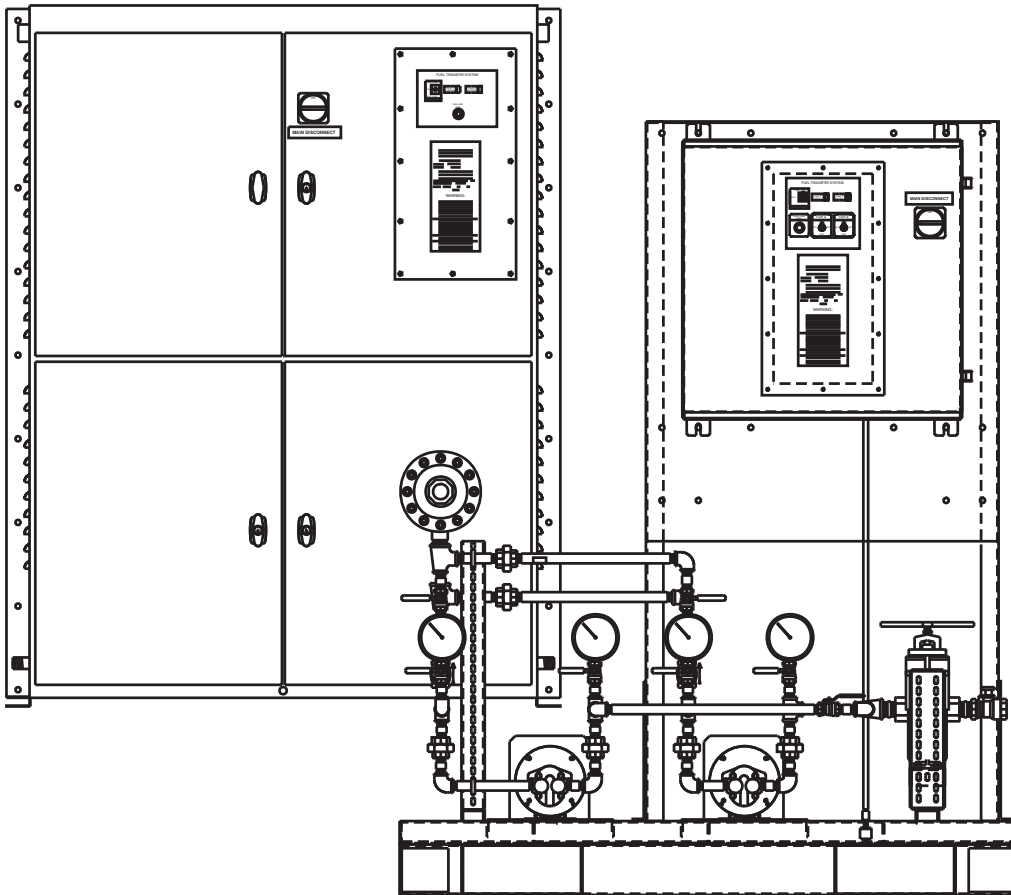


# SIMPLEX™

## PACKAGED PUMP SET & SKID PUMP SET MANUAL

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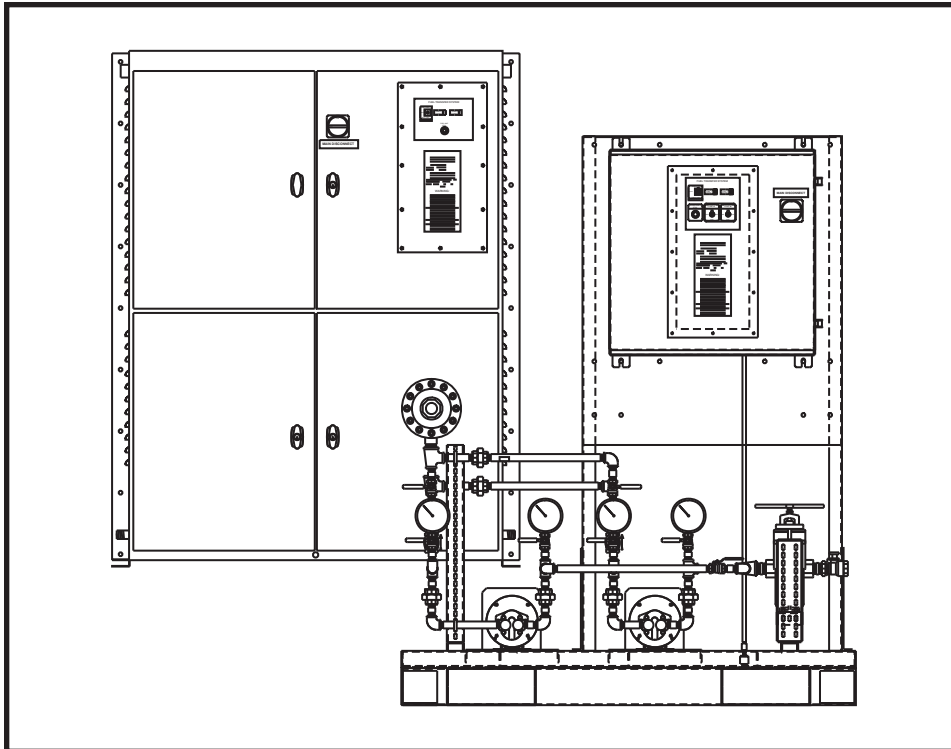
January 2011



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## DESCRIPTION

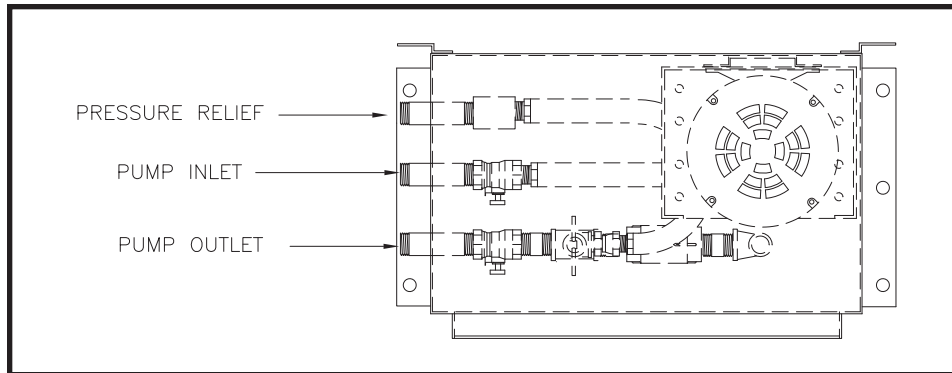
Packaged as a pre-engineered, integrated system of pumps, pump motors, controls and accessories, pre-plumbed and pre-wired, Simplex Packaged Pump Sets and Skid Pump Sets provide the user with the reliability of job engineered, system matched components, and factory assembled systems. These pump sets are intended for use with fuel oil, lube oil (class II or class III combustible liquids having a flash point of 100°F or higher).

Simplex Packaged Pump Sets are totally enclosed units suitable for wall or pad mounting. All devices, wiring and plumbing are contained within the weatherproof enclosure. Isolated compartments are provided for mechanical and electrical devices. External ports are provided for connection of field plumbing. The pump sets include a catch basin with a leak detector.

Due to design layout, Simplex Skid Pump Sets offer the customer a greater variety and quantity of options but because of its open catch basin they are suitable for indoor installation only.

### **! WARNING !**

**Do not fill with gasoline. This Pump Set is not meant for use with gasoline nor with other flammable liquids having a flash point less than 100°F. Use with gasoline or use with any flammable liquids at a temperature exceeding the flash point of that liquid, presents an immediate explosion and fire hazard. Do not use the Pump Set at a temperature exceeding the flash point of its contents.**



Part of Typical SPS-10 Pictorial Drawing

## PRIMARY INSPECTION

Preventative visual inspection of the shipping crate, Remote Pump Unit, and accessories must be performed before installation. Physical or electrical problems due to handling and vibration may occur during shipment.

1. If the packing crate shows signs of damage inspect the SPS cabinet for damage. Check the entire outside of the cabinet for damage which could cause internal mechanical or electrical problems.
2. Check main disconnect switch, door and hinge operation.
3. Check pump/motor hardware for tightness. Rotate motor shaft by hand and check for smooth operation. Check pump/motor coupler for proper alignment and spacing. The coupler should have approximately 1/8" clearance between coupler halves. If this clearance is reduced or the pump and motor are not properly aligned excessive noise and pump/motor wear will occur.
4. Check all electrical terminals and connections for tightness.

**If any problems are observed during Primary Inspection call the Simplex Service Manager at 217-483-1600 (24hrs.)**

## INSTALLATION

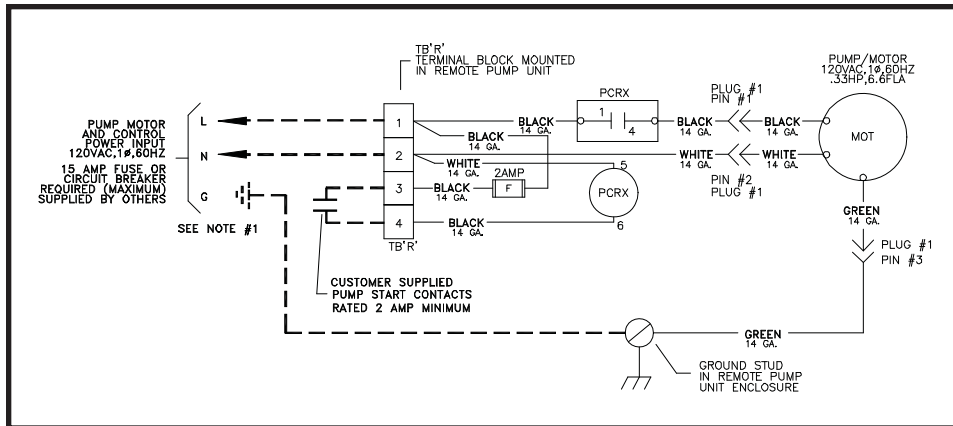
1. Properly mount and attach all components as shown in the dimensional drawings using the mounting feet/holes and plumbing provided. The pressure relief manifold should be plumbed back to the main fuel tank.
2. Connect all components to earth ground at ground studs provided as shown on the electrical drawings. Unit must be grounded for operator safety.

### **WARNING**

**If the pressure relief line is plumbed back to the pump suction line, the pump suction line between the pressure relief manifold and main tank cannot contain a foot valve or a check valve or damage to the pump will occur.**

### **WARNING**

**Ground must be connected as shown in the wiring drawing. Failure to properly ground the unit will result in a fire and personnel safety hazard.**



Part of Typical SPS-10 Electrical Drawing

3. If equipped, install level and alarm indication accessories as shown on dimensional drawing and connect them to the Pump Unit as shown on the electrical drawings.
4. If equipped, connect dry alarm contacts for customer use per specifications on the electrical drawings.
5. Connect pump motor/control power to the Remote Pump Unit per specifications on the electrical drawings.

### PRIMING THE SYSTEM (REQUIRED)

The pumps supplied with Simplex Pump Set are not self-priming. If a pump is allowed to run without fuel, pump damage will occur. Pump Sets are shipped from the factory filled with #30 oil to facilitate system priming. On systems that contain a hand pump the hand pump may be utilized to lift the fuel into the pump set cabinet. This will not eliminate the need to prime the system at the pump.

The Pump Set may be primed by installing a priming tee on the inlet side of the pump. An alternative is to disconnect the inlet line at the pump and fill the line with fuel. If the system contains a fuel strainer the strainer must be disassembled, filled with fuel, and reassembled.

### **WARNING**

Care must be taken when connecting control power to a system requiring three-phase control power. If the system is not properly wired the motor rotation will be reversed and damage to the pump shaft seal may occur. Standard pump rotation is clockwise as viewed from the motor end. Any pump which has been allowed to run in reverse must be checked for fuel leaks around the pump shaft. If the pump is leaking around the shaft the seals must be re-seated or replaced.

### **WARNING**

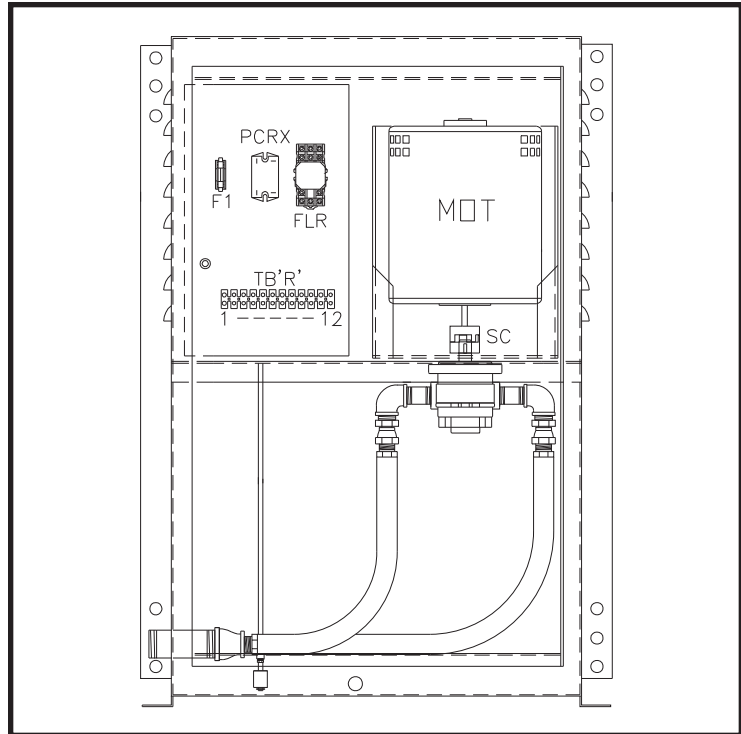
If the pump is allowed to run dry, the priming oil shipped in the pump will be depleted and it may be necessary to disconnect the plumbing at the pump input to re-prime the pump.

## PRIMING PROCEDURE

1. Ensure the Pump is filled with #30 priming oil.
2. Ensure that all ball valves are in the open position.
3. Use hand pump to lift fuel to fuel manifold level.
4. Open the pump inlet line or priming tee, fill the line with fuel, close the line (it is recommended that a foot valve be installed at the main fuel tank to hold the fuel column.)
5. If the system contains a fuel strainer, fill the strainer with fuel.
6. Energize the pump and observe fuel flow. If it is a duplex system, operate both pumps simultaneously.

If the system contains a vacuum gauge on the input side of the pump, the gauge should read 15" vacuum maximum under normal conditions (15" vacuum = 20' vertical lift). Vacuum gauge readings greater than 15" vacuum indicate excessive vertical lift demands or line restrictions.

If the system contains a pressure gauge on the output side of the pump the gauge should read 5 PSI minimum pressure 65psi maximum pressure under normal conditions (.433psi = 1' vertical head pressure). Pressure gauge readings greater than 65 PSI pressure indicate excessive line restrictions and/or friction. Pump Set flow switches have a 5 PSI minimum set point and system pressure lower than 5 PSI will initiate a loss of flow failure. Pressure relief valves have a 65 PSI set point. System pressure greater than 65 PSI will cause the pressure relief valve to open and vent fuel back to the main storage tank.



Part of Typical SPS-10 Pictorial Drawing

## SINGLE PUMP OPERATION

Apply control power to unit. If equipped, place the Main Disconnect Switch in the "On" position.

## AUTOMATIC

Place the Pump Selector Switch in the Auto position. When the call for fuel contacts close, the pump will start and run until the call for fuel contacts are opened.

## MANUAL

Place the Pump Selector Switch in the Manual Mode. The pump motor will run until the switch is returned to the "Off" or "Auto" mode positions or when the Overload Relay trips.

## DUPLEX PUMP OPERATION

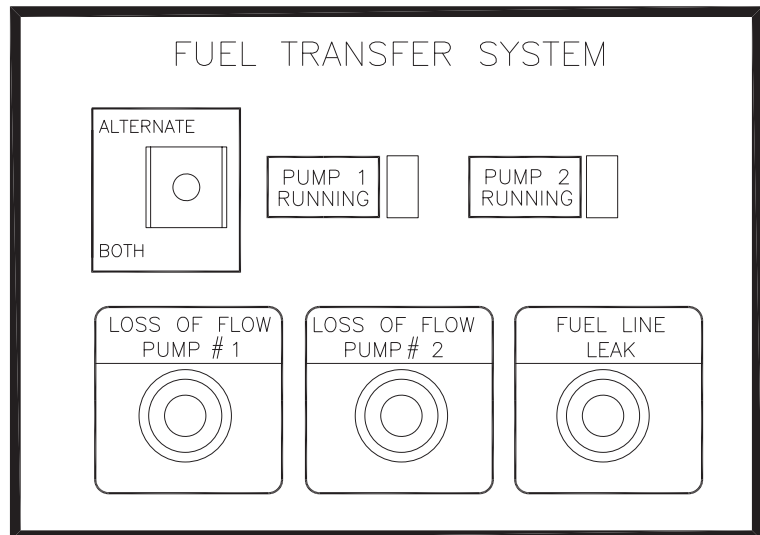
Duplex pump units are used to increase the reliability of a pumping system through the addition of a second, backup pump and level control. In a duplex system, one pump is designated the “lead” pump and the other is the “lag” pump. The lead pump automatically refills the tank over the tank’s normal operating range of 50% to full. Normally, once the tank has been initially filled, the fuel level should never drop below 50%. Less than 50% is indicative of either a failure of the lead pump or consumption in excess of pump capacity. The lag pump and its separate level controller, acting as a backup senses a drop in fuel level below 50% and starts the lag pump, which then continues to run, along with the lead pump, until the tank is full. To begin operation, apply control power to unit and place the Main Disconnect Switch in the “On” position.

### ALTERNATE

Place the Pump Mode Switch in the Alternate position. When the call to transfer fuel contacts close, Pump #1 will start and run until the call to transfer fuel contacts are opened. When the call to transfer fuel contacts close again Pump #2 will start and run until the call to transfer fuel contacts are opened. Repeated operation will continue to alternate the pumps.

### BOTH RUN

Place the Lead Pump Selector Switch in the Both position. When the call to transfer fuel contacts close both pumps will start and run until the call to transfer fuel contacts are opened. No lead/lag alternation occurs in the both mode.

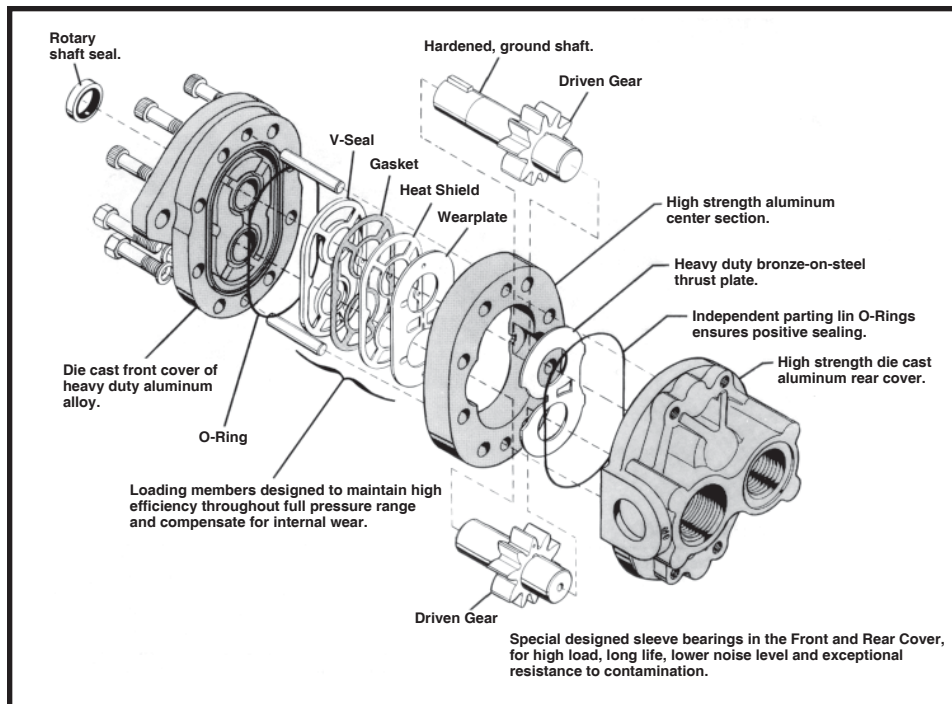


### FUEL LINE LEAK

If fuel is detected in the catch basin, the floatswitch will close, activating the fuel line leak alarm illuminating the leak indicator.

### LOSS OF FLOW

An adjustable time delay relay is wired in parallel with the motor starter circuit through a normally closed flow switch. The time delay relay, set to 30 seconds by Simplex, allows the pump time to establish positive flow and prevent false alarms. If the pump does not develop sufficient flow before the time delay relay picks up, or if flow is lost during operation, the lag pump will be signaled to start in duplex systems, the failed pump will be stopped and the pump fail indicator will light. Alarm contacts, rated 10A @ 125/250VAC, 10A @ 30VDC.



Super-XL Pump

## SUPER X-L PUMP

A Simplex Super-XL pressure loaded gear pump consists of two intermeshing, hardened steel, precision ground gear assemblies. These precision gears are enclosed by a high strength, die cast aluminum front cover, back cover and a high yield strength extruded aluminum center section. Gear assemblies consist of one drive gear shrink fit on a precision ground and polished drive shaft. This shaft extends outside the pump to permit coupling to an external prime mover by means of a standard key way. The second gear being the driven gear is also shrink fit on a precision ground and polished driven shaft. Retaining rings installed in grooves provided on the shaft ensure that the gears will not move axially and a key keeps the drive gear from moving radially.

## SERIES 420 PUMP

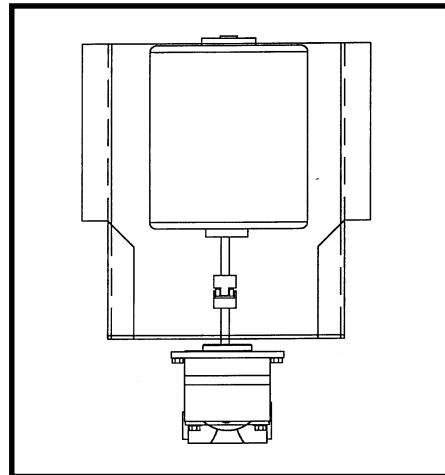
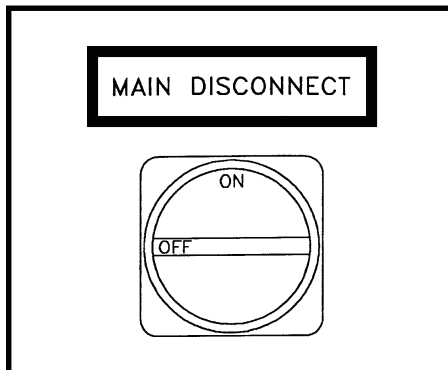
Simplex 420 internal gear rotary pumps are used for lubricating, low pressure hydraulic, transfer, circulating, burner oil and many other industrial applications. These pumps have earned the UL Listing mark.

There are only two moving parts. Pumping action is based on a rotor, idler gear and crescent-shaped partition cast integral with the cover. Precisely machined and assembled, these pumps achieve and retain their reliability over a wider range of viscosities than alternative designs. The rotors are precision milled and ground from bar stock. For added reliability, bushing support is provided for the rotor shaft. Pumps are equipped with a mechanical seal. And they're substantially quieter than other pump designs.

*See Appendix B - Technical Data for additional information regarding the Super-XL and Series 420 Pumps.*

## MAINTENANCE

Simplex Pump Sets should be visually inspected for maintenance purposes every six months during light duty cycles. Pumps sets used daily for long hours should be inspected every month.



**PUMP/MOTOR**

- Prior to performing the maintenance procedure ensure that the optional main disconnect switch *illustrated above* is operating properly, the user supplied circuit breaker is in the **OFF** position, and that all sources of power are isolated from the Pump Set. Proceed only after this is verified.
- Check main disconnect switch, door and hinge operation.
- Check cabinet mounting hardware at feet and wall mounting flange. Tighten as necessary.
- Test pumps in duplex pump sets. Ensure both pumps are operating normally, test each pump individually, test simultaneous operation, test alternating operation.
- Check pump/motor hardware for tightness. Pump/motor hardware will loosen after normal operation due to vibration. This hardware is double nutted, check all bolts for double nuts.
- Rotate shaft by hand and check for smooth operation. Check pump/motor coupler shown at left for proper alignment and spacing. The Lovejoy coupler should have approximately 1/8" clearance between coupler halves. If this clearance is reduced or the pump and motor are not properly aligned excessive noise and pump/motor wear will occur. Loosen pump motor mounting hardware to realign motor/coupler. Loosen one end of pump coupler to adjust for necessary coupler clearance.
- Check all electrical terminals and connections for tightness.
- All motors are permanently lubricated and do not require any lubrication
- All pumps are self-lubricating and do not require any maintenance.
- Check all plumbing joints for leaks. Tighten fittings and joints as necessary. Drain accumulated fuel in catch basin as necessary by removing catch basin plug.
- Inspect all fuel strainers. Disassemble strainer and clean strainer element, replace as necessary. Reassemble unit and check for leaks.
- Test hand pump operation, check for fuel leaks, tighten as necessary.

**TROUBLESHOOTING****NO FUEL DELIVERED**

1. Pump not primed.
2. Lift is too high.
3. Rotation direction incorrect.
4. Check valve installed backwards.

**INSUFFICIENT FUEL DELIVERED**

1. Air leak at inlet.
2. Defective solenoid valve or check valve.
3. Lift too high.
4. Pump worn.
5. Inoperative foot valve.
6. Piping improperly installed.
7. Fuel strainer plugged.

**RAPID PUMP WEAR**

1. Dirt or grit in fuel.
2. Pipe strain on pump causing bind.
3. Worn pump/motor coupler.
4. Pump has been run dry or with insufficient fuel.

**PUMP DELIVERS FOR SHORT PERIOD AND QUILTS**

1. Leak at inlet.
2. End of inlet not deep enough.
3. Air or gas in fuel.
4. Supply exhausted.
5. Vaporization of fuel at inlet.
6. Air or gas in inlet line.
7. Sand or abrasives in fuel.

**PUMP REQUIRES TOO MUCH POWER**

1. Air in plumbing lines.
2. Liquid heavy or too viscous.
3. Bent pump shaft, binding rotating element.
4. Misalignment of pump/motor coupler.

**NOISY OPERATION**

1. Insufficient fuel supply.
2. Air leaks in the inlet pipe.
3. Air or gas at inlet connection.
4. Pump and motor out of alignment.
5. Worn out spider coupling.
6. Pump coupler out of balance.

**PUMP REQUIRES FREQUENT RE-PRIMING**

1. Inoperative foot valve.
2. Inoperative check valve.
3. Inoperative solenoid valve.
4. Pump cavitation.
5. Plumbing air leaks.
6. Lift too high.
7. Pump seal leaking.

**MOTOR DOES NOT TURN OR TURNS INTERMITTENTLY**

1. Control power not available.
2. Motor thermal overload condition.
3. Pump failed and seized.
4. Motor failure.

## PUMP LEAKS FUEL

1. Loose pump plumbing fittings.
2. Worn pump shaft seal.
3. Pump pressure relief valve failure.
4. Fuel leak elsewhere running towards pump area.
5. Excessive head from overhead storage tank.
6. Worn pump O-rings.

## DRAWINGS AND PARTS LIST

The drawings included in this manual are the most accurate source of part numbers for your Pump Set. When ordering replacement parts for Simplex Pump Sets, always consult the Parts Legend Drawing. When contacting the Simplex Service Department always have your work order and drawing number ready for reference. The Work Order Number and the Drawing Numbers are also located on each drawing legend. *A typical drawing legend and parts list is illustrated at left.*

<b>SIMPLEX™</b>		SPRINGFIELD, ILLINOIS
SCALE : ~	APPROVED BY :	DRAWN BY : RLL
DATE : 21-27-2010		REVISED :
REMOTE PUMP UNIT		SKS-30-SD WIRING DIAGRAM
		OPT: 768, 399, 345, 340, 286, 260, 191, 100, 095, 087, 070, 062
115VAC, 1Ø, 60HZ		
W.O. # 75050-10-55/1		DRAWING NUMBER 217628

ASSEMBLY				
ITEM	QTY.	PART #	DESIG.	DESCRIPTION
1	1	217626	RPU	REMOTE PUMP UNIT SKS-30-SD 2 GPM., .50 H. P.
2	2	24630000A	MOT1, 2	PUMP MOTOR 0.50HP, 115VAC, 1PH, 60HZ, DDP 1800 RPM <b>OPTION-700</b>
3	2	24741020	PUMP1, 2	PUMP 2 G. P. M. SUPER XL <b>OPTION-507</b>
4	1	30049555	FSR	DUPLEX FUEL OIL STRAINER 1" NPT, W/BASKETS <b>OPTION-062</b>
5	4	24010050	BV4, BV3	BALL VALVE UNION END VITON SEAL, SHORT HANDLE 1.00" x 1.00"
6	2	24010106	[BV4]	TAIL PIECE 0.75" NPT. MALE
7	2	24010108	[BV3]	TAIL PIECE 0.50" NPT. MALE
8	1	25256660	DPS	DIFFERENTIAL PRESSURE 0-10PSI <b>OPTION-286</b>
9	4	24010090	BV1	BALL VALVE, ISOLATION 0.25"
10	2	15050510	PG	PRESSURE GAUGE, 0-200PSI 2.0" DIAL, BOTTOM MOUNT <b>OPTION 100</b>
11	2	22925001	SCV	SWING CHECK .75" NPT. BRONZE <b>OPTION-070</b>

## **APPENDIX A - ABBREVIATIONS USED IN THIS MANUAL**

Listed below are abbreviations of terms found on Fuel Supply Systems. When following a drawing utilize this guide to define abbreviated system and component names. As this is a master list, drawings and text pertaining to your equipment may not contain all these terms.

<b>AC</b> -Alternating Current	<b>MOT</b> -Motor
<b>AHR</b> -Alarm Horn Relay	<b>N.C.</b> -Normally Closed
<b>AR</b> -Alarm Horn	<b>NEC</b> -National Electric Code
<b>BPRV</b> -Back Pressure Regulating Valve	<b>NEMA</b> -National Electric Manufacturers Association
<b>BRK</b> -Motor/Pump Bracket	<b>NFPA</b> -National Fire Protection Association
<b>BV</b> -Ball Valve	<b>N.O.</b> -Normally Open
<b>C</b> -Contactor	<b>NP</b> -Nameplate
<b>CB</b> -Circuit Breaker	<b>NPT</b> -National Pipe Thread
<b>CSR</b> -Check Strainer Relay	<b>O.D.</b> -Outside Diameter
<b>CV</b> -Check Valve	<b>OLR</b> -Over Load Relay
<b>DC</b> -Direct Current	<b>OPT</b> -Option
<b>DPDT</b> -Double Pole Double Throw	<b>PCB</b> -Printed Circuit Board
<b>F</b> -Fuse	<b>PCRX</b> -Pump Control Relays
<b>FLS</b> -Flowswitch	<b>PG</b> -Pressure Gauge
<b>FS</b> -Floatswitch	<b>PLR</b> -Pipe Leak Relay
<b>FSR</b> -Simplex Fuel Strainer	<b>PRV</b> -Pressure Relief Valve
<b>GA</b> -Gauge	<b>PS</b> -Pressure Switch
<b>GAL</b> -Gallons	<b>PSI</b> -Pounds Per Square Inch
<b>GPM</b> -Gallons Per Minute	<b>PSR</b> -Pressure Switch Relay
<b>HFL</b> -High Fuel Level Relay	<b>PRR</b> -Pump Running Relay
<b>HG</b> -Mercury	<b>SC</b> -Swing Check Valve
<b>HP</b> -Horsepower	<b>SOL</b> -Solenoid
<b>HZ</b> -Hertz	<b>SST</b> -Simplex Super Tank
<b>I.D.</b> -Inside Diameter	<b>TB</b> -Terminal Block
<b>JB</b> -Junction Box	<b>T</b> -Control Transformer
<b>Hz</b> -Hertz	<b>TDR</b> -Time Delay Relay
<b>INHG</b> -Inches of Mercury	<b>TEFC</b> -Totally Enclosed, Fan Cooled
<b>L</b> -Lamp	<b>THR</b> -Tank Heater Control Relay
<b>L.E.D.</b> -Light Emitting Diode	<b>TS</b> -Transducer Pressure Switch
<b>LAFD</b> -Los Angeles Fire Department	<b>V</b> -Voltage
<b>LFF</b> -Loss of Flow Relay	<b>VAC</b> -Voltage, Alternating Current
<b>LFL</b> -Low Fuel Level Relay	<b>VDC</b> -Voltage, Direct Current
<b>LPR</b> -Low Pressure Relay	<b>VG</b> -Vacuum Gauge
<b>MDB</b> -Main Distribution Block	
<b>MDS</b> -Main Disconnect Switch	

## APPENDIX B - TECHNICAL DATA

### Conversion Factors

1HP = 33,000 ft. lbs. per minute  
 1HP = 42.4 btu per minute  
 1HP = 0.746 kw/hr (kilowatt hours)

1 U.S. gallon= 231 cubic inches

**Pipe Volume** varies as the square of the diameter; volume in gallons = 0.0034 D<sup>2</sup> L where:  
 D=inside diameter of pipe in inches;  
 L=length in inches

**Velocity** in feet per sec.=  $\frac{0.408 \times \text{flow (gpm)}}{D^2}$

where:

D=inside diameter of pipe in inches

**Atmospheric pressure** at sea level = 14.7PSI  
 Atmospheric pressure decreases approximately 0.41PSI for each one thousand feet of elevation up to 23,000 feet.

**Pressure (PSI)** = feet head x 0.433 x specific gravity

**Specific gravity** of oil is approximately 0.85.

**Thermal expansion** of oil is approximately 1 cubic inch per 1 gallon per 10°F rise in temperature.

### Hydraulic Formulas

$$\text{Horsepower} = \frac{\text{GPM} \times \text{PSI}}{1714}$$

$$\text{Torque (lb. in.)} = \frac{\text{CU IN./REV.} \times \text{PSI}}{2}$$

$$\text{Torque (lb. in.)} = \frac{\text{HP} \times 63025}{\text{RPM}}$$

$$\text{Flow (gpm)} = \frac{\text{CU IN./REV} \times \text{RPM}}{231}$$

### Head and Pressure Equivalents

When converting pressure from feet of water to P.S.I., the specific gravity of the liquid must be considered.

Here are some typical conversion figures:

1 P.S.I.=2.30 feet of water  
 (specific gravity 1.0)

1 P.S.I.=2.88 feet of oil  
 (specific gravity 0.8)

Feet Water	PSI Oil	PSI Water
1	.35	.43
2	.70	.87
3	1.05	1.3
4	1.4	1.73
5	1.75	2.17
10	3.5	4.33
15	5.2	6.5
20	7.0	8.66
25	8.7	10.8
30	10.5	13.0
35	12.2	15.2
40	14.0	17.3
45	15.7	19.5
50	17.5	21.7
55	19.2	23.9
60	21.0	26.0
65	22.7	28.1
70	24.5	30.5
75	26.2	32.5
80	28.0	34.6
85	29.7	36.8
90	31.5	39.0

### SUPER X-L PUMP

PUMP MODEL	DISPLACEMENT IN <sup>3</sup> (CC/REV.)	RPM	Flow, GPM (LPM)				
			100 PSI (6.9 Bar)	1000 PSI (69 Bar)	1500 PSI (103 Bar)	2000 PSI (138 Bar)	2500 PSI (172 Bar)
SUPER XL-11	.262 (4.29)	1800	1.99 (7.54)	1.86 (7.05)	1.79 (6.78)	1.73 (6.56)	1.66 (6.29)
SUPER XL-39	.942 (15.44)	1800	7.08 (26.83)	6.87 (26.04)	6.77 (25.66)	6.66 (25.24)	6.56 (24.86)
SUPER XL-62	1.47 (24.14)	1800	11.10 (42.07)	10.81 (40.97)	10.70 (40.55)	10.60 (40.17)	10.40 (39.42)
SUPER XL-90	2.23 (36.5)	1800	16.70 (63.29)	16.50 (62.54)	16.30 (61.78)		
SUPER XL-114	3.35 (54.9)	1800	25.30 (95.89)	24.90 (94.37)	24.60 (93.23)	24.40 (92.48)	

## PUMP PERFORMANCE DATA 40 SSU • 200 SSU • 500SSU (SERIES 420)

MODEL	RPM	40SSU						200SSU											
		0 PSI		50 PSI		100 PSI		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
		GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	1.9	¼	1.7	¼	1.5	⅓	1.9	⅛	1.9	⅛	1.7	¼	1.5	⅓	1.4	½	1.2	¾
	1800	2.9	¼	2.7	½	2.5	½	2.9	⅛	2.8	¼	2.7	⅓	2.5	½	2.3	¾	2.1	1½
422	1200	3.7	⅓	3.4	½	3.1	¾	3.7	⅛	3.4	¼	3.1	¼	2.8	½	3.0	1	2.8	1½
	1800	5.4	½	4.9	¾	4.8	1	5.5	¼	4.9	⅓	4.9	½	4.6	¾	4.3	1½	3.8	2
424	1200	9.0	¼	7.6	¾	6.0	1	9.0	⅓	8.6	½	8.2	1	7.7	2	7.1	3	-	-
	1800	11.5	⅓	11.1	1	10.7	1½	13.7	½	13.3	1	12.9	1½	10.9	3	10.2	5	-	-
426	1200	10.0	¾	8.2	1	6.3	1½	12.0	¾	11.0	1	10.5	1½	-	-	-	-	-	-
	1800	15.0	1	12.2	1½	9.5	3	18.0	1	17.0	1½	16.0	3	-	-	-	-	-	-
428	1200	20.9	¾	17.4	1½	14.0	3	24.5	¾	23.8	1½	23.0	3	-	-	-	-	-	-
	1800	31.2	1½	26.1	3	21.0	5	37.0	1½	36.0	3	35.0	5	-	-	-	-	-	-
429	1200	34.0	1½	29.0	3	22.0	5	41.0	1½	40.0	3	38.5	5	-	-	-	-	-	-
	1800	53.0	3	45.0	5	36.0	7½	61.7	3	61.0	5	60.0	7½	-	-	-	-	-	-

MODEL	RPM	500SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
		GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	1.8	⅛	1.8	⅛	1.7	¼	1.6	⅓	1.4	½	1.1	1
	1800	2.7	¼	2.7	¼	2.6	⅓	2.5	½	2.4	1	2.2	1½
422	1200	3.6	⅛	3.5	¼	3.3	⅓	2.8	½	2.7	¾	2.0	1½
	1800	5.3	¼	5.2	⅓	4.9	½	4.4	1	4.0	1½	3.0	2
424	1200	8.7	½	8.6	¾	8.5	1½	8.2	2	7.8	3	-	-
	1800	2.9	1	12.8	1½	12.7	2	12.5	3	12.0	5	-	-
426	1200	12.0	1	11.5	1½	11.0	2	-	-	-	-	-	-
	1800	18.1	1½	18.0	2	16.3	3	-	-	-	-	-	-
428	1200	24.5	1½	24.0	2	23.7	3	-	-	-	-	-	-
	1800	37.0	3	36.5	5	36.0	5	-	-	-	-	-	-
429	1200	41.0	2	40.0	5	39.5	5	-	-	-	-	-	-
	1800	61.7	5	61.0	5	60.0	7½	-	-	-	-	-	-

## PUMP PERFORMANCE DATA 1000 SSU • 5000 SSU • 10000SSU (SERIES 420)

		1000SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
MODEL	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	1.9	1/8	1.9	1/8	1.8	1/4	1.7	1/3	1.6	1/2	1.4	3/4
	1800	2.8	1/4	2.7	1/4	2.7	1/4	2.6	1/2	2.5	3/4	2.2	1 1/2
422	1200	3.5	1/4	3.4	1/4	3.3	1/3	3.0	3/4	2.6	3/4	1.8	1 1/2
	1800	5.0	1/3	4.9	1/2	4.9	3/4	4.7	1	4.2	1 1/2	3.4	2
424	1200	8.8	3/4	8.7	1	8.5	1 1/2	8.2	2	7.8	3	-	-
	1800	13.0	1 1/2	12.7	2	12.5	2	10.2	3	9.9	5	-	-
426	1200	12.5	1 1/2	12.0	1 1/2	11.8	2	-	-	-	-	-	-
	1800	18.7	2	18.5	2	17.0	3	-	-	-	-	-	-
428	1200	24.9	2	24.5	3	24.0	5	-	-	-	-	-	-
	1800	37.4	5	37.2	5	36.5	5	-	-	-	-	-	-
429	1200	41.7	3	41.7	5	41.0	5	-	-	-	-	-	-
	1800	61.7	5	61.7	7 1/2	61.0	7 1/2	-	-	-	-	-	-

		5000SSU									10000SSU						
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		0 PSI		50 PSI		100 PSI	
MODEL	RPM	PM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
420	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
422	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
424	1200	8.2	1	8.0	1 1/2	7.8	2	7.6	3	7.4	3	-	-	-	-	-	-
	1800	11.2	2	11.0	3	10.7	3	10.2	5	9.9	5	-	-	-	-	-	-
426	1200	12.5	2	12.4	2	11.6	3	-	-	-	-	-	-	-	-	-	-
	1800	18.7	3	18.5	3	17.5	5	-	-	-	-	-	-	-	-	-	-
428	1200	24.9	5	24.9	5	24.5	5	-	-	-	-	23.3	5	23.0	5	22.8	5
	1800	37.4	7 1/2	37.4	7 1/2	37.0	7 1/2	-	-	-	-	-	-	-	-	-	-
429	1200	41.7	5	41.0	5	40.0	7 1/2	-	-	-	-	-	-	-	-	-	-
	1800	61.7	7 1/2	61.7	7 1/2	61.0	10	-	-	-	-	-	-	-	-	-	-

## MOTORS FOR PUMP DRIVE *CONTINUOUS DUTY, 40°C, UL RECOGNIZED*

### Single Phase Motors

Split Phase Start, Drip Proof, Rigid Base, Class B  
Insulation, Moderate Starting Torque, Sleeve Bearing

HP	RPM	Voltage	NEMA Frame	Bearing	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	115	48	Sleeve	Auto	1.0	6.6
1/2	1800	115	56	Sleeve	None	1.0	9.2

Capacitor Start, Drip Proof, Rigid Base, Class B Insulation,  
High Starting Torque, Ball Bearing

HP	RPM	Voltage	NEMA Frame	Bearing	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	115/230	48	Sleeve	Auto	1.0	7.0/3.5
1/2	1800	115/230	56	Sleeve	Auto	1.0	9.2/4.6
3/4	1800	115/230	56	Sleeve	Auto	1.0	10.4/5.2

Capacitor Start, Drip Proof, Rigid Base, Class B Insulation,  
Moderate Starting Torque, Sleeve Bearing

HP	RPM	Voltage	NEMA Frame	Thermal Prot.	Service Factor	Approx. F.L. Amps
1	1800	115/208-230	56	Auto	1.15	13.4/6.8-6.7
1 1/2	1800	115/208-230	56H	Auto	1.15	18.0/9.3-9.0
2	1800	115/208-230	145T	None	1.15	21.0/11.3-10.5
3	1800	115/208-230	184T	None	1.15	33.0/16.5
5	1800	208-230	184T	None	1.15	23.0-21.0
7 1/2	1800	208-230	215T	None	1.15	35.2

Capacitor Start, Totally Enclosed, Fan-Cooled, Rigid  
Base, Class B Insulation, NEMA-L (>1.0 HP) High Starting  
Torque, Ball Bearing

HP	RPM	Voltage	NEMA Frame	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	115/208-230	56	Auto	1.15	6.6/3.1-3.3
1/2	1800	115/208-230	56	Auto	1.15	8.8/4.2-4.4
3/4	1800	115/208-230	56	Auto	1.15	11.0/5.4-5.5
1	1800	115/208-230	56	Auto	1.15	13.4/6.8-6.7
1 1/2	1800	115/208-230	56H	Auto	1.15	15.2/8.2-7.6
2	1800	115/208-230	145T	None	1.15	18.8/9.4
3	1800	115/208-230	184T	None	1.0	34.0/17.0
5	1800	208-230	213T	None	1.0	27.5-26.0
7 1/2	1800	208-230	215T	None	1.0	36.5-33.0

## MOTORS FOR PUMP DRIVE *CONTINUOUS DUTY, 40°C, UL RECOGNIZED*

### Three Phase Motors

Drip Proof, Rigid Base, Class B Insulation, NEMA B, High Starting Torque, Ball Bearing

HP	RPM	Voltage	NEMA Frame	Thermal Prot.	Service Factor	Approx. F.L. Amps
1/3	1800	208-230/460	56	Auto	1.35	1.5-1.6/0.8
1/2	1800	208-230/460	56	Auto	1.35	2.3-2.4/1.2
3/4	1800	208-230/460	56	Auto	1.25	2.9-3.0/1.5
1	1800	208-230/460	56	Auto	1.15	3.5-3.6/1.8
1 1/2	1800	208-230/460	145T	Auto	1.15	4.8-4.8/2.4
2	1800	208-230/460	145T	Auto	1.15	6.2-6.2/3.1
3	1800	208-230/460	145T	Auto	1.15	9.2-8.6/4.3
5	1800	230/460	184T	Auto	1.15	13.2/6.6
7 1/2	1800	230/460	213T	Auto	1.15	20.0/10.0
10	1800	230/460	215T	Auto	1.15	26.6/13.3

Totally Enclosed-Fan-Cooled, Rigid Base, Class B Insulation, Class F (182T -254T), NEMA B, High Starting Torque

HP	RPM	Voltage	NEMA Frame	Approx. F.L. Amps
1/3	1800	208-230/460	56	1.5-1.6/0.8
1/2	1800	208-230/460	56	2.3-2.4/1.2
3/4	1800	208-230/460	56	2.9-3.0/1.5
1	1800	208-230/460	56	3.5-3.6/1.8
1 1/2	1800	208-230/460	145T	4.8-4.8/2.4
2	1800	208-230/460	145T	6.0-5.8/2.9
3	1800	208-230/460	145T	8.6/4.3
5	1800	230/460	184T	14.0-13.2/6.6
7 1/2	1800	230/460	213T	21.0-20.0/10.0
10	1800	230/460	215T	28.0-27.0/13.5

### DC Motors - Ampere Ratings and Fuse Sizes

HP	Ratings of DC Motors Full-Load Amperes		Amp. Cap. of Fuses for Motors Recommended Values	
	120 Volts	240 Volts	120 Volts	240 Volts
1/8	1.4	.7	3	3
1/6	1.8	.9	3	3
1/4	2.9	1.5	5	3
1/3	3.6	1.8	5	3
1/2	5.2	2.6	7	3
3/4	7.4	3.7	10	5
1	9.4	4.7	15	7
1 1/2	13.2	6.6	20	10
2	17	8.5	25	12
3	25	12.2	30	15
5	40	20	50	25
7 1/2	58	29	80	40
10	76	38	100	50

## Pipe Friction- Fuel Oil 2

Pressure Drop in PSI per 100 feet of Pipe and Tube

NOMINAL SIZES - INSIDE DIAMETERS								
Pipe Size, In.	2.0 GPM	7.0 GPM	10.0 GPM	17.0 GPM	23.0 GPM	30. GPM	40.0 GPM	50.0 GPM
.50	2.337	24.65	56.10	148.75	233.75	408.00		
.75		3.61	7.31	21.25	39.53	64.6	93.5	182.75
1.00	.306	2.00	4.16	11.70	19.55	31.87	54.40	80.75
1.25	.10	.51	1.00	2.55	5.10	8.50	14.88	22.10
1.5		.23	.425	1.10	2.04	3.27	5.70	8.33
2.00			.13	.34	.60	.96	3.10	2.38
2.50			.10	1.62	.30	.51	.94	1.275
3.00					.10	1.74	3.06	4.93

NOTE: Pipe sizes shown apply to standard weight schedule 40 pipe.  
Tube is standard copper tubing

## FLAMMABLE LIQUIDS FLASH POINTS

Excerpts from NFPA 325, "Fire Hazards properties of Flammable Liquids..."

	Flash Points °F(°C)
Diesel Fuel Oil No. 1-D	100 Min. (38) or Legal
Diesel Fuel Oil No. 2-D	125 Min. (52) or Legal
Diesel Fuel Oil No. 4-D	130 Min. (54) or Legal
Fuel Oil No. 1 (Kerosene) (Range Oil) (Coal Oil)	100-162 (43-72)
Fuel Oil No.2	126-204 (52-96)
Fuel Oil No. 4	142-240 (61-116)
Fuel Oil No. 5 Light Fuel Oil No. 5 Heavy	156-336 (69-169) 160-250 (71-121)
Fuel Oil No. 6	150-270 (66-132)
Jet Fuels Jet A and A-1	110-150 (43-66)
Jet Fuels Jet B	-10 to +30 (-23 to -1)
Jet Fuels JP-4	-10 to +30 (-23 to -1)
Jet Fuels JP-5	95-145 (35-63)

## Specific Gravity and Viscosity of Oils

Oils	*Specify Gravity At 60°F	Viscosities In SSU at Various Temperatures							
		30°F	60°F	80°F	100°F	130°F	170°F	210°F	250°F
<b>Auto Lubricating S.A.E.-</b>									
10 Max.	.880 to .935	4,400	1,090	430	240	120	66		
20 Max.	.880 to .935	6,900	1,650	750	400	185	90	57	
30 Max.	.880 to .935	13,000	2,700	1,200	580	255	120	66	49
40	.880 to .935	25,000	4,850	2,000	950	380	150	80	55
50	.880 to .935	58,000	10,000	3,700	1,600	600	220	105	67
60	.880 to .935	100,000	15,000	5,300	2,300	800	285	128	76
70	.880 to .935		22,000	7,500	3,100	1,050	342	150	86
10W	.880 to .935								
20W	.880 to .935								
<b>Fuel Oil-</b>									
Diesel No. 2D	.82 to .95	138	70	53.6	45.5	39			
Diesel No. 3D	.82 to .95	390	145	92	65	48	39		
Diesel No. 4D	.82 to .95	4,400	700	280	140	70	44.2		
Diesel No. 5D	.82 to .95	16,500	3,500	1,500	750	320	136	76.5	54
No. 1	.82 to .95				35				
No. 2	.82 to .95	104	56	45.5	40				
No. 3	.82 to .95	126	68	53	45	39			
No. 5A	.82 to .95	1,480	420	215	125	72	48		
No. 5B	.82 to .95	850	600	490	400	315	235	178	141
No. 6	.82 to .95		72,000	21,500	7,800	2,150	590	225	110
Navy Spec.	.989 Max.	3,300	1,100	600	360	190	100	66	50.2
Navy II	1.0 Max.		24,000	8,600	3,500	1,150	370	160	89
<b>Turbine-</b>									
Heavy	.91 Avg.	4,800	1,280	625	350	170	86	57	
Light	.91 Avg.	770	330	208	138	87	58.8		