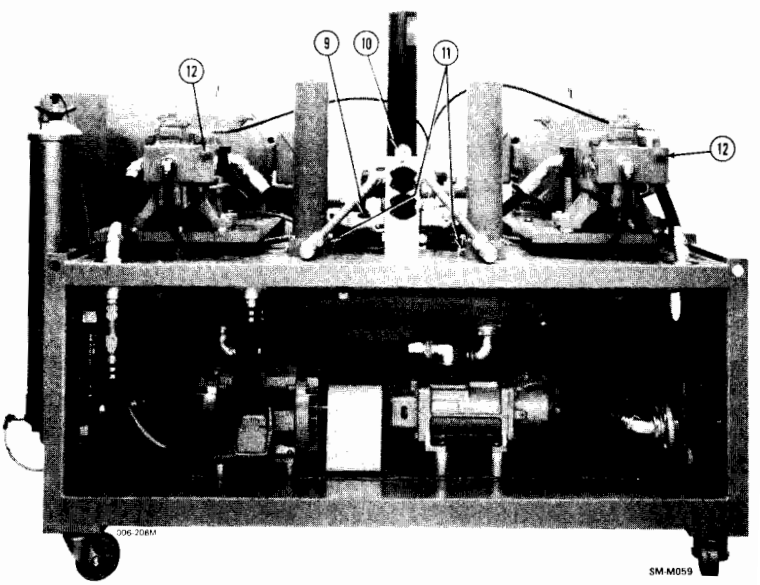


Figure 2-1. 506.71 and 506.81 HPS Controls and Indicators

***** WARNING *****

Do not start the HPS without considering possible actuator movement. Failure to have the system at zero balance (command = feedback) could result in violent actuator movement causing personal injury and/or equipment damage.

5. Turn the HIGH/LOW switch to the LOW position. This starts the supercharge pump, the main pump(s), and the running time meter(s). The pressure gage should indicate low pressure (approximately 150 psi/1.03 MPa).

6. Check the HPS for leaks and unusual sounds.

7. Turn the HIGH/LOW switch to the HIGH position to operate the HPS at full output pressure.

8. To change from high pressure to low pressure, turn the HIGH/LOW switch from HIGH to the center position.

9. To stop the HPS and remove output pressure, press the STOP button.

2.2.2 REMOTE OPERATION

Proceed with the following steps to operate the HPS from a remote control device (refer to figure 2-1):

1. Connect the cable from the remote control device to the cable receptacle located on the side of the pump motor starter box assembly.

2. Ensure all cooling water valves are open and the external hydraulic system is ready for operation. Ensure electrical power is applied to the HPS; the STOP button should be illuminated.

3. Turn the PUMP SELECTOR to the desired position. Either or both main pumps can be selected as determined by system requirements.

4. Turn the SPCH PUMP switch to the AUTO position.

***** WARNING *****

Do not start the HPS without considering possible actuator movement. Failure to have the system at zero balance (command = feedback) could result in violent actuator movement causing personal injury and/or equipment damage.

5. Start the HPS at the remote control device in the low-pressure mode (refer to the applicable remote control device product manual provided with the system).

Table 2-1. Model 506.71 and 506.81 HPS Controls and Indicators (Continued)

Item	Control/Indicator	Function
8	temperature gage	The temperature gage indicates the temperature of the hydraulic fluid in the HPS reservoir.
9	BACK-UP RELIEF VALVE	The BACK-UP RELIEF VALVE is adjusted to prevent output pressure from exceeding a preset level during overpressure surges or if, for example, the MAIN PRESSURE CONTROL valve becomes obstructed (refer to section III, subsection 3.1.1).
10	output pressure gage	The output pressure gage indicates the HPS output pressure.
11	DIRT ALARM indicators	The DIRT ALARM indicators (2) show when each high-pressure filter element needs replacement.
12	MAIN PRESSURE CONTROL	The MAIN PRESSURE CONTROLs (2) are used to adjust the HPS output pressure in the high-pressure mode (refer to section III, subsection 3.1.1).

2.2 OPERATING INSTRUCTIONS

The HPS can be operated locally, through the use of controls mounted on the pump motor starter box, or it can be operated from a remote control device mounted in the system electronics console.

2.2.1 LOCAL OPERATION

Proceed with the following steps to operate the HPS locally (refer to figure 2-1):

1. Remove the remote operation cable (if installed) from the electrical connector located on the side of the pump motor starter box assembly and install the jumper plug (chained to the receptacle) in the receptacle.

2. Ensure all cooling water valves are open and the external hydraulic system is ready for operation. Ensure electrical power is applied to the HPS; the STOP button should be illuminated.

3. Turn the PUMP SELECTOR switch to the desired position. Either or both main pumps can be selected as determined by system requirements.

4. Turn the SPCH PUMP switch to the AUTO position.

Table 2-1. Model 506.71 and 506.81 HPS Controls and Indicators

Item	Control/Indicator	Function
1	HIGH/LOW switch	The HIGH/LOW switch serves two functions: it turns on the HPS and selects either high-pressure or low-pressure operation. With the HPS off, turning the spring-loaded HIGH/LOW switch to the LOW position turns on the HPS. The HPS can only be started in the low-pressure mode. Once the HPS is running, turning the switch to the HIGH position selects high-pressure operation. Returning the switch to the middle position selects low-pressure operation. The switch is inactive during remote control operation.
2	STOP button/power on indicator	Pressing the STOP button turns off the HPS, regardless of any other switch or remote control settings. The STOP button also acts as a power-on indicator. The STOP button is illuminated whenever electrical power is applied to the HPS.
3	PUMP SELECTOR switch	The PUMP SELECTOR switch selects main pump NO. 1, main pump NO. 2, or BOTH main pumps when turned to the indicated positions.
4	SPCH PUMP switch	The SPCH PUMP switch controls the supercharge pump. Selecting the RUN position operates the supercharge pump, without operating the main pumps, to circulate hydraulic fluid through the heat exchanger and the fine filter without system hydraulic pressure applied. Selecting the AUTO position operates the supercharge pump only when the main pumps are running.
5	running time meters	The running time meters (2) indicate the total operating hours of each main pump.
6	FILTER DIRTY indicator	The FILTER DIRTY indicator lights when the low-pressure fine filter needs replacement. Refer to section III, Service, for filter element replacement instructions.
7	fluid-level gage	The transparent fluid-level gage indicates the level and relative contamination of the hydraulic fluid in the HPS reservoir.

6. Check the HPS and the external hydraulic system for leaks and unusual sounds.

7. Select high pressure at the remote control device.

8. To stop the HPS, press the hydraulic off button on the remote control device.

NOTE

Pressing the STOP button on the pump motor starter box assembly will stop the HPS in remote as well as in local operation.

2.2.3 COOLING OVER-TEMPERATURE FLUID

When the temperature of the hydraulic fluid in the HPS reservoir exceeds 140°F (60°C), the HPS will automatically turn off. The operator will not be able to restart the main pumps until the hydraulic fluid cools. Perform the following procedure when an over-temperature shutdown occurs:

1. Ensure the water supply to the heat exchanger is turned on.

2. Turn the SPCH PUMP switch to the RUN position. The supercharge pump will operate independently, circulating the hydraulic fluid through the heat exchanger to cool the fluid.

3. When the temperature gage reads 130°F (54°C), turn the SPCH PUMP switch to the AUTO position.

4. Reset the interlock on the remote control device (refer to the applicable remote control device product manual).

5. Restart the HPS.

When determing the cause of an over-temperature shutdown, first ensure the temperature gage actually reads higher than 140°F (60°C). If not, the over-temperature switch may be out of adjustment (refer to section III, subsection 3.1.3). Also, ensure the cooling water inlet and outlet valves are fully open. High inlet water temperature, low inlet-to-outlet water pressure differential, an improperly adjusted water-regulating valve, or clogged water tubes in the heat exchanger may also cause an over-temperature shutdown.

2. Turn the valve-adjusting screw, located on top of the water-regulating valve, fully counterclockwise.

3. Monitor the temperature gage while the hydraulic fluid temperature rises.

4. When the hydraulic fluid temperature reaches approximately 120°F (49°C), turn the valve-adjusting screw clockwise until water flow is detected (either audibly or by a customer-supplied visual flow indicator), then turn it counterclockwise until the water just stops.

5. If the temperature does not reach approximately 125°F (52°C) because of cool water or high water pressure, adjust the screw a half-turn (180 degrees) counterclockwise and note the effect after 15 minutes. Adjust further if necessary. If hydraulic fluid temperature exceeds 125°F (52°C), adjust the screw clockwise.

3.1.3 OVER-TEMPERATURE SWITCH ADJUSTMENT

The function of the over-temperature switch is to turn off the HPS if hydraulic fluid temperature exceeds a preset limit. The switch is adjusted at the factory to actuate at a hydraulic fluid temperature of 140°F (60°C). The location of the over-temperature switch is shown in figure 3-1. Perform the following procedure to adjust the over-temperature switch:

1. Remove the cover from the over-temperature switch and turn the adjusting screw (shown in figure 3-2) several turns clockwise to raise the actuation point.

2. Turn on the HPS and apply high pressure (refer to section II, subsection 2.2).

3. Turn off the cooling water supply to disable the cooling system.

4. When hydraulic fluid temperature reaches 140°F (60°C), as indicated on the temperature gage, turn the adjusting screw counterclockwise until the HPS turns off.

5. Turn on the cooling water supply.

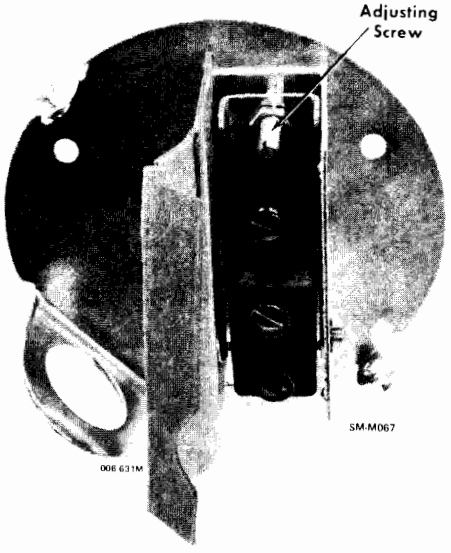


Figure 3-2. Over-Temperature Switch Adjustment

3.1.4 LOW-LEVEL SWITCH ADJUSTMENT

The low-level switch monitors the level of hydraulic fluid in the reservoir and turns off the HPS if the fluid level falls below the switch setting. The switch is adjusted at the factory for the minimum permissible level of fluid in the HPS reservoir. The switch can be adjusted to a higher level to enable earlier detection of fluid loss (such as would occur with system leaks and component or hose failure). Perform the following steps if readjustment is necessary.

NOTE

Ensure the HPS reservoir is filled to the proper level before adjusting the low-level switch. Do not overfill. The fluid level should never go above the fluid level sight gage.

1. Turn on the HPS and operate in the high-pressure mode (refer to section II, subsection 2.2).
2. Loosen the hand locknut on the stem of the switch.
3. Slowly raise the switch until the HPS turns off.
4. Lower the switch about 1.5 in. (38 mm) below the point where the HPS turned off.
5. Tighten the hand locknut.

3.2 FILTER MAINTENANCE

The 506.71/506.81 HPS contains filter elements which require periodic replacement. The following paragraphs provide the required procedures. Refer to figure 3-1 for filter locations.

3.2.1 HIGH-PRESSURE FILTER REPLACEMENT

The HPS contains two high-pressure filters, one for each main pump, as shown in figure 3-1. The high-pressure filter elements should be replaced whenever the DIRT ALARM indicators (mounted on the base of each high-pressure filter housing) point to CHANGE (red or yellow zone) and whenever the hydraulic fluid is replaced. The following procedure applies to either or both high-pressure filters as required.

1. Turn off the HPS.
2. Loosen the vent screw on top of the filter housing end-cap.
3. Open the cleaning port at the base of the filter housing and drain all fluid contained in the filter housing.
4. When the fluid is drained, close the cleaning port and tighten the vent screw. Discard the drained fluid.

CAUTION

Ensure that the cleaning port is closed. High pressure is present at the cleaning port during normal operation.

5. Using the square pin on top of the end-cap for leverage, unscrew and remove the end-cap.

6. Remove the compression spring plate on top of the filter elements and remove the filter elements (2).

7. Remove and save the grommet between the two filter elements. Discard the filter elements.

8. Inspect the O-ring and back-up washer in the end-cap. If replacement is not required, clean and lubricate with cup grease.

9. Inspect the filter housing for any remaining contamination.

10. Insert two clean filter elements (MTS part number 100533-05), with the grommet between the two elements, into the filter housing.

11. Insert the compression spring plate and replace the end-cap, being careful not to damage the O-ring and the back-up washer. Tighten the end-cap. Operate the HPS in the low-pressure mode for approximately 5 minutes to remove air from the filter housing. While doing so check for leaks.

3.2.2 LOW-PRESSURE FINE FILTER REPLACEMENT

Replace the low-pressure fine filter element whenever the FILTER DIRTY indicator on the pump motor starter box (refer to section II, subsection 2.1) is lit and the HPS is running at the normal operating temperature. The indicator may light during a cold-start condition, but should extinguish when the HPS reaches its normal operating temperature. Also, replace the low-pressure fine filter element whenever the hydraulic fluid in the HPS reservoir is replaced.

Perform the following steps to change the low-pressure fine filter. The location of the filter is shown in figure 3-1. Figure 3-3 illustrates the filter components.

1. Turn off the HPS.

2. Remove the transducer cable from the cover assembly.

3. Open one of the two bleed screws 1-1/2 turns.

4. Place a suitable container under the filter assembly and remove one of the two drain plugs to drain the filter housing.

5. When the filter housing is drained, close the bleed screw and replace the drain plug.

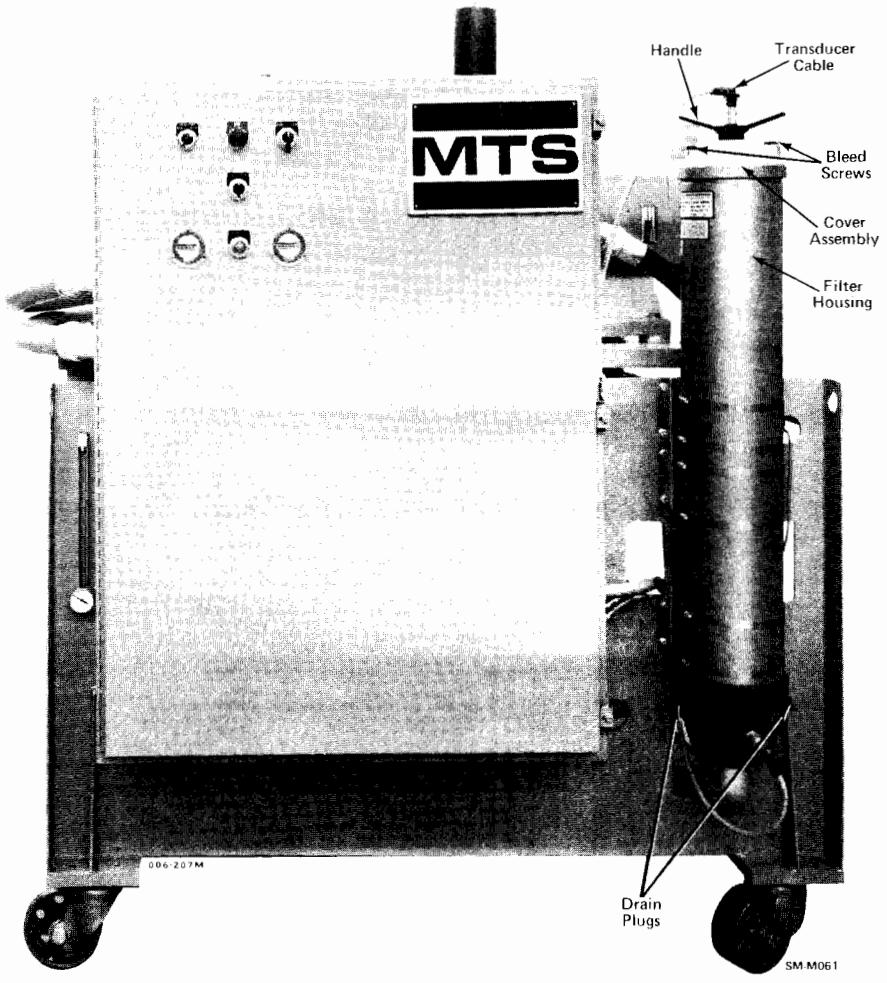


Figure 3-3. Low-Pressure Fine Filter

CAUTION

Ensure the bleed screw and drain plug are closed. Hydraulic pressure is present at these points during operation.

6. Remove the cover assembly by turning the handle counterclockwise until it screws off the standpipe and the cover assembly can be removed. Hand pressure should be all that is required.

7. Remove and discard the dirty filter element. Inspect the filter housing for any remaining contamination.

8. Insert a new filter element (MTS part number 114028-17).

9. Replace the cover assembly. Hand tighten only.

10. Bleed the filter housing as follows:

    A. Open the bleed screw 1-1/2 turns.

    B. Jog the supercharge pump by turning the SPCH PUMP switch to the RUN position momentarily and then back to the AUTO position. Continue to jog the supercharge pump until hydraulic fluid is present at the bleed screw.

    C. Close the bleed screw.

3.3 CHECKING AND REPLACING HYDRAULIC FLUID

Check the hydraulic fluid for contamination every 500 operating hours. Replacement of hydraulic fluid at this interval is necessary only in rare cases. System use and environment dictate the interval between regular fluid replacement.

NOTE

The ideal fluid change interval is affected by operating temperature and the amount of clean make-up fluid added on a regular basis. Fluid sampling should be performed at regular intervals to obtain maximum fluid life.

3.3.1 CHECKING HYDRAULIC FLUID

The transparent fluid-level gage gives a visual indication of the level and relative contamination of the hydraulic fluid. Fresh fluid is amber in color; when dirty, the color darkens to blackish brown. If there is any uncertainty regarding fluid contamination, obtain a sample of the fluid from the HPS reservoir and check it for the following qualities:

- Considerable darkness, burnt odor, or an opaque quality of the fluid indicates chemical breakdown. Replace the fluid. Considerable darkness also may indicate that the fluid has been allowed to rise above the maximum recommended temperature.

- A milky appearance indicates water is present in the fluid. Correct the source of the water leakage and replace the fluid.

- After allowing the sample to stand overnight, sediment at the bottom of the sample container indicates collapsed, ruptured, or clogged filters in the system. Replace the fluid and all filter elements.

When required, more extensive tests, such as chemical analysis, particle count, or viscosity checks, may be made to determine if the fluid is suitable for further use. Most oil companies have facilities for making these tests.

3.3.2 REPLACING HYDRAULIC FLUID

The following procedure is recommended for replacing the hydraulic fluid in the HPS reservoir. Perform this procedure whenever it has been determined that the hydraulic fluid is no longer suitable for use. Additional equipment required includes a Model 590.01 Fluid Transfer Pump or an equivalent transfer pump which provides 10-micron or better filtration.

NOTE

The ideal fluid change interval is affected by operating temperature and the amount of clean make-up fluid added on a regular basis. Fluid sampling should be performed at regular intervals to obtain maximum fluid life.

1. Turn off the HPS.
2. Remove the reservoir filler cap assembly and pump out the hydraulic fluid with the transfer pump. Any fluid remaining in the reservoir may be drained through the drain valve. Also, drain the oil from the entire system.
3. Remove the top plate from the reservoir.
4. Wipe out any remaining fluid or dirt with a lint-free cloth. Replace the top plate on the reservoir.

NOTE

Use of a transfer pump providing 10-micron or better filtration is very important since all commercial hydraulic fluids exceed the maximum amount of contamination allowable for use in MTS systems.

5. Using the transfer pump, transfer fresh hydraulic fluid into the reservoir. Refer to subsection 3.3.3 for the recommended hydraulic fluids.
6. Replace the high-pressure filter element (refer to subsection 3.2.1).
7. Operate the supercharge pump in the RUN mode for 4 to 6 hours before operating the system. If necessary, replace the low-pressure filter element (refer to subsection 3.2.2).

3.3.3 RECOMMENDED HYDRAULIC FLUIDS

In general, the hydraulic fluid must have a viscosity characteristic of ISO viscosity grade 46; approximately 225 SSu viscosity at 100°F (38°C). The viscosity index must be greater than 90. Additives for anti-foaming, anti-wear, oxidation resistance and high shear stability, are required.

The fluids listed in table 3-1 have proved acceptable and are recommended for use.

Table 3-1. Recommended Hydraulic Fluids

Manufacturer	Trade Name
Mobil Oil Company	Mobil DTE 25™
American Oil Company	Rykon Industrial Oil 46™ (old no. 21)
Shell	Tellus 46™
Texaco	Texaco Rando 46™
Daphne	Hydraulic Fluid S, Type 47™
Quaker[1]	Quintolubric™ (fire-resistant)

[1] Quaker Quintolubric is a synthetic-based hydraulic fluid and should not be mixed with petroleum-based hydraulic fluids.

Some MTS electrohydraulic testing systems are designed for use with a phosphate ester fire-resistant hydraulic fluid. Phosphate ester fluids have properties which call for a certain amount of caution on the part of the user.

NOTE

Quintolubric fire-resistant hydraulic fluid (recommended in table 3-1) is not a phosphate ester fluid.

Phosphate ester fluids dissolve ordinary paints. Any surface with which the fluid may come in contact should be painted with one of the following:

- Cat-A-Lac Top Coat 35407™ (Finch Paint and Chemical Company)
- Porselon™ (Protex-a-Cote, Inc.)
- Nupon Cote Enamel SGL 6528™ (The Glidden Company)

Phosphate ester fluids dissolve ordinary pipe sealing compounds. The following pipe sealing compounds are recommended:

- Loctite™ (Loctite Corporation)
- Seal Rite No. 5™ (Macksons Company)
- Polyseal Tape™ (General Electric Supply Company)

The following general precautions should also be observed:

- Butyl rubber-lined, high-pressure hoses are recommended for use with phosphate ester fluids.

NOTE

Butyl and e-p rubber are not compatible with regular petroleum-base hydraulic fluids.

- Ordinary O-rings should not be used with phosphate ester fluids. The use of Viton® O-rings is recommended.

- Accumulator bladders must be compatible. If it is necessary to replace an accumulator bladder, ensure the replacement is made of butyl, Viton, or e-p rubber.

- Do not mix a petroleum-based fluid with a phosphate ester fluid.

***** WARNING *****

Internal injury is possible if a phosphate ester fluid is swallowed. Follow instructions on the manufacturer's label and contact a physician immediately.

3.4 ACCUMULATOR CHECKING AND PRECHARGING

The purpose of the accumulator is to smooth the HPS output and to provide additional hydraulic fluid pressure for high instantaneous flow demands. To accomplish this, the accumulator is precharged with dry nitrogen to a pressure proportional to the HPS output pressure. The accumulator is typically supplied precharged to 1000 psi (6.89 MPa) which is the recommended level for operation at an HPS output pressure of 3000 psi (20.7 MPa). When the HPS is adjusted for another output pressure, the accumulator precharge must be adjusted proportionally. If the accumulator precharge is above or below the recommended level, the effect of the accumulator will be reduced.

With the HPS off, (zero pressure) check and, if necessary, renew the dry nitrogen precharge in the accumulator at least once a month. Required equipment includes an accumulator charge kit (MTS Model 590.05A-02 for use on MTS accumulators or 590.05A-01 for use on other types of accumulators), a nitrogen gas supply bottle, and a regulator with an output gage and an output valve. Perform the precharging procedure as described in the service section of the Series 111 Accumulator product manual (MTS part number 115533).

3.5 PUMP/MOTOR REPLACEMENT

The following procedures provide guide lines for removing, replacing, and aligning any HPS main pump, supercharge pump, or pump motor. Removal of a pump or motor may be required to replace faulty or worn components, or to replace the entire pump or motor.

3.5.1 PUMP/MOTOR REMOVAL

Perform the following steps to remove a main pump, supercharge pump, or any pump motor from the HPS.

***** WARNING *****

Disconnect the HPS from the ac power source to avoid electrical shock or inadvertent starting of the HPS.

1. Turn off ac power at the HPS disconnect switch (customer supplied).
2. Disconnect all hydraulic or electrical connections to the pump or motor to be removed.
   A. If removing a pump, ensure hydraulic pressure (indicated on the HPS pressure gage) is zero. Disconnect all hydraulic hoses to the pump. Plug or cap each hose as it is removed to avoid contamination of the hydraulic fluid.
   B. If removing a motor, open the junction box attached to the motor to expose the electrical connections. Disconnect each pair of electrical wires. If not labeled, label each pair as they are disconnected.
3. Remove the guard mounted over the pump/motor coupling.
4. Remove the four mounting bolts that secure the pump or motor to the HPS.
5. Remove the pump or motor by pulling it away from the other unit. The two halves of the pump/motor coupling will separate.
6. If it is necessary to remove the coupling half from the pump or motor shaft, do so by loosening the set screw on the coupling half and pulling the coupling half off of the shaft (refer to figure 3-5).

3.5.2 PUMP/MOTOR REPLACEMENT AND ALIGNMENT

Perform the following steps to replace a main pump, supercharge pump, or any pump motor on the HPS. A dial indicator is required for proper pump/motor alignment.

CAUTION

Pump/motor alignment is critical when replacing a pump or motor. Failure to properly align the pump and motor will result in severe damage to either or both units.

1. Slip the coupling half onto the shaft of the pump or motor to be replaced. Do not tighten the set screw at this time.

2. Place the pump or motor on the HPS and slide it into place so that the fingers of the coupling halves interlock and the rubber insert is positioned between the two coupling halves. Position the pump or motor so the mounting bolts can be inserted through the pump or motor mounting feet and screwed into their respective holes in the HPS.

3. Insert the mounting bolts and screw them into the HPS. Do not tighten at this time.

4. If a main pump is being replaced, ensure there is at least a 1/8-in. (3.2-mm) gap between the pump housing and the coupling (refer to figure 3-4). If a main pump motor is being replaced, check the gap on the main pump and adjust if necessary.

5. Tighten the coupling set screw to secure it to the pump or motor shaft.

6. With the mounting bolts loosened, shim the pump or motor mounting feet as required to prevent rocking.

7. Temporarily tighten the mounting bolts.

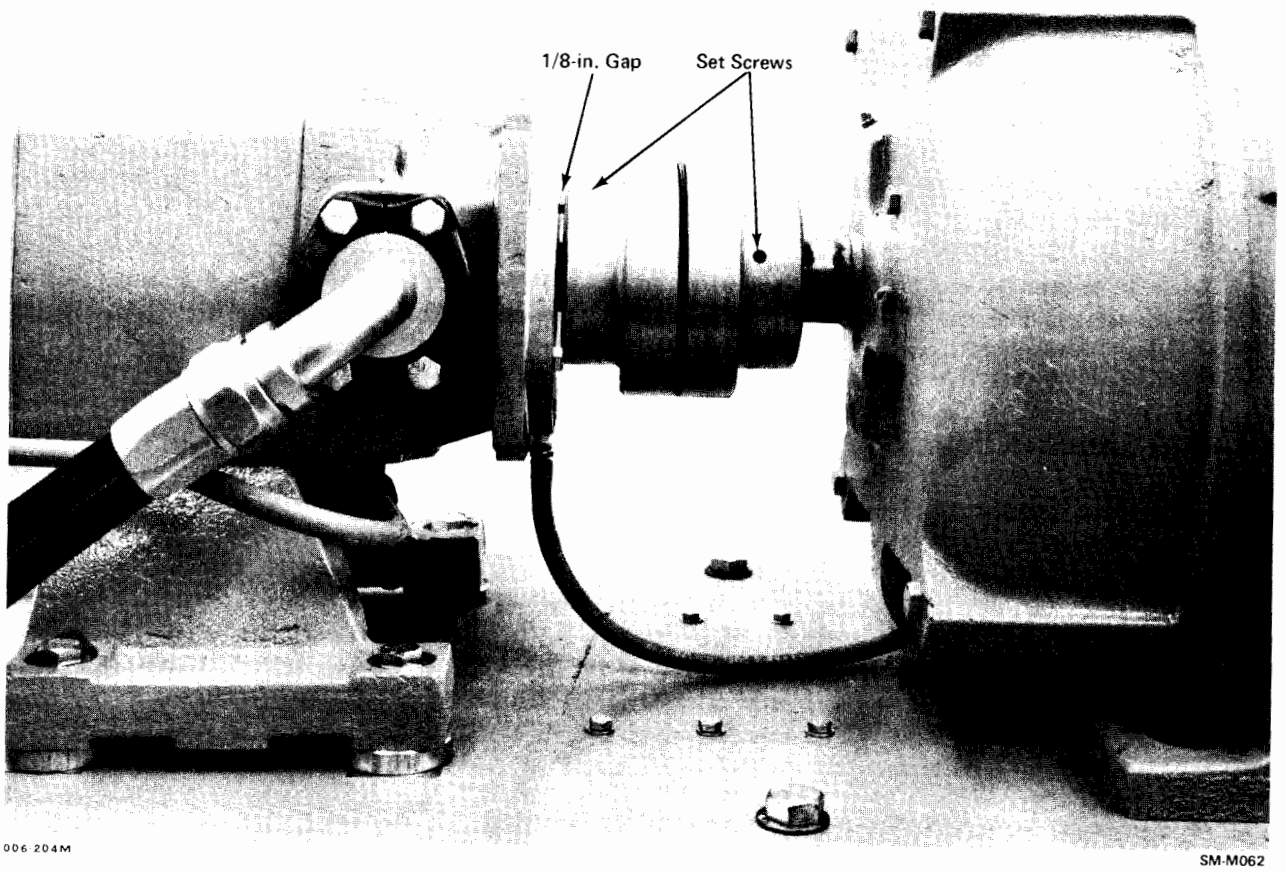


Figure 3-4. Pump/Motor Coupling

NOTE

In the following steps, align the pump or motor in the verticial axis first. The horizontal axis can then be aligned without affecting the vertical axis alignment.

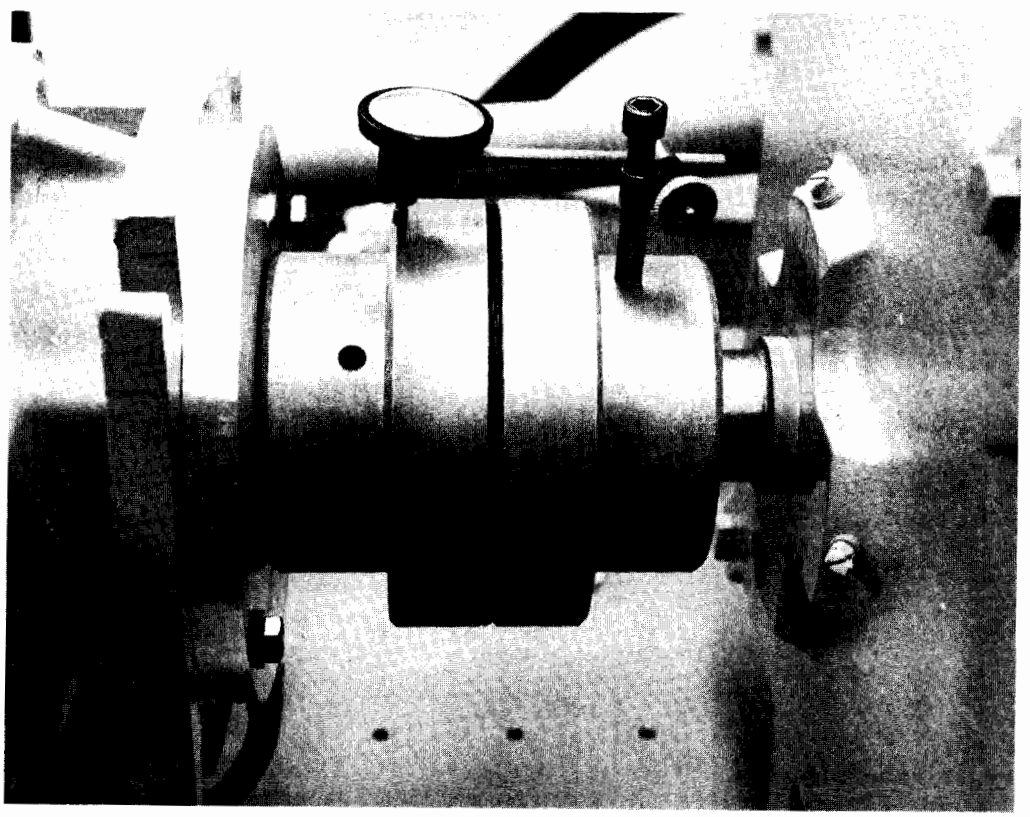
8. Use a straight edge to perform a rough alignment check.

   A. Place the straight edge across the top of the coupling. If required, loosen the mounting bolts and shim the mounting feet as needed to correct any vertical misalignment.

   B. Place the straight edge across the side of the coupling. Shift the pump or motor to correct any horizontal misalignment.

9. Tighten the mounting bolts.

10. Mount the dial indicator to the coupling as shown in figure 3-5.



006-627M

Figure 3-5. Dial Indicator Mounting

11. Check the total indicator reading (TIR) by rotating the coupling.

12. Shim and/or shift the pump or motor to achieve a TIR of less than 0.005 in. (0.127 mm).

13. Tighten the mounting bolts. Check the TIR to ensure it is still within the tolerance specified in step 12. If not loosen mounting bolts and repeat step 12. Remove the dial indicator when the TIR is within tolerance.

14. Reconnect all hydraulic hoses or electrical wires. Replace the coupling guard.

15. Turn on ac power at the HPS disconnect switch (customer supplied). Do not start the HPS at this time.

16. If a motor has been replaced, replace the cover on the junction box and perform a polarity check to ensure all electrical connections have been properly made.

CAUTION

Do not allow the replaced pump motor to operate any longer than is required to determine proper polarity. Equipment damage could result if the motor is allowed to run with incorrect polarity connections

A. If a supercharge pump motor was replaced, turn the SPCH PUMP switch to the RUN position, then immediately return it to the AUTO position. Check the direction that the supercharge pump motor is spinning. If it is spinning in the direction of the arrow on the motor housing, electrical connections are correct.

B. If a main pump motor was replaced, turn the PUMP SELECTOR switch to select the replaced pump motor. Start the HPS. Turn the HPS off as soon as the main pump motor starts. Check the direction that the main pump motor is spinning. If it is spinning in the direction of the arrow on the motor housing, electrical connections are correct.

If the pump motor spins in the opposite direction of the arrow, switch two phases of the input power. A schematic diagram is mounted on the motor housing.

SECTION IV
INSTALLATION

This section includes information concerning the preparation of the Model 506.71 or 506.81 Hydraulic Power Supply (HPS) for operation, and hydraulic, electrical, and water connections. Refer to the Hose Installation Drawing, if provided, for connections to the hydraulic system.

NOTE

The HPS installation site must have a ceiling height of at least 8 ft 2 in. (2.5 m) to allow changing of the low-pressure fine filter element.

4.1 HPS PREPARATION

Perform the following steps before connecting the HPS to electrical and water supplies:

1. Remove the shipping plate located under the hydraulic fluid filler cap.
2. Install the cartridge fuses in the pump motor starter box assembly.
3. Attach the chained jumper plug to the receptacle located on the side of the pump motor starter box assembly. The jumper plug may be replaced by the system cable from a remote control device when the HPS is ready for system operation.
4. Attach the transducer cable to the ΔP switch connector at the bottom of the low-pressure fine filter housing. The transducer cable is removed during shipment to avoid damage.

4.2 HYDRAULIC CONNECTIONS

Hydraulic hose connections from the HPS to the hydraulic system are made to the ports labeled P (pressure) and R (return) on the HPS manifold (refer to figure 4-1). Connect the appropriate pressure and return lines of the hydraulic system to these ports. Pressure and return connections from the HPS are typically made to a system servovalve manifold, hydraulic service manifold, or hydraulic distribution manifold. The HPS reservoir also has additional drain ports for any drainback connections required by the system. Refer to the provided system documentation for the appropriate connections.

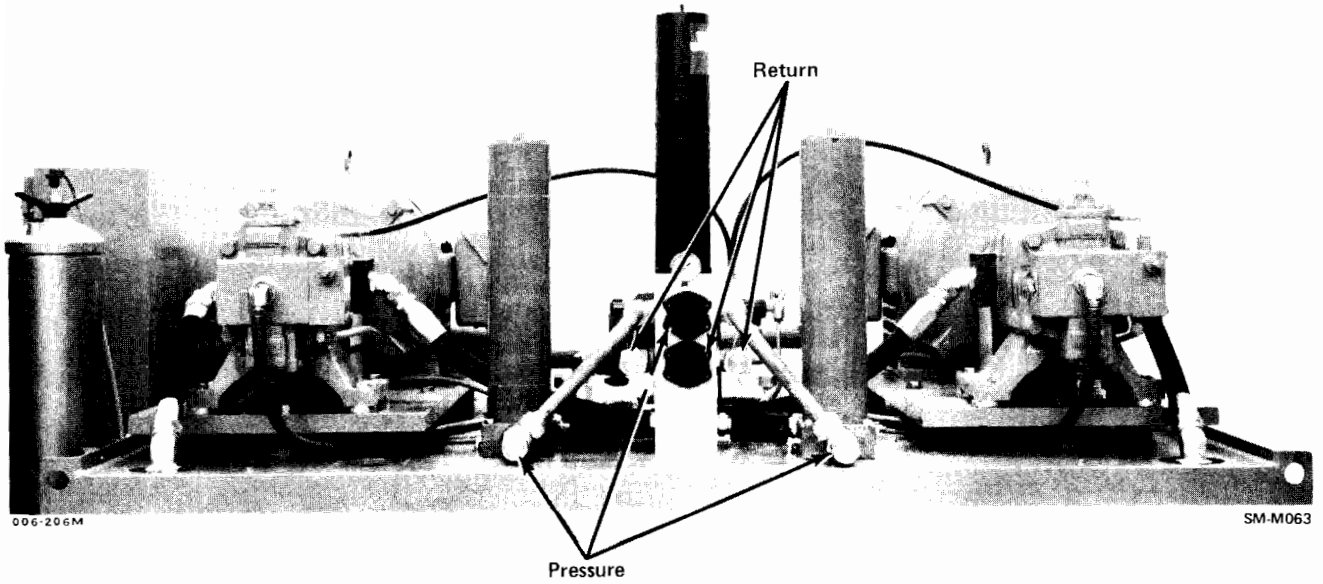


Figure 4-1. Hydraulic Connections

4.3 ELECTRICAL CONNECTIONS

NOTE

Electrical connections must be made by qualified personnel and conform to local codes and regulations.

The HPS is operated from a three-phase electrical power source. The operating voltage for which the HPS has been wired is labeled on the inside of the pump motor starter box assembly and on the pump motors. A power disconnect switch (customer supplied) must be installed at the user facility to enable the user to remove electrical power to the HPS. Local codes dictate the type of disconnect switch to be installed. Also, a good earth ground connection must be made (refer to figure 4-2).

With ac power turned off at the power disconnect switch, connect the three input leads from the disconnect switch to the three terminals under the terminal cover plate located inside the pump motor starter box assembly. Figure 4-2 shows the terminal cover plate.

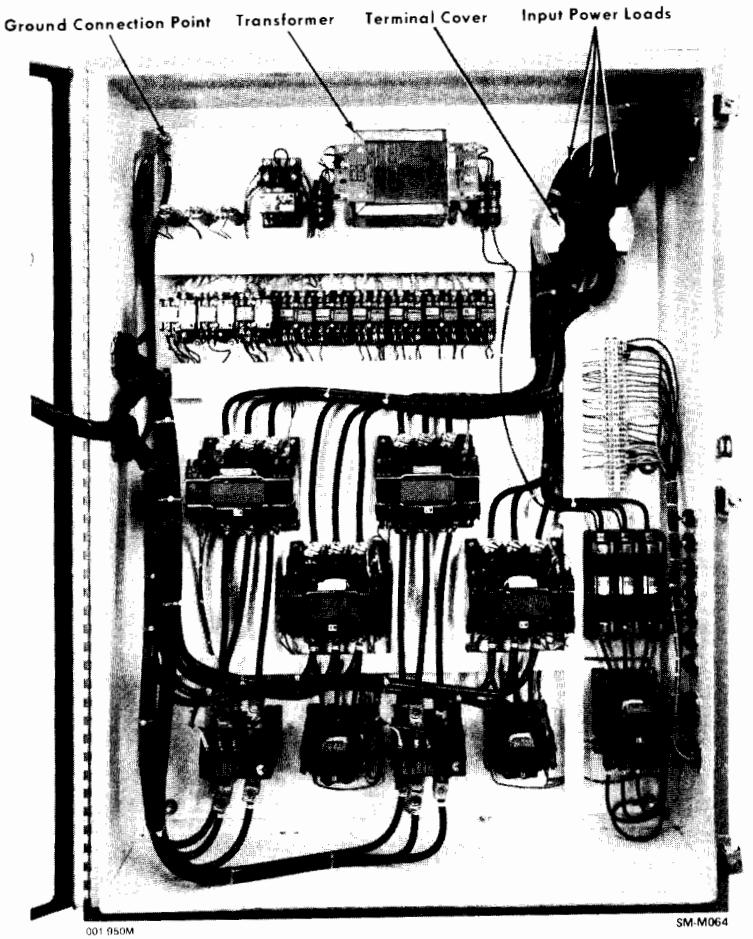


Figure 4-2. Pump Motor Starter Box Assembly

4.3.1 TRANSFORMER WIRING

Depending on the electrical power provided at the user facility, one of two different types of transformers is installed in the pump motor starter box assembly. It is recommended that the user checks the wiring configuration of the transformer before applying ac power to the HPS. Figure 4-3 shows the jumper wiring required on a standard transformer for source voltages of 230 Vac and 460 Vac.

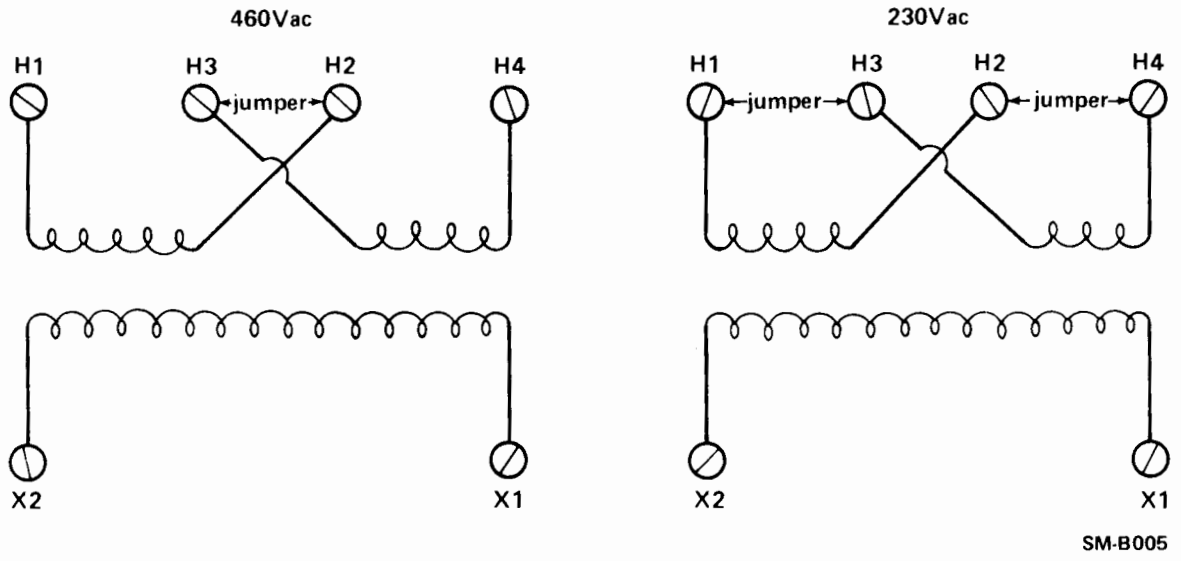


Figure 4-3. Standard Transformer Wiring

An optional multi-tap transformer may be provided where source voltages other than 230 Vac and 460 Vac are used. Figure 4-4 shows the typical wiring required for the various voltages. Source voltages are applied to terminals H1 through H5 as shown. Output voltages are tapped from terminals X1 through X4. Check output voltage with a voltmeter. Output voltage should be 110 Vac for systems using 50 Hz power and 115 to 120 Vac for systems using 60 Hz power.

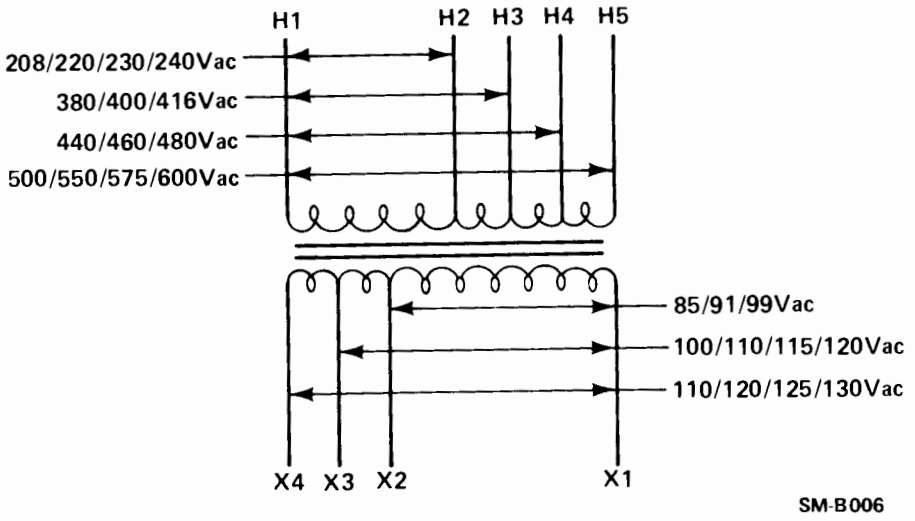


Figure 4-4. Typical Multi-Tap Transformer Wiring

4.3.2 POLARITY CHECK

Perform the following procedure to ensure electrical power is properly connected to the HPS:

1. Apply ac power to the HPS; the STOP button should be illuminated.

2. Jog the supercharge pump motor by turning the SPCH PUMP switch to the RUN position, then immediately returning it to the AUTO position.

3. Check the direction in which the supercharge pump motor is spinning. If it is spinning in the direction indicated by the arrow on the pump motor housing, electrical connections are correct; if it is spinning in the opposite direction indicated by the arrow, remove ac power to the HPS and switch two of the three incoming power leads.

4.4 COOLING WATER CONNECTIONS

The HPS requires connection to a suitable water supply, equipped with an appropriate shut-off valve, to cool the hydraulic fluid. The differential pressure required between the heat exchanger water inlet and outlet connections is 30 to 45 psi (0.2 to 0.3 MPa). The maximum allowable water pressure is 120 psi (0.83 MPa). The water supply must also be capable of providing water flow at a rate indicated in table 4-1. The required flow rate is determined by the power supply size, the heat exchanger size, and the water inlet temperature.

Table 4-1. Typical Water Flow Requirements

Cooling Water Inlet Temperature	HPS Model[1]			
	506.71-S	506.71-O	506.81-S	506.81-O
60°F (16°C)	30 gpm (114 ℓ/min)	30 gpm (114 ℓ/min)	30 gpm (114 ℓ/min)	30 gpm (114 ℓ/min)
65°F (18°C)	35 gpm (133 ℓ/min)	30 gpm (114 ℓ/min)	48 gpm (182 ℓ/min)	30 gpm (114 ℓ/min)
70°F (21°C)	53 gpm (201 ℓ/min)	30 gpm (114 ℓ/min)	100 gpm (380 ℓ/min)	30 gpm (114 ℓ/min)
75°F (24°C)	120 gpm (456 ℓ/min)	30 gpm (114 ℓ/min)	180 gpm (684 ℓ/min)	32 gpm (121 ℓ/min)
80°F (27°C)	—	36 gpm (137 ℓ/min)	—	45 gpm (171 ℓ/min)
85°F (30°C)	—	52 gpm (198 ℓ/min)	—	69 gpm (262 ℓ/min)
90°F (32°C)	—	74 gpm (281 ℓ/min)	—	100 gpm (380 ℓ/min)

[1] "S" denotes a standard-size heat exchanger; "O" denotes an over-size heat exchanger.

Using 2-in. (50-mm) inside diameter water service hose, make connections from the water supply and drain to the heat exchanger water inlet and outlet hose connections shown in figure 4-5.

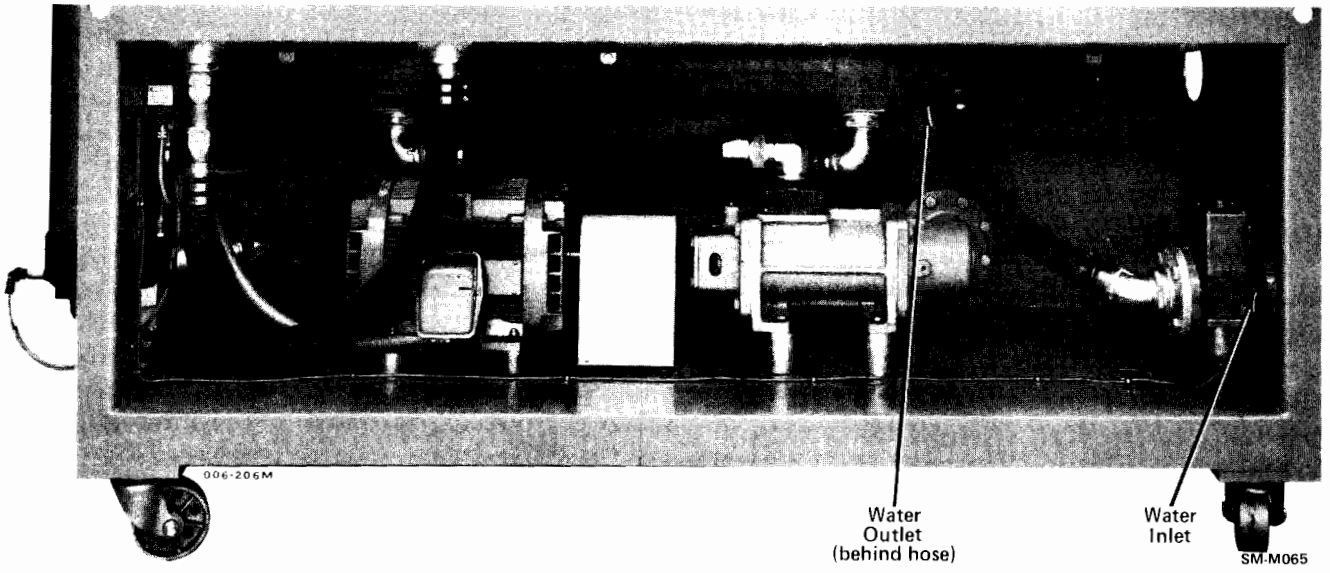


Figure 4-5. Heat Exchanger Water Connections

SECTION V
THEORY OF OPERATION

5.1 HYDRAULIC OPERATION

The following paragraphs discuss the hydraulic operation of the Model 506.71/506.81 Hydraulic Power Supply (HPS). Refer to figure 5-1 for the following discussion.

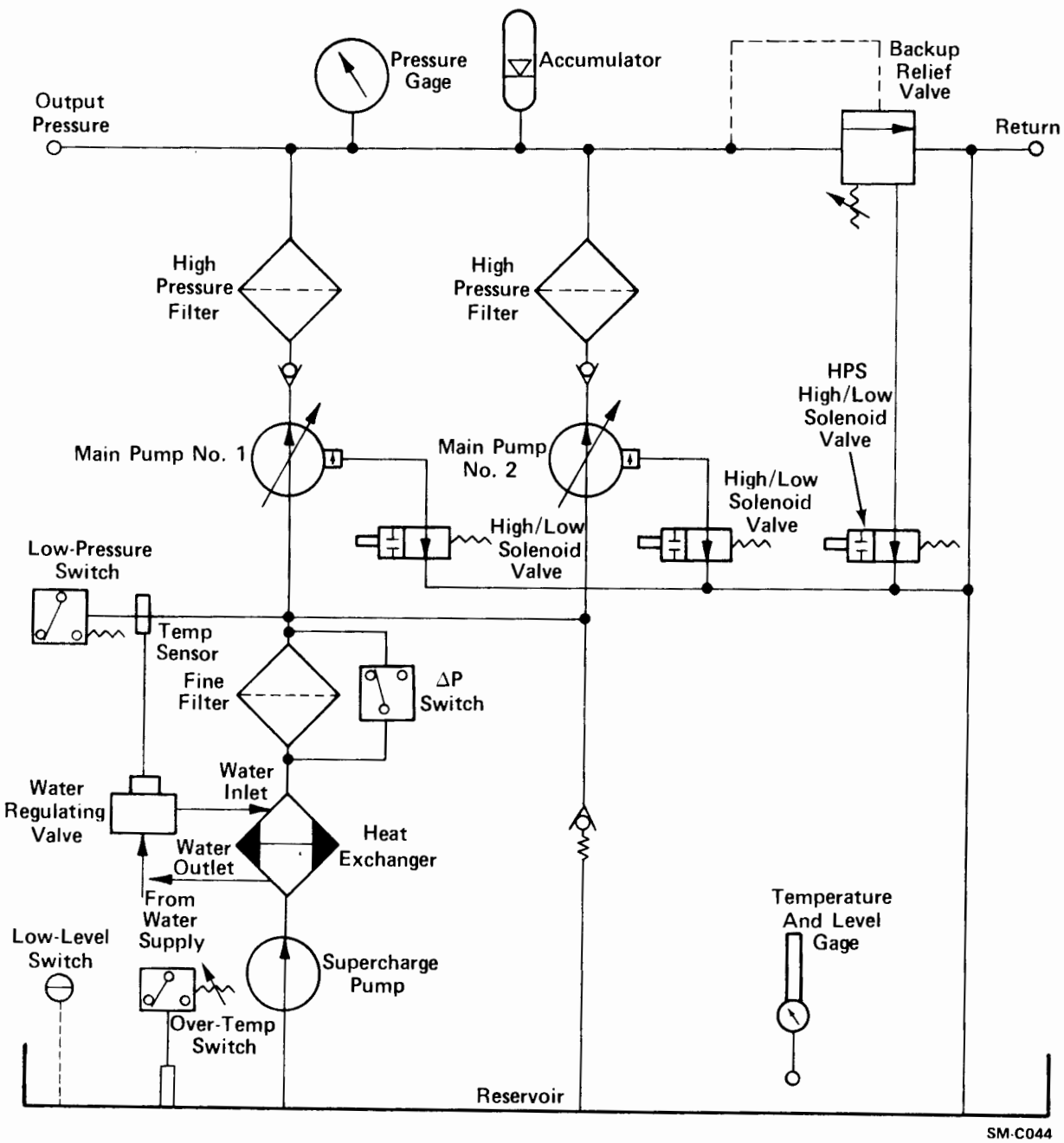


Figure 5-1. Model 506.71/506.81 HPS Hydraulic Block Diagram

The Model 506.71/506.81 HPS uses two variable-volume (pressure-compensated) main pumps, with pressurized (supercharged) hydraulic fluid inlets, to supply hydraulic pressure. Either or both main pumps may be used, depending on system requirements. A screw-type supercharge pump draws hydraulic fluid from the reservoir and forces it through a heat exchanger and a low-pressure fine filter (3-micron). Hydraulic fluid not required by the main pumps returns to the reservoir through a check valve. A ΔP switch monitors the cleanliness of the fine filter and lights a warning indicator when the filter is dirty.

Output pressure is controlled by an adjustment on each main pump and monitored by a pressure gage at the HPS output. Fluid from each main pump outlet passes through a check valve and a 10-micron high-pressure filter. An adjustable back-up relief valve limits output pressure by dumping fluid back to the reservoir when required.

High/low pressure operation is controlled by the high/low solenoid valves. These valves control the main pump vent ports and the back-up relief valve dump line. With the high/low solenoid valves de-energized, the main pump vent ports and the back-up relief valve dump line are open and output flow is dumped to the reservoir, limiting output pressure to approximately 150 psi (1.03 MPa). With the high/low solenoid valve energized, the main pump vent ports and the back-up relief valve dump line are blocked and system pressure can rise to a preset operating pressure, typically 3000 psi (20.7 MPa).

Hydraulic fluid temperature is maintained at a recommended operating level by a fluid-to-water heat exchanger which passes the fluid over water-filled tubes. Water flow through the tubes is automatically varied by an adjustable valve which monitors the fluid temperature. A temperature-sensitive switch turns the HPS off if fluid temperature exceeds a preset limit.

Pump protection is provided for both the main pumps and the supercharge pump. The main pumps are protected by a low-pressure switch which turns the HPS off if supercharge pressure drops below the normal operating pressure. The supercharge pump is protected by a low-level switch which turns the HPS off if the level of hydraulic fluid in the reservoir drops below a preset level.

The accumulator serves two functions: it reduces small pressure fluctuations by storing and releasing pressurized fluid and it makes up the difference in short-term peak flow demands.

5.2 ELECTRICAL CIRCUIT

The following paragraphs discuss the basic operation of the HPS electrical circuit. Figures 5-2 and 5-3 are typical circuits for supplies containing 24-Vdc compatible and 115-Vac compatible components, respectively. As shown, the major difference between the two is the addition of the rectification and regulation circuitry to the 24-Vdc circuit. The logic of both circuits is identical.

Because many circuit variations are available, refer to the Hydraulic Power Supply Electrical Schematic provided in the System Reference Manual (supplied with the system) for differences which might apply to the particular unit.

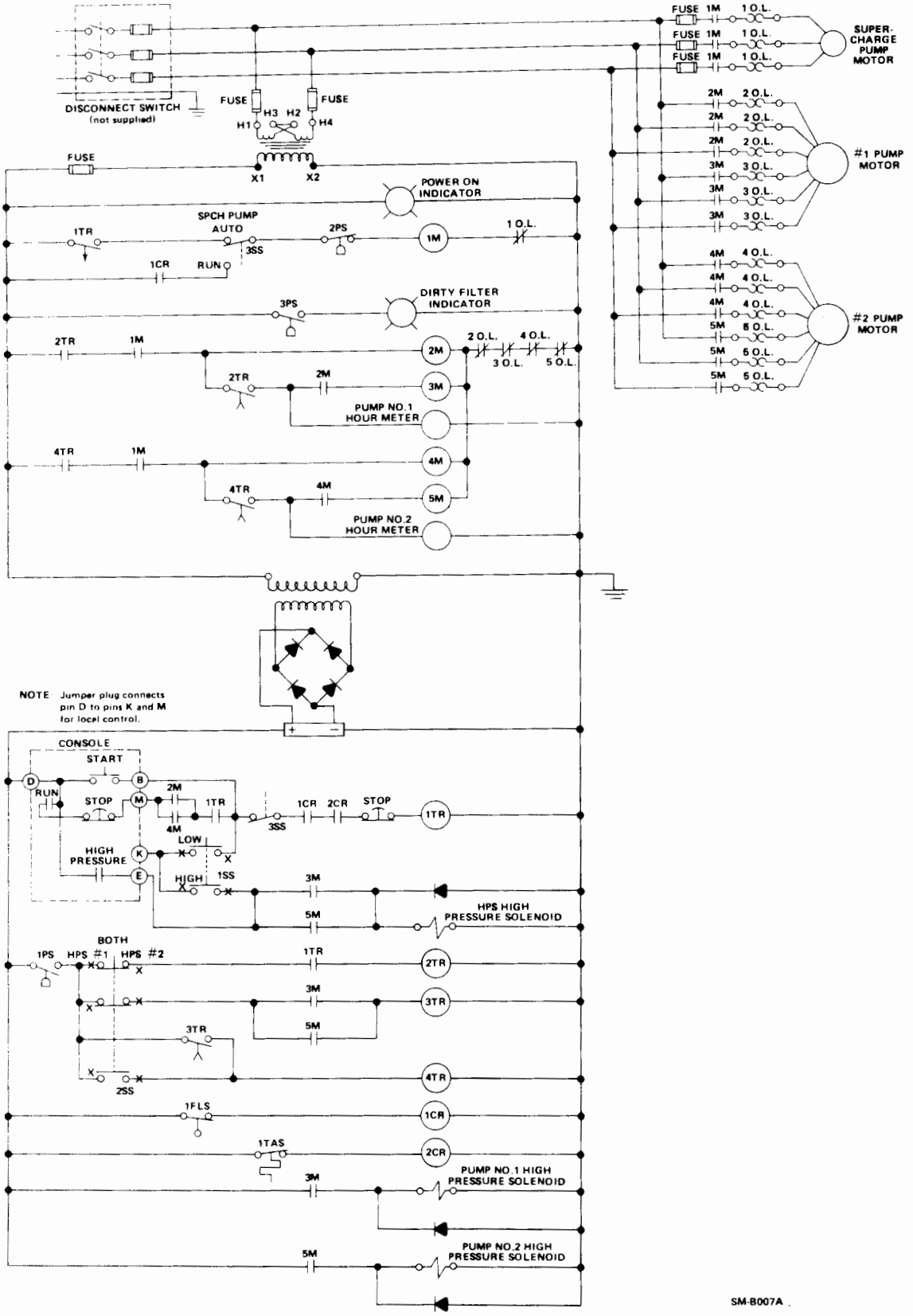


Figure 5-2. Typical 24 Vdc Electrical Schematic

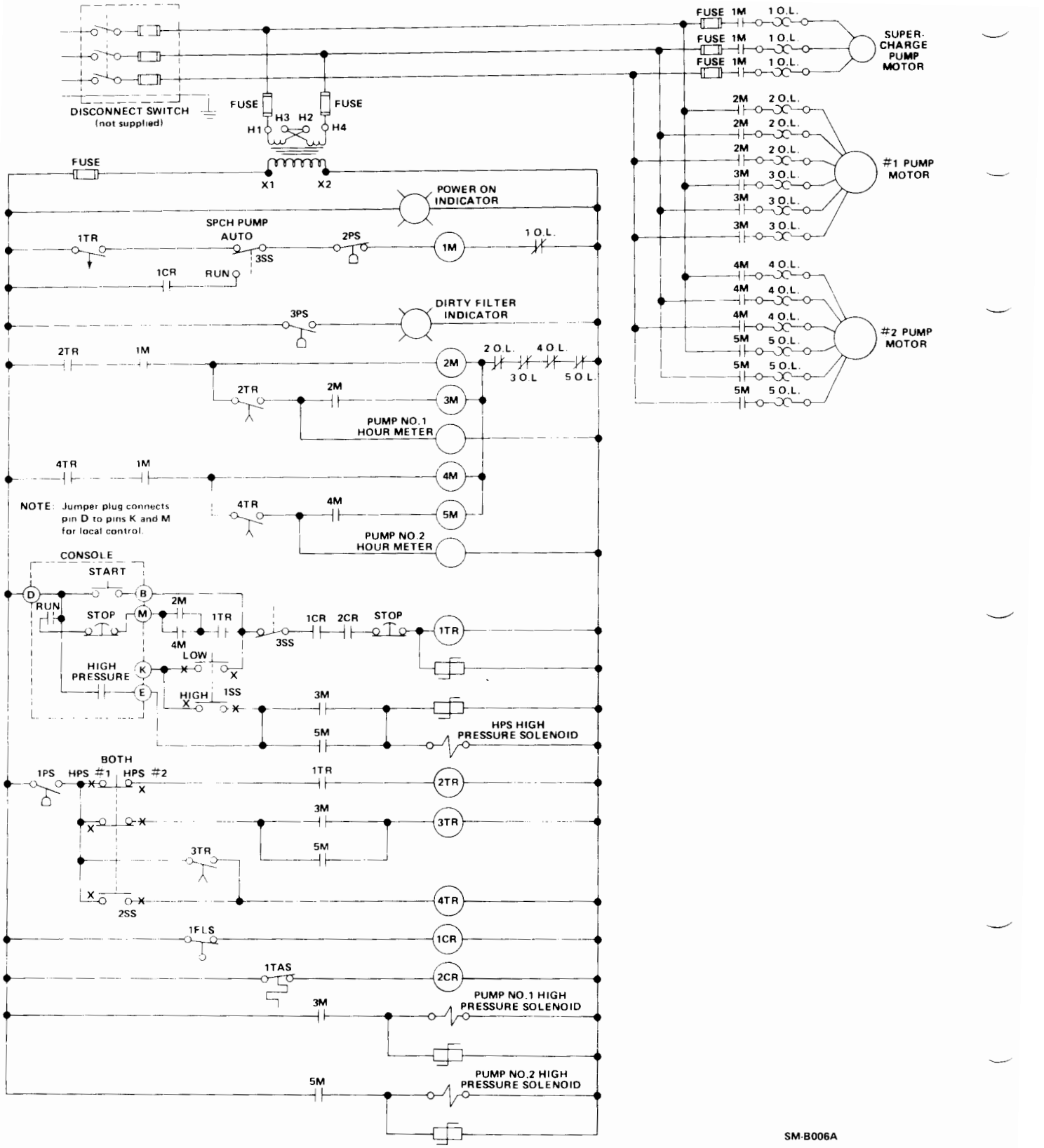


Figure 5-3. Typical 115 Vac Electrical Schematic

5.2.1 CONTROL

Pump motor operation is controlled by motor starters 1M through 5M. 1M controls the supercharge pump; 2M (start) and 3M (run) control main pump number 1; 4M (start) and 5M (run) control main pump number 2. The motor starter coils must be energized (contacts closed) to operate the respective pump motors.

Upon HPS start-up, relay 1TR is energized via the console START switch or the HPS HIGH/LOW switch. 1TR is the main control relay. De-energizing 1TR automatically shuts down the HPS. With the SPCH PUMP switch in the AUTO position, closing the 1TR contacts energizes starter 1M and starts the supercharge pump. Closing the 1TR contacts also energizes relay 2TR and/or 4TR (depending on the position of the PUMP SELECTOR SWITCH) which initiates the start-up sequence of the selected pump(s) when super charge pressure closes the low pressure switch (1PS). For example, if PUMP NO 1 is selected, the 2TR contacts energize starter 2M (via the closed 1M contacts) which starts main pump number 1 by energizing half of the motor windings after the delay caused by the 2TR time-delayed contacts energizes the remaining motor winding and, in turn, energizes starter 3M (via the 2TR time-delayed contacts).

The closed 3M contacts energize the main pump number 1 high-pressure solenoid and enable the HPS high-pressure solenoid. High pressure is not applied, however, until the HPS high-pressure solenoid is energized. This is accomplished when the HIGH/LOW switch is turned to high (closing switch 1SS) or high pressure is selected at the console.

Pushing the STOP button on either the HPS or the console turns off the HPS by de-energizing relay 1TR. Opening the 1TR contacts turns off the main pump motors and de-energizes the high-pressure solenoids. The supercharge pump, however, continues to run for approximately 10 seconds due to the delayed opening of the 1TR contacts in the 1M starter circuit.

5.2.2 ABNORMAL CONDITION SENSORS AND INTERLOCKS

The HPS contains abnormal condition sensors and interlock switches to terminate or prevent HPS operation under abnormal conditions. These devices include a fluid-level switch, an over-temperature switch, a low-pressure switch, and a dirty filter indicator/interlock.

The fluid level switch (1FLS) opens whenever the level of hydraulic fluid in the HPS reservoir drops below a preset level. Opening switch 1FLS de-energizes relay 1CR which, in turn, de-energizes relay 1TR, turning off all pump motors (refer to subsection 5.2.1). Opening the 1CR contacts also disables operation of the supercharge pump in the RUN mode.

The over-temperature switch (1TAS) opens whenever the temperature of the fluid in the HPS reservoir exceeds a preset limit. Opening 1TAS de-energizes relay 2CR and turns off all HPS pump motors. The supercharge pump, however, can be operated in the RUN mode under this condition in order to cool the fluid.

The low-pressure switch (1PS) opens whenever supercharge pressure to the main pumps drops below a preset limit. Opening 1PS de-energizes relay 2TR, 3TR, and 4TR, disabling the main pump relays. The supercharge pump is not affected.

The low-pressure fine filter is monitored by two ΔP switches (2PS and 3PS). Switch 3PS is set to activate at a lower pressure than switch 2PS. When an excessive differential pressure is sensed across the filter due to a dirty filter element, switch 3PS closes and lights the DIRTY FILTER indicator. If the differential pressure increases to the point where switch 2PS activates, 2PS opens and de-energizes starter 1M. This turns off the supercharge pump and thus opens the low-pressure switch (1PS) to turn off the main pump motors.

The pump motors are protected by thermal overload circuitry which turns the HPS off if the pump motor is drawing excessive current. This circuitry consists of thermal overload sensors which, upon detection of excessive current, opens the normally closed contacts in the motor starter relay which shuts down the HPS. When an overload condition occurs, the reset button on the thermal overload block must be pressed prior to system operation.