

NEOLine **40i** WATERJET INTENSIFIER

OPERATION AND MAINTENANCE MANUAL



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KMT WATERJET SYSTEMS 2015



KMT Waterjet Systems 635 West 12th Street PO 231 Baxter Springs, KS 66713-0231

Phone: (800) 826-9274 Fax: (620) 856-5050

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SECTION 1 INTRODUCTION

1.1 Overview

The NEOLine 40i combines all the unique capabilities and advantages of waterjet cutting systems with the reliability, ease of operation and service support that have made KMT Waterjet Systems a leader in waterjet technology.

Table 1-1 NEOLine 40i

Motor Horsepower Rating		Maximum	Maximum	Maximum Single	
HP	Kw	Operating Pressure	Flow Rate (at full pressure)	Orifice Diameter (at full pressure)	
40	29	55,000 psi (3,792 bar)	.72 gpm (2.7 L/min)	0.012 inch (0.30 mm)	

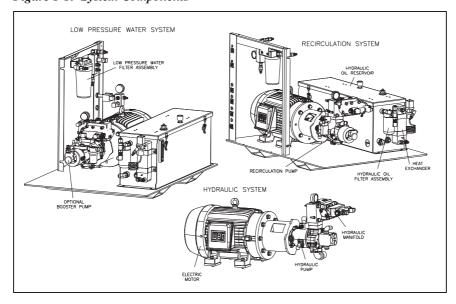
1.2 Operational Overview

The following provides a brief overview of the function and primary components associated with the individual systems. A detailed discussion of each system is provided in Sections 4 through 9. Equipment specifications are provided in Section 11, Specifications.

Low Pressure Water System

The low pressure water system supplies the cutting water flow to the intensifier. Optional system components include the booster pump.

Figure 1-1: System Components





Recirculation System

The recirculation system is a cooling and filtration system that provides properly conditioned oil to the main hydraulic system. Major system components include the recirculation pump, heat exchanger, oil filter assembly and the hydraulic oil reservoir.

Hydraulic System

The hydraulic system supplies the intensifier with the hydraulic oil required to produce high pressure water. Major system components include the electric motor, hydraulic pump, and the 4-way directional control valve mounted on the hydraulic manifold.

High Pressure Water System

The high pressure water system is the heart of the waterjet system. Water is pressurized and continuously delivered to the cutting head. As water passes through a tiny hole in the orifice, water pressure is converted to water velocity capable of cutting most any material.

The major components include the high pressure cylinder assemblies, hydraulic cylinder assembly, attenuator and the safety dump valve.

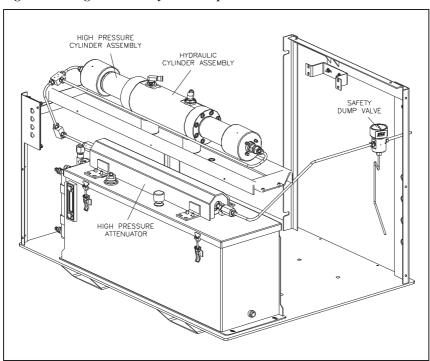


Figure 1-2: High Pressure System Components

1.3 Safety

The high pressure waterjet cutting system is a high energy cutting tool capable of cutting many dense or strong materials. Do not touch or be exposed to high pressure water. High pressure water will penetrate all parts of the human body. The liquid stream and the material ejected by the extreme pressure can result in severe injury.



All personnel operating, servicing or working near the waterjet cutting equipment shall adhere to the following safety precautions, as well as the applicable plant safety precautions.

- Only KMT factory trained, qualified personnel shall service and maintain the equipment.
- The operator shall practice and promote safety at all times to avoid potential injury and unnecessary downtime.
- The operator shall ensure that the work area around the equipment is clean and free of debris and oil spills.
- All protective guards, shields or covers shall be in place on the equipment at all times.



Safety glasses and ear protection shall be worn when operating or working near the equipment.

Lockout/Tagout Procedure

This lockout/tagout procedure is designed to protect all employees from injuries caused by the unexpected energizing or startup of the machine, or the release of stored energy during service and maintenance.

This is accomplished with energy isolating devices that prevent the transmission or release of energy. An energy source is any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy source that could cause injury to personnel.

A lockout device utilizes a lock and key to hold an energy isolating device in the safe position and prevents the machine from being energized. A tagout device is a prominent warning device that can be securely attached to the machine warning personnel not to operate the energy isolating device. This procedure requires the combination of a lockout device and a tagout device.

The lockout/tagout procedure applies to any employee who operates and/or performs service or maintenance on the machine. Before any maintenance or repairs are performed, the machine shall be isolated, and rendered inoperative as follows.

- 1. Shut down the machine by pressing the STOP button and open the high pressure cutting water valve to bleed the water and hydraulic pressure from the system.
- 2. Disconnect, lockout and tag the main, customer supplied, power source.
- 3. Lockout and tag the circuit breaker/disconnect on the electrical enclosure door.
- 4. Close, lockout and tag the manual shutoff valves for all service connections: cutting water in, cooling water in and out, and air.

Warning Labels

Warning labels are posted on the machine to indicate potential hazards. The operator and service personnel shall pay particular attention to these warning labels. Table 1-2 describes the necessary precautions and provides the part number required to order replacement labels.



Table 1-2 Warning Label Precautions

1



P/N 05114962

The electrical enclosure and motor junction box can present an electrical shock hazard. Always disconnect and lockout the main power before opening the enclosure.

Always disconnect and lockout the main power and the circuit breaker/disconnect on the electrical enclosure door before performing any type of maintenance

2



P/N 05114970

The surface of high pressure water and hydraulic components becomes hot during normal operation. Failed, or failing components, can become extremely hot during operation.

3



Ensure all protective guards, shields or covers are in place on the equipment at all times. Never operate the pump with the guards removed.

P/N 80082209

4



P/N 05098017

High pressure water and/or hydraulic pressure can remain in the system even when the pump has been shut off. All pressure can be safely bled from the system by opening the high pressure cutting water valve for a few seconds after shutting off the pump.

Pressing the EMERGENCY STOP button turns the control power to the intensifier off, stops the pump and bleeds the high pressure water through the safety dump valve.

Depressurization of the high pressure system creates a loud hissing sound when the dump valve opens. The sound fades quickly as the pressure drops.



Table 1-2 Warning Label Precautions



P/N 20415794

All personnel involved in the installation, operation and/or service of the intensifier must carefully read, understand and follow the procedures in this manual to avoid creating unsafe conditions, risking damage to the equipment, or personal injury.

Safety precautions and warnings for specific procedures are emphasized throughout this manual as illustrated in the following examples. These precautions must be reviewed and understood by operating and maintenance personnel prior to installing, operating or servicing the machine. Adherence to all Warnings, Cautions and Notes is essential to safe and efficient service and operation.



Warnings emphasize operating or service procedures, or conditions that can result in serious personal injury or death.



Cautions emphasize operating or service procedures, or conditions that can result in equipment damage or impairment of system operation.

NOTE

Notes provide additional information that can expedite or improve operating or service procedures.



Emergency Medical Treatment

An emergency medical card is included in the binder of this manual. This information should be used to aid in the treatment of a waterjet injury. Additional cards may be obtained by contacting KMT Waterjet Systems using the address or telephone number shown on the card.

Medical Alert

This card is to be carried by personnel working with high pressure waterjet equipment. Obtain medical treatment immediately for ANY high pressure waterjet injuries.

KMT Waterjet Systems 635 West 12th Street Baxter Springs, KS 66713 (620) 856-2151 This person has been working with water jetting at pressures to 60,000 psi (414 MPa, 4137 bar, 4,218 Kg/cm²) with a jet velocity of 3,000 fps (914 mps). Foreign material (sand) may have been injected with water. Unusual infections with microaerophilic organisms occurring at lower temperatures have been reported, such as gram negative pathogens as are found in sewage. Bacterial swabs and blood cultures may therefore be helpful. This injury must be treated as an acute surgical emergency and be evaluated by a qualified surgeon. Circulation may be compromised, therefore, DO NOT APPLY HEAT TO INJURED PART. For first aid: (1) Elevate injured part (2) Antibiotics (3) Keep injured person NPO.

1.4 Worlwide Product Support

The KMT Waterjet Customer Service Department is available to answer your questions regarding equipment installation and service. Technical assistance is available by phone and on-site support is available on request.

On-site technical assistance is available during equipment installation and startup. Additionally, technical support for service and maintenance issues and training of operators and maintenance personnel is available. Periodic training sessions are also conducted at KMT Waterjet and customer facilities.

Contact the KMT Waterjet Customer Service Department for additional information.

USA Customer Service Manager

KMT Waterjet Systems PO Box 231 635 West 12th Street Baxter Springs, KS 66713 USA

Phone: (800) 826-9274 Fax: (620) 856-2242

Email:

wj.service@kmtwaterjet.com wj.parts@kmtwaterjet.com

Europe Technical Manager

KMT Waterjet Systems GmbH Wasserstrahl-Schneidetechnik Auf der Laukert 11 D-61231 Bad Nauheim Germany

Phone: +49-6032-997-117 Fax: +49-6032-997-270

Email:

order.service@kmt-waterjet.com



1.5 Spare Parts

KMT Waterjet maintains a well-stocked Spare Parts Department, staffed by trained, knowledgeable personnel. If required, emergency shipment is available. Contact the Customer Service Department to order spare parts, or for additional information.

1.6 Manual Organization

This manual contains operating and maintenance procedures for the NEOLine 40i. Information is organized as follows:

- Section 1, Introduction, provides an overview of equipment features and options, a brief operational overview, details regarding safety issues and contact information for product support.
- Section 2, Installation, details installation requirements and procedures. Systematic guidelines for commissioning the intensifier are also provided.
- Section 3, Maintenance, highlights routine and preventive maintenance requirements. Precautions associated with high pressure cutting equipment are also reviewed.
- Section 4, Operation, explains the control functions where operating parameters are set and monitored.
- Sections 5 through 9 are specific to each individual system. Each section contains a detailed description of the principles of operation and the function of each system. Routine maintenance procedures associated with the system are also detailed.
- Section 10, Troubleshooting, is a comprehensive guide containing the information required to diagnose problems and repair the machine.
- Section 11, Specifications, contains a comprehensive list of equipment specifications; a detailed discussion of water quality standards and treatment guidelines; as well as horsepower requirements for various orifice sizes.
- Section 12, Parts List, contains part numbers, descriptions and drawings to facilitate the ordering of replacement parts.



SECTION 2 INSTALLATION

2.1 Overview

Installation and commissioning requirements and procedures are detailed in this section. These procedures require a thorough understanding of the individual components and systems, safety issues, and the overall operation of the intensifier.

All personnel involved in the installation, operation and/or service of the intensifier must carefully review this manual prior to installing and commissioning the machine.

The Technical Service Department at KMT Waterjet Systems is available to assist in the installation and commissioning process. Service and repair training for maintenance personnel is also available.

2.2 Installation Summary

The following summary lists the procedures required for the installation and commissioning of the intensifier system. Details and requirements for each item are discussed in this section.

- Upon receipt, the machine must be uncrated and moved into position on a level surface.
- Properly sized power drops with fused disconnects or circuit breakers, and properly sized starting components must be installed.
- A pneumatic drop with a manual shutoff valve and regulator for the air connection must be installed.
- Plumbing and manual shutoff valves for the inlet and outlet cooling water, and the inlet and outlet cutting water must be installed.

Prior to shipping a 3/8 inch high pressure tube is installed in the discharge side of the dump valve. Remove the tube and plumb the outlet cutting water connection directly to the dump valve.

Incoming source water must meet specific water quality standards, flow rates and pressure requirements. It may be necessary to install water conditioning and/or pressure boosting equipment to meet these water purity and pressure requirements.

- Drain water plumbing must be suitably located and installed for the proper disposal of wastewater.
- High pressure tubing runs from the intensifier to the cutting station must be installed with the appropriate mountings, support brackets and hardware.
- Wiring must be installed and connected between the intensifier and the cutting station control system.
- The machine must be commissioned and tested.



2.3 Site Requirements

The intensifier must be installed indoors where air borne dust and contaminants are minimal. The ambient temperature should be between 40° F (5° C) and 104° F (40° C), with a maximum relative humidity of 95 percent.

Refer to Table 2-1, Equipment Dimensions, to establish a suitable installation site. A minimum clearance of 36 inches (914 mm) should be provided on all sides of the machine to facilitate service.

Figure 2-1: Equipment Dimensions

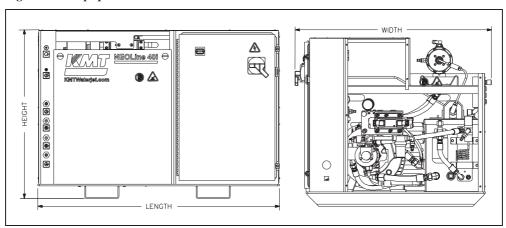


Table 2-1 Equipment Dimensions and Weight

Length	Width	Height	Weight
56.53" (1,436 mm)	45.94" (1,167 mm)	39.55" (1,005 mm)	2,150 lbs (975 kg)

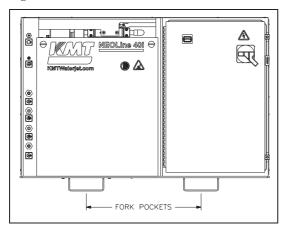
Transporting

The weight of the machine is not evenly distributed from one end to the other. Note the warnings stamped on the crate. The center of gravity is clearly identified on the sides of the crate. The forklift should be positioned accordingly.

When the machine has been removed from the crate, note the position of the fork pockets on the bottom of the machine. The pockets are positioned in relationship to the center of gravity to balance the weight on the forklift.



Figure 2-2: Fork Pockets





The machine **must** be lifted from the bottom. **Do not** attempt to lift the machine from the intensifier.

2.4 Power Requirements

Power supplied to the pump and wiring for remote control must comply with local, regional and national electrical codes. Service voltage and ampacity must meet the requirements detailed in Table 2-2. Voltage fluctuations in excess of +/- 10 percent of nominal voltage may damage the machine and void the warranty.

Table 2-2
Ampacity and Power Voltage Requirements

Power Voltage	Motor Horsepower	Full Load Amps	Recommended Circuit Breaker Amps
190/3/50	40	110	150
208/3/60	40	100	120
230/3/60	40	93	120
460/3/60	40	47	60
575/3/60	40	41	60



2.5 Service Connections

Depending on the model, the intensifier requires one or two incoming water sources, cooling water and cutting water; one or two drain lines, cooling water and wastewater; a high pressure discharge line, and an air supply line. All piping must comply with local, regional and national codes.

All service connections are made on the bulkhead of the machine as shown in Figure 2-3, Service connections. Table 2-3 lists the fittings required and the height of each interface connection.

With the exception of the wastewater drain line, manual shutoff valves should be installed for all connections. To facilitate service, the valves should be located as close as practical to the interface connection.



Thoroughly purge all supply plumbing prior to connection to remove any residue that could contaminate the system.

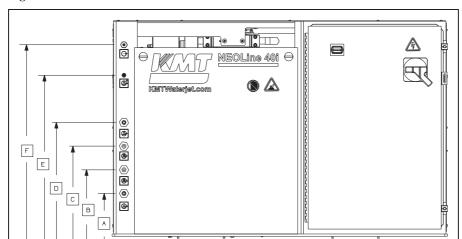


Figure 2-3: Service Connections



Table 2-3
Service Connections

		Connection	Height
A	Drain	1/2" NPT	10.24" (260 mm)
В	Cooling Water Out	1/2" NPT	14.24" (362 mm)
C	Cooling Water In	1/2" NPT	18.24 (463 mm)
D	Cutting Water In	1/2" NPT	20.43" (519 mm)
Е	Cutting Water Out	3/8" HP	30.24" (768 mm)
F	Plant Air In	1/4" NPT	35.38" (899 mm)

Cooling Water

Inlet cooling water flows through the oil-to-water heat exchanger in the hydraulic system to control heat buildup in the hydraulic oil. The cooling water is then discharged through the cooling water out port to either the drain or routed to a customer supplied water chiller.

Cooling water supply piping must be sized to meet the flow and pressure requirements of the equipment. If municipal or well water is used for cooling, ensure the supply flow and pressure meet the requirements in Section 11, Specifications.

If a facility-wide chilled water system is used for cooling, ensure there is a minimum of 60 psi (4.0 bar) pressure differential between the facility supply and discharge plumbing. Installation of an in-line pressure boosting pump may be necessary to provide adequate cooling flow. Dedicated chilled water systems should be sized according to pump horsepower as illustrated in Table 2-4, Chilled Water Systems.

Table 2-4
Chilled Water Systems
Cooling Requirements at Full Capacity

Horsepower	BTU/HR	
40	18,000	

Note: Coolant flow to the heat exchanger is regulated by the temperature of the contents in the hydraulic reservoir and will be shut off at times.

Cutting Water

Inlet cutting water is routed to the intensifier where it is pressurized and delivered to the cutting head. The cutting water supply must meet the minimum water quality standards outlined in Section 11, Specifications. Poor water quality will drastically shorten component life and void the warranty.



Cutting water supply piping must be sized to meet the flow and pressure requirements listed in Section 11. Only PVC, copper or rubber hose should be used between the cutting water source and the machine.

The inlet cutting water on standard units, not equipped with a booster pump, must be maintained at a minimum pressure of 60 psi (4 bar) at all times. If the facility water pressure is below, or can fall below 60 psi (4 bar), a water pressure booster pump is required.

NOTE

If the machine is equipped with the optional booster pump, the inlet water must be maintained at a minimum pressure of 35 psi (2.4 bar) at all times.



To avoid pressure spikes and premature component wear, adequate and consistent inlet water pressure is critical.

Drain

Cutting water released through the safety dump valve when the emergency stop button is initiated is discharged from the drain port. The discharge is considered wastewater and must be piped to an appropriate location, i.e. a sewer line. The volume of water released will be minimal and does not require high pressure plumbing; however, piping must comply with local, regional and national codes.

Plant Air

The facility compressed air connection should provide clean, dry air regulated to 85 psi (5.9 bar). Air usage is minimal, normally less than 1 scf/min.

NOTE

The reaction time of the pneumatic valve on the cutting head is a function of air and operating pressure. To achieve a consistent reaction time, when the operating pressure is changed, the air pressure should also be changed accordingly.

The following table provides specifications for each ISO air quality classification. KMT recommends adherence to Quality Class 4.



Table 2-5
ISO Air Quality Classifications

ISO Quality Class	Maximum Particle Size (microns)	Maximum Pressure Dew Point (water @ 100 psi)	Maximum Oil Content (Mg/m³)
1	0.1	-94° F (-60° C)	0.01
2	1	-40° F (-40° C)	0.1
3	5	-4° F (-20° C)	1
4	15	+38° F (+3° C)	5
5	40	+45° F (+7° C)	25
6		+50° F (+10° C)	

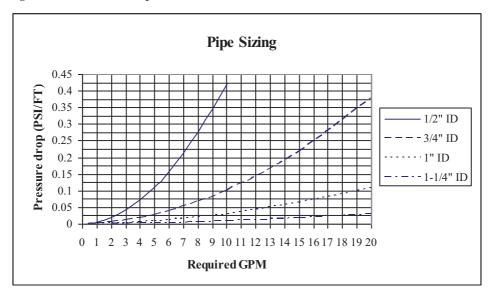
2.6 Flow Requirements

Figure 2-4, Pressure Drop Values, illustrates the pressure drop for four different pipe sizes. The graph can be used to calculate the minimum source water pressure.

- 1. Enter the graph at the required GPM and note the pressure drop figures for the different pipe sizes.
- 2. Multiply the pressure drop (PSI/FT) by the length in feet of each pipe size used from the water source to the intensifier. Add the values together for a total pressure drop value.
- 3. Add 30 to the total pressure drop to determine the minimum flowing, source water pressure required to provide adequate supply to the intensifier.

Cutting water and cooling water capacity should be calculated separately. Note that the cutting water requirements represent instantaneous, not average, demand.

Figure 2-4: Pressure Drop Values





2.7 High Pressure Piping

High pressure piping is used to transport high pressure cutting water from the machine to the cutting station. High pressure piping and fittings must be properly rated and sized. When transporting high pressure water over long distances, tubing and fittings with an outside diameter of 9/16-inch are recommended. The large tubing size reduces vibration, strain and motion; as well as reducing pressure drop and pulsation.



High pressure tubing and fittings must be rated for 60,000 psi (4,136 bar). Failure to use properly rated components may result in component failure causing equipment damage, personal injury or death.

High pressure tubing lengths must be coned and threaded prior to installation. KMT Waterjet provides both hand and power tools for coning and threading high pressure tubing. Tool descriptions and part numbers are provided in Table 2-6.

Table 2-6
Coning and Threading Tools

	Part Number	
	Hand Tools	Power Tools
1/4" Coning Tool	05108832	05109897
3/8" Coning Tool	05108857	05109889
9/16" Coning Tool	05108840	05109871
1/4" Threading Tool	05108865	05122742
3/8" Threading Tool	05108873	05120258
9/16" Threading Tool	05108881	05122759
1/4" Tube Vise	05108782	
3/8" Tube Vise	05108790	
9/16" Tube Vise	05108774	

Measurements and Dimensions

Tubing must be cut to the proper length, both ends of the tubing must then be coned, threaded and deburred.

To determine the tube length, measure the distance between the fittings, and add two times the engagement allowance shown in Table 2-7. Table 2-8 lists the required cone and thread dimensions illustrated in Figure 2-6.



Figure 2-5: Tube Length

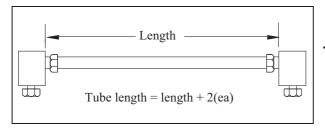


Table 2-7
Engagement Allowance (EA)

1/4" Tubing	0.49" (12.4 mm)
3/8" Tubing	0.68" (17.3 mm)
9/16" Tubing	0.86" (21.8 mm)

Figure 2-6: Cone and Thread Dimensions

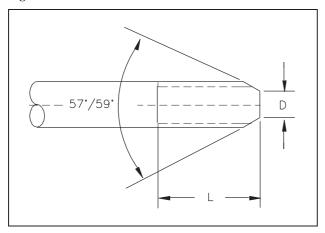


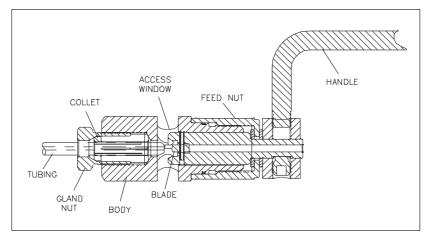
Table 2-8 Cone and Thread Dimensions

Tube OD	Tube ID	D (Maximum)	L (Maximum)	Thread UNF-LH
1/4" (6.35 mm)	0.083" (2.11 mm)	0.125" (3.2 mm)	0.562" (14.3 mm)	1/4" - 28
3/8" (9.52 mm)	0.125" (3.18 mm	0.219" (5.6 mm)	0.750" (19.1 mm)	3/8" - 24
9/16" (14.29 mm)	0.188" (4.78 mm)	0.281" (7.1 mm)	0.938" (23.8 mm)	9/16" - 18



Hand Coning

Figure 2-7: Hand Coning Tool



- 1. Place the body of the coning tool in a vise allowing adequate clearance for the rotation of the cutter handle. Position the tool so the cutter handle is elevated slightly so the lubricant will flow to the cutting blades.
- 2. Turn the feed nut counter-clockwise to retract the cutting blades past the access window.
- 3. Loosen the gland and insert the tubing through the collet. The end of the tubing should just make contact with the cutting blades. Loosely tighten the gland to slightly grip the tubing.
- 4. Turn the feed nut counter-clockwise 1/4 turn to retract the cutting blades away from the tubing, and tighten the gland with a wrench.
- 5. Apply a liberal amount of cutting oil to the exposed end of the tubing, the cutting blades and through the lubrication channel at the cutter handle.
 - Apply cutting oil frequently and liberally throughout the cutting operation. A medium weight cutting oil with high sulfur content is recommended.
- 6. Turn the feed nut clockwise until the cutting blades contact the end of the tubing.
- 7. In a smooth, continuous motion, turn the cutter handle in a clockwise direction. Simultaneously turn the feed nut in a clockwise direction to establish a constant feed. Do not remove too much material at once; the cutting blades should make light, uninterrupted cuts.

NOTE

Before interrupting the cut, back the cutter blades away from the tubing. Use compressed air or a small brush to remove the accumulation of chips from the blades and the tubing throughout the coning operation.

8. Continue the operation until the feed nut bottoms on the housing. Turn the cutter handle several more rotations to face-off the end of the cone.



9. Retract the cutter blades, loosen the gland and remove the tubing. Inspect the cone for surface finish and completeness.

Clean the machining chips from the blade and from the collet before coning the next tube.

Power Coning

- 1. Secure the tubing in a tube vise. No more than the recommended length of tubing should extend beyond the face of the vice. See Table 2-9, Recommended Extension Length.
- 2. Mount the coning tool in a 3/8-inch or 1/2-inch, variable speed power drill. Apply cutting oil to the end of the tube and slide the coning tool on the tubing.
- 3. Apply steady pressure against the end of the tubing while the cone is being cut.
 - Apply cutting oil frequently and liberally throughout the cutting operation. A medium weight cutting oil with high sulfur content is recommended.
- 4. The tool will stop cutting when the tube angle and facing is complete.

NOTE

Clean the machining chips from the blade and from the tool before coning the next tube.

Table 2-9
Recommended Extension Length

1/4" Tubing	1.25-1.50" (31.8-38.1 mm)
3/8" Tubing	1.25-1.50" (31.8-38.1 mm)
9/16" Tubing	1.75-2.00" (44.5-50.8 mm)

Hand Threading

- 1. Secure the coned tubing in a tube vise. No more than the recommended length of tubing should extend beyond the face of the vice. See Table 2-9, Recommended Extension Length.
- 2. Apply cutting oil to the end of the tube and slide the threading tool on the tubing.
- Grip the handles of the tool firmly, apply steady pressure and turn the tool counterclockwise. Approximately every half turn, reverse direction to break off and remove the chips.



Apply cutting oil frequently and liberally throughout the cutting operation. A medium weight cutting oil with high sulfur content is recommended.

4. Continue threading until the proper thread length is reached, see Table 2-8, Column L. Remove the tool from the end of the tubing.

NOTE
Clean the machining chips from the die and body of the tool before threading the next tube.

Power Threading

- 1. Secure the coned tubing in a tube vise. No more than the recommended length of tubing should extend beyond the face of the vice. See Table 2-9, Recommended Extension Length.
- 2. Mount the threading tool in a 3/8-inch or 1/2-inch, variable speed power drill. Apply cutting oil to the end of the tube and slide the threading tool on the tubing.
- 3. Make sure the drill is set to turn counter-clockwise. Apply steady pressure against the end of the tubing while the threads are being cut.
 - Apply cutting oil frequently and liberally throughout the cutting operation. A medium weight cutting oil with high sulfur content is recommended.
- 4. Continue threading until the proper thread length is attained; see Table 2-8, Column L. Reverse the direction of the drill and remove the threading tool.

NOTE
Clean the machining chips from the die and body of the tool before threading the next tube.

2.8 High Pressure Connections

When installing high pressure discharge piping it is essential that all burrs be carefully removed and the tubing sections purged with clean compressed air prior to assembly. Lightly spraying the inside of the tube with a carrier fluid, such as WD-40, before purging with air will help carry the burrs.

High pressure piping must be installed without torsional or bending stresses and proper supports and guides must be provided. Torsional stress will cause premature component failure.

Pure Goop anti-seize compound must be applied to the threads and contact surfaces of all stainless steel components prior to assembly. Failure to lubricate components with Pure Goop will result in galling, rendering the components useless.



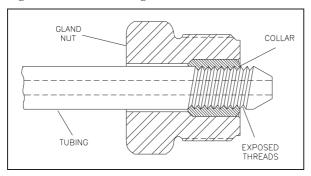


Do not use any other anti-seize compound. Apply Pure Goop **only to stainless steel** components.

Standard Connections

Standard connections are used for general applications where internal pressure is the only load on the tubing.

Figure 2-8: Standard High Pressure Connections



- 1. Deburr the tubing ID and thoroughly clean the tubing threads.
- 2. Slip the gland onto the tubing.
- 3. Apply Pure Goop to the threads on the tubing. Screw the collar onto the threaded end of the tubing leaving 1-1/2 to 2-1/2 threads exposed on the tubing between the collar and the coned tubing.
- 4. Apply Pure Goop to the male threads on the gland and insert the tubing into the connection. Engage the gland and tighten finger tight.
- 5. Tighten the gland to the torque specifications in Table 2-10.



Proper piping supports and guides must be provided. End connections will not support the tubing load alone.



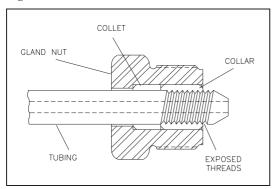
Table 2-10 Torque Specifications High Pressure Connections

1/4" Tubing	25 ft-lb (34 Nm)
3/8" Tubing	50 ft-lb (68 Nm)
9/16" Tubing	110 ft-lb (149 Nm)

Anti-Vibration Connections

The bending stresses resulting from excessive vibration or shock on the threaded area of the tubing can cause premature failure at the back of the thread. When tubing will be subjected to vibration, rotation and movement, anti-vibration connections must be used. The anti-vibration collet gland transfers the stress to the unthreaded section of the tubing, and the gripping action of the collet strengthens the entire assembly.

Figure 2-9: Anti-Vibration Connections



- 1. Deburr the tubing ID and thoroughly clean the tubing threads.
- 2. Slip the gland and the collet onto the tubing.
- 3. Apply Pure Goop to the threads on the tubing. Screw the collar onto the threaded end of the tubing leaving 1-1/2 to 2-1/2 threads exposed on the tubing between the collar and the coned tubing.
- 4. Apply Pure Goop to the male threads on the gland and insert the tubing into the connection. Engage the gland and tighten finger tight.
- 5. Tighten the gland to the torque specifications in Table 2-10

When a flexible whip is used to allow cutting nozzle movement, anti-vibration fittings and proper supports and guides must be provided to prevent failures from non-water related stresses. The whip will only flex in a single plane without being subjected to torsional stress. The use of high pressure swivels is strongly recommended.



2.9 Commissioning

When the machine has been positioned, all service connections installed, and the high pressure plumbing has been installed to the cutting area, the machine is ready to be commissioned.

The following procedure is used for the initial startup and testing of the machine.

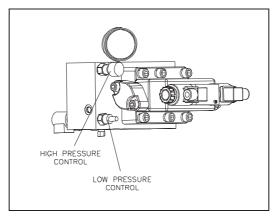
- 1. Check all areas in and around the pump for foreign objects and debris. Remove all tools, parts, etc. from the area.
- 2. Check the hydraulic fluid level. The hydraulic system is pre-filled prior to shipping. If the hydraulic fluid is low or empty due to leakage during transit, the system must be filled. Follow the instructions in Section 6, Recirculation System.



Prior to shipping, the breather was removed from the reservoir, placed in a plastic bag and attached to the pump. The breather must be installed on the reservoir prior to operation.

- 3. Open the shutoff valves on the service connections and check for leaks.
- 4. Check the connection between the customer supplied, main power disconnect and the machine. Verify the proper voltage supply.
- 5. Turn the control power on and use the customer supplied control to select low pressure operation.
- 6. To avoid a sudden increase in pressure, it is necessary to adjust the high pressure setting. The high pressure adjustment is made at the high pressure control valve on the hydraulic manifold. Refer to Section 7, Hydraulic System, for additional information.

Loosen the locking nut on the high pressure control valve by turning counter-clockwise. Turn the high pressure control valve counter-clockwise, decreasing the pressure to the lowest setting.



7. Check the motor rotation. The correct direction of rotation is marked with an arrow on the electric motor.





Do not allow the motor to run backward. Incorrect motor rotation will result in damage to the hydraulic pump.

Start the motor and observe the pressure gauge on the hydraulic manifold. If the motor rotation is correct, pressure will begin to build in just a few seconds. If the rotation is not correct, the gauge will not move.

If the motor shaft is rotating in the wrong direction turn the control power off. The electrical power phase must be reversed to any two motor leads. The leads must be reversed at the electric motor, or at the main power disconnect.

- 8. Remove the cutting orifice and open the nozzle valve.
- 9. Start the motor and run the machine at a low pressure for approximately five minutes with the orifice removed to purge the system.
- 10. Check for any leaks in the plumbing, or around the high pressure cylinders. If leaks are detected, stop the machine and correct any problems.
- 11. Check the safety circuits by pushing the EMERGENCY STOP button in and verifying that the power goes off and high pressure water is drained from the system. If applicable, check all remote start and emergency stop functions.
- 12. Install a large, inexpensive orifice and start the machine.
- 13. Use the customer supplied control to select high pressure operation and increase the high pressure setting in gradual increments, checking for leaks at each interval. Continue increasing the pressure until the operating pressure is reached.

The high pressure setting is increased by turning the high pressure control valve on the hydraulic manifold clockwise.

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It is strongly recommended that the high pressure plumbing be purged under high pressure operating conditions, using a large, inexpensive orifice. Contamination can be released when the tubing expands under pressure. Early orifice failures could be experienced if the piping is not adequately purged.

2.10 Decommissioning

All local regulations must be adhered to when the intensifier is decommissioned and taken out of service for any reason.



SECTION 3

MAINTENANCE

3.1 Overview

The NEOLine 40i has been designed to fail safely. Systems fail gradually; seals and connections can begin to leak slowly or suddenly through specially designed weep holes. Water or oil dripping from a weep hole indicates internal seals or valves are beginning to fail, a warning that maintenance will be required.

3.2 Maintenance

The waterjet system has been designed for ease of maintenance and long, reliable operation. In order to keep the equipment in optimum operating condition, routine and preventive maintenance is essential. Detailed maintenance procedures for specific systems are provided in subsequent sections of this manual.

Daily Inspection

The following inspection procedures should be performed each day. If problems are detected, they should be remedied before placing the machine in service.

- Prior to startup, inspect the area around the machine, the high pressure piping and connections for indications of leaks.
 - Make sure there is no maintenance work in process.
 - Check the hydraulic oil level.
- As the machine is started and water pressure increases, listen for unusual sounds.
 - Activate the EMERGENCY STOP button to verify the power goes off and the safety dump valve opens to bleed the high pressure from the system.
 - Check for water or oil leakage.
 - Check the condition of the hydraulic oil filter.
 - Check the condition of the low pressure water filter.

Periodic Maintenance

A number of factors can contribute to component failure; poor water quality, operating conditions, or improper maintenance procedures. Maintaining a service log can be a useful method of tracking component life and maintenance trends. Analyzing service intervals will assist in preparing a preventive maintenance schedule tailored to your specific application and production requirements. Periodic maintenance, at regularly scheduled intervals, will minimize unscheduled downtime and premature component failure.

Improper assembly can lead to the premature failure of components. Maintenance procedures must be followed carefully; components must be properly cleaned prior to assembly and tightened to the correct torque specifications.

• Maintain a clean, dust and dirt free work area for maintenance.



- Use only clean, dry air and clean, filtered solvent when flushing parts.
- Use lint free cloths for cleaning.
- Use extreme care when aligning close tolerance parts for assembly. Do not force the parts together. If parts bind during assembly, they must be disassembled and realigned.
- Use only original KMT Waterjet replacement parts for consistent performance and reliability; and to protect equipment warranty,

To avoid unsafe conditions and the risk of equipment damage, operating personnel and service technicians must carefully read and follow the procedures in this manual.

High Pressure System Maintenance

All high pressure service components are readily accessible, and can be removed from the unit easily for maintenance and service.

- High pressure fittings, valves and tubing must be rated for 60,000 psi (4,137 bar). Failure to use properly rated components may result in component failure, equipment damage and personal injury.
- Do not over-torque fittings to stop leakage.
- Ensure all components are clean, free of burrs, metal particles, dirt and dust prior to assembly.

After servicing high pressure components, the high pressure water system must be thoroughly flushed to remove any debris or contaminates.

- 1. Operate the intensifier for a short period with the nozzle valve open and the orifice removed.
- 2. Turn the intensifier off and install an orifice.
- 3. Turn the machine on and increase the operating pressure in gradual increments. Check all high pressure connections for leaks.

Many components are lubricated prior to assembly. Table 3-1 lists the recommended lubricants and their applications. Substitutions are not recommended.

Table 3-1 **Lubrication Specifications**

Description	Application	Part Number
Pure Goop, 1 ounce	Stainless steel threads and metal-to- metal joints	10084440
FML-2 Grease, 14-1/2 ounce	O-rings, backup rings, bearing rings, seal components	10087385
JL-M Grease, 16 ounce	Non-stainless steel threads	49832199



3.3 Maintenance Precautions

Make sure all safety devices are operational. Each device should be checked on a specified schedule. If the device does not function, it must be replaced before operating the machine.

Check the EMERGENCY STOP button. The normal operating position is pulled out. Turn the power on and activate the emergency stop button by pushing it in to verify the power goes off and the safety dump valve opens to bleed the high pressure from the system.

Before performing any maintenance on the equipment, take the system out of service and make sure the controls are properly locked and marked. Never perform any maintenance on the equipment without making sure the main control power is locked out in the OFF position.

- Never service or maintain the equipment while it is operating.
- All high pressure leaks must be repaired immediately. Press the EMERGENCY STOP button to turn the control power off and bleed off the high pressure water from the intensifier **before** performing maintenance.
- Never service or maintain any high pressure component, or loosen any high pressure fitting when it is pressurized. Press the EMERGENCY STOP button to turn the control power off and bleed off the high pressure water from the intensifier before servicing.
- If leakage occurs at a sealing surface, high pressure water is released through weep holes. If a pressurized fitting is loosened, a jet of high pressure water will exit the nearest weep hole with **possible hazardous results.**



3.4 Tool Kit

Table 3-2 provides a list of the spare parts and maintenance tools included in standard tool kit for NEOLine 40i pumps. Components can also be ordered individually.

Table 3-2 Installation Tool Kit 72112564

Part Number	Description	Quantity
10087385	FML-2 Grease, 14-1/2 ounce	1
80078330	Seal Removal Tool Stand	1
10079986	Strap Wrench	1
10081370	Spanner Wrench, .25	1
80079239	End Cap Wrench	1
10084440	Pure Goop, 1 ounce	3
10079853	Snap Ring Pliers	1
20494488	Vee Block	1
05066139	Cylinder Wrench	1
10148674	HP Seal Installation Tool	1
10149029	Emery Cloth, 320 Grit	2
10149037	Emery Cloth, 400 Grit	4
10149045	Emery Cloth, 600 Grit	6
10149052	Glass Pane, 8.0 x 8.0 x .25	1
72113886	Cartridge Removal Tool	1
80078256	Torque Wrench	1
05103957	Hex Driver	1
20470475	Seal Installation Tools, Pneumatic Valve	1
10079523	HP Plug, .38	1
10078129	HP Gland, .38	1
80082191	JL-M Grease, 15 milliliter	2
80078249	Socket Wrench	1
20487868	Threadlocker 242 Adhesive, .50 milliliter	1
20494983	Threadlocker Primer, 1-3/4 ounce	1
05053871	Combination Wrench	1

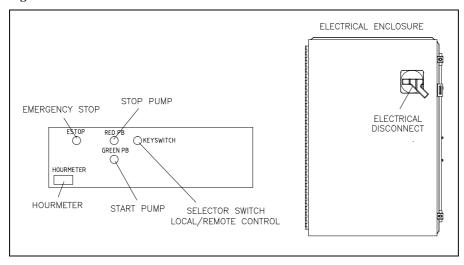


SECTION 4 OPERATION

4.1 Overview

The operator interface on the NEOLine 40i is through the controls on the top of the electrical enclosure or an optional, remote control panel. Figure 4-1 identifies the control components and functions.

Figure 4-1: Electrical Enclosure



- EMERGENCY STOP button turns the control power off. The electric motor, hydraulic pump and intensifier stop, the dump valve opens and high pressure is bled from the system. Pull the EMERGENCY STOP button out to reset.
- START button starts the pump and generates high pressure. This green button is illuminated during normal operation.
- STOP button turns the electric motor and hydraulic pump off. Control power remains on. This red button flashes during abnormal operation and remains on if the pump stops due to an abnormal condition. The STOP button is also used to reset shutdown alarm faults when they occur.
- SELECTOR SWITCH transfers control of the start and stop functions from the local panel to a remote panel. The switch must be in the remote position to remotely control the start and stop functions. Likewise, the switch must in the local position to control the start and stop functions from the local control panel.
- ELECTRICAL DISCONNECT opens and latches the electrical enclosure. Rotating the latch to the open position disconnects power from the motor and control circuits.
- Hourmeter displays the total operating hours.



4.2 Startup and Stop Sequence

The following procedure is used to start and stop the pump under normal operating conditions.

- 1. Pull the EMERGENCY STOP button out.
- 2. Press the START button. The green button will illuminate, the motor will start and after a brief delay, the hydraulic pump will start.
- 3. To stop the pump, press the STOP button. The green light will go off, the pump will stop, and the red light will illuminate.

Startup in Recirculation Mode

The recirculation mode is designed to circulate the hydraulic oil through a low-resistance path between the pump and the reservoir, and through the cooling system, without activating the intensifier. Primarily this feature cools the fluid quickly after an oil temperature fault, but it can also be used during commissioning or when replacing oil to bring colder oil up to normal operating temperature.

- 1. Disconnect either one of the two yellow, circular proximity switch cables located on each end of the hydraulic cylinder. This will prevent the intensifier from stroking while the pump is running.
- 2. Press the START button and monitor the temperature gauge on the reservoir. If a fault has occurred due to high oil temperature and the cause has been remedied, the recirculation process should take approximately 10 minutes.
- 3. When the oil returns normal operating temperature, press the STOP button and reconnect the proximity switch cable. Restart in normal operating mode.

Startup Following High Pressure Maintenance

The following startup procedure should be used following maintenance on any high pressure components.

- 1. Disconnect the electrical power cable from the solenoid valve on the dump valve.
- 2. Press the START button.

The intensifier will cycle and discharge water through the dump valve, purging the air from the high pressure cylinders and filling them with water.



Failure to purge the air from the high pressure system following maintenance will damage the high pressure seals.

- 3. Connect the electrical power cable to the solenoid valve on the dump valve.
- 4. Check for any leaks in the plumbing, or around the high pressure cylinders.



Emergency Stop

When the EMERGENCY STOP button is pressed, all electrical power is immediately terminated. The dump valve opens and high pressure is relieved in the system. The emergency stop function can be wired to a remote control panel.

4.3 Fault Conditions

Automatic shutdown will occur as a result of the faults listed in Table 4-1. The red, STOP button will blink and the number of blinks will indicate the type of fault. Press the STOP button once to reset any fault.

Table 4-1
Fault Conditions

Number of Blinks	Indication	Comments
1	Left Overstroke A left overstroke condition has occurred	Abnormally high stroke rate caused by an external or internal leak. Shutdown will occur if condition persists. Press the STOP button to reset.
2	Right Overstroke A right overstroke condition has occurred	Abnormally high stroke rate caused by an external or internal leak. Shutdown will occur if condition persists. Press the STOP button to reset.
3	Topworks Overstroke An intensifier overstroke condition has occurred.	Abnormally high stroke rate in both directions caused by an external or internal leak. Shutdown will occur if condition persists. Press the STOP button to reset.
4	Motor Overload Fault	The motor overload relay is monitored and displayed when the overloads trip. Overloads are set on automatic reset and the STOP button is pressed to reset the alarm.
5	High Oil Temperature High hydraulic oil temperature, in excess of 145° F (63° C)	The red light will illuminate and shutdown will occur. When the temperature returns to normal and the STOP button is pressed to reset the alarm, the red light will go off.
6	Low Oil Level Oil level is below 30 gallons (114 liters)	The red light will illuminate and shutdown will occur. When the fault has been corrected and the STOP button is pressed to reset the alarm, the red light will go off.



Table 4-1 Fault Conditions

Number of Blinks	Indication	Comments
7	Low Inlet Water Pressure Inlet water pressure is below 30 psi (2 bar)	The red light will illuminate and shutdown will occur. When the fault has been corrected and the STOP button is pressed to reset the alarm, the red light will go off.
8	Booster Pressure Fault (Optional) Boosted water pressure is below 60 psi (4 bar)	The red light will illuminate and shutdown will occur. When the fault has been corrected and the STOP button is pressed to reset the alarm, the red light will go off.

Remote Alarm Bit Codes

For convenience in monitoring the status of pump alarms at the CNC interface, the real time alarm status is provided via a 4-bit code. The bit code is available in a combination of four slimline relays in the bottom row of terminal blocks in the control panel. Typically reserved for OEM control connections, these are dry contacts that can be used over a 17-250V range of AC or DC voltages at up to 6A for maximum flexibility over a wide range of control architectures.

For safety considerations these codes are only for status indication; the reset action must still be done by pressing the local STOP button on the pump. This requires the operator to visually verify the condition of the intensifier, hydraulic hoses and tubing before starting the pump. This is especially important in cases where the pump is located in a remote area that may not be visible from the CNC interface.

The bit codes are listed in a table on the schematic as shown below.

Table 4-2 4-Bit Codes

Code	Indication
0000	Normal Operation
0001	Left Overstroke
0010	Right Overstroke
0011	Topworks Overstroke
0100	Motor Overload Fault
0101	Oil Temperature Fault
0110	Oil Level Fault
0111	Inlet Water Pressure Fault
1000	Booster Pressure Fault



Note the 0000 state is reserved to indicate normal operating conditions and the other eight states are reserved for individual fault conditions. The code is read as a typical binary number where the left most digit is the most significant bit (Alarm Code B3 on the schematic), and the right most digit is the least significant bit (Alarm Code B0 on the schematic).

For example, an oil temperature fault has occurred and the operator wants to read the code using the status of the relay LED indicators in the panel. As shown below, the status of the outputs on the PLC and the corresponding control relays indicate a code of 0101 or decimal number five. This also corresponds to the numbers of blinks seen at the fault indicator lamp on the pump.

_	PLC Output #	Q1.1	Q0.6	Q0.4	Q0.3
	Bit #	b3	b2	b1	b0
	State	0	1	0	1



SECTION 5

LOW PRESSURE WATER SYSTEM

5.1 Overview

The low pressure water system, cutting water supply circuit, supplies the intensifier with the required cutting water flow and pressure.

5.2 Cutting Water Supply Quality

The quality of the inlet cutting water supply is one of the most important factors affecting component life and performance. Impurities in the water create grinding and corrosive effects on all components. See Section 11, Specifications, for details regarding water quality standards.

5.3 Operation

Cutting water is introduced through the 1/2-inch NPT connection on the rear bulkhead of the machine and passes through the normally closed, inlet water solenoid valve. When the control power is turned on, the solenoid valve opens and allows water to flow through the valve. Inlet cutting water pressure, passing through the water solenoid valve, is displayed on the supply gauge mounted on the inlet manifold. Inlet cutting water pressure should be a minimum of 60 psi (4 bar) flowing and is monitored by a 60 psi pressure switch. If the pressure drops below 60 psi (4 bar) the switch activates an automatic shutdown circuit and the machine will not start.

If a shutdown occurs due to an overstroke condition, the inlet solenoid valve automatically closes to prevent water waste due to an external leak.

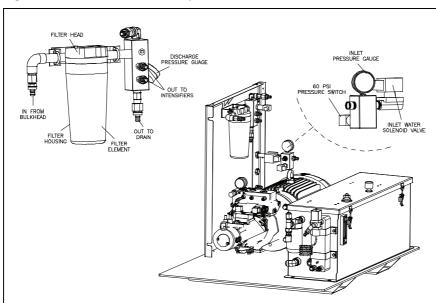


Figure 5-1: Low Pressure Water System



Cutting water then passes through the filter assembly where debris is removed to prevent contaminates from damaging the check valves and seals in the intensifier. The filter assembly consists of a filter head, housing and a 10 micron absolute filter. A bleed valve on the top of the filter head is used to release air inside the housing.

If the pressure entering the outlet manifold exceeds 125 psi (8.6 bar) a relief valve opens allowing water to exit through the 1/2-inch drain connection on the rear bulkhead. It is still possible to operate the machine; however, excess water will continue to be released through the drain.

Discharge pressure is displayed on the pressure gauge mounted on the outlet manifold. The gauge should read approximately 120 psi (8 bar) while the machine is idling. When it strokes, the pressure drop should be no greater than 30 psi (2 bar). The water pressure range should remain between 90-120 psi (6-8 bar) during operation. Discharge pressure is monitored by a 60 psi pressure switch. An automatic shutdown will occur if the pressure is below 60 psi (4 bar).

While the intensifier assembly reverses direction, the boosted pressure will fluctuate slightly above and below the normal setting.

A relief valve built into the filter assembly prevents excessive discharge pressure and typically operates when the machine is in a deadhead condition. From the outlet manifold, cutting water is routed to the sealing head inlet check valves on each end of the intensifier.

5.4 System Options

The optional booster pump increases the inlet cutting water pressure to ensure proper supply to the intensifier assembly.

Additional components associated with the optional booster pump include a strainer and a 30 psi pressure switch.

Operation with Optional Booster Pump and Strainer

Cutting water is introduced through the 1/2-inch NPT connection on the rear bulkhead of the machine and passes through the normally closed, inlet water solenoid valve. When the control power is turned on, the solenoid valve opens and allows water to flow through the valve. Inlet cutting water pressure, passing through the water solenoid valve, is displayed on the supply gauge mounted on the inlet manifold. Inlet cutting water pressure should be a minimum of 35 psi (2.4 bar) flowing and is monitored by a 30 psi pressure switch. If the pressure drops below 30 psi (2 bar) the switch activates an automatic shutdown circuit and the machine will not start.

NOTE

The machine will not start if inlet cutting water pressure is below 30 psi (2 bar).

Cutting water then passes through a strainer to remove debris before the water enters the booster pump. The booster pump increases the pressure to the relief valve setting, up to a maximum of 120 psi (8 bar) to ensure proper supply to the intensifier assembly.



Pressurized water passes through the filter assembly where debris is removed to prevent contaminates from damaging the check valves and seals in the intensifier. The filter assembly consists of a filter head, housing and a 10 micron absolute filter. A bleed valve on the top of the filter head is used to release air inside the housing.

FILTER HEAD

PRESSURE SWITCH

DISCHARGE

PRESSURE GAUGE

PRESSURE GAUGE

PRESSURE SWITCH

INLET

PRESSURE SWITCH

PRESSURE SWITCH

PRESSURE SWITCH

PRESSURE SWITCH

PRESSURE SWITCH

PRESSURE SWITCH

SOLEND VALVE

ACORN NOT

STRANER

Figure 5-2: Low Pressure Water System with Optional Booster Pump and Strainer

If the booster pump pressure entering the outlet manifold exceeds 125 psi (8.6 bar) a relief valve opens allowing water to exit through the 1/2-inch drain connection on the rear bulkhead. It is still possible to operate the machine; however, excess water will continue to be released through the drain.

Discharge pressure is displayed on the pressure gauge mounted on the outlet manifold. The gauge should read approximately 120 psi (8 bar) while the machine is idling. When it strokes, the pressure drop should be no greater than 30 psi (2 bar). The water pressure range should remain between 90-120 psi (6-8 bar) during operation. Discharge pressure is monitored by a 60 psi pressure switch. An automatic shutdown will occur if the pressure is below 60 psi (4 bar).

NOTE

While the intensifier assembly reverses direction, the boosted pressure will fluctuate slightly above and below the normal setting.

A relief valve built into the filter assembly prevents excessive discharge pressure and typically operates when the machine is in a deadhead condition. The booster pump is factory set to deliver 120 psi (8 bar) with an inlet pressure of 58 psi (4 bar). The pump may require adjustment to satisfy system requirements.



From the outlet manifold, cutting water is routed to the sealing head inlet check valves on each end of the intensifier.

5.5 Service and Maintenance Procedures

There are no routine service and maintenance procedures associated with the low pressure system on standard machines. When pumps are equipped with the optional booster pump and low pressure water filter, the filter element, strainer and booster pump will require routine servicing and maintenance.

Refer to Section 12, Parts List, for a complete listing of replacement parts and part numbers.

Filter Assembly and Strainer Maintenance

The life of the filter element is directly related to the quality of the inlet water. The condition of the filter element can be monitored by observing the pressure gauge on the inlet manifold. Document the pressure reading when the filter element is new. The element should be replaced when the pressure drops to 15 psi (1 bar) below the original value. When the filter element is replaced, the strainer should also be cleaned if applicable.

Use the following procedure to replace the filter element and clean the strainer.

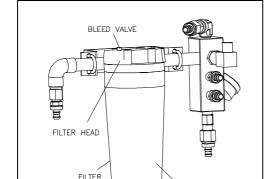
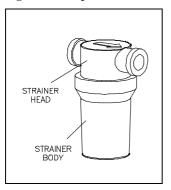


Figure 5-3: Filter Element

- 1. Turn the cutting water supply off.
- 2. Press the red bleed valve on the filter head to release any pressure trapped inside the housing.
- 3. Use a filter wrench to unscrew the housing and remove the old element.
- 4. Install the new element. Apply FML-2 grease to the o-ring in the filter housing and use the filter wrench to replace the housing.



Figure 5-4: Optional Strainer

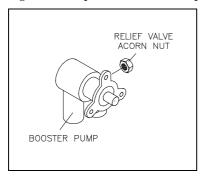


- 5. Unscrew and remove the strainer body. Remove and clean the mesh liner.
- 6. Ensure the gasket is properly positioned in the body, install the liner and screw the strainer body into the strainer head, hand tighten.
- 7. Turn the cutting water supply on.
- 8. Press the red bleed valve to remove any air inside the housing.
- 9. Start the machine and verify satisfactory pressure readings.

Optional Booster Pump Adjustment

If the discharge pressure from the booster pump stays below 90 psi (6 bar) while the intensifier is shifting, the relief valve on the booster pump should be adjusted.

Figure 5-5: Optional Booster Pump



- 1. Turn the cutting water supply on.
- 2. Start the machine and initiate normal, shifting operation.
- 3. Observe the discharge pressure from the booster pump. If the pressure stays below 90 psi (6bar), continue with Step 4.
- 4. Stop the intensifier and remove the acorn nut on the side of the pump to access the adjustment screw. It is normal for water to leak out when the acorn nut is removed.
- 5. Use a flat screwdriver and turn the adjustment screw clockwise to increase the discharge pressure or counter-clockwise to decrease the pressure. Adjust the pressure to the highest desired pressure, within normal booster pump range.





If the adjustment screw is turned too far out (counter-clockwise) an internal spring and relief will fall down inside the pump. If this occurs, the pump must be removed and the parts must be reinstalled to avoid component damage.

6. Replace the acorn nut, resume normal operation and observe the booster discharge pressure. Peak pressure should be in the range of 90 to 120 psi (6 to 8 bar). If it is not, repeat the adjustment procedure.



SECTION 6

RECIRCULATION SYSTEM

6.1 Overview

The oil recirculation circuit is a cooling and filtration system that provides properly conditioned oil to the main hydraulic system. Hydraulic oil is maintained at the proper operating temperature and condition by continuous recirculation.

System components include the recirculation pump, heat exchanger, oil filter assembly, hydraulic oil reservoir and the water modulating valve. A temperature/low level switch monitors temperature and oil level conditions in the hydraulic oil reservoir and provides automatic shutdown protection.

6.2 Operation

Cooling water is introduced through the 1/2-inch NPT connection on the rear bulkhead of the machine and routed to the inlet water side of the heat exchanger.

HYDRAULIC OIL
RESERVOIR

BREATHER

TEMPERATURE /LOW
LEVEL SWITCH

LEVEL/TEMPERATURE
SIGHT GAUGE

MATER
MODULATING VALVE

HEAT
EXCHANGER

FILTER
GAUGE
OIL FILL
PORT

Figure 6-1: Recirculation System Components

The recirculation pump pulls oil from the reservoir and sends it to the inlet oil side of the heat exchanger. The heat exchanger controls heat build-up in the hydraulic oil. The plate style design allows cooling water and oil to flow side by side through alternating plates. The cooled oil then passes through the filter element and returns to the reservoir.



A water modulating valve in the discharge line regulates the cooling flow through the heat exchanger. The valve is factory set, but may require adjustment to maintain the operating oil temperature at 115° F (46° C). Oil temperature can be visually monitored from a dual scale level/temperature sight gauge on the side of the hydraulic oil reservoir.

The cooling water is either discharged to the 1/2-inch NPT drain on the rear bulkhead or is routed to a customer supplied water chiller.

The hydraulic oil filter assembly consists of the filter head with pressure gauge and bypass relief valve, a filter element and the oil fill port. The filter element should be changed when the gauge reads 40 psi (2.8 bar) at normal operating temperature.

If the element is not replaced, and fills with debris, the bypass relief in the filter head will open to prevent over pressurization. The relief valve opens at 50 psi (3.4 bar). When the valve opens, the oil bypasses the filter and unfiltered oil is allowed to return to the reservoir.

The temperature/low level switch monitors the oil temperature and level in the reservoir. An automatic shutdown will occur if the operating oil temperature exceeds 145° F $(63^{\circ}$ C). An automatic shutdown will also occur if the oil level falls below 30 gal (114 L).

NOTE	

To conserve water usage it is recommended that the cooling water be shut off at the end of the day. A sensor bulb from the modulating valve is submerged in the reservoir. Even when the control power is off, the valve will remain open, allowing water to flow until the oil is cooled.

6.3 Service and Maintenance Procedures

To ensure the supply of properly conditioned oil to the main hydraulic system, the components will require routine servicing and maintenance. The procedures for servicing these components are detailed below.

Refer to Section 12, Parts List, for a complete listing of replacement parts and part numbers.

Hydraulic Oil Maintenance

The hydraulic oil should be replaced after 3,000 hours or one year of service, whichever comes first. The oil should be replaced sooner if a fluid sample indicates contamination that cannot be rectified by filtering.

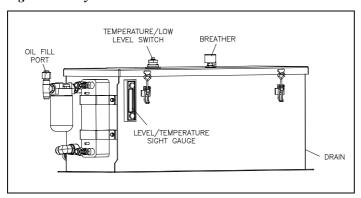
An air breather and filter is located on the top of the reservoir. The air breather prevents dirt from being sucked into the reservoir when the oil level drops, and allows air to escape when the level rises. The air breather **must not** be used as a fill point. **Oil must only be added at the fill port on the hydraulic filter.**





Do not attempt to fill the reservoir from the air breather.

Figure 6-2: Hydraulic Oil Reservoir



1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before performing maintenance.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before performing maintenance.

- 2. Drain the oil reservoir. The inlet hose from an oil transfer pump can be connected to the 1/2" NPT drain on the reservoir.
- 3. Pump the used oil out to a container and remove the inlet hose from the drain.
- 4. Use the discharge hose from the oil transfer pump to pump the fresh oil into the reservoir through the oil fill port.
- 5. Check the oil sight gauge on the reservoir to ensure proper fill level.
- 6. Remove the hose from the case drain on the hydraulic pump to make sure the pump case fills with oil. With the hose removed, head pressure from the reservoir will force oil into the pump case.



Oil in the pump case provides internal lubrication for the main hydraulic pump. Failure to the fill the pump case with oil will allow air to become trapped inside, damaging the pump.



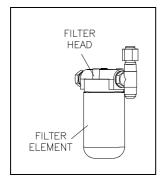
- 7. Remove the discharge hose from the fill port.
- 8. Check the sight gauge again and follow the same procedure to add additional oil if necessary.

Oil Filter Maintenance

If the filter element is not properly serviced and is allowed to fill with debris, the oil will be forced through the relief valve, bypassing the filter. The bypass relief valve opens at 50 psi (3.4 bar).

The filter element must be replaced when the pressure gauge reading is 40 psi (2.8 bar) or greater during normal operating conditions. Normal operating conditions indicate the machine is running and the oil temperature has reached 115° F (46° C).

Figure 6-3: Oil Filter Assembly



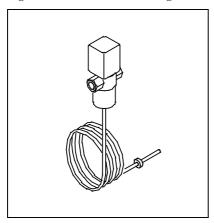
- 1. Use a filter wrench to unscrew the filter element from the filter head. Ensure the old gasket is removed with the filter.
- 2. Lubricate the gasket on the new element with fresh oil.
- 3. Use the filter wrench to screw the new element onto the filter head and hand-tighten. Do not over tighten.
- 4. Start the machine and check for leaks.

Operating Temperature Adjustment

The cooling water flow through the heat exchanger is regulated by the water modulating valve, a manually adjusted, thermostatic control valve. The valve is factory set to maintain the operating oil temperature at 115° F (46° C). In most cases, adjustment will be required at commissioning, and with seasonal changes to cooling water temperature. The temperature is adjusted by increasing or decreasing the spring tension on the valve.



Figure 6-4: Water Modulating Valve



- 1. Locate the adjusting knob, a screwdriver slot on the top of the valve.
- 2. Use a flat screwdriver and turn counter-clockwise to compress the spring, slowing water flow and increasing temperature. Or; turn clockwise to reduce spring tension, increasing water flow and decreasing the temperature.
- 3. Monitor the sight gauge on the side of the reservoir until the adjusted temperature can be determined. It will take some time for the temperature in the oil reservoir to change.
- 4. Repeat steps 2 and 3 if necessary.



SECTION 7

HYDRAULIC SYSTEM

7.1 Overview

The main hydraulic power circuit supplies the intensifier assembly with the hydraulic oil required to produce high pressure water. High pressure cutting water is generated from the oil pressure in the hydraulic cylinder.

System components include the electric motor, hydraulic pump, 4-way directional control valve and the hydraulic manifold. The manifold houses the high and low pressure control valves, hydraulic gauge, two pressure solenoid valve and the main system relief valve. The system relief valve monitors hydraulic oil pressure and provides system protection by limiting excess pressure.

7.2 Operation

The electric motor drives the main hydraulic pump, the recirculation pump and, if applicable, the optional booster pump. The motor drives the variable displacement, pressure compensated hydraulic pump by means of a flexible coupling.

Hydraulic fluid from the reservoir is drawn into the inlet, low pressure side of the hydraulic pump. Oil delivered to the pump should be maintained at 110-115° F (43-46° C). Hydraulic fluid then enters the bottom of the manifold through an internal anti-rotation check valve. After a shutdown, the anti-rotation check valve prevents the pump from running backwards.

PRESSURE
GALIGE
SYSTEM
RELIEF VALVE

HYDRAULIC
MOTOR

HIGH /LOW LIMIT
COMFENSATORS

HYDRAULIC
PLUMP

HYDRAULIC
CONTROL

HYDRAULIC
PLUMP

HYDRAULIC
CONTROL

HYDRAULIC
PLUMP

HYD

Figure 7-1: Hydraulic System Components

The main system relief valve provides system protection by monitoring the oil pressure entering the manifold. If the hydraulic pressure exceeds 2,973 psi (205 bar), the valve opens to limit the pressure. The valve is factory calibrated and is not serviceable. A drain line from the valve prevents oil from collecting behind the relief valve to ensure a constant pressure under all operating conditions.



The hydraulic system operates at high or low pressure settings up to the maximum flow capacity of the hydraulic pump. The high and low limit compensators mounted on the pump regulate the flow of hydraulic fluid to maintain constant operating pressures. Operating pressures are set and adjusted at the high and low pressure control valves on the manifold.



The high and low limit compensators regulate the flow of hydraulic fluid to the system by controlling the angle of the swashplate. If the oil is not properly maintained, the compensators can become blocked with debris. As a result, pump control will be lost and you will not be able to create hydraulic oil pressure.

The normally closed, two pressure solenoid valve is controlled by the operator's selection of high or low pressure. The valve is closed while operating in high pressure and is open during low pressure operation. A light on the solenoid connector indicates low pressure operation.

A reference gauge on the top of the manifold displays hydraulic pressure to the intensifier. When the intensifier shifts, it is normal for the pressure to quickly fall and then rise again.

The 4-way directional control valve directs pressurized oil to one end the hydraulic cylinder and returns fluid to the reservoir from the opposite end, causing the intensifier to stroke. The movement is controlled hydraulically by a pilot valve that is electronically operated by two solenoids. Indicators light up as each solenoid is energized.

The directional control valve sends flow to the hydraulic cylinder in one direction until the hydraulic piston activates the proximity switch at the end of the stroke. The activated switch sends a signal to reverse the direction of flow. The piston then moves in the opposite direction until it activates the proximity switch at the opposite end of the stroke.

7.3 Service and Maintenance Procedures

The extreme duty cycles demanded of the hydraulic system make routine inspection and maintenance acutely important. Leaks must be detected and remedied as soon as possible.

The operating pressure settings must be checked daily, and the electric motor must be inspected at regular intervals. It is also possible for the flexible coupling to fail and require replacement.

NOTE
Refer to Section 12, Parts List, for a complete listing of replacement parts and part numbers.

Hydraulic Operating Pressure

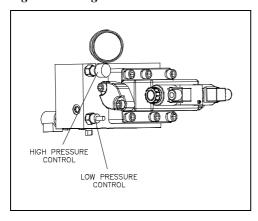
Hydraulic operating pressure settings should be checked daily and adjusted as necessary. High and low operating pressure is adjusted at the high and low pressure control valves per the specifications in Table 7-1.



Table 7-1
Hydraulic Operating Pressure Limits

	Adjustment		Pressure Limits	
	Increase	Decrease	Minimum	Maximum
High Pressure	Clockwise	Counter-clockwise	290 psi (20 bar)	2,750 psi (190 bar)
Low Pressure	Clockwise	Counter-clockwise	290 psi (20 bar)	1,500 psi (103 bar)

Figure 7-2: High/Low Pressure Controls



- 1. Check the operating pressure to determine if adjustment is necessary.
- 2. If high pressure adjustment is required, loosen the locking thumbscrew on the high pressure control valve by turning counter-clockwise.
- 3. Turn the knob on the control valve clockwise to increase operating pressure. Turn the knob counter-clockwise to decrease pressure.
- 4. Tighten the locking nut and verify the high pressure setting.
- 5. If low pressure adjustment is required, loosen the locking nut on the low pressure control valve by turning counter-clockwise.
- 6. Turn the hex clockwise to increase operating pressure. Turn the hex counter-clockwise to decrease pressure.
- 7. Tighten the locking nut and verify the low pressure setting.

Motor Maintenance

The motor should be inspected at regular intervals, approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation openings clear.



SECTION 8

ELECTRICAL SYSTEM

8.1 Overview

Major components of the electrical system for the NEOLine 40i include the electric motor and the wiring harness that connects the sensors and solenoid valves to the customer supplied controller.

The 12-lead electric motor can be wired for wye-delta, softstart or across-the-line starting. The motor includes a 9-post terminal block for the junction of motor and starter wire leads.

8.2 Sensors and Solenoids

Sensors monitor operating conditions and electronically operated solenoids provide basic intensifier shift control. The cables connected to these sensors and solenoids are bundled into a wiring harness. Table 8-1 lists the recommended shutdown settings.

Table 8-1 Recommended Shutdown Settings

Label	Sensor	Shutdown Setting
1	Low hydraulic oil level	18 gal (68 L)
1	High hydraulic oil temperature	145° F (63° C)

Figure 8-1: Sensors and Solenoids

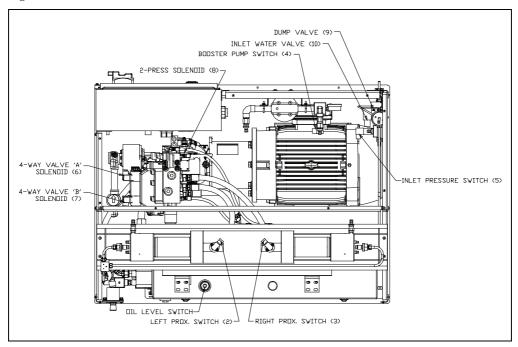
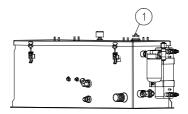




Table 8-2 Sensors and Solenoids

Component Function

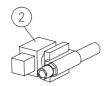
Hydraulic Reservoir



1 The temperature/low level switch monitors the oil temperature and level in the reservoir.

Although the float switch and the temperature switch are combined in a single unit, the two switches function independently.

Inlet Water Solenoid Valve



2 The normally closed, inlet water solenoid valve is located at the service bulkhead. When the control power is turned on, the valve opens and allows low pressure cutting water to enter.

Safety Dump Valve



When control power is removed, the safety dump valve releases the stored pressure in the intensifier and high pressure delivery lines. The high pressure dump valve assembly includes a normally open high pressure water valve and a solenoid operated air valve.

The normally open pneumatic dump valve is held closed by air pressure. When the air supply is interrupted, the valve opens and allows water to flow through the valve. Pressure is released in the intensifier and the high pressure water stream exits through the drain.

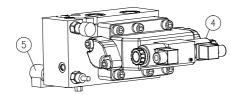


Table 8-2 Sensors and Solenoids

Component

Function

Hydraulic Manifold

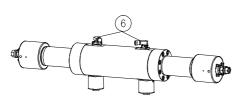


- 4 The 4-way directional control valve shifts the hydraulics back and forth to the intensifier. A shift valve directs pressurized oil to one end of the hydraulic cylinder and returns fluid to the reservoir from the opposite end, causing the intensifier to stroke. The movement is controlled electronically by two solenoids, signaled by the PLC. As power is directed from one solenoid to the other, LEDs are alternately illuminated.
- When low pressure is selected, a normally closed, solenoid valve is activated. The valve remains closed while operating in high pressure and is held open electrically during low pressure operation. An illuminated LED on the solenoid indicates low pressure operation.
- As pressurized hydraulic oil is sent to one side of the hydraulic cylinder, it pushes against the piston, moving it in one direction until it activates the proximity switch at the end of the stroke. The hydraulic flow is then sent to the opposite side of the cylinder, and the piston reverses direction until it activates the proximity

switch at the opposite end of the stroke.

The green light on the proximity switch indicates there is power to the switch. The light turns red when the switch is activated. The proximity switches are magnetically activated by the presence of the metallic surface of the piston. When the switch is activated, it sends a signal to the PLC to change the flow of the directional control valve and reverse direction.





Inlet Water Manifold



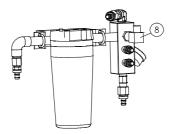
The 60 psi pressure switch, mounted on the inlet manifold, monitors the inlet cutting water. If the pressure drops below 60 psi (4 bar) the switch activates an automatic shutdown circuit, protecting the booster pump from damage due to insufficient water supply pressure.



Table 8-2 Sensors and Solenoids

Component Function

Low Pressure Water Filter Assembly



Optional

8 If the unit is equipped with the optional booster pump, the discharge pressure is monitored by a 60 psi pressure switch to ensure adequate water pressure and supply to the intensifiers. An automatic shutdown occurs if the pressure is below 60 psi (4 bar).



9 If the unit is equipped with the optional booster pump, the 30 psi pressure switch, mounted on the inlet manifold, monitors the inlet cutting water. If the pressure drops below 30 psi (2 bar) the switch activates an automatic shutdown circuit, protecting the booster pump from damage due to insufficient water supply pressure.

8.3 Service and Maintenance Procedures

Electrical components require minimal service. The proximity switches on the hydraulic cylinder may require replacement.

NOTE

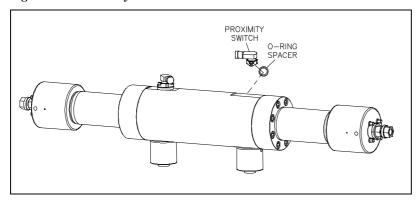
Refer to Section 12, Parts List for a complete listing of replacement parts and part numbers.

Proximity Switch Maintenance

A proximity switch has failed and needs to be replaced if the LEDs do not change state, indicating they are not sensing the piston, if an LED flashes continuously, or if the appropriate input is not noted on the PLC processor annunciator light panel in the electrical enclosure.



Figure 8-2: Proximity Switch



1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before performing maintenance on the system components.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before performing maintenance.

- 2. Remove the electrical cable from the failed proximity switch.
- 3. Remove the two socket head screws, the failed switch and the o-ring spacer.
- 4. Install a new proximity switch by positioning the o-ring spacer and the switch. Ensure the o-rings are correctly oriented.
- 5. Apply JL-M grease to the threads on the screws and tighten to 140-160 in-lbs (16-18 Nm).



Ensure that the proximity switch is properly installed and secured prior to starting the machine. Failure to tighten the two hold down screws on each switch will result in the spray of hydraulic oil.



SECTION 9

HIGH PRESSURE WATER SYSTEM

9.1 Overview

The high pressure water system is supported by both the cutting water supply circuit and the hydraulic circuit. Cutting water of sufficient flow and pressure is routed from the cutting water supply circuit to the intensifier where it is pressurized up to 55,000 psi (3,792 bar) and delivered to the cutting head.

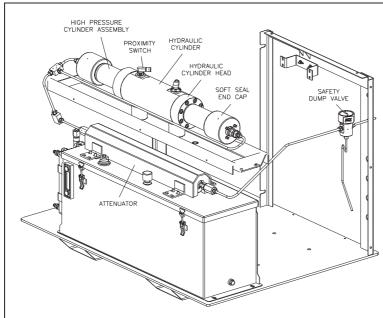
The directional control valve in the hydraulic system creates the stroking action of the intensifier by sending pressurized hydraulic oil to one side of the hydraulic cylinder or the other. As the flow is sent to one side, hydraulic fluid is returned to the reservoir from the opposite side.

System components include a double-ended hydraulic cylinder; reciprocating piston assembly; high pressure cylinders attached to each end of the hydraulic cylinder; two plungers, sealing heads and soft seal end caps; a one liter capacity attenuator, and a safety dump valve. Sophisticated check valves and seal assemblies ensure hydraulic oil, and the low pressure and high pressure water travel in the appropriate direction. Warning and shutdown sensors monitor system temperature and fluid levels to safeguard against component damage.

9.2 **Operation**

The directional control valve sends pressurized hydraulic oil to one side of the hydraulic cylinder. The pressurized oil pushes against the piston, moving it in one direction until it activates the proximity switch at the end of the stroke. The hydraulic flow is then sent to the opposite side of the cylinder, and the piston reverses direction until it activates the proximity switch at the opposite end of the stroke.

Figure 9-1: High Pressure Water System





The green light on the proximity switch indicates there is power to the switch. The red light illuminates when the switch is activated. The proximity switches are magnetically activated by the presence of the metallic surface of the piston. When the switch is activated, it sends a signal to the PLC to change the flow of the directional control valve and reverse direction.

As the pressurized oil pushes the piston in one direction, the plunger on that end extends and pushes against the water in the high pressure cylinder, increasing the pressure up to 55,000 psi (3,792 bar). When the piston reverses direction, the plunger retracts and the plunger in the opposite cylinder extends to deliver the high pressure water.

Low pressure water is routed through the inlet water ports to the inlet passages in the sealing heads. When the plunger retracts, the inlet check valve opens to allow water to fill the high pressure cylinder. When the plunger extends to create high pressure water, the inlet valve closes to seal the inlet passage and the discharge check valve opens to allow the high pressure water to exit the cylinder. As the plunger retracts, the discharge check valve closes.

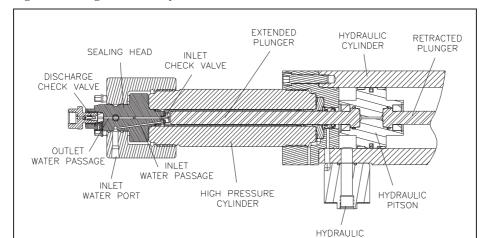


Figure 9-2: High Pressure Cylinder

The intensifier is a reciprocating pump. As the piston and plungers move from one side to the other, high pressure water exits one side of the intensifier as low pressure water fills the opposite side.

The high pressure water is then routed to the attenuator. The attenuator acts as a shock absorber to dampen pressure fluctuations and ensure a steady and consistent supply of water. From the attenuator, the high pressure water exits to the cutting head.

The safety dump valve releases the stored pressure in the intensifier and high pressure delivery lines. The high pressure dump valve assembly includes a normally open high pressure water valve and an electrically controlled air valve.

The normally open pneumatic dump valve is held closed by air pressure. When the air supply is interrupted and exhausted from an emergency stop or a normal stop, the valve opens and allows water to flow through the valve. Pressure is released in the intensifier and the high pressure water stream exits through the drain.



9.3 High Pressure System Components

The following figures illustrate the individual high pressure water system components.

Figure 9-3: High Pressure Cylinder Assembly

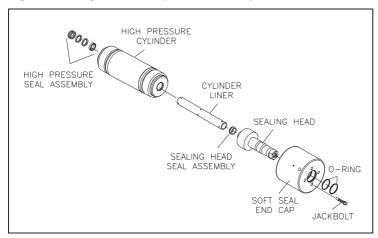


Figure 9-4: Hydraulic Cylinder Assembly

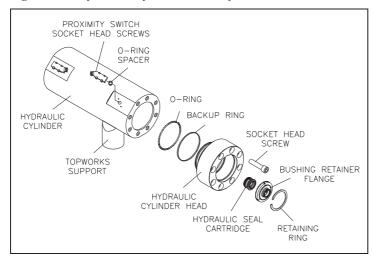
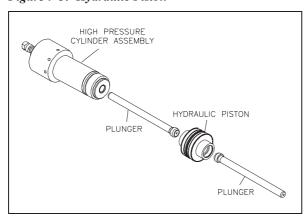


Figure 9-5: Hydraulic Piston





9.4 Service and Maintenance Overview

Never perform any type of maintenance on the high pressure water system while it is pressurized. Always turn the power off and bleed the high pressure water before servicing. Pressing the emergency stop button turns the control power off to the intensifier, and bleeds high pressure water through the dump valve.

Improper assembly can lead to the premature failure of components. Maintenance procedures must be followed carefully; components must be properly cleaned prior to assembly and tightened to the correct torque specifications.

Some high pressure components are not serviceable at the customer level, others require precise refinishing. KMT Waterjet Systems offers maintenance and refinishing services for these components.

NOTE
Refer to Section 12, Parts List for a complete listing of replacement parts and part numbers.



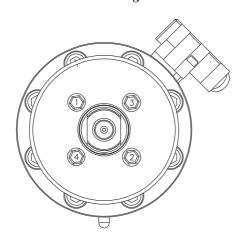
Torque Specifications

Table 9-1, Torque Specifications, details the torque specifications and tightening sequences for the high pressure components and connections.

Table 9-1
Torque Specifications

Soft Seal End Cap	
Jackbolts	4 (7/16") each
1st Stage	Hand Tight
2nd Stage	20 ft-lbs (27 Nm) Crossing Pattern
3rd Stage	32-35 ft-lbs (43-47 Nm) Crossing Pattern
4th Stage	32-35 ft-lbs (43-47 Nm) Circular Pattern
Socket Wrench Size	3/8 inch

4-Bolt Crossing Pattern



Hydraulic Cylinder Head	
Socket Head Screws	8 (M14) each
Torque	75-80 ft-lbs (102-108 Nm)
Hex Key	M12
Proximity Switch	
Socket Head Screws	2 (M6) each
Torque	140-160 in-lbs (16-18 Nm)
Hex Key	M5



Table 9-1
Torque Specifications

Torque Specifications		
Topworks Support		
Socket Head Screws	4 (M10) each	
Torque	46 ft-lbs (62 Nm)	
Hex Key	M8	
Sealing Head		
Discharge Gland	130 ft-lbs (176 Nm)	
Poppet Retainer	30 in-lbs (3.4 Nm)	
Pneumatic Control Valve		
HP Adapter	30 ft-lbs (40 Nm)	
1/4" Outlet to Drain	25 ft-lbs (34 Nm)	
Pneumatic Actuator	5 ft-lbs (7 Nm)	
3/8" HP Gland	50 ft-lbs (68 Nm)	
High Pressure Fittings		
1/4" HP Gland	25 ft-lbs (34 Nm)	
3/8" HP Gland	50 ft-lbs (68 Nm)	
9/16" HP Gland	110 ft-lbs (149 Nm)	

Specialized Maintenance Tools

KMT Waterjet has designed tools to facilitate the removal and installation of specialized system components. These tools are illustrated in Figure 9-6, Specialized Maintenance Tools, and part numbers are provided in Table 9-2.

Figure 9-6: Specialized Maintenance Tools

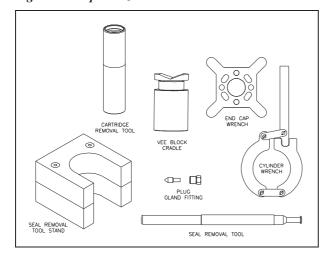




Table 9-2 Specialized Maintenance Tools

	Part Number
Cartridge Removal Tool	72113886
Vee Block Cradle	20494488
3/8" Plug	10079523
3/8" Gland Fitting	10078129
Seal Removal Tool	10148674
Cylinder Wrench	05066139
Seal Removal Tool Stand	80078330
End Cap Wrench	80079239

9.5 High and Low Pressure Water Piping

Before performing any maintenance on the high pressure components, it is necessary to remove the high and low pressure water piping. The following procedure should be used to remove and install the piping.



Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before performing maintenance on the high pressure system components.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before performing maintenance.

- 1. Turn the cutting water supply off.
- 2. Loosen and remove the high pressure gland fitting connected to the discharge high pressure check valve. Move the tubing to clear the work area.
- 3. Loosen and remove the low pressure piping connected to the inlet water port on the soft seal end cap.
- 4. When the required maintenance has been completed and the components reassembled, connect the low pressure water piping to the inlet water port on the soft seal end cap.
- 5. Apply Pure Goop to the threads on the high pressure gland fitting. Before installing the high pressure fitting, ensure proper collar position, 1 to 1-1/2 threads should be exposed. Install and tighten the fitting to the torque specifications in Table 2-1.
- 6. Turn the cutting water supply on and check for low pressure leaks.



- 7. Remove the cutting orifice and start the machine. Operate in low pressure mode to flush the high pressure passages.
- 8. Install the orifice and operate at high pressure to check for leaks.

9.6 High Pressure Cylinder Assembly

The high pressure cylinder, sealing head and soft seal end cap can be removed as an assembly when servicing the plunger, high pressure seals, hydraulic piston and seal cartridge. The soft seal end cap must be removed to service the inlet check valve, and the sealing head seal assembly.

High Pressure Cylinder Assembly Removal

1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

2. Disconnect the high and low pressure water piping, following the procedure, High and Low Pressure Water Piping.



Due to the weight of the cylinder assembly, adequate support must be provided to prevent damage to the plunger or seals during removal and installation. See Figure 9-6, Specialized Maintenance Tools for tools available to support the high pressure assembly for this procedure.

3. Position the vee block cradle tool under the cylinder assembly. Unthread and remove the assembly from the hydraulic cylinder head and plunger. The assembly can be rotated with the cylinder wrench or by hand.



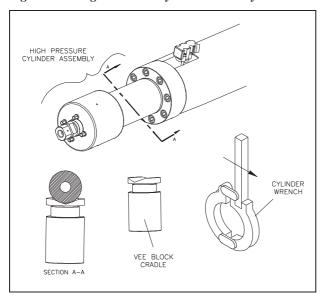


Figure 9-7: High Pressure Cylinder Assembly Removal and Installation



If thread or metal surface galling is detected during removal, galled surfaces and threads must be filed, sanded and lubricated prior to reassembly. See the procedure, High Pressure Cylinder Maintenance.

High Pressure Cylinder Assembly Installation

- 1. Verify that the high pressure cylinder threads have been sanded and dressed if galling was encountered during removal, and that the threads and alignment surfaces are adequately cleaned and lubricated with Pure Goop.
- 2. Verify that the high pressure seal assembly, packing follower and cylinder liner are correctly installed. Align the cylinder assembly with the plunger and the hydraulic cylinder head, using the cradle tool to support the weight. Carefully push and lift the assembly into position until the threads are ready to engage.
- 3. Thread the cylinder assembly into the hydraulic cylinder head.

NOTE

If galling occurs during threading, remove the high pressure cylinder assembly and inspect the mating surfaces and threads. Repair surfaces, thoroughly clean, lubricate and thread the cylinder assembly into the hydraulic cylinder head.

4. Connect the high and low pressure water piping, following the procedure, High and Low Pressure Water Piping.



5. Start the machine in low pressure mode to flush air from the high pressure components and to check for obvious leaks. After 5-10 strokes, switch to high pressure operation and check for leaks.

If leaks are detected, turn the machine off and remedy the problem. When the problem has been remedied, repeat the start up procedure, moving from low to high pressure soon after the intensifier starts pumping water. There is no further need to flush air from the system.

High Pressure Cylinder Maintenance

The plunger seal area in the high pressure cylinder bore should be inspected and cleaned each time the high pressure seal assembly is replaced.

- 1. Clean the sealing area on the inside diameter of the high pressure cylinder and inspect the bore for rings, scratches, pits, residue or other potential leak paths.
 - Seal material or residue can build up, forming a ring. Running a fingernail across the buildup will cause it to appear as a surface flaw. Grooves or ridges are typically seal debris buildup rather than marks on the inside diameter wall of the cylinder.
- 2. Polish the inside diameter of the cylinder where the seal will locate with 600-grit wet/dry sandpaper. Hold the sandpaper on the end of your finger and move in a cylindrical wiping motion. Polish in a circumferential motion only. Do not polish or drag the sandpaper along the length of the cylinder.
- 3. Clean the residue from the inside diameter of the cylinder and re-inspect for surface defects.

9.7 Soft Seal End Caps

The soft seal end cap must be removed to service the inlet check valve, and the sealing head seal assembly.

Soft Seal End Cap Removal

1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

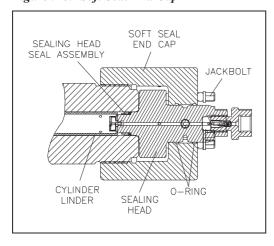
Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

- 2. Disconnect the high and low pressure water piping, following the procedure, High and Low Pressure Water Piping.
- 3. Loosen the jackbolts in the soft seal end cap.
- 4. Unscrew and remove the end cap from the high pressure cylinder.



- 5. Remove the sealing head. The sealing head may be removed with the end cap or after the end cap has been removed.
- 6. Remove the sealing head seal assembly.

Figure 9-8: Soft Seal End Cap



Soft Seal end Cap Installation

- 1. Apply FML-2 grease to the two o-rings and verify they are properly installed in the inside diameter grooves of the end cap.
- 2. Apply FML-2 grease to the inside and outside diameter of the sealing head seal assembly and install the seal assembly on the inlet end of the sealing head.
- 3. Apply Pure Goop to the coned sealing surface on the sealing head. Place the sealing head and the seal assembly in the end of the high pressure cylinder and press the sealing head into the cylinder by hand.
- 4. Apply JL-M grease to the full length of the threads and to the ends of the jackbolts. Apply JL-M grease to the internal threads in the SSEC. Install the jackbolts, ensuring they are slightly less than flush with the inner face of the end cap.



Make sure the JL-M lube is well mixed and not dried up due to age.

- 5. Verify that the high pressure cylinder threads are adequately cleaned and lubricated with Pure Goop.
- 6. Slide the end cap over the sealing head until it makes contact with the sealing head. Fully engage the threads on the end cap with the high pressure cylinder.
- 7. Unscrew the end cap until the inlet water port is properly oriented to facilitate the low pressure water connection. **Do not** unscrew the end cap more than one full turn.
- 8. Hand-tighten the jackbolts until the sealing head is seated against the cylinder.



- 9. Tighten the jackbolts following the tightening sequence and torque specifications in Table 9-1.
- 10. Connect the high and low pressure water piping and turn the low pressure water supply on.
- 11. Start the machine in low pressure mode to flush air from the high pressure components and to check for obvious leaks. After 5-10 strokes, switch to high pressure operation and check for leaks.

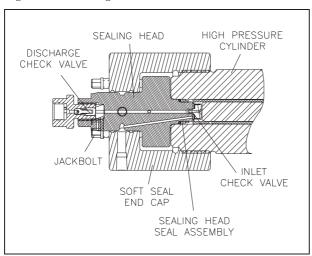
If leaks are detected, turn the machine off and remedy the problem. When the problem has been remedied, repeat the start up procedure.

9.8 Sealing Head

The sealing head is sealed to the outboard end of the high pressure cylinder by a replaceable plastic seal. The jackbolts in the soft seal end cap put preload on the threads on the end cap.

The inlet and discharge check valves in the sealing head ensure the low pressure and high pressure water only travels in the appropriate direction.

Figure 9-9: Sealing Head



High Pressure Discharge Check Valve

The high pressure discharge check valves should be serviced on a regular, preventive maintenance schedule. The high pressure discharge check valve can be serviced with the sealing head either installed or removed from the high pressure cylinder.



1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.

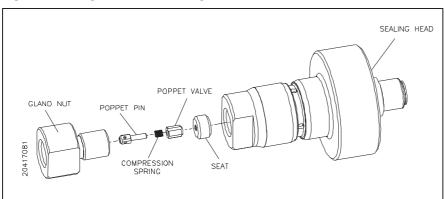


Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

- 2. Disconnect the high pressure water piping.
- 3. Use two, 1-3/16" wrenches to remove the gland nut. The poppet pin, spring and poppet check valve will normally remain in the gland nut when it is removed. Remove the components from the gland nut.
- 4. Use a magnet to remove the seat from the sealing head.
- 5. Inspect the seat for damage or cracking. A cracked or damaged seat must be replaced.

Figure 9-10: High Pressure Discharge Check Valve



6. Apply a thin film of Pure Goop to the face of the seat opposite the poppet valve and install the seat into the sealing head with the best surface facing the poppet check valve.

NOTE

The seat, spring and discharge poppet valve should be replaced as a set. If one component requires replacement, replace all components.

- 7. Inspect the poppet valve, pin and spring for wear. Replace the poppet pin and the spring if worn.
- 8. Install the poppet pin and the spring, with the larger end of the spring facing the poppet valve, and then install the poppet valve into the gland nut.

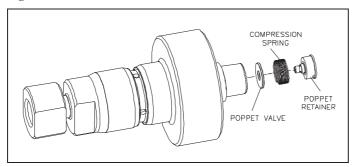


- 9. Apply Pure Goop to the external threads and on the gland nut and to the sealing surface of the body. Thread the gland nut into the sealing head. Hand-tighten until there is a 0.20 inch (5 mm) gap between the gland nut and the sealing head. **No threads should show.** If the gap exceeds 0.20 inch (5 mm), the poppet or seat has slipped out of position. The parts must be removed, inspected and re-assembled.
- 10. Use a crowfoot/torque wrench combination and tighten the gland nut to the torque specifications in Table 9-1.

Low Pressure Inlet Check Valve

The inlet check valves should be serviced on a regular, preventive maintenance schedule. The soft seal end cap must be removed to service the inlet check valve. Follow the procedure, Soft Seal End Cap Removal. When the end cap has been removed, proceed with Step 1 below.

Figure 9-11: Low Pressure Inlet Check Valve



- 1. Use a 1/2-inch flat blade screwdriver to remove the poppet retainer from the sealing head.
- Inspect the sealing head for scratches or wear on the inlet poppet valve contact surface. If defects are detected, the surface must be refinished. See the procedure, Sealing Head Maintenance.
- 3. Inspect both faces on the inlet poppet valve. The poppet valve can be installed with either face toward the sealing head. If one face is worn, but the opposite is not, the poppet can be reversed, placing the best surface toward the sealing head. If both faces are worn, the poppet valve must be replaced.
- 4. Spray Loctite 7649 on the threads of the poppet retainer and allow to dry. Assemble the spring and the inlet poppet valve on the poppet retainer. Apply on drop of Loctite 248 to the poppet retainer threads only. **Do not** get any Loctite on the poppet or any other surfaces on the inlet check valve.
- 5. Use the flat blade screwdriver to tighten the poppet retainer. Tighten the poppet retainer to the torque specifications in Table 9-1.
- 6. Inspect the assembled unit to ensure the poppet moves freely, the spring is fully guided on the poppet retainer, the spring end is 90 degrees from the screwdriver slot on the retainer and the poppet retainer is seated against the sealing head.

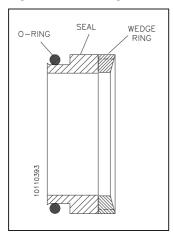


Sealing Head Seal Assembly

Whenever maintenance requires the sealing head to be removed, the sealing head seal assembly must be replaced.

- 1. Prior to installing a new seal assembly, inspect and clean the seal surfaces on the sealing head and the high pressure cylinder bore. Inspect and clean the cylinder liner.
- 2. Install the cylinder liner.
- 3. Lightly coat the seal components with FML-2 grease and slide the seal assembly onto the inlet end of the sealing head as illustrated. The wedge ring chamfer must be installed against the chamfered shoulder of the sealing head and the o-ring must face the inlet check valve.

Figure 9-12: Sealing Head Seal Assembly



Sealing Head Maintenance

The sealing head should be inspected for scratches or wear on the poppet valve contact surface. If defects are detected, the surface must be refinished. The sealing head can be returned to KMT Waterjet for refinishing.

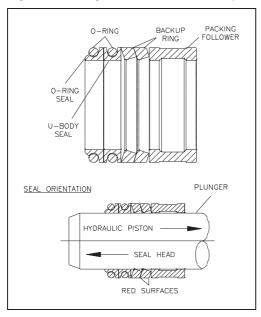
- 1. Inspect the inlet poppet valve sealing surface for pits, scratches or jetting erosion. If necessary, refinish the surface.
 - Place a piece of 1/4-1/2" thick plate glass, not window glass, on a sturdy table to provide an absolutely, flat surface. Place a piece of 400-grit wet/dry sandpaper on the glass. Use even, deliberate strokes, rotating the sealing head approximately 10-15 degrees after each stroke. Polish the sealing head until it is flat and smooth. Be careful not to cause additional damage by tilting or tipping the part while polishing.
- 2. When the sealing head is flat and smooth, perform a final polish with 600-grit wet/dry sandpaper.



9.9 High Pressure Seal Assembly

The following procedure should be used to replace the high pressure seal assembly.

Figure 9-13: High Pressure Seal Assembly



1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



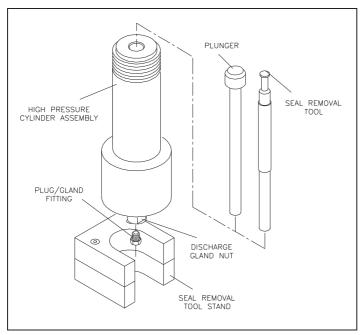
Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

- 2. Disconnect the high and low pressure water piping, following the procedure, High and Low Pressure Water Piping.
- 3. Remove the high pressure cylinder assembly, following the procedure, High Pressure Cylinder Assembly Removal.







- 4. Apply Pure Goop to the threads on the high pressure plug and gland fitting. Thread the plug and gland fitting into the discharge gland nut on the sealing head and hand tighten.
- 5. Position the cylinder assembly upright in the seal removal tool stand. If a tool stand is not available, position the cylinder on a platform of wooden blocks. Rest the outside edges of the end cap on the platform.
- 6. Fill the cylinder with water and slide the seal removal tool or a used plunger into the bronze packing follower to ensure a good seal for the removal of the seal assembly.
- 7. Place a shop towel around the plunger or seal removal tool to avoid splash back. Use a dead blow hammer to drive the removal tool or plunger into the cylinder until the seal components move up and out of the cylinder.
- 8. Remove the cylinder liner from the bore and inspect for possible heat or wear damage, or for debris. If cracks or brittleness are detected on the tabs on the ends of the liner, the liner must be replaced.
- 9. Feel approximately one inch into the cylinder bore for obvious ridges or grooves. If seal debris is present, follow the procedure, High Pressure Cylinder Maintenance.
- 10. Inspect the plunger surface for flaws. Rotate the plunger 360 degrees by hand while viewing light reflection on the surface to detect any dullness, streaks, pits or other defects. Run a fingernail perpendicular to the direction of the suspected flaws to determine the severity of defects. Depending on the seal life achieved with the removed seal assembly, make a judgment regarding plunger and/or cylinder replacement. If seal debris is present on the plunger, polish with 600-grit wet/dry sandpaper, using a radial motion.
- 11. Lightly coat the new seal components with FML-2 grease and install the new components on the plunger. Ensure the proper orientation of the backup rings as illustrated in Figure 9-13, High Pressure Seal Assembly.



- 12. Slide the cylinder liner over the plunger.
- 13. Install the high pressure cylinder assembly into the hydraulic cylinder head, following the procedure, High Pressure Cylinder Assembly Installation.
- 14. Reconnect the high and low pressure water piping and turn the low pressure water supply on.

9.10 Hydraulic Seal Cartridge Removal

The following procedure is used to remove and replace the hydraulic seal cartridge.

1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

- 2. Disconnect the high and low pressure water piping, following the procedure, High and Low Pressure Water Piping.
- 3. Remove the proximity switch on the end of the hydraulic cylinder to be serviced. This will allow the hydraulic oil to drain back to the reservoir, minimizing oil spillage. It will take approximately five minutes for the oil to drain.
- 4. Remove the high pressure cylinder assembly components, following the procedure, High Pressure Cylinder Assembly Removal.
- 5. Use a flat screwdriver to remove the retaining ring from the hydraulic cylinder head.
- 6. Remove the bushing retainer flange and clean the surfaces, weep holes and grooves. Check the retainer flange for cracks.
- 7. Replace the proximity switch by positioning the o-ring spacer and the switch. Apply JL-M grease to the threads on the socket head screws and tighten, following the torque specifications in Table 9-1.



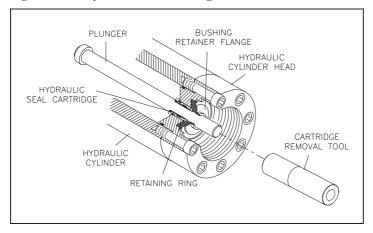
It is recommended that the proximity switch be reinstalled as soon as practical. Removal of the switch presents the potential of an oil spray hazard.

Ensure that the proximity switch is properly installed and secured prior to starting the machine. Failure to tighten the two hold down screws on each switch will result in the spray of hydraulic oil.



8. Thread the large end of the cartridge removal tool onto the hydraulic cartridge seal and pull the cartridge out, over the plunger.

Figure 9-15: Hydraulic Seal Cartridge Removal

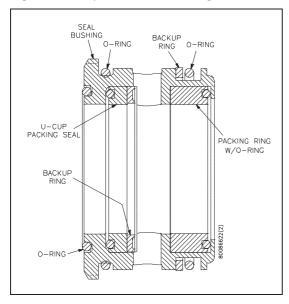


Hydraulic Seal Cartridge

Seals in the hydraulic cartridge can be removed and replaced, or the complete cartridge can be replaced.

Use caution during the removal and installation of the seal components to avoid scratching the surface of the cartridge. The seal removal tool, a plastic or wooden dowel, or similar object can be used for seal removal. **Do not** use screwdrivers, wires or other metal objects that could damage the cartridge. To avoid damaging the new seals, the seal installation tool can be used for installation.

Figure 9-16: Hydraulic Seal Cartridge



1. Carefully remove the worn seals and o-rings from the cartridge by pushing them with a plastic or wooden dowel, or similar object. Remove the seals closest to the open ends first, and work toward the center.



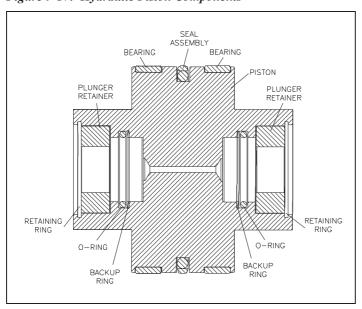
- 2. Inspect the seals for unusual wear, deformation or cuts. Note any unusual buildup of solid material or debris creating possible leak paths.
- 3. Inspect the surface of the cartridge body for scratches, deformation, signs of metal-to-metal contact or other unusual wear. Carefully examine the surface of the grooves on the inside diameter. Note any scratches in the axial direction that could create a leak path.
- 4. Apply FML-2 grease to the inside and outside diameter of the cartridge body, and to the individual seal components.
- 5. Install the seals, starting in the center and working toward the ends. See Figure 9-16 for the proper orientation of the u-cup packing seal. If available, use the seal installation tool to install the u-cup packing seal. See Figure 9-23, Pneumatic Valve Seal Tools.
- 6. Verify that the u-cup o-ring is properly positioned after installation.
- 7. When the seal components are properly installed, apply FML-2 grease to the exposed surfaces of the seals and slide the hydraulic cartridge seal over the plunger, into the cavity of the hydraulic cylinder head.
- 8. Thoroughly clean the bushing retainer flange, including the cross-drilled weep holes. Install the retainer flange over the plunger.
- 9. Install the retaining ring, ensuring the retaining ring fully seats inside the groove in the hydraulic cylinder head.
 - The o-rings on the hydraulic cartridge will take up clearance. Tap lightly on the bushing retainer flange with the cartridge removal tool to compress the o-rings enough to start the retaining ring in the groove. Use a flat blade screwdriver to push on the outer edge of the retainer flange while working one end of the retaining ring into the groove. The retainer flange should tilt or tip enough to allow the retaining ring to move into the groove. Continue working the ring into the groove while tilting the retainer flange until the ring is fully seated.
- 10. Install the high pressure cylinder into the hydraulic cylinder head, following the procedure, High Pressure Cylinder Assembly Installation.
- 11. Connect the high and low pressure water piping and turn the low pressure water supply on.



9.11 Hydraulic Piston and Plungers

Two bearing rings provide wear contact between the piston and the inside diameter of the hydraulic cylinder. On each end of the piston, a plunger retainer and retaining ring hold the plungers in position.

Figure 9-17: Hydraulic Piston Components



Hydraulic Piston and Plunger Removal

The following procedure is used to remove the hydraulic piston and plungers. It is necessary to remove the components from both ends of the intensifier.

1. Turn the machine off and observe the appropriate Lockout/Tagout procedures.



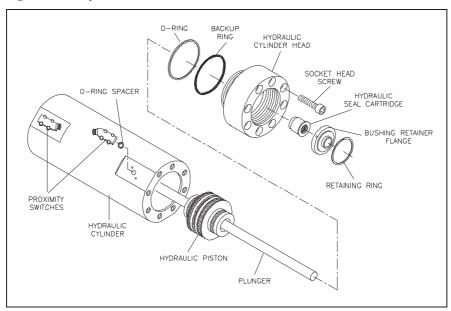
Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

- 2. Disconnect the high and low pressure water piping from both ends of the intensifier, following the procedure, High and Low Pressure Water Piping.
- 3. Remove the high pressure cylinder assembly on each end of the intensifier, following the procedure, High Pressure Cylinder Assembly Removal.



Figure 9-18: Hydraulic Piston Removal



- 4. Remove both of the proximity switches to prevent interference and to allow the hydraulic oil to drain back to the reservoir, minimizing oil spillage. It will take approximately five minutes for the oil to drain.
- 5. Remove the retaining rings, bushing retainer flanges and the hydraulic cartridge seals.
- 6. Loosen and remove the socket head screws in the hydraulic cylinder heads.
- 7. Remove the hydraulic cylinder heads with the o-rings and backup rings. The mounting flat for the proximity switch provides a small lip for loosening the cylinder head.
- 8. Grasp the plunger firmly and pull the piston out of the hydraulic cylinder.
- 9. Place the piston in a vice and remove the retaining ring on each end of the piston.
- 10. Pull each plunger to remove it from the piston. The plunger retainer will remain with the plunger when it is removed.
- 11. Remove the o-ring and the backup ring from each side of the piston.

Bearing Rings and Seal Assembly

1. Use a smooth, dull-edged blade made from brass or similar soft metal material to remove the two bearing rings and the two-piece seal assembly.

NOTE

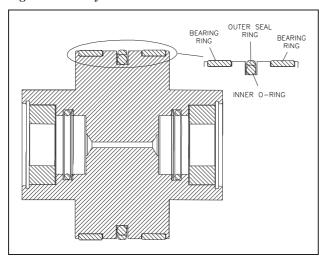
Do not scratch the surfaces of the piston seal groove. Scratches on the sides or bottom of the groove can result in hydraulic leaks.

2. Inspect the bottom of the seal grooves for marks, scratches and residue buildup. Clean and/or repair the groove surfaces as required.



- 3. Apply FML-2 grease to the new bearing rings and install the rings.
- 4. The piston seal assembly consists of a seal ring and an o-ring. Apply FML-2 grease to both rings. Use the smooth, dull-edged blade to install the o-ring, ensuring the ring is not twisted after installation. Slide the outer seal ring over the metal edges and ease it into position over the inner, o-ring.

Figure 9-19: Hydraulic Piston

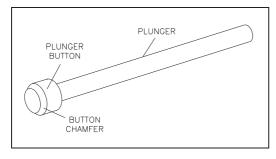


Plunger Maintenance

Plunger surfaces can become streaked with longitudinal scratches or flaws, and discolored or dull in appearance. If any of these conditions become severe, the high pressure seal assembly and possibly the hydraulic cartridge seal will leak.

Accumulation of debris on the surface of the plunger can be removed by polishing in a radial direction with 600-grit sandpaper. However, plunger surface flaws usually cannot be repaired on site. The plunger can be returned to KMT Waterjet for reconditioning.

Figure 9-20: Plunger



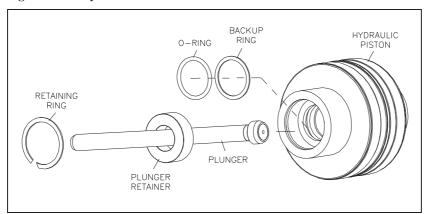
Hydraulic Piston and Plunger Installation

- 1. Apply FML-2 grease to the new o-ring and backup rings. Install the backup ring and then the o-ring in the groove in the plunger socket.
- 2. Slide the plunger retainer onto the piston and push the plunger onto the plunger socket.
- 3. Make sure the retainer is properly positioned in the socket.



4. Install the retaining ring into the cavity of the plunger socket.

Figure 9-21: Hydraulic Piston Installation



- 5. Repeat steps 1-3 to install the second plunger.
- 6. Ensure that the hydraulic cylinder bore is free of grit or contamination.
- 7. Lubricate the bearing rings and seal assembly, and lightly lubricate 2-3 inches of the cylinder bore with FML-2 grease.
- 8. Install the piston and plungers into the hydraulic cylinder bore.
- 9. Verify that the o-rings and backup rings are properly positioned in the grooves on the hydraulic cylinder heads, and that they are sufficiently lubricated with FML-2 grease.
- 10. Position the cylinder heads in the end of the hydraulic cylinder. Apply JL-M grease to the threads on the socket head screws. Install the screws in the hydraulic cylinder heads and tighten, following the torque specifications in Table 9-1.
- 11. Verify that the plunger moves freely when handled. If it feels tight, there may be residue buildup in the pocket or the pocket depth may be insufficient.
- 12. Replace the hydraulic cartridge seals, bushing retainer flanges and retaining rings in the hydraulic cylinder heads.
- 13. Replace the proximity switches by positioning the o-ring spacers and the switches. Apply JL-M grease to the threads on the socket head screws and tighten, following the torque specifications in Table 9-1.



Ensure that the proximity switches are properly installed and secured prior to starting the motor. Failure to tighten the two hold down screws on each switch will result in the spray of hydraulic oil.

14. Install the high pressure cylinders into the hydraulic cylinder heads and install the remaining cylinder assembly components, following the procedure, High Pressure Cylinder Assembly Installation.



15. Connect the high and low pressure water piping. And turn the low pressure water supply on.

9.12 Hydraulic Cylinder Maintenance

The inside diameter surface of the hydraulic cylinder should be inspected for wear grooves and surface finish whenever the hydraulic cylinder heads are removed. Excessive grooving is indicative of piston seal wear.

9.13 High Pressure Attenuator

The high pressure attenuator is not serviceable at the customer level. KMT Waterjet Systems tests the seals in the attenuator at pressures exceeding normal operating pressure, making disassembly difficult. If the attenuator develops a high pressure water leak, it should be replaced.



9.14 High Pressure Dump Valve

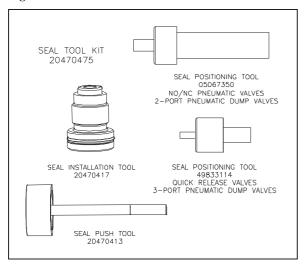
The high pressure dump valve assembly includes a normally open high pressure water valve and a solenoid operated air valve. The following procedure is recommended for servicing the high pressure dump valve. Failure to follow this procedure will cause damage to the stem, valve seat, or both.



The high pressure dump valve is designed to instantly release high pressure from the system. **Proper maintenance is imperative** to prevent potential personal injury.

Figure 9-22, Pneumatic Valve Seal Tools, illustrates the special tools recommended for this procedure.

Figure 9-22: Pneumatic Valve Seal Tools



Pneumatic Control Dump Valve

For reliable operation the valve seat, seal assembly, brass backup ring and stem shall always be replaced at the same time. The SST backup ring can be reused.

Before proceeding, disconnect and lockout the main power supply and the electrical enclosure; and ensure that all high pressure water and hydraulic pressure has been bled from the system.



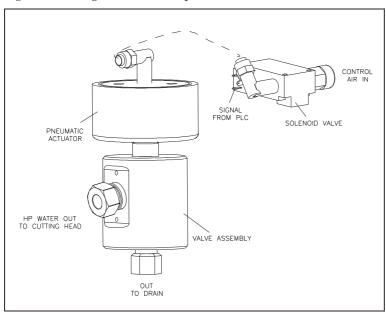


Severe injury can result if the machine is not properly locked out. Observe electrical Lock Out/Tag Out procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

- 1. Turn the air supply off.
- 2. Remove the air supply hose, and the electrical connection to the solenoid valve.

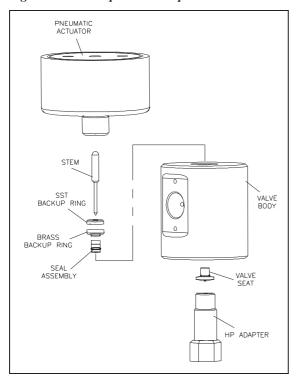
Figure 9-23: High Pressure Dump Valve



- 3. Loosen and remove the high pressure gland connections and the drain connection.
- 4. Remove the valve and actuator assembly from the machine.



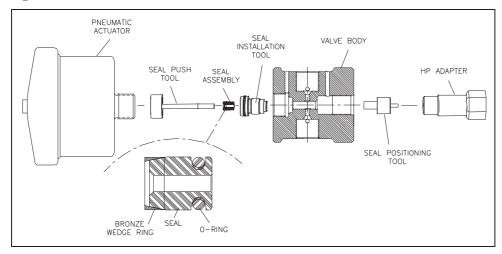
Figure 9-24: Dump Valve Components



- 5. Loosen the cylinder head on the actuator. Unscrew and remove the actuator from the valve body.
- 6. Unscrew the high pressure adapter and remove the adapter and valve seat.
- 7. Remove the stem, SST backup ring and brass backup ring from the valve body.
- 8. Remove the seal assembly by pushing it with the seal push tool (P/N 20470413). **The assembly must be pushed out through the actuator port in the top of the valve body.**
- 9. **Discard** the stem, brass backup ring, seal assembly and valve seat.
- 10. Clean and inspect the valve body, being careful not to damage or scratch the bore.



Figure 9-25: Valve Seal Installation



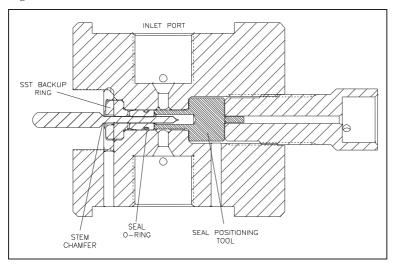
- 11. Place the seal positioning tool into the opposite end of the valve body as shown in Figure 9-25, Valve Seal Installation. Thread the high pressure adapter into the valve body until light contact is made with the positioning tool. **Tighten finger-tight only.**
- 12. Apply Pure Goop anti-seize compound to the threads on the seal installation tool. Screw the seal installation tool into the threads of the valve body. **Tighten finger-tight only.**
- 13. Lubricate the new seal and o-ring with FML-2 food grade grease. Insert the seal, o-ring and bronze wedge ring into the seal installation tool, inserting the o-ring end of the seal first so the tapered end of the seal (wedge ring end) faces the actuator. The tapered end of the seal must face the actuator.
- 14. Use the seal push tool to push the seal assembly into the bore of the valve body until the seal makes light contact with the seal positioning tool.
- 15. Remove the push tool and the installation tool from the valve body.
- 16. Install the existing SST backup ring and a new brass backup ring on a new stem. The vee groove on the SST backup ring must face toward the brass backup ring. The small OD of the brass backup ring must face toward the seal assembly.
- 17. Apply FML-2 grease to the tip of the stem and insert the stem with the backup rings into the top of the valve body so the stem enters the ID of the seal assembly. **Insert the stem until the chamfer on the stem is seated against the SST backup ring.** See Figure 9-26, Valve Stem Placement.



Do not push the o-ring on the seal assembly past the inlet port on the valve body. This will damage the seal o-ring.



Figure 9-26: Valve Stem Placement



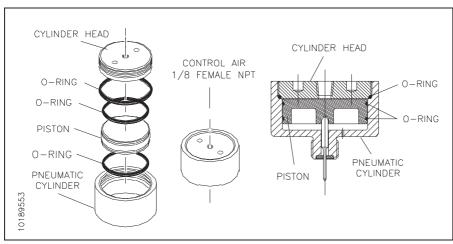
- 18. Remove the high pressure adapter and the seal positioning tool.
- 19. Apply Pure Goop anti-seize compound to the threads of the actuator and carefully thread it into the valve body, guiding the stem head into the hole in the actuator. Turn the actuator clockwise until resistance is felt. Reverse the actuator 1/4-turn, and give it a quick spin clockwise to seat it. **Hand-tighten only, 5 ft-lbs (7 Nm)**.
- 20. Apply Pure Goop anti-seize compound to all surfaces, except the ID, of a new valve seat. Install the seat into the valve body, inserting the small OD first.
- 21. Apply anti-seize compound to the threads on the high pressure adapter. Install the adapter and torque to 30 ft-lbs (40 Nm).
- 22. Replace the 1/4-inch drain gland nut and collar and torque to 25 ft-lbs (34 Nm).
- 23. Apply anti-seize compound to the threads on the 3/8-inch high pressure gland fittings. Install the collar and the gland fittings and torque to 50 ft-lbs (68 Nm).
- 24. Install the air supply hose and the electrical connection to the solenoid valve. Turn the air pressure to the actuator on and test the valve for leaks and proper operation.



Pneumatic Actuator

The following procedure is used to service the pneumatic actuator.

Figure 9-27: Pneumatic Actuator



1. Unscrew and remove the cylinder head using a strap wrench and a pin spanner. Remove the piston from the cylinder.



Do not install the pneumatic cylinder in a vise to remove the cylinder head. This may distort the body and seize the piston, preventing proper operation.

- 2. Remove the o-ring on the cylinder head. Apply FML-2 grease to a new o-ring and install.
- 3. Remove the two o-rings on the piston. Apply FML-2 grease to two new o-rings and install.
- 4. Install the piston in the pneumatic cylinder. Apply anti-seize compound to the threads on the cylinder head and screw it into the pneumatic cylinder.



SECTION 10

TROUBLESHOOTING

10.1 Overview

The troubleshooting guide will help identify the probable cause of a system malfunction and assist in providing corrective action. The following symptoms are discussed in this section:

- 1. High oil temperature
- 2. Low oil level
- 3. Restricted or no cooling flow
- 4. Hydraulic pressure but no high pressure water pressure
- 5. No hydraulic oil pressure
- 6. Pump shaft will not turn
- 7. Pump will not start
- 8. Pump quits running
- 9. Abnormal fluctuations in high pressure water signal
- 10. Hot surfaces on the high pressure cylinder components
- 11. Low cutting water supply pressure
- 12. Low cutting water pressure
- 13. Hydraulic oil leaking from the weep hole in the hydraulic cylinder head
- 14. Water leaking from the weep hole on the hydraulic cylinder head flange
- 15. Water leaking from the weep hole in the sealing head
- 16. Water leaking from the weep hole in the sealing head gland nut
- 17. Water leaking from the weep holes in the hard seal end cap
- 18. Inlet water flow is poor and the filter housing is not filling completely
- 19. Water is leaking around the bleed valve on the filter head

Optional Booster Pump

- 20. High boosted water temperature
- 21. Booster pump pressure drop is greater than 30 psi (2 bar) during stroke condition
- 22. Outlet booster pump pressure is falling below 60 psi (4 bar)



10.2 Troubleshooting Guide

Listen to the machine and observe it in operation. Learn to recognize the normal sounds and operating conditions of the system. Carefully define the symptom of the problem. Locate the symptom on the troubleshooting guide that most closely corresponds to the problem.

If the symptoms in the guide do not correspond to the malfunction, or if the problem is not resolved by the recommended corrective action, contact the KMT Customer Service Department for assistance.

	Malfunction Indication Comments				
1.	High oil temperature	Cooling water flow is restricted	Check cooling water source for proper temperature and flow rate.		
		Water modulating valve is stuck open or closed, or is	Replace the valve.		
		out of adjustment	Adjust the valve.		
		Scale build up in the heat exchanger has restricted the flow	The heat exchanger will need to be flushed or replaced.		
2.	Low oil level		Check the level gauge.		
			Check for hydraulic leaks.		
			Check the level switch.		
3.	Restricted or no cooling flow	Check cooling water flow to and from the heat exchanger	The water pressure differential across the heat exchanger requires a minimum of 35 psi (2.4 bar) for flow through the exchanger.		
		Water modulating valve is	Replace the valve.		
		stuck or out of adjustment	Adjust the valve.		
4.	Hydraulic pressure but no high pressure water pressure	Proximity switch failure	Jog the intensifier left and right and verify that the red light comes on at both proximity switches.		
		Coil failure on the directional control valve	Check the coils on the directional valve with a volt meter to verify if they are good or bad.		



	Malfornation Indication Community				
	Malfunction	Indication	Comments		
5.	No hydraulic oil pressure	The high and low limit compensators on the hydraulic pump are blocked with debris and are not controlling the swashplate	Disassemble the compensators, clean and inspect the components.		
		Incorrect motor rotation	Check the motor rotation.		
		The flexible coupling has failed	Replace the flexible coupling.		
6.	Pump shaft will not turn	The flexible coupling has failed	Replace the flexible coupling.		
		Hydraulic pump has seized	Replace the hydraulic pump.		
7.	Pump will not start	Emergency stop button is depressed	Check the E-STOP button on the control panel.		
			Check all remote E-STOP buttons.		
		Main power is disconnected	Check the main power and verify the main power disconnect is on.		
8.	Pump quits running	Electrical power has been interrupted	Check the power supply circuit for a tripped breaker.		
			Verify that power is available at the main power source.		



	Malfunction Indication Comments				
9.	Abnormal fluctuations in high pressure water signal	Large, worn or damaged orifice	Make sure the orifice does not exceed the capacity of the pump.		
			Make sure the orifice is in good working condition. Verify that the jewel is installed in the orifice mount.		
		Check valve leakage	Inspect the discharge check valves in the sealing heads.		
			Inspect the inlet check valves in the sealing heads.		
		Seal leakage	Inspect the high pressure seal on the plunger.		
			Inspect the sealing head seal assembly.		
		Hydraulic control malfunction	Check the operation of the hydraulic relief valve.		
			Verify the directional control valve is shifting properly.		
			Check the operation of the proximity switches.		
		Piping leaks	Check system components for leaks, including the dump valve connection.		



	NEOLine 40i Troubleshooting Guide			
	Malfunction	Indication	Comments	
10.	Hot surfaces on the high pressure cylinder components	Leaking discharge check valve, hot sealing head body and discharge gland	Inspect the condition of the seat, poppet valve, spring, poppet pin and sealing head surface on the discharge end of the sealing heads.	
		Leaking inlet check valve, hot inlet ring	Inspect the condition of the poppet valve, poppet retainer and the spring on the inlet end of the sealing heads.	
		Damaged sealing head	Check the sealing head for cracks.	
		Damaged high pressure cylinder	Check the high pressure cylinder for cracks.	
11.	Low cutting water supply pressure	Restricted water supply	Check cutting water supply flow and pressure.	
		Clogged water filter or strainer	Check the condition of the low pressure water filter and replace the filter element if necessary.	
			If applicable, check the strainer and clean if necessary.	
		Trapped air	Bleed the air from the cutting water plumbing.	
12.	Low cutting water pressure	Low hydraulic pressure setting	If operating in low pressure, switch to high pressure operation and check the hydraulic pressure setting.	
			Clean the high pressure adjustment valve.	
			Clean the compensators on the hydraulic pump.	
13.	Hydraulic oil leaking from the weep hole in the hydraulic cylinder head	Failed hydraulic cartridge seal	Replace the cartridge seal. If the leak persists, check the plunger for linear scratches or scoring.	



	NEOLine 401 Troubleshooting Guide				
	Malfunction	Indication	Comments		
14.	Water leaking from the weep hole on the hydraulic cylinder head flange	Failed high pressure seal assembly	Replace the high pressure seal assembly.		
	Cymider nead riange	Damaged plunger	Check the plunger for longitudinal scratches or flaws. If detected, replace the plunger or return to KMT Waterjet for evaluation and rework.		
		Seal material buildup on plunger	Polish the plunger surface following the procedure, Plunger Maintenance, detailed in Section 9, High Pressure Water System.		
		Damaged high pressure cylinder	Check for scratches, grooves or material buildup on the inside diameter of the cylinder. If detected, polish the bore following the procedure, High Pressure Cylinder Maintenance, detailed in Section 9, High Pressure Water System.		
			Check the inside diameter of the cylinder for expansion where the high pressure seal assembly is located. If detected, replace the cylinder.		



	Malfunction Indication Comments				
15.	Water leaking from the weep hole in the sealing head	Seat in the discharge check valve is not sealing properly	Make sure the gland is tightened to the proper torque specification.		
			Inspect the seat, sealing head and gland nut for scratches, erosion or cracks.		
		Improper torque on gland	Tighten the gland to the proper torque specification.		
		Erosion or scratches on the contact surface of the sealing head, or on the gland where the seat makes contact	Polish the surfaces following the procedure, Sealing Head Maintenance, detailed in Section 9, High Pressure Water System.		
		Internal crack in the sealing head	Replace the sealing head. A cracked sealing head can result in water leaking from the high pressure outlet passage to the low pressure inlet passages.		
			The sealing head body can become extremely hot.		
16.	Water leaking from the weep hole in the sealing head gland nut	High pressure piping gland is not tight and is not sealing properly	Tighten the gland to the proper torque specification.		
		Improper high pressure piping connection	Check the number of exposed threads past the collar on the high pressure piping. Only 1-1/2 to 2-1/2 threads should be exposed.		
			Check high pressure piping for damage, cracks or deformation.		
			Inspect the gland for deformation of the threads.		
		Damaged sealing head gland	Check the gland for cracks due to fatigue. If cracks are detected, replace the gland.		



	NEOLine 40i Troubleshooting Guide				
	Malfunction	Indication	Comments		
17.	Water leaking from the weep holes in the soft seal end cap	Worn sealing head seal assembly	Replace seal assembly.		
	Vid Vip	Damaged high pressure cylinder	Check for scratches or grooves on the sealing surface. If detected, polish to remove following the procedure, High Pressure Cylinder Maintenance, detailed in Section 9, High Pressure Water System.		
			Replace the high pressure cylinder.		
		External crack in sealing head	Replace the sealing head.		
		Damaged sealing head	Check for scratches or grooves on the sealing surface of the sealing head. If detected, polish the surface following the procedure, Sealing Head Maintenance, detailed in Section 9, High Pressure Water System.		
		Improper torque on jack bolts	Torque the jack bolts to the proper torque specification		
18.	Inlet water flow is poor and the filter housing is not filling completely	Pipe sizing for inlet cutting water should be checked for pressure and flow	Cutting water supply will be lacking capacity or flow.		
19.	Water is leaking around the bleed valve on the filter head	O-ring that closes the passage has deteriorated	A small o-ring under the valve can deteriorate causing the passage to remain open. The o-ring can be replaced by removed the screw and spring on the underneath side.		
	Optional Booster Pump				
20.	High boosted water temperature	Orifice is blocked with debris			
	Competatore	Long deadhead condition			
		Insufficient water supply			
		Booster pump temperature switch malfunction			



	Malfunction	Indication	Comments
21.	Booster pump pressure drop is greater than 30 psi	Inlet water pressure or flow is low	
	(2 bar) during stroke condition	Filter element is dirty and needs to be replaced	
		Booster pump is starting to fail	If the pressure consistently drops below 60 psi (4 bar) the pump will need to be replaced.
22.	Outlet booster pump	Inlet water pressure is low	
	pressure is falling below 60 psi (4 bar)	Filter element is dirty and needs to be replaced	
		Booster pump needs to be adjusted or replaced	Booster pump should be adjusted to 120 psi (8 bar) when deadheaded.



SECTION 11 SPECIFICATIONS

11.1 Overview

Comprehensive listings of specifications for the NEOLine 40i are provided in this section.

Table 11-1

	Motor Horsepower Rating	
Model	HP	Kw
NEOLine 40i	40	29

11.2 Installation Specifications

Environment

Installation location	Indoors	
Air borne dust/contaminants	Minimal	
Ambient temperature		
Minimum storage	36° F (2° C)	
Minimum operating	40° F (5° C)	
Maximum operating	104° F (40° C)	
Maximum relative humidity* (at maximum operating temperature)	95%	

^{*}Note: When the relative humidity is above 50%, the oil in the reservoir should be checked frequently for water content.

Sound Level

Sound level with optional side panels	79.0 [dB(A)]
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Equipment Dimensions and Weights

	Length	Width	Height	Weight
NEOLine 40i	56.53" (1,436 mm)	45.94" (1,167 mm)	39.55" (1,005 mm)	2,150 lbs (975 kg)



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		Connection	Height
A	Drain	1/2"NPT	10.24" (260 mm)
В	Cooling Water Out	1/2"NPT	14.24" (362 mm)
С	Cooling Water In	1/2"NPT	18.24" (463 mm)
D	Cutting Water In	1/2"NPT	20.43" (519 mm)
Е	Cutting Water Out	3/8" HP	30.24" (768 mm)
F	Plant Air In	1/4" NPT	35.38" (899 mm)

Plant Air

The facility compressed air connection should provide clean, dry air regulated to 85 psi (5.9 bar). Air usage is minimal, normally less than 1 scf/min.

The following table provides specifications for each ISO air quality classification. KMT recommends adherence to Quality Class 4.

Table 11-2 ISO Air Quality Classifications

ISO Quality Class	Maximum Particle Size (microns)	Maximum Pressure Dew Point (water @ 100 psi)	Maximum Oil Content (Mg/m³)
1	0.1	-94° F (-60° C)	0.01
2	1	-40° F (-40° C)	0.1
3	5	-4° F (-20° C)	1
4	15	+38° F (+3° C)	5
5	40	+45° F (+7° C)	25
6		+50° F (+10° C)	

11.3 Water Specifications

Cutting Water Supply (Low Pressure Water System)

Maximum required inlet water flow	3.0 gpm (11.4 L/min)	
Minimum inlet water pressure	35 psi (2.4 bar) flowing, with booster pump	
	60 psi (4 bar) flowing, without booster pump	
Maximum inlet water pressure	80 psi (5.5 bar)	
Maximum booster outlet water pressure	120 psi (8.3 bar)	
Optional booster pump factory set inlet pressure	58 psi (4 bar)	



Cutting Water Supply (Low Pressure Water System)

Optional booster pump factory set outlet pressure	120 psi (8.3 bar)
Optimum inlet water temperature	65° F (18° C)
Maximum inlet water temperature	85° F (29° C)
Booster pump heat, recommended	128° F (53° C), with booster pump

Recirculation System

Maximum consumption at 75° F (24° C)	2.5 gpm (9.5 L/min)
Total heat rejection	18,000 BTU/HR
Reservoir capacity	38 gal (144 L)
Low oil level shutdown, recommended	18 gal (68 L)
Minimum operating oil temperature	60° F (15° C)
Optimum operating oil temperature	115° F (46° C)
Hot oil shutdown, recommended	145° F (63° C)
Minimum inlet cooling water pressure	35 psi (2.4 bar)
Maximum inlet cooling water pressure	100 psi (6.9 bar)
Oil filtration rating (Beta filtration rating)	B ₇ ≥1000*
Fluid cleanliness rating (ISO fluid cleanliness rating))	17/14**
Nominal recirculation pressure	30 psi (2 bar)
Recommended oil type	
General service	Conoco Phillips Megaflow AW 46

General service	Conoco Phillips Megaflow AW 46
	Mobil DTE 10 Excel 46
Food service	Fuchs Cassida FM 46
	Mobil DTE FM 46
	Chevron Lubricating Oil FM 46

^{*} *Note:* For each particle per milliliter downstream of the filter greater than 7 microns, there are 1000 particles per milliliter larger than 7 microns upstream of the filter.

17 <1,300 particles per milliliter, >5 microns

14 <160 particles per milliliter, >15 microns

^{**}Note: Indicates ISO 4406 range numbers for maximum permissible number of particles per milliliter, greater than 5 and 15 microns.



Water Quality Standards

The quality of the inlet cutting water supply is one of the most important factors affecting component life and performance. Water treatment requirements can be determined by a water analysis.



Due to its aggressive nature, KMT does not recommended using deionized water in our pumps.

The cutting water supply must meet the following standards. A high concentration of dissolved solids, especially calcium, silica and chlorides will affect high pressure component life.

Table 11-3 Water Quality Standards

Constituent (mg/l)	Minimum Requirement	Better	Best
Alkalinity	50	25	10
Calcium	25	5	0.5
Chloride	100	15	1
Free Chlorine	1	1	0.05
Iron	0.2	0.1	0.01
Magnesium as Mg	0.5	0.1	0.1
Manganese as Mn	0.1	0.1	0.1
Nitrate	25	25	10
Silica	15	10	1
Sodium	50	10	1
Sulfate	25	25	1
TDS*	200	100	35**
Total Hardness	25	10	1
рН	6.5-8.5	6.5-8.5	6.5-8.5
Turbidity (NTU)	5	5	1

^{*} Note: Total dissolved solids

^{**}Note: Do not reduce the TDS beyond this amount or the water will be too aggressive.



Table 11-4 Water Impurities

Constituent	Chemical Formula	Comments
Alkalinity	Bicarbonate (HCO ₃) Carbonate (CO ₃) Hydrate (OH), expressed as CaCO ₃	Acid neutralizing capacity of water. Foaming and carryover of solids, causes embrittlement of steel, can produce CO ₂ , a source of corrosion.
Calcium	Ca	When dissolved makes water hard; contributes to the formation of scale.
Chloride	Cl	Adds to solid content and increases corrosive character of water; in relative percentage presence with oxygen induces stress corrosion cracking.
Free Chlorine	Cl ₂	Oxidizing agent; can attack elastomeric seals and damage reverse osmosis (RO) membranes.
Iron	Fe ⁺⁺ (ferrous) Fe ⁺⁺⁺ (ferric)	Discolors water or precipitation; source of scale and erosion.
Magnesium as Mg		When dissolved makes water hard; contributes to the formation of scale.
Manganese as Mn	Mn^{++}	Discolors water or precipitation; source of scale and erosion.
Nitrate	NO_3	Adds to solid content; effect is not generally significant industrially.
Silica	SiO_2	Causes scale
Sodium	Na	Found naturally; introduced to water in the ion exchange water softening process.
Sulfate	SO ₄	Adds to solid content; combines with calcium to form calcium sulfate scale.
TDS		Measure of the total amount of dissolved matter in water.
Total Hardness	CaCO ₃	Sum of all hardness constituents in water; typically expressed as their equivalent concentration of calcium carbonate; primarily due to calcium and magnesium in solution, but may include small amounts of metal. Carbonate hardness is usually due to magnesium and calcium bicarbonate; non-carbonate hardness is due to sulfates and chlorides.
рН		Intensity of the acidic or alkaline solids in water; pH scale runs from 0, highly acidic, to 14, highly alkaline; with 7 being neutral.



11.4 Electrical Specifications

Electrical System

Motor type	TEFC (Totally Enclosed Fan Cooled)
Controls	
Voltage	24 volts DC
Power supply	5 amps DC

Ampacity and Power Voltage Requirements

Power Voltage	Motor Horsepower	Full Load Amps	Circuit Breaker Amps
190/3/50	40	110	150
208/3/60	40	100	120
230/3/60	40	93	120
460/3/60	40	47	60
575/3/60	40	41	60

11.5 Hydraulic and High Pressure Water System Specifications

Hydraulic System

Maximum operating pressure	2,750 psi (190 bar)
Main system relief valve	2,973 psi (205 bar)



High Pressure Water System

Maximum flow rate	
55,000 psi (3,792 bar)	0.72 gpm (2.7 L/min)
Plunger diameter	0.875" (22 mm)
Piston diameter	4.03" (102.4 mm)
Intensification ratio	20:1
Minimum outlet pressure	5,800 psi (400 bar)
Maximum outlet pressure	55,000 psi (3,792 bar)
Pneumatic Control Valve	
Maximum water pressure	60,000 psi (4,137 bar)
Regulated air pressure	85 psi (5.9 bar)
Maximum flow rate	1.0 cfm (0.028) m ³ /min

Orifice Capacity

The following tables provide horsepower requirements for some of the more popular orifices.

Table 11-5 Single Orifice Diameter

	Horse	Kaino		Maximum Single Orifice Diameter
Model	HP	Kw	Operating Pressure	(at full pressure)
NEOLine 40i	40	29	55,000 psi (3,792 bar)	0.012 inch (0.30 mm)

Table 11-6 Horsepower Requirements

Orifice Size inches (mm)	45,000 psi (3,103 bar)	50,000 psi (3,447 bar)	55,000 psi (3,792 bar)
0.003 (0.076)	1.7	2.0	2.3
0.004 (0.102)	3.0	3.5	4.0
0.005 (0.127)	4.6	5.4	6.2
0.006 (0.152)	6.7	7.8	9.0
0.007 (0.178)	9.1	10.6	12.2
0.008 (0.203)	11.8	13.9	16.0
0.009 (0.229)	15.0	17.5	20.2
0.010 (0.254)	18.5	21.6	25.0



Table 11-6 Horsepower Requirements

Orifice Size inches (mm)	45,000 psi (3,103 bar)	50,000 psi (3,447 bar)	55,000 psi (3,792 bar)
0.011 (0.279)	22.4	26.2	30.2
0.012 (0.305)	26.6	31.2	36.0
0.013 (0.330)	31.2	36.6	42.2
0.014 (0.356)	36.2	42.4	48.9
0.015 (0.381)	41.6	48.7	56.2
0.016 (0.406)	47.3	55.4	63.9

The horsepower requirements for operating multiple orifices are determined by adding the requirements in Table 11-6 for each orifice. Examples are shown below.

Orifice Size inches (mm)	Number of Orifices	Operating Pressure	Calculation	Total Horsepower
0.005 (0.127)	3	55,000	3 x 6.2	18.6
0.012 (0.305) 0.006 (0.152)	1 1	50,000	31.2 + 7.8	39.0

Torque Specifications

Measurements are made with lubricated components and a certified calibrated torque wrench. Inconsistencies in wrench settings, lubrication and technique may not produce a leak free seal. If leakage occurs, the torque can be increased to seal the components. However, **do not exceed the recommended torque value by more than 15 percent**. If leakage persists, there is a component problem.



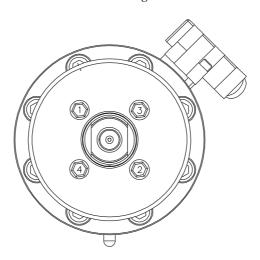
Excessive torque can cause component damage or failure, resulting in potential hazards to equipment and personnel.



Torque Specifications

Soft Seal End Cap	
Jackbolts	4 (7/16") each
1st Stage	Hand Tight
2nd Stage	20 ft-lbs (27 Nm) Crossing Pattern
3rd Stage	32-35 ft-lbs (43-47 Nm) Crossing Pattern
4th Stage	32-35 ft-lbs (43-47 Nm) Circular Pattern
Socket Wrench Size	3/8 inch

4-Bolt Crossing Pattern



Hydraulic Cylinder Head	
Socket Head Screws	8 (M14) each
Torque	75-80 ft-lbs (102-108 Nm)
Hex Key	M12
Topworks Support	
Socket Head Screws	4 (M10) each
Torque	46 ft-lbs (62 Nm)
Hex Key	M8



Torque Specifications

Proximity Switch	
Socket Head Screws	2 (M6) each
Torque	140-160 in-lbs (16-18 Nm)
1	, , ,
Hex Key	M5
Sealing Head	
Discharge Gland	130 ft-lbs (176 Nm)
Poppet Retainer	30 in-lbs (3.4 Nm)
Pneumatic Control Valve	
HP Adapter	30 ft-lbs (40 Nm)
1/4-inch Outlet to Drain	25 ft-lbs (34 Nm)
Pneumatic Actuator	5 ft-lbs (7 Nm)
3/8-inch HP Gland	50 ft-lbs (68 Nm)



SECTION 12 PARTS LIST

12.1 Overview

This section contains a comprehensive list of all standard and optional parts for the NEOLine 40i. To facilitate the ordering of replacements parts, item numbers in each table correspond to the identifying numbers in the accompanying figures.

Use the following information to contact the Customer Service Department at KMT Waterjet Systems.

Europe	Spare Parts Manager KMT Waterjet Systems GmbH Wasserstrahl Schneidetechnik Auf der Laukert 11 D-61231 Bad Nauheim Germany	Phone +49-6032-997-119 Fax +49-6032-997-271 Email order.spares@kmt-waterjet.com
Eu	Spa KM Wa Auf D-6 Ger	Phone Fax Email
USA	Customer Service Department KMT Waterjet Systems PO Box 231 635 West 12th Street Baxter Springs, KS 66713-0231 USA	Phone (800) 826-9274 Fax (620) 856-2242 Email wj.service@kmtwaterjet.com wj.parts@kmtwaterjet.com

12-1



12.2 Index

Parts are arranged in the following sequence:

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		Part				Part	
Table	Table Description	Number	Page	Table	Table Description	Number	Page
12-1	12-1 NEOLine 40i Intensifier Unit		12-3	12-12	12-12 Hydraulic Manifold Assembly	72108748	12-24
12-2	Intensifier Assembly	72109524	12-5	12-13	Hydraulic Hose Connections	72116728	12-26
12-3	Hydraulic Cartridge Seal	80086622	12-7	12-14	Reservoir Assembly	72114068	12-28
12-4	Sealing Head Assembly	20417081	12-8	12-15	Bulkhead Pipe Assembly W/O Booster Pump	72116785	12-30
12-5	Pneumatic Valve/Actuator Assembly	20427739	12-9	12-16	12-16 Bulkhead Pipe Assembly W/ Booster Pump	72108930	12-32
12-6	Hydraulic Piston Assembly	72112358	12-11	12-17	Low Pressure Water Filter Assembly	72116150	12-34
12-7	High Pressure Piping	72114935	12-13	12-18	Electrical Assembly	72123758	12-36
12-8	Hydraulic Power Package W/O Booster Pump	72133440	12-15	12-19	12-19 Electrical Configuration	72124203	12-38
12-9	Pump/Manifold Assembly	72133448	12-17	12-20	Controls Subassembly	72124492	12-40
12-10	Hydraulic Power Package W/ Booster Pump	72116679	12-19				
12-11	Pump/Manifold Assembly	72116686	12-21				



Table 12-1 NEOLine 40i Intensifier Unit

Description	High Pressure Piping	Hydraulic Power Package without Booster Pump	Hydraulic Power Package with Booster Pump	Hydraulic Hose Connections	Reservoir Assembly	Bulkhead Pipe Assembly without Booster Pump	Bulkhead Pipe Assembly with Booster Pump	Electrical Assembly
Part Number Description	72114935	72133440	72116679	72116728	72114068	72116785	72108930	72123758
Item	1	2		4	5	9		∞

Figure 12-1: NEOLine 40i Intensifier Unit 000 0 0 72124385(2) (∞) 3 0 0 0 G 0 \$ Ċ NEOLine 401 0 (9

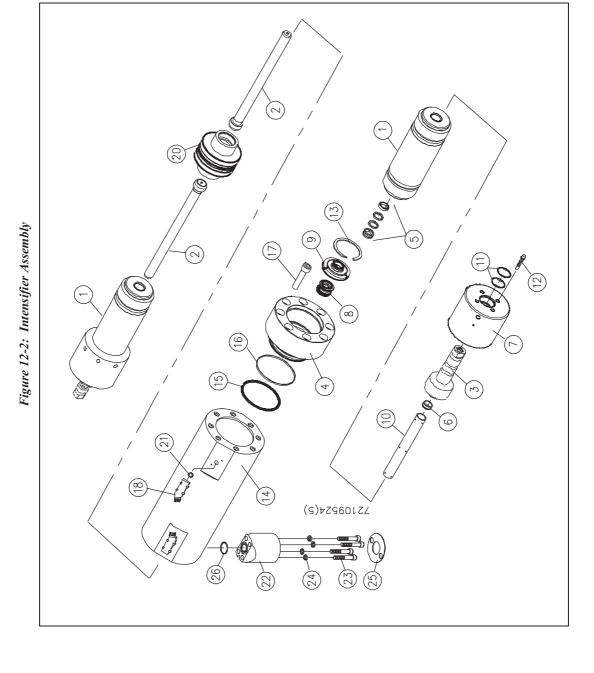
(OPTIONAL DRIP PAN)

/ (OPTIONAL COVER)



Table 12-2 Intensifier Assembly 72109524

	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
1	05059712	HP Cylinder	2	15	10075000	O-Ring, 3.75 x 4.0 x .13	2
2	05039771	Plunger	2	16	05034855	Backup Ring, 3.75 x 4.0	2
3	20417081	Sealing Head Assembly	2	17	05141106	Socket Head Screw, M14 x 60	16
4	05034772	Hydraulic Cylinder Head	2	18	20453934	Proximity Switch Kit	2
5	20422243	HP Seal Assembly	2		05127584	Proximity Switch	
9	10110393	Seal Assembly, Sealing Head	2		10183572	Socket Head Screw, M6 x 1 x 22MM	
7	20417138	HP Cylinder Nut	2	20	72112358	Piston Assembly	1
∞	80086622	Hydraulic Cartridge Seal Assembly	2	21	05144183	Spacer Assembly, Proximity Switch	2
6	05007786	Bushing Retainer Flange	2		05144191	O-Ring, .69 x .88 x .09	
10	20497767	Liner, HP Cylinder	2	22	20427804	Intensifier Support	2
11	10074920	O-Ring, 1.75 x .94 x .09	4	23	20427994	Socket Head Screw, M10 x 1.50 x 65MM	∞
12	80070352	Jackbolt	~	24	05061486	Lock Washer, M10	∞
13	05034798	Retaining Ring	2	25	05081872	Gasket, Topworks Support	2
14	05034764	Hydraulic Cylinder	1	26	10074409	O-Ring, $1.0 \times 1.25 \times .13$	2



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Table 12-3 Hydraulic Cartridge Seal 80086622

Item	Part Number	Part Description (Quantity	Item	Part Number	Quantity Item Number Description	Quantity
1	80086630	30086630 Seal Bushing	1	5	05129481	05129481 O-Ring, 1.0 x 1.13 x .06	1
2	05015060	Packaging Ring W/O-Ring	1	9	05013024	05013024 O-Ring, 1.25 x 1.38 x .06	1
3	10193522	O-Ring, 1.19 x 1.38 x .09	П	7	05129515	05129515 Backup Ring, 1.127 x .891	1
4	05050760	Backup Ring, 1.188 x 1.375	1	∞	05027255	05027255 Packing Seal, U-Cup, W/O-Ring	1

Figure 12-3: Hydraulic Cartridge Seal

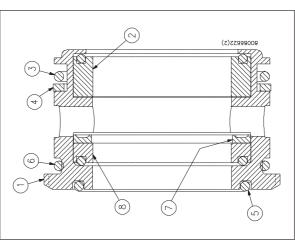
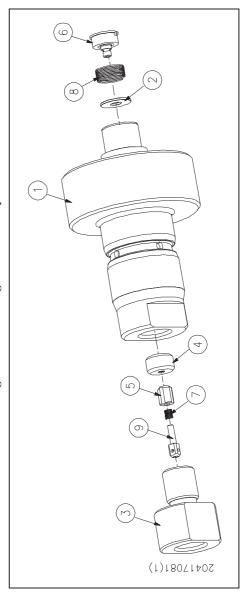


Table 12-4
Sealing Head Assembly
20417081

			707	100/1407			
ì	Part		;	į	Part	•	•
Item	Number	Item Number Description	Quantity	Item	Number	Quantity Item Number Description	Quantity
_	20417000	20417000 Sealing Head	1	9	10118552	10118552 Poppet Retainer	1
2	10107894	Inlet Poppet Valve	1	7	05147863	Compression Spring	1
3	05116777	Gland	1	∞	49884562	Compression Spring	1
4	05112768	Seat	1	6	05116751	05116751 Poppet Pin	1
S	05116561	Discharge Poppet Valve	1				

Figure 12-4: Sealing Head Assembly





Pneumatic Valve/Actuator Assembly, Normally Open 20427739 **Table 12-5**

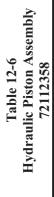
	Part		
Item	Number	Description	Quantity
1	20427648	Valve Body	
7	10178697	Valve Seat	1
3	49830904	Adapter, HP Water Valve	1
4	20435636	Valve Stem	1
5	10188233	Backup Ring, Brass	-
9	20428052	Seal Assembly	1
	10189553	Actuator Assembly, Normally Open	1
7	BV401184	Pneumatic Cylinder	1
∞	BV601184	Cylinder Head	1
6	BV501184	Piston	1
10	10187250	Backup Ring, SST	1
11	10074714	O-Ring, 2.44 x 2.63 x .09	1
12	10074565	O-Ring, 2.25 x 2.38 x .06	2



Figure 12-5: Pneumatic Valve/Actuator Assembly

10077030

ADAPTER, TUBE/PIPE, 25K.13
(SEE BULKHEAD PIPE ASSEMBLY)



Part Numbe 7211194 204988(Part Number 72111944 20498800	PartNumberDescription72111944Hydraulic Ram Piston, 4.0320498800Plunger/Piston Retainer	Quantity 1
20418031		Retaining Ring	2
05087713		O-Ring, 1.25 x 1.50 x .13	2
05049994		Backup Ring	2
05117965		Seal Assembly	_
05117940		Bearing Ring	2



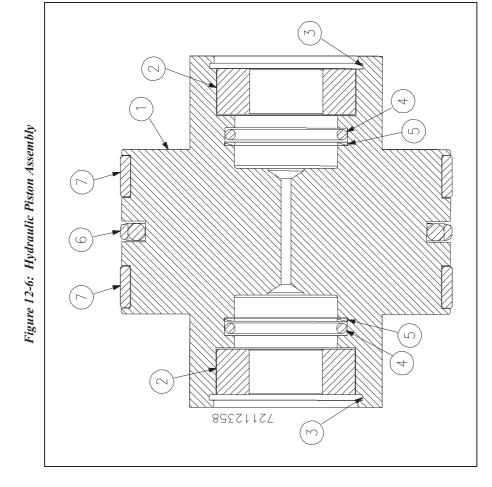
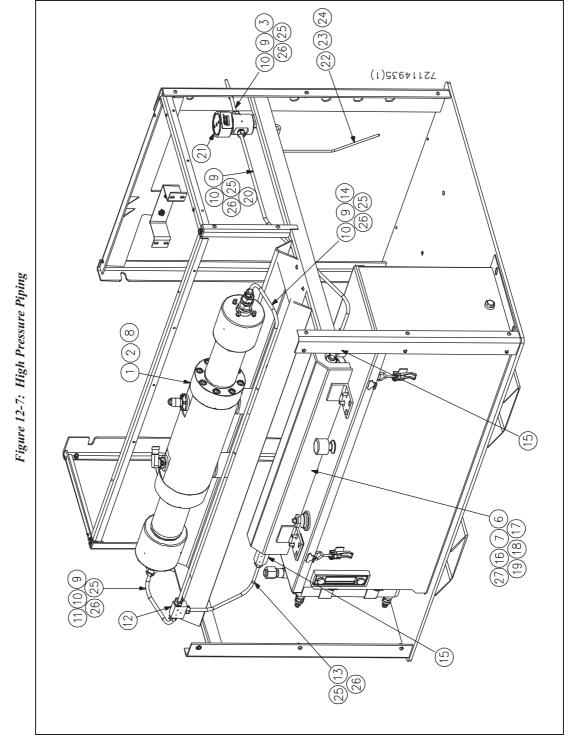




Table 12-7 High Pressure Piping 72114935

			17/	CC/117/			
	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
1	95383790	Socket Head Screw, 1/2-13 x 1	4	16	20498314	HP Attenuator, .96 Liter	1
2	95413696	Lock Washer, .50	4	17	10099281	Hex Nut, 5/16-18	8
3	72116208	UHP Tube, .38 x 6.75	1	18	10069755	Flat Washer, .31	8
9	72106039	Attenuator Housing	1	19	95830766	Lock Washer, .31	8
7	05144837	Spacer, Attenuator Bracket	4	20	72116215	HP Tube, Bent, .38	1
∞	72109524	Intensifier Assembly	1	21	20427739	Pneumatic Valve/Actuator Assembly	1
6	10078715	HP Collar, .38	4	22	72127342	HP Tube, Bent, .25	1
10	10078129	HP Gland, .38	4	23	10078426	HP Collar, .25	1
11	80070311	HP Tube, Bent, .38	1	24	10078459	HP Gland, .25	1
12	10078590	Tee Assembly, HP, .38	1	25	10186153	Flexible Conduit, .38	200.0"
13	72122824	HP Tube, Bent, .38	1	26	10083897	Ferrule, Hose, .25	8
14	80070303	HP Tube, Bent, .38	1	27	10112662	Neoprene	30.0"
15	10079531	Coupling, HP, .56 x .38	2	28	20472887	PED Decal, not shown	1





72111192 5-2015/Rev 05



Hydraulic Power Package without Booster Pump 72133440 **Table 12-8**

j	Part		
Item	Number	Description	Quantity
1	72160448	Electric Motor, 40HP	1
2	72133448	Pump/Manifold Assembly	1
3	72114092	Flange, Motor/Pump	1
4	72114110	Coupling, Flexible Drive	-
5	95716882	Hex Head Screw, 1/2-13 x 1-1/4	2
9	10170686	Lock Washer, .50	2
7	49898729	Flat Washer, M12	2
~	95423679	Hex Head Screw, 5/8-11 x 1-3/4	4
6	95688719	Lock Washer, .63	4
10	80087513	Flat Washer, .63	4
11	20496174	Motor Mount Pad	4
12	10066348	Hex Head Screw, 1/2-13 x 2-1/2	4
13	95413696	Lock Washer, .50	4
14	95273876	Flat Washer, .50	4



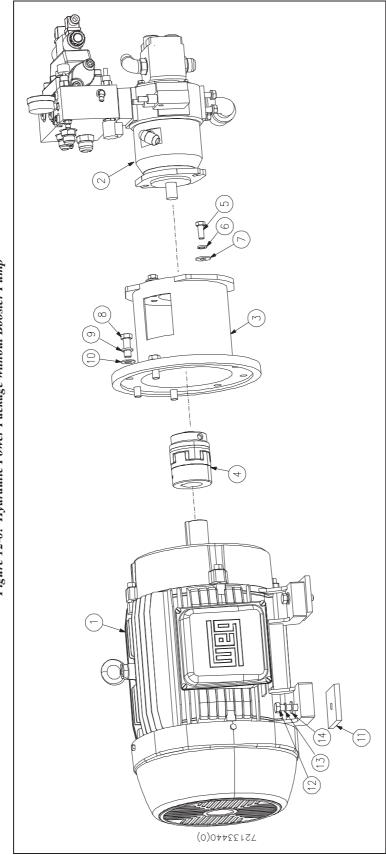


Figure 12-8: Hydraulic Power Package without Booster Pump



Table 12-9 Pump/Manifold Assembly 72133448

			/21.	0++6617/			
	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
1	05083258	Hydraulic Piston Pump	1	18	95688743	Lock Washer, .38	4
7	20498626	Gear Pump	-	19	05091756	Socket Head Screw, 7/16-14 x 6	4
3	72108748	Manifold Assembly	1	20	05050331	Adapter, JIC/ORB, .75 x .63	1
4	49876089	Adapter, JIC/ORB, .25 x .25	2	21	10119667	Split Flange Kit, 1.50	1
5	10118206	O-Ring, 1.31 x 1.56 x .13	2	22	05086210	Adapter, Hose/Flange, 2.0 x 1.50	1
9	72116694	Manifold Spacer	П	23	80086192	Adapter, JIC/ORB, 1.0 x 1.0	1
7	05050356	Lock Washer, .44	4	24	10091163	Adapter, JIC/ORB, .75 x .75	1
6	10074953	O-Ring, 1.50 x 1.75 x .13	П	25	10117026	Hex Head Screw, 3/8-16 x 1-1/4	7
111	95055281	Socket Head Screw, 3/8-16 x 1-1/2	4	26	95750394	Lock Washer, .38	7
12	10142644	Adapter, JIC/ORB, .25 x .25	-	27	10069714	Flat Washer, .38	7
13	05064407	Adapter, JIC/ORB, 1.0 x .75	П	28	05139720	O-Ring, 85MM x 3MM	1
14	95702619	Adapter, JIC/ORB, .75 x .75	П	29	10144749	Adapter, JIC/ORB, .25 x .25	1
15	05071055	Plug, ORB, .75	2	30	72117116	Manifold Spacer	1
16	05045497	Pressure Gauge, 0-5,000 psi	П	31	72127220	Bolt Spacer, Manifold	4
17	05089792	Flat Washer, .44	8	32	05071113	Adapter, JIC/ORB, .75 x .75	



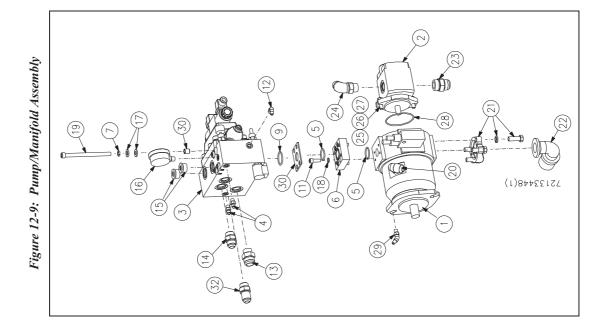




Table 12-10 Hydraulic Power Package with Booster Pump 72116679

Item	Part Number	Description	Quantity
1	72160448	Electric Motor, 40HP	1
7	72116686	Pump/Manifold Assembly	1
ю	72114092	Flange, Motor/Pump	1
4	72114110	Coupling, Flexible Drive	1
5	95716882	Hex Head Screw, 1/2-13 x 1-1/4	2
9	10170686	Lock Washer, .50	2
7	49898729	Flat Washer, M12	2
∞	95423679	Hex Head Screw, 5/8-11 x 1-3/4	4
6	95688719	Lock Washer, .63	4
10	80087513	Flat Washer, .63	4
11	20496174	Motor Mount Pad	4
12	10066348	Hex Head Screw, 1/2-13 x 2-1/2	4
13	95413696	Lock Washer, .50	4
14	95273876	Flat Washer, .50	4



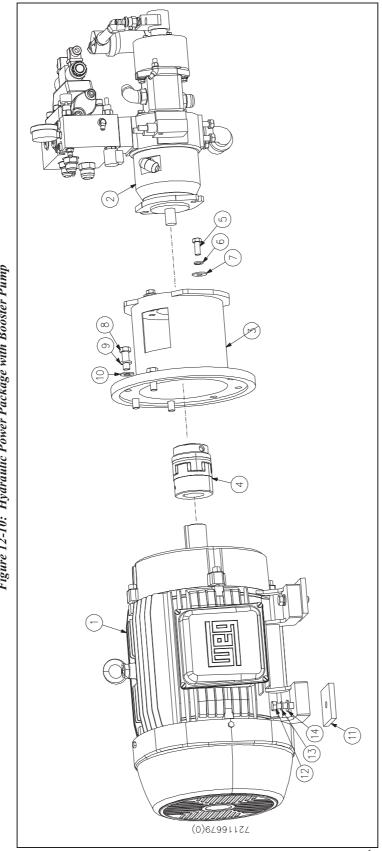


Figure 12-10: Hydraulic Power Package with Booster Pump



Table 12-11 Pump/Manifold Assembly 72116686

			177	0000117/			
	Part				Part		
Item	Number	Description	Quantity Item	Item	Number	Description	Quantity
1	05083258	Hydraulic Piston Pump	1	21	10119667	Split Flange Kit, 1.50	1
2	05045364	Gear Pump	1	22	05086210	Adapter, Hose/Flange, 2.0 x 1.50	1
3	72108748	Manifold Assembly	1	23	80086192	Adapter, JIC/ORB, 1.0 x 1.0	1
4	49876089	Adapter, JIC/ORB, .25 x .25	2	24	10091163	Adapter, JIC/ORB, .75 x .75	1
5	10118206	O-Ring, 1.31 x 1.56 x .13	2	25	10092302	Shaft Coupling	1
9	72116694	Manifold Spacer	П	26	05049168	Adapter, Water Pump	1
7	05050356	Lock Washer, .44	4	27	10116952	Caplug	2
6	10074953	O-Ring, 1.50 x 1.75 x .13	1	28	49887094	Vane Pump	1
11	95055281	Socket Head Screw, 3/8-16 x 1	4	29	95838314	Lock Washer, .25	3
12	10142644	Adapter, JIC/ORB, .25 x .25	1	30	95572897	Hex Head Screw, 1/4-20 x 5/8	3
13	05064407	Adapter, JIC/ORB, 1.0 x .75	1	31	49886989	Adapter, JIC/Pipe, .50 x .38	1
14	95702619	Adapter, JIC/ORB, .75 x .75	П	32	10189025	Adapter, Hose/JIC, .50 x .50	7
15	05071055	Plug, ORB, .75	2	33	10117026	Hex Head Screw, 3/8-16 x 1-1/4	7
16	05045497	Pressure Gauge, 0-5,000 psi	1	34	95750394	Lock Washer, .38	4
17	05089792	Flat Washer, .44	8	35	10069714	Flat Washer, .38	4
18	95688743	Lock Washer, .38	4	36	95416319	Hex Head Screw, 3/8-16 x 1	7
19	05091756	Socket Head Screw, 7/16-14 x 6	4	37	05139720	O-Ring, 85MM x 3MM	1
20	05050331	Adapter, JIC/ORB, .75 x .63	1	38	49890692	Coupling, Pipe, .50 x .38	1



Table 12-11
Pump/Manifold Assembly
72116686

			17/	0000117/			
Item	Part Number	Part Item Number Description	Quantity	Item	Part Number	Part Part Quantity Item Number Description	Quantity
39		10187722 Elbow, Pipe, .50 x .50	1	43	72117116	72117116 Manifold Spacer	1
40	20412815	Strainer	1	44	0506207	Pipe Nipple, $.50 \times 5.0$	1
41	49887011	Adapter, JIC/Pipe, .50 x .50	1	45	72127220	Bolt Spacer, Manifold	4
42	10144749	Adapter, JIC/ORB, .25 x .25	П	46		05071113 Adapter, JIC/ORB, .75 x .75	1

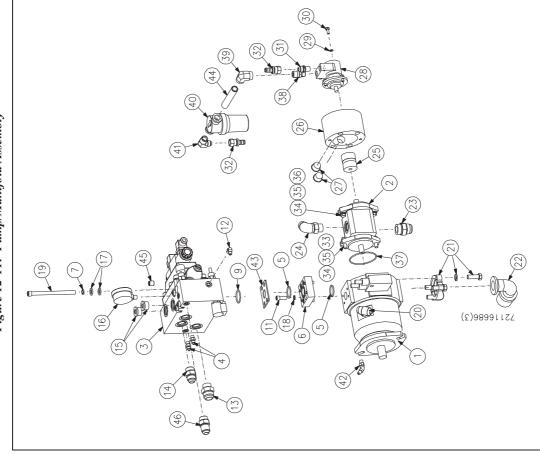


Figure 12-11: Pump/Manifold Assembly



Table 12-12 Hydraulic Manifold Assembly 72108748

	Part		
Item	Number	Description	Quantity
1	05044144M	Hydraulic Manifold	1
2	20437164	Directional Control Valve	1
3	10187052	Relief Valve, 25-3000 psi	1
4	10187060	Relief Valve, 25-1500 psi	1
5	05055017	Plug, ORB, .13	2
9	49889736	Check Valve	1
7	49889744	Retainer, Cartridge Valve	1
∞	05071055	Plug, ORB, .75	1
6	49889769	Plug, ORB, 25	1
10	95688750	Lock Washer, .50	9
11	95055059	Socket Head Screw, 1/2-13 x 2-1/2	9
12	80081733	Relief Valve, 205 Bar	1
13	10185585	Solenoid Valve, 24V DC	1

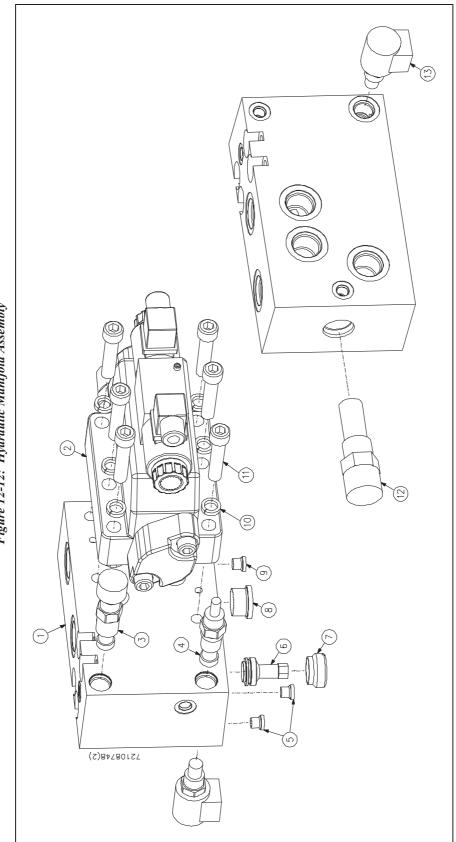


Figure 12-12: Hydraulic Manifold Assembly



Table 12-13 Hydraulic Hose Connections 72116728

	Part		
Item	Number	Description	Quantity
1	72115942	Hydraulic Hose Assembly, .75 x 26.0	2
2	72144723	Hydraulic Hose Assembly, .25 x 30.50	1
3	80085889	Hydraulic Hose Assembly, $.25 \times 20.0$	-
4	72115934	Hydraulic Hose Assembly, 1.0 x 16.0	1
5	20456208	Hydraulic Hose Assembly, .75 x 28.0	1
9	20499644	Hydraulic Hose Assembly, .25 x 15.50	1
7	72109466	Hydraulic Hose Assembly, 1.0 x 15.0	1
∞	72115926	Hydraulic Hose Assembly, .75 x 12.0	1
6	20456208	Hydraulic Hose Assembly, .75 x 28.0	1
10	10179018	Radiator Hose, 2.0	0.6
11	10083517	Hose Clamp	2
12	05052493	Adapter, JIC/ORB, .75 x .63	2

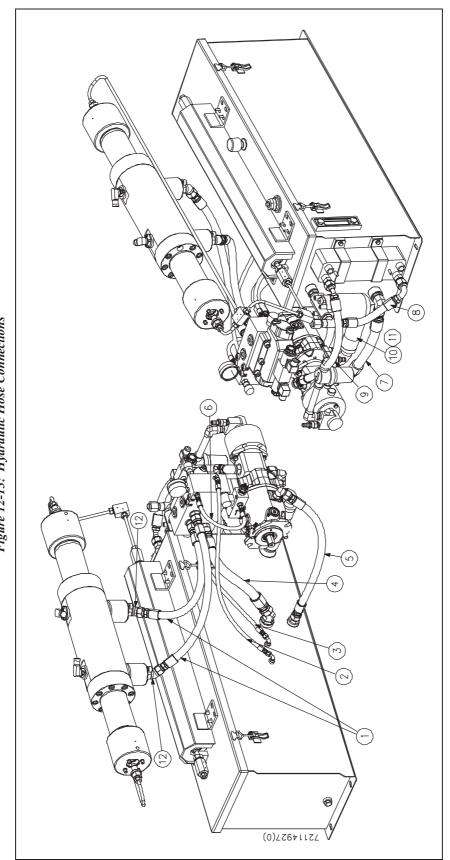
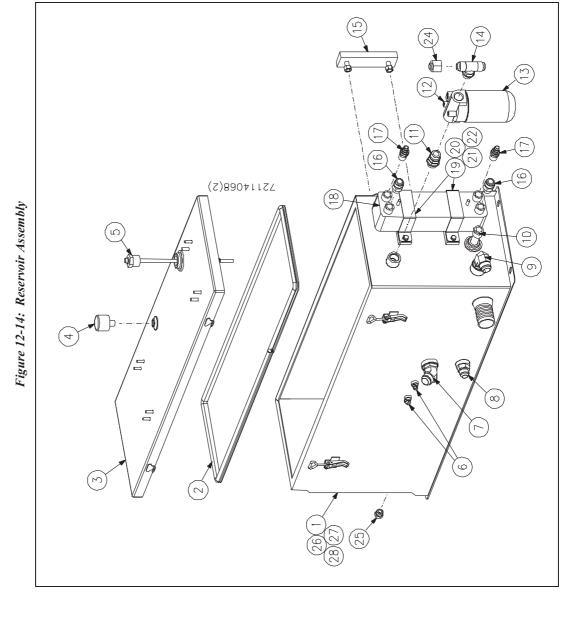


Figure 12-13: Hydraulic Hose Connections



Table 12-14 Reservoir Assembly 72114068

			1 - 1	COOLITE			
	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
П	72114034	Reservoir Weldment	1	15	10168862	Level/Temperature Gauge	1
2	72118430	Gasket	120.0"	16	05073150	Adapter, JIC/ORB, .75 x .63	7
3	72114042	Reservoir Lid	1	17	10079713	Hose Barb, .50 x .50	7
4	05092739	Air Breather	1	18	05145958	Heat Exchanger	1
5	05050026	Temperature/Level Switch	1	19	05145974	Bracket, Heat Exchanger	7
9	10142644	Adapter, JIC/ORB, .25 x .25	2	20	95830766	Lock Washer, .31	4
7	20427194	Adapter, JIC/ORB, 1.0 x 1.0	1	21	95119897	Hex Head Screw, 5/16-18 x 1/2	4
∞	95702619	Adapter, JIC/ORB, .75 x .75	1	22	72115546	Spacer, Heat Exchanger	7
6	80085970	Adapter, JIC/ORB, 1.0×1.0	1	23	80087687	Diffuser, not shown	1
10	10091858	Bulb Well	1	24	92669050	Cap, JIC, .75	1
11	05057542	Coupling, ORB, .75 x .75	1	25	95033619	Pipe Plug, .50	1
12	05049697	Hydraulic Filter Head	1	26	95383790	Socket Head Screw, 1/-13 x 1	4
13	05049689	Hydraulic Filter Element	1	27	95273876	Flat Washer, .50	4
14	05071063	Tee, JIC/ORB, .75 x .75	1	28	95413696	Lock Washer .50	4
				29	10082071	Pipe Plug, .38, not shown	1



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Table 12-15
Bulkhead Pipe Assembly without Booster Bump 72116785

			17/	C8/0117/			
	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
	10077055	Coupling, Bulkhead, Pipe, .94 x .25	1	18	10079226	Coupling, Pipe, .50 x .50	3
2	10078194	Coupling, Bulkhead, Pipe, 1.50 x .50	4	19	05105440	Pressure Gauge, 0-100 psi	1
3	20469985	Jam Nut, 3/4-16	1	20	20413789	Manifold, LP Water	1
4	10078335	Coupling, Pipe, .25 x .13	1	21	49833882	Adapter, Hose/ORB, .50 x .50	1
5	20453730	Check Valve	1	22	10078616	Tee, Pipe, .50	1
9	10189025	Adapter, Hose/JIC, .50 x .50	2	23	49834328	Adapter, Pipe/Tube, .50 x .25	1
7	49888035	Solenoid Valve	1	24	05135637	Plug, Pipe, .25	1
∞	72149283	Coupling, Tube, .25 x .13	1	25	72114076	Grommet	1
6	10079903	Poly Tube, 25	12.0"	26	05140751	Pressure Switch, 30 psi	1
10	72149291	Adapter, Tube/Pipe, .25 x .13	1	27	20421272	Hose, Push-on, .50	350.0"
11	10070092	Jam Nut, 1-14	4	28	20468724	Hose Barb, .50 x .50	1
12	10127801	Pipe Nipple, $.50 \times 3.0$	2	29	05044052	Pressure Gauge, 0-200 psi	1
13	95680922	Adapter, JIC/Pipe, $.50 \times .50$	1	30	72116150	Filter Subassembly, LP Water	1
14	10145829	Nipple, Close, .50	1	31	05111406	Adapter, JIC/Pipe, .50 x .25	7
15	10091866	Water Modulating Valve	1	32	10173805	Adapter, Hose/JIC, .50 x .50	1
16	10079713	Hose Barb, .50 x .50	3	33	95680922	Adapter, JIC/Pipe, .50 x .50	1
17	49890239	Solenoid Valve	1				



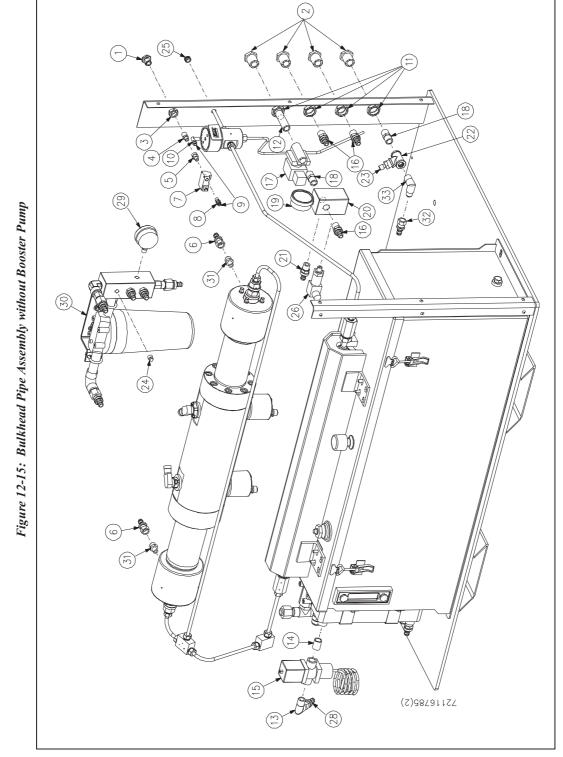




Table 12-16
Bulkhead Pipe Assembly with Booster Pump 72108930

			17/	0000017			
	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
-	10077055	Coupling, Bulkhead, Pipe, .94 x .25	1	19	05105440	Pressure Gauge, 0-100 psi	1
2	10078194	Coupling, Bulkhead, Pipe, 1.50 x .50	4	20	20413789	Manifold, LP Water	1
3	20469985	Jam Nut, 3/4-16	П	21	49833882	Adapter, Hose/ORB, .50 x .50	1
4	10078335	Coupling, Pipe, .25 x .13	П	22	10078616	Tee, Pipe, .50	1
5	20453730	Check Valve	П	23	49834328	Adapter, Pipe/Tube, .50 x .25	1
9	10189025	Adapter, Hose/JIC, .50 x .50	2	24	05142062	Pressure Switch, 60 psi	1
7	49888035	Solenoid Valve	П	25	72114076	Grommet	1
∞	72149283	Coupling, Tube, .25 x .13	П	26	05140751	Pressure Switch, 30 psi	1
6	10079903	Poly Tube, .25	12.0"	27	20421272	Hose, Push-On, .50	509.0"
10	72149291	Adapter, Tube/Pipe, .25 x .13	1	28	20468724	Hose Barb, .50 x .50	1
11	10070092	Jam Nut, 1-14	4	29	05044052	Pressure Gauge, 0-200 psi	1
12	10084523	Nipple, Pipe, $.50 \times 4.0$	П	30	72116150	LP Water Filter Subassembly	1
13	95680922	Adapter, JIC/Pipe .50 x .50	1	31	05111406	Adapter, JIC/Pipe, .50 x .25	2
14	1007226	Coupling, Pipe, .50 x .50	П	33	95680922	Adapter, JIC/Pipe, .50 x .50	1
15	10091866	Water Modulating Valve	П	34	10173805	Adapter, Hose/JIC, .50 \times .50	1
16	10079713	Hose Barb, .50 x .50	8				
17	49890239	Solenoid Valve	П				
18	10079226	Coupling, Pipe, .50 x .50	3				

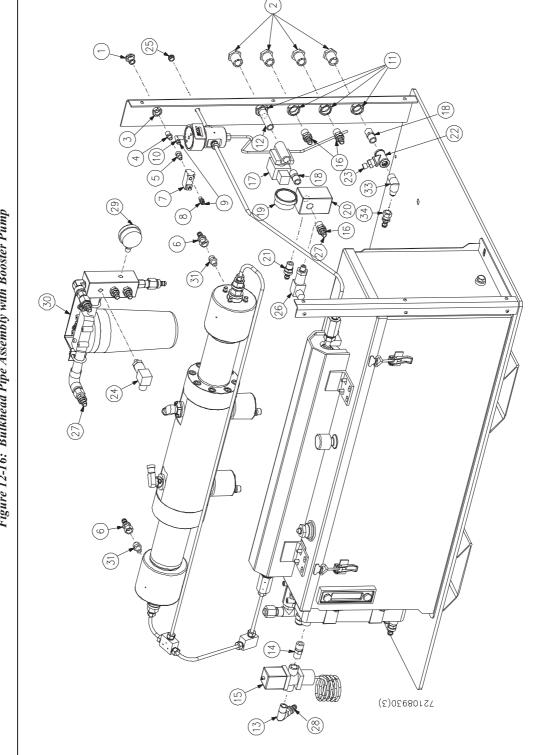


Figure 12-16: Bulkhead Pipe Assembly with Booster Pump



Table 12-17 Low Pressure Water Filter Assembly 72116150

	Part				Part		
Item		Number Description	Quantity	Item	Number	Quantity Item Number Description	Quantity
1		Not used on this assembly	1	10	05016381	05016381 Filter Housing Assembly	1
7	95391322	Flat Washer, .25	4	11	05135652	Check Valve	1
3	05070982	Relief Valve	1	12	10079713	Hose Barb, .50 x .50	1
4	10084556	Nipple, Pipe, $.75 \times 4.0$	2	13	95838314	Lock Washer, .25	4
5	10127298	Elbow, Pipe, .50 x .50	1	14	10106722	Filter Element, 10 Micron	1
9	20413848	Manifold, Low Pressure Outlet	1	15	95416335	Hex Nut, 1/4-20	4
7	10081230	Elbow, Pipe, .75 x .75	1	16	10078152	Bushing, Pipe, .75 x .50	1
∞	10083384	U-Bolt, .75	2	17	49833882	Adapter, Hose/ORB, .50 x .50	2
6	49835804	Adapter, Hose/Pipe, $.50 \times .50$	2				



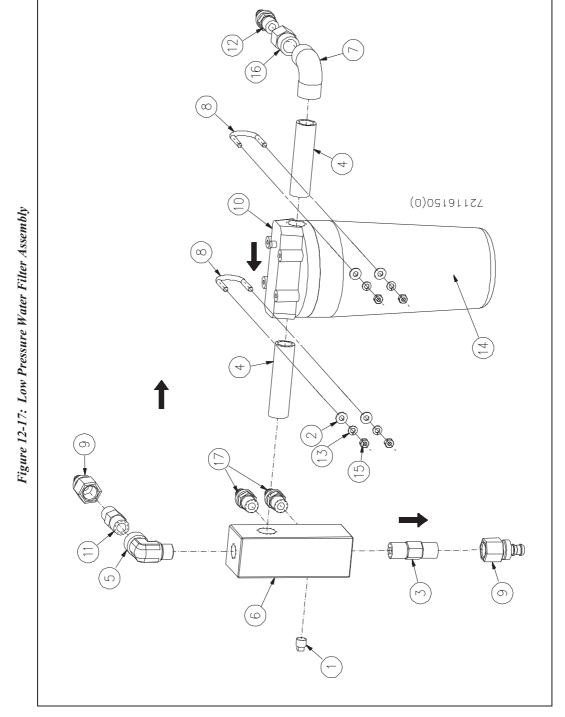




Table 12-18 Electrical Assembly 72123758

				-			
	Part				Part		
Item	Number	Description	Quantity Item	Item		Number Description	Quantity
-	72124203	Configuration		11	49874191	49874191 Hole Seal, .50	6
7	95273876	Flat Washer, .50	4	12	49874225	Hole Seal, 2.0	1
3	95413696	Lock Washer, .50	4	13	10087716	10087716 Bushing, Conduit, 2.0 x 1.50	1
4	95554416	Hex Nut, 1/2-13	4	14	72129771	72129771 Lock Nut, 2.0	1
5	95750394	Lock Nut, .38	4	15	72129523	Siemens Kit, not shown	1
9	61112970	Hex Nut, 3/8-16	4	16	72130473	72130473 Motor Harness	1
7	49874233	Hole Seal, 1.50	2				
∞	72109459	Harness, Sensor/Solenoid	-				
6	10125912	Cable Tie, .87	10				
10	80080237	Terminal Lug	9				



(1) (1) (4) (1) (1) (1) (1) (1) -- INLET PRESSURE SWITCH CONN DETAIL I (14) (13) BLACK 2 BLACK 1 0 • • **®** (0) (0)27882127 CONN DETAIL II DUMP VALVE CONN DETAIL II
INLET WATER VALVE CONN DETAIL II L RIGHT PROX. SWITCH - GRN/YLW BLACK 1 1 LEFT PROX. SWITCH D (1)(12) OIL LEVEL SWITCH — BLACK 2-CONN DETAIL 60 4-WAY VALVE 'A' — SOLENDID 4-WAY VALVE 'B'-SOLENDID

Figure 12-18: Electrical Assembly



Table 12-19 Electrical Configuration 72124203

			171	C074717/			
	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
_	72124492	Controls Subassembly	1	15	72102288	Overload Relay	
2	72118240	Circuit Breaker, 57-75A	1	16	72109698	Auxiliary Contact	1
3	10075257	Pan Head Screw, 10-32 x 1/2	2	17	10104628	Wire, #14, Black	144.0"
4	72109360	Rotary Drive	1	18	05019617	Connector, Crimp Ferrule, #14	4
5	05019427	Welding Cable, #6	48.0"	19	72135174	Circuit Breaker, 3.2A	1
7	20430277	Ground Lug	2	20	20489290	Power Supply	1
∞	95423596	Hex Head Screw, 1/4-20 x 3/4	2	21	05016407	Wire, #18, Blue	62.0"
6	10157659	Lock Washer, .25	2	22	72109938	Wire, #18, Blue	62.0"
10	20449111	Wire, #6, Green/Yellow	72.0"	23	05016399	Wire, #18, Green/Yellow	62.0"
11	10170355	Connector, Crimp Pin, #6	4	24	10170371	Connector, Crimp Pin, #18	9
12	72109888	Terminal Block	1				
13	72109269	Contactor	1				
14	10073500	Pan Head Screw, 8-32 x 3/4	4				

12-38

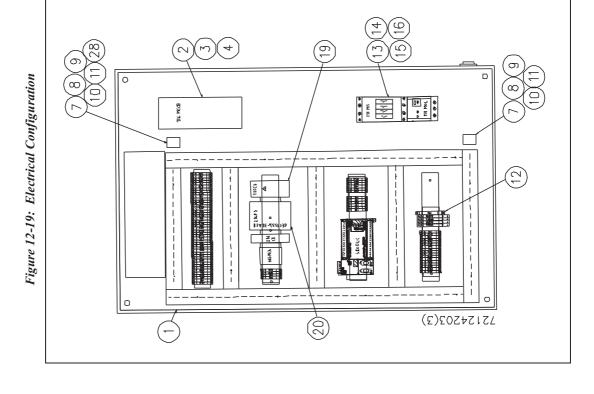




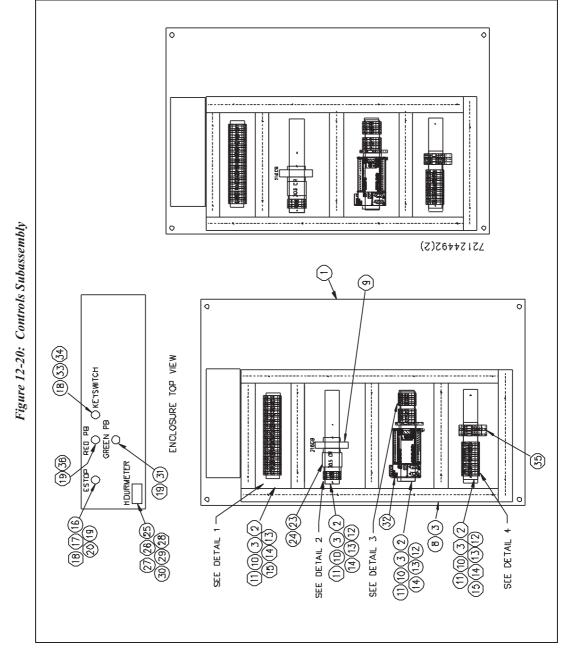


Table 12-20 Controls Subassembly 72124492

	Part				Part		
Item	Number	Description	Quantity	Item	Number	Description	Quantity
П	72109987	Subplate	1	19	72110169	Contact Block	3
7	72109797	DIN Rail	0.62	20	72122907	Contact Block	1
3	10073492	Pan Head Screw, 8-32 x 1/2	34	21	05140926	Wire, #16, Orange	192.0"
4	05016407	Wire, #18, Blue	1,000.0"	22	10185395	Connector, Crimp Ferrule, #16	∞
5	72109938	Wire, #18, Blue/White	1,000.0"	23	72109342	Relay Socket	1
9	05016399	Wire, #18, Green/Yellow	62.0"	24	72109334	Relay, Tube Base	1
7	10170371	Connector, Crimp Pin, #18	300	25	10189355	Hourmeter	1
∞	72122956	Wiring Duct	1.6	26	05000724	Gasket, Hourmeter	1
6	72109292	Circuit Breaker, 6A	1	27	05088356	Pan Head Screw, 6-32 x 3/8	7
10	72109846	Terminal Block	64	28	10069888	Lock Washer, #6	2
11	72109854	End Barrier	12	29	10069946	Hex Nut, #6-32	7
12	72109862	Jumper, Terminal Block	3	30	10099000	Disconnect	2
13	72109821	Marker Card	1	31	72109243	Pushbutton, Green	1
14	72109880	End Block	14	32	72109318	PLC, S7200	1
15	72109839	Terminal Block	11	33	72110177	Selector Switch	1
16	72109664	Pushbutton, E-Stop	1	34	72110185	Adapter, Contact Block	1
17	72109690	Adapter, Contact Block	1	35	72109755	Relay, Interface	4
18	72109672	Contact Block	7	36	72109235	Pushbutton, Red	1

12-40



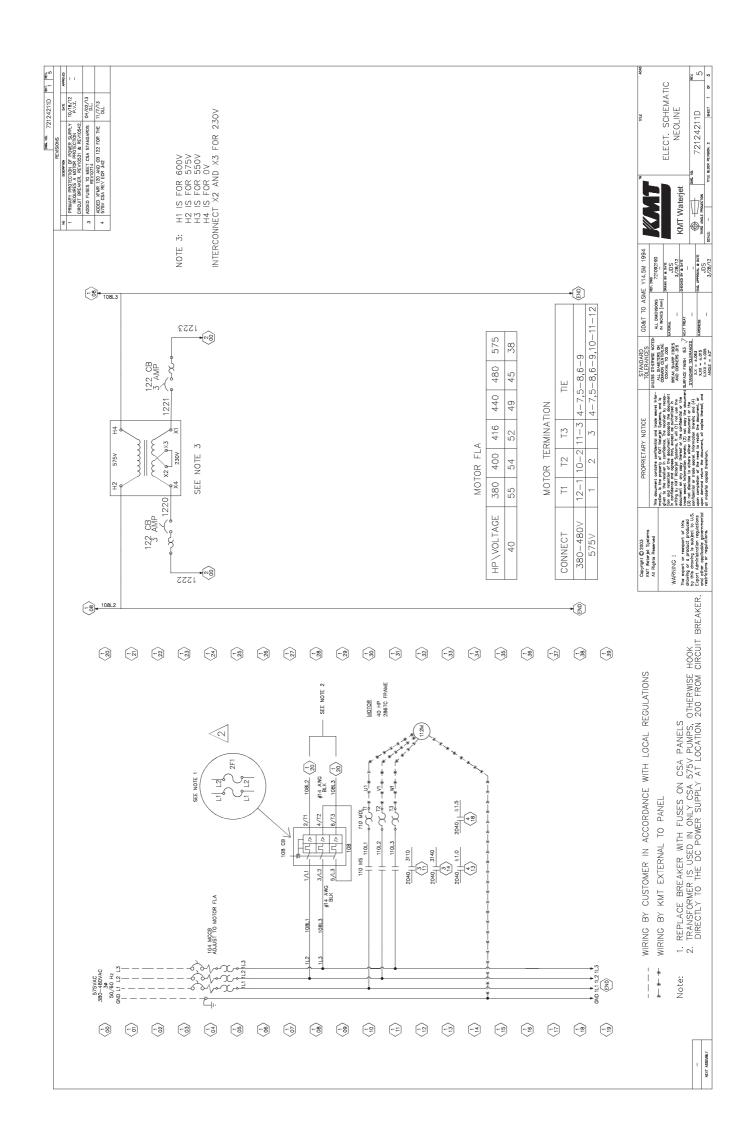


72111192 5-2015/Rev 05



Figure 12-20: Controls Subassembly

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	õ	-	

£2221 -42)•

BLUE W/WHT STRIPE

620

62 49

24VDC CONTROL

(%)

97 (28) (%) ²⁰ 42 $\binom{2}{12}$ 132

24vDC POWER SUPPLY

1222

(g₂) (28)

OPTIONAL REMOTE CONNECTOR

A - 4110 REMOTE STOP

C - 3140 INTENSIFER RUNNING LIGHT

D - 6100 FAULT BIT 0

F - 5140 CHECK INTENSIFIER LIGHT

H - 2040 24 VOLTS

J - 6200 FAULT BIT 1

K - 4160 REMOTE START

M - 3030 REMOTE E-STOP

E - 3031 REMOTE E-STOP
R - 6300 FAULT BIT 2
S - 3061 E-STOP ENGAGED
T - 3040 EMERGENCY STOP
V - 3041 EMERGENCY STOP
X - 3050 EMERGENCY STOP
Z - 6400 FAULT BIT 3
b - 3051 EMERGENCY STOP

- 4050 REMOTE 2-PRESSURE

2131 24 V NEUTRAL

PE GROUND

0110 0111

۵Ο

BIT CODE

FAULT

OF BLINKS

#

BLINK COUNTS AND BIT CODES FOR FAULTS

0010

0011

TOPWORKS OVERSTROKE

RIGHT OVERSTROKE LEFT OVERSTROKE

MOTOR OVERLOAD FAULT 0100 OIL TEMPERATURE FAULT 0101

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NORMAL OPERATION

PRESS STOP TO RESET ALARMS

BOOSTER PRESSURE FAULT 1000

15

<u>4</u>±

 $\overbrace{\overset{1}{16}}^{2}$ ¹22

INLET WATER FAULT

OIL LEVEL FAULT

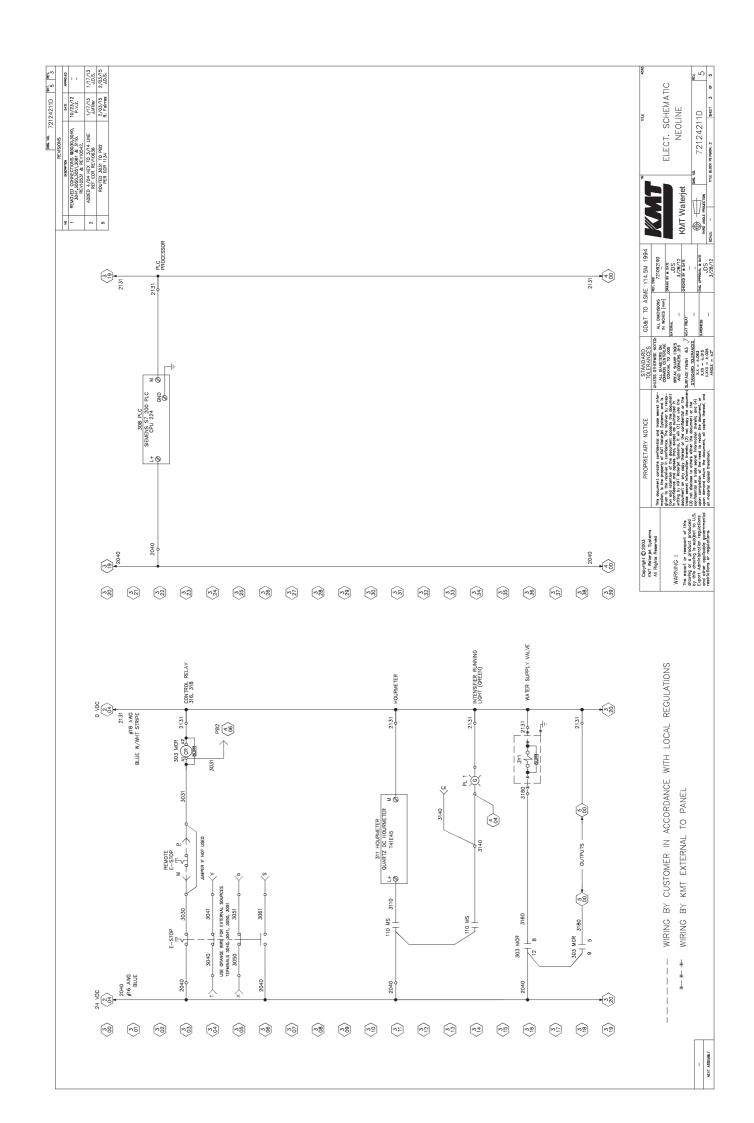
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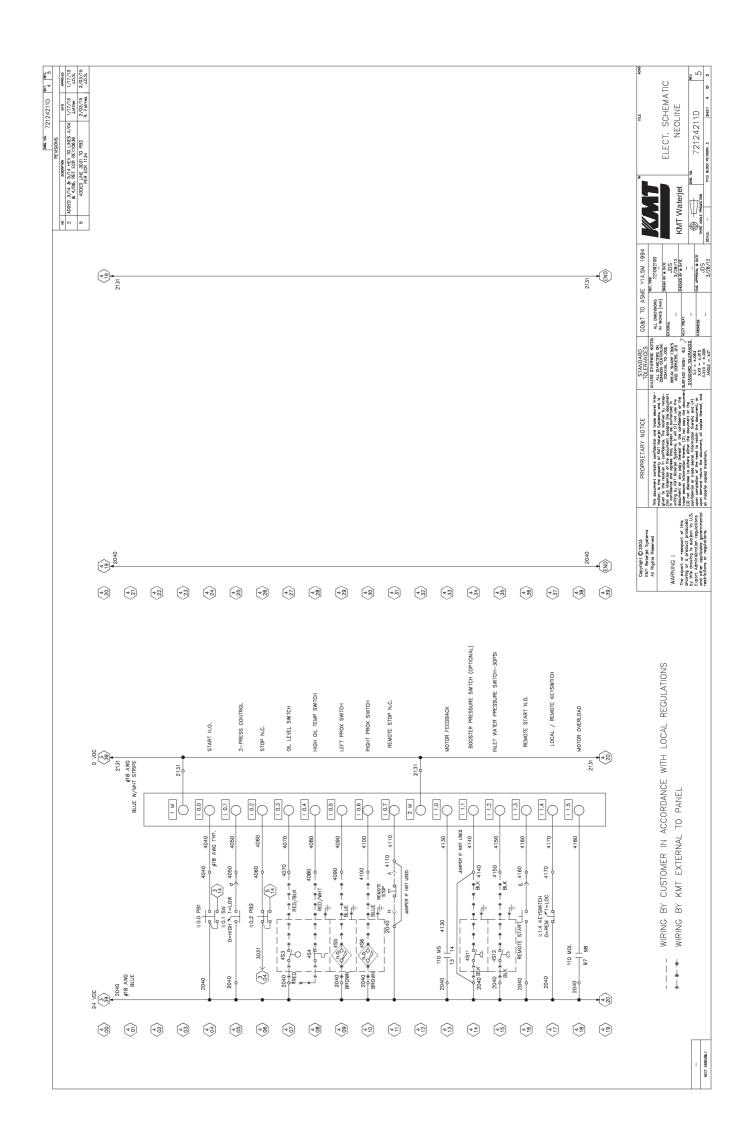
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GD&T TO ASME Y14.5M 1994	REF. DWD 72109219D		DRAWN BY & DATE	SQr	3/28/12	CHECKED BY & DATE	1	1	ENG. APPROVIL & DATE	SCI	0
GD&T TO ASN	ALL DIMENSIONS	IN INCHES [mm]		WATDRUG.	ı	HFLT TREAT			HARDAFSS		1
STANDARD	UNLESS OTHERWISE NOTED:	COMMON CENTERLINE	COAXIAL TO .005	RREAK SHARP FOOTS	AND CORNERS ,015	7 58 HPINT TATE	CTANDARD TO EBALORE	XX - + OBT	100 H - VV	2012 = XYY	XXXX = ±.005
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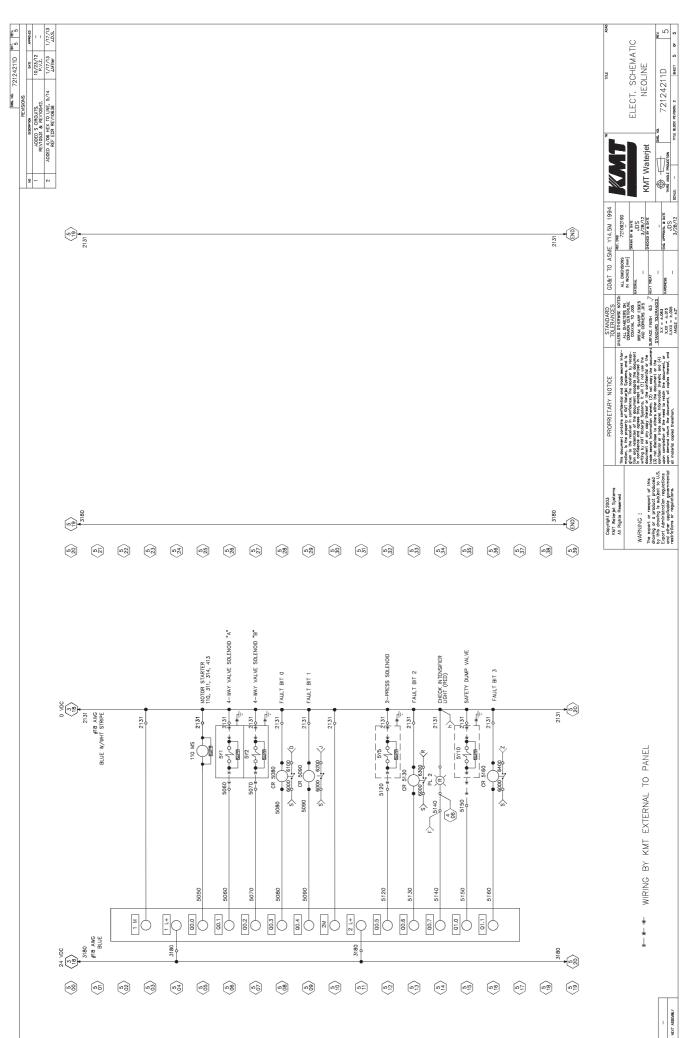
ELECT. SCHEMATIC

KMT Waterjet

72124211D









PURE GOOPTM

November 2003

1. PRODUCT IDENTIFICATION

PURE GOOP: Thread lubricant

Manufactured by: Emergency Contact:

Swagelok Company Chemtrec (800) 424-9300 29500 Solon Road

Solon, Ohio USA 44139 Tel: (440) 248-4600 Fax: (440) 349-5970

2. INGREDIENTS

Ingredients	CAS#	WT%	PEL
Polychlorotrifluoroethylene	9002-83-9	75-85	Not Available
Polytetrafluoroethylene	9002-84-0	15-20	Not Available
Amorphous Silica	7631-86-9	1-5	Not Available

3. HEALTH HAZARD INFORMATION

• European Community Danger Group:..... None

• Special Hazards for man or environment: None

• LD₅₀/LC₅₀ Not Available

Routes of Entry

[Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
	No	No	Yes	Yes	Yes

4. FIRST AID MEASURES

• If inhaled (Overexposure): If person is affected by fumes, remove person to fresh air.

Seek medical attention.

• After contact with skin (Overexposure): Wash thoroughly with soap and water. If severe irritation

develops, seek medical attention.

• After contact with eyes: Rinse thoroughly with water for 15 minutes, seek medical

attention. Do not rub eyes.

• If swallowed: Seek medical attention.

• Medical information: Unlikely to cause ill effects. Inhaling fumes of decomposition

products can cause temporary influenza-like symptoms which are described as "polymer fume fever". Symptoms include

fever, cough, and malaise.

5. FIRE FIGHTING MEASURES

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PURE GOOPTM

November 2003

Suitable extinguishing agents: Carbon dioxide, foam, agent suitable for environment.

• Not suitable for safety reasons: None known.

 Special dangers caused by substance preparation itself, by combustion products or gases formed: May decompose above $500^{\circ}\text{F}/260^{\circ}\text{C}$ to produce organo-chlorine compounds, organo-fluorine compounds, hydrogen fluoride, and

chlorine gas.

Additional information: None.

Auto ignition	UEL	LEL	Sensitivities
Not Applicable	Not Available	Not Available	Not Available

6. ACCIDENTAL RELEASE MEASURES

• Measures for protection of people: Put on necessary protective equipment. Eye and hand protection as

needed.

• Measures for protection of the

environment: None required.

• Cleaning measures: Use absorbent material and suitable cleaner.

• Additional information: None.

7. HANDLING AND STORAGE

• Safety information: None.

• Information on protection from fire: May decompose above 500°F/260°C to produce organo-chlorine

compounds, organo-fluorine compounds, hydrogen fluoride, and

chlorine gas.

Additional information: Store in a cool, dry place for optimal product performance.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Precautionary measures to protect

employees: None required.
Respiratory protection: None required.

• Hand protection: Rubber gloves are recommended to minimize exposure.

Eye protection: Safety glasses or goggles are recommended to minimize exposure.

• Skin protection: Wash hands after use.

KMT 20416083 Page 2 of 4



PURE GOOPTM

November 2003

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance Odor **Density** Vapor Pressure pH Opaque-white Not Applicable 2.1 gm/cm^3 -<0.01mm Hg Neutral **Boiling Point Melting Point Flash Point Flammability Explosive** Not Available Not Available Not Available Not Available Not Applicable

10. STABILITY AND REACTIVITY

• Conditions to avoid: May decompose above 500°F/260°C to produce organo-chlorine or

compounds, organo-fluorine compounds, hydrogen fluoride, and chlorine

gas.

Materials to avoid: Sodium, potassium, barium, calcium, finely divided zinc,

aluminum, magnesium, and beryllium. Avoid aluminum-threaded connections where galling and seizure may initiate a reaction. Reacts

with amines, liquid fluorine, and liquid chlorine trifluoride.

• Hazardous decomposition products: See Sections 4 and 5.

11. TOXICOLOGICAL INFORMATION

Acute toxic properties: None known.

• Health effects: See Sections 4 and 5.

• Additional health effects: None known.

		Reproductive		Synergistic	
Sensitization	Teratogenicity	Toxicity	Mutagenicity	Products	Carcinogenicity
Not Available	Not Available	Not Available	Not Available	Not Available	Listed ingredients are not suspected carcinogens according to NTP, and IARC

12. ECOLOGICAL INFORMATION

Mobility: Paste-like viscosity.Degradability: Not established.

Accumulation: No known adverse bioaccumulation or biomagnification effects.

• Short / Long term effects

on ecotoxicity: No known ecological effects.

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PURE GOOPTM

November 2003

13. DISPOSAL CONSIDERATIONS

Appropriate methods of disposal: Unused product not considered a hazardous waste in the United States.

Dispose of in a responsible manner.

• European Community(EC)

considerations: Use appropriate waste codes based on ingredients.

14. TRANSPORT INFORMATION

Transport precautions: Consult applicable regulations when transporting this product

Additional information: None.

15. REGULATORY INFORMATION

EC regulations: This product has been classified under CHIP-96 guidelines based on

chemical content.

US/Canadian regulation listings: SARA 313 - NO, TSCA - YES, Canada's Controlled Products - NO

EC Relevant risk: None.

• EC Relevant safety: S: 37/39 - Wear suitable gloves and eye/face protection.

S:20 - When using do not eat or drink.

• Additional information: Consult country codes for specific requirements.

16. OTHER INFORMATION

• Further information contact:

• Sources of information used to compile document:

in a responsible manner.

Your Swagelok Distributor or the contacts listed in Section 1 of this sheet. Properties of individual ingredients were used to compile this document. This Material Safety Data Sheet was designed to give the distributors and users of PURE GOOP information to handle and use the product

	Preparation Data	
Environmental and Safety Department	(440) 349-5955	November 2003

KMT 20416083 Page 4 of 4



Material Safety Data Sheet



OTHER

Revision Date: 12/10/2004 Issue date: 12/13/2004

CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name: Loctite(R) 222 Threadlocker Low Strength

Product Use: Sealant Company address: Henkel Canada, Inc. 2255 Meadowpine Boulevard Mississauga, Ontario L5N 7P2 Item No.: 21464 Region: Canada **Contact Information:** Telephone: 905.814.6511 Emergency telephone: 905.814.6511

OCHA DEI

Internet: www.loctite.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

ACCILI TI V

Polyglycol dimethacrylate 25852-47-5	<u>%</u> 30-60	None	None	<u>OTHER</u> None
Polyglycol oleate 9004-96-0	30-60	None	None	None
Silica, amorphous, treated 68909-20-6	5-10	10 mg/m³ (Inhal)	20mppcf	6 mg/m³
Saccharin 81-07-2	1-5	None	None	None
Propylene glycol 57-55-6	1-5	None	None	None
Cumene hydroperoxide 80-15-9	1-5	None	None	1 ppm (6 mg/m³) Skin (WEEL)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Physical state: Liquid WHMIS hazard class: D.2.B

Color: Purple Mild Odor:

WARNING: CAUSES EYE IRRITATION.

MAY CAUSE ALLERGIC SKIN REACTION.

MAY CAUSE SKIN IRRITATION.

MAY CAUSE RESPIRATORY TRACT IRRITATION.

Relevant routes of exposure: Skin, Inhalation, Eyes

Potential Health Effects

Inhalation: May cause respiratory tract irritation.

Skin contact: May cause allergic skin reaction. May cause skin irritation.

Eye contact: Contact with eyes will cause irritation. Ingestion: Not expected to be harmful by ingestion.

Existing conditions aggravated by

exposure:

Eye, skin, and respiratory disorders.

See Section 11 for additional toxicological information.

Product name: Loctite(R) 222 Threadlocker Low Strength Item No.: 21464

4. FIRST AID MEASURES

Inhalation: Remove to fresh air. If symptoms develop and persist, get medical attention.

Skin contact: Wash with soap and water. Remove contaminated clothing and shoes. Wash clothing before reuse.

Get medical attention if symptoms occur.

Eye contact: Flush with copious amounts of water, preferably, lukewarm water for at least 15 minutes, holding

eyelids open all the time. Get medical attention.

Ingestion: Do not induce vomiting. Keep individual calm. Obtain medical attention.

5. FIRE-FIGHTING MEASURES

Flash point: Greater than 93°C (200°F) Tagliabue closed cup

Autoignition temperature: Not available

Flammable/Explosive limits-lower %: Not available

Flammable/Explosive limits-upper %: Not available

Extinguishing media: Foam, dry chemical or carbon dioxide.

Special fire fighting procedures: Wear self-contained breathing apparatus and full protective clothing, such as turn-out gear.

Unusual fire or explosion hazards: None

Hazardous combustion products: Oxides of carbon. Oxides of sulfur. Oxides of nitrogen. Irritating organic vapors.

Sensitivity to mechanical impact: Not available.

Sensitivity to static discharge: Not available.

6. ACCIDENTAL RELEASE MEASURES

Environmental precautions: Prevent product from entering drains or open waters.

Clean-up methods: Soak up with inert absorbent. Store in a partly filled, closed container until disposal.

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes, skin and clothing. Avoid breathing vapor and mist. Wash thoroughly after

handling. Use only with adequate ventilation.

Storage: For safe storage, store at or below 38°C (100°F). Keep in a cool, well ventilated area away from heat,

sparks and open flame. Keep container tightly closed until ready for use.

Incompatible products: Refer to Section 10.

For information on product shelf life contact Loctite Canada Customer Service at (905) 814-6511.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: No specific ventilation requirements noted, but forced ventilation may still be required if concentrations

exceed occupational exposure limts.

Respiratory protection: Use NIOSH approved respirator if there is potential to exceed exposure limit(s).

Item No.: 21464 Product name: Loctite(R) 222 Threadlocker Low Strength

2 of 5

Skin protection: Use impermeable gloves and protective clothing as necessary to prevent skin contact. Neoprene

gloves. Butyl rubber gloves. Natural rubber gloves.

Eye/face protection: Safety goggles or safety glasses with side shields.

See Section 2 for exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid
Color: Purple
Odor: Mild

Odor Threshold: Not available

Vapor pressure: Less than 5 mm Hg at 27°C (80°F)

pH: Not applicable

Boiling point/range: Greater than 149°C (300°F)

Melting point/range:

Specific gravity:

Vapor density:

Evaporation rate:

Solubility in water:

Partition coefficient (n-octanol/water):

Not available

Not available

Slight

Not available

VOC content: 11.8%; 127 grams/liter (EPA Method 24)

10. STABILITY AND REACTIVITY

Stability: Stable.

Hazardous polymerization: Will not occur.

Hazardous decomposition products: Oxides of carbon. Oxides of sulfur. Oxides of nitrogen. Irritating organic vapors.

Incompatability: Strong oxidizers.

Conditions to avoid: See "Handling and Storage" (Section 7) and "Incompatability" (Section 10).

11. TOXICOLOGICAL INFORMATION

Product toxicity data: Acute oral LD50 greater than 10, 000 mg/kg (rat). Acute dermal LD50 greater than 5000 mg/kg (rabbit).

Toxicologically synergistic products: Not available.

Refer to the following for Irritancy of Product, Sensitization to Product, Carcinogenicity, Reproductive Toxicity, Teratogenicity, and Mutagenicity.

Ingredient Toxicity Data & Carcinogen Status

Hazardous components	LD50s & LC50s	Other LD50s	NTP	IARC	OSHA	ACGIH -
	(NIOSH):	and LC50s:	Carcinogen	Carcinogen	Carcinogen	Carcinogens
Polyglycol dimethacrylate 25852-47-5	None	None	No	No	No	No
Polyglycol oleate 9004-96-0	Oral LD50 (Mouse) > 25 g/kg	None	No	No	No	No
Silica, amorphous, treated 68909-20-6	None	None	No	No	No	No
Saccharin 81-07-2	Oral LD50 (Mouse) = 17 g/kg	None	No	No	No	No

Item No.: 21464 Product name: Loctite(R) 222 Threadlocker Low Strength

Propylene glycol	Oral LD50 (Rat)	None	No	No	No	No
57-55-6	= 20 g/kg					
	Dermal LD50					
	(Rabbit) = 20800					
	mg/kg					
	Oral LD50					
	(Mouse) = 22					
	g/kg					
Cumene hydroperoxide	Inhalation LC50	None	No	No	No	No
80-15-9	(Mouse) = 200					
	ppm					
	Inhalation LC50					
	(Rat) = 220 ppm					
	Oral LD50 (Rat)					
	= 382 mg/kg					

Literature Referenced Target Organ & Other Health Effects

Hazardous components	Health Effects/Target Organs	
Polyglycol dimethacrylate 25852-47-5	Allergen, Irritant	
Polyglycol oleate 9004-96-0	Irritant	
Silica, amorphous, treated 68909-20-6	No Target Organs	
Saccharin 81-07-2	No Target Organs	
Propylene glycol 57-55-6	Irritant	
Cumene hydroperoxide 80-15-9	Allergen, Central nervous system, Corrosive, Irritant, Mutagen	

12. ECOLOGICAL INFORMATION

Ecological information: Not available

13. DISPOSAL CONSIDERATIONS

Information provided is for unused product only.

Recommended method of disposal: Dispose of in accordance with federal and local regulations.

14. TRANSPORT INFORMATION

Canada Transportation of Dangerous Goods - Ground:
Proper shipping name:
Unrestricted

Proper shipping name: Unrestrict
Hazard class or division: None
Identification number: None
Packing group: None

International Air Transportation (ICAO/IATA):

Proper shipping name: Unrestricted Hazard class or division: None Identification number: None Packing group: None

WaterTransportation (IMO/IMDG):

Proper shipping name: Unrestricted Hazard class or division: None Identification number: None Packing group: None Marine pollutant: None

Item No.: 21464 Product name: Loctite(R) 222 Threadlocker Low Strength

15. REGULATORY INFORMATION

Canada Regulatory Information

CEPA DSL/NDSL Status: All components are listed on or are exempt from listing on the Domestic Substances List.

United States Regulatory Information

TSCA 8 (b) Inventory Status: All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.

16. OTHER INFORMATION

This material safety data sheet contains changes from the previous version in sections: New Material Safety Data Sheet format.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Product Regulations.

Prepared by: Kyra Kozak Woods, Health and Regulatory Affairs Specialist

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Item No.: 21464 Product name: Loctite(R) 222 Threadlocker Low Strength 5 of 5

	SECTION 1 – PRO			
Product Name: JL-M Lubricant	SECTION 1-1 RO	Manufacturer's Nan		
	ercedes: 03/17/00		ress: 1000 Gregg Str	eet
Prepared by: C. Semerod	03/1//00	Manufacturer 5 Aug	Carnegie, PA 1	
Emergency Information: (412) 279-1149		Manufacturer's Pho		3100
	SECTION 2 – HAZAF			
CHEMICAL NAME:	CAS NO.:	OSHA PEL:	ACGIH TLV:	(STEL)
Molybdenum Disulfide	1317-33-5	10 mg/m3	10 mg/m3	N/A
Silica, Fused	60676-86-0	0.1 mg/m3	0.1 mg/m3	N/A N/A
Graphite	7782-42-5	0.1 mg/ms	2 mg/m3	N/A
Silica, Crystalline	14808-60-7		0.1 mg/m3	N/A N/A
Lubricating Oils, Petroleum,	64742-58-1	5 mg/m3*	5 mg/m3*	10mg/m3*
Hydrotreated, Spent	04/42-30-1	5 mg/m3	3 mg/m3	Tomg/m3
Residual Oils (Petroleum),	64742-62-7	5 mg/m3*	5 mg/m3*	10 mg/m3*
Solvent Dewaxed	01712 02 7	c mg me	c mg me	ro mg/ me
Solvent-Refined Heavy Paraffinic	64741-88-4	5 mg/m3*	5 mg/m3*	10 mg/m3*
Distillate (Petroleum)		g	g	g
Solvent –Dewaxed Hydrotreated	64742-65-0	5 mg/m3*	5 mg/m3*	10 mg/m3*
Heavy Paraffinic Distillate (Petroleum)		g	g	g
Hydrotreated Heavy Paraffinic	64742-54-7	5 mg/m3*	5 mg/m3*	10 mg/m3*
Distillate (Petroleum)		g	g	- 1 g
Proprietary Additives Mixture (<1%)				
(*) Designates limits set by OSHA and the	ACGIH for oil mist. This pro	duct is sold in a paste fo	orm so misting should	not occur.
SECTION 3 – PHYSIC				PLOSION DATA
Appearance and Odor: Dark Grey Paste,		Flash Point: 338 degr		
Boiling Point: > 500 degrees F		Lower Explosive Lim		
% Volatile: 0%		Upper Explosive Limit: N/A		
Vapor Density: > 1 (Air = 1)		Extinguishing Media: Carbon Dioxide, Regular Foam, Dry Chemical		
Evaporation Rate: < 1 (Ether = 1)		Special Fire Fighting Procedures: Fire may produce dense smoke,		
Specific Gravity: 4.8 (Water = 1)		firefighters should wear self contained breathing apparatus. Use		
Vapor Pressure: Essentially 0 (mm Hg)		water to cool fire ex	posed containers.	9 11
Solubility in Water: Insoluble		Unusual Fire & Expl	osion Hazards: Decon	position and combustion
pH: N/A	by-products may be	toxic. Heated contain	ers may rupture or explode	
SECTION 5 – REACTI	VITY DATA	SECTIO	N 6 – STORAGE	& HANDLING
Stability: Stable Hazardous Polyme	rization: Will not occur.	Handling Precautions	s: Use good personal h	ygiene practices. Clean
Incompatibility: Avoid contact with oxidi	zing agents, heat, sparks or	contaminated cloth	ing and protective equ	ipment before reuse.
flame.				
Hazardous Combustion By-Products: Car		Storage Precautions:	Store in a cool dry loo	cation. Keep container
Dioxide, Aldehydes, and Nitrogen Oxide	s	tightly closed when r	ot in use and during t	ransport. Keep away from
Hazardous Decomposition: Thermal deco	mposition may yield	open sparks or flame	es.	
methacrylate monomers.				
	SECTION 7 – HE	EALTH HAZARDS	9	
Effects of Overexposure:		First Aid Procedures		
Skin: May Cause Irritation			_	n irritated area. Flush
Eyes: Eye Irritant. May cause rednes	s and Blurred vision.		mild soap and water.	Seek medical attention if
Ingestion: Not Expected		irritation persists.		
Inhalation: Not Expected (Chronic res	piratory diseases may be			vater, holding eyelids open.
aggravated by dust exposure.)		Seek medical attention if irritation persists.		
NFPA CODES: Health: 1				ntaneous vomiting occurs,
Flammability: 1		_		n into the lungs. Seek
Reactivity: 0		immediate medica		1. 1
Carcinogenicity: Silica is a suspected card			to fresh air. Obtain n	iedical attention if
form by the IARC and NTP however, not		necessary.		
SECTION 8 – SPECIAL I				SAL PROCEDURES
	nield			pilled material. Wear
Eye Protection: Safety Glasses or Face Sl				•••
Protective Gloves: Recommended		proper protective e		
Protective Gloves: Recommended Respiratory Protection: Avoid breathing		Disposal Procedures	Dispose of in accorda	ng up a spill. ance with any applicable
Protective Gloves: Recommended	IA limits.	Disposal Procedures federal, state, or loc	Dispose of in accorda	

The information in this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any representation or warranty, expressed or implied, regarding the accuracy or correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with the handling, storage, use or disposal of the product.



Section 1

PRODUCT NAME OR NUMBER:

LUBRIPLATE Super FML-0, FML-1, FML-2

GENERIC/CHEMICAL NAME: Petroleum Lubricating Grease

Manufacturer's Name: Fiske Brothers Refining Co.

1500 Oakdale Ave., Toledo, Ohio 43605 - 129 Lockwood St., Newark, NJ 07105

FORMULA:

Calcium Soap, USP Mineral Oil and Additives

NSF Registration No's:

125742, 125740, 125741

Emergency Telephone Number: 1-800-255-3924 - CHEM-TEL (24 hour)

Telephone Number for Information:

419-691-2491 - Toledo Office

Section 2 - Hazardous Ingredients/Identity Information

Hazardous Components OSHA PEL ACGIH TLV Other Limits Recommended % (optional)

Non-hazardous

Address:

Hazardous Material Identification System (HMIS): Health - 1, Flammability - 1,

Not a Controlled Product under (WHMIS) - Canada

ammability - 1, Reactivity - 0

Special Protection: See Section 9

Section 3 - Health Hazard Data

Threshold Limit Value: 5 mg/m³ for oil mist in air. OSHA Regulation 29 CFR 1910.1000

Effects of Overexposure: Prolonged or repeated skin contact may cause skin irritation. Product contacting the eyes may cause eye irritation. Human health risks vary from person to person. As a precaution, exposure to liquids, vapors, mists and fumes should be minimized. This product has a low order of acute oral toxicity, but minute amounts aspirated into the lungs during ingestion may cause mild

to severe pulmonary injury.

Carcinogenicity: NTP? No IARC Monographs? No OSHA Regulated? No

Section 4 - Emergency and First Aid Procedures

EYE CONTACT: Flush with clear water for 15 minutes or until irritation subsides. If irritation persists, consult a physician.

SKIN CONTACT: Remove any contaminated clothing and wash with soap and warm water. If injected by high pressure under skin, regardless of the appearance or its size, contact a physician IMMEDIATELY. Delay may cause loss of affected part of the body.

<u>INHALATION</u>: Vapor pressure is very low and inhalation at room temperature is not a problem. If overcome by vapor from hot product, immediately remove from exposure and call a physician.

INGESTION: If ingested, call a physician immediately. Do not induce vomiting.

Section 5 - Fire and Explosion Hazard Data

Flash Point (Method Used): COC - 435°F Flammable Limits: LEL 0.9% UEL 7.0%

Extinguishing Media: Foam, Dry Chemical, Carbon Dioxide or Water Spray (Fog)

Special Fire Fighting Procedures: Cool exposed containers with water. Use air-supplied breathing equipment for

enclosed or confined spaces.

Unusual Fire and Explosion Hazards: Do not store or mix with strong oxidants. Empty containers retain residue.

Do not cut, drill, grind, or weld, as they may explode.

PRODUCT NAME OR NUMBER - LUBRIPLATE Super FML-0, FML-1, FML-2

Section 6 - Physical/Chemical Characteristics

Boiling Point: $>550^{\circ}$ F **Specific Gravity (H _2O = 1):** 0.90 - 0.91

Vapor Pressure (mm Hg.): <0.01 Melting Point: Semi-solid

Vapor Density (AIR = 1): >5 Evaporation Rate: <0.01

(Butyl Acetate = 1)

Solubility in Water: Negligible

Appearance and Odor: Smooth, white grease with mineral oil odor.

Section 7 - Reactivity Data

Stability: Unstable Conditions to Avoid: N/A

Stable X

Incompatibility (Materials to Avoid): Avoid contact with strong oxidants like liquid chlorine, concentrated oxygen.

Hazardous Decomposition or Byproducts: May form SO 2. If incomplete combustion, Carbon Monoxide.

Hazardous Polymerization: May Occur Conditions to Avoid: N/A

Will Not Occur X

Section 8 - Spill or Leak Procedures

Steps to be taken in case material is released or spilled:

Scrape up grease, wash remainder with suitable petroleum solvent or add absorbent. Keep petroleum products out of sewers and watercourses. Advise authorities if product has entered or may enter sewers and watercourses.

Waste disposal method:

Assure conformity with applicable disposal regulations. Dispose of absorbed material at an approved waste disposal facility or site.

SARA/TITLE III, Section 313 Status - Zinc Compounds - <6%

Section 9 - Special Protection Information

Respiratory Protection (Specify type): Normally not needed

Ventilation Local Exhaust: Used to capture fumes and vapors Special: N/A

Mechanical (General) Other: N/A

Protective Gloves: Use oil-resistant gloves, if needed. **Eye Protection:** If chance of eye contact, wear goggles.

Other Protective Equipment: Use oil-resistant apron, if needed.

Section 10 - Special Precautions

Precautions to be taken in handling and storing:

Keep containers closed when not in use. Do not handle or store near heat, sparks, flame, or strong oxidants.

Other Precautions:

Remove oil-soaked clothing and launder before reuse. Cleanse skin thoroughly after contact.

The above information is furnished without warranty, expressed or implied, except that it is accurate to the best knowledge of Fiske Brothers Refining Company. The data on these sheets relates only to the specific material designated herein. Fiske Brothers Refining Company assumes no legal responsibility for use or reliance upon this data.

Date Prepared: January, 2006 Prepared by: James R. Kontak

KMT 20416107







Hydraulic AW (All Grades)

Material Safety Data Sheet

 Product and Company Identificati 	١.	Product	and	Company	Identification
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Product Name: Hydraulic AW (All Grades)

MSDS Number: 778830

Synonyms: Hydraulic AW 32

Hydraulic AW 46 Hydraulic AW 68 Hydraulic AW 100

Intended Use: Hydraulic Fluid

Manufacturer/Supplier: ConocoPhillips Lubricants

600 N. Dairy Ashford, 2W900 Houston, Texas 77079-1175

Emergency Health and Safety Number: Chemtrec: 800-424-9300 (24 Hours)

Customer Service: U.S.: 800-822-6457 or International: +1-83-2486-3363

Technical Information: 800-766-0050

MSDS Information: Internet: http://w3.conocophillips.com/NetMSDS/

2. Hazards Identification

Emergency Overview

NFPA

This material is not considered hazardous according to OSHA criteria.



Appearance: Clear and bright Physical Form: Liquid Odor: Petroleum

Potential Health Effects

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Contact may cause mild skin irritation including redness and a burning sensation. Prolonged or repeated contact can defat the skin, causing drying and cracking of the skin, and possibly dermatitis (inflammation). No harmful effects from skin absorption are expected.

Inhalation (Breathing): No information available on acute toxicity.

Ingestion (Swallowing): No harmful effects expected from ingestion.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract, nausea and diarrhea. Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.

Pre-Existing Medical Conditions: Conditions which may be aggravated by exposure include skin disorders.

See Section 11 for additional Toxicity Information.

778830 - Hydraulic AW (All Grades)

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KMT 72134505

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Status: Final

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Date of Issue: 27-Jan-2009 Status: Final

3. Composition / Information on Ingredients

Component	CASRN	Concentration*
Lubricant Base Oil (Petroleum)	VARIOUS	>99
Additives	PROPRIETARY	<1

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4. First Aid Measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If symptoms persist, seek medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Notes to Physician: High-pressure hydrocarbon injection injuries may produce substantial necrosis of underlying tissue despite an innocuous appearing external wound. These injuries often require extensive emergency surgical debridement and all injuries should be evaluated by a specialist in order to assess the extent of injury. Early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities.

5. Fire-Fighting Measures

NFPA 704 Hazard Class

Health: 0 Flammability: 1 Instability: 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of sulfur, nitrogen or phosphorus may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

6. Accidental Release Measures

Personal Precautions: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. The use of explosion-proof electrical equipment is recommended. Stay upwind and away from spill/release. Notify persons and shipping down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8).

^{*} All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

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Environmental Precautions: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

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Methods for Containment and Clean-Up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents).

7. Handling and Storage

Precautions for safe handling: Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment.

High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing of high pressure hydraulic oil equipment.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Conditions for safe storage: Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Keep container(s) tightly closed. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Storage temperatures above 113°F may lead to thermal decomposition, resulting in the generation of hydrogen sulfide and other sulfur containing gases.

8. Exposure Controls / Personal Protection

Component	US-ACGIH	OSHA	Other
Lubricant Base Oil (Petroleum)	TWA: 5mg/m ³	TWA: 5 mg/m ³	
	STEL: 10 mg/m ³	as Oil Mist, if generated	
	as Oil Mist, if generated	_	

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Suggested protective materials: Nitrile.

Respiratory Protection: Where there is potential for airborne exposure above the exposure limit a NIOSH certified air purifying respirator equipped with R or P95 filters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health (IDLH).

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

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9. Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

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Appearance: Clear and bright

Physical Form: Liquid Petroleum Odor: **Odor Threshold:** No data Not applicable pH: Vapor Pressure: <1 mm Hg Vapor Density (air=1): >1 **Boiling Point/Range:** No data <15.8°F / <-9°C **Melting/Freezing Point:**

Pour Point: <15.8°F / <-9°C Solubility in Water: Insoluble Partition Coefficient (n-octanol/water) (Kow): No data

Specific Gravity: 0.87 - 0.89 @ 60°F (15.6°C)

Bulk Density: 7.2 - 7.4 lbs/gal

Viscosity: 5.2 - 10.5 cSt @ 100°C; 30 - 110 cSt @ 40°C

Evaporation Rate (nBuAc=1): No data

Flash Point: >320°F / >160°C

Test Method: Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010

LEL (vol % in air):No dataUEL (vol % in air):No dataAutoignition Temperature:No data

10. Stability and Reactivity

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Extended exposure to high temperatures can cause decomposition.

Materials to Avoid (Incompatible Materials): Avoid contact with oxidizing agents and reducing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

11. Toxicological Information

Chronic Toxicity:

Lubricant Base Oil (Petroleum)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including severe hydrocracking/hydroprocessing to reduce aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

Acute Toxicity:

Component	Oral LD50	Dermal LD50	Inhalation LC50
Lubricant Base Oil (Petroleum)	>5 g/kg	>2 g/kg	No data

12. Ecological Information

Ecotoxicity: Experimental studies show that acute aquatic toxicity values are greater than 1000 mg/l. These values are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon compositions.

778830 - Hydraulic AW (All Grades) **Date of Issue:** 27-Jan-2009

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Mobility: Volatilization to air is not expected to be a significant fate process due to the low vapor pressure of this material. In water, base oils will float and spread over the surface at a rate dependent upon viscosity. There will be significant removal of hydrocarbons from the water by sediment adsorption. In soil and sediment, hydrocarbon components will show low mobility with adsorption to sediments being the predominant physical process. The main fate process is expected to be slow biodegradation of base oil components in soil and sediment.

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Persistence and degradability: The hydrocarbons in this material are not readily biodegradable, but since they can be degraded by microorganisms, they are regarded as inherently biodegradable.

Bioaccumulation Potential: Log Kow values measured for the hydrocarbon components of this material range from 4 to over 6, and therefore regarded as having the potential to bioaccumulate. In practice, metabolic processes may reduce bioconcentration.

13. Disposal Considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

This material under most intended uses would become "Used Oil" due to contamination by physical or chemical impurities. Whenever possible, Recycle Used Oil in accordance with applicable federal and state or local regulations. Container contents should be completely used and containers should be emptied prior to discard.

14. Transportation Information

U.S. Department of Transportation (DOT)

Shipping Description: Not regulated

Note: If shipped by land in a packaging having a capacity of 3,500 gallons or more, the

provisions of 49 CFR, Part 130 apply. (Contains oil)

International Maritime Dangerous Goods (IMDG)

Shipping Description: Not regulated

Note: U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 25.

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #: Not regulated

Note: U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 24.

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:			
Max. Net Qty. Per Package:			

15. Regulatory Information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: No
Chronic Health: No
Fire Hazard: No
Pressure Hazard: No
Reactive Hazard: No

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CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

Component	Concentration*	de minimis
Zinc Compound(s)	<1.5	1.0%

EPA (CERCLA) Reportable Quantity (in pounds):

This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65:

This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class None

National Chemical Inventories:

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA. All components are either on the DSL, or are exempt from DSL listing requirements.

U.S. Export Control Classification Number: EAR99

16. Other Information

Date of Issue: 27-Jan-2009 Status: Final

Revised Sections or Basis for Revision: Product Name / Synonyms (Section 1)

Physical Properties (Section 9) Regulatory information (Section 15)

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MSDS Number: 778830

Guide to Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; IARC = International Agency for Research on Cancer; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:

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SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION
PRODUCT IDENTIFICATION:: GERALYN AW 68
MANUFACTURER IDENTIFICATION Company Name : FUCHS LUBRICANTS CO. Address : 17050 LATHROP AVE. HARVEY IL 60426 Telephone : 708-333-8900 Emergency Contact : Regulatory Compliance Department Emergency Telephone : 708-333-8900 (8am - 5pm CST, M-F) 800-255-3924 (24 Hours)
MSDS PRINT DATE : 07/26/2007
* EMERGENCY OVERVIEW This product is a liquid that is insoluble in water. Direct eye contact may cause minor, short term irritation. Short term skin exposure is not expected to be irritating. Inhalation and ingestion are not anticipated routes of exposure during normal conditions of use. * HMIS Rating: Health- 1 Flammability- 1 Reactivity- 0 PPE- X
SECTION 2 - COMPONENT DATA
Components listed in this section may contribute to the potential hazards associated with exposure to the concentrate. The product may contain additional non-hazardous or trade-secret components.
Mineral Oil Cas#: proprietary Percent: > 90 Exposure Limit: ACGIH TLV: 5 mg/m3 (as mist) ACGIH STEL: 10 mg/m3 (as mist) OSHA PEL: 5 mg/m3 (as mist)
- Carcinogenic Components: This product contains no carcinogens.
SECTION 3 - HAZARDS IDENTIFICATION
DOTENTIAL BEALTH FEFFOTS and SYMDTOMS from SHORT TERM/ACTITE EYDOSIDE.

POTENTIAL HEALTH EFFECTS and SYMPTOMS from SHORT TERM/ACUTE EXPOSURE:

- EYE EXPOSURE This product is not expected to cause eye irritation under normal conditions of use. Symptoms of slight eye irritation may result when direct contact occurs, or when exposed to high mist levels in poorly ventilated areas.
- SKIN EXPOSURE -Short term skin contact is not expected to cause skin irritation. Prolonged or repeated direct exposure to the skin may result in



PRODUCT NAME: GERALYN AW 68

symptoms of irritation and redness. In severe cases, prolonged or repeated contact may result in dermatitis accompanied by symptoms of irritation, itching, dryness, cracking and/or inflammation.

- INHALATION -

This product has low volatility and so is not expected to cause respiratory tract irritation during normal conditions of use. Exposure to high mist levels in poorly ventilated areas may cause upper respiratory tract irritation and difficulty breathing.

- INGESTION -

Ingestion may cause slight stomach irritation and discomfort.

POTENTIAL CHRONIC HEALTH EFFECTS:

No further data known.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

No further data known.

CARCINOGENICITY:

This product is not listed as a known or suspected carcinogen by IARC, OSHA, or the NTP.

SECTION 4 - FIRST AID MEASURES

EYE CONTACT:

Upon direct eye contact, hold eyelids open and flush with a steady, gentle stream of water for at least 15 minutes. If irritation is due to exposure to mist or vapors, remove the individual to fresh air. If irritation persists, flush the eyes with clean water until the irritation subsides. If symptoms persist, contact a physician.

SKIN CONTACT:

Remove product from the skin by washing with a mild soap and water. Contaminated clothing should be removed to prevent prolonged exposure. If symptoms of exposure persist, contact a physician.

INHALATION:

Inhalation is not an expected route of exposure. If respiratory irritation or distress occurs, remove the employee to fresh air. Contact a physician or other medical professional if irritation or distress persists.

INGESTION:

If small amounts are ingested, first aid measures are not likely to be necessary. If larger amounts are ingested or if symptoms of ingestion occur, dilute stomach contents with two glasses of water or milk. (NOTE: Do NOT give anything by mouth to an unconscious person.) Do not induce



PRODUCT NAME: GERALYN AW 68
vomiting without medical supervision. If vomiting occurs spontaneously keep airway clear. If symptoms of ingestion persist, seek medical attention.
NOTE TO PHYSICIAN: No further data known.
SECTION 5 - FIRE FIGHTING MEASURES
FIRE AND EXPLOSIVE PROPERTIES: Flashpoint
EXTINGUISHING MEDIA: In accordance with NFPA guidance, dry chemical, foam, or CO2 fire extinguishers are all acceptable. Note that while water fog extinguishers are also acceptable, do NOT apply a direct stream of water onto burning product because it may cause spreading and increase fire intensity.
UNUSUAL FIRE & EXPLOSION HAZARDS: No further data known.
FIRE-FIGHTING PROCEDURES AND EQUIPMENT: Emergency responders in the danger area should wear bunker gear and self- contained breathing apparatus for fires beyond the incipient stage. See Section 8 of the MSDS for other PPE to be worn as conditions warrant.
SECTION 6 - ACCIDENTAL RELEASE MEASURES
CLEAN-UP MEASURES: Important: As with any spill or leak, before responding ensure that you are familiar with the potential hazards and recommendations of the MSDS. Appropriate personal protective equipment must be worn. See Section 8 of this MSDS for PPE recommendations.
If possible, safely contain the spill with dikes or other spill response equipment appropriate for petroleum or organic material releases. Take measures to prevent spreading of product. Note that while product will ignite it will not readily burn. However, as a precaution eliminate ignition sources. Prevent from entering sewers or waterways. Large volumes may be transferred to an appropriate container for proper disposal. Small volumes or residues may be soaked up with absorbents. Spill response materials should be collected for proper disposal.
SECTION 7 - HANDLING AND STORAGE

HANDLING:



PRODUCT NAME: GERALYN AW 68

As with any industrial chemical, handle the product in a manner that minimizes exposure to practicable levels. Prior to handling, consult Section 8 of this MSDS to evaluate personal protective equipment needs. Open containers slowly to relieve any pressure. Follow all other standard industrial hygiene practices.

Empty containers may contain product residue. All safety precautions taken when handling this product should also be taken when handling empty drums and containers. Keep containers closed when not in use.

Product residue in empty containers is combustible but will not readily burn. NOTE however, that excessive heating or cutting of empty containers may create an ignition source sufficient to start a fire and in extreme cases, cause an explosion.

STORAGE:

Protect product quality by storing indoors and away from extreme temperatures. Close all containers when not in use.

SPECIAL COMMENTS:

No further data known.

SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION _____

PERSONAL PROTECTIVE EQUIPMENT:

Selection of personal protective equipment should be based upon the anticipated exposure and made in accordance with OSHA's Personal Protective Equipment Standard found in 29 CFR 1910 Subpart I. The following information may be used to assist in PPE selection.

- EYE PROTECTION -

Wear eye protection appropriate to prevent eye exposure. Where splashing is not likely, chemical safety glasses with side shields are recommended. Where splashing may occur, chemical goggles or full face shield is recommended.

- SKIN PROTECTION -

Gloves are not normally needed during normal conditions of use. If health effects are experienced, oil or chemical resistent gloves such as butyl or nitrile are recommended.

Where splashing or soaking is likely, wear oil or chemical resistent clothing to prevent exposure.

- RESPIRATORY PROTECTION -

A respirator may be worn to reduce exposure to vapors, dust, or mist. Select a NIOSH/MSHA approved respirator appropriate for the type and physical character of the airborne material. A self-contained breathing



PRODUCT NAME: GERALYN AW 68

apparatus is recommended in all situations where airborne contaminant concentration has not been confirmed to be below safe levels. Respirator use should comply with the OSHA Respirator Protection Standard found in 29 CFR 1910.134.

ENGINEERING CONTROLS:

Normal general ventilation is expected to be adequate. It is recommended that ventilation be designed in all instances to maintain airborne concentrations at lowest practicable levels. Ventilation should at a minimum, prevent airborne concentrations from exceeding any exposure limits listed in Section 2 of this MSDS.

The user may wish to refer to 29 CFR 1910.1000(d)(2) and the ACGIH "Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indicies" (Appendix C) for the determination of exposure limits of mixtures. An industrial hygienist or similar professional may be consulted to confirm that the calculated exposure limits apply.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical Appearance : Water white Odor : Mild petroleum Physical State : Liquid

SECTION 10 - STABILITY AND REACTIVITY

INCOMPATIBILITIES:

This product is incompatible with strong oxidizing agents.

DECOMPOSITION PRODUCTS MAY INCLUDE:

Thermal decomposition products are dependent on combustion conditions. A complex mixture of airborne solid, liquid, particulates and gasses may evolve when the material burns. Combustion byproducts may include: oxides of carbon,

incompletely burned hydrocarbons as fumes and smoke.

CONDITIONS TO AVOID:

Avoid contact with incompatible materials and exposure to extreme temperatures.

POLYMERIZATION:

This product is not expected to polymerize.

STABILITY:



PRODUCT NAME: GERALYN AW 68
This product is stable.
SECTION 11 - TOXICOLOGICAL INFORMATION
EYE EFFECTS: No further toxicological data known.
SKIN EFFECTS: No further toxicological data known.
ORAL EFFECTS: No further toxicological data known.
INHALATION EFFECTS: No further toxicological data known.
OTHER: No further data known.
SECTION 12 - ECOLOGICAL INFORMATION
ECOTOXICOLOGICAL INFORMATION: This product has not been evaluated for ecotoxicity. As with any industrial chemical, exposure to the environment should be prevented and minimized wherever possible. ENVIRONMENTAL FATE: The degree of biodegradability and persistence of this product has not been determined.
SECTION 13 - DISPOSAL CONSIDERATIONS
WASTE DISPOSAL: Ensure that collection, transport, treatment, and disposal of waste product, containers and rinsate complies with all applicable laws and regulations. Note that use, mixture, processing, or contamination of the product may cause the material to be classified as a hazardous waste. It is the responsibility of the product user or owner to determine at the time of disposal, whether the product is regulated as a hazardous waste.
SECTION 14 - TRANSPORT INFORMATION
DOT HAZARDOUS MATERIAL INFORMATION: * Not otherwise DOT regulated.
SECTION 15 - REGULATORY INFORMATION
FEDERAL REGULATIONS:



PRODUCT NAME: GERALYN AW 68

SARA 313:

This product contains NONE of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Clean Water Act / Oil Pollution Act:

This product contains mineral oil and is subject to regulation by Section 311 of the Clean Water Act and the Oil Pollution Act. Releases of the product into or leading to surface waters must be reported to the National Response Center at 1-800-424-8802.

CERCLA Reportable Quantity:

Any components listed below have been assigned a reportable quantity (RQ) by the Federal EPA. Releases of the product into the environment that exceed the RQ for a particular component must be reported to the National Response Center at 1-800-424-8802.

	Component									RQ															
*	_	*	_	*	_	*	_	*	_	*	_	*	 *	_	*	_	*	_	_*	_	*	_	*	_	*

Toxic Substances Control Act:

The components of this product are listed on the TSCA Inventory.

Ozone Depleting Substances:

This product contains no ozone depleting substances as defined by the Clean Air Act.

Hazardous Air Pollutants:

Any components listed below are defined by the Federal EPA as hazardous air pollutants.

	(Cor	npo	one	ent																				
*	_	*	-	*	-	*	_	*	_	*	_	*	_	*	_	*	_	*	_	*	_	*	_	*	 *

STATE REGULATIONS:

This product contains mineral oil, and as used, may be regulated by state used oil regulations. Check with the appropriate state agency to determine whether such a regulation exists.

No further data known.

	SECTION 16 - OTHER INFORMATION	
Date of issue	: Corporate Regulatory Compliance : 07/26/2007 : 11/01/2006	



PRODUCT NAME: GERALYN AW 68

NOTICE: This MSDS provides a good faith representation of information believed to be accurate as of the last revision date. This document does not create any express or implied product warranties. Since conditions of use are beyond the control of Fuchs Lubricants Co., all risks associated with product use are assumed by the user.

KMT 20461677



Material Safety Data Sheet



Revision Date: 04/12/2006 **Issue date:** 04/12/2006

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name:242® ThreadlockerItem No. :24231Product type:Anaerobic SealantRegion:United State

Company address: Henkel Corporation 1001 Trout Brook Crossing

Rocky Hill, Connecticut 06067

Region: United States
Contact Information:
Telephone: 860.571.5100

Emergency telephone: 860.571.5100

Internet: www.loctite.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous components Polyglycol dimethacrylate 25852-47-5	<u>%</u> 60-100	ACGIH TLV None	OSHA PEL None	OTHER None
Polyglycol oleate 9004-96-0	10-30	None	None	None
Saccharin 81-07-2	1-5	None	None	None
Silica, amorphous, fumed, crystalline-free 112945-52-5	1-5	6 mg/m³ TWA	10 mg/m³ TWA	3 mg/m³ TWA respirable dust
Cumene hydroperoxide 80-15-9	1-5	None	None	1 ppm (6 mg/m³) Skin (WEEL), 1ppm, skin TWA, (WEEL)
Propylene glycol 57-55-6	1-5	None	None	10 mg/m³ TWA, (WEEL)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

HMIS:

 Physical state:
 Liquid
 HEALTH:
 2*

 Color:
 Blue
 FLAMMABILITY:
 1

 Odor:
 Mild
 PHYSICAL HAZARD:
 1

Personal Protection: See Section 8

WARNING: CAUSES EYE IRRITATION.

MAY CAUSE SKIN IRRITATION.

MAY CAUSE ALLERGIC SKIN REACTION.

MAY CAUSE RESPIRATORY TRACT IRRITATION.

Relevant routes of exposure: Skin, Inhalation, Eyes

Potential Health Effects

Inhalation: May cause respiratory tract irritation.

Skin contact: May cause allergic skin reaction. May cause skin irritation.

Eye contact:Contact with eyes will cause irritation.
Ingestion:
Not expected to be harmful by ingestion.

Item No.: 24231 Product name: 242® Threadlocker

Existing conditions aggravated by exposure:

Eye, skin, and respiratory disorders.

See Section 11 for additional toxicological information.

4. FIRST AID MEASURES

Inhalation: Remove to fresh air. If symptoms develop and persist, get medical attention.

Skin contact: Wash with soap and water. Remove contaminated clothing and shoes. Wash clothing before reuse.

Get medical attention if symptoms occur.

Eye contact: Flush with copious amounts of water, preferably, lukewarm water for at least 15 minutes, holding

eyelids open all the time. Get medical attention.

Ingestion: Do not induce vomiting. Keep individual calm. Obtain medical attention.

5. FIRE-FIGHTING MEASURES

Flash point: Greater than 93°C (200°F) Tagliabue closed cup

Autoignition temperature: Not available

Flammable/Explosive limits-lower %: 2.6 % (propylene glycol)

Flammable/Explosive limits-upper %: 12.5 % (propylene glycol)

Extinguishing media: Foam, dry chemical or carbon dioxide.

Special fire fighting procedures: None

Unusual fire or explosion hazards: None

Hazardous combustion products: Oxides of carbon. Oxides of sulfur. Oxides of nitrogen. Irritating organic vapors.

6. ACCIDENTAL RELEASE MEASURES

Environmental precautions: Prevent product from entering drains or open waters.

Clean-up methods: Soak up with inert absorbent. Store in a partly filled, closed container until disposal.

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes, skin and clothing. Avoid breathing vapor and mist. Wash thoroughly after

handling.

Storage: For safe storage, store at or below 38°C (100°F). Keep in a cool, well ventilated area away from heat,

sparks and open flame. Keep container tightly closed until ready for use.

Incompatible products: Refer to Section 10.

For information on product shelf life contact Henkel Customer Service at (800) 243-4874.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: No specific ventilation requirements noted, but forced ventilation may still be required if concentrations

exceed occupational exposure limts.

Item No.: 24231 Product name: 242® Threadlocker

Respiratory protection: Use NIOSH approved respirator if there is potential to exceed exposure limit(s).

Skin protection: Use impermeable gloves and protective clothing as necessary to prevent skin contact. Neoprene

gloves. Butyl rubber gloves. Natural rubber gloves.

Eye/face protection: Safety goggles or safety glasses with side shields.

See Section 2 for exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid
Color: Blue
Odor: Mild

Vapor pressure: Less than 5 mm Hg at 27°C (80°F)

pH: Not applicable

Boiling point/range: Greater than 149°C (300°F)

Melting point/range:

Specific gravity:

Vapor density:

Evaporation rate:

Solubility in water:

Partition coefficient (n-octanol/water):

Not available
Not available
Slight
Not available

VOC content: 4.48%; 49.3 grams/liter (EPA Method 24)

10. STABILITY AND REACTIVITY

Stability: Stable.

Hazardous polymerization: Will not occur.

Hazardous decomposition products: Oxides of carbon. Oxides of sulfur. Oxides of nitrogen. Irritating organic vapors.

Incompatability: Strong oxidizers. Free radical initiators. Strong reducing agents. Alkalis. Oxygen scavengers. Other

polymerization initiators. Copper. Iron. Zinc. Aluminum. Rust.

Conditions to avoid: See "Handling and Storage" (Section 7) and "Incompatability" (Section 10).

11. TOXICOLOGICAL INFORMATION

Product toxicity data: Acute oral LD50 greater than 10, 000 mg/kg (rat). Acute dermal LD50 greater than 5000 mg/kg (rabbit).

Carcinogen Status

Hazardous components	NTP Carcinogen	IARC Carcinogen	OSHA Carcinogen
Polyglycol dimethacrylate 25852-47-5	No	No	No
Polyglycol oleate 9004-96-0	No	No	No
Saccharin 81-07-2	No	No	No
Silica, amorphous, fumed, crystalline-free 112945-52-5	No	No	No
Cumene hydroperoxide 80-15-9	No	No	No
Propylene glycol 57-55-6	No	No	No

Literature Referenced Target Organ & Other Health Effects

Item No.: 24231 Product name: 242® Threadlocker 3 of 5

Hazardous components	Health Effects/Target Organs
Polyglycol dimethacrylate 25852-47-5	Allergen, Irritant
Polyglycol oleate 9004-96-0	Irritant
Saccharin 81-07-2	No Target Organs
Silica, amorphous, fumed, crystalline-free 112945-52-5	Nuisance dust
Cumene hydroperoxide 80-15-9	Allergen, Central nervous system, Corrosive, Irritant, Mutagen
Propylene glycol 57-55-6	Irritant

12. ECOLOGICAL INFORMATION

Ecological information: Not available

13. DISPOSAL CONSIDERATIONS

Information provided is for unused product only.

Recommended method of disposal: Dispose of according to Federal, State and local governmental regulations.

EPA hazardous waste number: Not a RCRA hazardous waste.

14. TRANSPORT INFORMATION

U.S. Department of Transportation Ground (49 CFR):

Proper shipping name: Unrestricted Hazard class or division: None Identification number: None Packing group: None

International Air Transportation (ICAO/IATA):

Proper shipping name: Unrestricted
Hazard class or division: None
Identification number: None
Packing group: None

WaterTransportation (IMO/IMDG):

Proper shipping name: Unrestricted Hazard class or division: None Identification number: None Packing group: None Marine pollutant: Unrestricted None

Item No.: 24231 Product name: 242® Threadlocker 4 of 5

15. REGULATORY INFORMATION

United States Regulatory Information

TSCA 8 (b) Inventory Status: All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.

TSCA 12 (b) Export Notification: 4-Methoxyphenol (150-76-5).

CERCLA/SARA Section 302 EHS: None above reporting de minimus.

CERCLA/SARA Section 311/312: Immediate Health Hazard, Delayed Health Hazard

CERCLA/SARA 313: This product contains the following toxic chemicals subject to the reporting requirements of section 313

of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372). Cumene

hydroperoxide (CAS# 80-15-9) .

California Proposition 65: This product contains a chemical known to the State of California to cause cancer and birth defects or

other reproductive harm.

Canada Regulatory Information

CEPA DSL/NDSL Status: All components are listed on or are exempt from listing on the Domestic Substances List.

WHMIS hazard class: D.2.B

16. OTHER INFORMATION

This material safety data sheet contains changes from the previous version in sections: 15

Prepared by: Kyra Kozak Woods, Product Safety and Regulatory Affairs Specialist

DISCLAIMER: The data contained herein are furnished for information only and are believed to be reliable. However, Henkel Corporation does not assume responsibility for any results obtained by persons over whose methods Henkel Corporation has no control. It is the user's responsibility to determine the suitability of Henkel's products or any production methods mentioned herein for a particular purpose, and to adopt such precautions as may be advisable for the protection of property and persons against any hazards that may be involved in the handling and use of any of Henkel Corporation's products. In light of the foregoing, Henkel Corporation specifically disclaims all warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation further disclaims any liability for consequential or incidental damages of any kind, including lost profits.

Item No.: 24231 Product name: 242® Threadlocker 5 of 5



Material Safety Data Sheet



Revision Date: 04/01/2004 **Issue date:** 04/01/2004

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name:Loctite(R) 7649 Primer NItem number:19269Product type:AcceleratorRegion:United States

Company address:
Henkel Corporation
1001 Trout Brook Crossing

Contact Information:
Telephone: 860.571.5100
Emergency telephone: 860.571.5100

Rocky Hill, Connecticut 06067 Internet: www.loctite.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

 Hazardous components
 %
 ACGIH TLV
 OSHA PEL
 OTHER

 Acetone
 60-100
 500 ppm TWA
 1000 ppm TWA
 None

67-64-1 750 ppm STEL 2400 mg/m³ TWA

2-Ethylhexanoic acid 0.1-1 5 mg/m³ TWA None None

149-57-5

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

HMIS:

 Physical state:
 Liquid
 HEALTH:
 2*

 Color:
 Green
 FLAMMABILITY:
 3

 Odor:
 Acetone
 PHYSICAL HAZARD:
 0

Personal Protection: See Section 8

DANGER: FLAMMABLE LIQUID AND VAPOR. CAUSES EYE AND SKIN IRRITATION.

MAY CAUSE RESPIRATORY TRACT IRRITATION.

Relevant routes of exposure: Inhalation, Skin contact, Eye contact, Ingestion

Potential Health Effects

Inhalation: Harmful if inhaled. Vapors and mists will irritate nose and throat and possibly eyes. May cause

respiratory tract irritation. Headache, dizziness, nausea, and loss of coordination are indications of

excessive exposure to vapors or spray mists.

Skin contact: May cause skin irritation. Solvent action can dry and defat the skin, causing the skin to crack, leading

to dermatitis.

Eye contact: Vapors may irritate eyes. Contact with eyes will cause irritation.

Ingestion: Harmful if swallowed.

Existing conditions aggravated by

exposure:

Eye, skin, and respiratory disorders.

See Section 11 for additional toxicological information.

Item number: 19269 Product name: Loctite(R) 7649 Primer N

4. FIRST AID MEASURES

Inhalation: Remove to fresh air. If discomfort persists seek medical attention.

Skin contact: Wash with soap and water.

Eye contact: Flush with copious amounts of water, preferably, lukewarm water for at least 15 minutes, holding

eyelids open all the time.

Ingestion: If conscious, drink plenty of water. Do not induce vomiting. Keep individual calm. Obtain medical

attention.

5. FIRE-FIGHTING MEASURES

Flash point: -20°C (-4°F) (estimated)

Autoignition temperature: 465°C (869°F)

Flammable/Explosive limits-lower %: 2.6 %

Flammable/Explosive limits-upper %: 13 %

Extinguishing media: Foam, dry chemical or carbon dioxide.

Special fire fighting procedures: None

Unusual fire or explosion hazards: Vapors may accumulate in low or confined areas, travel considerable distance to source of ignition,

and flash back.

Hazardous combustion products: Oxides of carbon. Oxides of nitrogen. Irritating organic vapors.

6. ACCIDENTAL RELEASE MEASURES

Environmental precautions: Prevent product from entering drains or open waters.

Clean-up methods: Remove all ignition sources. Ensure adequate ventilation. Soak up with inert absorbent. Store in a

closed container until ready for disposal.

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes, skin and clothing. Avoid breathing vapor and mist. Wash thoroughly after

handling. During use and until all vapors are gone: Keep area ventilated - do not smoke; extinguish all flames, pilot lights, and heaters; turn off stoves, electrical tools and appliances, and any other sources

of ignition.

Storage: Store away from heat, sparks, flames, or other sources of ignition. For safe storage, store at or below

49°C (120°F).

Incompatible products: Refer to Section 10.

For information on product shelf life contact Henkel Customer Service at (800) 243-4874.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: Use local ventilation if general ventilation is insufficient to maintain vapor concentration below

established exposure limits.

Respiratory protection: Use NIOSH approved respirator if there is potential to exceed exposure limit(s).

Item number: 19269 Product name: Loctite(R) 7649 Primer N

Skin protection: Chemical resistant, impermeable gloves.

Eyelface protection: Safety goggles or safety glasses with side shields.

See Section 2 for exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid
Color: Green
Odor: Acetone

Vapor pressure: 172 mmHg at 20 °C (68 °F)

pH: Not applicable
Boiling point/range: 56°C (133°F)
Melting point/range: Not available
Specific gravity: 0.7936
Vapor density: 2.0

For tition coefficient (n-octanol/water):

2.0

1.9 (Ether = 1)

Completely miscible

Not available

VOC content: 1.48%; 11.7 grams/liter (EPA Method 24)

10. STABILITY AND REACTIVITY

Stability: Stable.

Hazardous polymerization: Will not occur.

Hazardous decomposition products: Oxides of carbon. Oxides of nitrogen. Irritating organic vapors.

Incompatability: Strong oxidizers.

Conditions to avoid: See "Handling and Storage" (Section 7) and "Incompatability" (Section 10).

11. TOXICOLOGICAL INFORMATION

Carcinogen Status

Hazardous components	NTP Carcinogen	IARC Carcinogen	OSHA Carcinogen
Acetone	No	No	No
2-Ethylhexanoic acid	No	No	No

Literature Referenced Target Organ & Other Health Effects

Hazardous components	Health Effects/Target Organs
Acetone	Blood, Central nervous system, Irritant, Reproductive
2-Ethylhexanoic acid	Developmental, Eyes, Irritant, Liver, Reproductive

12. ECOLOGICAL INFORMATION

Ecological information: Not available

13. DISPOSAL CONSIDERATIONS

Information provided is for unused product only.

Recommended method of disposal: Dispose of according to Federal, State and local governmental regulations.

EPA hazardous waste number: D001: Ignitable.

Item number: 19269 Product name: Loctite(R) 7649 Primer N

3 of 4

14. TRANSPORT INFORMATION

U.S. Department of Transportation Ground (49 CFR):

Proper shipping name: Acetone
Hazard class or division: 3
Identification number: UN 1090
Packing group: II

Exceptions: Consumer Commodity ORM-D (Not more than 1 Liter)

International Air Transportation (ICAO/IATA):

Proper shipping name: Acetone
Hazard class or division: 3
Identification number: UN 1090
Packing group: II

Exceptions: Consumer Commodity ID8000 (Not more than 500 ml)

WaterTransportation (IMO/IMDG):

Proper shipping name: Acetone
Hazard class or division: 3
Identification number: UN 1090

Packing group:

Exceptions: Dangerous goods in limited quantities of class 3 (Not more than 1 liter(s))

Marine pollutant: None

15. REGULATORY INFORMATION

United States Regulatory Information

TSCA 8 (b) Inventory Status: All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.

TSCA 12 (b) Export Notification: Acetone (CAS# 67-64-1).

CERCLA/SARA Section 302 EHS: None.

CERCLA/SARA Section 311/312: Immediate Health Hazard, Delayed Health Hazard, Fire

CERCLA/SARA 313: None above reporting de minimus.

California Proposition 65: This product contains a chemical known to the State of California to cause cancer and birth defects or

other reproductive harm. Nickel (CAS# 7440-02-0). Cobalt (CAS# 7440-48-4). Formaldehyde (CAS#

50-00-0). Acetaldehyde (CAS# 75-07-0). Benzene (CAS# 71-43-2).

Canada Regulatory Information

CEPA DSL/NDSL Status: All components are listed on or are exempt from listing on the Domestic Substances List.

WHMIS hazard class: B.2, D.2.A, D.2.B

16. OTHER INFORMATION

This material safety data sheet contains changes from the previous version in sections: Expanded chemical information in Section 2 and related sections.

Prepared by: Kyra Kozak Woods, Health and Regulatory Affairs Specialist

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Item number: 19269 Product name: Loctite(R) 7649 Primer N

MATERIAL SAFETY DATA SHEET QUICK TAP

SECTION 1: IDENTIFICATION

Company Name: QUALICHEM, INC.

Address: P.O. BOX 926

SALEM, VA 24153

Phone No. (540) 375-6700 Fax No. (540) 375-3880

Emergency Phone No. | CHEM-TEL 800-255-3924

Date Prepared: 9/14/10 Date Revised: 3/28/12

SECTION 2: INGREDIENTS

<u>MATERIAL</u> <u>CAS NO.</u> <u>%</u> ALKANES, CHLORO 5-10

SECTION 3: HEALTH HAZARDS

Ingestion: MAY CAUSE IRRITATION OF THE DIGESTIVE SYSTEM.

Inhalation: NOT A LIKELY ROUTE OF EXPOSURE. MAY CAUSE IRRITATION.

Skin Contact: MAY CAUSE IRRITATION.
Eye Contact: MAY CAUSE IRRITATION.
Other Information: NONE KNOWN.

SECTION 4: FIRST AID

Ingestion: DRINK SEVERAL GLASSES OF WATER TO DILUTE. DO NOT INDUCE VOMITING.

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET

MEDICAL ATTENTION.

Inhalation: REMOVE VICTIM TO FRESH AIR. GET MEDICAL ATTENTION IF SYMPTOMS

PERSIST.

Skin Contact: WASH WITH PLAIN WATER OR SOAP AND WATER.

Eye Contact: IMMEDIATELY FLUSH WITH CLEAR WATER FOR 15 MINUTES AND GET MEDICAL

ATTENTION IF IRRITATION PERSISTS.

Notes to Physician: NONE KNOWN. TREAT SYMPTOMS WITH SUPPORTIVE MEASURES.

SECTION 5: FIRE AND EXPLOSION HAZARD DATA

Flash Point/Method: >200°C/ C.C.
Lower Limit in Air: ND

Upper Limit in Air: ND

Extinguishing Media: FOAM, DRY CHEMICAL, CO2, WATER SPRAY OR FOG.

Procedures: | SELF-CONTAINED BREATHING APPARATUS SHOULD BE USED IN CONFINED

AREAS. COOL EXPOSED CONTAINERS WITH WATER. AVOID BREATHING

SMOKE, VAPOR OR FUMES.

Unusual Hazards: NONE

Combustion Products: OXIDES OF CARBON AND SULFUR MAY BE PRODUCED

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: | WEAR PERSONAL PROTECTIVE EQUIPMENT AS SPECIFIED IN SECTION 8.

SPILLED MATERIAL CAN BE VERY SLIPPERY.

Procedures for Clean-up: | SMALL SPILLS - ABSORB IN SAWDUST OR ANY AVAILABLE ABSORBANT, PLACE

RESIDUE IN SUITABLE CONTAINER FOR DISPOSAL. LARGE SPILLS - DIKE OR OTHERWISE CONTAIN LIQUID. ABSORB IN SAWDUST OR ANY AVAILABLE ABSORBANT, PLACE RESIDUE IN A SEALED, LIQUID-PROOF CONTAINER FOR DISPOSAL. CLEAN CONTAMINATED SURFACES WITH WATER OR AQUEOUS CLEANING AGENTS. OBEY ALL FEDERAL, STATE OR LOCAL REGULATIONS.

Prohibited Materials: NONE

MATERIAL SAFETY DATA SHEET QUICK TAP

Handling:	AVOID EYE AND SKIN CONTACT. DO NOT TAKE INTERNALLY. USE WITH
	ADEQUATE VENTILATION.
Storage:	KEEP OUT OF REACH OF CHILDREN. STORE IN A COOL, DRY PLACE. KEEP
	CONTAINERS TIGHTLY CLOSED WHEN NOT IN USE

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Precautionary Measures:	STANDARD INDUSTRIAL HANDLING PRECAUTIONS. WASH THOROUGHLY AFTER HANDLING CHEMICALS.
Engineering Controls:	USE WITH ADEQUATE VENTILATION.
Control Limits:	NONE.
Equipment for Personal	
Protection:	WEAR CHEMICAL SAFETY GLASSES OR GOGGLES, PROTECTIVE GLOVES, AND
	STANDARD PROTECTIVE CLOTHING WHEN HANDLING THE CONCENTRATE.
	FYEWASH STATION IN AREA OF USE

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	CLEAR, LIGHT AMBER LIQUID.
Odor:	MILD FATTY
pH (5% in DI water)):	NA
Specific Gravity:	0.90-0.92
Density:	7.59 lbs./gal.
Solubility in Water:	INSOLUBLE
Boiling Point:	>600°F
Percent Volatile:	0
Vapor Pressure (mmHg):	N.D.
Vapor Density:	N.D. BUT HEAVIER THAN AIR
Evaporation Rate:	(water=1): <1

SECTION 10: STABILITY AND REACTIVITY

Stability:	STABLE
Conditions to Avoid:	NONE
Hazardous Polymerization:	STABLE
Incompatibility:	STRONG OXIDIZING AGENTS, ACIDS OR ALKALIES.
Hazardous Decomposition	
Products:	OXIDES OF CARBON AND SULFUR WILL BE PRODUCED BY COMBUSTION.

SECTION 11: TOXICOLOGICAL INFORMATION

Materials and Tests: Carcinogenicity:	NO TOXICITY STUDIES HAVE BEEN CONDUCTED ON THIS PRODUCT. NO COMPONENT OF THIS PRODUCT IS LISTED AS A CARCINOGEN BY IARC, NTP, OR ACGIH.
Sensitization:	NOT A SENSITIZER.
Mutagenicity:	NO COMPONENT OF THIS PRODUCT IS CLASSIFIED AS A MUTAGEN.
Teratogenicity:	NO COMPONENT OF THIS PRODUCT IS CLASSIFIED AS A TERATOGEN

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity:	NO TOXICITY TESTING HAS BEEN PERFORMED ON THIS PRODUCT.
Lootoxicity.	NO TOXIOTTI LOTING TIAO BEENT EN ORMED ON THIO TRODUCT.

SECTION 13: DISPOSAL CONSIDERATIONS

General Considerations:	THIS PRODUCT WOULD NOT BE CONSIDERED AS A HAZARDOUS WASTE.		
Procedures:	DISPOSAL BY USE PREFERRED. DISPOSE OF THIS PRODUCT FOLLOWING ALL		
	FEDERAL, STATE, OR LOCAL REGULATIONS.		

MATERIAL SAFETY DATA SHEET QUICK TAP

Shipping Name:	NOT REGULATED.					
SECTION 15: REGULATORY INFORMATION						
Regulation CERCLA (40 CFR302.4):	<u>Material</u> NONE	<u>RQ</u>	<u>Max. %</u>			
SARA 302 (Sect. 355, Appendix A):	<u>Material</u> NONE	TPQ	<u>Max. %</u>			
SARA 311/312:	<u>Categories</u> NONE	Ŀ	<u>Hazards</u>			
SARA 313 (40 CFR 372.45):	<u>Material</u> NONE		Max. %			
CWA (40 CFR 401.15):	NONE					
RCRA (40 CFR 261): Notes:	NONE THIS PRODUCT NOT A HAZARDOUS WASTE PER RCRA REGULATIONS.					
OSHA (29 CFR 1910.1200):	ALL COMPONENTS LISTED UNDER THIS STANDARD ARE SHOWN IN SECTION 2 OF THIS MSDS.					
WHMIS (Canada):	CLASS D-2B: MATERIAL CAUSING OTHER TOXIC EFFECTS (TOXIC). THIS PRODUCT HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CONTROLLED PRODUCTS REGULATIONS AND THE MSDS CONTAINS ALL THE INFORMATION REQUIRED BY THE CONTROLLED PRODUCTS REGULATIONS.					
Inventories:	ALL INGREDIENTS IN THIS PRODUCT ARE LISTED IN TSCA AND DSL (CANADA) INVENTORIES.					

SPECIAL STATE REGULATIONS

<u>STATE</u>	<u>INGREDIENT</u>	<u>%</u>	REGULATORY DESIGNATION
NONE			

SECTION 16 OTHER INFORMATION

SUGGESTED HAZARD RATINGS

NFPA*	HAZARD	HMIS*				
1	HEALTH (Blue)	1				
	FIRE (Red)	1				
	REACTIVITY (Yellow)	0				
	PERSONAL PROTECTION	В				
	SPECIAL HAZARDS					

^{*}Notes: 0 = Insignificant; 1 = Slight; 2 = Moderate; 3 = High; 4 = Extreme

The data contained in this Material Safety Data Sheet has been prepared based upon an evaluation of the ingredients in the product, their concentration in the product and potential interactions. The information is offered in good faith and is believed to be accurate. It is furnished to the customer who is urged to study it carefully to become aware of hazards, if any, in the storage, handling, use and disposal of the product; and to ensure his employees are properly informed and advised of all safety precautions required. The information is furnished for compliance with the "Occupational Safety and Health Act" of 1970, the "Hazards Communication Act" of 1983 as well as various other Federal, State and Local regulations. Use or dissemination of all or part of this information for any other purpose is prohibited by law.