HYPERJET 30/50 PUMP MANUAL

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Symbols used in content

Discard part

Keep this part; you will install it later in the procedure.

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Safety

Safety
Important! Read carefully before use. Keep for future reference.

Pages: 7

- **Intended use statement**
  Pumps | Intended use · Intended user · Modifications
- **Emergency medical information**
  Vital information to be given to medical personnel in case of emergency.
- **Personal Protective Equipment (PPE)**
  Recommendations for PPE.
- **Lockout/Tagout (LOTO)**
- **Safety precautions**
  General precautions · Service and maintenance precautions
- **Pump safety labels · HyperJet 30/50**

- **How we show safety messages in content**

  In our content, safety messages are highlighted with the safety alert symbol and a signal word, only a signal word, or only a signal word panel. Pay attention to these safety messages—they alert you to hazardous situations!

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Intended use statement

Where used
All Flow pumps

Intended use

The pump is used to deliver ultrahigh-pressure water to a waterjet cutting or cleaning system.

This machinery is intended to be used indoors in a typical commercial/industrial manufacturing workshop type environment by trained personnel familiar with the risks and hazards involved and how to avoid them.

The service and maintenance of the machinery is intended to be performed only by trained personnel.

Intended user

The waterjet pump is intended to be used only by trained personnel familiar with the electrical, mechanical, pneumatic, hydraulic and acoustic risks and hazards associated with ultra-high pressure waterjet pumps and how to mitigate or avoid them during all phases of use.

Modifications

This pump is intended solely for the purpose described above. Use of the pump for a different purpose or conversion of the pump without the written agreement of the manufacturer shall not be considered as intended use. The manufacturer shall not be liable for damage incurred as a result in such cases. The risk shall be borne solely by the owner. Also, if the system is altered after distribution, conformity of the machine to the EC directives and standards no longer applies and the CE mark must be removed.

We recommend the exclusive use of original replacement parts.

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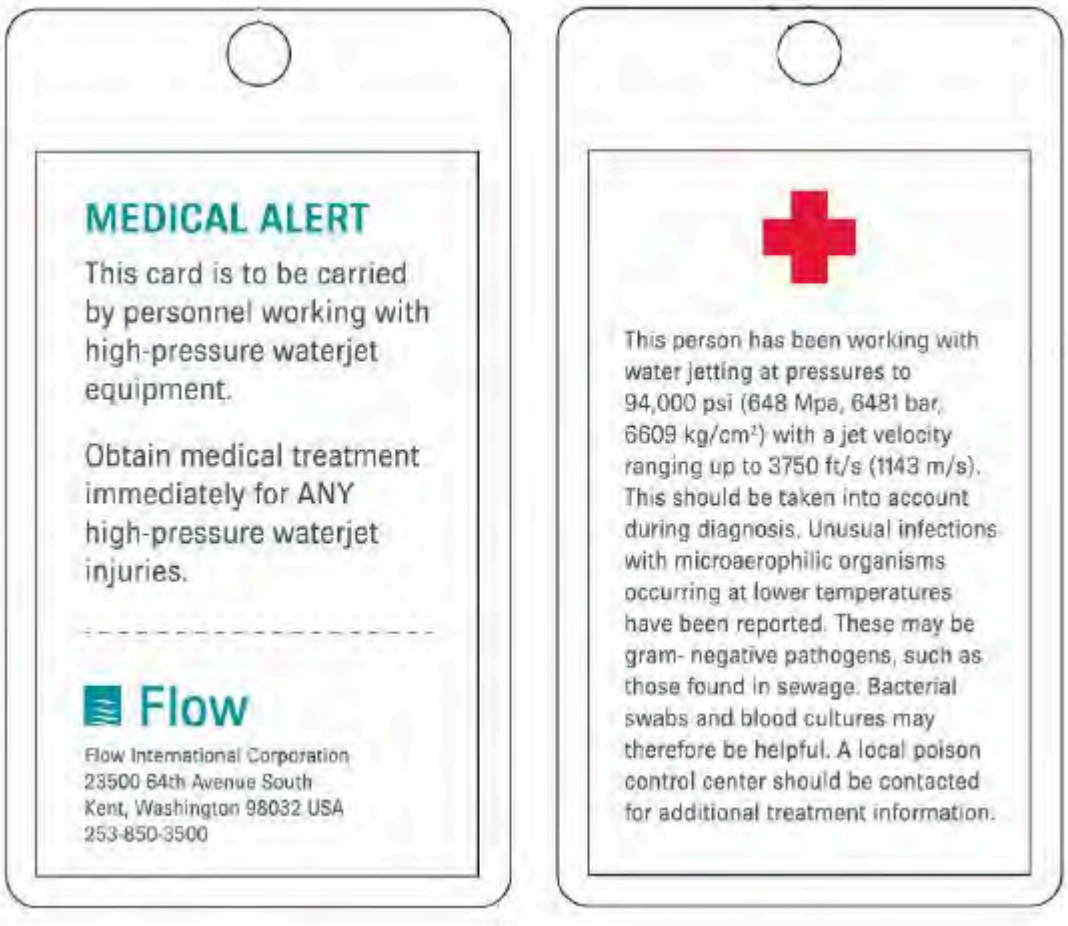
Emergency medical information

WARNING! Obtain medical treatment immediately for ANY high-pressure waterjet injuries. Even minor injuries that are painless or inconspicuous can lead to grave health problems.

It is vital that medical personnel have information about this type of injury. We recommend that anyone who works with high-pressure waterjet equipment carry a waterproof medical alert card. This card should describe their work and the nature of injuries inherent in using waterjets. You should also inform medical personnel what type of abrasive you used and the type of material you cut.



Medical Alert card part numbers (by language)

Czech A-8466CZ
English A-8466
French A-8466F
German A-8466G
Italian A-8466I
Polish A-8466PL
Portuguese A-8466P
Russian A-8466RU
Spanish A-8466S

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Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is equipment worn to minimize exposure to serious workplace injuries and illnesses. All PPE clothing and equipment should be of safe design and construction, and should be maintained in a clean and reliable fashion.

We recommend your safety personnel approve all PPE for anyone who works around high-pressure waterjet equipment.

	**Wear a mask!** Wear a dust mask to reduce particle or dust inhalation when you fill the abrasive delivery system with abrasive.
	**Wear eye protection!** Wear safety glasses with side shields or safety goggles to shield your eyes from flying debris and spray, including pressurized abrasive that may leak from the hopper silo or hose.
	**Wear ear protection!** Wear ear protection while the machine is in operation.
	**Wear protective clothing!** Wear protective clothing to shield your body from flying debris and spray.

	**Wear protective gloves!** Wear protective gloves when you handle sharp catcher tank slats or have to work around dirty water in the catcher tank. When you clean a hopper (ADS), wear gloves to prevent abrasive particles from penetrating any skin abrasions.
	**Wear protective footwear!** Wear steel or composite toe footwear.

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Lockout/Tagout (LOTO)

Where used
HyperJet 30/50 · MotoJet X/MotoJet

Who does this procedure apply to?
Lockout/Tagout procedures apply to any personnel who operates and/or performs service or maintenance on the equipment. Only trained personnel can do Lockout/Tagout.

What is Lockout/Tagout for?
These procedures are designed to protect all personnel from injuries caused by the unexpected energizing or startup of the equipment, 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.

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

Recommendation
These instructions are supplemental to your facility Lockout/Tagout procedures. We recommend your safety personnel approve all Lockout/Tagout instructions for anyone who works around high-pressure waterjet equipment.

Lockout/Tagout

Before any maintenance or repairs are performed, the pump shall be isolated, and rendered inoperative as follows:

1. Shut down the pump 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 to the pump.
3. Close, lockout and tag the manual shutoff valves for all service connections: cutting water in, cooling water in, and air.

Reverse the Lockout/Tagout

1. Remove the lockout/tagout devices from the service connections, and then open the shutoff valves.
2. Remove the lockout/tagout devices from the main, customer-supplied pump power source. Turn the power back on.

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Safety precautions

Where used

HyperJet 30/50 · MotoJet X/MotoJet

General precautions

General precautions are as follows:

- 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.
- High-pressure tubing, fittings, and valves must be rated for a minimum of 6500 bar (94,000 psi) or 4550 bar (66,000 psi), based on your configuration. Failure to use properly rated components may result in component failure causing equipment damage, personal injury, or death.
- Exposed hydraulic fluid would be the major source of combustible material. Dry chemical, carbon dioxide, foam and water spray are all acceptable means of firefighting.
- The work area around the equipment shall be clean and free of debris and oil spills. To reduce the likelihood of slip, trip and fall hazards, it is the responsibility of the user of this equipment to clean up spills near the equipment.
- All protective guards, shields, or covers shall be in place on the equipment at all times.
- With the top cover open and the unit running, the risk of exposure to steam or a high-pressure stream exists.

Service and maintenance precautions

Service and maintenance precautions are as follows:

- Make sure all safety devices are operational. Check each device on a specified schedule. If the device does not function, ensure it is replaced by Flow trained personnel before operating the pump.
- 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 bleed down 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.
- Steam or fog inside the top cover is an indication of a high-pressure leak. 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 lifting the cover.
- 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.
- Prior to startup, make sure no maintenance work is in process.
- Do not patch high-pressure tubing—replace it. Welding on high-pressure component or high-pressure tubing is forbidden.
- Do not step on or lean against high-pressure tubing. Doing so could cause leaks.
- Do not touch weep holes with your bare hands or try to stop water by plugging the holes.
- Maintenance procedures should be performed in a well-ventilated area.

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Pump safety labels · HyperJet 30/50

Where used

HyperJet 30/50

Summary

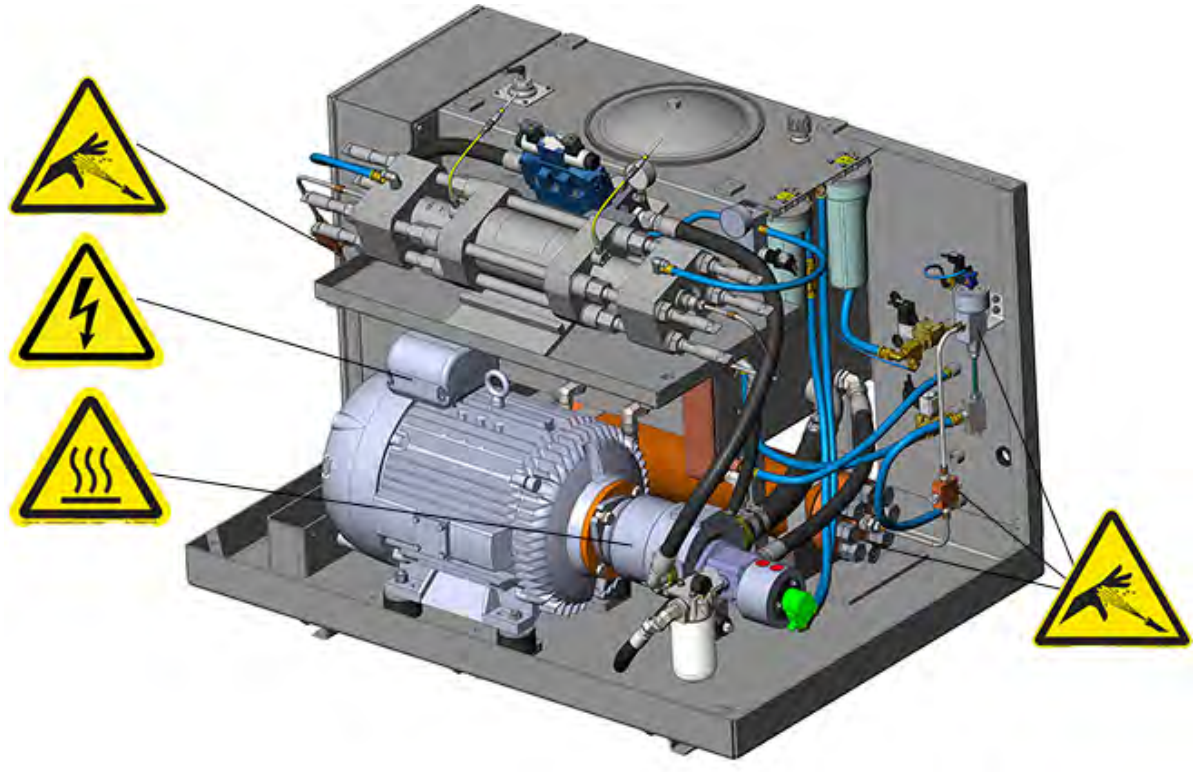
Safety labels alert you to a hazard. Do not remove the labels from your system. If a label becomes illegible or damaged, replace it immediately.

Hazard alert labels warn you of hazards which could result in personal injury.

	The control 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 control enclosure door before performing any type of maintenance.
	The hydraulic pump can generate significant heat during operation. Do not touch hydraulic pump and other nearby components while pump is operation. Always disconnect and lockout the main power and the circuit breaker/disconnect on the control enclosure door before performing any type of maintenance.
	All high-pressure components can contain pressurized water that can cause severe injury. Do not assume the high pressure system is de-energized before servicing or adjusting high-pressure parts. Always disconnect and lockout the main power and the circuit breaker/disconnect on the control enclosure door before performing any type of maintenance.

View 1 · Safety label for pump control enclosure

View 2 · Safety labels for HyperJet 30/50



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How we show safety messages in content

In our content, safety messages are highlighted with the safety alert symbol and a signal word, only a signal word, or only a signal word panel. Pay attention to these safety messages—they alert you to hazardous situations!

Safety alert symbol

 This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Signal words

WARNING!
WARNING indicates a hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION!
CAUTION indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.

Signal word panels

DANGER indicates a hazardous situation, which if not avoided, will result in death or serious injury.

NOTICE indicates a non-hazardous situation, which if not avoided, could result in property damage.

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Overview

Overview

Pages: 5

- **Introduction to HyperJet 30/50 pumps**
  HyperJet 30/50 features
- **Pump labels · HyperJet 30/50**
  HyperJet 30/50 | Bulkhead interface labels · Control panel interface labels · Product nameplate · Other labels
- **Specifications**
  HyperJet 30/50 | Physical · Electrical system · High Pressure water system · Low Pressure water system · Hydraulic system · Recirculation system
- **Facility requirements**
  HyperJet 30/50 | Clearances · Electrical · Environment · Air, Drain, and Water
- **Inlet water quality recommendation**
  Water quality plays a crucial role in determining how well an ultrahigh-pressure waterjet system operates. Maintain inlet water quality and temperature within the recommended parameters to ensure optimum performance of ultrahigh-pressure pumps and components.

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Introduction to HyperJet 30/50 pumps

Standard features include:

- 94K Intensifier
- 30 or 50 hp
- Top cover and doors
- Proportional pressure control
- Control enclosure and electrical
- EtherCat interface using FlowCut with Flow *Mach* series machines for parameter setting and monitoring
- Interface protocols: Modbus TCP, EtherCat
- Remote control capability (hardwired) and EtherCat
- Isolated high voltage components meet IEC 60204 standards
- IE3 and NEMA premium motor designs
- Onboard oil-to-water cooling circuit
- 20 amp Machine Power Feeder

For an overview of the function and primary components associated with each system within the pump, go to:

- **High Pressure water system**
- **Low Pressure water system**
- **Hydraulic system**
- **Recirculation system**

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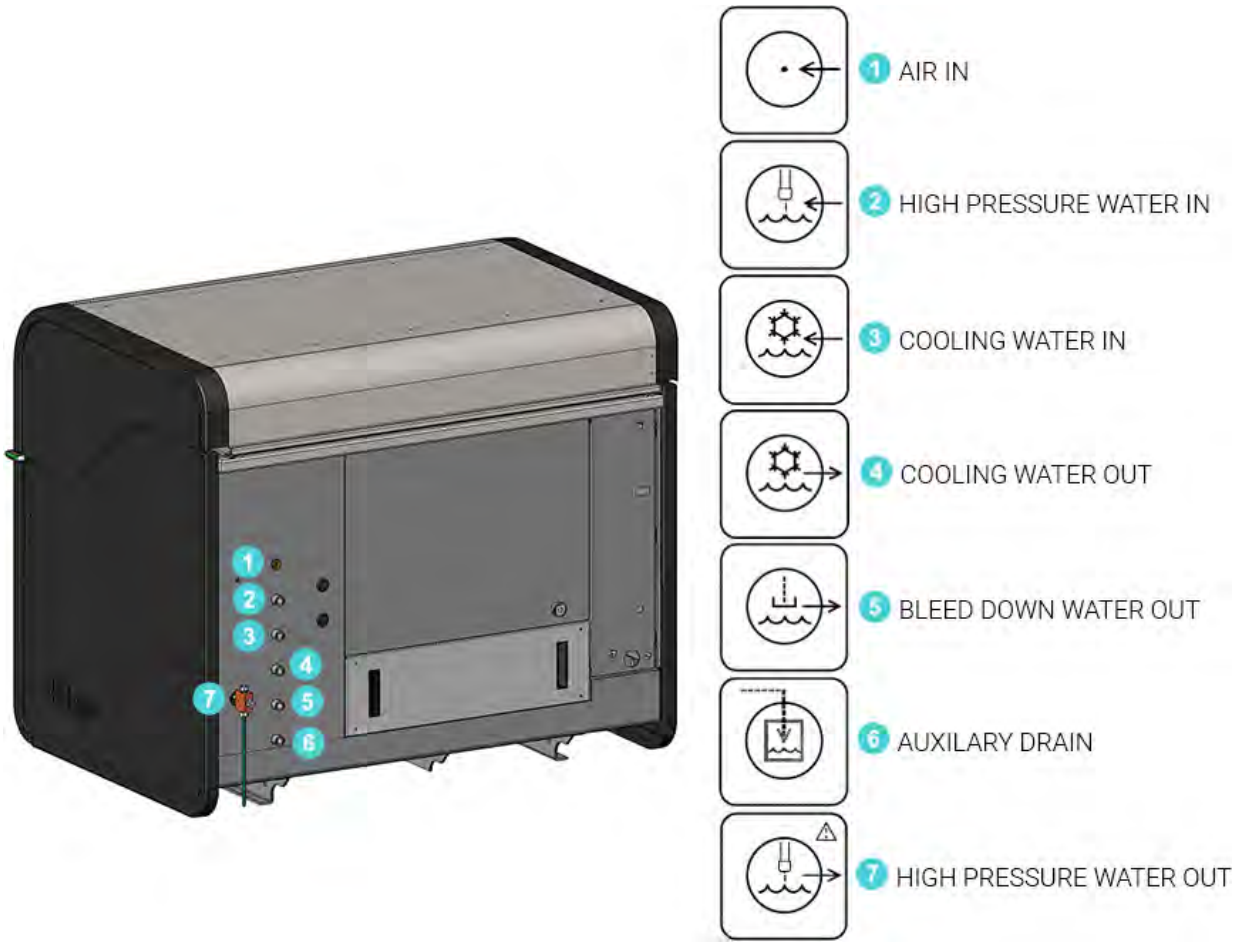
Pump labels · HyperJet 30/50

Where used
HyperJet 30/50

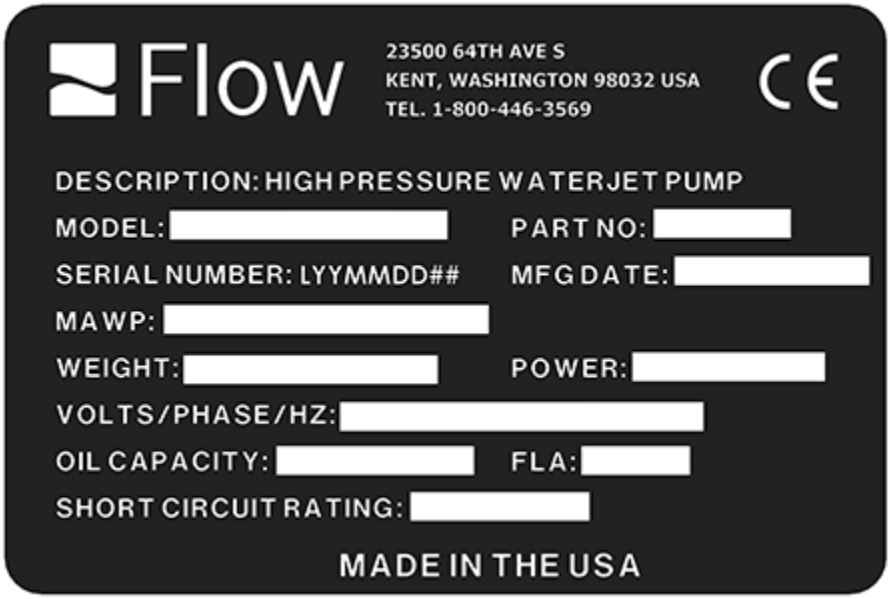
Bulkhead interface labels



Control panel interface labels

Product nameplate

The nameplate for the pump is located on the rear side of the enclosure.



Other labels

Protective Earth Ground

Located in the control enclosure.

Rotation direction

Located on motor fan casing. Indicates the direction the motor rotates.

Safety labels

Please see **Pump safety labels · HyperJet 30/50**.

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Specifications

Where used
HyperJet 30/50

Physical

Specifications
Dimensions (W × D × H) ..... 1535 × 1087 × 1311 mm (60.4 × 42.8 × 51.6 in.)
Weights
Dry weight ..... 935 kg (2060 lb)
Wet weight ..... 1081 kg (2384 lb)
Sound level ..... ≤ 80 dB(A)

Electrical system

Electrical schematic 1011344

Motor
Type ..... TEFC (Totally Enclosed Fan Cooled)
Efficiency class IE3
Voltage/Frequency 380/480V (3-phase)
Pump FLA · 380VAC/50Hz
30 hp 53A
50 hp 69A
Pump FLA · 480VAC/60Hz
30 hp 40A
50 hp 58A
Minimum current ampacity
30 hp 67A
50 hp 87A

Controls
Voltage ..... 24 volts DC
Power supply ..... 5 amps DC

High Pressure water system

Specifications

Operating outlet pressure setting
- Minimum …… 689 bar (10,000 psi)
- Maximum …… 6000 bar (87,000 psi)

Bleed down valve
- Maximum generated water pressure …… 6480 bar (94,000 psi)
- Regulated air pressure …… 5.9–6.9 bar @ 0.03 m^3/min (85–100 psi @ 1.0 cfm)

High-pressure tubing …… rated for 6890 bar (100,000 psi) max generated pressure

Low Pressure water system

Specifications

Minimum inlet supply pressure …… 2.4 bar (35 psi)
Post boost pump shutdown pressure …… 4.1 bar (60 psi)
Filtration provided ..... 0.5 micron and 1.0 micron

Hydraulic system

Specifications

Oil pressure setting
- Minimum …… 34 bar (500 psi)
- Maximum …… 196 bar (2850 psi)

Main system relief valve pressure …… 205 bar (2973 psi)
Operating oil temperature …… 38–49°C (100–120°F)

Recirculation system

Specifications

Total heat rejection …… 22,000 BTU/hr
Hydraulic oil
Required oil type …… P66 Megaflow AW 46 or equivalent ISO VG 46 oil
Reservoir capacity …… 170 L (45 gal)
Recommended minimum fill level …… 151 L (40 gal)

Maximum oil filter pressure …… 2.8 bar (40 psi)
Oil filter bypass pressure …… 3.4 bar (50 psi)
Operating oil temperature …… 38–49°C (100–120°F)
Optimum operating oil temperature …… 42°C (108°F)

Oil temperature warning …… 55°C (131°F)
Oil temperature shutdown …… 65°C (149°F)
Low oil level shutdown …… 133 L (35 gal)

Oil filtration rating (Beta)[1] …… $B_7 \geq 1000$
ISO fluid cleanliness rating [2] …… 17/14
Nominal recirculation pressure …… 2 bar (30 psi)

1. 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.
2. Indicates ISO 4406 range numbers for maximum permissible number of particles per milliliter, greater than 5 and 15 microns.
    - 17 <1300 particles per milliliter, >5 microns
    - 14 <160 particles per milliliter, >15 microns

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Facility requirements

Where used
HyperJet 30/50

Clearances

Clearances/Location
Minimum distance from all walls ..... 1000 mm (39.4 in.)
Location ..... within 10 m (33 ft) of X-Y machine electrical enclosure

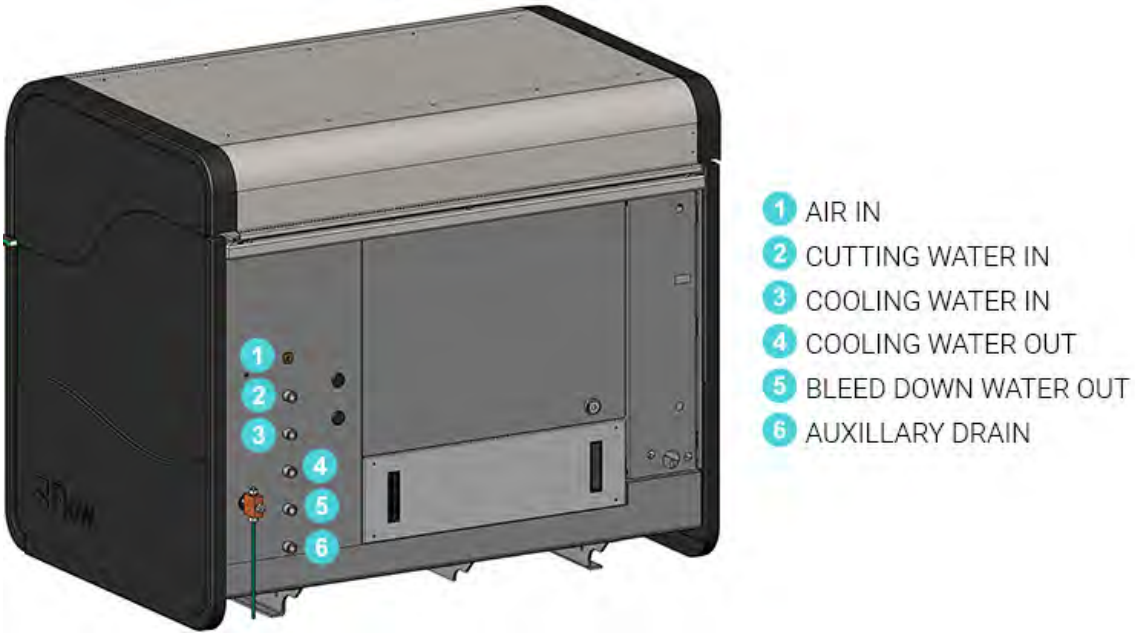
Electrical

Electrical
Voltage/Frequency 380/480V (3-phase)
Pump FLA · 380VAC/50Hz
30 hp 53A
50 hp 69A
Pump FLA · 480VAC/60Hz
30 hp 40A
50 hp 58A
Minimum current ampacity
30 hp 67A
50 hp 87A
Interface type ..... 1.5 Knockout

Environment

Ambient environment
Installation location ..... indoors
Airborne dust/contaminants ..... minimal
Ambient temperature
Minimum storage ..... 2°C (36°F)
During operation ..... 5°–40°C (40°–104°F)
Maximum relative humidity 95%

Air, drain, and water



Air [1]

Required connections ..... one
Capacity ..... 5.5–7.0 bar (85–100 psi), 1 scfm
Quality ..... per ISO 8573-1:2010; ISO Class 4
Maximum particle size ..... 15 microns
Maximum pressure dew point [water @ 7 bar (100 psi)] ..... +3°C (+38°F)
Maximum oil content ..... 5 mg/m^3
Interface type ..... ¼ in. NPTF

Drain

Required connections ..... two
Cooling water out capacity ..... 11 L/min (3 gpm)
Bleed down water capacity ..... 4 L/min (1 gpm) intermittent
Interface type ..... ½ in. NPTF

Water [1, 2]

Required connections ..... two
Cutting water in capacity ..... 7.6 L/min @ 3–7 bar (2 gpm @ 45–100 psi)
Cooling water in capacity ..... 11 L/min @ 2.5–7.0 bar, 24°C max, (3 gpm @ 35–100 psi, 75°F max)
Interface type ..... ½ in. NPTF

1. We recommend that you install manual shut-off valves for these service connections: cutting water in, cooling water in, and air. Locate valves as close as possible to the pump interface connection to make them easier to service.
2. See **Inlet water quality recommendation**.

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Inlet water quality recommendation

Water quality plays a crucial role in determining how well an ultrahigh-pressure waterjet system operates. Maintain inlet water quality and temperature within the recommended parameters to ensure optimum performance of ultrahigh-pressure pumps and components.

Primary water source

Use a municipal tap water supply source (or equivalent) for the primary water to the pump. Process water, boiler condensate, or untreated water sources are generally not acceptable. Do not use water treated by the deionization (DI) process.

Reverse osmosis (RO) process is acceptable under certain circumstances. RO can cause damage unless a proper bypass feature is put in place.

Primary water treatments

As impurities are removed from the water, it becomes more aggressive, seeking to replace the removed impurities with whatever it contacts. Excessive water treatment can be detrimental to components in the high-pressure water system.

Chillers
If the temperature of the inlet water to the pump does not fall within the range specified, a chiller may be required to achieve the expected pump maintenance cycles. The capacity of a chiller is determined by horsepower, application, and site-specific conditions.

Water softeners
Use a sodium ion exchange water softener system to treat water hardness. We recommend a dual sodium ion exchange system to allow for regular regeneration of the system and to provide a continuous supply of treated water.

The water softener system must have the capacity to handle 1.5 times the maximum flow rate of the pump. Both the exiting flow rate [liters (gallons) per minute] and the flow rate of liters (gallons) per duty cycle should be considered.

Most water utilities change the source of the water supply seasonally. This causes water hardness to

change significantly. Select a softener that handles the highest expected hardness levels.

Water with unusually high iron levels may require additional water softening treatment from your local water treatment supplier.

Suspended particulate filtration
Filter the primary water supply for suspended particulate matter. Our pumps include filters for this purpose. Replace filter cartridges as specified in the manual and only use filters with absolute ratings.

We recommend you install a quality 1- or 2-stage 5-micron absolute pre-filter in the primary water source.

Cooling water for intensifier pumps does not have to be filtered.

Recommended plumbing materials

We recommend that you use pipes and fittings made with copper or Schedule 80 PVC. Do not use pipes and fittings made with iron or aluminum. Use only quality hoses such as Push-Lok® or stainless steel.

Water flow rates

Primary water
Required primary water flow rate is determined by pump and orifice size.

Cooling water
Recommended cooling water flow rate is 11 L/min (3 gpm) per 50 hp (motor) at 15.5°C (60°F) inlet water temperature. This flow rate will increase as inlet water temperature increases.

Water quality · 6500 bar (94K) intensifier pumps

General properties

Temperature ..... 5°–20°C (41°–68°F)
Clarity ..... clear
Color ..... colorless
Odor ..... none present
Electrical conductivity ..... 100–400 µS/cm
pH 7–8.5
Total Dissolved Solids (TDS) ..... 70–280 mg/l

Anions

Chloride | Cl ..... 0–100 mg/l
Silica | SiO_2 ..... 0–8 mg/l
Sulfate | SO_4 ..... 0–25 mg/l

Carbonate

m-Alkalinity | $CaCO_3$ ..... 0–320 mg/l
Hardness | $CaCO_3$ ..... 0–30 mg/l; 0–1.7°dh

Cations

Calcium | Ca ..... 0–25 mg/l
Iron | Fe ..... 0–0.1 mg/l
Magnesium | Mg ..... 0–1 mg/l
Magnesium | Mn ..... 0–0.05 mg/l
Sodium ..... 0–110 mg/l

Dissolved gases

Carbon Dioxide | CO_2 ..... 0–10 mg/l
Free Chlorine | Cl_2 ..... 0–0.1 mg/l
Oxygen | O_2 ..... 0–1 mg/l

Water properties

Additional reference for the water properties shown in the water quality recommendations.

General properties

Clarity
Turbidity indicates the existence of very fine particles. Small particles can destroy orifices. Primary water should be clear.

Color
Color can derive from dissolved iron or from organic compounds. Primary water should be colorless.

Odor
Chlorine, organic solvent, and sulfur compounds can generate noticeable smell. Primary water should be odorless.

pH
With increasing pH, the formation of solids increases. Water hardness should be stabilized. With decreasing pH, cavitation damage can occur through off-gassing carbon dioxide.

Total Dissolved Solids (TDS)
Measure of the total amount of dissolved matter in water.

Anions

Chloride | Cl
Adds to solid content and increases the corrosiveness of water; in relative percentage presence with oxygen induces stress corrosion cracking.

Silica | SiO^2
With higher amounts of silicate and untreated water, the silicate has the tendency to crystallise under high pressure. This effect increases significantly as pressure increases. Crystals reduce the life of orifices, check valves, and pressure control valves.

Sulfate | SO^4
Adds to solid content; combines with calcium to form calcium sulfate scale.

Carbonate

m-Alkalinity*
Acid neutralizing capacity of water. Foaming and carryover of solids, causes embrittlement of steel, can produce CO_2, a source of corrosion.

* Bicarbonate (HCO^3), Carbonate (CO_3), and Hydrate (OH) expressed as $CaCO_3$.

Hardness
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. Non-carbonate hardness is due to sulfates and chlorides.

Cations

Calcium | Ca
When dissolved makes water hard; contributes to the formation of scale.

Iron | Fe
Discolors water or precipitation; source of scale and erosion.

Magnesium | Mg
When dissolved makes water hard; contributes to the formation of scale.

Manganese | Mn
Discolors water or precipitation; source of scale and erosion.

Sodium
Found naturally; introduced to water in the ion exchange water softening process.

Dissolved gases

Free Chlorine | Cl_2
Oxidizing agent; can attack elastomeric seals and damage reverse osmosis (RO) membranes.

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Operation

Operation

Pages: 4

- **Operation overview**
  Overview of HyperJet 30/50 operation, including operating modes.

- **How to configure pressure setpoints**
  HyperJet 30/50 | Configure pressure setpoints in FlowCut · Configure pressure setpoints at the pump

- **Indicator status, warnings, and shutdowns**
  HyperJet 30/50 | Indicator status · Warnings · Shutdowns

- **Troubleshooting by symptom**
  HyperJet 30/50 | Troubleshooting the pump by symptom

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Operation overview

Where used
HyperJet 30/50

1. Emergency Stop (E-stop)
2. Main Power disconnect switch
3. LED light bar
4. High/Low Pressure Setpoint selector switch
5. Local/Remote keyed switch
6. Start/Stop button with indicator

Item	Description	Comment
1	Emergency Stop (E-stop)	When you press the the E-stop button, it immediately stops the pump and bleeds high or ultra-high water pressure. To reset after an E-stop, make sure the issue that prompted the stop has been resolved and then disengage the E-stop. Disengaging the E-stop will not restart the pump.
2	Main Power disconnect switch	—
3	LED light bar	If the light bar is solid green, there are no faults. If it's not illuminated, there is a **fault**.

4	High/Low Pressure Setpoint selector switch	High Pressure default setpoint is 87,000 psi. Applied for standard cutting. Low Pressure default setpoint is 15,000 psi. Applied when piercing brittle materials. See **How to configure pressure setpoints**
5	Local/Remote keyed switch	See **Operating modes**
6	Start/Stop button with indicator light	See **Operating modes** and **Indicator status, warnings, and shutdowns**

Operating modes

The pump operates in two modes: Local or Remote.

- In Local mode, the pump is turned on and off via switches on the pump. A white status LED in the middle of the Start/Stop button indicates the current pump condition via a flashing sequence.
- In Remote mode, the pump is operated remotely over EtherCAT protocol or by using a hardwired remote interface connection.
  - For machines that use EtherCAT protocol and hard wired E-stop circuit, you can do the following in FlowCut: start and stop the pump, configure pressure setpoints, and acknowledge FlowSense error messages.
  - For machines that use a hardwired remote interface connection, you can start and stop the pump in FlowCut. Pressure setpoints must be set at the pump, and you must push the local Stop button to acknowledge a fault.

Regardless of mode, the pump will automatically shut off if it doesn't deliver high-pressure water within 30 minutes.

When high pressure is reduced to start a piercing operation, the bleed down valve opens for 0.5 seconds to quickly reduce the pressure level.

How to configure pressure setpoints

Where used

HyperJet 30/50

Summary

High and low pressure setpoints are configured two ways: directly at the pump or through FlowCut software, depending on configuration.

Configure pressure setpoints at the pump

Low Pressure setpoint

To set the Low Pressure setpoint at the pump, do the following:

1. Engage the E-stop, select Local mode, and then select Low setpoint.
2. While holding the Stop button, push the Start button—in 2500 psi increments—up to 25,000 psi.
    - If you push the Start button after the setpoint reaches 25,000 psi, it will reset the Low setpoint to 15,000 psi.

High Pressure setpoint

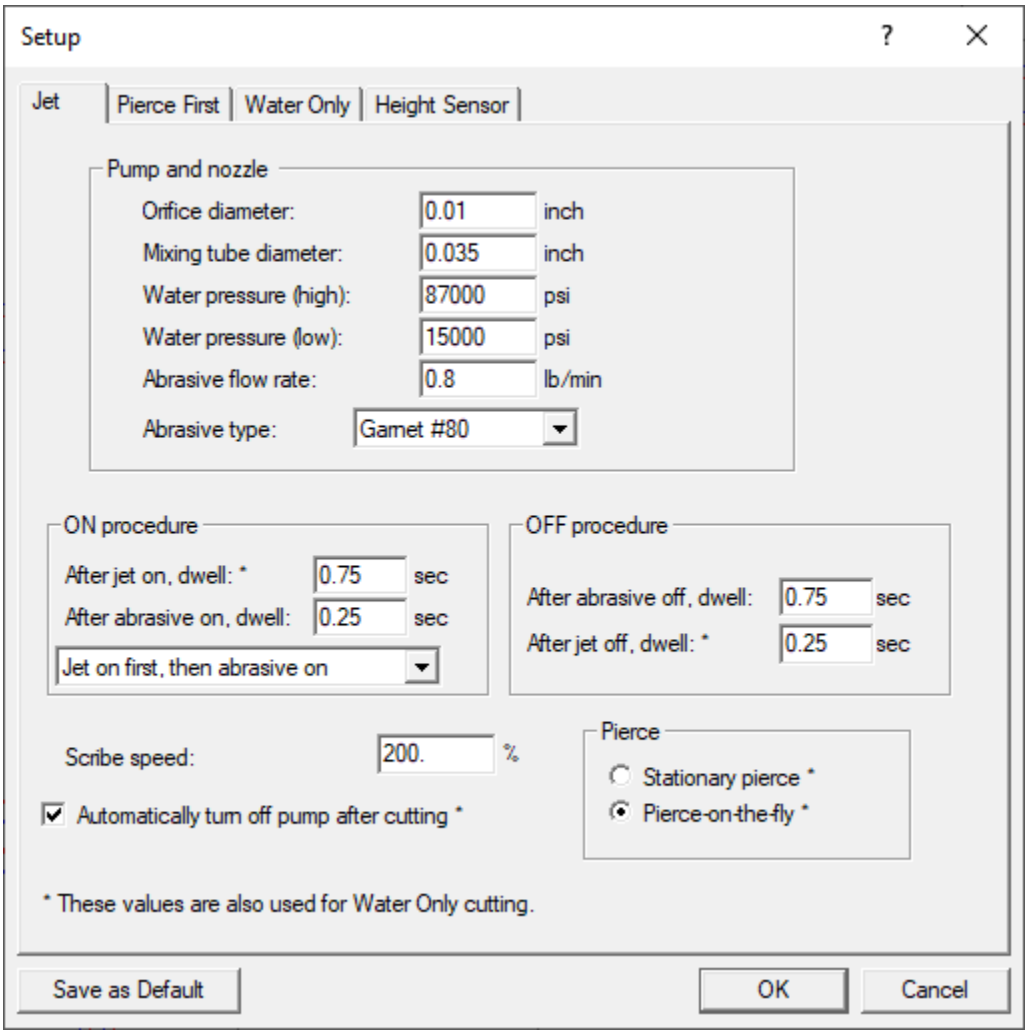
To set the High Pressure setpoint at the pump, do the following:

1. Engage the E-stop, select Local mode, and then select High setpoint.
2. While holding the Stop button, push the Start button—in 2500 psi increments—up to 87,000 psi.
    - If you push the Start button after the setpoint reaches 87,000 psi, it will reset the High setpoint to 30,000 psi.

Configure pressure setpoints in FlowCut

To set the pressure in FlowCut, do the following:

- Go to **Setup** > **Jet**. On the **Jet** tab, enter a value for **Water pressure (high)** and **Water pressure (low)**.



Indicator status, warnings, and shutdowns

Where used
HyperJet 30/50

Indicator status

A white status LED in the middle of the Start/Stop button indicates the current pump condition.

LED Sequence	Description
Solid Green	Pump is ready to start.
Solid Red	Active safety relay. To acknowledge the fault, push the pump's Stop button or acknowledge the fault message in FlowCut's diagnostic tool, FlowSense.
Flashing Green	Pump is in operation.
Flashing Yellow	Pump was stopped by the pump's Stop button, from FlowCut, or from hardwired Stop interface. Pump can be restarted after four seconds. After five seconds, the LED will change to solid green.
Flashing Red	Active fault; see Warnings and Shutdowns.

Warnings

When a warning alarm occurs, the pump will continue to run. Once the condition causing the warning alarm is resolved, push the pump's Stop button or acknowledge the error in FlowCut.

Yellow LED Sequence	FlowSense warning code	Description	Reference
Flash: 1 Pause: 2 seconds	5	High hydraulic oil temperature	Comment 1
Flash: 2 Pause: 2 seconds	6	Intensifier's left check valve temperature high	Comment 2
Flash: 3 Pause: 2 seconds	7	Intensifier's right check valve temperature high	Comment 3
Flash: 4 Pause: 2 seconds	12	Bleed down valve temperature high	Comment 4
Rapid blinking Pause: 0.5 seconds	25	Startup oil temperature out of range	Comment 5
—	26	Pump in Local mode	Comment 6
—	27	Pump lost EtherCAT connection	Comment 7

Comments

1. Oil temperature is ≥ 49°C (120°F). Check the water supply.
2. Left-side check valve temperature is above 50°C (122°F). Check left-side intensifier lines. Power down the system and check for leakage through valve.
3. Right-side check valve temperature is above 50°C (122°F). Check right-side intensifier lines. Power down the system and check for leakage through valve.
4. Bleed down valve temperature is above 50°C (122°F). Check bleed down valve and lines. Power down the system and check for leakage through valve.
5. The pump oil temperature is either below 2°C (35°F) or above 55°C (131°F). Investigate hydraulic oil conditions.
6. Key switch is set to Local mode. Set switch to Remote mode to operate the pump remotely.
7. M-series machine detected EtherCat communication loss from the pump. Inspect machine-to-pump EtherCat connection, verify EtherCat communication status lights.

Shutdowns

When a shutdown alarm occurs, shutdown is immediate. The motor stops, the bleed down valve opens, and all high pressure and hydraulic pressure are relieved from the system. Once the condition causing the shutdown alarm is resolved, push the pump's Stop button or acknowledge the error in FlowCut.

Red LED Sequence	FlowSense shutdown code	Description	Reference
Flash: 1 Pause: 2 seconds	4	Low inlet water pressure	Comment 1
Flash: 2 Pause: 2 seconds	10	Failed to shift at startup	Comment 2
Flash: 3 Pause: 2 seconds	3	Low hydraulic oil level	Comment 3
Flash: 4 Pause: 2 seconds	5	High hydraulic oil temperature	Comment 4
Flash: 5 Pause: 2 seconds	9	Emergency Stop	Comment 5
Flash: 6 Pause: 2 seconds	8	Overstroke	Comment 6
Flash: 7 Pause: 2 seconds	1	Motor feedback	Comment 7
Flash: 8 Pause: 2 seconds	7	Lost EtherCat connection	Comment 8
Flash: 9 Pause: 2 seconds	11	Startup oil temperature out of range	Comment 9

Comments

1. A shutdown has occurred due to low inlet water pressure, less than 2 bar (30 psi). Check the water supply and the condition of the inlet water filters.
2. A shutdown has occurred due to failure to shift during startup, 12 second timer. Check shift sensors and solenoids, check intensifier hydraulics.
3. Oil level is low due to leaks. Check the oil level and check for hydraulic leaks.
4. Oil temperature has reached 60°C (140°F). Cooling water flow is restricted; check the cooling water supply.
5. A shutdown has occurred due to E-stop button being engaged locally or remotely, light curtain

has been tripped. Check E-stop and light curtain.

6. An overstroke condition has occurred. Abnormally high stroke rate caused by an external or internal leak. Shutdown will occur if condition persists. Check plumbing for leaks, check the orifice, and check incoming water pressure.
7. A shutdown has occurred due to missing feedback from softstarter or Y-Delta motor starter. Please contact Flow Technical Service as this could be a serious issue with the pump electronics
8. Lost EtherCat connection with machine. Check EtherCat cable for damages. Check FlowCut's diagnostic tool, FlowSense.
9. Oil temperature at startup has remained out of range for more than three minutes. The pump oil temperature is either below 2°C or above 55°C. Investigate hydraulic oil conditions. Allow pump hydraulic oil to return to acceptable temperatures.

Troubleshooting by symptom

Where used

HyperJet 30/50

Related articles

High-pressure leaks and weep holes
Indicator status, warnings, and shutdowns

If the issue is not resolved by the recommended solution or if you are experiencing a symptom not shown, please contact Flow Technical Service for assistance.

Symptom	Solutions
Low cutting water pressure	Low hydraulic pressure setting. If operating in low pressure, switch to high pressure operation and check the hydraulic pressure setting.
Pump will not start	Emergency stop button is depressed. Pull the E-stop button out and reset emergency stop function relay. Check all remote emergency stop function relays and reset. A protection fault has been activated; check for fault messages. Inlet water valve is turned off; turn the water valve on.
Pump quits running	Unsafe operation has been detected; check for fault messages. Electrical power has been interrupted; check the power supply circuit for a tripped breaker.
No control power	Safety function relay has been tripped; check all safety function relays and reset. Remote interface plug is disconnected; connect the plug.
E-stop light does not illuminate	Control power has been interrupted; verify the remote interface plug is connected.

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Get started: HyperJet 30/50 Upkeep Fundamentals

Get started: HyperJet 30/50 Upkeep Fundamentals

Pages: 6

- **Flow Parts · HyperJet 30/50 pumps**
  HyperJet 30/50 | Assemblies · Filters · Hydraulic oil · Lubricants · Maintenance kits · Tools/ Tool kits
- **Routine maintenance schedule · HyperJet 30/50 pumps**
  HyperJet 30/50 | Start-up checks · Other routine maintenance
- **Best practices for pump maintenance and service**
  General best practices · Keeping components clean is critical · Troubleshooting tips
- **Torque specification for pumps**
  If a torque value for a gland nut is not specified, reference this table to determine torque value.
- **Recommended cleaners and lubricants for pumps**
- **Decommissioning a pump**
  Guidelines for decommissioning a pump.

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Flow Parts · HyperJet 30/50 pumps

Where used
HyperJet 30/50

Assemblies
Bleed down valve 1011225

Check valve 020071-1
End cap 014817-1
Filler tube 020595-1
High-pressure cylinder 020592-1
Seal carrier 040015-1
Plunger 010253-1

Components
Check valve body 020077-1

Filters
Oil filter 05049689
Water filters
0.5 micron filter A-1449
1 micron filter A-1555

Hydraulic oil
P66 Megaflow AW 46
5 gallon pail 1011002
55 gallon drum 1011003
275 gallon tote 1011004

Lubricants
Blue Lubricant A-2185
Loctite 242 ..... A-3203
Parker Super O-Lube 200006
White Food Grade Grease A-4689

Maintenance kits
Bleed down valve repair kit 20477518
Inlet check valve repair kit 014884-1
Outlet check valve repair kit 014885-1
Low-pressure seal kit 013157-1

Minor maintenance kit …….. 062964-1
Major maintenance kit …….. 062964-2
Overhaul maintenance kit …….. 062964-3

Tools/Tool kits

Bleed down valve tool kit …….. 1011742
Check valve lapping kit …….. B-1813-3
Pressure loading tool kit …….. 042512-3
Shift pin tool …….. 002228-1

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Routine maintenance schedule · HyperJet 30/50 pumps

Where used
HyperJet 30/50

Start-up checks

Action	Item	Before start-up	After start-up
Check oil level	Hydraulic system	✓	✓
Inspect for leaks and abnormal conditions	High Pressure system Low Pressure system Hydraulic system	✓	✓
Control panel checks	Lights	✓	✓
Listen for unusual sounds	Pump unit	—	✓
Pressure checks	Discharge cutting water Inlet cutting water Boost water Inlet cooling water Hydraulic operating oil Compressed air	—	✓
Temperature checks	Sealing head High-pressure cylinder Hydraulic cylinder Hydraulic oil Bleed down valve	—	✓
Filters	Inlet water filter Hydraulic oil filter	✓	✓

Other routine maintenance

Action	Interval
Inspect recirculation system for leaks and abnormal conditions	Weekly
Temperature checks for inlet cooling water, discharge cooling water, electric motor, and hydraulic pump	Weekly
Control panel checks for safety functions [1]	Weekly
Inspect and/or replace hydraulic hoses	Inspect annually; replace every 5000 hours.
Change hydraulic oil in reservoir	The hydraulic oil should be changed at intervals required to maintain ISO 4406 cleanliness level 18/15/13, not to exceed 6000 hours. The oil should be replaced sooner if a fluid sample indicates contamination that cannot be rectified by filtering.
Replace hydraulic oil filter	Every 3000 hours or when the pressure gauge reads 3 bar (40 psi) at normal operating temperature; which ever comes first.
Replace inlet water filters	As required; replace filters when the pressure on the gauge drops from 100 psi to 65 psi, with the cutting head open.
Install Minor maintenance kit [2]	Starting at 500 hours
Install Major maintenance kit [2]	Starting at 1000 hours
Install Overhaul maintenance kit [2]	Starting at 1500 hours

Notes

1. To check the emergency stop circuits, press the Emergency Stop button and verify the motor stops, alarms activate, and the high-pressure water drains from the system. If applicable, check all remote start and emergency stop functions.
2. Recommended maintenance is at fixed intervals, continuing through the life of the pump. You'll install a maintenance kit—every 500 hours —for the life of the pump. (Minor, Major, Overhaul, repeat.)

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Best practices for pump maintenance and service

Where used
All Flow pumps

General best practices

- Inspect the equipment every day before operating it. Routinely check for loose bolts or wire connections.
- Maintain records of service performed. This provide valuable information to help you stock spare parts and avoid surprise repairs.
- Read through the maintenance procedure before you start the work. Install all the parts included in a maintenance kit at the same time.
- Handle critical parts with care to avoid scratches or dents to components.
- Avoid using substitutes for the fluids, sealants, and lubricants recommended by Flow.
- All threaded high-pressure connections require an even coating of Blue Lubricant.
- Protect all machined and lapped mating surfaces against nicks, scratches, and burrs.
- All parts that contain high-pressure water are susceptible to stress fatigue accelerated by nicks, scratches, or other surface disruptions. Replace damaged components!
- Life expectancy of high-pressure water seals and other high-pressure parts is related to stress on the parts, and is a function of stroke rate, water pressure, and inlet water temperature. Don't exceed pump ratings; this leads to increased costs and downtime.

Keeping components clean is critical!

- Keeping components clean is critical. Make every effort to find a clean area to service the components—do not tear down parts in the same area where cleaning is taking place. Airborne dirt and abrasive have serious detrimental effects on part life.
- Before you clean parts, make sure that you wipe all components with a lint-free rag to remove most of the Blue Lubricant and debris.
- Clean all parts with fresh, clean solvent that does not leave a residue, such as Citra-Safe® or isopropyl alcohol. We recommend that you set up a dedicated solvent tank for these critical parts. Contamination from other industrial parts will seriously reduce part life.
- Carefully clean and blow compressed air on parts being reassembled. Don't use paper towels or create airborne dust.

Troubleshooting tips

- Listen to the equipment and watch it operate. Learn to recognize the normal noises, temperature, and operating conditions. This will increase your ability to notice any unusual equipment behavior.
- Monitor weep holes—they provide an outlet for high-pressure water in case of seal problems and can help identify problems with the pump.

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Torque specification for pumps

Where used
All Flow pumps

If a torque value for a gland nut is not specified, reference this table to determine torque value.

- Always leave 3–4 threads showing between the end of the high-pressure tubing and gland nut collar.
- Always lubricate threads and the area between the gland nuts and collars with Blue Lubricant.

If the high-pressure tubing OD is…	Then torque the gland nut to…
1/4 in.	20–34 N-m (15–25 ft-lb)
3/8 in.	47–60 N-m (35–45 ft-lb)
9/16 in.	80–100 N-m (60–75 ft-lb)

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Recommended cleaners and lubricants for pumps

Where used
All Intensifier pumps

To	Use this
Clean high-pressure pump parts	Citra-safe® Isopropyl alcohol (not for use in ultrasonic cleaners)
Lubricate threaded high-pressure connections	Blue Lubricant (A-2185)
Lubricate O-rings that come in contact with water	White Food Grade Grease (A-4689)
Lubricate O-rings that come in contact with hydraulic oil	Parker Super O-Lube (200006)

Decommissioning a pump

Where used

All Flow pumps

When a pump is decommissioned and taken out of service for any reason, all local regulations must be adhered to. All utilities must be de-energized and disconnected. The hydraulic oil contained in the unit must be drained and disposed of according to local codes. If the unit is to be disposed of, all local codes must be observed.

We recommend recycling the unit. Most of the heavy metallic content of the unit can be recycled. Contact Flow if assistance is required in identifying materials.

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High Pressure water system

High Pressure water system

Pages: 3

- **High Pressure water system**
  Overview of High Pressure water system for HyperJet 30/50.

- **High-pressure leaks and weep holes**
  HyperJet 30/50 | Attenuator leaks · Bleed down valve leaks · High-pressure tubing leaks · Intensifier leaks

- **Install bleed down valve repair kit · 20477518**
  HyperJet 30/50 | Step-by-step instructions to install bleed down valve repair kit 20477518.

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High Pressure water system

Where used

HyperJet 30/50

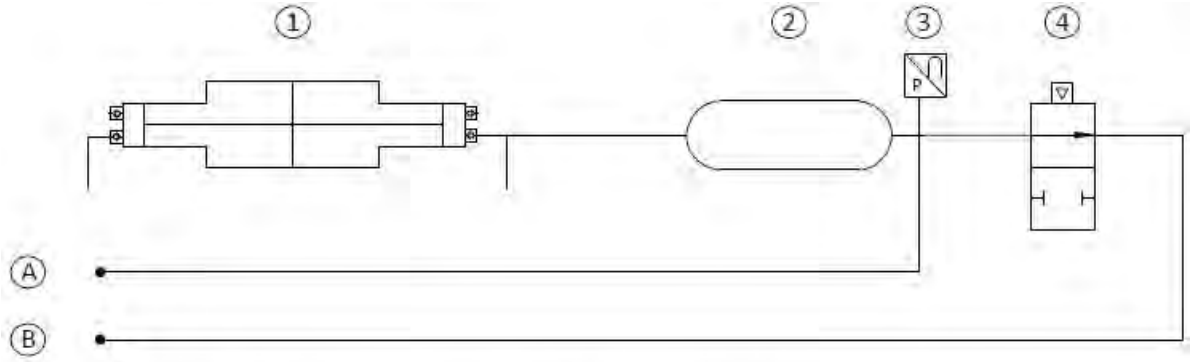
Summary

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 a maximum of 6480 bar (94,000 psi) with the cutting head valve closed or 6000 bar (87,000 psi) with the cutting head valve open.

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.

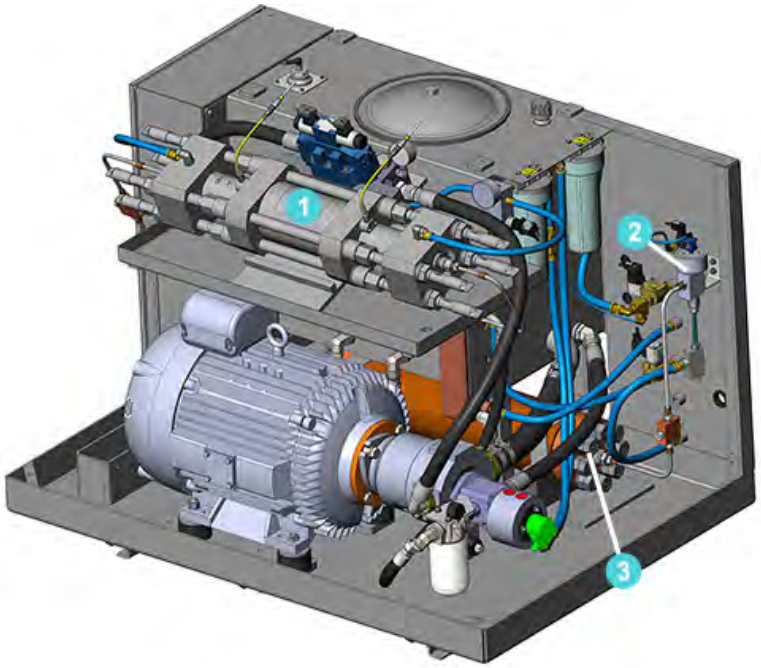
System components include a double-ended hydraulic cylinder; reciprocating piston assembly; high-pressure cylinders attached to each end of the hydraulic cylinder; two plungers, sealing heads and hard seal end caps; one liter capacity attenuator, and a bleed down valve. Check valves and seal assemblies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

View 1 · High Pressure water system circuit



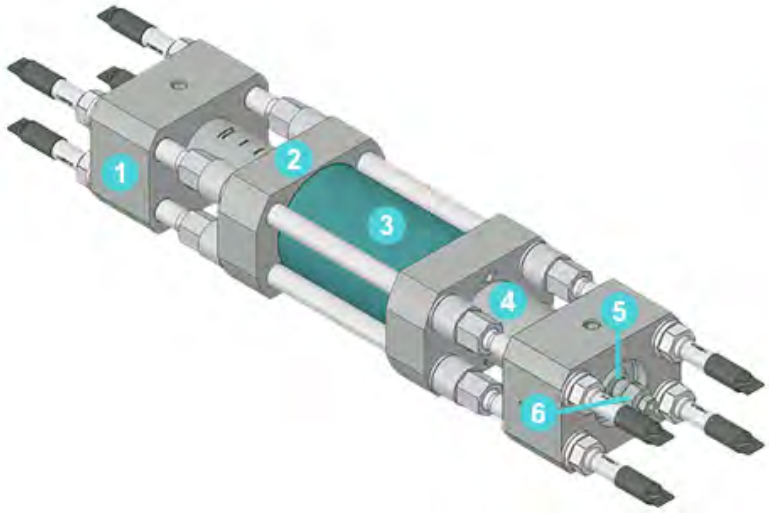
1	Intensifier	4	Bleed down valve
2	High-pressure attenuator	A	High-pressure water outlet
3	High-pressure transducer	B	Bleed down valve drain

View 2 · High Pressure water system



1. Intensifier
2. Bleed down valve
3. Attenuator assembly

View 3 · Intensifier



1. End cap
2. End bell
3. Low-pressure cylinder
4. High-pressure cylinder
5. Check valve
6. Outlet body adapter

Reference

[High-pressure leaks/weep holes]
[Intensifier maintenance]

Maintenance procedures

[Install bleed down valve repair kit · 20477518]

Notes

- If leaks are detected during a maintenance interval, do not over-torque fittings to stop leakage.
- After servicing any high-pressure component, the High Pressure water system must be

thoroughly flushed to remove any debris or contaminates.

Specifications

Operating outlet pressure setting
- Minimum ……. 689 bar (10,000 psi)
- Maximum ……. 6000 bar (87,000 psi)

Bleed down valve
- Maximum generated water pressure ……. 6480 bar (94,000 psi)
- Regulated air pressure ……. 5.9–6.9 bar @ 0.03 m^3/min (85–100 psi @ 1.0 cfm)

High-pressure tubing ……. rated for 6890 bar (100,000 psi) max generated pressure

How it works

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.

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 6480 bar (94,000 psi) with the cutting head valve closed. When the piston reverses direction, the plunger retracts and the plunger in the opposite cylinder extends to deliver the high pressure water.

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High-pressure leaks and weep holes

Where used
HyperJet 30/50

- Monitor weep holes—they provide an outlet for high-pressure water in case of seal problems and can help identify problems with the pump.
- If leaks are detected, do not over-torque fittings to stop leakage.

Attenuator leaks

Leaks from the attenuator are not field repairable. **Do not attempt to repair!** Please contact Flow to schedule service.

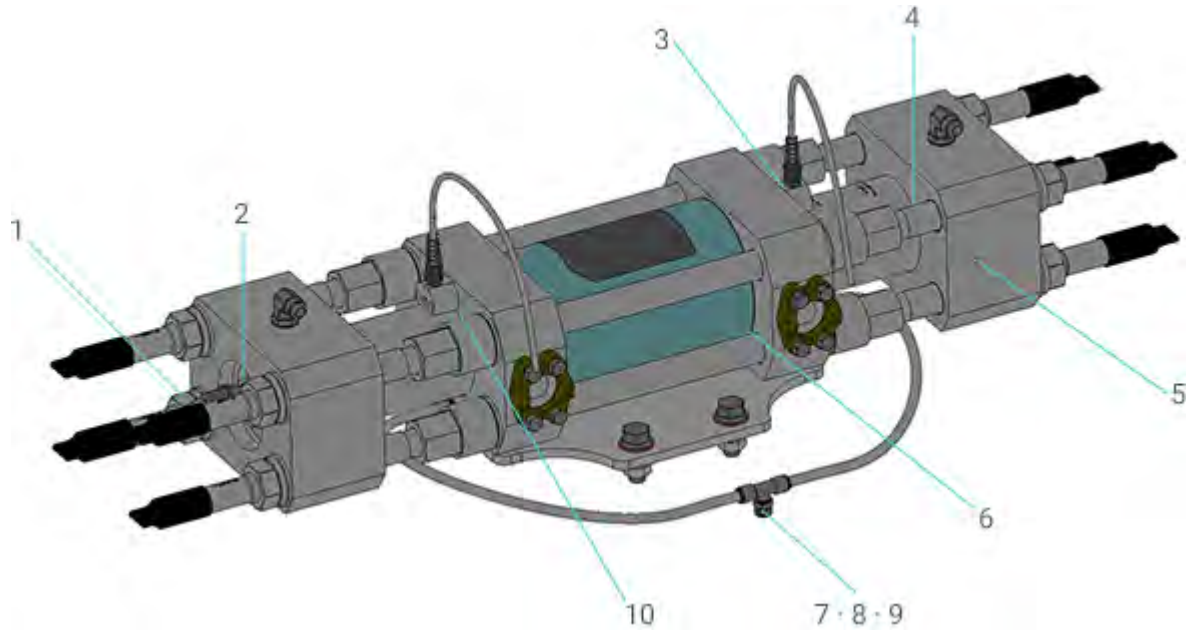
Bleed down valve leaks

High-pressure tubing leaks

If the high-pressure tubing is leaking, do the following:

- Verify the fitting is torqued to recommended torque values. If there is still a leak after you torqued the fittings, replace the tubing.
- Verify the gland nut collar is installed correctly. There should be 3–4 threads visible between the end of the tubing and gland nut collar.
- Check to see if any of the fittings are eroded. If so, replace them.

Intensifier leaks



1	Insufficient torque on HP fitting, damaged cone on HP tubing, or failed outlet adapter
2	Outlet insert, check valve body, or check valve O-ring failure
3	Insufficient torque on shift sensor screws or failed shift sensor O-ring
4	HP cylinder or check valve body failure
5	HP cylinder or check valve body failure
6	End bell O-ring failure
7	HP cylinder or seal carrier assembly failure [1, 2]
8	Leaking water ⇒ HP cylinder or seal carrier assembly failure [1] Leaking oil ⇒ Oil shaft seal failure [1, 2]
9	Leaking water ⇒ HP cylinder or seal carrier assembly failure [1, 2] Leaking oil ⇒ Oil shaft seal failure [1, 2]
10	HP cylinder or seal carrier assembly failure

Notes

1. Weep hole locations 7, 8, and 9 are combined into one location on each end cap. The drains for these locations are plumbed into the drain system and do not leave visual evidence of weeping. To examine leakage, disconnect the tubing from the push-connect fittings of the tee fitting (located on the mounting plate).
2. A small amount of leakage is normal during operation.

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Install bleed down valve repair kit · 20477518

Where used

HyperJet 30/50

Recommended maintenance interval

As required

Bleed down valve repair kit · 20477518

1	O-ring; -143
2	O-ring; -035
1	Valve stem
1	Valve seat
1	Backup ring; Brass
1	Seal assembly
1	Backup ring; SST

Bleed down valve tool kit · 1011742

Tools

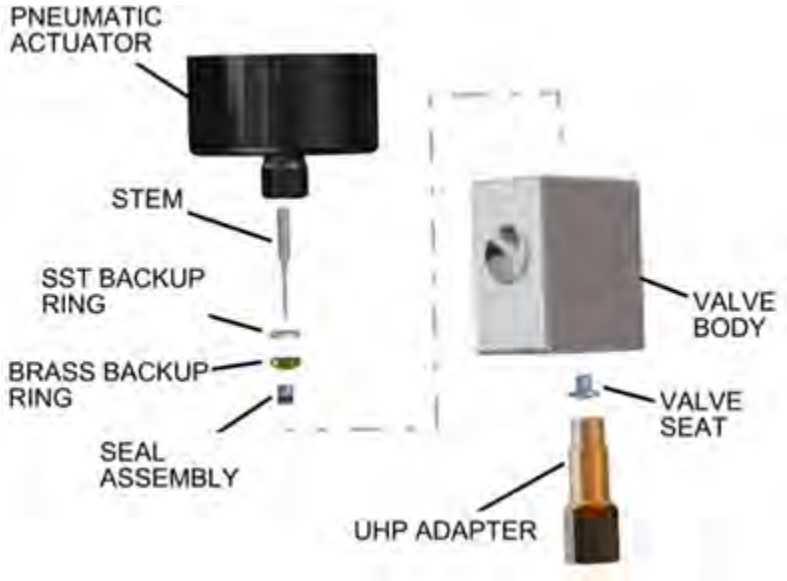
Pin spanner; adjustable
Soft-jaw vice
Strap wrench

Supplies

Blue Lubricant
Parker Super O-Lube
White Food Grade Grease

View 1

View 2



Part 01

1. Stop the pump, and then **do a Lockout/Tagout**.
2. Turn the air supply off, and then remove the air line and the electrical connection to the solenoid valve.
3. Loosen and remove the high-pressure gland connections and the drain connection.
4. Remove the valve and actuator assembly. Loosen the cylinder head on the actuator, and then unscrew and remove the actuator from the valve body.
5. Unscrew the adapter and remove the adapter and valve seat.

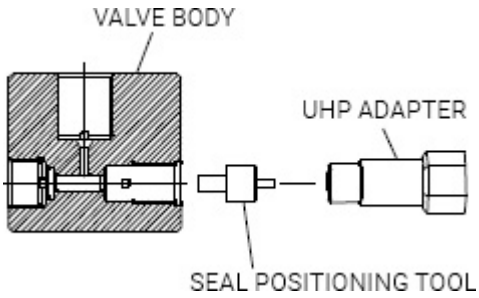
   Valve seat
6. Remove the stem, SST backup ring, and brass backup ring from the valve body.

   Stem · SST backup ring · Brass backup ring
7. Use the seal push tool to push the seal assembly out through the actuator port in the top of the valve body—do not remove any other way!

   Seal assembly
8. Clean and inspect the valve body, being careful not to damage or scratch the bore.

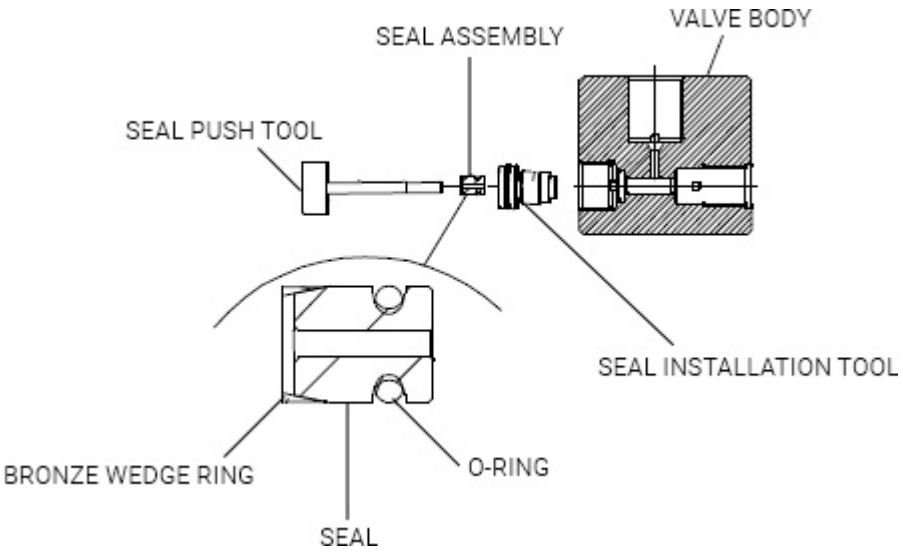
Part 02 · Service the valve body

1. Place the seal positioning tool into the end of the valve body, and then thread the adapter into the valve body until light contact is made with the tool—hand tight only.

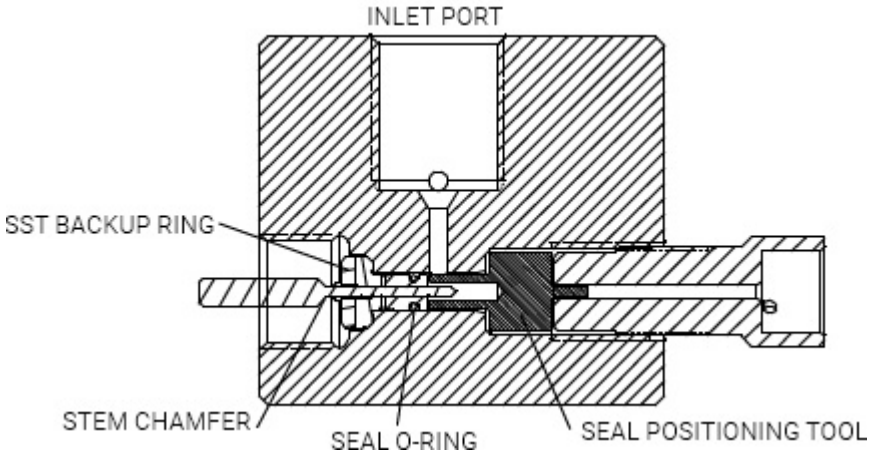


2. Apply a thin, even layer of BLUE LUBRICANT to the threads of the seal installation tool, and then screw the tool into the threads of the valve body.
3. Apply a thin, even layer of WHITE FOOD GRADE GREASE to the O-ring on the seal assembly, and then insert the assembly—O-ring end first—into the seal installation tool. The bronze wedge ring will face the actuator.

4. 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 positioning tool.



5. Remove the push tool and the installation tool from the valve body.
6. Install the SST backup ring and brass backup ring on the 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.
7. 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.
   NOTICE 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.



8. Remove the adapter and the seal positioning tool.

Part 03 · Service the actuator

1. Unscrew and remove the cylinder head using a strap wrench and a pin spanner. Remove the piston from the cylinder.
   NOTICE 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 and discard. Apply a thin, even layer of PARKER O-RING LUBE to the new O-ring and install.
3. Remove the two O-rings on the piston and discard. Apply a thin, even layer of PARKER SUPER O-LUBE to the two new O-rings and install.
4. Install the piston in the pneumatic cylinder. Apply a thin, even layer of BLUE LUBRICANT to the threads on the cylinder head and screw it into the pneumatic cylinder.

Part 04

1. Apply a thin, even layer of BLUE LUBRICANT to the threads of the actuator and carefully thread it into the valve body, guiding the stem into the bore of the actuator.
2. 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, 7 N-m (5 ft-lb).
3. Apply a thin, even layer of BLUE LUBRICANT to all surfaces—except the ID—of the valve seat, and then insert it—small OD end first—into the outlet port of the valve body.
4. Apply a thin, even layer of BLUE LUBRICANT to the threads on the adapter. Install the adapter, and then torque to 95 N-m (70 ft-lb).

5. Mount the bleed down valve into the pump, and then connect the HP lines to the inlet and outlet ports. Install the air line and the electrical connection to the solenoid valve.
6. **Reverse the Lockout/Tagout**, power on the pump, and check for leaks.
7. Start the pump, run to full pressure, and check for leaks.
8. Stop the pump and verify proper operation of the bleed down valve. If there are no issues, return pump to service.

Flow
SHAPE TECHNOLOGIES GROUP®

High Pressure water system: Intensifier maintenance

High Pressure water system: Intensifier maintenance

Pages: 8

- **High Pressure water system: Intensifier maintenance**
  Includes links to maintenance procedures and exploded views of the high-pressure end of the intensifier and check valve assembly.

- **Using the pressure loading tool**
  HyperJet 30/50 | Unload the tie rods · Load the tie rods

- **Replace seal carrier assembly**
  HyperJet 30/50 | Step-by-step instructions for replacing a seal carrier assembly.

- **Replace high-pressure cylinders**
  HyperJet 30/50 | Step-by-step instructions for replacing high-pressure cylinders.

- **Replace check valve assembly**
  HyperJet 30/50 | Step-by-step instructions for replacing the check valve assembly.

- **Install inlet check valve repair kit · 014884-1**
  HyperJet 30/50 | Step-by-step instructions to install inlet check valve repair kit 014884-1.

- **How to lap the check valve body**
  HyperJet 30/50 | Step-by-step instructions for lapping the check valve body.

- **Install outlet check valve repair kit · 014885-1**
  HyperJet 30/50 | Step-by-step instructions to install outlet check valve repair kit 014885-1.

Flow
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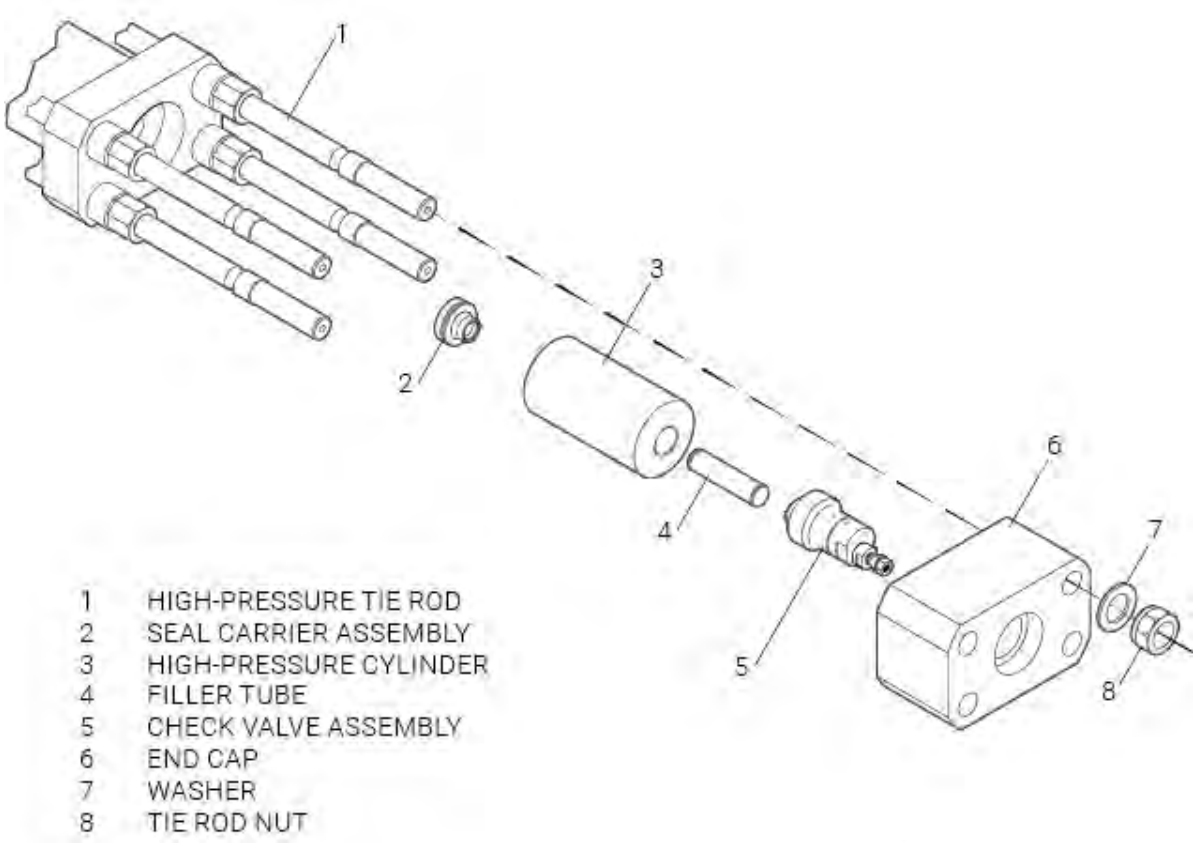
High Pressure water system: Intensifier maintenance

Maintenance procedures

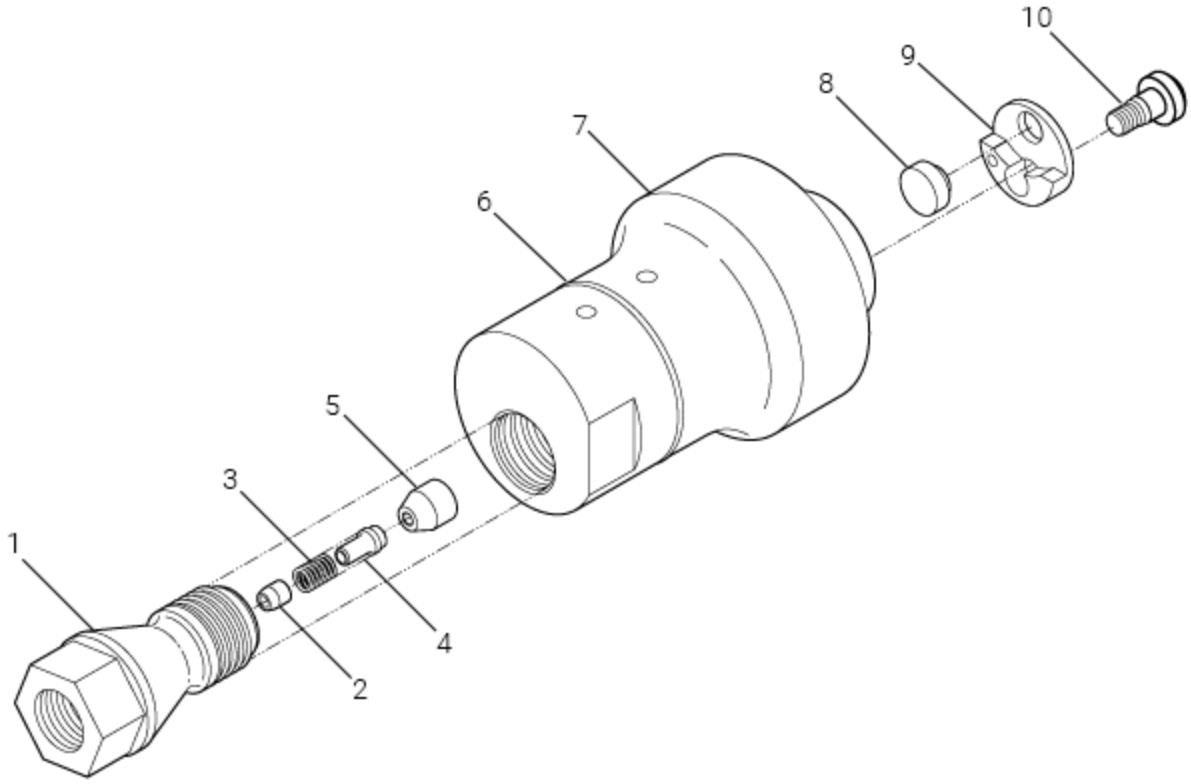
- Using the pressure loading tool
- Replace seal carrier assembly
- Replace high-pressure cylinders
- Replace check valve assembly
- Install inlet check valve repair kit · 014884-1
- How to lap the check valve body
- Install outlet check valve repair kit · 014885-1

View 1 · Intensifier: High-pressure end



1	HIGH-PRESSURE TIE ROD
2	SEAL CARRIER ASSEMBLY
3	HIGH-PRESSURE CYLINDER
4	FILLER TUBE
5	CHECK VALVE ASSEMBLY
6	END CAP
7	WASHER
8	TIE ROD NUT

View 2 · Check valve assembly



1	OUTLET ADAPTER	6	O-RING
2	SPRING SEAT	7	BODY
3	COMPRESSION SPRING	8	INLET POPPET
4	OUTLET POPPET	9	INLET SUPPORT
5	SEAT	10	RETAINER SCREW

Flow
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Using the pressure loading tool

Where used

HyperJet 30/50

Summary

The pressure loading tool is used to load and unload the tie rods of the 94K intensifier. It is a delicate instrument that must be handled with care. All personnel should be trained on how to use the tool before they use the tool.

Tool maintenance

- Inspect the tool piston stop regularly for damage. Replace if it's not flat. Do not grind to remove damage.
- The tool's pressure gauge should be calibrated annually by a qualified laboratory.

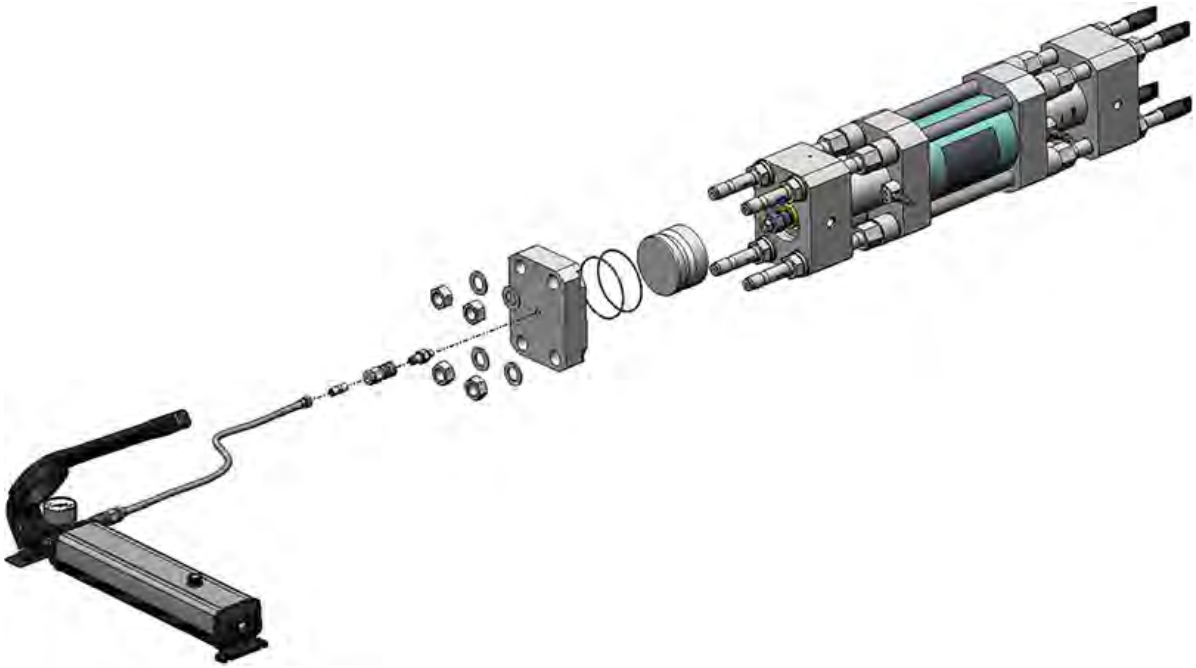
Recommendations

- Don't use the tool for anything other than unloading or loading the intensifier tie rods.
- Use only approved hydraulic oil in the hand pump (A-24498-1).
- For ease of use and to prevent damage to the hand pump, mount the hand pump permanently to a rigid cart and store in a clean location. Cover the cart with a dust cover.
- When the tool is not in use, keep dust caps in place on the quick disconnect fittings.
- When storing the pressure hose, do not kink or bend it.

Safety precautions

- Always do a Lockout/Tagout (LOTO) for the pump before using the tool.
- Do not disconnect the hydraulic hose from the pressure loading piston assembly unless the pressure release valve on the hand pump is opened.
- To avoid pinching, keep fingers away from tie rod nuts when releasing the pressure from the pressure loading tool.

View 1 · Pressure loading tool kit (042512-3)

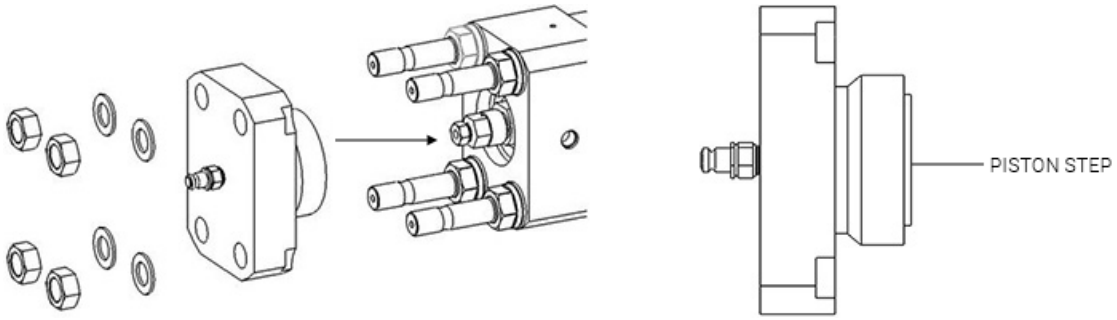


Unload the tie rods

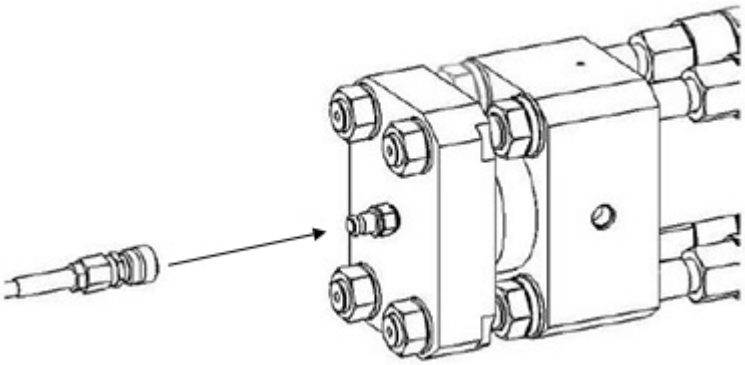
To unload the tie rods, do the following:

1. Apply ANTI-SEIZE to all exposed threads of each tie rod. Apply ANTI-SEIZE to the tool nut threads and the contacting faces of their washers.
2. Install the tool on the tie rods ensuring that the tool piston step is located in the end cap counterbore. Run up the four tool nuts hand tight.

   NOTICE Make sure the tool piston step is fully engaged in the counterbore before continuing. Failure to do so can damage the end cap or the pressure loading tool.

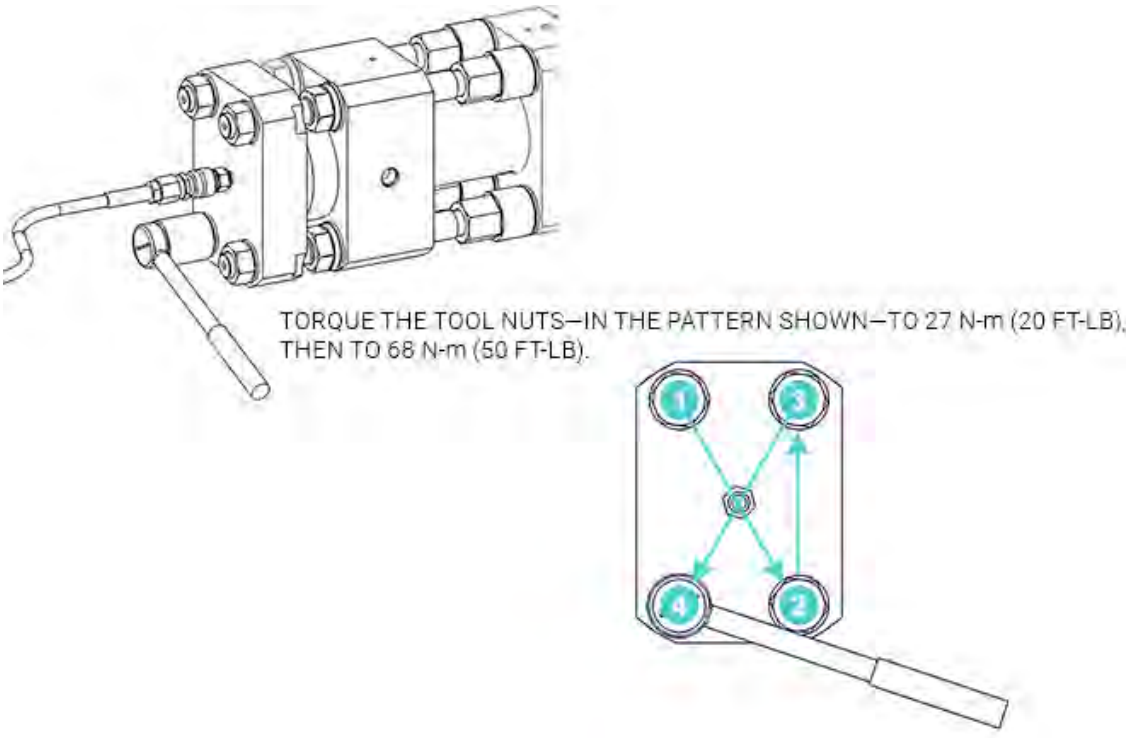


3. Connect the hand pump hose to the tool at the quick disconnect (QD) fitting.



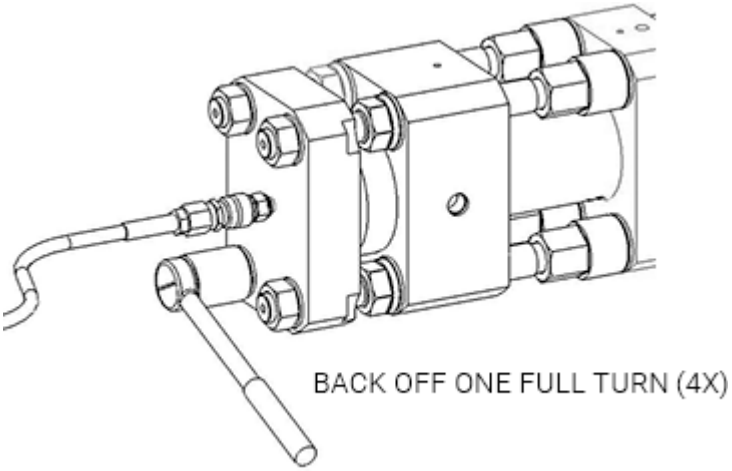
4. Open the pressure-release valve on the hand pump by turning it counterclockwise one turn.

5. Collapse the tool using a ratchet and socket on the tool nuts. Torque the tool nuts—in the pattern shown—to 27 N-m (20 ft-lb), and then to 68 N-m (50 ft-lb). Oil from the tool will flow back to the hand pump reservoir.



6. Back off each tool nut one full turn with the ratchet and socket.

   NOTICE Failure to properly back off the tool nuts will make it impossible to remove the tool from the tie rod, and could damage the intensifier.

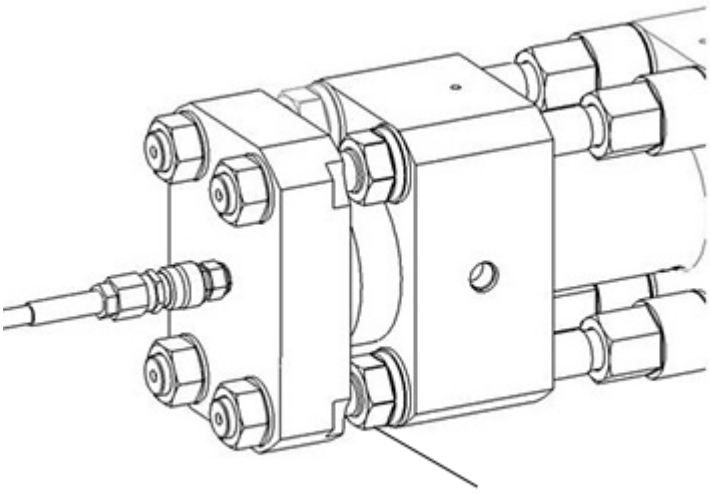


7. Close the pressure-release valve by turning it clockwise until tight.

8. Pump the tool to 9200 psi (63 MPa), as read on the pressure gauge. Wait 10 seconds, and then check the gauge reading. If the needle fell off the mark, tighten the pressure relief valve again and bring pressure back up to the 9200 psi (63 MPa) mark.

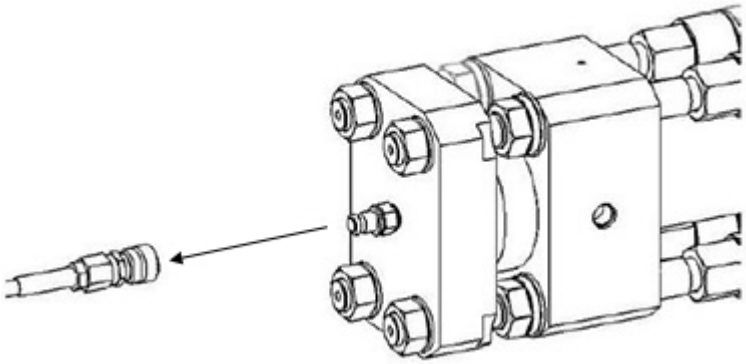
   It will take 60-70 pumps before pressure begins to build.

9. Loosen the four end cap nuts and back off two full turns.

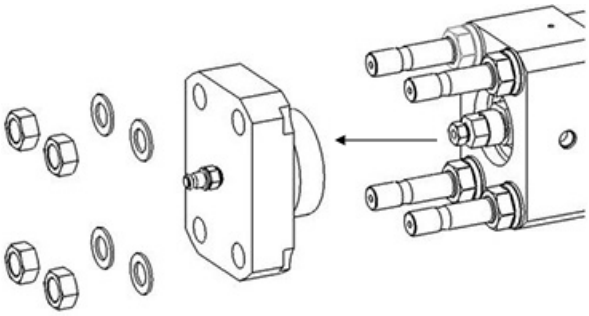


10. Bleed off tool pressure by opening the pressure-release valve on the hand pump.

11. Disconnect the hand pump hose from the tool at the QD fitting.



12. Remove the tool nuts and washers and then remove the tool.

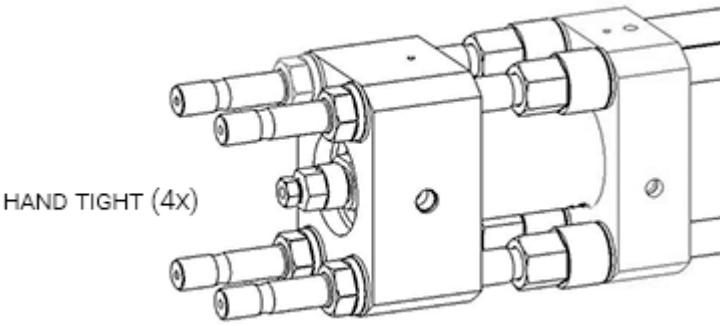


13. Remove the end cap nuts and washers.
14. Thoroughly clean the tie rods and all nuts and washers to remove the old ANTI-SEIZE.

Load the tie rods

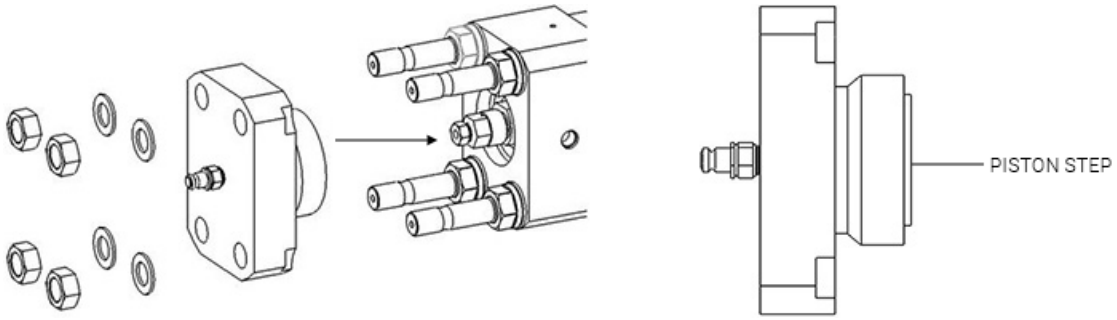
To load the tie rods, do the following:

1. Apply ANTI-SEIZE to all exposed threads of each tie rod. Apply ANTI-SEIZE to the threads of the end cap nuts and tool nuts and the contacting faces of the nuts and their washers.
2. Install the end cap washers and nuts on the tie rods and run up hand tight to the end cap.

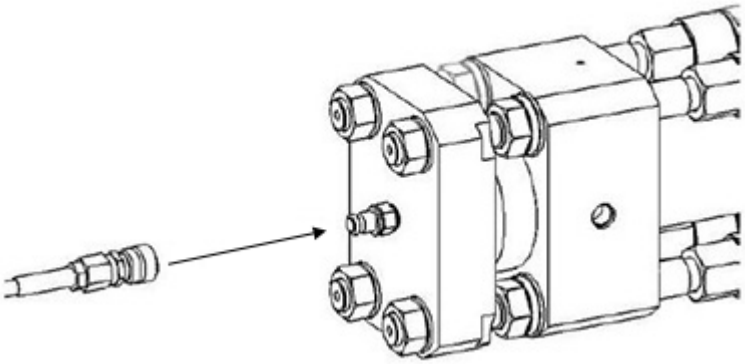


3. Install the tool on the tie rods ensuring that the tool piston step is located in the end cap counterbore. Run up the four tool nuts hand tight.

   NOTICE Make sure the tool piston step is fully engaged in the counterbore before continuing. Failure to do so can damage the end cap or the pressure loading tool.

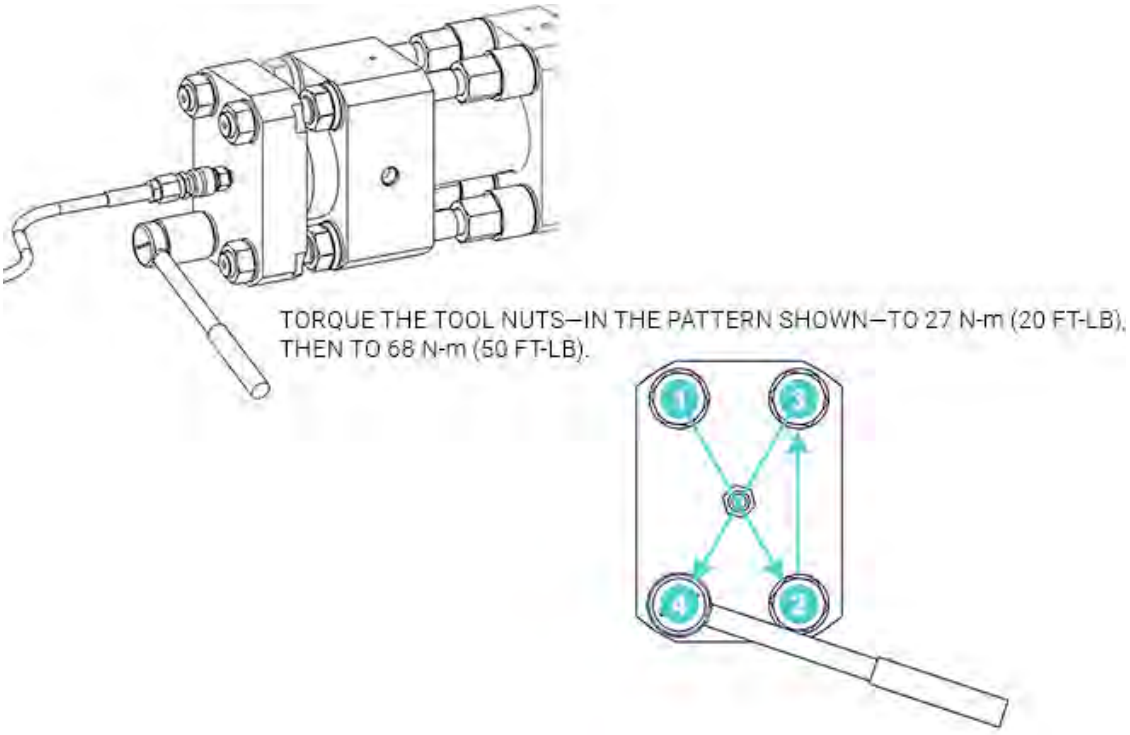


4. Connect the hand pump hose to the tool at the quick disconnect (QD) fitting.



5. Open the pressure-release valve on the hand pump by turning it counterclockwise one turn.

6. Collapse the tool using a ratchet and socket on the tool nuts. Torque the tool nuts—in the pattern shown—to 27 N-m (20 ft-lb), and then to 68 N-m (50 ft-lb). Oil from the tool will flow back to the hand pump reservoir.



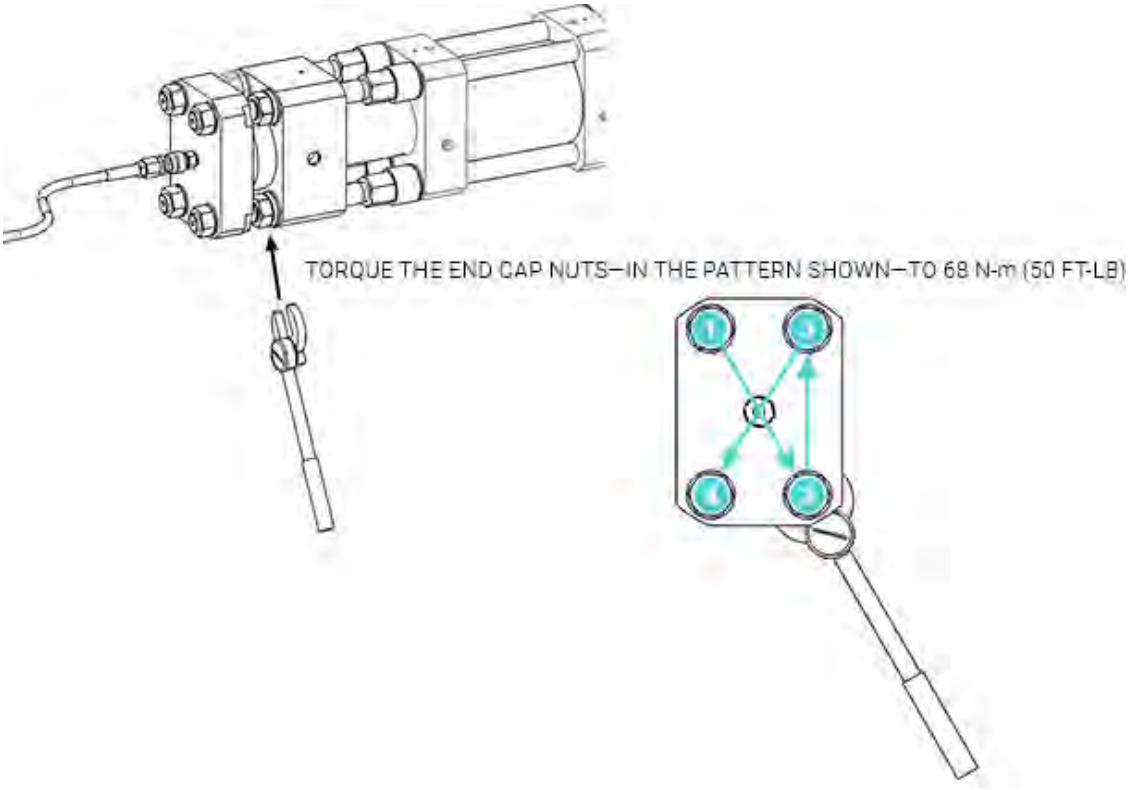
7. Close the pressure-release valve by turning it clockwise until tight.

8. Pump the tool to 9200 psi (63 MPa), as read on the pressure gauge. Wait 10 seconds, and then check the gauge reading. If the needle fell off the mark, tighten the pressure relief valve again and bring pressure back up to the 9200 psi (63 MPa) mark.

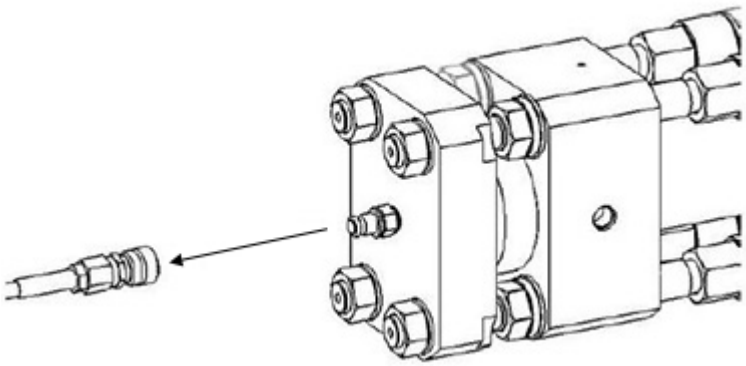
9. Run up the end cap nuts by hand. Using a torque wrench with a crow's foot end, torque the end cap nuts—in the pattern shown—to 68 N-m (50 ft-lb).

   As the nuts are torqued, the pressure gauge will show a decrease in pressure. This is normal; do not adust pressure.

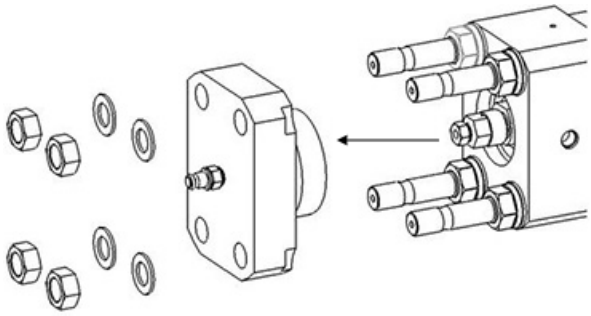
   NOTICE Do not pump the tool after you start torquing the end cap nuts. Pumping the tool can cause misalignment and break parts.



10. Open the pressure-release valve to bleed off remaining tool pressure.
11. Disconnect the hand pump hose from the tool at the QD fitting.



12. Remove the tool nuts and washers and then remove the tool.



13. Thoroughly clean the tie rods and all nuts and washers to remove the old ANTI-SEIZE.

Flow
SHAPE TECHNOLOGIES GROUP®

Replace seal carrier assembly

Where used
HyperJet 30/50

Recommended maintenance interval
As required

Parts
Seal carrier assembly ……. 040015-1

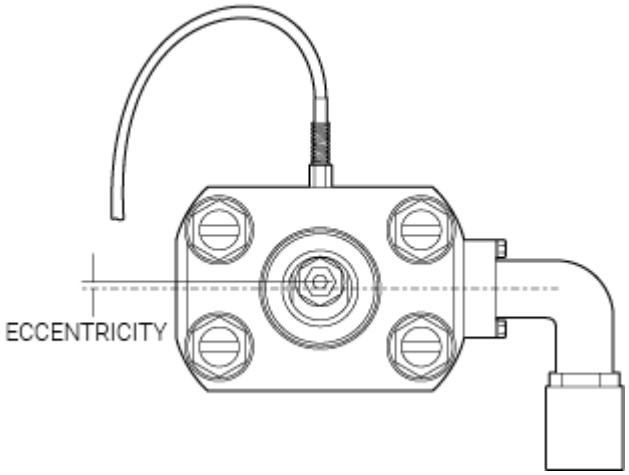
Tools
Pressure loading tool kit
Open-end wrenches ……. 1 in. | 7/8 in. | 13/16 in.
Flathead screwdriver

Recommendation
We recommend that all seal carrier assemblies on the intensifier be serviced at the same time to unnecessary downtime.

Part 01

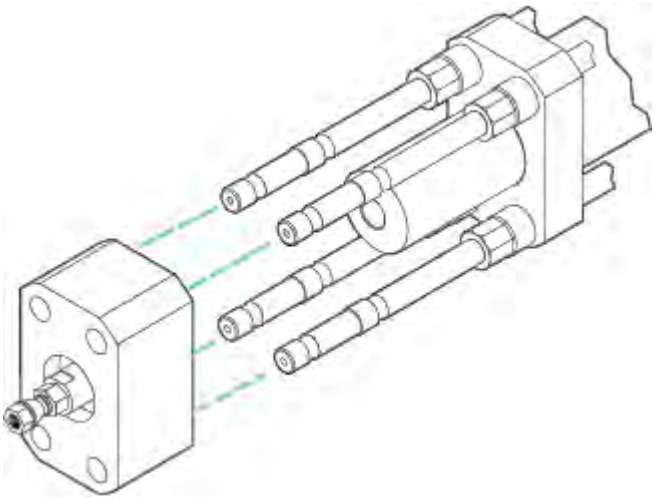
1. Stop the pump, and then **do a Lockout/Tagout**.
2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. **Unload the intensifier tie rods** with the pressure loading tool.
5. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier.

   When you reinstall the the check valve body, correct orientation is critical to ensure the correct fit of high-pressure tubing—which is affected by the eccentricity of the outlet body.



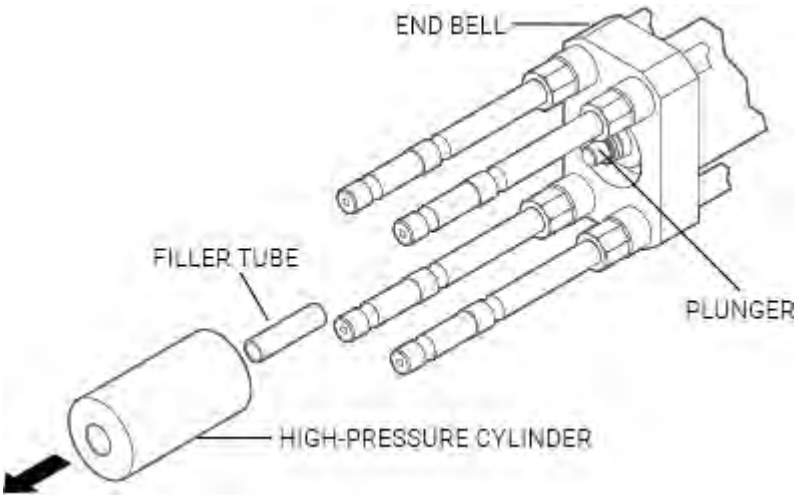
Part 02

1. Remove the end cap from the tie rods. The check valve assembly will remain inside the end cap due to compression of the O-ring on the check valve body.



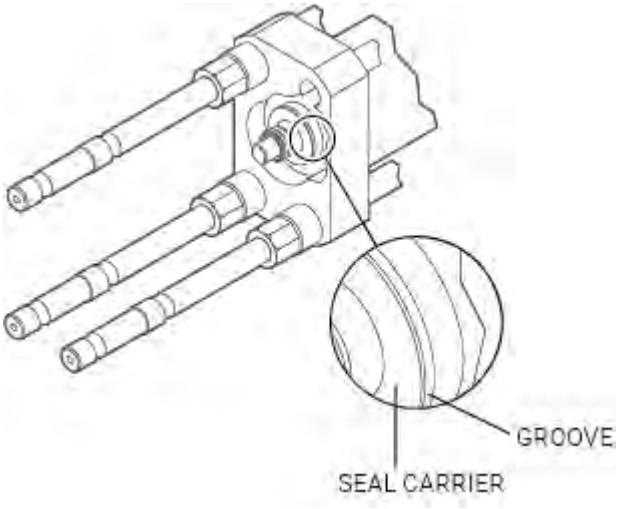
2. Remove the high-pressure cylinder and filler tube from the intensifier end bell. Rocking the cylinder gently while pulling will help separate the cylinder from the end bell.

   NOTICE When the cylinder is clear of the end bell, pull it straight out to avoid contact with the ceramic plunger. Otherwise, you could damage the plunger.



3. Pry the seal carrier away from the end bell using a small pry bar in the groove provided. Once the seal carrier is away from the end bell, slide it off the ceramic plunger by hand.

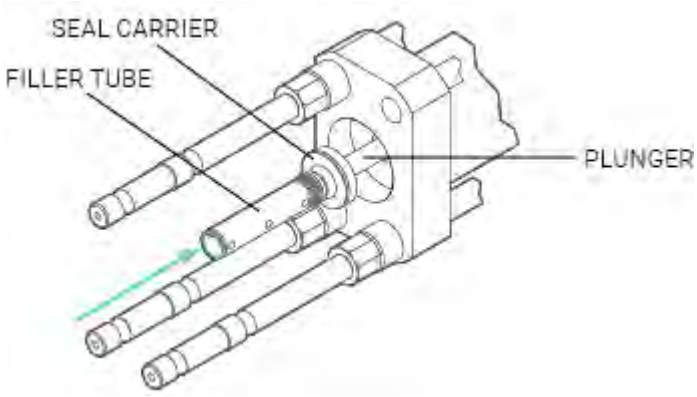
   Seal carrier assembly



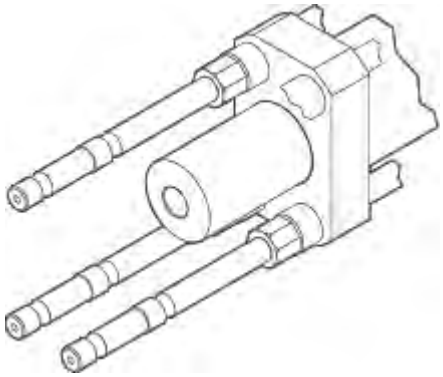
4. Clean and inspect the high-pressure cylinder, filler tube, and plunger.

Part 03

1. Place the new seal carrier assembly onto the plunger. Using the filler tube as a tool, push the assembly along the plunger until it butts against the end bell face.

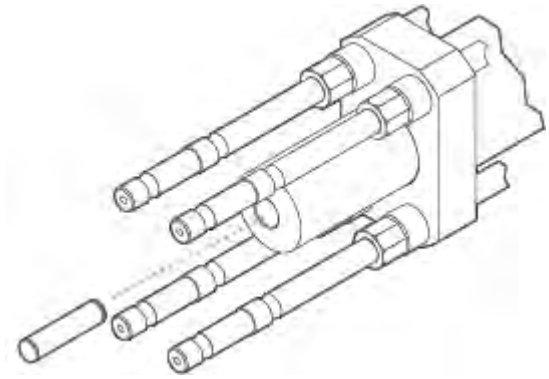


2. Slide the high-pressure cylinder over the ceramic plunger and into the end bell bushing. A slight rocking motion will help ease the cylinder into position.

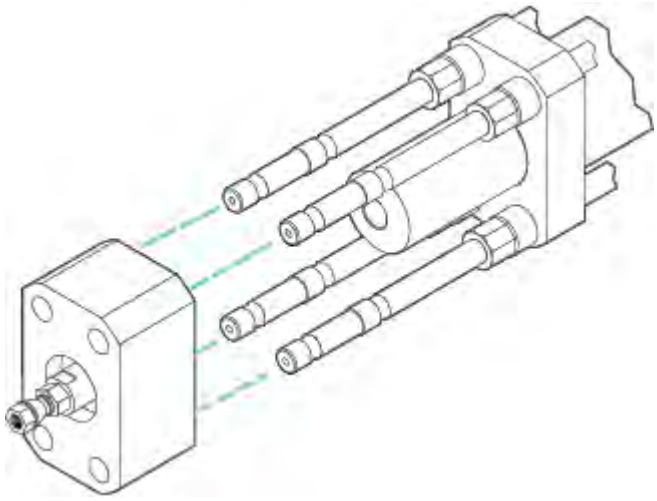


3. Install the filler tube in the high-pressure cylinder.

   NOTICE Make sure the filler tube is oriented correctly. There is a wall inside the tube that must be at the outermost end of the tube when it is inserted. Failure to orient the tube correctly will damage the intensifier assembly.



4. Install the end cap (complete with check valve assembly) by sliding it along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap. Take care to align the check valve assembly with the correct orientation as previously noted.



Part 04

1. **Load the intensifier tie rods** with the pressure loading tool.
2. Connect the high-pressure tubing and the inlet water hose.
3. **Reverse the Lockout/Tagout**.

Flow
SHAPE TECHNOLOGIES GROUP®

Replace high-pressure cylinders

Where used
HyperJet 30/50

Recommended maintenance interval
As required

Parts
High-pressure cylinder ……. 020592-1

Tools
Open-end wrenches ……. 1 in. | 7/8 in. | 13/16 in.
Pressure loading tool kit

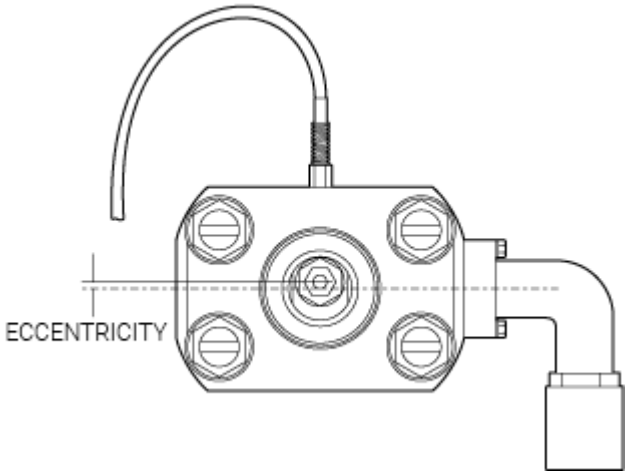
Recommendations

- Service both of the high-pressure cylinders on the intensifier at the same time to prevent unnecessary downtime.
- Cylinder failures that occur at the conical sealing surfaces of the cylinder can cause failures of the check valve body or seal carrier. While the intensifier is open, it is a good idea to inspect the sealing surfaces of these components.

Part 01

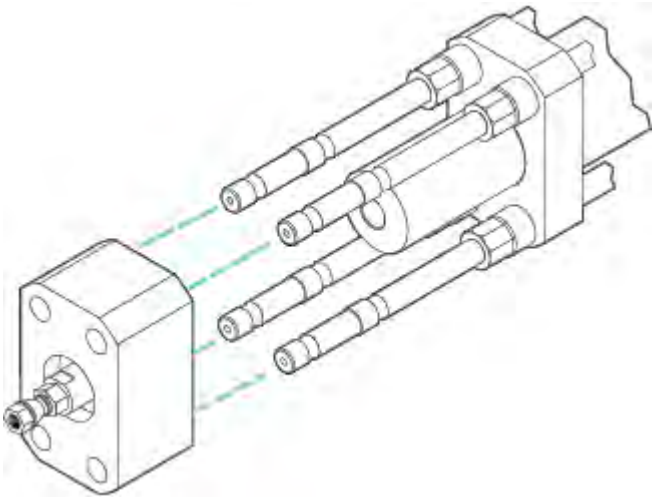
1. Stop the pump, and then **do a Lockout/Tagout**.
2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. **Unload the intensifier tie rods** with the pressure loading tool.
5. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier.

   When you reinstall the the check valve body, correct orientation is critical to ensure the correct fit of high-pressure tubing—which is affected by the eccentricity of the outlet body.



Part 02

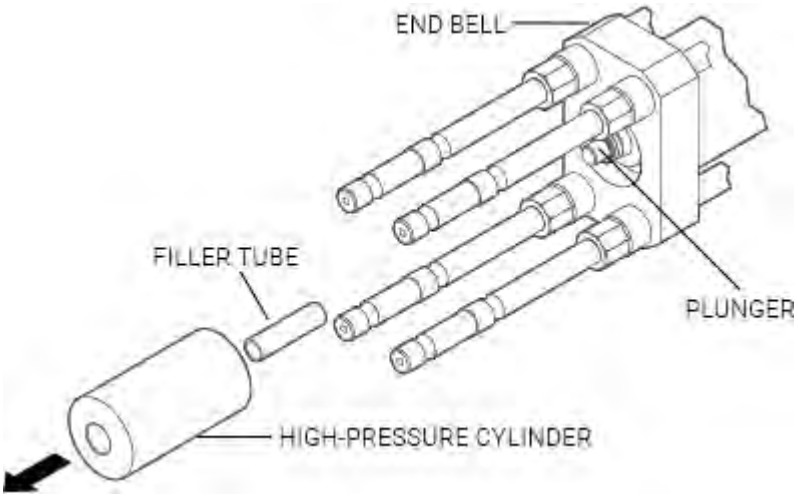
1. Remove the end cap from the tie rods.The check valve assembly will remain inside the end cap due to compression of the O-ring on the check valve body.



2. Remove the high-pressure cylinder and filler tube from the intensifier end bell. Rocking the cylinder gently while pulling will help separate the cylinder from the end bell

   NOTICE When the cylinder is clear of the end bell, pull it straight out to avoid contact with the ceramic plunger. Otherwise, you could damage the plunger.

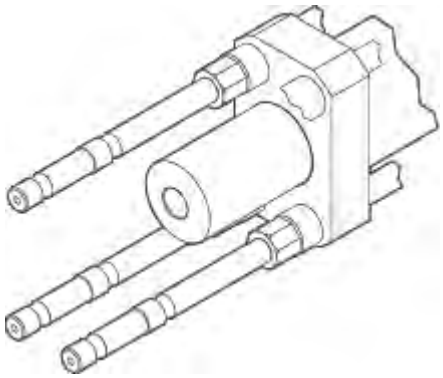
   High-pressure cylinder



3. Clean and inspect the filler tube and plunger for damage. Replace if necessary.

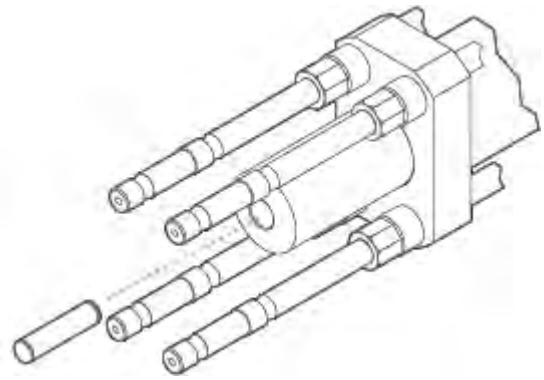
Part 03

1. Slide the new high-pressure cylinder over the ceramic plunger and into the end bell bushing. A slight rocking motion will help ease the cylinder into position.

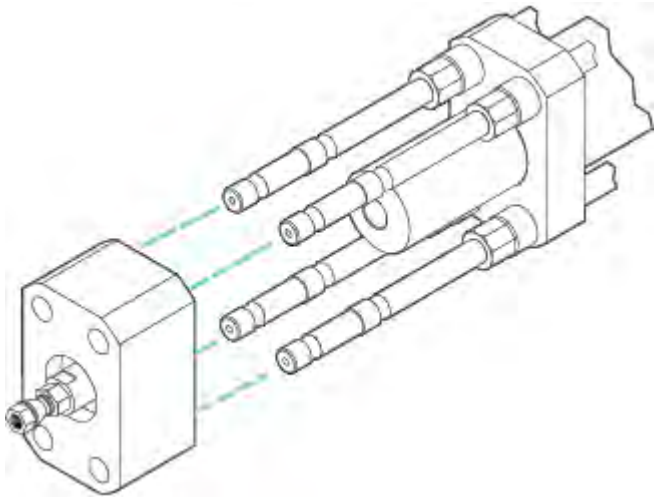


2. Install the filler tube in the high-pressure cylinder.

   NOTICE Make sure the filler tube is oriented correctly. There is a wall inside the tube that must be at the outermost end of the tube when it is inserted. Failure to orient the tube correctly will damage the intensifier assembly.



3. Install the end cap (complete with check valve assembly) by sliding it along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap. Take care to align the check valve assembly with the correct orientation as previously noted.



Part 04

1. **Load the intensifier tie rods** with the pressure loading tool.
2. Connect the high-pressure tubing and the inlet water hose.
3. **Reverse the Lockout/Tagout**.

Flow
SHAPE TECHNOLOGIES GROUP®

Replace check valve assembly

Where used
HyperJet 30/50

Recommended maintenance interval
As required

Parts
Check valve assembly …… 020071-1

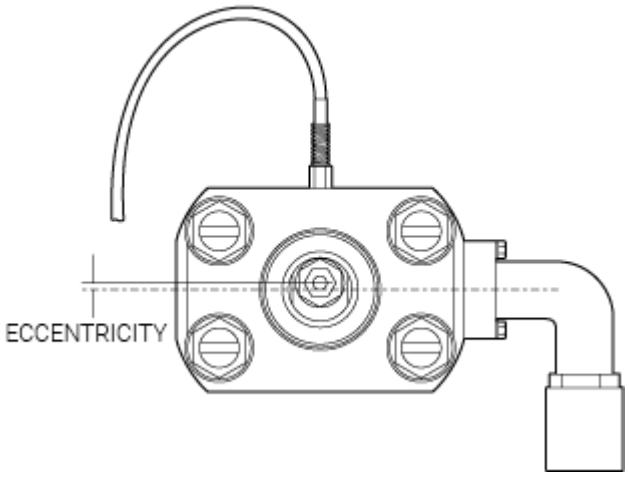
Tools
Open-end wrenches …… 1 in. | 7/8 in. | 13/16 in.
1-¼ in. socket (½ in. drive) and handle
Pressure loading tool kit

Supplies
White Food Grade Grease

Part 01

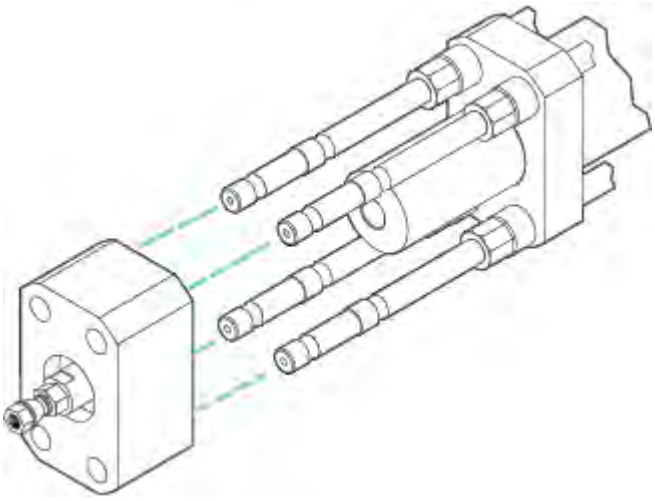
1. Stop the pump, and then **do a Lockout/Tagout**.
2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. Using a 1-¼ in. socket—loosen, but do not remove—the outlet adapter from the check valve body.
5. **Unload the intensifier tie rods** with the pressure loading tool.
6. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier.

   When you reinstall the the check valve body, correct orientation is critical to ensure the correct fit of high-pressure tubing—which is affected by the eccentricity of the outlet body.



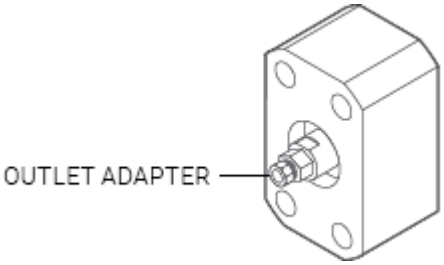
Part 02

1. Remove the end cap from the tie rods. Note that the check valve assembly will remain inside the end cap due to compression of the O-ring on the check valve body.



2. Remove the check valve assembly from the end cap by pushing on the outlet adapter.

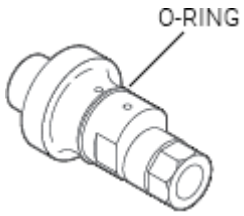
   Check valve assembly



3. Clean and inspect the end cap. Replace if necessary.

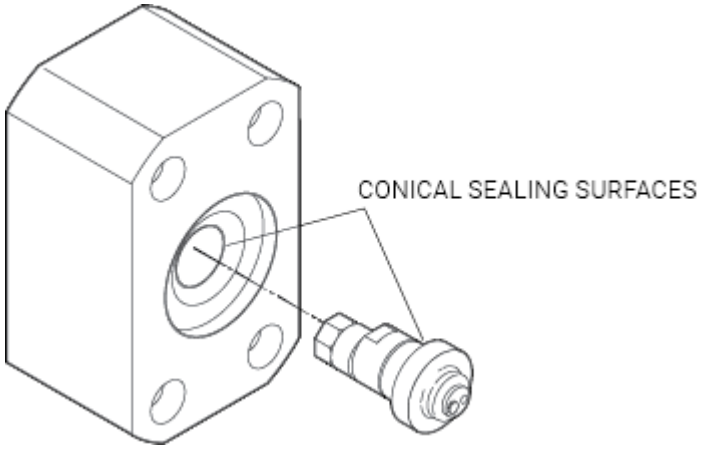
Part 03

1. Remove the O-ring from the new check valve assembly. Apply a thin, even layer of WHITE FOOD GRADE GREASE to the O-ring, and then reinstall it.

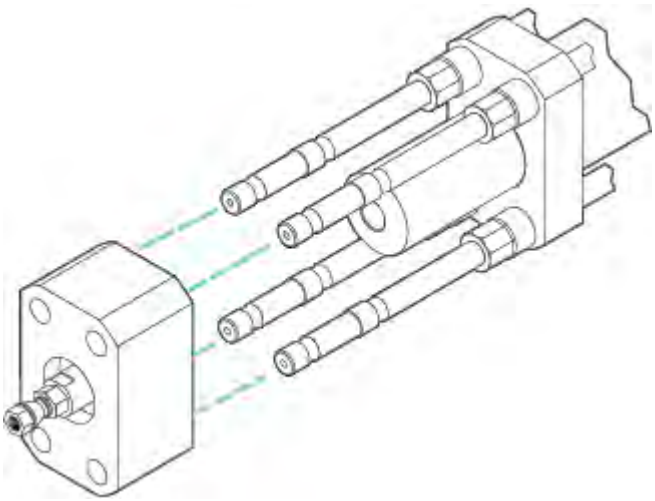


2. Ensure the conical sealing surfaces of the check valve assembly and the end cap are clean and free of debris, and then install the assembly by pushing it into the end cap. Take care to align the check valve assembly with the correct orientation as previously noted.

   Do not apply grease or lubricant to the conical sealing surfaces. This can cause an inlet water leak.



3. Install the end cap (complete with check valve assembly) by sliding it along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap.



Part 04

1. **Load the intensifier tie rods** with the pressure loading tool.
2. Connect the high-pressure tubing and the inlet water hose.
3. **Reverse the Lockout/Tagout**.

Flow
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Install inlet check valve repair kit · 014884-1

Where used
HyperJet 30/50

Recommended maintenance interval
As required

Inlet check valve repair kit · 014884-1
2 Retainer screw
2 Inlet poppet
2 Inlet support

Tools
Check valve lapping kit
Pressure loading tool kit

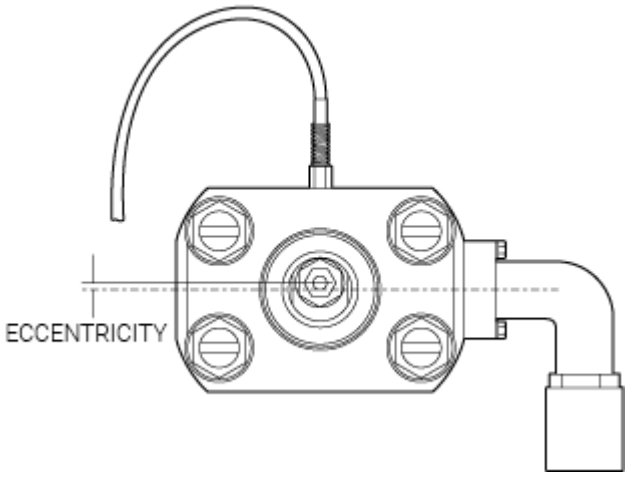
¼ in. & ½ in. drive torque wrenches
Open-end wrenches …… 1 in. | 7/8 in. | 13/16 in. | 5/16 in.
1-¼ in. socket (½ in. drive) and handle
5/16 in. socket (¼ in. drive)
Soft-jaw vise

Supplies
Blue Lubricant
Loctite 242
White Food Grade Grease

Part 01

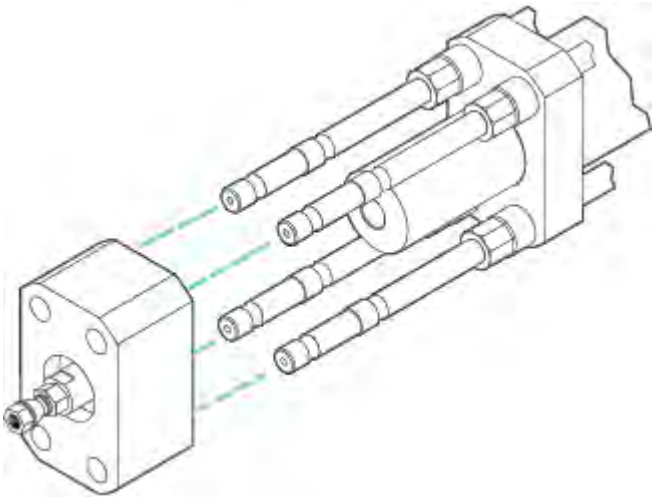
1. Stop the pump, and then **do a Lockout/Tagout**.
2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. Using a 1-¼ in. socket—loosen, but do not remove—the outlet adapter from the check valve body.
5. **Unload the intensifier tie rods** with the pressure loading tool.
6. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier.

   When you reinstall the the check valve body, correct orientation is critical to ensure the correct fit of high-pressure tubing—which is affected by the eccentricity of the outlet body.

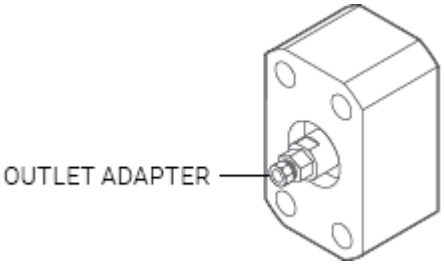


Part 02

1. Remove the end cap from the tie rods. Note that the check valve assembly will remain inside the end cap due to compression of the O-ring on the check valve body.



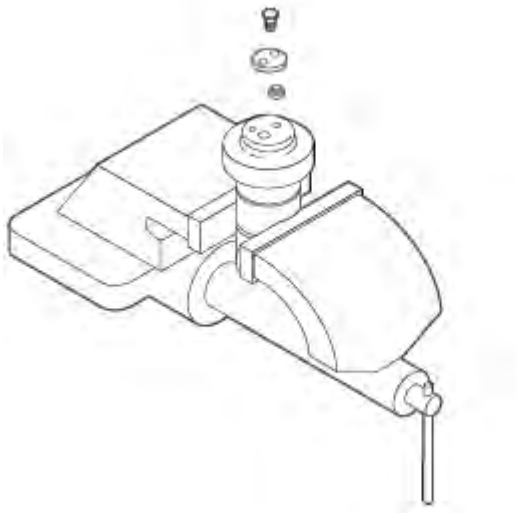
2. Remove the check valve assembly from the end cap by pushing on the outlet adapter.



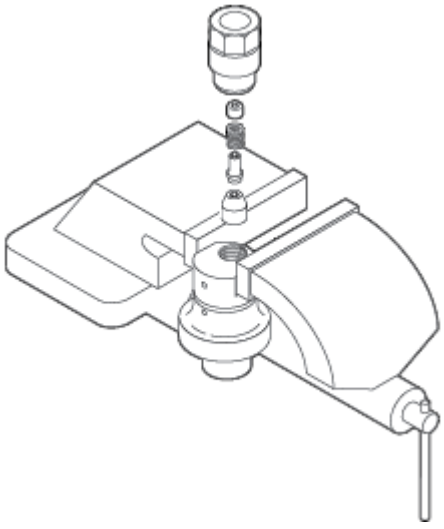
3. Clean and inspect the end cap. Replace if necessary.
4. In a soft-jawed vise, clamp the check valve assembly—inlet end up—on the flats machined into the body.

5. Using a 5/16 in. open-end wrench, remove the retainer screw from the face of the check valve body. Remove the inlet support and the inlet poppet.

   Retainer screw · Inlet support · Inlet poppet



6. Clamp the check valve assembly—outlet end up— on the flats machined into the body.
7. Remove the outlet adapter from the check valve body. Remove the outlet poppet, compression spring, outlet seat, and outlet spring seat and set aside. Also remove the O-ring from the check valve body and set it aside.

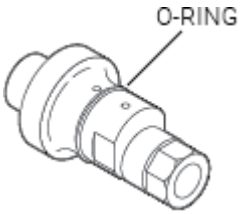


8. Clean and inspect the outlet seat, outlet poppet, compression spring, outlet spring seat, and the threads and bore of the outlet adapter with solvent.
9. Clean and inspect the check valve body, and then **lap the check valve body**.

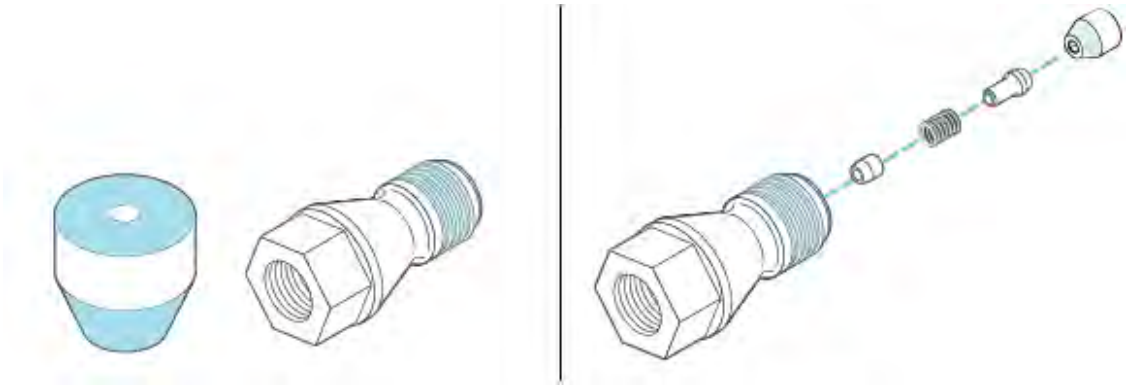
Part 03

1. Apply one drop of Loctite #242 to the threads of the new retainer screw. Position the new inlet support and new poppet on the main body, with the pin of the inlet support in its locating hole. Insert the retainer screw and tighten to 40 in-lb (4.5 N-m).

2. Apply a thin, even layer of WHITE FOOD GRADE GREASE to the check valve O-ring, and then install it onto the body.



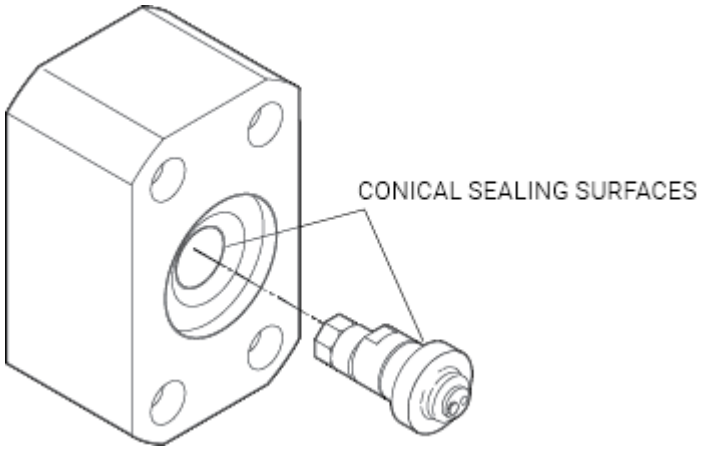
3. Apply a thin, even layer of BLUE LUBRICANT to the outlet adapter threads and the conical surfaces of the outlet seat, and then assemble the outlet components of the check valve body.



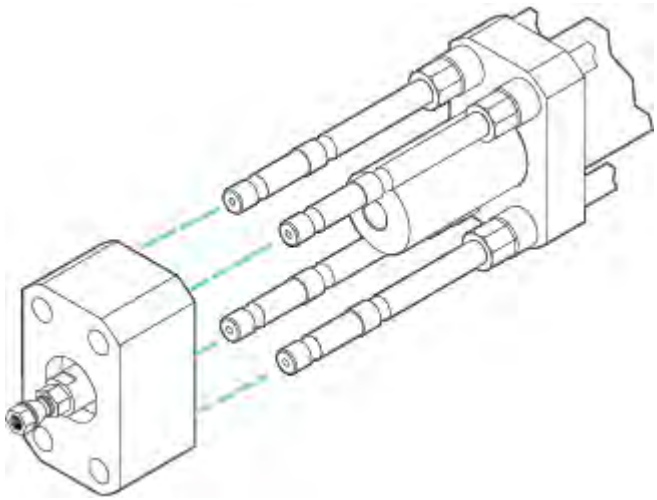
4. Thread the outlet adapter into the check valve body. Secure hand tight.

5. Ensure the conical sealing surfaces of the check valve assembly and the end cap are clean and free of debris, and then install the assembly by pushing it into the end cap. Take care to align the check valve assembly with the correct orientation as previously noted.

   Do not apply grease or lubricant to the conical sealing surfaces. This can cause an inlet water leak.



6. Install the end cap (complete with check valve assembly) by sliding it along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap.



Part 04

1. **Load the intensifier tie rods** with the pressure loading tool.
2. Torque the outlet adapter to 200 ft-lb (271 N-m).
3. Connect the high-pressure tubing and the inlet water hose.
4. **Reverse the Lockout/Tagout**.

Flow
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How to lap the check valve body

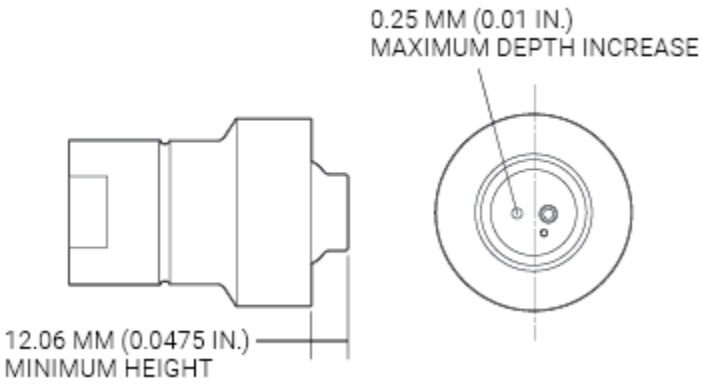
Where used

HyperJet 30/50

Recommended maintenance interval

Any time you install an inlet check valve repair kit or as otherwise required. You can reuse the check valve body down to minimum dimensions, but you must discard the check valve body if it becomes smaller.

Minimum height of check valve body shoulder ……. 0.475 in. (12.06 mm)
Maximum depth increase ……. 0.25 mm (0.01 in.)



Check valve lapping kit · B-1813-3

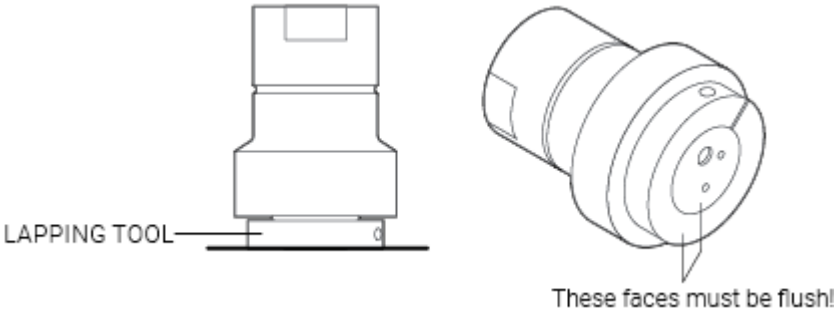
1 Glass plate
1 320 grit paper
1 600 grit paper
1 Check valve body lapping tool

Notes

- If the sealing surface cannot easily be restored by the lapping techniques described, you can machine it flat before lapping as long as you machine *only* the sealing surface, maintain the perpendicularity of the face to the component axis, and maintain the minimum dimensions.
- Hand lapping, machining, machine grinding, polishing, or a combination thereof are usually all acceptable ways to remove surface imperfections before final lapping.
- If the retainer screw does not seat correctly, it must be replaced.

To lap the check valve body, do the following:

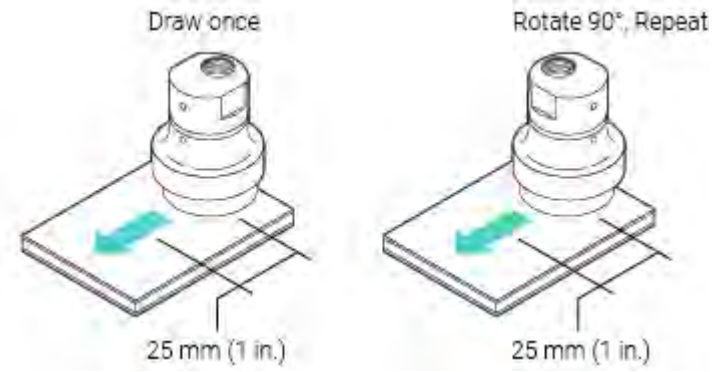
1. Make sure you have **removed all outlet and inlet check valve components**—you are *only* lapping the check valve body.
2. Install the lapping tool around the nose of the check valve, and then place the assembly—end face down—on a flat surface.
3. Slide the tool down as far as it will go, until the check valve body and tool end faces are flush. Tighten the lapping tool onto the check valve body.



4. Attach the 320 grit paper to one side of the glass plate, and the 600 grit paper to the other side.
5. Place a few drops of water on the 320 grit paper, and then lap the check valve body in a figure-8 pattern until all surface imperfections have been removed.

6. Turn the glass plate over and place a few drops of water on the 600 grit paper. Lap the check valve body in a figure-8 pattern until the body is evenly polished.

7. Turn the glass plate over to the 320 grit side. Draw the check valve body for 25 mm (1 in.) in a straight line along the paper one time, and then rotate the body 90° and repeat the 25 mm (1 in.) score.



8. Carefully clean the newly-lapped check valve body with clean solvent such as isopropyl alcohol. Dry and inspect the part.

   NOTICE Inspection is critical. Lapping debris remaining after incomplete cleaning will result in reduced component life.

Install outlet check valve repair kit · 014885-1

Where used
HyperJet 30/50

Recommended maintenance interval
As required

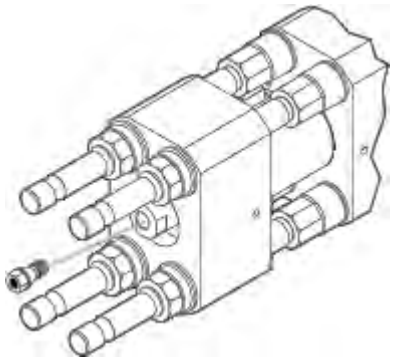
Check valve outlet repair kit · 014885-1
2 Outlet poppet
2 Outlet seat
2 Compression spring

Tools
1-¼ in. socket (½ in. drive) and handle
Open-end wrenches …… 1 in. | 7/8 in. | 13/16 in.

Supplies
Blue Lubricant

Part 01

1. Stop the pump, and then **do a Lockout/Tagout**.
2. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
3. Using a 1-¼ in. socket and handle, unscrew the outlet adapter from the check valve body.

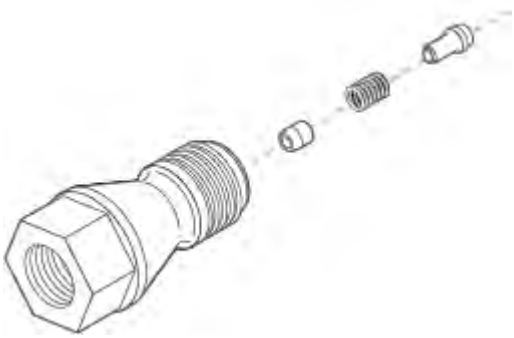


Part 02

1. Remove the outlet poppet, compression spring, and outlet spring seat from the outlet adapter.

   Outlet poppet · Compression spring

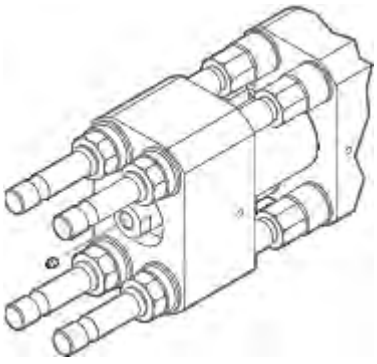
   Outlet spring seat



2. Remove the outlet seat from the check valve body

   If the seat is difficult to remove, insert the sharpened end of a small dowel into the seat. Push until the seat is fixed to the dowel, then pull it out.

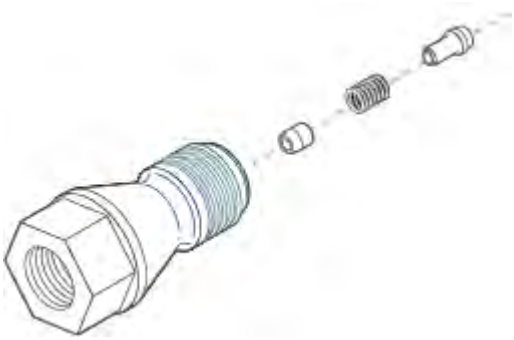
   Outlet seat



3. Using fresh solvent, clean the threads and bore of the outlet adapter and check valve body.

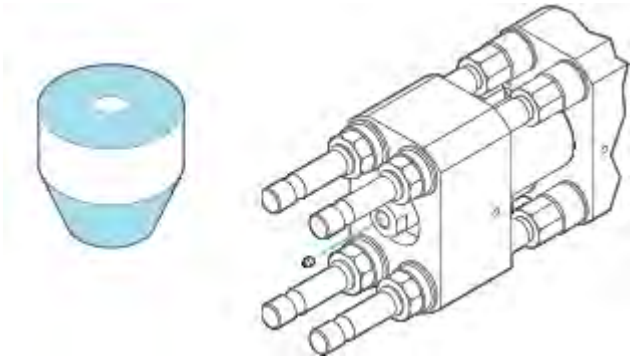
Part 03

1. Apply a thin, even layer of BLUE LUBRICANT to the threads of the outlet adapter and insert the outlet spring seat, new compression spring, and new outlet poppet—in the order shown—into the bore.

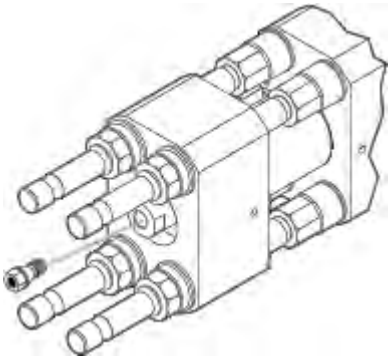


2. Apply a thin, even layer of BLUE LUBRICANT to the outlet seat (as shown) and then insert it—non-coned end first—into the bore of the check valve body.

   Make sure the coned end is pointing out once installed, and that there is no Blue Lubricant on the sealing face of the outlet seat.



3. Thread the outlet adapter into the check valve body, and then torque to 200 ft-lb (271 N-m).



Part 04

1. Connect the high-pressure tubing and the inlet water hose.
2. **Reverse the Lockout/Tagout**.

Flow
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Low Pressure water system

Low Pressure water system

Pages: 2

- **Low Pressure water system**
  Overview of Low Pressure water system for HyperJet 30/50.

- **Replace inlet water filters**

Flow
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Low Pressure water system

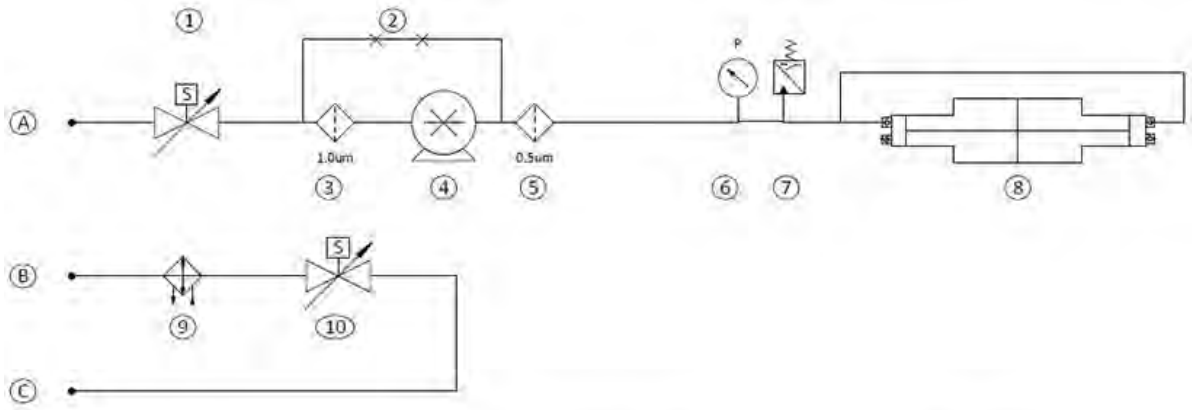
Where used

HyperJet 30/50

Summary

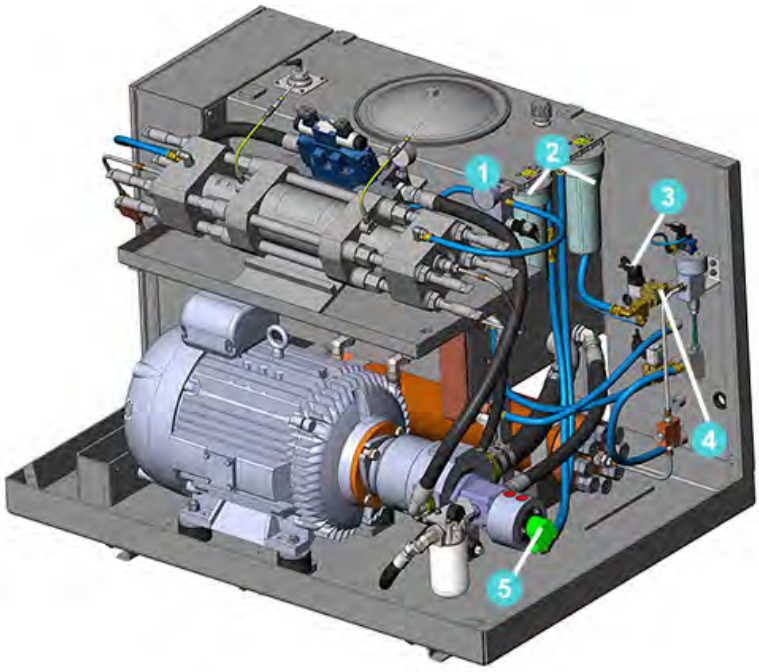
The cutting water supply circuit supplies the intensifier with the required cutting water flow and pressure. System components include the inlet water solenoid valve, boost pump, and inlet water filers. A pressure switch, connected to the PLC, monitors the inlet cutting water pressure and provides automatic shutdown protection if the inlet pressure is too low.

View 1 · Low Pressure water system circuit



1	Inlet water solenoid valve	6	Pressure gauge	A	Inlet water
2	Capillary tube	7	Pressure switch	B	Cooling water inlet
3	Water filter, 1 micron	8	Intensifier	C	Cooling water outlet
4	Boost pump	9	Heat exchanger		
5	Water filter, 0.5 micron	10	Discharge water solenoid valve		

View 2 · Low Pressure water system



1. Pressure gauge
2. Inlet water filters
3. Pressure switch
4. Inlet water solenoid valve
5. Boost pump

Maintenance procedures

Replace inlet water filters

Specifications

Minimum inlet supply pressure …….. 2.4 bar (35 psi)
Post boost pump shutdown pressure …….. 4.1 bar (60 psi)
Filtration provided ..... 0.5 micron and 1.0 micron

How it works

Cutting water is introduced through the bulkhead and enters the inlet water solenoid valve. When the motor is turned on, the solenoid valve opens and allows water to pass through the valve. The inlet water is monitored by a pressure switch. The motor will not start if inlet cutting water pressure drops below the shutdown pressure.

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 **Inlet water quality recommendation** for more information.

The cutting water passes from the inlet water valve to the first filter assembly (1 micron filter) where debris is removed to prevent contaminants from damaging the boost pump. The boost pump increases the pressure to ensure proper supply to the intensifier. Pressurized water passes through the second filter assembly (0.5 micron filter) where debris is removed to prevent contaminants from damaging the

check valves and seals in the intensifier.

Boost pressure is displayed on the pressure gauge located on the front of the second filter assembly. The gauge should read the maximum pressure while the machine is idling. When it strokes, the pressure drop should be no greater than 2 bar (30 psi). While the intensifier assembly reverses direction, the boost pressure will fluctuate slightly above and below the normal setting.

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Replace inlet water filters

Where used

HyperJet 30/50 · MotoJet X · MotoJet

Summary

The life of the filter element is directly related to the quality of the inlet water. Look at the the pressure gauge on the front of the filter assembly regularly. Document the pressure reading when the filter elements are new.

Recommended maintenance interval

As required; replace filters when the pressure on the gauge drops from 100 psi to 65 psi, with the cutting head open.

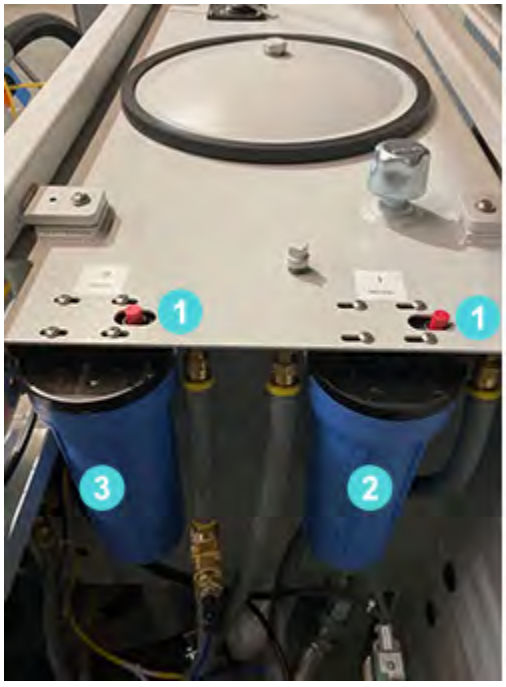
Parts

0.5 micron filter ……. A-1449
1 micron filter ……. A-1555

Tools and supplies

Bucket
Clean, lint-free rag
Strap wrench

View 1



1. Reset buttons
2. Rear filter, 1 micron
3. Front filter, 0.5 micron

To replace the inlet water filters, do the following:

1. Stop the pump, and then **do a Lockout/Tagout**. Turn off the water supply.
2. Place a bucket under the filter housing, and then use a strap wrench to carefully unscrew and remove the filter bowls from the filter head.
3. Remove the filter elements from the filter bowls, and then use fresh water and a clean, lint-free rag to carefully clean the filter bowls.

   Filter elements
4. Install new filters in the filter bowls.
5. Position the filter bowl with the 1 micron filter installed in the rear filter head, and then manually tighten, hand-tight.
6. Position the filter bowl with the 0.5 micron filter in the front filter head, and then manually tighten, hand-tight.
7. Use a strap wrench to tighten both filter bowls.
8. Disconnect the water inlet from one side of the intensifier and insert a quick connect fitting to purge air from the filter assembly so water will flow freely to the end cap.
9. **Reverse the Lockout/Tagout**, and then apply power to the pump.Turn the water supply back on.
10. Disengage the E-stop and press the red Reset buttons to turn the cutting water supply on.
11. Allow water to flow for three minutes to purge all air from the lines, filters, and boost pump. ***NOTICE*** You must purge air from the filters and the system before operating the pump. Operating the pump with air in the line can cause considerable damage due to the lack of water resistance against the hydraulic oil pressure in the intensifier.
12. Turn off water and reconnect the fitting to the end cap, and then turn the water on again. Check for leaks.

Flow
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Recirculation system

Recirculation system

Pages: 3

- **Recirculation system**
  Overview of Recirculation system for HyperJet 30/50.
- **Change the hydraulic oil**
  Instructions for changing the hydraulic oil on a HyperJet 30/50 pump.
- **Replace oil filter**
  Instructions for replacing the oil filter on a HyperJet 30/50 pump.

Flow
SHAPE TECHNOLOGIES GROUP®

Recirculation system

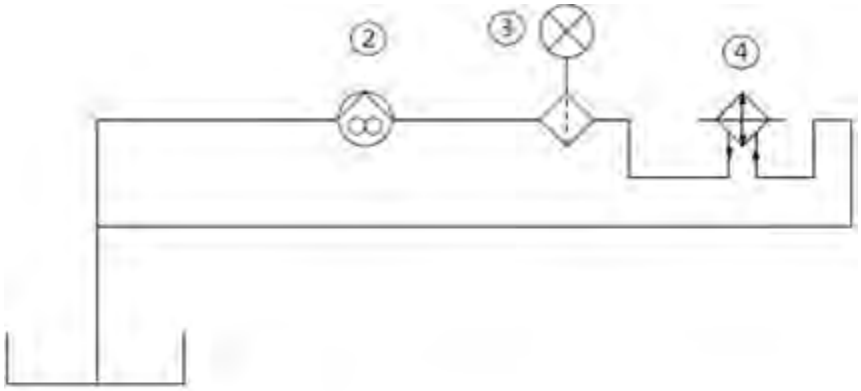
Where used

HyperJet 30/50

Summary

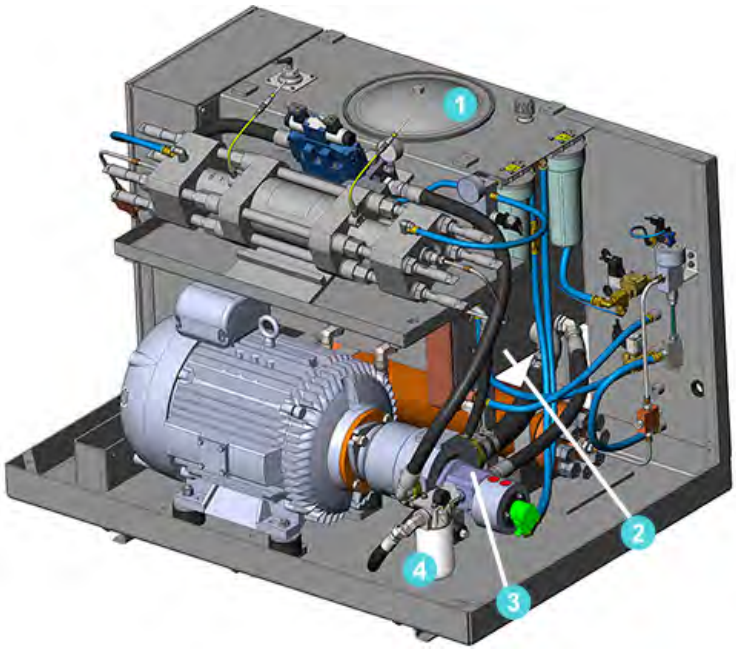
The oil recirculation circuit is a cooling and filtration system that provides properly conditioned oil to the main hydraulic system. System components include a solenoid valve, recirculation pump, heat exchanger, oil filter assembly, and the hydraulic oil reservoir. A temperature sensor/low level switch, connected to the PLC, monitors temperature and oil level conditions in the hydraulic oil reservoir and provides automatic shutdown protection.

View 1· Recirculation system circuit



1 Hydraulic oil reservoir
2 Recirculation pump
3 Hydraulic oil filter with gauge
4 Heat exchanger

View 2 · Recirculation system



1. Hydraulic oil reservoir
2. Oil-to-water heat exchanger
3. Recirculation pump
4. Hydraulic oil filter assembly

Maintenance procedures

- Change hydraulic oil
- Replace oil filter

Specifications

Total heat rejection …… 22,000 BTU/hr
Hydraulic oil
Required oil type …… P66 Megaflow AW 46 or equivalent ISO VG 46 oil
Reservoir capacity …… 170 L (45 gal)
Recommended minimum fill level …… 151 L (40 gal)

Maximum oil filter pressure …… 2.8 bar (40 psi)
Oil filter bypass pressure …… 3.4 bar (50 psi)
Operating oil temperature …… 38–49°C (100–120°F)
Optimum operating oil temperature …… 42°C (108°F)

Oil temperature warning …… 55°C (131°F)
Oil temperature shutdown …… 65°C (149°F)
Low oil level shutdown …… 133 L (35 gal)

Oil filtration rating (Beta)[1] …… $B_7 \geq 1000$
ISO fluid cleanliness rating [2] …… 17/14
Nominal recirculation pressure …… 2 bar (30 psi)

1. 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.
2. Indicates ISO 4406 range numbers for maximum permissible number of particles per milliliter, greater than 5 and 15 microns.
    - 17 <1300 particles per milliliter, >5 microns
    - 14 <160 particles per milliliter, >15 microns

How it works (Oil-to-Water Cooling System)

Cooling water is introduced through the bulkhead of the pump. A solenoid valve in the outlet line regulates the cooling water flow through the heat exchanger.

The recirculation pump pulls oil from the hydraulic oil reservoir and sends it to the heat exchanger, filter and back to the reservoir. The oil-to-water 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 cooling water either is discharged to the drain on the bulkhead or is routed to a customer-supplied water chiller.

The hydraulic oil filter assembly consists of the filter head, a filter element, pressure gauge, and a bypass relief valve. The pump is equipped with a pressure gauge that indicates inlet pressure. The temperature sensor/low level switch monitors the oil temperature and level in the reservoir. An automatic warning and an automatic shutdown will occur if the operating oil temperature exceeds the specification. An automatic shutdown will also occur if the oil level falls below the specified volume.

Flow
SHAPE TECHNOLOGIES GROUP®

Change the hydraulic oil

Where used
HyperJet 30/50 · MotoJet X · MotoJet

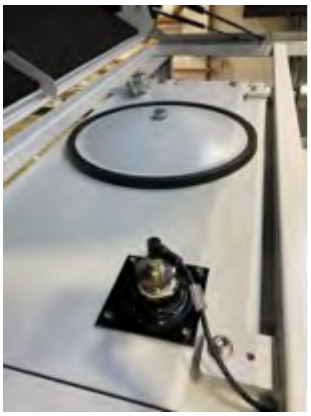
Recommended maintenance interval
The hydraulic oil should be changed at intervals required to maintain ISO 4406 cleanliness level 18/15/13, not to exceed 6000 hours. The oil should be replaced sooner if a fluid sample indicates contamination that cannot be rectified by filtering.

Oil
P66 Megaflow AW 46 or equivalent ISO VG 46 oil ……. 45 gal

Supplies
Fitting and hose for draining oil
Plug for dipstick opening
55 gallon drum

Part 01 · Drain the reservoir

1. Power down the pump, making sure you do a complete **Lockout/Tagout**.
2. Plug the dipstick opening.

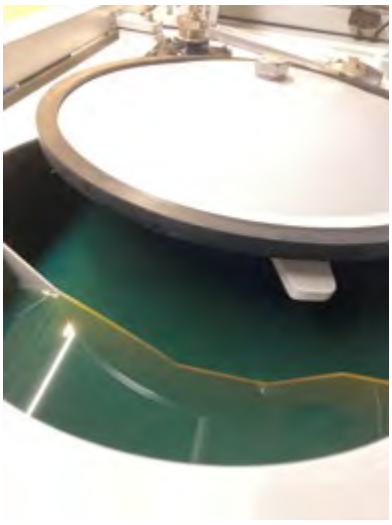


3. Remove the drain plug, and then install a fitting and hose to drain the reservoir.

4. Apply air pressure—at no more than 3 psi—to the fitting to drain the reservoir into a drum.
5. When the reservoir is empty, remove drain hose and fitting and replace the drain plug.

Part 02 · Fill the reservoir

1. Remove the reservoir cover, and then fill the reservoir with oil.
    - Reservoir baffle has three steps in it—oil level should be just above the middle step.



2. Replace the cover, clean off any excess oil, and check for leaks.
3. **Reverse the Lockout/Tagout** and apply power to the pump. Start the pump and verify proper operation.

Flow
SHAPE TECHNOLOGIES GROUP®

Replace oil filter

Where used
HyperJet 30/50 · MotoJet X · MotoJet

Recommended maintenance interval
Every 3000 hours or when the pressure gauge reads 3 bar (40 psi) at normal operating temperature; which ever comes first.

NOTICE If the element is not replaced, the bypass relief valve in the filter head will open to prevent over pressurization. When the relief valve opens, the oil bypasses the filter element and unfiltered oil is allowed to return to the reservoir.

Parts
Oil filter element and gasket ……. 05049689

Tools and supplies
Filter wrench
Hydraulic oil (fresh)
Plug for dipstick opening

To change the oil filter, do the following:

1. Do a **Lockout/Tagout** for the pump.
2. Remove the end panel near the oil filter, and then plug the dipstick opening to limit oil leakage during the service.

3. Use a filter wrench to unscrew the filter element from the filter head. Make sure the gasket is removed with the element.

   Filter element/gasket

4. Install the new gasket—taper side first—in the new filter element.

5. Lubricate the mating surface of the gasket with fresh hydraulic oil, and then install the element onto the filter head and hand-tighten.
6. Remove the plug from the dipstick opening
7. **Reverse the Lockout/Tagout**, start the pump, and then check for leaks.

Hydraulic system

Hydraulic system

Pages: 1

- **Hydraulic system**
  Overview of Hydraulic system for HyperJet 30/50.

Flow
SHAPE TECHNOLOGIES GROUP®

Hydraulic system

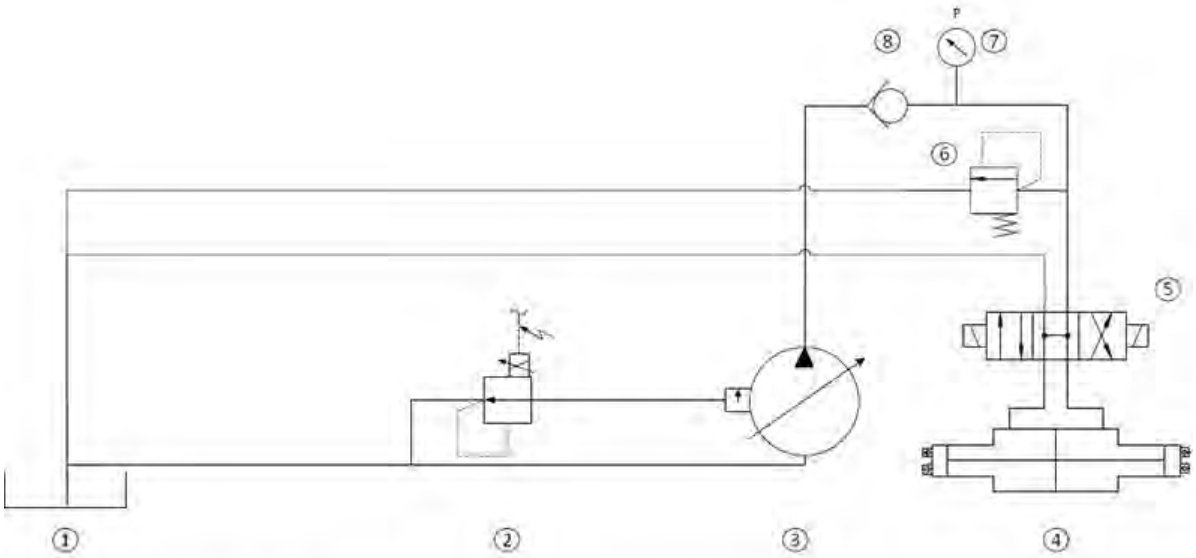
Where used

HyperJet 30/50

Summary

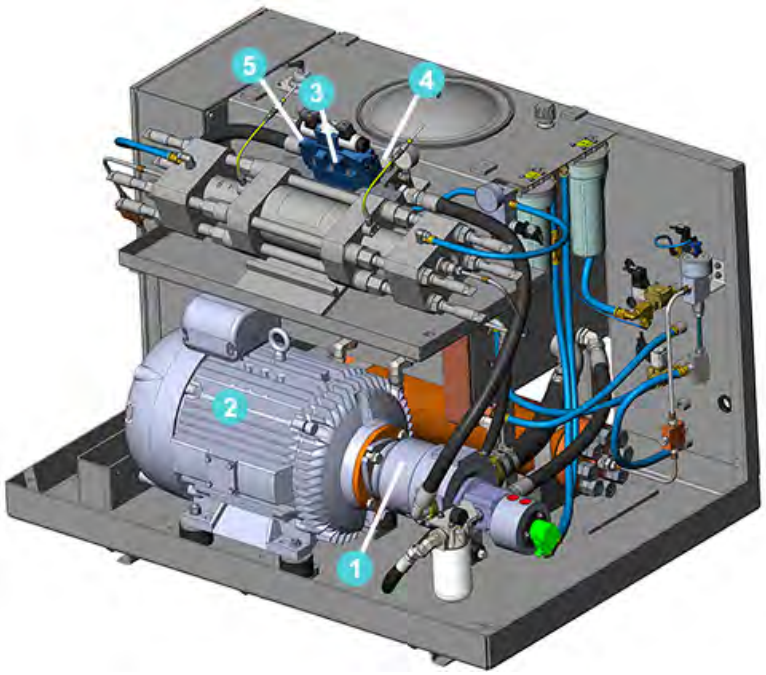
The main hydraulic power circuit supplies the intensifier assembly with the hydraulic oil required to produce high pressure water. System components include the hydraulic pump, 4-way directional control valve, the hydraulic manifold with system relief valve, the proportional control valve and a hydraulic gauge. The system relief valve monitors hydraulic oil pressure and provides system protection by limiting excess pressure.

View 1· Hydraulic system circuit



1	Hydraulic reservoir	5	Directional control valve
2	Proportional control relief valve	6	Relief valve
3	Hydraulic pump with compensator	7	Pressure gauge
4	Intensifier	8	Check valve

View 2 · Hydraulic system



1. Hydraulic pump
2. Electric motor
3. Directional control valve
4. Hydraulic manifold
5. Main system relief valve

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.
- Hydraulic operating pressure settings should be checked daily and adjusted as necessary. High pressure adjustments are made from the control panel.

Specifications

Oil pressure setting
Minimum ……. 34 bar (500 psi)
Maximum ……. 196 bar (2850 psi)
Main system relief valve pressure ……. 205 bar (2973 psi)
Operating oil temperature ……. 38–49°C (100–120°F)

How it works

The electric motor drives three pumps mounted in tandem; the main hydraulic pump, the recirculation pump and the boost pump.

Hydraulic fluid from the reservoir is drawn into the inlet, low pressure side of the hydraulic pump. Hydraulic fluid then enters the manifold.

The main system relief valve provides system protection by monitoring the oil pressure entering the

manifold. If the hydraulic pressure exceeds the maximum system pressure, the valve opens to limit the pressure.

The hydraulic system operates at the proportional valve setting up to the maximum flow capacity of the hydraulic pump. Operating pressure is set on the proportional control valves on the hydraulic pump.

WARNING! The proportional valve regulates the flow of hydraulic fluid to the system. If the oil is not properly maintained, debris can block the hydraulic system. As a result, pump control will be lost and you will not be able to create hydraulic oil pressure.

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

Megaflow® AW Hydraulic Oil

Material Safety Data Sheet

1. Product and Company Identification

Product Name: Megaflow® AW Hydraulic Oil

MSDS Number: 814637

Synonyms/Other Means of Identification:
Megaflow® AW Hydraulic Oil 22
Megaflow® AW Hydraulic Oil 32
Megaflow® AW Hydraulic Oil 46
Megaflow® AW Hydraulic Oil 68
Megaflow® AW Hydraulic Oil 100
Megaflow® AW Hydraulic Oil 150
Megaflow® AW Hydraulic Oil 220
Megaflow® AW Hydraulic Oil 320
Megaflow® AW Ultra-Clean Hydraulic Oil 32
Megaflow® AW Ultra-Clean Hydraulic Oil 46
Megaflow® AW Ultra-Clean Hydraulic Oil 68
Megaflow® AW Ultra-Clean Hydraulic Oil 100

Intended Use: Hydraulic Fluid

Manufacturer:
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.: 1-800-822-6457 or International: +1-83-2486-3363

Technical Information: 1-877-445-9198

MSDS Information:
Phone: 800-762-0942
Email: MSDS@conocophillips.com
www.conocophillips.com

2. Hazards Identification

Emergency Overview

This material is not considered hazardous according to OSHA criteria.

NFPA

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. Repeated exposure may cause skin dryness or cracking. No harmful effects from skin absorption are expected.

Inhalation (Breathing): Not expected to be toxic.

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

Signs and Symptoms: Inhalation of oil mists or vapors generated at elevated temperatures may cause respiratory irritation. Accidental ingestion can result in minor irritation of the digestive tract, nausea and diarrhea.

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

See Section 11 for additional Toxicity Information.

3. Composition / Information on Ingredients

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

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

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. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician. (see Note to Physician)

Inhalation (Breathing): First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

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

Notes to Physician: 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.

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.

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. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

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. Stay upwind and away from spill/release. Avoid direct contact with material. For larges spillages, notify persons 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). See Sections 2 and 7 for additional information on hazards and precautionary measures.

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. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. 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).

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). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

7. Handling and Storage

Precautions for safe handling: Keep away from flames and hot surfaces. 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.

Spills will produce extremely slippery surfaces. 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.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"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.

8. Exposure Controls / Personal Protection

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

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.

Appearance:	Clear and bright
Physical Form:	Liquid
Odor:	Petroleum
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure:	<1 mm Hg
Vapor Density (air=1):	>1
Initial Boiling Point/Range:	No data
Melting/Freezing Point:	<5°F / <-15°C
Pour Point:	<5°F / <-15°C
Solubility in Water:	Insoluble
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity (water=1):	0.87 @ 60ºF (15.6ºC)
Bulk Density:	7.3 lbs/gal
Viscosity:	4 - 24 cSt @ 100°C; 22 - 320 cSt @ 40°C
Evaporation Rate (nBuAc=1):	No data
Flash Point:	>302°F / >150°C
Test Method:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
Lower Explosive Limits (vol % in air):	No data
Upper Explosive Limits (vol % in air):	No data
Auto-ignition 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. Avoid all possible sources of ignition.

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

Lubricant Base Oil (Petroleum)

Acute Toxicity:

Component	Oral LD50	Dermal LD50	Inhalation LC50
Lubricant Base Oil (Petroleum)	> 5 g/kg	> 2 g/kg	> 5 mg/L

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.

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.

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:	---	---	---
Packaging Instruction # after 12/31/2010:	---	---	---

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

CERCLA/SARA - Section 313 and 40 CFR 372:
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

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.

Canadian Regulations:
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:	03-Aug-2010
Status:	FINAL
Previous Issue Date:	14-Nov-2008
Revised Sections or Basis for Revision:	Periodic review and update
MSDS Number:	814637

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:
The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.